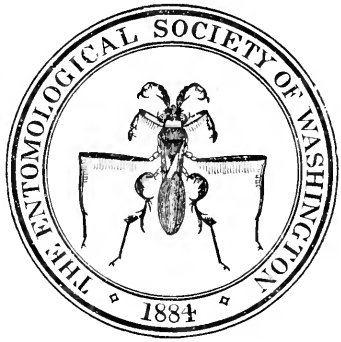
# PROCEEDINGS

OF THE

# ENTOMOLOGICAL SOCIETY

OF

# WASHINGTON

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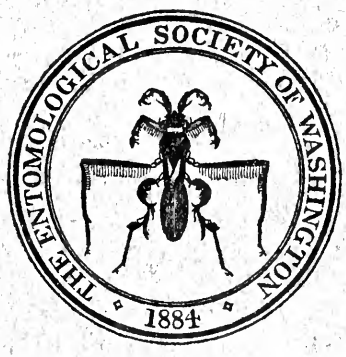


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Annual dues of active members, $3.00; of corresponding members $2.00; initiation fee (for active members only), $1.00.

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**PROCEEDINGS**

**ENTOMOLOGICAL SOCIETY OF WASHINGTON.**

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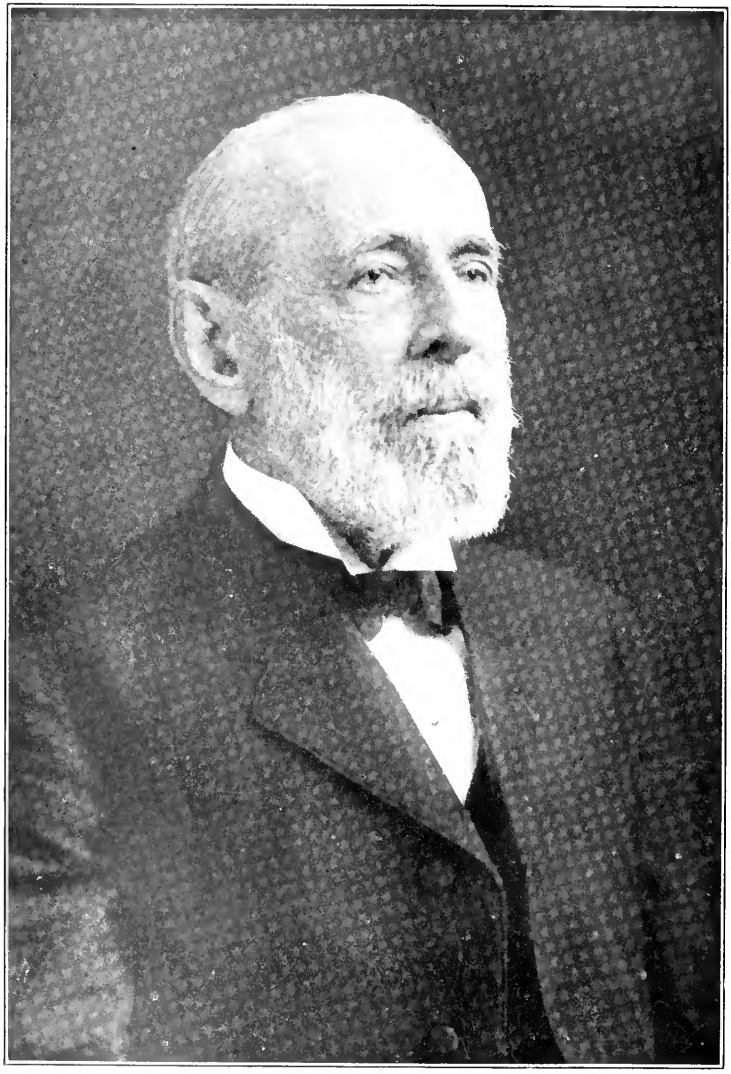

PHILIP REESE UHLER

# PROCEEDINGS

OF THE

# ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI 1914 No. 1


TWO HUNDRED AND SEVENTY-FIRST MEETING, NOVEMBER 6, 1913.

The following resolutions and biography were presented by a special committee consisting of E. A. Schwarz, Otto Heidemann and Nathan Banks and were accepted by the Society.

### PHILIP REESE UHLER.

The Entomological Society of Washington learns with deep regret of the death, on October 21, of Dr. P. R. Uhler, of Baltimore, one of the founders of this society and one of its most distinguished members.

He was the first, and for many years, the only American authority on the order of Hemiptera, and though he published but little in recent years on account of his failing health, he will be remembered as one of the illustrious group, LeConte, Horn, Scudder, Osten Sacken, Edwards, and Cresson, who by their diligent and excellent work, brought American systematic entomology to that prominence which it has ever since maintained.

His genial nature, his kindness in helping younger students, and his charming hospitality will long be a cherished memory.

The Entomological Society of Washington desires to record its realization of the loss to the Society as well as to American Entomology, and to express to the family of Dr. Uhler its regard and sympathy.

### LIFE AND WRITINGS OF PHILIP REESE UHLER.

Dr. P. R. Uhler was born in Baltimore on June 3, 1835, and died in that city on October 21, 1913. He was the eldest son of George Washington Uhler and Anna Maria Reese. His father was a prominent merchant of Baltimore, and the boy attended several

private schools and received a broad general education, including much training in Latin and German. When young Uhler was about ten years old his father bought a farm near Reisterstown, where the family often spent vacations. Here the boy began collecting insects, and was encouraged by the well-known Lepidopterist, the Rev. J. G. Morris and J. F. Wild, a German amateur Entomologist residing in Baltimore.

When of age his father placed him in his establishment, but the young man was so interested in collecting and studying geological, botanical, and zoological material that most of his time was spent in this way. He soon obtained a local reputation as an all around naturalist. Although in later life he specialized in Hemiptera, he never lost interest in the broader problems of natural history and science in general, and was always quick to perceive the application of these broader studies to his special work on Hemiptera.

In 1864 he was appointed by Prof. Louis Agassiz to take charge of the collection of insects in the Museum of Comparative Zoology. He also had charge of the library. Here he remained three years, during which time the Museum received large accessions of material. He made collecting trips for the Museum, to Maryland and to Haiti, West Indies. In 1867 he returned to Baltimore.

Before Dr. Uhler went to Cambridge he had been, for a short time, assistant librarian to the Rev. J. G. Morris, at the Peabody Institute. Upon his return he was again appointed, and in 1870 became librarian. Upon the death of the Provost of the Institute (Dr. N. H. Morrison) in 1880, he succeeded to that position, which he held until failing health compelled him to ask for retirement in 1911. He perfected the cataloguing system at the Institute.

His early work at the Peabody Institute allowed him sufficient leisure to study and publish on the Hemiptera. For many years he was practically the only authority on Hemiptera. The Hemiptera from the various government expeditions were sent him for study, and many private collectors gave him material. In 1875 he spent two weeks on the plains and mountains of eastern Colorado. Here he collected insects of all orders, and in addition to reporting on the Hemiptera, he made a report, with notes of habits and occurrence, on all other insects. About 1888, in company of his wife he visited Europe, purchasing books for the Peabody Institute and examining the Hemiptera in European collections. His entomological correspondence was very extensive, and in the course of years he had to determine many thousands of Hemiptera for his numerous friends and correspondents. But he attended to his arduous and often thankless work with the greatest patience and thoroughness.

With the increased duties at the Peabody Institute in 1890, and with the gradual failing of his eyesight he was forced to neglect systematic work and did little thereafter. The most important of his systematic papers are the revisions of the Cydnidæ and the Saldidæ. He had planned and partially completed a large work on the Capsidæ, but much of this was never published, and is now superseded by the papers of Reuter. Faunistic papers were especially favored by Dr. Uhler and some of them were published in the proceedings of our society. In each of these he presented some observations on the relationships of the Hemipterous fauna, or considerations on geographic distribution. In his systematic work he gave full, often elaborate descriptions, but rarely with figures or tables.

A few years before his death he donated his collection to the National Museum, but some of his types are in the Boston Society of Natural History and in Colorado, Kansas and California, while the West Indian types were returned to London. He described about six hundred species.

In his early life he published a few papers on economic entomology, Orthoptera, Coleoptera and Neuroptera, but his chief service in this order was the translation from the Latin of Dr. Hagen's Synopsis of North American Neuroptera. His types of Odonata and Orthoptera are in the Museum of Comparative Zoology. He also published several papers on archæology, and in later life on library methods. Some would say he was a naturalist of the old school; but no, he was a naturalist of Nature's school, a school to which all ages by patient work and untrammeled enthusiasm must ever pledge allegiance. As such the life of Uhler will be an inspiration to every young naturalist, who, amid the multiplicity of paths of modern investigation leading to some paltry rewards is tempted to forsake the love of Nature. Before his ill health Dr. Uhler often attended our meetings, frequently taking part in the discussion in an intelligent and animated way, and all who saw him will long remember how he and Henry Ulke would greet each other in the good old German fashion. The Washington entomologists will not forget the delightful meetings of our Society, held at Dr. Uhler's invitation at his hospitable home in Baltimore.

Dr. Uhler was connected with many scientific societies; besides being a charter member of ours. He was a fellow of the A. A. A. S., of the Entomological Society of America, of the American Entomological Society, and of the Philadelphia Academy of Natural Sciences, a founder, lecturer, and president of the Maryland Academy of Sciences, and an honorary member of the International Congress of Entomology. In 1900 New York University conferred on him the honorary degree of Doctor of Laws.

Personally Dr. Uhler was of medium height and build, and possessed a very congenial disposition that won for him a host of friends. He was a ready speaker and his lectures at the Maryland Academy were both interesting and instructive.

He was twice married, first in 1867 to Miss Sophia Werdebaugh of Baltimore, who died in 1883. A son of this union, Horace Scudder Uhler is now a professor in Yale. In 1886 Dr. Uhler married Miss Pearl B. Daniels, who had helped him prepare his List of Hemiptera. A daughter, Miriam D., and her mother remain to mourn their loss.

A list of Dr. Uhler's papers on Hemiptera, was published by Mr. Henshaw in Psyche in 1903, together with a useful index. His other papers have been fewer, and incorporated chronologically with his papers on Hemiptera in the following list.

THE WRITINGS OF PHILIP REESE UHLER.

1855 Descriptions of a few species of Coleoptera supposed to be new. Proc. Acad. Nat. Sci. Phil., 1855, pp. 415–18.

1857 Contributions to the Neuropterology of the United States. Proc. Acad. Nat. Sci. Phil., 1857, pp. 87–89.

1858 Descriptions of new species of Neuropterous insects collected by the North Pacific exploring expedition under Capt. John Rodgers. Proc. Acad. Nat. Sci. Phil., 1858, pp. 29–31.

Orthoptera, Hemiptera, and Neuroptera; in instructions for collecting insects. Ann. Rep. Smiths. Inst. f. 1858, pp. 164–67, 1859.

1859 Insects. Amer. Farmer, August, 1859, p. 39–40.

Insects, No. 2, Chinch-bug, lady-bird, Amer. Farmer, September, 1859, pp. 68–69.

1860 Hemiptera of the North Pacific exploring expedition under Com'rs. Rodgers and Ringgold. Proc. Acad. Nat. Sci. Phil., 1860, pp. 221–31.

1861 Insects injurious to vegetation. Rept. Comm. Patents, for 1860, Agriculture, 1861, pp. 312–322.

Homoptera of the North Pacific exploring expedition under Com'rs. Rodgers and Ringgold. Proc. Acad. Nat. Sci. Phil., 1861, pp. 282–284.

1861 Descriptions of four species of Hemiptera collected by the Northwestern boundary survey. Proc. Acad Nat. Sci. Phil., 1861, pp. 284–86.

Rectification of the paper upon the Hemiptera of the North Pacific expedition. Proc. Acad. Nat. Sci. Phil., 1861. pp. 286–87.

Descriptions of a few new species of Hemiptera, and observations upon some already described. Proc. Ent. Soc. Phil., 1861, vol. 1, pp. 21–24.

1863 Hemipterological contributions, No. I. Proc. Ent. Soc. Phil., 1863, vol. II, pp. 155–162.

1863 Hemipterological contributions. No. II, Proc. Ent. Soc. Phil., 1863, vol. II, pp. 361–366.

1864 Orthopterological contributions. Proc. Ent. Soc. Phil., 1864, vol. II, pp. 543–555,

1867 Some remarks on the Odonata of Haiti. Proc. Bost. Soc. Nat. His., vol. XI, pp. 295–298.

1869 Notices of the Hemiptera obtained by the expedition of Prof., James Orton in Ecuador and Brazil. Proc. Bost. Soc. Nat. Hist., 1869, vol. 12, pp. 321–327.

1870 (Podisus placidus) Amer. Ent. Bot. 1870, vol. II, p. 203.

1871 Notices of some Heteroptera in the collection of Dr. T. W. Harris. Proc. Bost. Soc. Nat. Hist. 1871, vol. 14, pp. 93–109.

1871 (Salt water Hemiptera). Amer. Jour. Science, 1871, ser. 3, vol. I, pp. 105–106.

A list of Hemiptera collected in eastern Colorado and northwestern New Mexico, by C. Thomas, during the expedition of 1869. Rept. U. S. Geol. Surv. Terr. Wyoming, 1871, pp. 471–472.

1872 Notices of the Hemiptera of the western territories of the United States, chiefly from the surveys of Dr. F. V. Hayden. Rept. U. S. Geol. Surv. Terr. Montana, 1872, pp. 392–423.

1875 List of the species of Hemiptera and Neuroptera obtained by Prof. James Orton, in northern Peru. Proc. Bost. Soc. Nat. Hist., 1875, vol. 17, pp. 282–286.

Report upon the collections of Hemiptera made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1873, and 1874. Rept. Geol. and Geog. Survey of Capt. G. Wheeler, 1875, vol. 5, pp. 829–842, pl. 42.

1876 List of the Hemiptera of the region west of the Mississippi River, including those collected during the Hayden explorations of 1873. Bull. U. S. Geol. and Geog. Surv. 1876, vol. I, pp. 269–361, pl. 19–21.

1877 Report upon the Hemiptera collected during the years 1874, 1875, by P. R. Uhler. Rept. Geol. Surv. of Capt. G. Wheeler app. N. N. 1877.

Report upon the insects collected by P. R. Uhler, during the explorations of 1875, including monographs of the families Cydnidæ and Saldæ, and the Hemiptera collected by A. S. Packard, Jr., M.D. Bull. U. S. Geol. and Geog. Surv., 1877, vol. 3, pp. 355–475; 765–801, pls. 27–28.

1878 Notices of the Hemiptera Heteroptera in the collection of the late T. W. Harris, M.D. Proc. Bost. Soc. Nat. Hist., 1878, vol. 19, pp. 365–446.

On the Hemiptera collected by Dr. Elliott Coues, U. S. A., in Dakota and Montana, during 1873, 1874. Bull. U. S. Geol. and Geog. Surv., 1878, vol. 4, pp. 503–512.

1879 List of animals observed at Fort Wool, Va. Studies biol. lab. Johns Hopkins Univ., 1879, vol. 1, no. 3, pp. 17–34.

1880 Remarks on a new form of jassid. Amer. Entom., 1880, vol. 3, pp. 72–73.

1884 Order VI, Hemiptera. Standard Nat. Hist., 1884, vol. 2, pp. 204–296. Riverside Nat. Hist., 1888, vol. 2, pp. 204–296.

1886 Check list of the Hemiptera Heteroptera of North America. Brooklyn Ent. Soc., 1886, 30 pp.

A new noxious capsid. Can. Ent., 1886, vol. 18, pp. 208–209.

1887 (Lygus monachus.) U. S. Dept. Agric. Div. Ent. Bull., 13, 1887, pp. 63–64.

Observations on some North American Capsidæ. Ent. Amer., 1887, vol. 2, pp. 229–231.

Observations on some Capsidæ with descriptions of a few new species. (No. 2.) Ent. Amer. 1887, vol. 3, pp. 29–35.

Observations on North American Capsidæ with descriptions of new species. (No. 3.) Ent. Amer., 1887, vol. 3, pp. 67–72.

Observations on Capsidæ with descriptions of new species. (No. 4.) Amer. Ent. 1887, vol. 3, pp. 149–151.

1888 Preliminary survey of the Cicadidæ of the United States, Antilles and Mexico. Ent. Amer., 1888, vol. 4, pp. 21–23; 81–85.

1889 New Genera and species of the American Homoptera. Trans. Maryland Acad. Sci., 1888, vol. 1, pp. 33–44.

1889 Observations upon the Heteroptera collected in southern Florida by Mr. E. A. Schwarz. Proc. Ent. Soc. Wash., 1889, vol. 1, pp. 142–143.

Observations on the insects of the Bermudas. Heilprins' The Bermuda Islands. Phil., 1889, pp. 152–158.

1890 Observations on North American Capsidæ, with descriptions of new species. No. 5. Trans. Maryland Acad. Sci., 1890, vol. 1, pp. 73–88.

1891 Observations on some remarkable forms of Capsidæ. Proc. Ent. Soc. Wash., 1891, vol. 2, pp. 119–123.

Remarkable new Homoptera. Trans. Maryland Acad. Sci., 1891, vol. 1, pp. 143–147.

1892 Preliminary survey of the Cicadidæ of the United States, Antilles and Mexico. Trans. Maryland Acad. Sci., 1892, vol. 1, pp. 147–175.

Additions to the family Cicadidæ. Trans. Maryland Acad. Sci., 1892, vol. 1, pp. 175–179.

Observations on some remarkable Heteroptera of North America. Trans. Maryland Acad. Sci., 1892, vol. 1, pp. 179–184.

1893 Summary of the collection of Hemiptera secured by Mr. E. A. Schwarz in Utah. Proc. Ent. Soc., Wash., 1893, vol. 2, pp. 366–385.

Hemiptera-Heteroptera of the Death Valley expedition. N. Amer. Fauna, 1893, no. 7, pp. 260–265.

A list of the Hemiptera-Heteroptera collected in the island of St. Vincent by Mr. Herbert H. Smith, with descriptions of new genera and species. Proc. Zool. Soc. London, 1893, pp. 705–719.

1894 A list of the Hemiptera-Heteroptera of the families Anthocoridæ and Ceratocombidæ collected by Mr. H. H. Smith in the island of St. Vincent; with descriptions of new genera and species. Proc. Zool. Soc. Lond., 1894, pp. 156–160.

On the Hemiptera-Heteroptera of the island of Grenada, West Indies Proc. Zool. Soc. London, 1894, pp. 167–224.

Observations upon the Heteropterous Hemiptera of Lower California, with descriptions of new species. Proc. Cal. Acad. Sci., 1894, ser. 2, vol. 4, pp. 223–295.

1895 An enumeration of the Hemiptera-Homoptera of the Island of St. Vincent, W. I. Proc. Zool. Soc. London, 1895, pp. 55–84.

A preliminary list of the Hemiptera of Colorado, with descriptions of new species by P. R. Uhler and J. H. Cowen, and the authors. Bull. 31 Colo. Agric. Exper. Station, 1895, pp. 1–137.

Summary of the Hemiptera of Japan, presented to the U. S. Nat. Museum by Prof. Mitukuri. Proc. U. S. Nat. Mus., 1896, vol. 19. pp. 255–297.

1897 Notes on predaceous Heteroptera with Prof. Uhler's descriptions of two species, by A. H. Kirkland. Can. Ent., vol. 29, 1897, pp. 115–18.

Contributions towards a knowledge of the Hemiptera-Heteroptera of North America. No. 1. Trans. Maryland Acad. Sci., 1897, vol. 1, pp. 383–394.

1897 New Hemiptera. Can. Ent., 1897, vol. 29, pp. 116–118.

1899 A new destructive capsid. Ent. News, 1899, vol. 10, p. 59.

1900 Aids to a recognition of some North American genera and species of the old family Fulgoridæ. Trans. Maryland Acad. Sci., 1900, vol. 1, pp. 401–408.

1901 Some new genera and species of North American Hemiptera. Proc. Ent. Soc. Wash., 1901, vol. 4, pp. 507–515.

1903 A new Cicada from Haiti. Trans. Maryland Acad. Sci., 1903, vol. II, p. 18.

Enumeration of the Cicadidæ of Brazil in the collection of Mr. Herbert H. Smith. Trans. Maryland Acad. Sci., vol. II, 1903, pp. 1–17.

1904 Recognition of two North American species of Cicada Latr. Ent. News, vol. 16, no. 3, pp. 74–77, 1904.

List of Hemiptera-Heteroptera of Las Vegas Hot Springs, New Mexico, collected by E. A. Schwarz, and H. S. Barber. Proc. U. S. Nat. Mus., vol. 27, pp. 349–361, 1904.

1905 Recognition of two North American species of Cicada Latr. Ent. News, 1905; pp. 74–77.

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The Society also adopted the following resolutions presented by a special committee consisting of A. L. Quaintance, W. B. Wood and A. D. Hopkins.

A. G. HAMMAR.

The accidental death of Mr. Alfred G. Hammar, while hunting in the Capitan Mountains near Roswell, New Mexico, is learned with deep regret by the members of the Entomological Society of Washington. Mr. Hammar was a regular attendant of the meetings of the Society during his winter sojourns in Washington, and took a deep interest in its work, and by his contributions of papers and participations in discussions, added much of interest to its meetings.

Mr. Hammar accomplished much valuable work in the field of economic entomology, notably his thorough-going biologic studies of the codling moth in Pennsylvania, Michigan, and New Mexico, and of the grape root worm in Pennsylvania.

His genial nature and uniform courtesy to his associates have won him a place high in the esteem of all who had come to know him.

The Entomological Society of Washington wishes to here record its feeling of the loss to the Society, as well as to American Economic Entomology, and to express to his wife and brother its sincere sympathy.

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The following papers were presented.

Coleoptera at the British Museum, Bloomsbury. T. D. A. Cockerell.

A new Tachinid Parasite of *Diabrotica vittata*. W. R. Walton.

Notes on the Entomology of the Arizona Wild Cotton. W. D. Pierce and A. W. Morrill.

Experiments with the Arizona Wild Cotton Weevil on Texas Cotton. B. R. Coad and W. D. Pierce.

Description of a New Blister Mite on Arizona Wild Cotton. Nathan Banks.

Two Microlepidoptera on *Thurberia*. August Busck.

The Chestnut Bast-miner. August Busck.[1]

## COLEOPTERA AT THE BRITISH MUSEUM, BLOOMSBURY.

By T. D. A. Cockerell.

In the old days, which I am just old enough to remember, the natural history departments of the British Museum were in the original building in Bloomsbury, London. The entomologists had to work in underground rooms, which were so dark that critical work must often have been difficult, and we cannot wonder that some of the descriptions prepared there are hard to understand. Even at South Kensington, the light is not always as good

[1] Published in Ins. Ins. Mens., II, pp. 3–4, 1914.

as one could wish, but the conditions there are infinitely better than those in the old quarters. In spite of disadvantages, the entomologists of those earlier times were full of zeal, and gave a remarkable token of this in the collection they formed of beetles found on the Museum premises, either in the building or (principally) in the large, paved courtyard in front of it. This collection is still extant, and many years ago, when I was preparing a list of the insects of Middlesex, I was allowed to copy the data for use therein. Shortly after, I left England, and the list of Middlesex insects, which had appeared in part in the Entomologist, was discontinued, with only a very small part of the Coleoptera published. Looking over my old notes, I find I have still this British Museum list, and it occurs to me that some account of it may interest workers in the U. S. National Museum. The very large number of Coleoptera found at the British Museum may no doubt be attributed in part to the rather close proximity of Covent Garden Market. The market close to the National Museum at Washington may be expected similarly to be a source of insects wandering on to the Museum premises. Conditions at Bloomsbury are, however, much more thoroughly urban than those at Washington. Lists of this sort while not exhibiting the insects in their most natural surroundings, are of value and interest as showing how many species are spread by the agency of man, and may be found in the midst of cities and in other apparently unlikely places. When the facts are understood, we may marvel, not that so many insects are spread beyond their original habitat and establish themselves in new countries, but rather that more do not do so. Thus, it is really surprising that more European Coleoptera have not become established in America.

It is not worth while to give the whole list of British Museum beetles. I give instead the lists for several genera as a good sample of the whole. For each genus mentioned, I give all the species reported.

*Cicindela campestris* L.

*Notiophilus aquaticus* L., *palustris* Duft., *biguttatus* F.

*Amara apricaria* Payk., *familiaris* Duft., *acuminata* Payk., *trivialis* Gyll. *lunicollis* Schiodte, *similata* Gyll., *plebeia* Gyll.

*Cercyon hæmorrhoidalis* F., *flavipes* F., *unipunctatus* L., *quisquilius* L., *melanocephalus* L., *terminatus* Marsh., *nigriceps* Marsh.

*Choleva fumata* Spence.

*Mycetoporus longulus* Mann., *lepidus* Grav. *angularis* Rey, *clavicornis* Steph.

*Philonthus splendens* F., *laminatus* Creutz, *æneus* Rossi, *politus* F., *marginatus* F., *varius* Gyll., *sordidus* Grav., *cephalotes* Grav., *bipustulatus* Panz., *varians* Payk., *ventralis* Grav., *nigritulus* Grav.

*Oxytelus rugosus* F., *laqueatus* Marsh., *sculptus* Grav., *sculpturatus* Grav., *nitidulus* Grav., *complanatus* Er., *depressus* Grav.
*Rhizophagus depressus* F., *perforatus* Er., *parallelocollis* Gyll., *bipustulatus* F.,
*Cryptophagus pilosus* Gyll., *saginatus* Sturm, *scanicus* L., *badius* Sturm, *cellaris* Scop., *acutangulus* Gyll., *dentatus* Herbst., *distinguendus* Sturm, *bicolor* Sturm, *vini* Panz.
*Phyllotreta vittula* Redt., *undulata* Kuts., *nemorum* L.
*Alphitobius diaperinus* Panz., *piceus* Ol.
*Otiorhynchus scabrosus* Marsh., *sulcatus* F.,
*Hypera punctata* F., *polygoni* L., *nigrirostris* F.,
*Hylesinus crenatus* F., *fraxini* F.,
*Tomicus typographus* L., *chalcographus* L.

In the list as it stands, I find in *Tenebrio* only *molitor* L. (no *obscurus*); in *Bruchus* only *flavimanus* Boh. Possibly some of the very common species were not preserved. In *Cerambycidæ* I find only five species: *Callidium alni* L., *C. variabile* L., *Gracilia pygmæa* F., *Molorchus minor* L., *Acanthocinus ædilis* L., *Chrysomela* is represented only by *polita* L., a species common around London (Isleworth, Bedford Park, Hendon). There are only four *Histeridæ*: *Hister cadaverinus* Hoff., *H. purpurascens* Herbst., *Saprinus æneus* F., *Deudrophilus punctatus* Herbst. The only *Dytiscidæ* are *Hydroporus pubescens* Gyll., H. *palustris* L., *Agabus bipustulatus* L. and *Acilius sulcatus* L.

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——Mr. Schwarz said that he believed there is a list of the insects of Paris. He also remembered that many years ago the Entomological Society of Berlin brought together a list of the insects found in the city of Berlin. The number of insects found in the city of Washington, D. C., is immensely greater than that found in most other cities, a fact which is easily explained by the large number of squares and parks. There should be an unpublished list of the insects found on the Smithsonian grounds present in the old files of the Division of Entomology. In this connection he mentioned a curious fact namely, that there is at the corner of 12th and D Streets an ash tree which thirty-five years ago was badly infested with a Lepidopterous borer, *Agalia polistiformis*, and on which two predaceous Elaterid beetles, *Chalcolepidius viridipilis* and *Hemirhipus fascicularis* were always to be found. Today the same tree is still living and harbors the same insects.

——Dr. Hopkins mentioned the large number of species of forest insects, injurious, beneficial, and neutral, which were attracted by

the odor of pine lumber in the extensive lumber yards of B Street N. W. As a consequence a large number of old Norway spruce trees on the Agricultural Grounds have died during the past three years, having been killed by three species of Scolytids—*Ips calligraphus*, *Ips grandicollis*, and *Ips avulsus*, the first attacking the lower trunk, the second the upper portion, and the third the tops and branches. Each species has its usual set of parasitic and predatory enemies, associates, and scavengers, making in all quite an extensive fauna.

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## A NEW TACHINID PARASITE OF DIABROTICA VITTATA.

By W. R. Walton, *Bureau of Entomology.*

One Tachinid parasite of *Diabrotica* has been known to science since 1871, in which year *Celatoria (Melanosphora) diabroticæ* was described by Dr. Henry Shimer.[1] Subsequently the late D. W. Coquillett redescribed this species under other generic and specific names.[2]

Shimer's brief and characterless description of *diabroticæ* together with his placing of the species in the genus *Melanosphora* of the Dexiidæ offer an excellent excuse for this redescription and synonymous specific name. Shimer's figure, depicting the wing venation fairly well, affords the one clue which preserves his diagnosis from oblivion.

In his redescription of *C. diabroticæ* Mr. Coquillett unfortunately confuses the sexes as he says: "Venter in female normal; in the male, furnished with a large, longitudinally compressed process." As a matter of fact the female is the possessor of this process which is excellently shown in Dr. Marx's drawing accompanying his article. Mr. C. H. T. Townsend has previously commented upon this misinterpretation.[3] Mr. Coquillett also describes here for the first time the peculiar spiny puparium which is quite distinctive of this group, for which Mr. Townsend proposes the name *Celatoriinæ*.

During the early part of June of the present year a wild cucumber vine on the premises occupied by the author at Hyattsville, Maryland, became heavily infested with the beetle, *Diabrotica vittata* Fabr. While observing the movements of the beetles on June 4, several minute tachinid flies were seen sitting upon the upper sur-

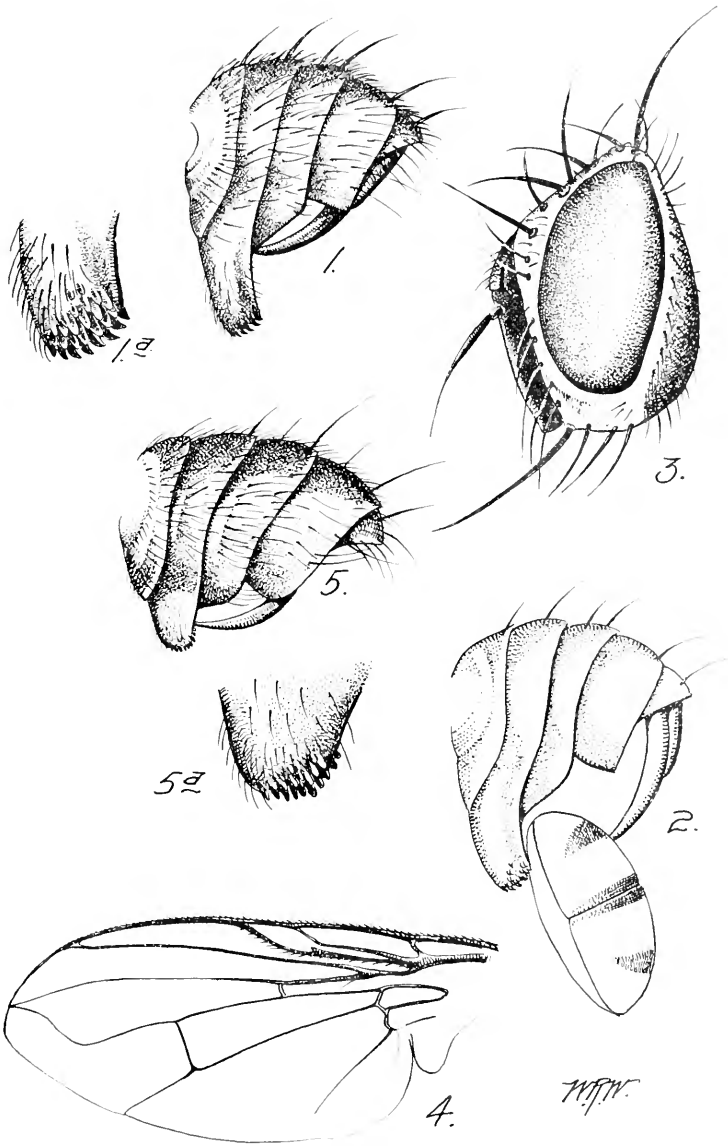
[1] American Naturalist, vol. v, p. 219, 1871.
[2] *Celatoria crawii*, Insect Life, vol. II, p. 235, 1890.
[3] Annals Ent. Soc. of Am., vol. IV, p. 140, June, 1911.

faces of the leaves. Suddenly one of these individuals dashed at a beetle, they grappled, the beetle rolled over upon its back. Then, almost instantly, the fly disengaged herself, resuming the pose upon the leaf, preening her body with the hind legs. The beetle rolled off to the ground and presently flew away. This was observed several times and finally a fly and the beetle attacked were captured for examination. The beetle was found to have a clean hole punched through the center of one elytron. An examination of the abdominal appendages of the fly (plate I, fig. 1) left little doubt as to the origin of this puncture. By referring to the figure it will be seen that the second abdominal segment is immensely prolonged downward into a laterally compressed tubercle, the apex of which is armed with short, flattened, somewhat pointed, spine-like, processes, directed slightly caudad. Opposed to this, with its base attached to apex of the abdomen, is a long curved, strongly chitinized piercer. This is normally held with its tip ensheathed in the posterior edge of the abdominal process described above. In life it is easily visible with the aid of a hand lens. Figure 2 of plate I shows the author's interpretation of the function of these two appendages.

The contact of the fly with the beetle is much too brief and the conflict too strenuous for the eye to observe what actually takes place. But taking into consideration the position of the punctures on the elytra of the beetle and the conformation of the puncturing apparatus, together with the fact that the beetle is turned upon its back during the conflict, this hypothetical figure seems quite plausible.

Several punctured beetles were collected and placed in a breeding jar and on July 10 one fly puparium was found therein. This resembles the puparium of *Celatoria* quite closely in that it is covered with short, spine-like processes. Owing to the writer's prolonged absence from the city, further results of this rearing were lost. But the facts outlined above indicate conclusively the parasitism of this fly on *Diabrotica*.

When first observed it was naturally supposed to be *Celatoria diabroticæ* Shimer. In size and general appearance it closely resembles that species but a careful examination revealed important structural differences which make it necessary to propose not only a new species but also to erect a new genus for its reception. This latter action becomes necessary because the first vein is spiny for almost its entire length. It seems quite apparent that this character is wholly artificial, but as it has been utilized extensively as a primary generic and even group character, and is of undoubted convenience in spite of its apparent artificiality, the name *Neocelatoria ferox* n. gen. n. sp. is herewith proposed for this curious fly.




*Neoceratoria ferox* Walton; *1*, Abdomen of female; *1a*, Enlarged view of abdominal tubercle; *2*, Hypothetical drawing showing probable functioning of appendages; *3*, Head of female; *4*, Wing.

*Celatoria diabrotica* Shimer; *5*, Abdomen of female; *5a*, Abdominal tubercle enlarged.

**Neocelatoria** n. genus.

First vein bristly on its apical two-thirds; face on lower half of sides bare; proboscis scarcely longer than height of head; apical cell ending at wing tip barely open or slightly closed; eyes bare; frontal vitta opaque; palpi subcylindrical; penultimate joint of arista slightly longer than broad; sides of face at narrowest point not nearly one-third as wide as median depression; head at vibrissæ shorter than at root of antennæ; horizontal diameter of occiput above neck less than one-half length of eye. With one or more frontal bristles below base of antennæ. Female with one or two pairs of orbitals. Female with second segment of the abdomen prolonged ventrally into a long setigerous tubercle, quite twice as deep as the fourth abdominal segment.

**Neocelatoria ferox** n. sp.

Minute, blackish, wings broad, hyaline, Eyes large, occupying nearly two-thirds of the head, each fully as wide as front. Front cinereous, sides nearly parallel. Vertex slightly black. Frontal vitta dark brown, nearly black, occupying about one-third of the front immediately over root of antennæ, gradually widening towards vertex where it occupies fully one-half of the width of front. Entire face including depression cinereous; sides at narrowest part not more than one-tenth as wide as depression; antennæ black, slightly cinereous, almost or quite as long as face. Third joint at least five times as long as second; arista thickened to the middle; second joint slightly longer than broad; post vertical and ocellar bristles strong. Usually two pairs of orbital bristles (in female), frontal bristles descending nearly to tip of second joint; proboscis short, fleshy, black; palpi yellow. Beard and hairs of lower occiput white; vibrissæ on oral margin; oral cavity large, occupying the entire width of face. Facial ridges bristly on more than lower half; thorax black, humeri and median vitta thinly gray pollinose to the transverse suture; posterior to this nearly bare. Abdomen black, shining, somewhat laterally compressed; bases of second, third and fourth segments thinly gray pollinose. First segment without marginals; second segment bearing marginals only; third segment bearing a pair of small discals and marginals; fourth with a marginal row only. Post sutural bristles three; sternopleurals three with some coarse hairs. Scutellum black, bearing three pairs of long marginals, the apical pair the smallest. Abdomen viewed from the side showing a deep, compressed, setigerous prolongation of the second segment, the lower end of which projects considerably below the level of the bottom of hind coxæ. Ovipositor and piercer black, strongly chitinized, slightly compressed laterally, curved forward with its tip ensheathed in the prolongation of the second segment. Legs rather stout, black; middle tibiæ with a single strong bristle on the front side near middle; hind tibiæ not ciliate; wings clear hyaline; hind cross vein nearly rectangular, straight; veins brown; halteres yellow; calypters whitish; length three to four mm.

Described from two females collected at Hyattsville, Maryland, June 4, 1913. Type a female deposited in U. S. National Museum, Washington, D. C. A figure of the abdomen of *Celatoria diabrotica* has been provided for the purpose of comparison (plate I, fig. 3).

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## NOTES ON THE ENTOMOLOGY OF THE ARIZONA WILD COTTON.

By W. D. Pierce and A. W. Morrill.

Arizona wild cotton, *Thurberia thespesioides*, has been under observation for several years, by Prof. J. J. Thornber, of the University of Arizona, who has acquired specimens from many different localities in southern Arizona and has in fact recommended it as a flowering shrub. Possibly it first received attention from an entomological standpoint from one of us (Morrill), when, in August, 1912, in company with Prof. R. H. Forbes, director of the Arizona Experiment Station, several plants were found and examined near Fish Creek on the Roosevelt Road, where the plant had not previously been known to exist. A considerable number of bolls were examined, but no insect injury of any kind was noted. Believing that the cotton boll weevil would attack this as a food plant, a number of the bolls and squares were mailed to the laboratory of the Bureau of Entomology at Dallas, Texas, for testing with live weevils. This material was not received in good condition, however, so the testing of the attraction of the Arizona wild cotton for the typical *Anthonomus grandis* was deferred until the past summer.

The plant assumed economic importance when Mr. O. F. Cook made an announcement in February, 1913, of the finding of the Mexican cotton boll weevil in the bolls in Sabino Canyon, Santa Catalina mountains. This announcement was followed very shortly by the receipt at Washington of a sack of infested bolls from Stone Cabin Canyon, Santa Rita Mountains. Out of a total of 743 bolls, 220 weevil stages were obtained. Of these, 171 were dead but 18 live adults were found in their cells. In the bolls the mortality was provisionally classified as follows:

| | *per cent* |
|---|---|
| Due to climatic causes | 65.00 |
| Due to predators | 2.27 |
| Due to parasites | 1.82 |
| Due to fungus | 8.63 |
| Total for all classes | 77.72 |

Among the parasites were found the traces of two specimens of a *Cerambycobius*. The remaining parasites were Braconids. The material also contained thirteen stages of a Lepidopterous boll feeder, of which one larva was found alive. A predaceous Coleopterous larva was also found.

During the last two weeks in August the authors made a thorough examination of the insects associated with this plant in several localities in Arizona. The lowest altitude at which the plant was found growing was about 2500 feet in Fish Creek Canyon, sixteen miles west of Roosevelt. In this section the plant is quite common not only on the side of the canyon a short distance above the bed but even on the top of the high plateau nearby at an elevation of approximately 3300 feet. Many squares, a few blooms and a few bolls were found on the plants in this section on August 19. No weevil indications could be found here.

On the following day a search was made for the wild cotton plant in one of the canyons near Roosevelt and in a side canyon which opens into Fish Creek Canyon, but no wild cotton plants were found. Judging from observations afterward made in the Santa Catalina and Santa Rita Mountains the authors would consider both of these canyons as likely places for the plant to occur.

Owing to the extensive cultivation of cotton in the Salt River Valley below this point a search has been made for the plant in Hieroglyphic Canyon and also in another canyon of the Salt River Mountains south of Phœnix, by Mr. E. E. Russell under direction of the Arizona State Entomologist's office. No trace of the plant was found. It is quite probable that the wild cotton exists somewhere nearer the Salt River Valley cotton plantations than Fish Creek but no search other than mentioned has yet been made.

From Phœnix we proceeded to Tucson which is on the mesa surrounded by mountain ranges. The presence of cotton at Tucson lent considerable importance to the conditions here. Within a few years cotton will be grown for twenty or thirty miles in the Santa Cruz Valley if conditions permit. North of Tucson and coming within a very few miles of the cotton fields already planted are the Santa Catalina Mountains. The plant occurs according to our observations and those of Professor Thornber in Pima, Ventana, Sabino, Bear and Soldiers Canyons in this range. We found the weevil in the second and Mr. Cook found it in the third. It no doubt will be found in the others. Joining these mountains on the east are the Tanque Verde and Rincon Mountains in both of which ranges the plant occurs. South of Tucson about thirty miles are the Santa Rita Mountains in which the wild cotton is common. We found it in Sawmill and Stone Cabin Canyons, with the weevil abundant. West of Tucson is a very dry unpromising range of mountains, the Tucson Mountains, in which we found

absolutely no signs of the plant. Outside of our records *Thurberia* is known also to occur in the Mule Pass, Chiricahua, and Huachuca Mountains, at Ft. Bowie, Davidson Springs and near Dragoon, Arizona, and in southwestern Chihuahua and Guadalajara, Mexico.

In altitude the plant occurs from 2300 (Fish Creek Canyon, Arizona) to 5000 feet. (Sawmill Canyon, Santa Rita Mountains, Arizona.) According to Mr. F. L. Lewton it occurs as high as 7000 feet altitude in Mexico. It is perennial, resembling the cotton plant so closely that it is locally known as wild cotton.

Entomologically *Thurberia* is a very interesting plant. The large nectary of the midrib on the underside of the leaves, the three nectaries at the base of the involucral bracts, and the nectar of the flowers prove powerful attractions to insects. The tender foliage and the succulent buds and bolls furnish excellent insect food.

## BOLL WEEVIL.

By far the most important species attacking the wild cotton is the boll weevil, *Anthonomus grandis*, var. *thurberiæ* Pierce which is known to breed in the squares and bolls in Ventana and Sabino Canyons of the Santa Catalina Mountains, and Sawmill and Stone Cabin Canyons of the Santa Rita Mountains. It passes the winter spring and summer in cells in the bolls, emerging in August or as late as September 1 to begin attack on the new crop of squares and bolls. It hardly seems possible that the weevil can have more than two generations a year on this plant. The eggs are laid at the base of squares, and are covered by a transparent gelatinous scale upon which is usually a little clot of excrement. The eggs are elongate, often twice as long as wide. On August 25 in Stone Cabin Canyon no larvæ were found over one-fifth grown, although it is quite possible the weevil may develop earlier in the lower canyons. The first adults were bred from Stone Cabin Canyon bolls about November 10.

The adult weevils are robust and generally larger than the Mexican cotton boll weevil and one receives a very strong impression that he is dealing with a distinct species. The records made by Mr. Coad at Victoria, Tex., however, have proven the Arizona form to be conspecific with the cotton boll weevil. The typical *grandis* occurs at altitudes under 2000 feet, while *thurberiæ* is found only at altitudes of over 4000 feet. The food plants are considered generically different by botanists. Geographically the two varieties are separated by hundreds of miles. The cotton weevil occurs in Cuba, Costa Rica, Mexico and the southern United States while *thurberiæ* occurs in southern Arizona and also probably in the mountains of Mexico.

### LEAF WORM.

Next in interest is *Alabama argillacea*, one full grown larva of which was found on *Thurberia* in Stone Cabin Canyon, while the species was also found on the extremely isolated patch of cotton at Tucson thirty miles distant to the north, and also in the cotton fields at Phœnix. This species is known to display a tremendous power of flight in its annual northward dispersion. The question of greatest interest is whether the mild winters of Phœnix and Tucson will enable it to hibernate in Arizona and be present for the next cotton crop. At Victoria, Texas, Mr. Coad experimentally fed *Alabama* larvæ on his Thurberia plants and in some experiments gave them a choice between cotton and Thurberia leaves but found that they fed on both and that they matured normally when fed on the *Thurberia*. On the other hand they did not seek the *Thurberia* naturally.

This insect occurs on cotton in South and Central America and the West Indies, and only comes into the United States in warm seasons. It has never previously been taken on any other food plant than cotton.

The absence of the cotton worm with the single exception noted, in the sections where the Arizona wild cotton was examined, indicates the improbability of the insect being indigenous to Arizona. The discovery of the insect upon cultivated cotton near Tucson the first season of its growth in that locality is almost positive evidence that the moths of this insect had reached Arizona by flight from points hundreds of miles to the south.

### THE THURBERIA BOLL WORM.

The Thurberia boll worm is considered the most destructive of all the insects found attacking Arizona wild cotton. During the latter part of August the eggs of this Noctuid were very abundant in Stone Cabin Canyon in the Santa Rita Range and were also found in Sawmill Canyon a few miles distant, but in this latter locality they were noticeably scarce. In Ventana Canyon in the Santa Catalina Mountains one of the authors (Morrill) in company with Prof. G. F. Freeman on July 1, 1913, estimated that about a fourth of the old bolls attached to the plants had been eaten out by worms, undiscovered at that time. A single old boll similarly destroyed was found at Fish Creek Canyon in August. Further evidence of the wide distribution of the insect in Arizona exists in the eggs found upon the herbarium specimens of the National Museum from near Bisbee (probably in Mule Mountains) and from the Rincon Mountains. It is of interest to note that the first of these records is dated September 14, 1892.

The egg is pure white in color, truncate-conical in form, with crater like apical depression. Greatest diameter 0.79 to 0.83 mm. height, 0.79 to 0.8 mm.; diameter of entrance to apical cavity, 0.13 mm.; edges ragged. Surface of eggs marked with slightly depressed reticulations forming polygonal cells, small at base of the eggs and gradually increasing in size as the diameter of the egg decreases. About 52 cells occur around largest circumference and about 21 cells around smallest circumference. As the embryo develops the egg gradually becomes distinctly pinkish.

The pupa is robust measuring about 10 mm. in length, and 5 mm. in width. Its color is light brown with dark brown spiracles.

The full grown larva is about 25 mm. in length, 5 mm. in diameter and cylindrical in general form. The head and cervical shield are yellowish brown in color as is also the anal shield. The spiracles are jet black. Integument marked with a rather broad stripe of deep pink extending along each side of the body interrupted at the joints. This stripe shades to paler pink above. Dorsal organ greenish and conspicuous. Where integumental color is absent or pale the body fluid and internal organs give greenish tone. In the younger stages the larvae are more distinctly pinkish in color and lack the green tinge.

The eggs are deposited exclusively, as far as observed, on the tips of the involucral bracts and of the leaf lobes. Of 40 specimens of eggs 35 were found to occur singly. The exceptions consisted of one group of three and one group of two eggs.

The larva does not eat the egg shell after emergence nor has it been found feeding except upon the squares and bolls. Into these parts it eats its way exhibiting feeding habits quite similar to those of the cotton boll worm (*Heliothis obsoleta*). The young larva eats into several of the squares and finally attacks a boll and finishes growth inside of one. No observations have been made showing the number of bolls a single larva may destroy. The stems which bear the damaged boll are fastened to the plant by a band of silk apparently spun by the larva as it approaches the boll. This is strong enough to hold the boll if the stem should become detached as it sometimes does, but it seems probable that there is some other purpose in this action. The entrance to the cotton boll is made almost invariably near the base between the bracts. It is 2.25 and 3 mm. in diameter in the specimens observed.

When placed together the worms do not show cannibalistic tendencies. Sixteen out of nineteen worms under observation removed from the bolls which they had completely eaten out, burrowed into the ground without hesitation. Pupal cells thinly lined with silk were constructed at depths of from one to three inches below the surface. The Thurberia boll worms appear to

feed upon Egyptian cotton as readily as upon the wild cotton. One worm about one-half grown on October 2 was placed in a hole cut through the carpel of an Egyptian cotton boll and four days later it was noted that it had consumed two cotton seeds and having plugged up the artificial entrance hole with excrement it had made a new hole as an exit. In two instances larvæ about three-fourths grown were placed inside bracts of Egyptian cotton squares and ate out the interior of the flower bud in each case.

A few observations indicate the general similarity of the seasonal history of the Thurberia boll worm with that of the Thurberia boll weevil. No eggs or larvæ of the boll worm were found on July 2 in Ventana Canyon although the insects were abundant there as indicated by the large percentage of old injured bolls as noted above. The plants at that time were far advanced in their development as compared with other localities; squares and blooms were abundant and a few half grown bolls were seen. On August 25 in Stone Cabin Canyon it was estimated that 50 per cent of the eggs of the Thurberia boll worm had already hatched. Pink lepidopterous larvæ associated with these eggs, and now known to be the young boll worms, were found boring into the squares of the wild cotton plant. The worms found were in no case of greater length than 10 mm. and were therefore less than one-half grown. On September 1 worms of full size were found in the Ventana Canyon by Messrs. Pierce and Thornber and on October 1, Dr. O. C. Bartlett collected in the same canyon 24 boll worms of which 18 were full grown, four about three-fourths full grown, one about one-half grown and one about one-third grown.

After reaching full size the worms apparently remain for a considerable period inside the empty boll, but as far as observed they do not pupate there. Specimens which went into the ground and pupated during the first ten days of October have not yet (November 15) emerged.

Dr. Dyar, who has examined the larvæ finds that they resemble those of *Sacadodes pyralis* Dyar, the pink boll worm of cotton in Trinidad.

### BLISTER MITES.

In the Santa Rita and also the Santa Catalina Mountains we found quite commonly a blister mite of the genus *Eriophyes*, to be described as new by Mr. Banks. The tiny eggs of this species are found in clusters like raspberries on the foliage in August. The mites are so numerous that their feeding causes the surface of the leaf to take on a fuzzy brown appearance. In Ventana Canyon many plants were found killed or almost so by this species which was abundant on both sides of every leaf and on the stems and

squares. It is of interest to note that a mite of this genus (*Eriophyes gossypii*) attacks cotton in Montserrat, St. Vincent, and St. Lucia of the West Indies.

LEAF GALL.

A species of Itonididæ (Cecidomyiidæ) is very common upon the plants in Stone Cabin Canyon. This insect oviposits in the midribs of the tiny leaves causing the leaves to form a sort of pocket-gall, but not preventing the leaf from completing its growth somewhat deformed. Within the walls of this gall the larva feeds. We have no Itonidid enemies of cotton in the United States but in the West Indies, *Contarinia gossypii* does considerable damage.

MEALY BUG.

A species of mealy bug (*Pseudococcus sp.*) was found on Thurberia near McCleary's Ranch in Stone Cabin Canyon on August 25. Between 20 and 25 specimens in all were collected and observed including two specimens of adult females. These insects were in most instances found inside rolls of the leaves evidently produced by the Itonidid maggots which are mentioned above. One of the full grown female specimens confined in a box without food gave birth to between fifteen and twenty larvæ within twelve hours. The two adults and several specimens one-half to three-fourths grown were kept in vials and fed upon Thurberia squares hoping to breed a sufficient supply for study. Later (after September 3) the insects were fed on Egyptian cotton squares at Phœnix. In all about fifty specimens were cared for but notwithstanding daily attention no more adults were bred and the mature females soon died.

It is suspected that the wild cotton mealy bug is the same as that found on *Gaertneria xanthocarpa* in Pima Canyon on August 23 and that the same species was found on *Thurberia* in Ventana Canyon on August 31. On October 1, Mr. O. C. Bartlett was unable to find any additional specimens on wild cotton in Ventana Canyon.

The following notes were made concerning the adult specimens: Length 5.5 mm., width 3 mm., color shining dark gray. Short marginal ribbons of wax increasing slightly in length, posteriorly. No conspicuous marginal spines. Newly born larvæ quiescent with wax filaments from the body of the adult among them making a loose cottony mass.

In one vial containing an adult female and larva mass a dipterous pupa appeared. This was bred out and proved to be a species of *Leucopis*.

Mr. Coad was able to carry this mealy bug on cotton leaves at Victoria for a month.

MISCELLANEOUS INSECTS BREEDING ON THURBERIA.

A very tiny leaf miner was found quite abundantly in all of the places where we found the plant. This species has not yet been bred, but is quite different from the ordinary cotton leaf miner.

A new species of *Bucculatrix* was found feeding on the leaves of Thurberia in all the places investigated, and at McCleary's Ranch in Stone Cabin Canyon, this species had found the three or four plants which had been grown there at an altitude of about 4000 feet. The tiny larva of this species spins an elongate white corrugated cocoon less than $\frac{1}{4}$ inch long. The species will be described by Mr. Busck. Specimens of this genus have been found on cotton in Mexico.

Another Lepidopterous larva, determined by Mr. Busck as *Dichomeris deflecta* Busck, makes a fold in the leaf by means of two or three silken threads, and feeds within this fold. It is very active and when its hiding place is disturbed quickly slips out. It pupates in its fold. It fed on cotton at Victoria, but Mr. Coad could not carry it through to maturity. It is parasitized by a species of Braconidæ.

A species of Geometridæ was very commonly found feeding on the foliage of Thurberia in Stone Cabin Canyon. Geometridæ are commonly found on cotton.

One beautiful yellow and brownish Bombycine larva was found feeding on a Thurberia plant in Stone Cabin Canyon. This was successfully bred by Mr. Coad and determined by Dr. Dyar as *Lirimiris truncata* H. S., a species new to the United States.

A species of *Ephestia* breeds in the bolls quite commonly. Only one specimen has so far been carried to maturity. This was determined by Dr. Dyar.

A very pretty yellow *Spilochalcis* was bred in May from bolls infested by the *Ephestia*, and is very probably a parasite of it.

Two species of Thysanoptera were found in Thurberia flowers. Several specimens of *Frankliniella insularis* Franklin, (*Euthrips*) determined by A. C. Morgan, were found in a flower in Stone Cabin Canyon. This species occurs in Mexico, at Brownsville, Texas, and in Barbados.

A Ptinid, *Prostephanus truncatus* Horn breeds abundantly in the dead stalks. One Cerambycid stalk-boring larva was also found in Stone Cabin Canyon.

A Scutellarid, *Aulacostethus marmoratus* Say was found commonly feeding and breeding on dead bolls of Thurberia.

Twice in Stone Cabin Canyon a species of Eucharidæ was observed ovipositing in apparently healthy squares. In one instance the sprig was gently plucked and transferred to a vial without disturbing the tiny insect and both of us observed its ovipositor in-

serted in the square. This specimen is described as a new species of *Chalcura* by Mr. Crawford.

At Victoria, Texas, Mr. Coad's Thurberia plants became heavily infested by *Aphis gossypii*,

MISCELLANEOUS VISITORS.

The majority of the miscellaneous insects visiting this plant were present for its nectar although some were predatory.

The Hemiptera should probably be included among the injurious insects, but no definite records of feeding were obtained against those not already mentioned. An *Aleyrodes* in the winged form was occasionally seen. Mr. Heidemann has determined the following species taken in Stone Cabin Canyon: *Lygæus bicolor* H. S., *L. lateralis* Dall, *Dendrocoris arizonensis* Barber, *Corizus punctatus* Signoret, *Notocyrtus* sp. and *Creontiades rubrinervis* Stal. From Thurberia in Pima Canyon we obtained *Lopidea confluens* Say and an *Empoasca*. A *Zelus renardii* Stal was collected in Ventana Canyon.

One small brown female Mantis, *Litaneutria obscura* Scudder, and two species of grasshoppers, *Barytettix neomexicana* Scudder, and a *Schistocerca* found only in nymphal stages, were taken in Stone Cabin Canyon, and the Barytettix was also on the plant in the Santa Catalina Mountains. These insects were determined by Mr. Caudell.

The following beetles determined by Mr. Schwarz were collected on *Thurberia* at Fish Creek, *Scymnus ardelio* Horn, two species of *Attalus*, one of them new, *Petalium bistriatum* Say and *Lema balteata* Le Conte. In Stone Cabin Canyon we took *Scymnus ardelio* Horn, *Hippodamia convergens* Guerin, *Thalassa montezuma* Mulsant, *Cryptorhopalum pumilum* Casey, *Chauliognathus profundus* Le Conte, and *C. obscurus* Schæffer, *Enoclerus abruptus* Le Conte, a species of *Hydnocera*, *Hymenorus rotundicollis* Casey, and *Epitragus fusiformis* Casey. This last mentioned species and the *Chauliognathus profundus* were very common on many plants.

Three species of Bruchus were found at the nectar in Stone Cabin Canyon, *Bruchis impiger* Horn, *B. amicus* Horn and *B. chiricahuæ* Fall. In Pima Canyon *Bruchus crenatus* Schæffer was collected.

Among the visitors at the nectar in Stone Cabin Canyon were three species of weevils, *Cyphus lautus* Le Conte, *Coleocerus dispar* Horn and *Læmosaccus texanus* Schæffer.

The Hymenoptera were abundant visitors at the nectaries and pollen. The bees have been determined by Messrs. Cockerell and Crawford, the ants by Dr. W. M. Wheeler, the wasps by Mr. Rohwer.

The ants were constant visitors on the plants. The following species were taken; *Myrmecocystus melliger* Forel, subsp. *orbiceps* Wheeler, *Formica rufibarbis* Fabricius var. *gnava* Buckley, *Cremastogaster opaca* Mayr var., *Camponotus bruesi* Wheeler, *Camponotus fallax* Nylander var., *Camponotus mina* Forel, subsp. *zuni* Wheeler var., and two species of *Pheidole*.

Among the bees were *Melissodes communis* Cresson and *Perdita mentzeliarum* Ckll. and a new species in each of these genera, and *Halictus mesillensis* Ckll. Professor Cockerell's notes follow this paper.

Mr. Crawford has determined the chalcids and finds seven species probably all undescribed. Two of these he presents in an accompanying paper. The yellow *Spilochalcis* and the *Chalcura* have already been mentioned. A beautiful black *Spilochalcis* was also taken in Stone Cabin Canyon, and in this same locality was found a species of *Habrocytus*. In Fish Creek Canyon we found a new species of *Perilampus*, a *Conura*, and a new species of *Rileya*, described in the accompanying paper.

Mr. Rohwer has determined the wasps to be a new species of *Tiphia*, two species of *Paratyphia*, and has also determined a Braconid of the genus *Monogonogastra*. A specimen of *Polistes bellicosus* Cresson was taken at nectar and was found to be parasitized by a *Xenos*.

Outside of two notices of the boll weevil on *Thurberia*[1] this is the first paper in which any insects are recorded from the plant. It is therefore of interest to note that this paper mentions 83 different species in 8 orders of Insecta and one of Acarina. The species are distributed as follows, Acarina 1, Hemiptera 14, Orthoptera 3, Thysanoptera 2, Lepidoptera 7, Coleoptera 24, Hymenoptera 29, Diptera 2, and Strepisptera 1.

These insects may be classed as injurious 25, nectar visiting 40, parasitic 12, and predaceous 6, in their purposes of visiting the plant.

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## STUDIES OF THE ARIZONA THURBERIA WEEVIL ON COTTON IN TEXAS.

By B. R. Coad and W. D. Pierce, *Bureau of Entomology.*

In order to establish the taxonomic status of the weevil breeding in Arizona in the squares and bolls of *Thurberia thespesioides* a number of studies have been undertaken. In connection with these studies individuals of both sexes of the Arizona and Texas

[1] Cook, 1913, Science, February, 1913.
Pierce, 1913, The occurrence of cotton boll weevil in Arizona, Journ. Agr. Research, I, no. 2, pp. 89–96, pl. VI.

varieties were taken to Stockholm, Sweden, by Mr. A. N. Caudell, and compared with the type of *Anthonomus grandis*. On account of Mr. Caudell's careful comparison the usual form of this species, known as the Mexican cotton boll weevil, must be known as *Anthonomus grandis grandis* Boheman and the Arizona wild cotton, or Thurberia weevil, as *Anthonomus grandis thurberiæ* Pierce.[1]

The experiments described in this paper have been carried out along several different lines. The principal results have been the ascertaining of the ability of the two varieties to interbreed and produce fertile offspring, and the working out of the developmental period for certain seasons of the year.

The first weevils were obtained from the Santa Rita Mountains, Arizona, in May, 1913, and were extracted from their cells in the Thurberia bolls, at Washington about May 15, and then shipped with fresh Hibiscus foliage to Victoria, Tex., where they were received May 20. A second sending was received from the same locality in Arizona about September 1.

The weevils extracted in May were divided into three lots, the first being male and female *thurberiæ*, the second *thurberiæ* females placed with *grandis* males, the third *grandis* females placed with *thurberiæ* males.

Three pairs of typical *thurberiæ* were placed on cotton but they did not take readily to the new food plant. Only eight eggs were deposited and these by a single pair. From the eight eggs just two weevils matured. The period of development was 19 days, identical with that for typical *grandis* at that season. In 83 weevil-feeding days, 60 feeding punctures were made, or 0.7 per day with 3 the maximum. In 30 weevil-oviposition days, only 8 eggs were laid, or 0.2 per day.

Inasmuch as the *thurberiæ* individuals received in May were together, there was a possibility of fertilization. They had just been extracted from their hibernation cells and had not fed when received at Victoria. In the experiment with female *thurberiæ* and male *grandis* no eggs were laid by either female until June 2, 12 days after being placed with the *grandis* males. Copulation was observed in one pair on the second day of the experiment. Each pair was actually observed in copula three times and the actual number of copulations was probably considerably greater. In 161 weevil-feeding days, 461 feeding punctures were made, with the average per individual 2.8 per day. In 64 weevil-oviposition days 245 eggs were laid, with an average of 3.8 per day and a maximum of 10. Eggs were obtained from June 2 to July 3 from these two females. The offspring were bred from June 26

[1] Journ. Agric. Research, vol. 1, no. 2, November, 1913.

to July 16. The average period of development to maturity ranged from 16 days from eggs laid June 6 to 12.4 days from eggs laid June 26. The offspring numbered 20 males and 20 females.

In the third series the males of *thurberiæ* were placed with hibernated females of *grandis* collected in the field. These females were already fertile as they began oviposition almost immediately. In 200 weevil-feeding days, 454 feeding punctures were made, with the average per individual 2.2 per day. In 94 weevil-oviposition days 717 eggs were laid with the average 7.6 eggs per day and a maximum of 16. Eggs were obtained from May 22 to July 7. The offspring were bred from June to July 20. The average period of development to maturity ranged from 20 days for eggs laid May 28 to 12 days for eggs laid June 6. The offspring numbered 137 females and 145 males.

The weevils with the female *thurberiæ* strain in the second series averaged day for day a fraction of a day shorter developmental period than the offspring of the female *grandis* which may have had a male *thurberiæ* strain in the latter part of the experiment.

The offspring of the male *grandis*, female *thurberiæ* breedings were interbred. In 22 weevil-oviposition days 179 eggs were laid, with an average of 8.1 per day and a maximum of 15. Eggs were obtained from July 2 to 17 and the offspring were bred from July 16 to 28. The average period of development to maturity ranged from 15 days for eggs laid July 3, to 11 days for eggs laid July 15. The offspring numbered 12 females and 20 males.

The offspring of the male *thurberiæ*, female *grandis* breedings were interbred. In 72 weevil-oviposition days, 253 eggs were laid, with an average of 3.5 per day and a maximum of 15. Eggs were obtained from June 24 to July 11 and the offspring were bred from July 7 to 22. The average period of development to maturity ranged from 11 to 18 days. The offspring numbered 32 females and 25 males.

A comparison of average development dating from 5 day oviposition periods is available in five combinations for July 1 to 5. The offspring of native *grandis* took 12.1 days; of female *grandis* by male *thurberiæ* 12.4 days; and of the male and female offspring of the female *grandis*, male *thurberiæ* combination 14.9 days; of female *thurberiæ* by male *grandis* 12.6 days; and of the male and female offspring of the female *thurberiæ*, male *grandis* combination 14.2 days. The accompanying table (Table I) gives the complete record.

In September more material was received from Arizona. Complete studies of this material have not been made but the following results have already been obtained (see Table II).

TABLE I. *Summary of average development from 5-day oviposition periods.*

| Date of oviposition | Developmental period from eggs deposited by: Typical *grandis* | Male *thurberiæ* female *grandis* | Male *thurberiæ* female *grandis* | Typical *thurberiæ* | Male *grandis* female *thurberiæ* | Male *grandis* female *thurberiæ* |
|---|---|---|---|---|---|---|
| | *days* | *days* | *days* | *days* | *days* | *days* |
| May 27–31 | | 17.6 | | 19 | | |
| June 1–5 | | 15.8 | | | | |
| June 6–10 | 15.7 | 16.0 | | | 16.0 | |
| June 11–15 | 15.2 | 14.9 | | | 13.8 | |
| June 16–20 | 14.8 | 12.4 | | | 14.5 | |
| June 21–25 | 14.2 | 12.6 | 13.0 | | 13.4 | |
| June 26–30 | 14.4 | 12.4 | 13.0 | | 12.4 | |
| July 1–5 | 12.1 | 12.4 | 14.9 | | 12.6 | 14.2 |
| July 6–10 | | 12.4 | 14.0 | | | 14.3 |
| July 11–15 | | | | | | 13.8 |
| Weighted average | 14.4 | 14.4 | 13.6 | 19 | 13.3 | 14.3 |

TABLE II. *Summary of average development from eggs laid on same day.*

| Date of oviposition | Developmental period from eggs deposited by: Typical *grandis* | Typical *thurberiæ* | Male *grandis* female *thurberiæ* | Male *thurberiæ* female *grandis* |
|---|---|---|---|---|
| September 2 | 16.5 | 16 | | |
| September 3 | 15.6 | 18 | | |
| September 4 | 15.0 | 17 | | |
| September 5 | 18.0 | 19 | | 18 |
| September 6 | | 16 | | |
| September 7 | 20.5 | 16 | 18.5 | |
| September 8 | 18.0 | 17 | | |
| September 9 | 20.0 | | 18.6 | |
| September 10 | | 19 | | 19.5 |
| September 11 | | | | 19.7 |
| Average | 17.9 | 17.2 | 18.5 | 19.0 |

Male *grandis* were placed with female *thurberia* which were isolated when extracted from their 1912 pupal cells in the latter part of August. The three females thus used began oviposition in 2, 2 and 4 days after being placed with the males on cotton squares. During the month of September they deposited 87, 92 and 137 eggs each, with an average of 3.5 eggs per female per day. The developmental period of the progeny determined up to October 1 averaged 18.5 days for 4 males and 3 females, all unusually small.

Male *thurberiæ* were placed with known infertile female *grandis* and these deposited, during September, 79 and 25 eggs each, with an average of 1.9 eggs per female per day. The developmental period of the progeny determined to October 1 averaged 19 days for 5 females and 5 males.

Typical *thurberiæ* pairs were placed on cotton squares and bolls. The development in bolls has not yet been determined but is successful. On squares the females deposited during September, 71, 71, 90 and 171 eggs each, with an average of 4.5 eggs per female per day, which was better than the average in either cross. The developmental period of the progeny determined to October 1 averaged 17.2 days for 7 females and 12 males.

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——In discussing the two preceding papers Mr. Hunter referred to the biological and possible economic importance of the observations that had been made.

It has been known for a long time that the principal barrier the cotton boll weevil encounters in the United States is dryness of climate. This has prevented the invasion of important cotton producing areas in western Texas. The Arizona weevil has evidently acquired an ability to withstand such conditions. This is a strong indication of the plasticity of the species. Another indication of this is the fact that the Arizona weevils adapted themselves perfectly to the conditions of the humid country at Victoria, Texas, as soon as they were transported to that place, and is further evidenced by the ready change from *Thurberia* to cotton when transported to a new region.

The ability of the Arizona weevil to maintain itself in the face of extremely arid conditions shows its possible great economic importance. If it should by accident, or otherwise, be established in the arid country of western Texas it would probably maintain itself. If this should happen there would be a continuous

infestation of the cotton belt by weevils from the extreme west to the east. In this way the production in western Texas which has been generally considered to be sufficient to offset any great reduction of the crop in the eastern part of the belt on account of the ravages of the weevil could not be depended upon. This consideration is of special importance on account of the fact that production in the western part of the belt has been considered sufficient to enable the United States to continue its supremacy in cotton production regardless of an extensive falling off in production elsewhere.

——Dr. Hopkins stated that the fact that the two forms interbreed in confinement is not sufficient evidence that they are the same species. If they are the same, they should be included under the name *grandis;* otherwise the Arizona form should be designated as a species under a new name.

He entered a protest against trinomials for so called varieties and sub-species, arguing that if a form can be readily recognized it should be considered a species as long as it can be so distinguished. If it should enter the range of an allied species from which it cannot be readily separated, the prior name should be applied to both.

It seemed to him that if the Arizona form becomes established in the *grandis* area and inter-breeds in nature, they should both, including varieties, come under the name *grandis*, but as long as the Arizona form is restricted to its present known area, it should be recognized as a good species under the name *thurberiæ*.

——Dr. Howard referred to the observations mentioned by Mr. Pierce, of the oviposition of *Chalcura* in the flowers of *Thurberia*. The only Eucharid whose life history is known is a parasite of ants; hence, the oviposition of *Chalcura* in the flowers of wild cotton is a puzzle. Inasmuch, however, as *Orasema* has been shown by Wheeler to have a hypermetamorphosis, and as *Perilampus* of an allied family has been shown by Harry Smith also to undergo a hypermetamorphosis, the speaker suggested that in all probability *Chalcura* may eventually be shown to have an active larva of the first stage which will be capable of attaching itself to bees frequenting the wild cotton flowers and thus be carried to their nests where it will attack their larvæ.

——Mr. Hood stated that the thrips taken by Mr. Pierce on *Thurberia* should be known as *Frankliniella insularis* (Franklin), and that the genus *Euthrips* Targioni-Tozzetti, in which it had been placed, is used by the best workers in the stead of *Anaphothrips* Uzel. In addition to the localities mentioned, *Frankliniella insularis* has been recorded in the literature from Brownsville, Texas (Russell, Proc. Ent. Soc. Wash., vol. xiv, p. 128; 1912); Monterey, Mexico; and Miraflores, Canal Zone, Panama (Hood, Psyche, vol. xx, p. 119, 1913). It has also been taken at Georgetown, British Guiana, by Messrs. G. E. Bodkin and L. D. Cleare, and has been found by Mr. Alex. Wetmore in the stomach of a Green Mango Humming Bird (*Anthracothorax viridis*), taken at Utuado, Porto Rico (Biological Survey, No. 105072).

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## TWO NEW PARASITIC HYMENOPTERA FROM ARIZONA.

By J. C. Crawford, *U. S. National Museum.*

**Rileya piercei** n. sp.

*Male.* Length about 2 mm. Black, with the femora except tips black and a broad annulus on hind tibiæ, brown; sculpture about as in *R. cecidomyiæ* but the second abdominal segment occupying most of abdomen. In *cecidomyiæ* the first and second are short and the third and fourth are almost subequal in length.

Described from one specimen collected on *Thurberia thespesioides*, August 19, 1913, at Fish Creek, Arizona, by Mr. W. D. Pierce, after whom the species is named.

*Type:* Cat. No. 16701, U. S. N. M.

**Chalcura arizonensis** n. sp.

*Female.* Length about 3 mm. Black, with the sculpture about as in *C. gibbosa* Prov. but the dentation on the second joint of the funicle as long as on the first; pedicel concolorous with the funicle instead of light; the transverse rugæ at the inner edge of the lateral lobes of mesoscutum extending on to the shiny disks and these rugæ not so greatly elevated as in *gibbosa*.

Described from one specimen collected by Mr. W. D. Pierce in Stone Cabin Canyon, Santa Rita Mountains, Arizona, August 25, 1913, and with the additional record "ovipositing in bud of *Thurberia thespesioides*."

*Type:* Cat. No. 16702 U. S. N. M.

## TWO MICROLEPIDOPTERA ON THURBERIA THESPESIOIDES.

By August Busck, *Bureau of Entomology.*

**Dichomeris deflecta** Busck, Proc. Ent. Soc. Wash., vol. xi, p. 91, 1909.

This peculiar species was described from a single specimen from Arizona. The very long, porrected, compressed palpi with the short, deflected terminal joint are unlike those of any other species in the genus, but this is a difference of degree rather than of kind. The species is otherwise typical of the genus *Dichomeris* and is properly included therein.

The larva is a leaf-folder on *Thurberia thespesioides* and was bred by Mr. W. D. Pierce, at Santa Catalina Mountains, Arizona. The imago issued August 24, 1913. The following is a description of the larva.

Head and first thoracic segment dark reddish brown; eyes and mouth parts black; anal plate large, black, with long black bristles. Remainder of the body white, with four straight, longitudinal rows of large, round, black tubercles, two dorsal and two lateral. There are two such tubercles on each segment in each row, and on account of their size, they are nearly confluent longitudinally. Between these rows of tubercles run a central and two lateral, thin, purplish, longitudinal lines. Below the lateral rows of tubercles each abdominal segment has two more, smaller, oval, brown tubercles, set obliquely. Each tubercle bears a single long, light colored hair. Thoracic feet black, prolegs white, each with an anterior and a posterior row of long brown hooks.

**Bucculatrix thurberiella** n. sp.

Face tuft, head and thorax white. Antennæ white with dark fuscous annulations. Forewings white; extreme costal edge blackish; an outwardly black streak beyond the middle of costa is continued as a very fine, easily lost line across the wing to a group of black scales below apex, where the cilia is also dotted with black; a few easily lost black scales on basal third of dorsum and a group of black scales on the middle of dorsum is followed by scattered light brown scales. The apical part of the wing above the oblique costal streak is dusted with brown and black scales. Cilia ochreous white. Hind wing and cilia ochreous white. Legs white on the inner side, black exteriorly; tarsi black with narrow white annulations. Alar expanse: 7 to 8 mm.

*Habitat:* Santa Catalina Mountains, Arizona.
*Type:* No. 16699, U. S. N. M.
Bred by Mr. Pierce from *Thurberia thespesioides*, in August and September.
The larva is dirty white, rough skinned, with prominent, white

tubercles and with two dorsal rows of black dots, one on each segment. Head light ochreous with black eye spots and reddish brown mouth parts.

Cocoon ribbed, typical of the genus, pearly white, length 8–9 mm.

## BEES VISITING THURBERIA.

By T. D. A. Cockerell.

In August, 1913, Mr. W. D. Pierce collected bees from the flowers of *Thurberia thespesioides* Gray, in Stone Cabin Canyon, Santa Rita Mountains, Arizona. This plant, given in the Synoptical Flora as a synonym of *Ingenhouzia triloba* D. C., is so near to *Gossypium* that it was once described under that generic name. On this account any insects frequenting it are of more than ordinary interest. The bees collected are as follows:

**Melissodes thurberiæ** n. sp.

*Female.* Closely allied to and resembling *M. thelypodii* Ckll., to which it runs in my table in Trans. Amer. Ent. Society, 1906. It differs from *thelypodii* by the pale hair of thorax above (which agrees in character and arrangement with that of *M. martini*, except that there is no black hair); the wings darker and redder; the tegulæ piceous, with the posterior margin broadly ferruginous; scutellum with a slight median longitudinal ridge.

The disc of mesothorax has considerably smaller and closer punctures than *M. martini* Ckll., and they run principally in transverse lines. The same characters, and the dark tegulæ, readily distinguish it from *M. hitei* Ckll.. Although the hair of thorax above is creamy white, there is a little orange tuft on base of wings. White hair appears at extreme sides of fifth abdominal segment, whereas in *M. hitei* the hair in this place is black. Head very broad; vertex in type with only one dark hair. Length of anterior wing $11\frac{1}{3}$ mm.

*Type:* Cat. No. 16845, U. S. N. M.. Collected on August 26.

**Melissodes communis** Cresson.

*Female.* Differs from a cotype by smaller size, and darker stigma and nervures. The single specimen is in bad condition; probably a series, well preserved, would indicate a distinct subspecies. Collected August 25.

**Perdita mentzeliarum** Ckll.

I cannot distinguish these from the variable species *P. mentzeliarum*, which usually visits *Nuttalia* (*Mentzelia* Auctt.). Perhaps they are strays from adjacent *Nuttalia* flowers. Two female specimens August 27.

**Perdita punctifera** n. sp.

*Female.* Runs in my table in Proc. Phila. Acad., 1896, to *P. mentzeliæ* Ckll., to which it is nearly related, differing by the white lateral face marks being longer, and sharply pointed above, though notched on inner side (they are like those of *P. pallidior* Ckll.); the clypeus with a small white spot, more or less distinctly triangular, on its upper margin; the light color of the antennæ creamy-white instead of yellow. From *P. pallidior* it is easily known by the heavily banded abdomen and largely darkened legs, both characters being as in *mentzeliæ*.

*Type:* Cat. No. 16844, U. S. N. M. Three specimens collected on August 27.

Certainly this insect is very close to *P. mentzeliæ*, and from its combination of characters one might suppose it to be a hybrid, *mentzeliæ* × *pallidior*, were those species present. Further investigation of the series of species to which this belongs will, I believe, elicit some facts of great interest. The differential characters may behave in a Mendelian manner in hybrids, and some of the apparently distinct species may represent the results of earlier crosses.

The Thurberia bees certainly do not show any great degree of modification or specialization. The impression gained is that *Thurberia* may have entered the region within comparatively recent times, its bee-fauna being apparently in the earliest stages of differentiation. It is singular that we do not find the bees which habitually occur on other Malvaceæ in the southwest.

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——In connection with the papers on the Thurberia weevil Mr. Barber spoke of two of his breeding experiments and has furnished the following abstract of his remarks.

## ON INTERSPECIFIC MATING IN PHENGODES AND INBREEDING IN EROS. (COLEOPTERA.)

By Herbert S. Barber, *Bureau of Entomology.*

The results of an experiment started in 1912 show some contrast to the results of Messrs. Coad and Pierce in interbreeding the Thurberia and Cotton Boll Weevils, but the writer does not believe that the mere interbreeding of forms proves their specific identity. A few females of a species of *Phengodes* were received through Mr. Charles Schæffer from Long Island, and there being no males of the same species at hand were confined with males of our local species *P. laticollis*. The two species appear to live in different types of

country, and to be easily distinguished in the male, female and larval stages. Several males were confined, one after the other, with each female. Usually, when a male *laticollis* is introduced into a jar with a female of its own species, mating occurs very quickly, but with the females of this other species most of the males failed to recognize the female, and only in a few instances displayed sexual excitement, which was of short duration except in two cases. One of these males attempted copulation a few times without success, while the other succeeded after many fruitless attempts, but displayed great difficulty in disengaging himself afterward. This female that had been fertilized laid eggs in due time. The other was restless and abnormal in actions, but laid three infertile eggs, and finally died. All the other females died without laying eggs. Of the 48 eggs laid by the fertilized female, many were infertile. In others the embryo developed but failed to issue, and only ten larvæ hatched. Of these most were very badly deformed and unable to feed. Two of them, however, fed and have lived fifteen months in confinement. They display the specific characters of the male parent. It appears from the above that in addition to the isolation of the two species by habitat the species are separated by (1) lack of sexual attraction, (2) mechanical difficulty in copulation, and (3) in some manner the fertilization is faulty and results in gross abnormalities. The writer believes that these two forms are very distinct species, but that chance migration of the males may, very rarely, result in interspecific unions, with a slight chance of the survival of hybrid offspring which would naturally be reabsorbed in the local species if it should prove to be fertile.

The question of sexual attraction even within a single species is in itself a very interesting and important question. We are, of course, utterly unable to detect the difference in odors or other factors by which one sex recognizes the opposite sex of its own kind, and is stimulted to sexual excitement while with another species the stimulus may be absent or repulsive. Some groups are sexually mature as soon as they have hardened after issuance from the pupa, and mate with their own brothers or sisters, but most appear to have some obstacle that prevents breeding. The first group are usually somewhat degraded and are inclined to form numerous local races or color forms. An example of this group is *Eros humeralis* of which the following brief observation is significant:

From a colony of larvæ found last spring (1913) in a rotten sycamore log, the individuals were isolated in plaster cells where they pupated and matured. The adults showed no desire for migration but lay quiet in the cells. A male was introduced into a cell

with a female and immediately mated. Next day he was placed with another female and immediately mated. Both females deposited eggs, and the young began feeding in the wood, but the female parents at no time displayed a desire for a migration flight. It is believed the colony was originally from a single set of eggs and that more than two generations would have been passed within the log in nature.

In the second group the "provisions" against, or obstacles to inbreeding assume varied forms. Usually the ratio chance of unions between brothers and sisters to unions between unrelated individuals, is so low that the offspring would be quickly reabsorbed into the normal form, but the details of habit that control this low percentage may be varied. Chief of these is the instinct for migration, which appears to precede sexual maturity in many social insects, but there appears to be also a remarkable difference in time of development of the opposite sexes among the progeny of a single parent of some species. The writer believes from preliminary experiments, that in *Phengodes* the males develop after two years in the larval stage, while their sisters must spend three or more years as larvæ. In this genus the males are strong migrants while the females must lay their eggs where they have transformed. The writer has shown that in *Micromalthus* the males issue about two weeks after their sisters are out, but subsequent observations indicate that males issue abnormally or irregularly at times. Attempts to mate specimens from different colonies in the breeding cells all failed, and as both males and females manifested only a desire to migrate from the time of their issuance almost until death, it is believed sexual maturity will develop only after such migratory flight.

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## ON THE PROPER GENERIC NAMES FOR CERTAIN THYSANOPTERA OF ECONOMIC IMPORTANCE.

By J. Douglas Hood, *United States Biological Survey.*

The tobacco thrips, the pear thrips, and the orange thrips—species responsible in the United States for damage amounting to many thousands of dollars every year and each the subject of several published accounts—are at present wrongly placed in the genus *Euthrips* Targioni-Tozzetti by all North American workers. The purpose of this paper is to correct the generic positions of these and other allied species and to direct attention to several papers which have been overlooked in America, that the proper names for these insects may be used in the rapidly-growing economic literature.

To this end the present account is divided into three parts: first, a brief, general discussion of the nomenclature of the several groups of species which have masqueraded under the name *Euthrips*; second, a catalogue of the American components of the genera to which these species, in the light of our present knowledge, actually belong; and, third, a bibliography of all papers necessary to a proper study of these problems. To the papers by Buffa (1907) and Karny (1912) I am particularly indebted for many of the points brought out below.

Probably no other genus of Thysanoptera has presented more difficult questions of nomenclature, nor disclosed more diverse opinions regarding its proper application, than the genus *Euthrips* Targioni-Tozzetti. It was proposed in 1881 as a substitute for the name *Thrips* which has been used by Haliday (1836) for a subgenus of *Thrips* Linné (1758),—evidently for no better reason than to avoid the duplication of the generic name in a subgenus. Haliday divided Linné's genus *Thrips* into the five subgenera, *Aptinothrips*, *Chirothrips*, *Limothrips*, *Belothrips*, and *Thrips* s.s., of which the first four were new. Targioni-Tozzetti accepted the division of the genus into five subgenera and, except for a few slight changes, reproduced Haliday's key in Italian. The only important change was the employment of the subgeneric name *Euthrips* in the place of *Thrips*. That he proposed *Euthrips* in the sense of *Thrips* s. s., is shown by: (1) its derivation (from $\epsilon\dot{\upsilon}$, *true* or *well* + $\theta\rho\dot{\iota}\psi$); (2) the placing of *Thrips* in its synonymy in two places; (3) the fact that he does not use the subgeneric name *Thrips*; and (4) the inclusion in *Euthrips* of the species which Haliday assigned to the subgenus *Thrips*. This suppression of the subgenus *Thrips* is in direct opposition to Article 9 of the International Code of Zoological Nomenclature, which reads as follows: "If a genus is divided into subgenera, the name of the typical subgenus must be the same as the name of the genus." Article 31 of the Entomological Code (Banks and Caudell, 1912) is equally explicit. It is evident, therefore, that *Euthrips* Targioni-Tozzetti (1881) is an absolute synonym of the genus *Thrips* Linné (1758), and isogenotypic therewith.[1] *Euthrips, therefore, can never be used as a generic name in zoology.*

Karny (1912) and Buffa (1907), by a different course of reasoning, retain *Euthrips* as a valid generic name, and use it in the place of *Anaphothrips* Uzel. According to them, the type of *Euthrips* must be chosen from one of its three originally included species. This contention I have shown to be at fault, for the name was erected as a substitute for a perfectly valid older name which was

[1] The type of *Thrips* Linné (1758) was designated as *T. physapus* L. by Westwood in 1840.

cited in its synonymy. *Anaphothrips* is thus restored in the sense of *Euthrips*, Karny (nec Targioni-Tozzetti), and its type hereby designated as *Thrips obscura* Müller (=*Thrips striata* Osborn=*Anaphothrips virgo* Uzel).

In the place of *Euthrips* the European workers for many years used the name *Physapus* De Geer (or *Physopus*, as emended by Uzel). This name was first used by De Geer in 1744, before the appearance of Linné's Systema Naturæ, and is thus without standing in zoological nomenclature. In 1773 De Geer cited his earlier paper, but accepted Linné's name *Thrips* (1758). Hence the name *Physapus* can not date from this use by De Geer in 1773. Opinion 5, rendered by the International Commission on Zoological Nomenclature, covers this point in the following words: "A pre-Linnæan name, ineligible because of its publication prior to 1758, does not become eligible simply by being cited or reprinted with its original diagnosis after 1757. To become eligible under the Code, such names must be reinforced by adoption or acceptance by the author publishing the reprint." A ruling to this effect is also incorporated in the Entomological Code. *Physapus*, then, must date from its definition by Amyot and Serville in 1843, this being its first adoption in literature subsequent to 1758. The name is preempted, however, by *Physapus* Leach (1830?,see Bibliography), a genus of Ephemerida. *Physopus*, Uzel (1895), is also unavailable, being simply an emended spelling of the older name. *Physapus, therefore, can not be used as a generic name in Thysanoptera.*

The literature previous to 1907 furnishes only two names that may be used for the mutually homogeneous segregates of this old genus *Physapus* (=*Euthrips*, auctores, nec Targioni-Tozzetti). These are *Taeniothrips* Amyot et Serville (type, *Thrips primula* Haliday) and *Odoniothrips* Amyot et Serville (type, *Thrips phalerata* Haliday), both erected in 1843.

To the former of these belongs *Euthrips pyri* Daniel, the pear thrips. It is positively congeneric with *T. primula* (Haliday), and even under the microscope might easily be mistaken for that species. *Primula* differs from *pyri* principally in that the apical antennal segments are much more slender and the anterior vein of the fore wings is set with three spines, instead of five, in its apical half.

To *Odontothrips* must be assigned two North American species commonly listed in *Euthrips*. These are *Euthrips ulicis californicus* Moulton, described as a variety of Haliday's *Thrips ulicis*; and *Thrips phalerata* Haliday, recently recorded by Morgan (1913) from Florida under the name *Euthrips phalerata*.

This disposes of three of the twenty-two species of "*Euthrips*" recorded from North America. Of the remainder, one, *Euthrips*

*citri* Moulton, the orange thrips, belongs in the genus *Scirtothrips* Shull (1909). This genus was compared at the time of its original description with *Anaphothrips* Uzel, to which, however, it is not at all closely related. The most casual observation under high magnification shows the thorax of all the known species to be finely and closely transversely striate and the abdomen to be clothed more or less completely with minute, hair-like, chitinous processes. These characters ally it rather closely to *Scricothrips* Haliday, from which it differs notably in the more sparsely spinose anterior vein of the fore wing. As in *Scricothrips*, the species are active jumpers, and in life or when mounted dry have a dull, silky luster. To *Scirtothrips*, therefore, in addition to the type species *ruthreni* Shull and *S. niveus* Hood, must be assigned *Euthrips citri* Moulton (the orange thrips), *Euthrips longipennis* Bagnall (=*Euthrips parvus* Moulton), *Anaphothrips albus* Jones, and a sixth species whose description by the writer will probably appear elsewhere before the publication of the present paper.

Thirteen additional species, all but two of which were described in *Euthrips* by American authors, really belong with *Frankliniella stylosa* Hood in the genus *Frankliniella* Karny (1910), which was erected at the instance of Franklin (1908) as a substitute for *Physapus*, Karny (nec Amyot et Serville). As the type of this genus has never been fixed, I hereby designate *Thrips intonsa* Trybom (=*Physopus vulgatissima*, Uzel, nec Haliday) as the genotype. The North American species belonging here are enumerated in the catalogue below.

The five remaining species (*Euthrips albus*, *E. ehrhorni*, and *E. orchidii*, Moulton; and *E. costalis* and *E. longirostrum*, Jones) may all be placed for the present at least, in *Physothrips* Karny (1912). Only one of these, *Euthrips orchidii* Moulton, is in the material before me; it seems to be congeneric with *Physothrips ulmifoliorum* (Haliday), the type of genus.

## CATALOGUE.

No attempt has been made to cite every reference to the several species, only those being given which are of especial interest to the taxonomist.

### FRANKLINIELLA Karny, 1910.

*Thrips*, *Physapus*, *Physopus*, and *Euthrips*, auct.

*Frankliniella* Karny, Mitteil. Naturw. Ver. Univ. Wien, Jahrg. VIII, p. 46 (type, *Thrips intonsa* Trybom, = *Physopus vulgatissima*, Uzel, nec Haliday, herein designated).

1. *bispinosa* (Morgan); *Euthrips tritici* var. *bispinosus* Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 10, figs. 17–18.

2. *cephalica* (Crawford); *Euthrips cephalicus* Crawford, Pomona Coll. Journ. Ent., vol. II, 1910, p. 153, fig. 63, A–H; *Frankliniella cephalica*, Karny, Zool. Ann., vol. IV, 1912, p. 335.
3. *floridense* (Morgan); *Euthrips floridensis* Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 5, figs. 9–12.
4. *fusca* (Hinds); *Euthrips fuscus* Hinds, Proc. U. S. Nat. Mus., vol. XXVI, 1902, p. 154, pl. IV, figs. 40, 41; *Euthrips nicotianæ* Hinds, Proc. Biol. Soc. Wash., vol. XVIII, 1905, p. 198; *Frankliniella fusca*, Karny, Zool. Ann., vol. IV, 1912, p. 335; *F. nicotianæ*, idem, ibidem, p. 336.
5. *gossypii* (Morgan); *Euthrips gossypii* Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 9, figs. 19–22.
6. *helianthi* (Moulton); *Euthrips helianthi* Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 40, pl. IV, figs. 26–29; *F.* [*rankliniella*] *helianthi*, Karny, Zool. Ann., vol. IV, 1912, p. 336.
7. *insularis* (Franklin); *Euthrips insularis* Franklin, Proc. U. S. Nat. Mus., vol. XXXIII, 1908, p. 715, pl. LXIII, figs. 1–3, 5–7, pl. LXV, figs. 19, 24; *Euthrips insularis* var. *reticulata* Crawford, Pomona Coll. Journ. Ent., vol. I, 1909, p. 116 (a worthless variety); *Frankliniella insularis*, Karny, Zool. Ann., vol. IV, 1912, p. 334.
8. *minuta* (Moulton); *Euthrips minutus* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 56, pl. IV, figs. 32, 33; *Euthrips minutus* var. *sejosus* Crawford, Pomona Coll. Journ., Ent., vol. I, 1909, p. 105, fig. 47, A–G (a worthless variety); *Frankliniella minuta*, Karny, Zool. Ann., vol. IV, 1912, p. 335.
9. *tritici* var. **moultoni, nom. nov.**; *Euthrips tritici californicus* Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 28; preempted[1] by *Euthrips ulicis californicus* Moulton, 1907, = *Odontothrips ulicis californicus* (Moulton).
10. *nervosa* (Uzel); *Physopus nervosa* Uzel, Mon. d. Ordn. Thys., 1895, p. 102; *Thrips* (*Euthrips*) *maidis* Beach, Proc. Iowa Acad. Sci., vol. III, 1896, p. 219; *Frankliniella nervosa*, Karny, Zool. Ann., vol. IV, 1912, p. 335.
11. *occidentalis* (Pergande); *Euthrips occidentalis* Pergande, Ins. Life., vol. VII, 1895, p. 392; *Frankliniella occidentalis*, Zoöl. Ann., vol. IV, 1912, p. 335.
12. *runneri* (Morgan); *Euthrips runneri* Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 7, figs. 13-16.

[1] "Specific and subspecific names are subject to the same rules and recommendations, and from a nomenclatorial standpoint they are coordinate—that is, they are of the same value." (Article 11, International Code.) *Euthrips ulicis californicus* and *E. triciti californicus*, though both originally described as varieties, were written as trinomials, and thus brought within the scope of the above rule. The Entomological Code is more sweeping, specifying in Section 37 that, "In species, subspecies, varieties, or races, the same name shall not be used twice in the same genus."

13. *stylosa* Hood, Proc. Ent. Soc. Wash., vol. XIV, 1912, p. 134, pl. V, fig. 7.
14. *tritici* (Fitch); *Thrips tritici* Fitch, Country Gentleman, vol. VI, 1855, p. 385, figs. a–g; *Frankliniella tritici*, Karny, Zool. Ann., vol. IV, 1912, p. 335.

PHYSOTHRIPS Karny, 1912.

*Thrips*, *Physapus*, *Physopus*, and *Euthrips*, auct.
*Physothrips* Karny, Zool. Ann., vol. IV, 1912, p. 336 (type, *Thrips ulmifoliorum* Haliday, by designation).

1. *albus* (Moulton); *Euthrips albus* Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 39, pl. III, figs. 20–22, pl. IV, fig. 30; [*Physothrips*] *albus*, Karny, Zool. Ann., vol. IV, 1912, p. 340.
2. *costalis* (Jones); *Euthrips costalis* Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 13, pl. IV, figs. 1–4; [*Physothrips*] *costalis*, Karny, Zool. Ann., vol. IV, 1912, p. 344.
3. *ehrhornii* (Moulton); *Euthrips ehrhornii* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 54, pl. III, figs. 25, 26; *Euthrips ehrhornii*, Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 12 (description of male); *Physothrips ehrhornii*, Karny, Zool. Ann., vol. IV, 1912, p. 338.
4. *longirostrum* (Jones); *Euthrips longirostrum* Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 12, pl. III, figs. 6–9; *Physothrips longirostrum*, Karny, Zool. Ann., vol. IV, 1912, p. 344.
5. *orchidii* (Moulton); *Euthrips orchidii* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 52, pl. II, figs. 15–18; *Physothrips orchidii*, Karny, Zool. Ann., vol. IV, 1912, p. 339.

TÆNIOTHRIPS Amyot et Serville, 1843.

*Thrips*, *Physapus*, *Physopus*, and *Euthrips* auct.
*Tæniothrips* Amyot and Serville, Hist. Nat. des Ins., Hémiptères, 1843, p. 644.
———, Karny, Zool. Ann., vol. IV, 1912, p. 340 (type, *Thrips primula* Haliday, by designation).

1. *pyri* (Daniel); *Euthrips pyri* Daniel, Ent. News, vol. XV, 1904, p. 294; *Physothrips pyri*, Karny, Zool. Ann., vol. IV, 1912, p. 338.

ODONTOTHRIPS Amyot et Serville, 1843.

*Thrips*, *Physapus*, *Physopus*, and *Euthrips*, auct.
*Odontothrips* Amyot and Serville, Hist. Nat. des Ins., Hémiptères, 1843 p. 642.
———, Karny, Berl. Ent. Zeitschr., vol. LII, 1907, p. 45 (type *Thrips phalerata* Haliday, by designation).
———, Karny, Zool. Ann., vol. IV, 1912, p. 329.

1. *phaleratus* (Haliday); *Thr.* [*ips*] *phalerata* Haliday, Ent. Mag., vol. III, 1836, p. 447; *O.* [*dontothrips*] *phalerata*, Amyot and Serville, Hist. Nat. des Ins., Hémiptères, 1843, p. 643; *Odontothrips phaleratus*, Karny, Zool. Ann., vol. IV, 1912, p. 329; *Euthrips phalerata*, Morgan, Proc. U. S. Nat. Mus., vol. 46, 1913, p. 1, figs. 1–4.
2. *ulicis californicus* (Moulton); *Euthrips ulicis californicus* Moulton, Tech. Ser. No. 12, Pt. III, Bur. Ent., U. S. Dept. Agr., 1907, p. 55, pl. iii, fig. 27, pl. iv, figs. 28–31; *Odontothrips ulicis*, Karny, Zool. Ann., vol. IV, 1912, p. 329.

## Scirtothrips Shull, 1909.

*Scirtothrips* Shull, Ent. News, vol. XX, 1909, p. 222 (type, *S. ruthreni* Shull, monobasic).

*Anaphothrips* (pars), Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 15.

*Physothrips* (pars), Karny, Zool. Ann., vol. IV, 1912, p. 336.

*Scirtothrips* (pars), idem, ibidem.

1. *albus* (Jones); *Anaphothrips albus* Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 16, pl. iv, figs. 5–8; [*Scirtothrips*] *albus*, Karny, Zool. Ann., vol. IV, 1912, p. 334.
2. *citri* (Moulton), *Euthrips citri* Moulton, Tech. Ser. No. 12, Pt. VII, Bur. Ent., U. S. Dept. Agr., 1909, p. 121; *Physothrips citri*, Karny, Zool. Ann., vol. IV, 1912, p. 339.
3. *longipennis* (Bagnall); *Euthrips longipennis* Bagnall, Ann. Soc. Ent. Belg., vol. LIII, 1909, p. 173; *Euthrips parvus* Moulton, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., 1911, p. 38, pl. IV, figs. 23-25.
4. *niveus* Hood, Proc. Biol. Soc. Wash., vol. XXVI, 1913, p. 161.
5. *ruthreni* Shull, Ent. News, vol. XX, 1909, p. 222, figs. 2–4; *Anaphothrips ruthreni*, Jones, Tech. Ser. No. 23, Pt. I, Bur. Ent., U. S. Dept. Agr., 1912, p. 15.

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1758 von Linné, Carl, Systema Naturæ, Regnum Animale, ed. X, p. 457. Original description of the genus *Thrips*.

1773 De Geer, Carl, Memoires pour Servir a l'Histoire des Insectes, . vol. III, pp. 1–18, pl. I, figs. 1–13. *Physapus* De Geer (1744) cited as a synonym of *Thrips* Linné (1758).

1776 Müller, Otto Friedrich, Zoologicæ Daniæ Prodromus, seu Animalium Daniæ et Norvegiæ Indigenarum, p. 96. Original description of *Anaphothrips obscurus*.

1830 LEACH, WILLIAM ELFORD, Entomology. The Edinburgh Encyclopaedia, vol. IX, pp. 57–172 (Reprint?). The name *Physapus* proposed for a genus of *Ephemerida* on page 137. (Agassiz gives 1817 as the date of erection of *Physapus*, which was copied by Scudder; Hinds gives the following reference in his bibliography, "Leach, W. E., Amer. ed., New Edinburgh Encyclopaedia, VIII$_2$, 1816, p. 715"; other authors give dates ranging from 1814–1817. However, the paper was certainly published prior to 1813, the date of erection of *Physapus* Amyot et Serville.)

1836 HALIDAY, ALEXIS H., An Epitome of the British Genera, in the Order Thysanoptera, with Indications of a few of the Species, Ent. Mag., vol. III, pp. 439–451. The genus *Thrips* divided into five subgenera; original descriptions of *Odontothrips ulicis* and *O. phaleratus*.

1840 WESTWOOD, JOHN OBADIAH, Synopsis of the Genera of British Insects, pp. 1–158 (bound at end of vol. II of An Introduction to the Modern Classification of Insects. *Thrips physapus* L. designated as the type of *Thrips* Linné.

1843 AMYOT, CHARLES JEAN BAPTISTE, and SERVILLE, JEAN GUILLAUME AUDINET, Hist. Nat. des Insectes, Hémiptères, pp. 9 and 637–646. The genus *Physapus* De Geer revived; *Odontothrips* and *Taeniothrips* described as new.

1855 FITCH, ASA, The Wheat Thrips and Three-banded Thrips, Country Gent., vol. VI, pp. 385–386, figs. a–g. Original description of *Frankliniella tritici*.

1881 TARGIONI-TOZZETTI, GIOVANNI, Fisapodi, Annalli di Agricoltura, 1881, No. 34, Parte Scientifica, pp. 120–134, Tav. 3, figs. 14, 15a–15g. The subgenus *Euthrips* erected as a substitute for *Thrips* s.s.

1895 PERGANDE, THEODORE, Observations on Certain Thripidæ, Ins. Life, vol. VII, pp. 390–395. Original description of *Frankliniella occidentalis;* the name *Euthrips* used for the first time in the place of *Physapus*, a course later followed by Hinds.

1895 UZEL, HEINRICH, Monographie der Ordnung Thysanoptera, pp. 1–472, pls. I–X. *Physapus* emended to *Physopus*, with which is united *Taeniothrips* and *Odontothrips; Thrips obscura* Müller redescribed as *Anaphothrips virgo*.

1896 BEACH, ALICE M., Contributions to a Knowledge of the Thripidæ of Iowa, Proc. Iowa Acad. Sci., vol. III, pp. 214–227. Following Pergande the name *Euthrips* used in the sense of *Physapus; Frankliniella nervosa* (Uzel) redescribed as *Thrips* (*Euthrips*) *maidis*.

1902 HINDS, WARREN ELMER, Contribution to a Monograph of the Insects of the Order Thysanoptera Inhabiting North America, Proc. U. S. Nat. Mus., vol. XXVI, pp. 79–242, pls. I–XI. Following Pergande and Beach, the name *Euthrips* is used instead of *Physapus* Amyot et Serville (*Physopus*, Uzel, emend.); original description of *Frankliniella fusca; Thrips* (*Euthrips*) *maidis* Beach placed in the synonymy of *Physopus nervosa* Uzel.

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1907 Buffa, Pietro, Trentuna specie di Tisanotteri italiani, Atti d. Soc. Toscana d. Sci. Nat., Mem., vol. XXIII, pp. 1–77, Tav. I, II. The genus *Euthrips* discussed at length and clearly shown to have no relation whatever to *Physapus* Amyot et Serville.

1908 Franklin, Henry James, On a Collection of Thysanopterous Insects from Barbados and St. Vincent Islands, Proc. U. S. Nat. Mus., vol. XXXIII, pp. 715–730, pls. LXIII–LXV. Original description of *Frankliniella insularis*; the name *Physapus* declared unavailable for a genus of Thysanoptera.

1909 Moulton, Dudley, The Orange Thrips, Tech. Ser. No. 12, Pt. VII Bur. Ent., U. S. Dept. Agr., pp. I–II, 119–122, pl. VIII. Original description of *Scirtothrips citri*.

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1910 Crawford, David L., Thysanoptera of Mexico and the South. II, Pomona Coll. Journ. Ent., vol. II, pp. 153–170, figs. 63–70. Original description of *Frankliniella cephalica* and of its worthless "variety" *reticulata*.

1910–1913 Opinions [1–56] Rendered by the International Commission on Zoological Nomenclature, Smithsonian Institution, Washington, D. C., Publications 1938 (July, 1910), 1989 (October, 1910), 2013 (July, 1911), 2060 (February, 1912), and 2169 (May, 1913).

1910 KARNY, HEINRICH, Neue Thysanopteren der Wiener Gegend, Mitteil. d. Naturw. Ver. an. d. Univ. Wien, VIII Jahrg., pp. 41–57, Taf. V. Original description of the genus *Frankliniella*.

1911 MOULTON, DUDLEY, Synopsis, Catalogue, and Bibliography of North American Thysanoptera, with Descriptions of New Species, Tech. Ser. No. 21, Bur. Ent., U. S. Dept. Agr., pp. 1–56, pls. I–VI. Key to North American species of "*Euthrips*" (nec Targioni-Tozzetti); *Scirtothrips longipennis* redescribed as *Euthrips parvus*; original descriptions of *Frankliniella helianthi* and of *Physothrips albus*. The following names are omitted from the list of North American species:

1. Genus *Ctenothrips* Franklin.
2. *Ctenothrips bridwelli* Franklin.
3. *Anaphothrips secticornis* (Trybom).
4. *Anaphothrips longipennis* Crawford.
5. *Thrips lactucæ* Beach.
6. *Thrips trifasciatus* Ashmead.
7. *Phlœothrips caryæ* Fitch.
8. *Phlœothrips mali* Fitch.

1911 TRYBOM, FILIP, Physapoden aus Ägypten und dem Sudan, Results of the Swedish Zool. Exped. to Egypt and the White Nile, 1901, No. 19, pp. 1–16, Taf. I. *Physapus* declared a valid genus name in Thysanoptera.

1912 JONES, PAUL ROBERT, Some New California and Georgia Thysanoptera, Tech. Ser. No 23, Pt. I, Bur. Ent., U. S. Dept. Agr., pp. I–VI, 1–24, pls. I–VII. Key to North American species of "*Euthrips*" (nec Targioni-Tozzetti); *Scirtothrips* sunk as a synonym of *Anaphothrips*; *Physothrips costalis*, *Ph. longirostrum*, and *Scirtothrips albus* described as new.

1912 KARNY, HEINRICH, Revision der von Serville aufgestellten Thysanopteren-Genera, Zool. Ann., vol. IV, pp. 322–344 The genus *Thysothrips* erected; *Euthrips* used for the first time in the sense of *Anaphothrips* Uzel; an excellent synopsis of the known species of the various genera.

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1912 HOOD, JOSEPH DOUGLAS, Descriptions of New North American Thysanoptera, Proc. Ent. Soc. Wash., vol. XIV, pp. 129–160, pls. IV–VIII. Original description of *Frankliniella stylosa*.

1913 HOOD, JOSEPH DOUGLAS, Nine New Thysanoptera from the United States, Proc. Biol. Soc. Wash., vol. XXVI, pp. 161–166. Original description of *Scirtothrips niveus*.

1913 Morgan, Alfred Cookman, New Genera and Species of Thysanoptera, with Notes on Distribution and Food Plants, Proc. U. S. Nat. Mus., vol. 46, pp. 1–55, figs. 1–79. *Odontothrips phaleratus* (Haliday) recorded for the first time from North America; original descriptions of *Frankliniella bispinosa* (Morgan), *F. floridense* (Morgan), *F. gossypii* (Morgan), and *F. runneri* (Morgan), all of which were assigned to *Euthrips*.

## A NEW MITE FROM THURBERIA.

By Nathan Banks, *Bureau of Entomology.*

**Eriophyes thurberiæ** n.sp.

Body but little more than three times as long as broad, tapering but little behind; the cephalic plate rather narrow in front, with lines, and two rather long dorsal setæ. Abdomen with about fifty rings, plainly punctured; first ventral setæ fully as long as width of body, second pair not noticeable, third pair not as long as width of body, caudal setæ heavier, as long as twice width of body. Legs very short, hardly as long as one-half of width of body, last joint (fifth) nearly as long as preceding joint, but very much more slender, third joint about as long as fourth and fully as thick. Length, 140 $\mu$.

Inhabits much-folded gall on leaves of *Thurberia thespesioides*, near Tucson, Arizona (Pierce coll.).

ACKNOWLEDGMENT.

The Entomological Society of Washington is indebted to Entomological News through Dr. P. P. Calvert for the use of the plate from which the frontispiece of this number is printed.

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## ANNOUNCEMENT

Separates of all the important papers published in the PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON and a number from other journals are for sale at approximately two cents per page (no article less than ten cents). They can be had by applying to the Corresponding Secretary of the Entomological Society, U. S. National Museum, Washington, D. C. No receipt will be mailed for the sale of printed matter unless especially requested.

## OF SPECIAL INTEREST

DYAR, H. G. The Life Histories of the New York Slug Caterpillars. Journ. New York Ent. Soc., 1895–1899. (Complete) ..... $1.50

DYAR, H. G. Life Histories of North American Geometridæ. Psyche, 1899–1905, 63 parts (part 20 missing) ..... $ .75

EDWARDS, H. Bibliographical Catalog of the Described Transformations of North American Lepidoptera, 1889 ..... $1.00

SMITH, J. B. Contribution Toward a Monograph of the Noctuidæ of Temperate North America.—Five parts, Mamestra, Xylophasia and Superina, some Taenicompid genera, Homohadena, Agrotes. (May be had separately.) Set ..... $2.25

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## PROCEEDINGS
## ENTOMOLOGICAL SOCIETY OF WASHINGTON.

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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI 1914 No. 2

## Two Hundred and Seventy-Second Meeting, December 4, 1913.

The following officers were elected for the year 1914: President, W. D. Hunter; First Vice-President, A. N. Caudell; Second Vice-President, E. R. Sasscer; Recording Secretary, W. B. Wood; Secretary-Treasurer, S. A. Rohwer; Editor, W. D. Hunter; additional members of Executive Committee, E. A. Schwarz, L. O. Howard, and August Busck. Prof. A. L. Quaintance was nominated to represent the Society at the Washington Academy of Sciences.

Mr. Henry Tryon, Government Entomologist of Queensland, and Dr. T. Harvey Johnston, of the University of Melbourne, addressed the Society. These gentlemen constitute a commission which has been sent abroad by the government of Australia to study the possibility of controlling the cacti of Australia. Among other possibilities that are being considered is the introduction of destructive cactus insects from the United States. The speakers referred to their special interest in the investigation in this country on account of the studies of cactus insects which have been conducted. The importance of the cactus problem in Australia was graphically described, and hope was expressed that the investigation would reveal biological factors that might assist in control.

Doctor Martini, of the Hamburg School of Tropical Medicine, also addressed the Society with reference to his studies in the United States, and his recent trip to the Canal Zone.

Mr. A. H. Jennings gave an account of his recent extensive trip in the British West Indies in company with Doctor Sambon, of the London School of Tropical Medicine, for the purpose of determining whether endemic centers of pellagra are found where certain biting flies are absent.

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Two Hundred and Seventy-Third Meeting, January 4, 1914.

The following were elected to membership in the Society: B. R. Coad, A. W. Jobbins-Pomeroy, Father De Gryse, R. H. Hutchison, E. A. McGregor, Wm. Schaus, J. K. Strauss, and G. N. Wolcott.

The retiring President delivered the following address:

## ANNUAL ADDRESS OF THE PRESIDENT.

### ON THE CLASSIFICATION OF THE MICROLEPIDOPTERA.

By August Busck.

The term Microlepidoptera was originally used by German Lepidopterists about the middle of the last century as a literal translation of the much older, popular name, "Kleinschmetterlinge." It was used as a collective name for the five then recognized families of small moths: the Pyralids, the Tineids, the Tortricids, the Pterophorids and the Ornerodids. At that time it was already recognized by leading workers, such as Zeller, Herrich-Schäffer and Stainton, that their division of the Lepidoptera into Macros and Micros was not a natural one, but this division has been retained in about the original sense even up to the present day in Germany.

Most modern students have discarded the name Microlepidoptera as untenable; first, because it is said to be a misnomer; second, because it could not be sharply defined as a natural group, if the original conception should be retained.

It is true that mere size does not make the distinction. Some large moths are included in the term, while many small Lepidoptera fall outside the conception. However, these exceptions form a small percentage of the whole and the bulk of the Microlepidoptera are truly micros in a literal sense.

The second objection, that the term is not definable as a natural group, is true if the original conception is strictly adhered to.

The large Pyralid group has a quite separate origin from, and cannot properly be associated with, the rest of the Microlepidoptera, in the last century's sense. It has also been found that the Ægeridæ and the Cossidæ, which were originally classed as Macros, have their affinities with the Micros. But with these and a few other minor subtractions and additions the group becomes an undisputed natural one, and it seems unwise altogether to abandon such a long established, commonly used, descriptive name, which conveys a generally understood, even if not sharply defined conception. The term may conveniently be retained, if restricted to denote collectively the natural group of superfamilies considered in the present paper. This conception does not coincide with the term as used by Stainton and the other old authors, nor does it coincide with Hampson's and Dyar's superfamily Tineoidæ, differing from both mainly in the exclusion of the Pyralidæ, together with the smaller families of Pyralid origin.

The systematic arrangement of the Microlepidoptera has progressed along much the same lines as that of the other groups of insects from the time of Linnæus to the present day. It has developed from a system founded on external, easily observed characters, such as color and outline, to one founded on structure.

From Linnæus up through the illustrious series of old world scientists who worked with this group of insects, Fabricius, Schiffermüller, Ochsenheimer, Treitschke, Hübner, Haworth, Curtis, Stephens, Latreille, Duponchel, Guenée, and others, color and pattern, together with the form of wings, antennæ and palpi, were the main characters used for generic differentiation.

Herrich-Schäffer was the first to realize the systematic value of wing venation and his monumental work, Die Schmetterlinge von Europa, must be regarded as the cornerstone for the modern classification of Lepidoptera. So far in advance of its period was this work that very few contemporaneous and subsequent students realized it as anything but a laborious curiosity. There was a certain wondering admiration for it, but no actual belief in its practical value and no desire to go to the trouble of using it. Even such an enthusiastic student as Stainton took no pains to go into the subject, though he probably realized its eventual value. He had his artist make most careful plates of wing venation for his Insecta Britannica, but neither here nor in his later works, did he ever use the venation in his generic tables of definition.

Neither did Zeller and Walker take much advantage of Herrich-Schäffer's good work, but continued to make genera on "obvious" characters; among which they and others naturally included secondary male sexual characters, a procedure which has unfortunately been followed up to a quite recent time.

Heinemann, Lederer and Wocke followed Herrich-Schäffer's lead, but without advancing beyond his recognition of the venation as an aid to classification, and they and other workers of the period continued to be influenced by Zeller, who was the object of a cult entirely out of proportion to his merits as a systematist.

Our American pioneers in the Microlepidoptera, Brackenridge-Clemens, and in a less degree, Chambers, had a keen appreciation of the value of wing venation as a generic character and drew, for example, far more advantage from Stainton's plates than did Stainton himself.

Walsingham began his career as a Microlepidopterist as a disciple of Stainton and Zeller and his earlier work shows the effect. In his later working years, he realized the fallacies of this system and consigned many of his earlier genera to the synonomy, continuing his work together with Durrant, on sounder lines.

To Herrich-Schäffer and his followers the characters of the venation were merely a means of classification. They found that groups of species, which had been associated in genera on other characters, agreed in venation and that this character was more dependable than most of those which had hitherto been used. There was, as yet, no science of phylogeny and no continuity in the arrangement of the genera.

It was not until Darwin's theory of evolution had been advanced, that the time was ripe for the realization of the full importance of wing venation as indicative of phylogenetic relationship and many years passed without the application of this principle.

It remained for Edward Meyrick first to apply Darwin's theories to the study of Microlepidoptera, and, with the aid of modern morphological studies, to grasp the possibilities of the wing venanation as a means of recognizing natural relationship and lines of development. His ingenious rearrangement of the Microlepidoptera along natural evolutionary lines revolutionized the study of this group and has resulted in a sound appreciation of their mutual relationship and an undoubtedly nearly natural grouping of these insects.

Similar masterful studies of the lepidopterous wing venation with similar good results were made independently in Germany by Arnold Spuler and in America by Comstock. To them is due, among other things, the important discovery of the fundamental significance of the clavus, or as it is better known in this country by Comstock's somewhat later name, the jugum, a small projection from the base of the fore-wing which serves to hold the two wings together in the primitive groups of Lepidoptera, the Micropterygidæ and the Hepialidæ.

The classification of these masters has been adopted and further developed by all modern students, and the one paramount character used in this classification is the wing venation. This does not mean that it is the only character used. Every structural difference, especially of the palpi, antennæ and legs, is considered, as are the early stages and the biology, but all of these are given less weight than the venation and are now never used except in connection with the venation.

That this is a sound scientific view is easily understood when it is considered that all of the external characters more or less directly serve some purpose useful to the insect and therefore tend to become modified in response to the requirements of changed conditions in the environment.

On the other hand, the venation is not influenced in such a direct way and undergoes changes but slowly through long periods of evolution. It might be supposed that the mechanical function of the veins as a support to the wing surface would invite modification of the veins, and such is truly the case to some extent, the tendency in the evolution being a strengthening of the costal area at the expense of the dorsal. But the mechanical support would not be especially benefited by such minute changes in the structure as we find; the entire outline of the wing may be greatly changed without any radical change in the venation.

At the same time, the venation is so plastic as to mirror in minute modifications any and every step in the evolution of the genera. Given merely the denuded wings of a Microlepidopteron it is possible with certainty to place the species generically.

It has long been realized that the origin of all Lepidoptera is to be found in the Micropterygidæ. These possess several additional veins, which cannot be explained in any other way than as primitive characters, according to the fundamental law that no new organ can be developed except as a modification of an existing character. The survival of a few species of this ancestral group is exceedingly fortunate. Without these we should be without the key to the relationship of the entire order, because the higher Lepidoptera are so different from any other group of insects that their relationship hardly could have been established without the connecting link of the Micropterygidæ.

The Micropterygidæ are in turn generally conceded to have developed from the caddis-flies; certain of the Trichoptera (the genus *Rhyacophila*) agree very closely in neuration as well as in other characters with the more generalized Micropterygidæ, while no other insect of any order approaches this type. This is correctly taken as conclusive evidence that the Micropterygidæ are derived from, or are at least correlated with the Trichoptera.

which order, on the whole, is the more primitive group with a much more complicated venation in its more generalized genera.

The possession of additional veins in the hind-wings is the most important character which distinguishes the Micropterygidæ and the Hepialidæ, the other primitive group of Lepidoptera, from all the rest of the Lepidoptera. Another distinguishing character of these two families, the mode of interlocking the wings was independently pointed out by Spuler and Comstock. The lobe at the base of the fore-wing, which serves to hold the hind-wing in place, the clavus or jugum, is undoubtedly a good primitive character. It is found in both fore- and hind-wings in all the Trichoptera; it also persists though less developed in the hind-wing of the Micropterygidæ and is analogous with the posterior lobe in the hind-wings of the Diptera.

Besides the jugum, there are already, in the Micropterygidæ, a series of small stiff spines on the costal edge of the hind-wing which assist in holding the wings together. These spines develop gradually in the higher Lepidoptera into the so-called frenulum, which in the primitive group, Aculeatæ, persist as a series of spines but in the higher groups is reduced to a single strong spine in the male, and to two, three or four similar, weaker spines in the females. This is one of the curious examples of how the males lead in the evolution. Another, even more remarkable example of this is found in certain isolated genera where the males are ahead of the females in the venation, having two veins entirely coincident, which in the more conservative females are only stalked.

The Ægeridæ is the only family in which the females have also advanced to the single frenulum. Everywhere else this is distinctly a male character and is a dependable one on which to distinguish the two sexes.

In some of the highest groups of Lepidoptera, the Saturnids and the Butterflies, where the strongly developed dorsal part of the fore-wings broadly overlaps the equally developed costal part of the hind-wings and thus insures the interlocking of the wings, the frenulum has become obsolete.

When a partially denuded wing of a Micropterygid is examined under strong magnification it is found that its surface is covered with minute curved spines between the scales and much more numerous than these. Spuler was the first to point out this character, which is found in all Trichoptera, as well as in some other groups such as the Blattidæ and the Perlidæ.

These spines, "aculei," are not loosely inserted in pockets in the surface of the wing as are the scales, but are minute, hollow protuberances of the wing itself, and do not rub off when the wing is denuded. This primitive character is lost in all the higher

Lepidoptera, except in a small group of families, which until recently has been associated with, and derived from the Tineidæ, but which, on this character alone must be placed, as Spuler has done, quite apart from the other non-aculeate Mierolepidoptera.

The development of the venation is towards the reduction of the number of veins, mainly by coalescence, though frequently by becoming obsolete, and this is the guiding principle in the classification. Thus a genus with all the veins present cannot be deduced from one with a less number of veins, according to the fundamental law that a lost character cannot be regained. Similarly, a genus with two veins separate cannot normally be derived from one in which these two veins are stalked, that is, partly coalescent.

The reduction of veins has gone on in all branches of the system of families, but reaches its climax in the genus *Opostega*, where all but a few principal longitudinal veins have become obsolete. In it we have a striking case of an apparently "simplest" form, which in reality is the most highly developed in the group.

A very different result from the same tendency to vein reduction is found in the Cosmopterygidæ, where the number of veins in some genera has been preserved, but where several of the veins have coalesced at base on account of the wings becoming very narrow and pointed, producing a many branched venation.

On these principles the present system has been built up, not that the venation alone has been used (in fact, most of the genera were made on other characters entirely, long before the value of venation was realized) but the vein characters are now used as the final test. If two species vary in any essential of the venation, they are separated generically on that character alone, even should they agree in all other characters.

However, the venation, as well as any other character, must be used with good sense, and only one thoroughly familiar with the group as a whole, is safe in applying the test in the numerous difficulties which occur.

Thus a character may be an essential one in a higher developed group of genera and of relative unimportance in a more generalized group which has not yet acquired the same constancy. In the Gelechiidæ, Xyloryctidæ, Œcophoridæ and Cosmopterygidæ, for example, veins 7 and 8 of the fore-wings are invariably stalked, or coincident without exceptions, but in lower groups, like the Plutellidæ or Acrolophidæ, these same veins may be stalked or separate within the same genus or even within the same species, and consequently cannot be given the same value here as in the higher groups. But it should be noted that even with this variability, the venation furnishes sufficient stable characters in the

lower families also. A species of *Monopis*, for example, can always be determined generically with certainty from the venation alone, though hardly two specimens can be found in which the vein course is identical.

Much more difficult problems arise because the potentiality of vein differentiation after all is a limited one, and that therefore genera of different groups, converging toward the same general scheme of a wing support, may independently attain results which are embarrassingly similar.

This fact has in many cases long delayed the true appreciation of some groups and only patient study and comparison with allied forms have made it possible to place them where they rightly belong. An example will illustrate these difficulties. The Gracilaridæ, to which the leafmining genus, *Phyllonorycter* (*Lithocolletis*), belongs, are distinguished from all other Micros by the fact that the mature larvæ have prolegs on only three of the middle abdominal segments instead of on four or more, and by the fact that the first larval stages exhibit a very peculiar, highly specialized modification of the mouth parts, not approached by any other lepidopterous larva. Until recently the group has been regarded as a part of the Tineidæ or Plutellidæ, because the pterogostic and oral characters apparently did not preclude a derivation from some generalized form within these families. However, it was felt that they were in some way out of place and about a year ago, our fellow member, Dr. Charles Ely, who was making a thorough study of the American species of *Gracilaria*, called my attention to an undeniable evidence of their separate family rank, which has been before all students of the group in Stainton's careful plates of wing venation published fifty years ago, but which no one had properly interpreted before. Stainton's figures of the wings of *Gracilaria* and *Ornix* both have the full number of veins in the hind-wings, eight, apparently only slightly differently placed. But if we study them carefully, we will see that it is not the same veins that have persisted. *Ornix* has one costal vein more than *Gracilaria* and *Gracilaria* has one dorsal vein more than *Ornix*.

The large number of common characters both in the larvæ and the adults prove conclusively that these two genera are truly closely related. The only explanation, then, is that both must have been derived from a common ancestor having nine or more veins. By denuding various species of *Gracilaria* we found some in which all of the nine and even ten veins had persisted. Such a group with this number of veins clearly can not be derived from either the Tineidæ or the Plutellidæ, which have only eight veins, but must have developed independently, from a point lower down, nearer the Micropterygidæ.

A parallel case is that of the Cygnodiidæ. Until a few years ago the species of this group were classed in the same family as the Cosmopterygidæ, which they resemble superficially very much. In a paper before this Society in 1909, I pointed out, as Herrich-Schäffer had already figured without realizing its importance, that some of the genera of this group have nine veins in the hind-wing and therefore cannot be derived from a stock where the vein reduction has already taken place.

Incidentally these two examples illustrate the value of conscientious figures, which depict all the student sees, not merely what he wants to see. In the venation plates of these two old authors, Herrich-Schäffer and Stainton, we have had before us for more than half a century, the faithfully presented evidence of important phylogenetic significance, which only now has been realized and in both cases it was this evidence that gave the initiative to further study and better understanding.

A very satisfactory appreciation of the genera has been reached by the study of the wing venation. There is no doubt that most of the genera recognized at present are natural entities. The component species of any genus agree in practically all characters except in color and in secondary sexual male characters and even these latter, as well as the color scheme and pattern are often peculiar to a genus, differing among its species only in details.

Their biology and larval characters also prove that the present day genera are natural entities. In very many cases it is possible to definitely determine the genus of a Microlepidopteron merely from the work, or the mode of pupation or some other biological peculiarity. The mines of *Phyllonorycter* (*Lithocolletis*), *Tischeria*, *Phyllocnistis*, and *Nepticula*, or the cocoons of *Bucculatrix*, *Marmara*, or *Gracilaria* are familiar examples of this fact.

Likewise, we now have a reasonably satisfactory understanding of the grouping of the genera. There is no doubt that practically all families at present recognized are actual natural groups of closely correlated genera, agreeing in essential pterogostic and oral characters, as well as in general habitus, often exhibiting even a common pattern scheme and a similar biology.

It is when it comes to a phylogenetic valuation of these so-called families, that there is considerable room for improvement. In other words, the groups of genera, which, by nearly unanimous consent are called families, are phylogenetically of very different systematic value. For example, the characters which separate Cosmopterygidæ and the Gelechiidæ from the Xyloryctidæ or from the Œcophoridæ and Blastobasidæ are not nearly as fundamental as those which distinguish the Coleophoridæ or the Acrolophidæ, even though they may be fully as easy to observe, and the

so-called families Graciilaridæ, Cygnodiidæ or Acrolophidæ are each phylogenetically equivalent to the entire group of families derived from the so-called families Plutellidæ and Tineidæ.

From the aculeate Micropterygid stock two main groups arise, one which has retained the aculeation and one in which this character is lost. The aculeate group contains such families as the Prodoxidæ, the Adelidæ, and the Incurvariidæ and culminate in the leafmining Nepticulidæ;[1] *Opostega* also must be referred to this group.

The generalized nonaculeates give rise to a number of independent main branches, each in reality of more than family rank, such as the Acrolophidæ, Cossidæ, Tineidæ, Hyponomeutidæ, Gracilariidæ, Coleophoridæ, and Cygnodiidæ, from which in turn the higher families, such as the Gelechiidæ and Cosmopterygidæ, the Plutellidæ and Hemerophilidæ and the Heliodinidæ are minor branches (pl. II).

It may be questioned whether it would be advisable to introduce a number of intermediate valuations in the form of subfamilies and superfamilies and suborders (and even these forms will hardly express the complex system adequately) and whether such a scheme would be rather a cumbersome, impractical burden for the student. My own inclination is to express the system in as true terms as possible.

But the terminology is the least part, the main thing is, that the student should keep in mind the fact that the families of Microlepidoptera, as they are at present used by the leading specialists of the group, are not truly equivalent entities. Only thereby is a sound perspective of the group possible, and only thereby can further addition to the systematic structure be made along natural lines.

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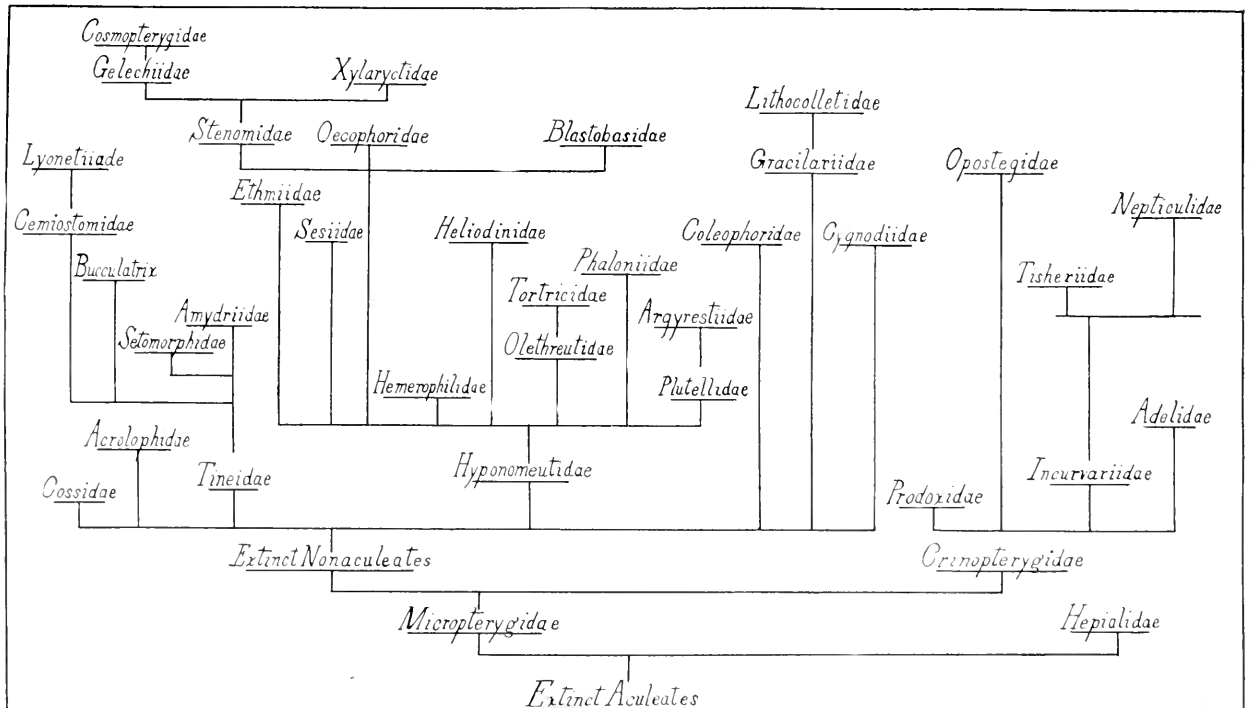
## Two Hundred and Seventy-Fourth Meeting, February 5, 1914.

A special committee consisting of Messrs. Heidemann, Schwarz, and Banks, presented a biographical sketch of O. M. Reuter which was accepted for publication.

The following papers were presented:

[1] The highest specialization, connected with the leafmining habit, is found at the apex of several of these branches and has therefore been quite independently reached by such genera as *Nepticula, Phyllonorycter* (*Lithocolletis*), and *Tischeria*.




Phylogeny of Principal Families of the Microlepidoptera.

On the Abdominal Structure of the Beetle Larvæ of the Campodeiform Type.....Dr. Adam Böving
Ceratopogoninae Sucking the Blood of Caterpillars.....Frederick Knab
Notes on Some Forest Coleophora with Descriptions of two New Species.....Carl Heinrich
A Revision of the North American Species of the Family Perilampidæ
J. C. Crawford

## ON THE ABDOMINAL STRUCTURE OF CERTAIN BEETLE LARVÆ OF THE CAMPODEIFORM TYPE. A STUDY OF THE RELATION BETWEEN THE STRUCTURE OF THE INTEGUMENT AND THE MUSCLES.[1]

By A. G. Böving, Ph.D., *Bureau of Entomology.*

Doctor Hopkins' classical monograph of the genus *Dendroctonus*, 1909,[2] was the first successful attempt to formulate a complete and practical terminology for the external structure of a Coleopterous larva, and may well serve, as Doctor Hopkins expressed it in his introduction, "as a guide to the determination of further facts relating to insect anatomy in general." The need of such a uniform terminology for the Coleopterous larva as elaborated by Doctor Hopkins in this monograph, had long been felt, because a truly comparative description is not possible without a defined terminology comprising *all* the body parts. The descriptions of even Schiödte, the unsurpassed master of larval classification, are lacking in this respect. The work of Doctor Hopkins was readily appreciated by students of the subject. Thus Henriksen[3] Kemner[4] Rosenberg,[5] and the writer[6] have at once adopted his terminology in so far as it was found applicable to the so-called compodeiform larval type with which these authors worked. The external skeleton of the abdominal parts of this campodei-

[1] Contribution from Division of Forest Insect Investigations. Bur. of Ent., U. S. Dept. of Agric.

[2] Hopkins, A. D., The genus Dendroctonus. (U. S. Dept. Agric., Bur. of Ent., Tech. Ser. no. 17. Part I, Washington, D. C., 1909, pp. 57–64.)

[3] Henriksen, Kaj L., Danske Elateridelarver, Entomologiske Meddelelser, II ser., vol. IV, 1911, pp. 225–331. Idem, Pragtbiller og Smeldere "Danmarks Fauna," published by Dansk Naturhistorisk Forening, 1913.

[4] Kemner, A. Beitrage zur Kenntnis einiger Schwedischen Koleopterenlarven, Arkiv für Zoologie, Bd. 7, no. 31, 1912, p. 1–31.

[5] Rosenberg, E. C., Bidrag til Kundskaben om Billernes Levevis, Udvikling og Systematik. III, Billefauna i Dyreboer, Entomologiske Meddelelser, vol. 10, 1913, pp. 37–76.

[6] Böving, Adam, Nye Bidrag til Carabernes Udviklinghistorie I Entomologiske Meddelelser, II ser, vol. III, 1910, pp. 219–376. Idem, Nye Bidrag til Carabernes Udviklingshistorie, II. Entomologiske Meddelelser II, ser. vol. IV, 1911, pp. 129–180.

form type differs, however, from that of the Scolytidæ with which Doctor Hopkins dealt, and his terminology elaborated for the Scolytidæ is therefore not immediately applicable to the campodeiform larvæ. In the hope of finding a foundation for a natural and logical terminology for the body of this type, I began, some years ago, a detailed study both of the external and internal surfaces of the skin as well as of the arrangement of the muscles in these larvæ. I have been fortunate in being able to continue these studies under most favorable conditions since my arrival in this country. In Denmark, I studied more particularly the Carabid, Dytiscid and Hydrophilid larvæ, while here the Trogositid, Clerid and Elaterid larvæ were chosen, because they play a more important rôle in the Branch of Forest Insects, with which I became connected.

Some of the results of these studies are presented in this paper, and I believe they will be found useful in the study of other campodeiform larvæ. The eventual application of these results also to the deviating eruciform type to which the Scolytidæ belong, I purposely postpone. I believe that the characters of these two groups eventually may be homologized, but this will involve considerable further anatomical study and the question is not taken up in this paper. From the insufficient investigations I have made of Lepidopterous, Hymenopterous and Neuropterous larvæ, I am inclined to believe that the characters described in the present paper will be found useful in the larval study of all the insects with complete metamorphosis.

While the terminology has been derived from an anatomical study of the inside of the integuments and of the muscles, the structures can also be made out externally, but they can only be understood by a study of the inside, and it would have been impossible to homologize the external characters without a comparative study of the muscles. It should be stated however that the terms used in this paper for the various structural parts are purely provisional. The limitation and definition of the areas has been the main object; the names have been a minor consideration.

## THE INTERSEGMENTAL SKIN

The segments of an insect larva are, as is well known, connected by a perpendicular intersegmental skin, but a more intimate study of this skin has never been made. This intersegmental skin is divided on each side into two more or less wedge-shaped parts: the superior cunea (*s*) with the point downwards, and the inferior cunea (*i*) with the point upwards. The ends of these two cuneæ pass each other more or less, that of the superior cunea always

in front of the inferior. At the end of each cunea there is a thickening of the membrane which on the inside forms a small notch to which muscles are attached. I call these thickenings relatively, the anterior (*an*) and the posterior (*pn*) cuneal notch. Another similar notch is found in the upper portion of the anterior cunea; I call this the superior cuneal notch (*sn*). Finally there is a fourth notch on the median ventral line of the posterior cunea; this I term the ventral cuneal notch (*vn*).

### THE LATERAL ZONE

Between the posterior cuneal notch of one intersegmental skin and the anterior cuneal notch of the succeeding intersegmental skin is found, on the inside of the integument, a staff-like or even carinated apodeme, which on the outside appears as a deep groove. This groove has been named by Doctor Hopkins the pleural suture (*pl*). Above and parallel with the pleural suture is found a similar one which I call the antipleural suture (*anti*). This is sometimes more, sometimes less developed than the pleural suture. It is somewhat shorter than the pleural suture and does not reach either of the margins of the segment. The bandlike region between these two sutures I call the lateral zone. This lateral zone has, as already pointed out by Dr. David Sharp in his handbook, 1901, p. 90, a mechanical use in the dorso-ventral compression of the larval body corresponding to that of the intersegmental skin in the telescoping compression, and it is stiffened on the inside by a circular thickening which touches both the antipleural and the pleural suture. This circular thickening limits an area, which on the outside is elevated and rounded; it is the area which has been termed the pleural lobe (*pll*) by Doctor Hopkins. The rest of the lateral zone is divided by oblique sutures into four small triangular parts, two before, and two behind the pleural lobe. I call these respectively the protopleurite (*prpl*), the deuteropleurite (*dpl*), the tritopleurite (*tripl*) and the tetrapleurite (*tetpl*). All of these four small areas are prolonged more or less upward along the superior cunea.

The whole lateral zone can be compressed by two systems of perpendicular muscles. The muscles of the first system run upwards from the middle of the pleural suture; while the muscles of the other system run downward from each end of the antipleural suture. When the muscles are relaxed, the pleural and antipleural sutures are again separated by the elasticity of the pleural lobe and of the oblique sutures.

## THE DETERMINATION OF THE LINES AND AREAS ABOVE AND BELOW THE LATERAL ZONE

Above the antipleural suture the segment is divided into the following areas:

Prescutum (*prsc*), scutum (*sc*), scutellum (*scl*), parascutum (*pasc*), postscutellum (*pscl*), and the spiracular area (*spa*).

The scutum and scutellum, which are sometimes hardly separable, form the central dorsal part; in front of these is the prescutum, below and partly around them the parascutum, and behind them, the postscutellum. Underneath those areas and limited on the other side by the antipleural suture lies the spiracular area.

All areas are defined by lines, fine wrinkles in the integument, radiating from and determined by muscle attachments. In order to make the figures as comprehensible as possible and in order to avoid too many letters I have signified the muscle spot, its radiating lines, and the area determined thereby, by the same letter, and each muscle is then determined by the letters of the two muscle spots between which it runs. The boundary line of scutum and scutellum, I call the scutal line (*sc*). This is determined by a muscle spot from which a long muscle (*sc-pn*) runs down to the posterior cuneal notch. The transversal line separating scutum and scutellum I call the scuto-scutellar line. The prescutum is bounded by a line, the prescutal line (*prsc*), which runs from the superior cuneal notch to the anterior margin of scutum. The boundary line of parascutum, I call the parascutal line (*pasc*). This is determined by a bundle of three muscles (*pasc-pl*), which run down to the pleural suture (*pl*). The parascutum is divided by a more or less curved line connecting the scutal and the parascutal line. I call this line the parascutal divisor (*d*). It is determined by a flat muscle band (*d-s*), which runs backwards to the superior cunea (*s*). This line is in reality a row of little dots and varies considerably in size and position in the different types of larvae; often it is also continued downward, below the parascutal line. The postscutellum (*pscl*) is limited by the postscutellar line, which runs behind the parascutum through the superior attachment of the muscle (*pscl-hypl*), and terminates at the posterior end of the antipleural suture. The spiracular area (*spa*), is characterized by the presence of the spiracle and is limited above by the parascutal line, below by the antipleural suture.

## AREAS BELOW THE LATERAL ZONE

Below the pleural suture the segment is separated into the following areas: the hypopleurite (*hypl*) immediately below the pleural suture, the presternum (*prst*) and sternum (*st*), generally

more or less united, separated by the triangular parasternum (*past*), from the sternellum (*stl*), behind which is the poststernellum (*pstl*).

The line limiting the hypopleurite below, I call the hypopleural line (*hypl*) and it is determined by perpendicular muscles running from the posterior end of the antipleural suture (*anti-hypl*). This hypopleural line consists of two pieces. Below the anterior piece lies the parasternum, below the posterior, the poststernellum. The line separating the parasternum from the sternum I call the sternal line (*st*). This is determined by three long oblique muscles, two from the superior cunea, just in front of the spiracle of the following joint (*s-st*) and one (*an-st*) from the anterior cuneal notch. The two first mentioned muscles are closely united at their lower end in the *Trogosita* and *Alaus* larvæ, while in *Clerus* they are plainly separated (fig. 1, pl. III). The line limiting poststernellum anteriorly against sternellum I call the poststernellar line (*pstl*), and this is determined by a short oblique muscle from the anterior cuneal notch (*an-pstl*). The other, anterior, side of sternellum is defined by a line, the sternellar line (*stl*), from the end of the anterior piece of the hypopleural line to the posterior end of the sternal line.

The study of the muscles, is as stated in the beginning, essential to the correct understanding of these integumental parts. Without such a study it is well nigh impossible to interpret the structure of the surface in the more complicated cases. A few examples will suffice to demonstrate this. In *Alaus* (fig. 8, pl. VI), the muscles show that the first line below the pleural suture is but a branch from the hypopleural line which is normally simple, and that the hypopleurite, consequently, in this larval type consists of two distinct pads, while in the other types this area is undivided. Similarly, it could not have been recognized without muscle study that the broken sternal line in *Trogosita* (fig. 5, pl. V), is identical with the straight sternal line in *Clerus* (fig. 1, pl. IV), and *Alaus*, a modification which makes the shape of the parasternum quite different in these forms.

In the above I have only mentioned the muscles, which have a direct bearing on the formation of the various areas. There are, however, a great many others, and a short account of these may be useful in the identification and location of the leading muscles, used in this paper. They are:

(*s-s*). Longitudinal, bandlike dorsal, muscles in parallel series immediately underneath the integument as far down as to the spiracle; they run between a superior cunea in front and the following superior cunea posteriorly (fig. 3).

(*i-i*). Longitudinal, bandlike, ventral muscles in parallel series

immediately underneath the integument, below the pleural suture; they run between an inferior cunea in front and the following inferior cunea (fig. 3).

(*st-i*). Small oblique muscles between sternum and the inferior cunea (fig. 2).

(*s-fw*[7]*-sc*). Longitudinal muscles from the superior cunea above the superior cuneal notch, across the scutellum to the scutum.

(*s-fw-scl*). Oblique muscles from the superior cunea to the scutellum (fig. 3).

(*an-tetpl*). An oblique, single, small muscle from the anterior cuneal notch to the superior part of the tetrapleurite (fig. 4).

(*an-sn*). A vertical pair of muscles from the anterior cuneal notch to the superior cuneal notch (fig. 4).

(*an-pn*). A single, horizontal muscle between a posterior cuneal notch and the anterior cuneal notch of the following intersegmental skin (fig. 3).

(*vn-dpl*). One or two large, oblique muscles from the ventral cuneal notch to the anterior curve of the pleural suture below the deuteropleurite (fig. 4).

(*dpl-fw-s*). An oblique, short, but rather broad band from the anterior curve of the pleural suture below the deuteropleurite to the superior cunea near the spiracle (fig. 4).

(*dpl-prst*). A vertical muscle from the anterior curve of the pleural suture below the deuteropleurite to the presternum. (This I have found only in *Trogosita*, fig. 6.)

(*spa-pn*). A pair of perpendicular muscles between the posterior cuneal notch and the spiracular area just below the spiracle.

(*pl-hypl*). One or some few small vertical muscles from the middle of the pleural suture to the hypopleural line (fig. 4, fig. 6, 2. Not found in *Alaus*.)

(*tetpl-hypl*). A vertical muscle from the tetrapleurite to the hypopleural line (fig. 4).

(*pscl-hypl*). A long, perpendicular muscle from postscutellum to the hypopleural line, the definition of the postscutellar line (fig. 2). See p. 58.

In the preceding I have endeavored to demonstrate that the abdomen of the larvæ under consideration is made up, in an identical manner, of the intersegmental skin, the lateral zone, and the regions above and below the lateral zone, and further that the arrangement of the muscles between these parts is uniform. This remarkable uniformity of structure has been preserved throughout the genetic evolution because it enables and conditions the elementary movements of the abdomen. These elementary movements are but two. First, the telescoping of the segments,

[7] *fw* indicates "forwards to;" *bw* indicates "backwards to."

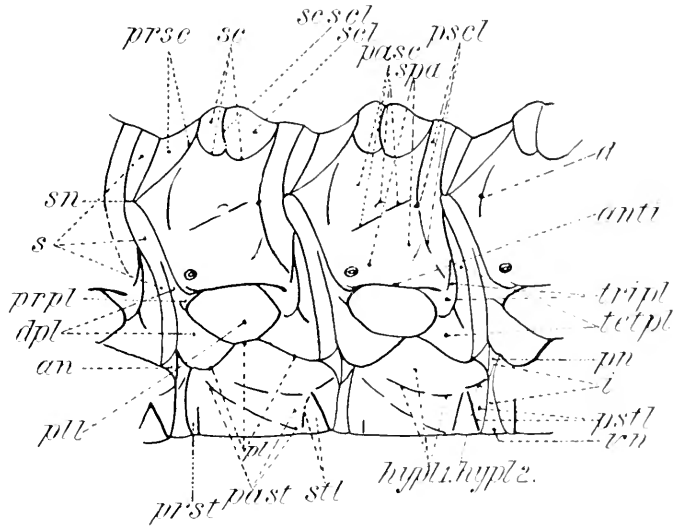



Fig 1. *Clerus* (×20)
*The areas of abdomen*

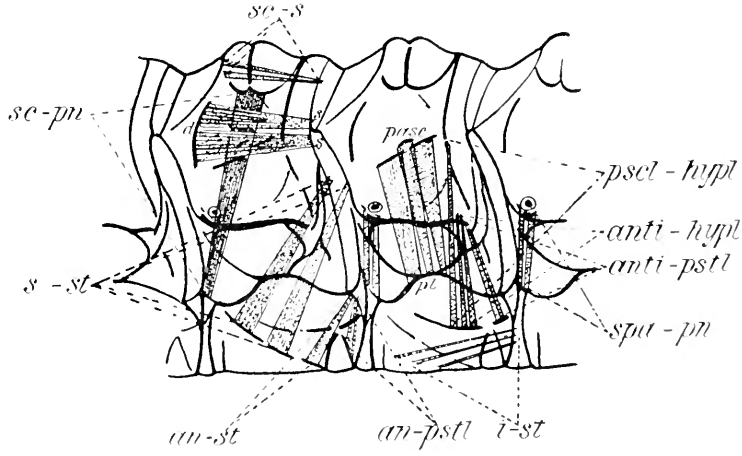



Fig 2. *Clerus* (×20)
*Muscles causing boundary lines of the different areas*

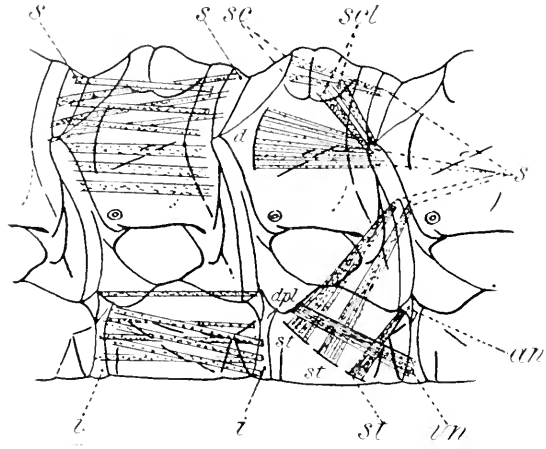



Fig 3. *Clerus* (×20)
*Muscles effecting the telescopic movement*

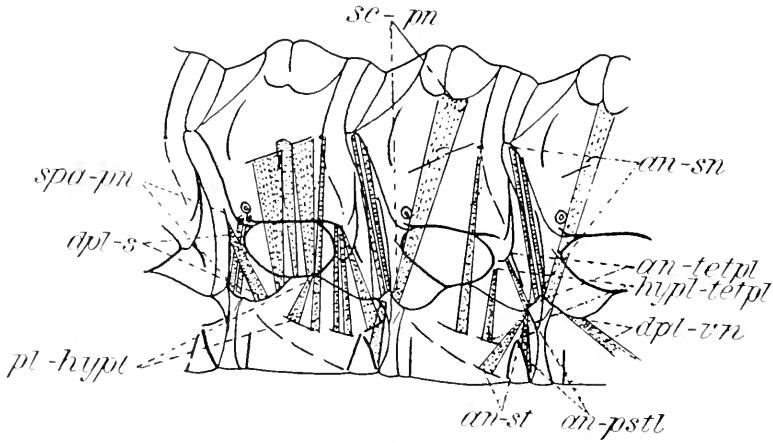



Fig 4. *Clerus* (×20)
*Muscles effecting the dorso-ventral movement*

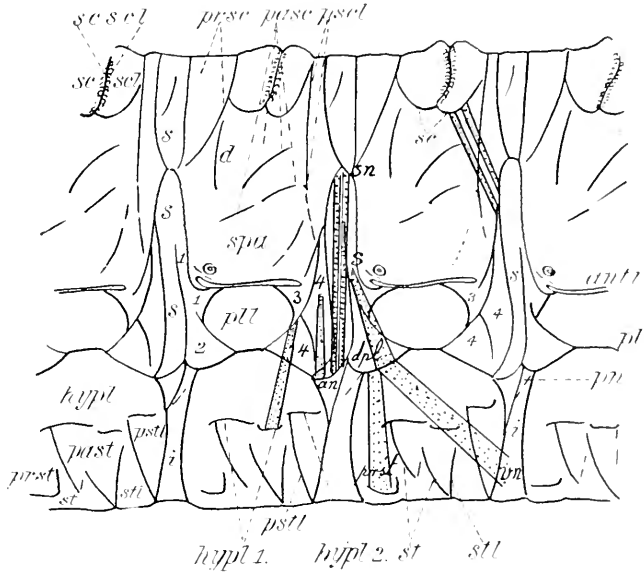



Fig 5. *Trogositu* (× 20)

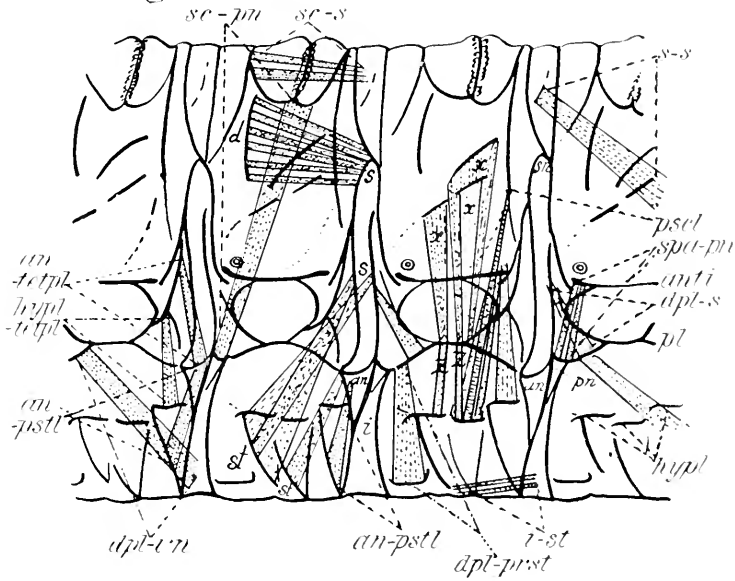



Fig 6. *Trogositu* (× 20)

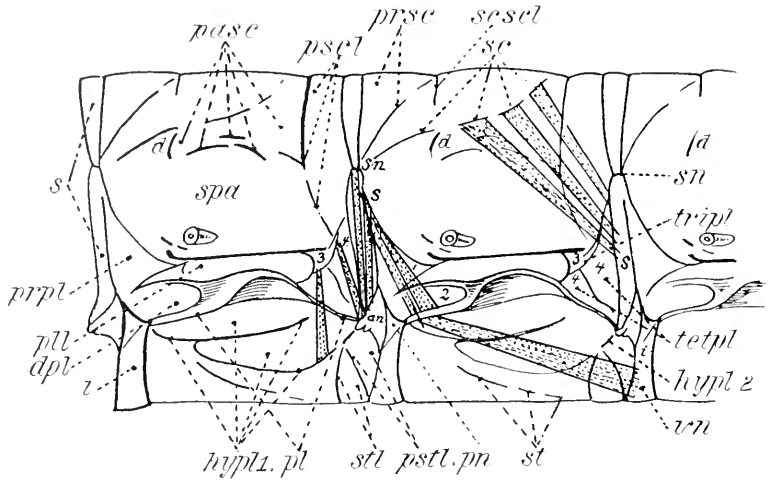



Fig 7. *Alaus* (×8)

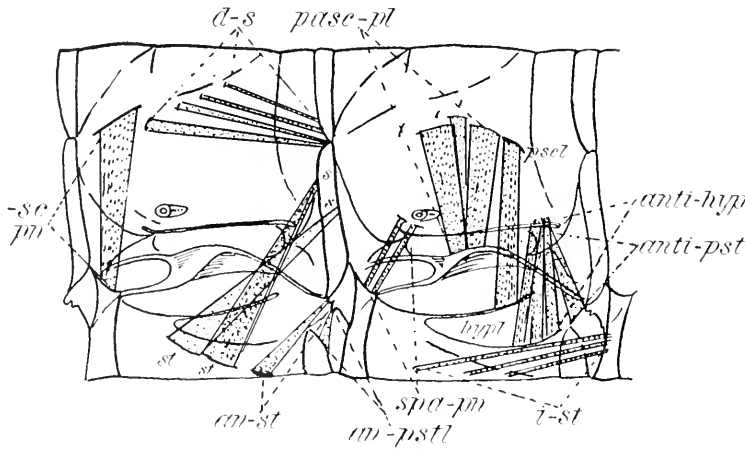



Fig 8 *Alaus* (×8)

by which the intersegmental skin is bent inwards and the front margin of each segment is pushed into the posterior margin of the preceding segment. Second, the dorso-ventral flattening of the abdomen by which the lateral zone is compressed and the edges of the two cuneæ are made to pass further by each other.

The telescoping movement is mainly produced by contraction of the longitudinal muscle bands and the dorso-ventral movement is performed by contraction of the perpendicular muscles. The oblique muscles assist in both of these movements. It is a matter of course that in these elementary movements of the abdomen the muscles on both sides of the body act in unison. A one-sided action of the longitudinal muscles controlling the telescoping of the segments naturally produces a movement of the abdomen to that side, movements which, however, are more or less assisted by the system of transverse and especially of the oblique muscles. In a great many beetle larvæ, more especially in those which live in galleries in wood or bark, such as Cerambycids or *Trogosita*, or those which crawl among moist, dead leaves, such as the Hydrophilids: *Enochrus* and *Hydrobius*, are developed the so-called ambulatory ampullæ, which assist in the locomotion.

There seem to be no special muscles for the retraction of these ampullæ; they are controlled by a mechanical combination of muscles, present in all campodeiform larvæ.

It should be noted here, that the muscles only cause the contraction of these ampullæ as well as the compression and telescoping of the segments. The opposite action in these larvæ by which the parts are extended is not produced by the muscle system at all, but by blood pressure, aided by the elasticity of the integument, which in some parts is especially developed for this purpose, as in the sutures and circular thickening of the lateral zone.

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In discussing the foregoing paper Dr. A. D. Hopkins said: "I am naturally gratified that the results of Doctor Böving's study of the muscles of the abdominal segment in certain 'campodeiform' types of coleopterous larvæ has tended to verify my conclusions and suggestions relating to the external elements of the 'eruciform' type as represented by the scolytid larvæ.

"I want to congratulate him on this splendid piece of work and the further contribution of facts bearing on this important subject. It is of the greatest importance that we should be able to identify the immature stages of forest insects because it is the

wood and bark boring larvæ that are most frequently met with by investigators and sent in by correspondents.

"I think that we will find the principal distinguishing characters in the head and mouth parts but these must be correlated with thoracic and abdominal characters. Therefore we need a more exact knowledge of the primary external elements of structure and a key to such of the so-called homologous elements as are of the greatest taxonomic value.

"In my work on the anatomy of *Dendroctonus*, I found that the pleural suture was of fundamental importance as a guide to the location and identification of elements of structure in the adult, pupa and larva (Technical Series 17, part 5, Bureau of Entomology, 1909, fig. 9, 38, 39). In the work carried on by Mr. Snodgrass and myself on the thorax of insects we found that the key to the structure of the pleurum in adult insects was the pleural suture (Proc. U. S. N. M., vol. xxxvi, 1909, p. 536, fig. 3). Now with the additional facts revealed by Doctor Böving relating to the musculatory system of the abdominal segment in coleopterous larvæ, I am convinced, that the pleural suture is the key to the structural modification and homology of the pleurum in all segments of all stages of insects, and therefore largely a key to the morphology of the hexapodal type.

"All of this shows that the essential features in the development from the egg to the adult in the insects with a so-called incomplete metamorphoses is not so very different from those in insects with a so-called complete metamorphoses. Therefore much of the terminology, as applied to the primary elements of the adult, is applicable to all stages, such as the tergum with its prescutum, scutum, scutellum and postscutellum, the sternum with its presternum, sternum, sternellum and poststernellum; the pleurum with its epipleurum and hypopleurum; the epipleurum with its epimeral area, lobe or sclerite and its spiracle area, lobe or membrane; the hypopleurum with its episternal area, lobe or sclerite and its coxal area, lobe or coxa—and so on as applied to all body segments of all stages.

"It must be kept in mind, however, that there is an almost unlimited range of modification in each and all of the named elements. There is often a most complex subdivision of one, the

fusion of two or more or the suppression of one or more elements. Therefore, in order to correctly homologize and generalize, one must have a comprehensive knowledge of the manifestation of the primary elements as represented by characteristic examples of all stages in all orders."

## CERATOPOGONINÆ SUCKING THE BLOOD OF CATERPILLARS

By Frederick Knab, *Bureau of Entomology.*

Under date of December 29, 1913, my friend Mr. C. A. Mosier sent me from Florida some small Diptera with the information that they were sucking the blood of a sphingid caterpillar which was feeding on the foliage of the papaya. The flies were busily sucking, while the caterpillar thrashed about and in that way succeeded in dislodging some of its enemies. The caterpillar was that of the well-known papaya sphinx, *Erinnyis ello* L. The flies, strangely enough, were of two widely different species, one of them a biting chironomid of the genus *Forcipomyia*, the other a lauxaniid of the genus *Pachycerina*. The *Forcipomyia*, of which fourteen females were sent, proves to be closely related to the Antillean *F. propinquus* Will., but distinct and undescribed, and I propose to call it *Forcipomyia erucicida*. Specimens collected by Mrs. A. T. Slosson at Lake Worth and Biscayne Bay, Florida, stood in the national collection labeled "*Culicoides eriophorus* Will." and included with them were specimens of *Forcipomyia propinquus* from Cuba. I find it necessary to mention these erroneous determinations, as they have found their way into the literature of the present subject.[1]

Prof. C. F. Baker records a biting midge attacking the caterpillars of the geometrid moth *Melanchroia geometroides* (Walker) in Cuba, swarming about them and killing large numbers of them.[2] The midges were determined by the late D. W. Coquillett as "*Ceratopogon eriophorus* Will.," but it would seem that the specimens were not preserved. As there are no true *eriophorus* in the collection, and the Cuban specimens (collected by Mr. E. A.

[1] In this connection it should be noted that Williston's description of *F. eriophorus* (Trans. Ent. Soc. Lond., 1896, p. 279) is of the female, and not of the male as there stated. The figures of the tarsus and wing of *F. propinquus* (l. c., pl. 9, figs. 41, 41a) also are of the female, instead of the male.

[2] Remarkable habits of an important predaceous fly (Ceratopogon eriophorus Will.). U. S. Dept. Agric., Bur. Ent., Bull. 67, pp. 117–118. 1907.

Schwarz at Cayamas) so labeled are *Forcipomyia propinquus*, it is safe to conclude that this last mentioned was the species observed by Professor Baker.

Doctor Lutz records two observations of *Forcipomyia* attacking caterpillars. One was by Townsend, who took specimens sucking a sphingid larva in Peru, the other by Barbiellini, who made a similar observation at São Paulo, Brazil.[3]

A further record of *Forcipomyia* attacking caterpillars comes from Prof. F. W. Urich and is published here for the first time. The observation was made in October, 1911, during Professor Urich's stay on the Isthmus of Tehuantepec. The species observed is also closely related to *F. propinquus* and I propose to call it *Forcipomyia crudelis*.

These records of closely related species of *Forcipomyia* attacking caterpillars would lead one to suppose that these flies feed exclusively on lepidopterous larvæ, and the writer was inclined to adopt this view. However, among a number of specimens of *Forcipomyia propinquus*, taken by Mr. A. Busck in the island of Santo Domingo, was a female bearing a label indicating that it had inflicted a painful bite on the collector. Also, the writer, while at Miami, Florida, took two females of *F. crucicida*, along with other Ceratopogoninæ, on the flowers of an avocado (*Persea* sp.). Thus there is a wide range of feeding habits indicated, which does not, however, preclude decided food predilections on the part of these insects.

It may be further pointed out that Ceratopogoninæ have been observed attacking adult insects. F. H. Gravely, in India, found a specimen of *Culicoides* attacking an *Anopheles* mosquito, the former having its proboscis so firmly fastened in the abdomen of the mosquito that it remained attached when the catch was placed in alcohol.[4] It must be pointed out that some species of *Culicoides* are very troublesome blood-suckers of man and of other warm-blooded animals, so that Gravely was well justified in thinking that his *Culicoides* probably normally "sucks mammalian blood, and was taking it second-hand from the mosquito." But more recent observations, made by Major N. P. O'Gorman Lalor in Lower Burma, show that these attacks of Ceratopogoninæ upon mosquitoes are far too frequent to be accounted for in this way. In these observations three species of *Anopheles* were found to be attacked. Caught specimens of *Anopheles fuliginosus* "have been found infested to the extent of 6 per cent, and this probably implies a much wider infestation of that species in nature."[5]

[3] Mem. Inst. Oswaldo Cruz, IV, p. 24, 1912.

[4] Mosquito sucked by a midge. Records Indian Mus., IV, p. 45, 1911.

[5] Note on a parasitic fly which infests malaria carrying Anopheles in Lower Burma. Paludism (Simla), no. 5, pp. 42–43, 1912.

Recently I have had the priviledge of examining specimens of a species of *Ceratopogon* (restricted sense) captured by Mr. I. P. Kryger in Denmark while fastened to the wings of a geometrid moth (*Cidaria didymata* L.). So tightly had the small flies inserted their beaks into the wing-veins of the moth that they remained in position long after they had been introduced into the killing-bottle and death had followed.[6] Of course the moth must have been a recently emerged one, in which the blood was still present in the wing-veins. The midges belong in the neighborhood of *Ceratopogon murinus* Winnertz, but I have been unable to place them satisfactorily and they are probably an undescribed species.

As to the *Pachycerina* captured by Mr. Mosier along with the *Forcipomyias* on the caterpillar of the papaya sphinx, nothing appears to be known of their habits. Probably they were attracted by the blood exuding from the injured caterpillar, and were not participants in the primary attack of the *Forcipomyias*. The species was represented in the national collection by a single specimen taken by Mrs. Slosson at Biscayne Bay, Florida, and determined by D. W. Coquillett as *Pachycerina flavida* Wiedemann.

**Forcipomyia erucicida** n. sp.

*Female:* Occiput dull brown, clothed with coarse yellow hairs. Antennæ with the shaft yellowish, shading to brownish distally, the proximal joints subglobose and subovate, the last five lengthened, subcylindrical. Palpi black, the antepenultimate segment thickened, the penultimate nearly as long, slender, subcylindrical, the last joint short. Thorax and scutellum brownish black, a pale spot on the humerus, clothed with coarse, shining yellow hair. Postnotum black. Abdomen black, clothed with blackish hairs with yellow luster. Wings smoky, clothed with coarse black hairs, a patch of yellow hairs at base of costa; subcostal cell thickened and strongly pigmented, its distal end slightly beyond the middle of the wing. Halteres with white knob. Legs yellowish, clothed with coarse, irregular yellow hairs, a broad blackish ring at the ends of the middle and hind femora, a narrower blackish ring close to base of the corresponding tibiæ; tarsi tinged with brown, slender, the first joint of the hind pair about half the length of the second, last joint slightly thickened, subcylindrical. Claws long and slender; empodium fleshy, ciliate. Length: Body about 2 mm., wing 2 mm.

*Male:* Antennæ plumose, luteous brown, the tori very large, the proximal joints of the shaft subglobose. Palpi considerably longer than in the female. Abdomen slender, elongate, black, with broad pale segmental rings on the proximal half; lateral ciliation of long and coarse brown hair

[6] En Myg, der angriber en Sommerfugl. Ent. Meddel., pp. 83-88, 1914.

with yellow luster. Wings narrower than in the female. Length: Body about 3 mm., wing 1.8 mm.

Buena Vista, Florida, December 29, 1913 (C. A. Mosier); Miami, Florida, two females on flowers of avocado (*Persea* sp.), December 20, 1912, two males, November 22 and 23, 1912 (F. Knab); Little River, Florida, two females November 30, 1912 (Knab); Biscayne Bay and Lake Worth, Florida (Mrs. A. T. Slosson).

*Type:* Cat. No. 18419, U. S. N. M.

Closely resembles *Forcipomyia propinquus* Williston, but differs principally in the shape of the palpi and hind tarsi, both being more slender than in Williston's species.

**Forcipomyia crudelis** n. sp.

*Female:* Occiput dull brown, clothed with coarse yellow hair. Antennæ with the proximal portion of the shaft yellowish, of subglobose and subovate joints, the last five joints blackish and clothed with white pubescence, elongate and subcylindrical. Palpi black, the antepenultimate joint greatly thickened. Thorax and scutellum brownish black, a small yellowish humeral spot, vestiture of coarse yellow hair. Abdomen black, clothed dorsally with dark hair, at the sides with tufts of shining yellow hair at the bases of the segments. Wings smoky, clothed with coarse black hair; costa black to end of first vein and on this portion bearing long and dense black hair, a patch of yellow hair at its base; submarginal cell indistinct, ending slightly beyond middle of wing. Halteres with brownish stem and whitish knob. Legs yellow, clothed with coarse, irregular yellow hairs; an ill-defined brown ring subapically on middle and hind femora; entire fore tarsi infuscated, middle and hind tarsi with the last three joints dark; first joint of hind tarsi slightly less than half the length of the second, the last joint nearly as long as the fourth. Claws long and slender; empodium fleshy, ciliate. Length: Body about 1.5 mm., wing 1.7 mm.

Plantation "La Oaxaqueña," near Santa Lucrecia, Mexico, October, 1911. (F. W. Urich.)

*Type:* Cat. No. 18420, U. S. N. M.

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## NOTES ON SOME FOREST COLEOPHORA WITH DESCRIPTIONS OF TWO NEW SPECIES.[1]

By Carl Heinrich, *Bureau of Entomology.*

The following species of *Coleophora* were reared by Mr. A. Busck and the writer during the past summer, at the Falls Church, Virginia, station of the Forest Insect Investigations Division of

[1] Contribution from the Division of Forest Insect Investigations, Bureau of Entomology.

the Bureau of Entomology. The writer is indebted to Mr. Busck for final determination of the species.

**Coleophora leucochrysella** Clemens. Dyar N. A. Lp. No. 6026.

Eleven specimens of this beautiful moth were reared under Hopkins U. S. No. 11135.

Larval case 10 to 11 mm. long; first two-thirds made from material of the leaf; light yellow; elongate cylindrical, somewhat flattened and slightly bulged in the middle with distinct fin-like projection from base to middle; mouth deflected about 30 degrees; posterior third made of pure silk, slightly darker, curving in to a blunt point and splitting vertically along the posterior extremity of the keel.

*Habitat:* Falls Church, Virginia, and Charter Oak, Pennsylvania.
*Foodplant: Castanea dentata*

The larva mines the leaves from the under surface. The clear, rectangular mine with the small circular entrance on the under side clearly distinguishes the work of the species. A number of full grown larvæ collected at Falls Church, Virginia, during the early part of May, by Mr. Busck and the writer, pupated June 2, the adult moths issuing June 16 to 20. The larvæ overwinter in the cases, which are attached to the twigs or the bark of the tree, and feed up during the following May.

Two new species of Hymenopterous parasites of the larvæ (*Microdus* sp. and *Microbracon* sp., determined by Mr. S. A. Rohwer) were reared from larvæ collected at Falls Church, and from a couple of larvæ collected at Charter Oak, Pennsylvania, by Mr. T. E. Snyder, of the Bureau of Entomology.

**Coleophora carpinella** n. sp.

Palpi grayish white tinged with brownish ochreous. Antennæ slightly thickened and clothed with brownish ochreous scales to basal fourth; white beyond and distinctly annulated with deep brown. Face and head brownish ochreous shading to white. Fore-wings deep brown with darker dustings in apical portion and with white streak along costa from base to costo-apical cilia, narrowing and faintly visible beyond first third and bordered with brown on extreme costal margin; cilia shaded from brownish ochreous on costo-apical to lead gray on dorso-apical portions. Hind-wings dull steel gray, cilia steel gray along costal and lead gray along dorsal margins with lighter shadings toward base of wing. Abdomen brown dusted with grayish white above and beneath; anal tuft slightly paler brown. Legs light brown on outer, white on inner side, tarsi annulated with darker brown. Alar expanse: 7 to 7.5 mm.

*Habitat:* Hyattsville, Maryland.
*Foodplant: Carpinus.*

*Type:* Cat. No. 18183, U. S. N. M.

Described from seven specimens reared June 28, to July 12, 1913, under Hopkins U. S. No. 11143 from larvæ feeding on leaves of *Carpinus*. There are also three specimens of the same species in the U. S. National Museum, reared by Mr. Busck in 1901 from the same food plant.

The larval case is dark brown, smooth; 6 to 7 mm. long and 1 to 1.5 mm. wide; cylindrical in form with posterior end flattened and slightly wider than diameter of the case; mouth slightly deflected.

This species resembles *C. caryæfoliella* Clemens, from which it differs in its smaller size, the dark apical dusting on fore-wings, the generally darker color of wings and cilia and the greater deflection of the mouth of the larval case.

**Coleophora alniella** n. sp.

Palpi white very faintly tinged with ochreous. Antennæ white, annulated with golden brown; base slightly thickened with scales, white to ochreous, not erected. Face and head golden ochreous shading to white on sides. Fore-wing nearly a uniform golden brown with white streak along costa from base to costo-apical cilia; cilia shading from white at end of costal streak to golden brown on dorso-apical margin. Hind-wings and cilia steel gray with faint golden tints. Abdomen brown with argentious dustings above and beneath. Legs light golden brown on outer, silvery on inner side; tarsi but faintly annulated. Alar expanse: 8 to 9 mm.

*Habitat:* Hyattsville, Maryland.

*Foodplant: Alnus.*

*Type:* Cat. No. 18184, U. S. N. M.

Described from three specimens reared June 30 and July 5, 1913, under Hopk. U. S. No. 11139, from larvæ feeding on leaves of *Alnus.*

The larval case is dark brown, rather rough and fibrous; 6 to 7 mm. long by 1.5 mm. wide; a slightly flattened cylinder in form, with posterior end flattened to somewhat curved edge like the blade of an axe; mouth deflected to 90 degrees.

This species so closely resembles *C. caryæfoliella* Clemens, that it is difficult to separate the two on adult characters. I find quite a little variation in the specimens of the hickory species before me, so that whatever very slight size and color differences there are, offer no sure means of differentiating the species. It seems however, that in this case the differences in the foodplant and larval cases should be sufficient to warrant the erection of a new species.

The chief structural differences are in the posterior end and mouth of the case. In *caryæfoliella* the posterior end is flattened to a straight line, and the mouth deflects to about 40 degrees.

In *alniella* the posterior end is flattened to a slightly curved line and the mouth deflects to about 90 degrees. These differences are constant in all the specimens that have come under my observation.

**Coleophora querciella** Clemens. Dyar List N. A. Lep. No. 6040.

Palpi white with very fine golden brown dustings on apical segment. Antennal base clothed above with a long projecting tuft; white, intermarked with golden brown. Antennæ white, annulated beyond basal fourth with light brown. Face and head white. Fore-wings white with apical dustings shading from golden brown to black; cilia black on costo-apical portion to silver gray on dorsal margin. Hind-wings and costal cilia of same, argentious with faint golden overtone; dorsal cilia somewhat darker. Abdomen white. Legs white with faint brownish markings; tarsi not annulated. Alar expanse: 12 mm.

*Habitat:* Falls Church, Virginia.
*Foodplant: Quercus.*
Two adults reared under Hopk. U. S. No. 11135c and 11135d from larvæ collected on *Quercus prinus* and *Quercus alba*. Moths issued June 21 and 25, 1913. I had considerable misgiving about the identity of the species, as Clemens knew it only in the larval stage and his description of the larval case, while corresponding in nearly all details with the specimens before us, is misleading in one point. He describes the posterior end as "squarely excised," while as a matter of fact it curves inward to a blunt point, similar to *C. leucochrysella* Clemens. Larval case 9 mm. long.

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## THE SPECIES OF PERILAMPIDÆ OF AMERICA NORTH OF MEXICO.

By J. C. Crawford, *U. S. National Museum.*

The species in this family fall in three genera *Euperilampus*, *Perilampus*, and *Chrysolampus*. The species which Ashmead referred to the genus *Elatus* must be transferred to *Chrysolampus* since it has only one ring joint and Walker's original description of *Elatus* characterizes that genus as having two ring joints.

### Genus Euperilampus Walker.

The only species of this genus occurring north of Mexico is *E. triangularis* Say. *E. opacus* Ashm. is a *Eurytoma*, Doctor Ashmead being misled by a piece of extraneous matter which had adhered to the scutellum.

## Genus Perilampus Latreille.

TABLE OF SPECIES.

1. Face with a carina from anterior ocellus running laterad and turning downward on each side and extending to, or almost to, the level of insertion of antennæ ..... 2
   Face without such carina or at most an indistinct one running only laterad from anterior ocellus ..... 7
2. Species distinctly greenish, bluish or coppery ..... 3
   Species black or aeneous ..... 4
3. Green or bluish, facial carina prominent, upper part of face between carina and eyes vertically striate; below from eyes to mouth-parts strongly rugose ..... *hyalinus* Say
   Bronzy, facial carina delicate, upper part of face almost smooth, lower part with only a few wrinkles ..... *subcarinatus* n. sp.
4. Face strongly produced, a line connecting lower margins of eyes being some distance above upper margin of clypeus ..... *robertsoni* n. sp.
   Face not strongly produced, upper margin of clypeus about on a level with lower end of eyes ..... 5
5. Face in front of malar furrow rugose-granular ..... 6
   Face in front of malar furrow smooth ..... *carinifrons* n. sp.
6. Parapsidal areas reticulate, upper part of face between carina and eyes reticulate ..... *platygaster* Say
   Parapsidal areas and upper part of face between carina and eyes smooth ..... *bakeri* n. sp.
7. Third joint of antennæ as long as wide ..... *anomoccrus* n. sp.
   Third joint of antennæ much shorter than wide ..... 8
8. Wings under marginal veins with a large infuscated cloud ..... *stygicus* Provancher
   Wings without such a cloud ..... 9
9. Malar furrow distinctly longer than width of malar space at apex ..... *similis* n. sp.
   Malar furrow shorter than width of malar space at apex ..... 10
10. Sides of face above vertically wrinkled; in male the wrinkles extending downward to level of insertion of antennæ ..... *chrysopæ* n. sp.
    Sides of face smooth ..... 11
11. Punctures along middle line of mesoscutum and scutellum well separated ..... *granulosus* n.sp.
    Punctures of middle of mesoscutum and scutellum close ..... 12
12. Small less than 3 mm. face above gently curved ..... *fulvicornis* Ashmead
    Large, about 4 mm., face above produced, angulated from anterior ocellus laterad and no true carina beyond, simulating one being sharply angulated ..... *canadensis* n. sp.

**Perilampus subcarinatus** n. sp.

*Female:* Length 3 mm. Dark olive green; facial carina delicate, reaching almost to lower level of eyes, face in front of malar furrow with rugulæ

converging toward clypeus, behind the malar furrow with similar more distinct rugulæ extending in the same general direction; ocellar triangle transversely rugulose; pronotum and mesonotum coarsely rugoso-punctate, inner margin of parapsidal areas with a broad smooth band; scutellum with the apex emarginate; legs green, bases and apices of tibiæ, underside of anterior tibiæ and tarsi testaceous.

*Type-locality:* San Bernardino County, California.
*Type-specimen:* Cat. No. 18298, U. S. N. M.
Described from two specimens collected in May.

**Perilampus robertsoni** n. sp.

*Female:* Length about 2.5 mm. Black, face smooth, malar furrow distinctly longer than width of malar space at apex, facial carina indistinct beyond the point where it turns downward along inner orbits; ocellar triangle rugulose, in front of lateral ocelli indistinctly rugulose; pronotum and mesonotum coarsely rugoso-punctate; inner margins of parapsidal areas with a broad smooth area; scutellum at apex slightly emarginate; legs black, the knees, bases and apices of tibiæ and the tarsi testaceous.

*Male:* Length about 2.5 mm. Similar to the female but the malar space vertically lineolate; the facial carina distinct almost to lower margin of eyes; ocellar triangle and the areas in front of lateral ocelli more distinctly sculptured than in female.

*Type-locality:* Southern Illinois.
*Type-specimen:* Cat. No. 18299, U. S. N. M.
Described from one female and two males collected by Mr. Chas. Robertson and bearing his Nos. 9729 (type female), 9841 (allotype), 9730 (paratype).
This species is named in honor of the collector and is readily distinguished from the other species by the elongate face.

**Perilampus carinifrons** n. sp.

*Female:* Length about 3.25 mm. Black, facial carina extending only slightly below middle of anterior orbits; face smooth, malar space vertically lineolate; antennæ dark brown, scape black; ocellar triangle indistinctly transversely rugulose, pro- and mesonotum coarsely rugoso-punctate, inner edge of parapsidal areas with a broad smooth band; legs black, the knees reddish, tarsi testaceous.

*Male:* Length about 2 mm. Similar to the female but the funicle ferruginous beneath; the tibiæ obscurely reddish.

*Type-locality:* Kerrville, Texas.
Other localities: Corpus Christi, Beeville, and Dallas, Texas.
Described from four females and two males; types collected by F. C. Pratt, June 19, 1907; two females from Corpus Christi collected October 16, 1908, by Messrs. J. D. Mitchell and F. C.

Bishopp; a male from Beeville, Texas, September 7, J. D. Mitchell, collector; a female from Dallas, Texas, October 12, 1905, F. C. Bishopp, collector.

*Type-specimen (female):* Cat. No. 18300, U. S. N. M.

**Perilampus bakeri** n. sp.

*Female:* Length about 3 mm. Black, facial carina extending about to level of insertion of antennæ, below this the sides of face granular; posterior orbits vertically lineolate; face between carina and inner orbits very indistinctly finely wrinkled, at upper end of orbit more granular; ocellar triangle with a few transverse striæ; antennæ dark brown; pro- and mesonotum coarsely rugoso-punctate, inner margin of parapsidal areas with a broad smooth band; scutellum at apex sub-emarginate; legs black, knees, bases and apices of tibiæ, a stripe on rear of front tibiæ and all tarsi reddish testaceous.

*Male:* Length about 3 mm. Similar to the female but the antennæ ferruginous beneath; the sculpture of the face stronger; the sides of the face between the facial carinæ finely vertically rugulose, between the carina and the eye more distinctly sculptured than in female, the upper portion being distinctly granular.

*Type-locality:* Colorado.

*Type-specimen:* Cat. No. 18301, U. S. N. M.

Described from four females and two males from the C. F. Baker collection, type female bearing the No. 2044, the allotype No 1584, one female and one male paratypes No. 1591, one female, No. 1596, and one, No. 1630.

**Perilampus anomocerus** n. sp.

*Female:* Length about 2 mm. Green, with the thorax above coppery and the abdomen so dark as to appear almost black; face produced, the malar furrow slightly longer than the width of the malar space at apex; upper margin of the clypeus slightly below the level of the lower margin of eyes; face rather densely pubescent, each hair situated in a distinct puncture; anterior portion of the malar space smooth, posterior part vertically rugulose; scape green, rest of antennæ ferruginous, above brownish; ring-joint distinctly as long as broad; mesonotum coarsely umbilicately punctured, the punctures well separated especially along median line, the space between the punctures finely lineolate; medial half of parapsidal areas smooth, polished; wings hyaline, with a small indistinct brownish spot at apex of submarginal vein; femora, except apices, greenish, tibiæ and tarsi reddish testaceous.

*Allotype:* Length about 2 mm. Similar to the female except in secondary sexual characters.

*Type-locality:* Colorado.

*Type-specimen:* Cat. No. 18302, U. S. N. M.

Described from nine females and two males from a large series in the C. F. Baker collection, the types and one paratype female with his No. 1584, the paratype male and one female with his No. 2044, one No. 2084, one No. 2158, and four, No. 1591.

**Perilampus similis** n. sp.

*Female:* Length about 2 mm. Black, with a more or less distinct greenish tinge on head and thorax; very similar to *P. anomocerus*, having a similar produced face but the ring-joint very short, distinctly less than half as long as broad; femora black, tibiæ and tarsi reddish testaceous, the tibiæ all with a dark brown stripe above.

*Type-locality:* Colorado.
*Type-specimen:* Cat. No. 18303, U. S. N. M.
Described from four specimens from the C. F. Baker collection, all bearing his No. 2041.

**Perilampus chrysopæ** n. sp.

*Female:* Length about 2 mm. Green, malar furrow about half as long as width of malar space at apex; upper part of face wrinkled; ocellar triangle transversely rugose; scape greenish, flagellum ferruginous with the base somewhat brownish; pro- and mesonotum coarsely, closely rugosopunctate, inner half of parapsidal areas smooth; scutellum at apex emarginate; legs greenish, knees, bases and apical portion of tibiæ and tarsi testaceous.

*Male:* Length about 2 mm. Similar to the female but the sculpture of the face much stronger and extending half way down anterior orbits; antennæ above brown.

*Type-locality:* Batesburg, South Carolina.
*Type-specimen:* Cat. No. 18304, U. S. N. M.
Described from seven females and six males reared from cocoons of *Chrysopa* sp. with the Bureau of Entomology, U. S. Department of Agriculture Hunter No. 3414.

**Perilampus granulosus** n. sp.

*Female:* Length about 2 mm. Green, malar furrow almost as long as the width of malar space at apex; flagellum ferruginous; pedicel brown; scape with a distinct greenish tinge; pro- and mesonotum coarsely umbilicately punctured, the punctures well separated especially medially where they are more than half a puncture width apart, the space between punctures on rear of mesoscutum and on scutellum smooth; laterad on scutellum, parapsidal areas and middle lobe of mesoscutum between the punctures the surface is granular; inner edge of parapsidal areas with a broad smooth band; femora brown, their apices, the tibiæ, and tarsi reddish testaceous.

*Male:* Length about 2 mm. Similar to the female except in secondary

sexual characters but the granular areas on the mesonotum extend further centrad.

*Type-locality:* Alabama.
*Type-specimen:* Cat. No. 18305, U. S. N. M.
Described from one female and two males from the C. F. Baker collection; female with his No. 1967, allotype with his No. 2497, and the paratype, No. 1912.

**Perilampus canadensis** n. sp.

*Female:* Length about 4 mm. Black, with a distinct bronzy luster on the mesonotum; antennæ dark, apically becoming obscurely ferruginous; vertex produced, sharply angulated, appearing, unless examined closely, carinate as in the species which have a facial carina; sides of face and malar space below with a few coarse punctures, malar furrow somewhat more than half as long as width of malar space at apex; ocellar triangle transversely rugulose; pro- and mesonotum coarsely, closely rugoso-punctate, inner edge of parapsidal areas with a broad smooth band; legs black, tarsi testaceous.

*Male:* Length about 4 mm. Similar to the female but more distinctly bronzy, and the head bronzy; femora distinctly greenish; tibiæ obscurely ferruginous.

*Type-locality:* Canada.
*Type-specimen:* Cat. No. 18306, U. S. N. M.
Described from one male and one female from the C. F. Baker collection; the female with his No. 2021, the male, No. 2066.
This species, owing to the produced vertex, resembles the species belonging to the other section of the genus but careful examination shows that the face bears no real carina, the sharp angulation of the produced portion merely simulating a carina.

## Genus Chrysolampus Spinola.

Doctor Ashmead considered *Lamprostylus* as a synonym of *Chrysolampus* and this synonomy is here adopted. *L. floridanus* Ashm., however, is a species of the genus *Eurytoma*, and is consequently omitted.

### TABLE OF SPECIES.

1. Mesoscutum and scutellum coarsely rugoso-punctate ..... *lycti* n. sp.
   Mesoscutum not as above, either with well separated punctures or finely rugulose ..... 2
2. Mesoscutum transversely rugulose ..... *sisymbrii* Ashm.
   Mesoscutum punctured ..... 3
3. Scutellum parapsidal areas and pronotum above, except anteriorly, almost entirely impunctured ..... *parcipunctatus* n. sp.
   Scutellum and pronotum almost covered with punctures ..... *schwarzi* n. sp.

**Chrysolampus lycti** n. sp.

*Female:* Length about 2.75 mm. Dark bronzy with the head green and the abdomen so dark as to appear almost black; sides of face below level of insertion of antennæ obliquely rugose, above smooth, rear of head circularly rugose with the posterior orbits smooth; parapsidal areas smooth, the outer margin with about two rows of very coarse punctures, sculpture of the median lobe of mesoscutum and of scutellum is in reality umbilicate punctures but they are so coarse and crowded as to become reticulately rugose; scutellum before apex with a transverse carina and back of this one row of longitudinal carinæ; propodeum reticulately rugose, medially with a longitudinal carina; femora brown, with a greenish luster, posterior ones more green; knees, tibiæ and tarsi reddish testaceous, the posterior tibiæ brown except bases and apices; abdomen smooth.

*Male:* Length about 2.5 mm. Similar to the female but the face above level of insertion of antennæ is vertically rugulose.

*Type-locality:* Top of the Alleghanies, Pocahontas County, West Virginia.

*Host:* Lyctus striatus.

*Type-specimen:* Cat. No. 18307, U. S. N. M.

Described from one female and seven males collected by Dr. A. D. Hopkins and recorded under his West Virginia note No. 5781.

This is the species recorded in Bulletin 32, West Virginia Agricultural Experiment Station by Dr. A. D. Hopkins as *Perilampus hyalinus* Say, the determination being made by Doctor Ashmead.

**Chrysolampus parcipunctatus** n. sp.

*Female:* Length about 3 mm. Green, face below level of insertion of antennæ with fine oblique striæ which at insertion of antennæ curve and extend upward for a short distance but are much more indistinct than the oblique portion; face with large scattered punctures; posterior surface of head very finely circularly striate; pronotum with scattered large punctures, viewed from above the visible portion except at extreme base almost impunctured; middle lobe of mesoscutum basally transversely rugulose and with scattered large punctures; parapsidal areas with a few punctures outwardly and a few along inner line; scutellum with a few large punctures basally and along lateral margins; propodeum with medial longitudinal carinæ, very finely substransversely rugulose; petiole about as long as propodeum, with a median longitudinal carina, the sculpture about as coarse as that on propodeum; coxæ and femora green; apices of femora, tibiæ and tarsi reddish testaceous, tibiæ with a brownish spot medially.

*Type-locality:* Los Angeles County, California.

*Type-specimen:* Cat. No. 18309, U. S. N. M.

Described from one specimen collected in April.

**Chrysolampus schwarzi** n. sp.

*Female:* Length 4 mm. Green, face above level of insertion of antennæ vertically rugulose, at insertion of antennæ curving inward and becoming oblique, the face also having scattered punctures; the clypeus smooth with a few scattered punctures; vertical striæ on face reaching almost to level of anterior ocellus, above this the face smooth except for the scattered punctures; rear of head semicircularly rugulose; pronotum with coarse punctures separated by about half a puncture width; middle lobe of mesoscutum at extreme base transversely rugulose, rest of surface with punctures about as close as on pronotum and between them the surface on the anterior part transversely rugulose; parapsidal areas anteriorly transversely rugulose with scattered large punctures; scutellum with large punctures but with the medium line almost impunctured; propodeum irregularly rugulose, petiole about as long as the propodeum, with a median longitudinal carina, surface irregularly rugose; coxæ and femora green, tibiæ bronzy with the bases and apices reddish testaceous.

*Type-locality:* Wasatch, Utah.

Described from two specimens collected June 27, 1891, by Mr. E. A. Schwarz.

*Type-specimen:* Cat. No. 18308. U. S. N. M.

The manuscript name used by Doctor Ashmead is adopted.

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## O. M. REUTER.

By Otto Heidemann, *Bureau of Entomology.*

Dr. O. M. Reuter, entomologist, poet and philosopher, one of our foremost hemipterists, died on September 2, 1913, in Abo, Finland, his native town, at the age of sixty-three years.

Five years before his death his eyesight became impaired and during the last two years he was totally blind. In spite of failing eyesight he contemplated new studies in some groups of the Hemiptera and finished some of his manuscripts with the aid of his assistant, Dr. B. Poppius.

In his last letter written in September, 1912, Doctor Reuter said: "I intend to finish my work on the Termatophylidæ and have the paper published in Wytsman's Genera Insectorum, also the genera of Cimicidæ."

His chief study was the large and very difficult family of the Capsidæ (or Miridæ of some authors). Besides numerous Palæarctic species, he described 56 new species of North American Capsids as early as 1875, and 78 more new species in his publication on Neartic Capsidæ in 1909. In 1905, appeared his classification of the Capsidæ (Hemipterologische Speculationen); but the

most important work he published in recent years was an essay written in German "Neue Beiträge zur Phylogenie and Systematik der Miriden, 1910."

He described many North and South American, Mexican and West Indian Capsidæ and some new North American species of the families Pentatomidæ, Anthocoridæ, Nabidæ and Reduviidæ.

It was his good fortune to possess great energy and working power, which enabled him, while performing his duties as an instructor in zoology at the University of Helsingfors, to publish nearly 500 papers upon the subject of entomology.

The following is a list of papers on American Hemiptera published by Doctor Reuter:

Acanthiidæ americanæ. Öfv. K. Vet. Ak. Förh., 1871, p. 557–568.

Capsinæ ex America boreali in Museo Holmiensi asservatæ. Öfv. K. Vet. Ak. Förh., 1875, no. 9, Stockholm.

Monographia generis Oncocephalus proximeque affinium. Act. Soc. Sc. Fenn., XII, 1883, pp. 675–758.

Monographia Anthocoridarum orbis terrestris. Act. Soc. Sc. Fenn., XIV, 1884, pp. 555–758.

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## A NEW SPECIES OF THE BRACONID GENUS PHANEROTOMA WESMAEL.

By R. A. Cushman, *Bureau of Entomology.*

**Phanerotoma recurvariæ** n. sp.

*Female:* Length 3 mm. Flavous, somewhat paler medially on first and second tergites, wings hyaline. Face, vertex and posterior orbits finely shagreened, clypeus smooth, somewhat paler than face, outline laterally and apically with brown, the suture straight, mandibles pale outlines and tipped with brown; occiput behind ocelli finely, transversely striate; eyes large, the malar space hardly one-fourth as long as the greatest diameter

of the eyes, ocelli situated in a blackish spot; antennæ flavous with dark tips, scape large, as long as pedicel and first flagellar joint together, last four joints of flagellum bead-like; thorax finely shagreened and clothed with short, fine, silvery pubescence; propodeum with an irregular transverse carina and an indistinct triangular areola, the posterior face irregularly, longitudinally striate; wings hyaline, veins brown except in middle of wing, where they are pale, stigma and parastigma pale more or less infuscated behind; coxæ, trochanters, tibiæ basally, and anterior femora whitish, apical tarsal joints blackish, apex of posterior tibiæ somewhat infuscated, legs otherwise concolorous with the body; carapace except apically on the third tergite distinctly, coarsely, longitudinally striate, apically and between the striæ shagreened, deeply, roundly emarginate at apex, venter whitish.

*Male:* Differs from the female principally in having the scape relatively shorter, the flagellar joints beyond the middle longer, and the emargination of the carapace less pronounced.

*Type:* Cat. U. S. Nat. Mus. No. 18417.
*Type-locality:* Benton Harbor, Michigan.
*Host: Recurvaria nanella* Hübn.
Described from four females and four males reared June 24, 1913 by J. H. Paine of the Bureau of Entomology, under Quaintance No. 10602.

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Dr. J. M. Aldrich addressed the Society informally on the use by Indians of the west of larvæ of a species of the genus *Coloradia* as food, and exhibited specimens.

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## CONCERNING SOME APHELININÆ.[1]

By L. O. Howard.

### Genus Mesidia Foerster.

*Mesidia* Foerster. Hymenopterologische Studien, Heft. 2, 1856, p. 30.

The genus *Mesidia* was founded by Foerster on page 30 of his Hymenopterological Studies, second part (1856) but he mentioned no species. Kirchner, in his Catalogue of the Hymenoptera of Europe (1867) lists, on page 143, *Mesidia pallida* Kirch., and in a footnote states that as Foerster founded the genus and kept his species in manuscript which was never published he takes the liberty of giving a specific name to help establish the genus. In this condition the genus rested until 1904, when Gustav Mayr

[1] Presented at the meeting of April 2, 1914.

described *Mesidia pumila* in the third number of his Hymenopterological Miscellanies from a specimen taken by Doctor Foerster, and this may have been the type of the genus for all we know to the contrary. Mayr does not mention whether the club of the antenna is solid or is jointed. Ashmead, in his Classification of the Chalcid Flies, assumes that it is solid and gives the antennæ of *Mesidia* as six-jointed. In Technical Series No. 12, part IV, New Genera and Species of Aphelininæ, the writer described *Mesidia mexicana* n. sp., and erroneously, in his table of genera, stated that the antennæ are seven-jointed; the same error was perpetuated in the figure. Reexamination of the type shows that the antennæ are really eight-jointed, the club being distinctly three-jointed.

The matter now becomes complicated from the finding of a single slide of a Mesidia-like form bred by Prof. C. P. Gillette at Fort Collins, Colorado, from *Brachycolus tritici*, which possesses all of the characters of *Mesidia* with the exception that the club is solid.

Inasmuch as Mayr did not state in so many words that the antennal club of *M. pumila* is solid, although the presumption would be in favor of solidity, the writer by letter begged his friend, Dr. Anton Handlirsch of the Vienna Museum, to which institution Mayr's collection went after his lamented death, to examine the type, with the result that Handlirsch found the club to be solid. Therefore the species named by Gillette is a true *Mesidia* (and is described below), while the writer's *Mesidia mexicana* becomes the type of a new genus which is also here described under the name *Dirphys*.

**Mesidia gillettei** n. sp.

*Female:* Length 1.02 mm.; expanse 2.77 mm.; greatest width of fore-wing 0.44 mm. General color dull honey-yellow, legs and antennæ concolorous with body or perhaps a little lighter, the 2 terminal tarsal sclerites of each leg darker. Pedicel and first and second funicle joints subequal in length, third funicle joint somewhat shorter; club about as long as second and third funicle joints together, somewhat laterally pointed at apex when seen at side; eyes hairy. Wings broad, veins distinctly honey-yellow, stigmal vein very short; oblique hairless streak broad and distinct, widening somewhat towards base. Abdomen ovate, a trifle broader than thorax and about as long; ovipositor not exserted.

*Male:* Unknown.

*Type:* No. 18322, U. S. N. M.

Described from a single female reared by C. P. Gillette, October 13, 1908, from *Brachycolus tritici*, presumably at Fort Collins, Colorado.

### Dirphys new genus.

*Type: Mesidia mexicana* How. Tech. Ser. No. 12, pt. IV, Bureau of Ent., U. S. Dept. of Agr., p. 74, 1907.

*Female:* Antennæ eight-jointed, markedly clavate, club distinctly three-jointed; the three funicle joints about equal in length, but increasing in width from one to three. Eyes hairy. Mesoscutellum transverse, broader than long. Fore-wings broad, with a broad distinct oblique hairless line; submarginal vein unusually broad, stigmal very short and without knob. Hind femora somewhat swollen. Abdomen triangular in shape seen from above, ovipositor well exserted.

It should be explained that the figure accompanying the original description of *D.* (*Mesidia*) *mexicana*, the artist, working without supervision, being confused by the presence on the same slide of fragments of what appears to be a *Coccophagus*, the antennæ in particular are entirely erroneous. The description of the antennæ is also obviously that of the other insect. In the true *Dirphys mexicana* the antennæ are pallid with the club faintly yellowish.

### Genus Paraphelinus Perkins.

*Paraphelinus* Perkins. Bull. 1, part 6, Report of Work of the Experiment Station of the Hawaiian Sugar Planters Assoc., Honolulu, January, 1906, p. 264.

Type: *P. xiphidii* Perk. Loc. cit.

Perkins's *P. xiphidii* was reared from the eggs of *Xiphidium varipenne* Swezey. The only other species so far discovered, viz.: *P. speciosissimus* Girault (Journ. N. Y. Ent. Soc., 1911, p. 181) and *P. australiensis* Girault (Archiv für Naturgeschichte, 1913, pp. 74–75, Ab. A. 6 heft), were both described from single captured specimens, so that their host relations are unknown. The receipt of the new species here described from Mr. P. L. Guppy of Trinidad, who reared it from the eggs of the sugar cane leaf-hopper, *Tomaspis varia*, makes it probable that all species of this interesting genus are parasites in the eggs of Orthoptera and Homoptera that are inserted in twigs or canes. This would be an unique feature in Aphelinine biology (the other forms all ovipositing only in Coccidæ, Aphididæ and Aleyrodidæ) were it not for the old disputed species *Agonioneurus locustarum* Giraud (placed in *Aphelinus* by Dalla Torre) and which was described by Dr. J. Giraud in his Memoir on the insects which live upon the common rose (Verh. d. Zool.-Bot. ges. Wien., vol. 18, 1863, pp. 1278–1279) and which he reared from the eggs of *Xiphidium fuscum* F. It seems to me quite possible that in the old *A. locustarum* we may have another species of *Paraphelinus*. There is

nothing in the original description which would seriously deny this guess, except the absence of the hairless discal streak on the primaries, and this is obscure in the species about to be described.

**Paraphelinus tomaspidis** n. sp.

*Female:* Length 0.57 mm.; expanse 1.15 mm.; greatest width of fore-wing 0.153 mm. General color dull honey-yellow, legs and antennæ pallid. Pedicel longer than third funicle joint; first and second funicle joints together equaling length of third, and both set somewhat obliquely when seen from side; club longer than the three funicle joints and slightly hooked at tip, as indicated in Perkins's figure of the antenna of *P. xiphidii*. Wings hyaline; oblique hairless streak below stigma indistinct and incomplete. Ovipositor well exserted.

*Male:* Unknown.

Described from two female specimens reared from eggs of *Tomaspis varia* by P. L. Guppy, Trinidad.

*Type:* No. 18321, U. S. N. M.

Mr. Guppy writes that only three specimens were reared, and that the species is extremely active, "running backwards and forwards all the time."

## Genus Physcus Howard.

TABLE OF SPECIES.

1. Mesoscutellum much longer than wide ..... *gracilis* n. sp.
   Mesoscutellum at least as wide as long ..... 2
2. Antennal club concolorous with two preceding sclerites... *stanfordi* n. sp.
   Club dark brown, preceding sclerites yellow or white ..... 3
3. Mesoscutum with minute punctures ..... *testaceus* Masi
   Mesoscutum longitudinally shagreened ..... 4
4. Light yellow in color with cross banded abdomen ..... *flavidus* Zehnt.
   Thorax dark brown, abdomen yellow with brown sides. *flaviventris* How.
   Dark in general color ..... 5
5. Scutellum with 2 light round spots surrounded with a rosette of shagreenings ..... *fijiensis* n. sp.
   Such spots not evident ..... 6
6. Marginal vein distinctly yellow ..... *townsendi* n. sp.
   Marginal vein slightly dusky, not yellow ..... *varicornis* How.

## Genus Physcus Howard.

*Physcus* Howard. Tech. Ser. 1, U. S. Dept. Agr., Div. of Ent., 1895, p. 43.
Type: *Physcus varicornis* (How.), *Coccophagus varicornis* How. Ann. Rept. Dept. Agr., 1880, p. 360.

**Physcus fijiensis** n. sp.

*Female:* Length 1.1 mm.; expanse 2.17 mm.; greatest width of fore-wing 0.374 mm. Body rather stout, two and one-half times longer than broad; head nearly half as long as thorax, abdomen slightly longer than thorax, wings reaching well behind tip of abdomen, and about as broad as thorax. Mesoscutellum about as long as broad, well rounded caudad and roundly constricted cephalad. Mesoscutum and scutellum strongly longitudinally shagreened, scutellum with two round spots from each of which the shagreen cells radiate like a rosette. Stigmal vein slender with only a slight knob. General color dark brown, metanotum and center of abdomen dark yellowish, funicle joints two and three of the antennæ white, tip of club whitish, remainder of antennæ nearly black; middle legs yellowish, hind legs light yellowish; front femora and tibiæ brown. Wings hyaline.

Described from seven female specimens reared by Albert Koebele, October 24, 1899, Sava, Fiji, from an *Aspidiotus* on a semi-climbing rutaceous vine.

*Type:* No. 18317, U. S. N. M.

This species will probably, in large series, be found to vary in thoracic coloration since in two of the specimens the mesoscutellum has a central longitudinal yellowish stripe, while the mesoscutum has two such stripes parallel the one to the other.

**Physcus gracilis** n. sp.

*Female:* Length 0.918 mm.; expanse 1.97 mm.; greatest width of fore-wing 0.289 mm. Body slender, thorax more than twice as long as broad; mesoscutellum elongate, longer than broad, scapula impinging on a straight line; fore-wings long, extending when closed very considerably beyond the tip of the abdomen, the stigmal vein just about reaching the abdomen tip. Mesoscutum very faintly longitudinally shagreened; stigmal vein very slightly enlarged at tip. General color reddish yellow, lighter at tip of abdomen and deeper and darker at front border of mesoscutum; legs concolorous with body; scape, pedicel and funicle joints 2 and 3 of the antennæ white, first funicle joint and club dark brown.

Described from seven females from Perth, West Australia, Geo. Compere (Compere's No. 981) and one from Swan River, West Australia (Compere's No. 810). Apparently reared from a Lepidosaphes.

*Type:* No. 18318, U. S. N. M.

**Physcus townsendi** n. sp.

*Female:* Length 0.986 mm.; expanse 2.07 mm.; greatest width of fore-wing 0.374 mm. A stout-bodied form with ovipositor well extruded. Mesoscutellum wider than long, sharply angled against scapulæ and scutum. Mesonotum faintly longitudinally shagreened. Stigmal club larger than

with preceding species, no trace of a postmarginal. General color dark brown, nearly black, opaque; hind coxae whitish; all femora and tibiæ dark brown, light at extremities, except middle tibiæ of which the apical half is yellowish; all tarsi yellowish except the brown terminal segments. Wings hyaline, marginal vein distinctly yellow; antennæ white with first funicle joint and club black.

Described from one female, reared by C. H. T. Townsend at Lima, Peru (Townsend's No. 1145 degree 3a), December 31, 1909. *Type:* No. 18319, U. S. N. M.

**Physcus stanfordi** n. sp.

*Female:* Length 1.1 mm.; expanse 2.07 mm.; greatest width of fore-wing 0.289 mm. A rather slender, elongate form with mesoscutellum rather longer than broad and with the line of impingement of scapulæ on scutellum rounded at anal angle. Mesoscutum and mesoscutellum faintly longitudinally reticulate. General color brown, the abdomen cross-banded with darker brown. Antennal scape brown, pedicel brown above at base, light yellow below; funicle joint one brown, remainder of flagellum, including club somewhat dusky (no contrast between segments two and three and the club such as occurs with other species). Legs colored as with preceding species. Wings hyaline, veins slightly dusky, stigmal vein very slightly enlarged at tip.

Described from one female specimen reared March 22, 1902, by G. A. Coleman of Stanford University from his *Leucaspis kelloggi*. *Type:* No. 18320, U. S. N. M.

## Genus Azotus Howard.

*Azotus* Howard. Proc. Ent. Soc. Washington, IV, 2, 1898, p. 138.
Type: *A. marchali* How., loc. cit., p. 139.

Since I described the genus *Azotus* in the Proceedings of this Society in 1898, four species in addition to the type have been found and described, viz.: *A. capensis* How., *A. pinifoliæ* Mercet, *A. pulchriceps* Zehntner, and *A. speciosissimus* Gir. All have been reared from Coccidæ except the last which was captured. The recorded distribution of the genus is France, Spain, Australia, Java, South Africa and Japan. It is probably of oriental origin and imported into Europe. Specimens of *A. marchali* have been reared in the Bureau of Entomology by Mr. J. F. Zimmer from *Aspidiotus uvæ* Comst. collected in the District of Columbia, so that this species has probably become widely spread.

In a lot of reared parasites received a few years ago from Mr. S. I. Kuwana, of Tokio, the following new species was found.

Fig. 1. *Azotus chionaspidis*, right fore-wing, greatly enlarged.

**Azotus chionaspidis** n. sp.

*Female:* Length, exclusive of ovipositor, 0.61 mm.; expanse 1.19 mm.; greatest width of fore-wing 0.136 mm. General color dull light brown; mesoscutum and scutellum lustrous metallic green, shagreened; head from above lighter than rest of body; eyes bright red; funicle joints two and four silvery white, rest of antennæ dark brown; all legs brown, lighter at knees, middle tibiæ lighter towards tip, tarsi white with terminal joint dusky. Fore-wings irregularly infuscated as in accompanying figure which also shows the distribution of bristles and discal cilia; hind-wings slightly infuscated for basal half.

*Male:* Unknown.

Described from a single female reared by Prof. S. I. Kuwana, Tokio, Japan, August 17, 1909, from *Chionaspis difficilis*.

*Type:* No. 18323, U. S. N. M.

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## NEW PARASITIC HYMENOPTERA FROM BRITISH GUIANA.

By J. C. Crawford, *U. S. National Museum.*

(**Telenomus**) **Prophanurus minutissimus** Ashmead.

A large series of this species was bred from the eggs of *Lycophotia infecta*, in British Guiana, by Mr. G. E. Bodkin. When the species was originally described the host was given as *Dactylopius* species; this record is very probably erroneous as the species of this group, so far as they have been bred, are egg parasites.

**Prophanurus alecto** n. sp.

*Female:* Length about 0.7 mm. Black, with flattened form, the vertex horizontal, posterior orbits broad, not carinate; antennæ reddish-testaceous, the pedicel about as long as the first two joints of the funicle combined,

the first three joints of funicle subquadrate, the fourth transverse, the club five jointed; mesoscutum rather coarsely and closely punctured; scutellum similarly punctured but the disk smooth and polished; legs brown with the bases and apices of femora and tibiæ, and the tarsi entirely, lighter; first abdominal segment striate at base, second with a basal row of pits and beyond this a few short striæ medially.

*Male:* Length about 0.7 mm. Similar to the female; the antennæ flavous, pedicel longer than first joint of funicle; the first three joints of funicle almost subequal in length, slightly longer than broad; the following joints transverse, the last conical; legs, except coxæ, flavous, the femora slightly infuscated; striæ on second abdominal segment beyond the basal pits, longer and more numerous than in female.

*Type-locality:* Plantation La Bonne Intention, British Guiana. Other locality: Plantation Oitvlugt, British Guiana.

*Host:* Eggs of *Diatræa saccharalis*.

The series from the type locality contains six females and one male with the date February 2, 1913; from the other locality one female and eight males, with the date January 31, 1913, all collected by Mr. G. E. Bodkin.

*Type:* Cat. No. 18170, U. S. N. M.

This species is near to (*Telenomus*) *Prophanurus impressus* Ashmead to which it runs in his table[1] but differs in the flattened head and the dark legs of the female, etc.

**Prophanurus thais** n. sp.

*Female:* Length about 0.9 mm. Black, the legs, except the dark front coxæ, testaceous; head transverse, the posterior orbits very narrow, carinate; face reticulated; scape testaceous, funicle light brown, becoming darker apically; club five-jointed, dark brown; pedicel and first joint of funicle subequal in length, following joints of funicle subquadrate; mesoscutum with coarse punctures, the extreme rear smooth, the scutellum smooth; first abdominal segment rugose almost to apex, second segment with basal row of pits but beyond them smooth.

*Male:* Length about 0.9 mm. Similar to the female, the antennæ testaceous shading into brown on apical half of funicle; pedicel about as long as third joint of funicle, distinctly shorter than the first, the first and second subequal; fourth joint of funicle longer than broad, the following joints subquadrate; the last twice as long as broad.

*Type-locality:* Georgetown, British Guiana. Described from 15 specimens bred July 7, 1912, from the eggs of a large pentatomid by Mr. G. E. Bodkin.

*Type:* Cat. No. 18171, U. S. N. M.

[1] Journ. Linn. Soc. Lond., 2, vol. xxv, 1894, pp. 201–203.

**Aphanurus bodkini** n. sp.

*Female:* Length 2 mm. Black, the face finely reticulated and with sparse large punctures; the antennal scrobes transversely rugose, the vertex carinate, the carina on each side extending down the posterior orbits; scape, pedicel, and first joint of funicle reddish honey-color, the rest of the antennæ dark brown, the club composed of six segments; first joint of funicle longer than the pedicel; second joint subquadrate, the third transverse; mesoscutum and scutellum irregularly rugose; the scutellum with a row of pits at apex; metanotum with a middle raised area extending over the propodeum and carinate at apex; this area with three or four longitudinal carinæ; the legs, except the black coxæ, entirely reddish honey-color; first abdominal segment with strong carinæ extending to apex, the second segment slightly wider than long, at base with a row of pits, beyond finely longitudinally rugose for about two-thirds its length.

*Male:* Length 1.75 mm. Similar to the female but the antennæ and legs more yellowish, third joint of antennæ twice as long as pedicel, strongly clavate, fourth and fifth joints also clavate, sixth and following joints distinctly narrower than the fifth and successively narrowing making the antennæ distinctly attenuate.

Described from eighteen females and two males from British Guiana, bred October 9, 1913, from the eggs of *Empicoris variolosus* by Mr. G. E. Bodkin.

*Type:* Cat. No. 18174, U. S. N. M.

**Chalcis pandora** n. sp.

*Female:* Length about 5 mm. Black, head and dorsum of thorax coarsely umbilicately punctured; carina at the front of the malar space running direct to the eye; scutellum with the apical edge rather strongly produced and flat, the plate covered by yellowish pubescence; tegulæ white; legs black; apical half front femora and front tibiæ, except a spot on middle of lower side, light yellowish; mid-femora at apex and the mid-tibiæ, except an elongated black stripe on lower side, light yellowish; hind femora with light yellowish spot at apex; hind tibiæ above with a light yellowish stripe narrowed medially; tarsi, except apices, light yellowish; lower margin of hind femora near base with a large tooth and between this and the apex about eight or nine small teeth; inner side of hind femora finely punctured, the lower margin near the middle with a distinct tubercle; hind coxæ on inner side below with a distinct tubercle near middle; first abdominal segment smooth, the following segments finely punctured and with sparse light yellowish hairs becoming more abundant toward apex of abdomen.

*Male:* Length about 4.5 mm. Similar to the female except for secondary sexual characters.

Described from six specimens from British Guiana, bred April 19, 1913, from larva of a hesperid by Mr. G. E. Bodkin.

*Type:* Cat. No. 18175, U. S. N. M.

Among the secondary sexual characters in this genus, are the tubercles on the hind-coxæ and on the lower inner margin of hind femora, so these characters mentioned for the female will not be found in the male.

**Holcencyrtus calypso** n. sp.

*Female:* Length about 0.87 mm. Face bronzy æneous, frons greenish; mesoscutum green, scutellum bronzy æneous with the apex green; abdomen æneous; face and frons reticulate, vertex sharply carinate behind; lateral ocelli about their own width from eye margin; face produced below, the malar space being almost as long as the eye; antennæ dark brown, clavate; funicular joints subquadrate, the pedicel as long as joints one and two of funicle combined; club about as long as the last three joints of funicle combined; mesoscutum and scutellum reticulate, the former more distinctly and coarsely so; scutellum with a distinct medial longitudinal depression at base; wings hyaline; legs brown, knees, tibiæ at apices and tarsi reddish-testaceous.

Described from many specimens from British Guiana, bred July 20, 1913, from the larvæ of *Calpodes ethlius* by Mr. G. E. Bodkin.

*Type:* Cat. No. 18172, U. S. N. M.

**Elachertus meridionalis** n. sp.

*Female:* Length 1.75 mm. Black, the head with green and purplish tints, the abdomen with a large whitish spot near base; frons finely lineolate and with a few scattered, large punctures; scape testaceous, pedicel light brown, rest of antennæ dark brown; first joint of funicle longer than pedicel; mesoscutum finely irregularly rugose, almost obscuring the parapsidal furrows; axillæ finely lineolate; scutellum finely longitudinally aciculate; metanotum long, smooth; propodeum about twice as long as the metanotum, with a strong median carina; legs whitish, the coxæ almost entirely brown, the hind femora and hind tibiæ with about the apical half brown.

*Male:* Length 1.5 mm. Similar to the female but with less intense brown on the hind femora and tibiæ.

Described from eighteen specimens from British Guiana, reared August 20, 1913, from the larvæ of *Calpodes ethlius* by G. A. Bodkin.

*Type:* Cat. No. 18173, U. S. N. M.

## DESCRIPTION OF A NEW SPECIES OF AGROMYZA FROM PORTO RICO.

By J. R. Malloch.

**Agromyza inæqualis** n. sp.

*Male:* Black. Frons opaque, brown-black on center stripe, shining black on frontal triangle and orbits, the former subtriangular and not reaching to middle of frons; viewed from the side the frontal stripe shows slight signs of whitish pollen; the frontal lunule is distinctly white pollinose as seen from above; antennæ black, arista concolorous; proboscis yellowish at apex, palpi black; cheeks black; mesonotum rather glossy black, with a slight bluish tinge; pleuræ and scutellum concolorous, the former very slightly whitish pollinose. Abdomen glossy black, with a very decided blue-green luster. Legs wholly black. Squamæ whitish yellow, fringe concolorous. Wings clear, veins black. Halteres whitish yellow, the stalk yellow.

Fig. 1. *Agromyza inæqualis* n. sp.

Frons slightly over one-third the width of head, very slightly converging anteriorily; orbits distinct, each slightly less than half as wide as frontal stripe; four pairs of orbital bristles present, the upper one in almost transverse line with the anterior angle of frontal triangle, very weak, the second about twice as long and very strong, the third much weaker, but still stronger than the upper, and the anterior pair of about the same strength as the upper, or posterior, pair; a few weak, scattered hairs present on orbits between the bristles and the eye margin; vertical bristles strong; antennæ moderate in size, situated about middle of head in profile, third joint rounded, the pubescence very short; arista thickened at base, tapering, its length equal to from its base to the upper orbital bristle, pubescence very indistinct; cheek very short and narrow, less than one-sixth the height of eye and almost as high as long; marginal bristles distinct but not numer-

ous; vibrissa well differentiated; face in profile slightly retreating, mouth margin not produced; mesonotum with two pairs of strong dorso-centrals, the anterior pair placed far forward, generally about three-fourths of the distance to the suture; sometimes there is a setula anterior to this bristle but it cannot be considered as a dorso-central; the pair of bristles between the posterior dorso-centrals is distinct but rather weak; discal hairs weak, but numerous, about ten to twelve rows between the dorso-centrals. Abdomen ovate, tapering towards apex; surface hairs numerous but not bristle-like; hypopygium small; legs rather stout; mid-tibia with the posterior bristles well developed and rather closely placed, the upper one distinctly the longest. Wings as figure. Length 2 to 2.5 mm.

*Female:* Similar to the male in all particulars except the ovipositor which is rather short and of the normal form, not projecting further than the length of last abdominal segment.

*Type-locality:* Rio Piedras, Porto Rico, December 2, 1913 (T. H. Jones), Porto Rico Sugar Growers' Association, Accession No. 983, 1913. Three males and one female. Reared from *Vigna repens* (?).

*Type:* Male, deposited in U. S. National Museum, Washington, D. C. This species will run down to *viridula* Coq. in the synoptic table of this genus in my recent paper in the Annals of the Entomological Society of America, but the very marked difference in the size of the orbital bristles should readily separate it from that species, and also from *dubitata* Malloch, which it also resembles very closely. In general appearance this species resembles closely the species belonging to the *virens* group, but the pale halteres may be readily used as a means for separation.

## FOUR NEW SPECIES OF TACHINIDÆ FROM NORTH AMERICA.

By W. R. Walton, *Bureau of Entomology.*

### Polychætoneura new genus.

Body with true macrochætæ, palpi normal, proboscis short fleshy, first, third and fifth veins all bearing closely set black setulæ for at least two-thirds their lengths. Ocellar bristles present normal, facial ridges bristly on lowest fifth only. Arista pubescent, second joint slightly longer than broad. Apical cell entering costa at extreme tip of wing, fourth vein rounded in a circle of large radius, posterior cross vein straight, approximating 90 degrees of angle, entering fourth vein midway to bend. Costal spine small. Head much shorter at vibrissæ than at base of antennæ. Face on lower half of sides, bare. Third antennal joint broad, rounded at apex. Eyes of female bare. Abdomen ovate, legs short.

*Type: Polychaetoneura elyii* n. sp.

**Polychaetoneura elyii** n. sp.

Length 3 to 4 mm. Female, yellow, thorax gray pollinose. Front slightly wider than eye, yellow, parafrontals yellow, whitish pollinose. Frontal vitta yellow, opaque, nearly twice as wide as either parafrontal. Face yellowish-white fading into white on cheeks and epistoma, facial depression very broad, sides of face narrow not more than one-eighth as wide as depression. Vibrissæ black situated slightly below front edge of oral margin. Palpi and proboscis whitish. Antennæ large, reaching almost to oral margin, first, second and base of third joints pure yellow, apical two-thirds of latter darker verging on brown. Arista incrassated on basal third which part is yellow, remainder black. Arista pubescent, almost to, but not reaching tip, hairs nearly as long as greatest diameter of style. Cheeks whitish bearing a few short bristles on front portion of disc and two or three forwardly curving macrochætæ on their lower margins.

Two pairs of orbitals, frontals descending to lower edge of first antennal joint. Entire occiput whitish thinly clothed with whitish bristles and hairs. Thorax including scutellum, entirely opaque gray pollinose, only the merest suggestion of vittæ on the anterior portion when viewed from behind. Post sutural bristles four, sterno pleurals two with sometimes a large bristle-like hair or two below them towards the middle of sterno pleural plate. Abdomen ovate yellow, slightly darker toward apex. First segment destitute of true macrochætæ, second, third and fourth, bearing marginals, the latter two with a row of six or more. Genitalia concealed, venter yellow. Legs including coxæ yellow, middle tibiæ on front side slightly beyond middle with a single strong macrochæta. Hind tibiæ not ciliate. Wings rather short and broad, veins mostly yellow, apical cell open in tip of wing in female.

Described from three females reared from *Schizura concinna* at East River, Connecticut, August 2, 1912, by Mr. C. R. Ely, in honor of whom the species is named. This insect is remarkable chiefly because of its having the fifth vein of the wings bearing setulæ, a character unique among the Tachinids of this country so far as I am aware.

**Dionea timberlakei** n. sp.

*Female:* Rather slender, black and orange yellow. Wings slightly infuscated along costal margin. Length 5 to 7 mm. Female, frontal vitta opaque velvety black, bordered on each side with bands of shining black which occupy full width of parafrontals at vertex, but taper to a point at base of antennæ, area outside of these also lower half of front and fascialia silvery pollinose. Antennæ opaque black, about two-thirds length of face, third joint about twice length of second gently rounded at apex. Arista

incrassated on basal third. Two pairs of orbitals present. Cheeks black, thinly grayish pollinose not wider than one-sixth eye height, transverse impression silvery. Inferior occiput swollen, superior linear, silvery, head wider at vibrissæ than at base of antennæ. Palpi yellowish. Intermediate third of proboscis cylindrical, black, chitinized, apical third fleshy, yellowish, entire length slightly greater than height of head.

Thorax shining black, marked with three short, silvery, pollinose vittæ one over each humerus and one median in a similar manner to *Morelia micans*. Scutellum triangular, shining black, bearing three pairs of marginals and a strongly cruciate apical pair. Dorso-central bristles three, sternopleurals two. Abdomen slender, shining, absolutely bare of pollen, five segments visible, the first quite short and black. Second and third segments orange yellow, bearing a median black vitta which does not reach the anterior or posterior margins in the latter. Fourth segment somewhat wrinkled transversely, dark yellow, marked with a broad black median vitta extending to the lateral margins at the apex of segment. Fifth segments (figs. 3–4) shining black, wrinkled, with a triangular depression in the center upon the margins of which are borne some short black spines, apex provided with the usual stout forceps as shown in the figures.

Segments two to four inclusive, bearing stout median and lateral marginals. No discals present on any segment. Legs rather long and stout, middle tibiæ bearing three strong macrochætæ on front side near middle. Posterior bearing two outside and two inside near middle, apical tibial spurs unusually long and stout.

Wings narrow, slightly infuscated along costal margin. Costal spine present but small. Veins yellowish at base, black at apex. Bend of fourth vein very slightly angulated, apical cell barely open in margin. Hind cross vein enters fourth vein much nearer to bend than to small cross vein. Angle with fifth vein about 115 degrees. Calypters whitish.

*Male:* Differs from female as follows: larger, strongly resembles male of *Leucostoma*. Orbital bristles absent, head (fig. 5) wider than thorax and large in proportion to body. Front very narrow, bare excepting a single row of frontals. Third antennal joint about one and one-half times longer than second. Palpi slender nearly black. Abdomen more ovate, black, longitudinal median bands of second and third segments broader and continuous. Fourth segment sometimes almost entirely black, showing a mere line of yellow on lateral margins. Ordinary vestiture of the abdomen longer and more erect than in female. Venter yellow with a narrow black median vitta. Hypopygium barely visible, black. The bend of the fourth vein is subject to considerable variation in this species, in some specimens it is gently rounded, others have it slightly angulated, one of the latter, a male, bears a distinct short stump at the bend.

Described from seven specimens, male and female, collected at Salt Lake, Utah, May 15 to 21, by P. H. Timberlake of the Bureau of Entomology and in honor of whom this species is named. Two

males standing in U. S. Museum collection under *Leucostoma* undetermined specifically, bearing label Cache County, Utah, J. M. Aldrich. Species belonging to this genus are said to be parasitic on beetles of the genus *Cassida* in Europe.

**Linnæmyia fulvicauda** n. sp.

Resembles *hæmorroidalis* Fall. but differs as follows: Cheeks black, palpi black, not flattened transversely when viewed from front. Fourth segment of abdomen pure orange yellow, front and superior occiput usually golden pollinose. Third antennal joint rounded at apex. Length 8 to 9 mm. Female, frontal vitta dark brown to blackish, sides of front thinly sprinkled with black hairs, and covered with golden pollen which extends downwards on parafacials around border of eyes and also to superior occiput; remainder of face whitish pollinose excepting facial ridges which are bordered on inner side with blackish. Antennæ brown, basal joints black. Third joint (fig. 6a) about twice length of second, straight or slightly concave on anterior border; apex broadly rounded. Arista rather slender, black, second joint about as long as broad. Eyes rather densely hairy. Cheeks distinctly black, clothed with bristly hairs. Palpi black, linear. Proboscis about as long as head height, blackish, chitinized on intermediate third.

Thorax gray, marked with four distinct black vittæ. Scutellum rounded, black, a faint yellowish tinge at apex. Dorso-centrals three, sternopleurals three. Abdomen ovate, three basal segments black pseudomaculate with gray. Second and third bearing discals and marginals. Fourth, dorsally, pure orange yellow slightly yellow pollinose. Genitalia retracted, yellow. Wings slightly grayish. Veins yellowish. Third vein bristly half way to small cross vein. Bend of fourth appendiculate; apical cell open in costa. Legs black including coxæ, hind tibiæ not ciliate, middle tibiæ bearing from two to five strong macrochætæ on front side. Angle of hind crossvein 115 degrees in four specimens, enters fourth vein close to bend.

Male differs as follows: Third antennal joint distinctly convex on front border (fig. 6), nearly two and one-half times length of second. Yellow pollen of front does not usually extend to parafacials. Eyes more densely hairy. Palpi brownish. Hypopygium exerted, doubled forward, entirely yellow. Apical cell more narrowly open in costa. Front in both sexes of about same width, i.e., three-fourths that of eye.

Described from five specimens, male and female, reared from *Remigia repanda* Fabr., by T. H. Jones from specimens taken at Aibonito and Rio Piedras, Porto Rico. Issued February 3 to 23, 1912. Type a female.

**Compsilura oppugnator** n. sp.

*Female:* Black and gray, wings hyaline. Length 7 mm. Front about two-thirds as wide as eye, vitta dark brown, parafrontals golden yellow

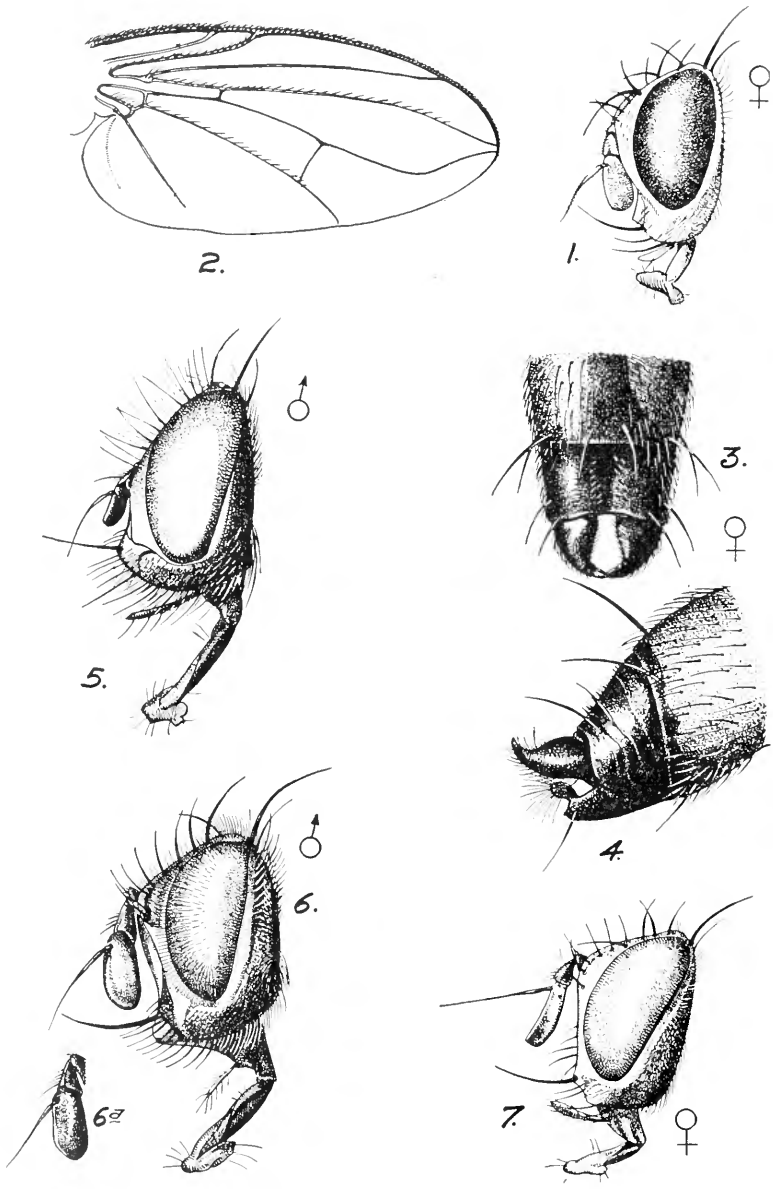


Fig. 1. *Azotus chionaspidis.* Right fore-wing greatly enlarged.

*Polychætoneura elyii: 1* lateral view of head; *2*, wing of same.

*Dionea timberlakei: 3*, female, dorsal view of apical abdominal segments; *4*, same lateral view; *5*, head of male, lateral view.

*Linnæmyia fulvicauda: 6*, male, lateral view of head; *6a*, antennæ of female.

pollinose. Two pairs of orbital bristles present, frontals descending to apex of second antennal joint (fig. 7). Face including cheeks gray pollinose, parafacials not more than one-sixth as wide as facial depression; fascialia bristly on nearly the lower half. Vibrissæ on oral margin not strongly crueiate. Proboscis brown, short and fleshy, palpi dark yellow. Cheeks about one-sixth height of eye. Ocellar bristles absent, eyes in the type nearly bare. Posterior orbits yellowish, occiput gray, rather thinly clothed with whitish hairs. Thorax gray pollinose, four distinct black vittæ visible extending nearly to scutellum where each outer pair is approximated but not joined. Scutellum triangular, gray pollinose, bearing three marginal pairs, also a discal pair; apicals absent. Dorso-central bristles three, sternopleurals three. Abdomen elongate ovate, black, intermediate segments broadly gray pollinose on basal two-thirds extending almost to posterior margins at center and on the extreme sides of segment. A narrow median vitta apparent on intermediate segments. Fourth segment black and grayish pollinose at base, yellow on apical third, anal plate yellow. First and second segments destitute of true median marginal or discal macrochætæ, third bearing a median marginal pair but without discals, fourth with both discals and the usual row of stout marginals.

The two intermediate segments each bearing on its ventral surface a median keel armed with backward curving short stout spines precisely as in *concinnata;* apical segment armed with a curved chitinized piercer. Legs black, middle tibiæ bearing a single stout macrochæta on the front side near the middle, hind tibiæ subciliate.

Wings hyaline, first posterior cell narrowly open in margin, distinctly before tip of wing; fourth vein shortly rounded at bend; costal spine obsolete. Calypters whitish nearly transparent, edges yellowish.

Described from a single female reared from *Cirphis latiuscula* H. S., at Rio Piedras, Porto Rico, January 30, 1912, by Mr. T. H. Jones.

The species described above resembles *Compsilura concinnata* rather strongly, the chief differences are as follows: Front and posterior orbits yellow pollinose; eyes nearly bare; apical pair of scutellar bristles absent; discal macrochætæ of intermediate abdominal segments absent; cheeks not more than one-sixth eye height; tip of fourth abdominal segment and anal plate yellow. The genus *Compsilura* has hitherto not been reported from this country, except of course as artificially introduced into the New England States, and some of the characters above enumerated are by a few authors regarded as of generic value. But as the proposed species is based upon a single reared female specimen, the habitus and main structural characters of which agree exactly with *Compsilura*, I think that it would better be referred here, at least until such time as the male becomes known.

## THE EGG OF PSEUDOSERMYLE TRUNCATA CAUDELL.

By A. N. Caudell, *Bureau of Entomology.*

Messrs. Schwarz and Barber brought from Sabino Canyon, Arizona, a female of the above species which was taken by Mr. F. I. Tucker. It was inclosed in a glass jar and before dying it deposited several eggs, one of which is here figured. This egg is of considerable interest, not so much for the odd shape, for extraordinary shapes are common in this family of Orthoptera, but for the fact that they are not dropped at random by the insect but fastened to some object. In nature, they are very securely glued to the stems and branches of the food plant. The common supposition has been that the eggs of Phasmids were

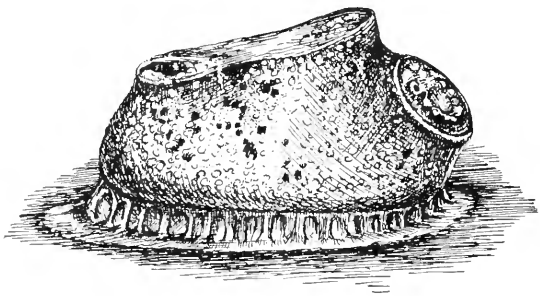

Fig. 1. Egg of *Pseudosermyle truncata,* greatly enlarged.

dropped free but just how far this is true is not at all certain. The eggs of a goodly number of species have been described but the habits of oviposition are but little recorded. Brunner and Redtenbacher in their recent monograph of the family make no mention of exceptions to the rule of free dropping of eggs, nor does Sharp in the Cambridge Natural History. In fact, the only mention I know of the fastening of the eggs of walking sticks is by Shelford in Rept. Brit. Assoc. Adv. Sci., 1901, p. 689–691, where it is stated that in Borneo the Phasmidae of the genera *Necroscia*, *Marmessoidea* and *Agondasoidea* stick the eggs in rows on the leaves of the food plant, not dropped at random as in others.

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*Actual date of publication, June 12, 1914.*

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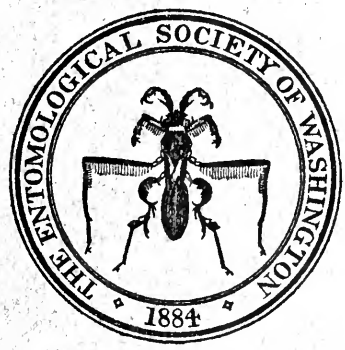




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OF THE

# ENTOMOLOGICAL SOCIETY

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VOL. XVI 1914 No. 3

TWO HUNDRED AND SEVENTY-FIFTH MEETING,
MARCH 5, 1914.

The following program was presented:

Variations in Insects and their Transmission.....Nathan Banks[1]
Method of Fumigating Imported Seed
E. R. Sasscer and Dr. Lon A. Hawkins[2]
A new species of *Callichroma* from Texas.....W. S. Fisher
A Revision of the North American Species of the Braconid genus *Habrobracon*.....R. A. Cushman
Secondary and Tertiary Sexual Characters in Muscoid Flies and their Classificatory Value.....Charles H. T. Townsend

At the conclusion of the program Mr. C. P. Alexander of Cornell University addressed the Society on his studies of the family Tipulidæ, and Mr. M. D. Mitzmain gave an account of his recent work in the Philippine Islands on the insect transmission of surra in stock animals.

## A NEW SPECIES OF CALLICHROMA FROM TEXAS.

BY W. S. FISHER, *Bureau of Entomology.*

**Callichroma schwarzi** n. sp.

*Male:* Rather dull in lustre and of a greenish-blue color throughout above, same beneath but more shining; abdomen rufo-ferruginous; antennæ, all of the femora, tibiæ and tarsi black. Prothorax as in *C. plicatum* Lec., with front deeply constricted, two elevated spaces just back of the constriction and one long transverse elevated ridge on the poste-

[1] Withdrawn by author.
[2] Withdrawn for publication elsewhere.
[3] To be published later.

rior area; with unequally transverse rugæ; densely and finely punctate, with short inconspicuous black hairs. Prosternum concave and transversely plicate. Antennæ twice the length of the body. Elytra strongly tapering from base to apex, tips separately rounded, sides slightly arcuate; clothed with short inconspicuous ashy grey pubescence; densely and finely punctate except small space at base close to the suture with coarser punctures. Under surface covered with ashy grey pubescence. Scutellum triangular, longer than wide, grooved down the middle, irregularly coarsely punctate. Femora of front and middle pair of legs short and thickened, posterior femora long, reaching a little beyond the tips of the elytra, slightly thickened externally. Posterior tibiæ nearly as long as the femora, arcuate and flattened. Notch of the fifth ventral segment parabolic. Length 35 mm.; width at base of elytra 9 mm.

*Female:* Differs from the male in being smaller, antennæ not reaching the tips of the elytra, prothorax similar to that of *C. splendidum* Lec., not transversely rugose at center but densely finely punctured, and slightly rugose toward the sides. Elytra with two inconspicuous transverse bands of a violet shade, one just in front and the other just back of the middle. Posterior femora slightly arcuate. Posterior tibiæ nearly straight. Length 28 mm.; width, 7 mm.

*Habitat:* McAllen, Texas.

*Type* and *allotype* Cat. No. 18237 U. S. N. M. Paratypes in the author's collection.

Described from four specimens, two females and two males, received from D. K. McMillan with the following note, "Collected May 22, 1909, on the blossoms of *Cissus incisa*, rather common and a number of mating pairs were crawling among the foliage."

This species is allied to *C. plicatum* Lec. but is distinguished from that and the other species found in the United States by having dull greenish-blue elytra and all of the femora black. Named for E. A. Schwarz.

The following table will assist in the identification of the species found north of Mexico.

All of the femora testaceous tipped with black..... 1
All of the femora entirely black..... 2
Front and middle femora black, the posterior ferrugineous tipped with black, elytra blue.....*cobaltinum* Lec.
1. Thorax and elytra varying from blue to green, thorax with a coppery hue.....*splendidum* Lec.
Thorax and elytra bright green, without coppery hue. Male with fifth ventral deeply broadly emarginate.....*smaragdinum* Casey
Male with fifth ventral parabolic, not emarginate.....*plicatum* Lec.
2. Elytra velvety black.....*melancholicum* Bates
Elytra greenish-blue.....*schwarzi* Fisher.

## A REVISION OF THE NORTH AMERICAN SPECIES OF THE BRACONID GENUS HABROBRACON JOHNSON (ASHMEAD).

By R. A. Cushman, *Bureau of Entomology.*

The name *Habrobracon* was given by Ashmead in his Classification of the Ichneumon Flies (1900) to include those members of the genus *Bracon* in which the second abscissa of the radius is "not, or scarcely, longer than the first, usually a little shorter than the first transverse cubitus, or no longer." Previous to this date, however, W. G. Johnson published a note (Ent. News, 1895, VI, p. 324–5) in which he used the name in connection with the species *hebetor* Say and *gelechiæ* Ashmead. Ashmead (loc. cit., p. 173) gives as the first publication of the name the above note by Johnson. This makes it necessary to credit the genus to Johnson. Viereck (Bull. 83, U. S. Nat. Mus., 1914, p. 65) credits the genus to Ashmead and fixes *Bracon gelechiæ* Ashmead as the type.

The following description of the genus is gleaned from Ashmead's table of the tribe Braconini:

> Second abscissa of radius not, or scarcely, longer than the first, usually shorter than the first transverse cubitus, or no longer. First discoidal cell petiolate; head, thorax, and abdomen most frequently coriaceous or shagreened, rarely smooth and shining; antennal characters as in *Bracon (sensu stricto)*; ovipositor short, rarely two-thirds the length of the abdomen, most frequently much shorter; last joint of hind tarsi about the length of the third, shorter than the second.

To the above may be added the following: Eyes more or less completely surrounded by a yellow or testaceous ring which sometimes extends inward so as to embrace more or less of the face and of the vertex; mandibles pale with black tips; first tergite with two furrows which converge anteriorly and set off a nearly equilateral, triangular, median area; second tergite subequal in length with the first, longer than the third, sculptured usually more coarsely than, and frequently differently from, those following.

The species of this genus show marked variations, not only in intensity and arrangement of color, but in such structural characters as the number of antennal joints, wing venation, sculpture and proportionate lengths of the tergites, relative length of ovipositor and abdomen, and even in the shape of the first tergite. A misunderstanding of the range of these variations, through lack of sufficient material for study, has led to the description of a number of species separated from others by the use of one or more of these variable characters.

The following table will separate the seven North American species referred to the genus. In the examination of the speci-

mens a Zeiss binocular with objective $a_3$ and eyepiece 4, giving a magnification of 61 diameters, was used. This high magnification is necessary for the observation of the minute sculptural characters used.

## Habrobracon Johnson (Ashmead).

### TABLE OF SPECIES.

Antennæ stout and tapering toward the tip, flagellar joints beyond the second but little longer than wide; ocellar spot nearly or quite separated from the occipital spot by inward extensions of the yellow orbital ring behind the ocelli; face largely or wholly yellowish..... 1

Antennæ slender not tapering toward the tip, flagellar joints much longer than wide; ocellar spot and occipital spot broadly confluent... 2

1. Body smooth or but very faintly sculptured throughout; antennæ in female 13 to 15-jointed (17-jointed, according to Wesmael), in male 20 to 22-jointed (20 to 26, according to Wesmael); ocellar spot almost invariably entirely separated from occipital spot. *brevicornis* (Wesm.) (= *hebetor* auct. not Say = *juglandis* Ashm.)

   Body distinctly sculptured; antennæ in female 20 to 22-jointed, in male 23 to 25-jointed; ocellar spot except in very pale specimens not entirely separated from occipital spot..... *variabilis* n. sp.

2. Second tergite with a median embossed area set off at least anteriorly by crenulate grooves, its surface differently sculptured from the rest of the tergite (in the male this character is less evident, the area being more narrow and the grooves less distinct); rest of tergite more or less finely, irregularly, longitudinally or reticulately rugulose..... 3

   Second tergite without an embossed area, granularly roughened, without rugæ though sometimes with very fine reticulation on the basal middle..... 5

3. Furrows of first tergite narrow and not crenulate, the triangle without large punctures apically, lateral areas shagreened; second tergite reticulate..... *platynotæ* n. sp.

   Furrows of first tergite broad and crenulate, the triangle with a few large punctures apically, lateral areas much roughened; second tergite longitudinally rugulose..... 4

4. Mesoscutum with a large quadrate testaceous spot in front of the scutellum from which lines of the same color extend forward along the positions of the notauli; face in female with broad inward extensions of the yellow orbital rings below the antennæ; antennæ testaceous, infuscated beyond the middle, 23 to 24-jointed, in male (lost, but from the description evidently a poorly developed specimen) 21-jointed; abdomen in female yellowish, darker laterally *xanthonotus* (Ashm.)

Mesoscutum entirely black or with the color pattern reduced to lines indicating positions of notauli; face in female with the yellow reduced to a small spot beneath each antennal fossa, separated from the orbital ring by a brownish stain; antennæ black or occasionally somewhat testaceous, with 24 or more joints in female and 25 or more in male; abdomen in female with same color pattern as in *xanthonotus* but darker throughout, in male with the second tergite pale and the remaining tergites dark.....*hopkinsi* Vier. (= *mali* Vier.)

5. Abdomen in female much wider than half its length, wider than the thorax, sixth and seventh tergites barely visible from above; female black, male with abdomen, especially second and third tergites, broadly margined with yellow, dark medially
*gelechiæ* Ashm. (=*notaticeps* Ashm.)

Abdomen in female not much wider than half its length, not wider than the thorax; tergites 6 and 7 distinctly visible from above; sexes similarly colored.....*johannseni* Vier. (= *tetralopha* Vier.)

**Habrobracon brevicornis** (Wesmael).

*Bracon brevicornis* Wesmael, Nouv. Mem. as.sc. Bruxelles, XI, 1838, p. 23, fig. 2 (wing).

Brischke, Schr. Naturf. Ges. Danzig, (2) IV, 1882, p. 135. Host.—*Dioryctria abietella.*

Kirby, Trans. Ent. Soc. Lond., 1884, Proc., p. xxxi. Host.—*Ephestia elutella.*

Marshall, Trans. Ent. Soc. Lond., 1885, p. 24, Pl. I, figs. 1a (wing) and 1b (head and thorax). Redescription. Hosts.—*Mylois ceratoniae.* Galls of *Andricus terminalis.*

Geikie, Trans. County of Middlesex Nat. Hist. and Sci. Soc., Nov. 8, 1887. Host.—*Ephestia kuehniella.*

Ichneumonid Klein, Trans. Ent. Soc. Lond., 1887, Proc. p. lii–liv. Host.—*Ephestia kuehniella.*

*Bracon brevicornis* Billups, Trans. Ent., Soc. Lond., 1888, Proc. p. xxviii. Host.—*Ephestia kuehniella.*

Marshall, Andre's Spec. Hym. Eur., IV, 1888, p. 139. Redescription.

*Bracon juglandis* Ashmead, Proc. U. S. Nat. Mus., 1890, p. 62. Host.—Tineid? infesting old walnuts.

*Bracon brevicornis* Danysz, Bull. Séances Soc. Ent. France, 1893, p. clxxviii.

*Habrobracon hebetor* Johnson, Ent. News, VI, 1895, p. 324. Host.—*Ephestia kuehniella.* Also mentions Klein's article using name *Bracon brevicornis.*

*Bracon* (*Habrobracon*) *honestor* Riley and Howard, Ins. Life, VII, 1895, p. 428. Misprint in specific name corrected in general index. Host.—*Plodia interpunctella.*

*Bracon brevicornis* Schmiedeknecht, Illust. Wochenschr. f. Ent., I, 1896, p. 541.

*Bracon (Habrobracon) hebetor* Chittenden, U. S. Dept. Agr. Bur. Ent. Bul. No. 8 (n.s.), 1897, pp. 38–40. Suggests possibility, according to Ashmead of synonymy with *brevicornis*. Hosts.—*Ephestia cahiritella, Galleria mellonella.*

*Bracon juglandis* Chittenden, loc. cit. Referred to as variety of *hebetor*. Hosts.—*Ephestia cahiritella, Plodia interpunctella.*

*Habrobracon hebetor* Buchwald & Berliner, Zeitschr. f. d. gesamte Getriedewesen, II, 1910, pp. 1–4, figs. 1 and 2. Host.—*Ephestia kuehniella.*

Specimens in the National Museum determined by Ashmead and others as *hebetor* Say and *juglandis* Ashm. agree with Marshall's description of *brevicornis* Wesm. and are identical with a specimen from Europe determined by Schmiedeknecht as *brevicornis*. Chittenden (Bur. Ent. Bul. 8, p. 39) suggests, on the authority of Ashmead, that these two species are synonyms of *brevicornis* Wesm. All of the reared specimens of *hebetor* and *juglandis* in the collection are reared from hosts that breed in stored products of various sorts, principally from various species of the genus *Ephestia*. This seems to be the normal host of the species as well as of *brevicornis* in Europe. All the specimens in the National Museum that can be construed as agreeing otherwise with *hebetor* Say differ from the original description of that species in having the coxæ largely black not "yellowish-white." Furthermore, Say makes no mention of the black occipital spot which appears in all dark specimens. In the description of *Bracon dorsator* on the page following that of *hebetor*, Say observes that *dorsator* agrees with *hebetor* in that "the first cubital cellule is wider by one-third than the second at their junction." In all the specimens in the National Museum this difference is at least one-half and usually more. It seems from these facts that the specimens reared from such hosts as those mentioned above are not the *hebetor* of Say. Such being the case the *hebetor* of authors must sink into synonymy with *brevicornis* Wesm., while the *hebetor* of Say must stand as an unknown species.

Specimens of this species in the National Museum, in addition to those which agree with Marshall's description of the species, show variations of practically all grades from those in which the dorsum of the thorax and abdomen is entirely black except the apical tergite and faint traces of the thoracic markings, and the ocellar and occipital spots narrowly joined, to those in which the color is largely yellowish without the typical spots on the head, the dark color of the mesonotum reduced to three small spots and the abdomen nearly uniformly pale. In some specimens the head is practically all black with only faint indications of the color pattern. The number of antennal joints in females

varies from 13 to 15 and in males from 20 to 22. The size also varies considerably, the smallest males being about 2 mm. long and the largest females about 3 mm.

The material examined consists of nearly a hundred specimens from Illinois, Massachusetts, California, Nevada, Florida, West Virginia, Ohio, New York, and the District of Columbia together with a number of unlabeled specimens and three from Europe. Many of these were reared from such hosts as *Ephestia kuehniella*, *E. elutella*, *Plodia interpunctella*, and *Galleria mellonella*.

**Habrobracon variabilis** n.sp.

*Female:* Length 3 mm. Face and orbit yellow, this color triangularly extended inward behind the ocelli from each side so that the dark spot in which are located the ocelli is nearly separated from the dark occipital spot; antennæ 21-jointed, black, stout, tapering toward the apex, the joints of the flagellum except the first but little longer than thick; palpi yellowish.

Thorax largely dark brown above, the scutellum laterally, posterior middle of mesoscutum and the positions of the notauli testaceous; testaceous below; all legs except hind coxæ basally, hind tibiæ apically, and basal joints of hind tarsi, which are infuscated, testaceous; wings dusky, apical third hyaline, veins except costa and anterior edge of stigma pale, a small whitish spot on the base of the stigma.

Abdomen with the first tergite dark brown, pale apically, the second testaceous except for a dark spot on the basal middle and a suffused spot on each side, the third, fourth, and fifth dark brown except laterally and medially where they are testaceous, the remaining visible tergites testaceous; first tergite with the furrows crenulate, the triangle without large punctures apically, sides beyond spiracles arcuate; second tergite with a median basal embossed area, coincident with the median dark spot set off laterally by obscurely crenulate furrows, rest of tergite finely, irregularly, longitudinally rugulose; third to fifth similarly sculptured but the sculpture changing gradually until in the fifth it becomes reticulate rugulose; remaining tergites barely visible; exserted portion of ovipositor slightly less than half the length of abdomen.

*Male:* Length 2.5 mm. similar to female; antennæ 25-jointed, more slender, all flagellar joints distinctly longer than thick; all coxæ testaceous; first tergite pale testaceous with the triangle somewhat darker and with its sides straight; second tergite entirely yellowish.

*Host.*—*Canarsia hammondi*.

*Type locality.*—Siloam Springs, Ark.

*Type* Cat. U. S. N. M. No. 18275.

Allied to *brevicornis* Wesm. from which it is at once distinguished by the distinct abdominal sculpture, the larger num-

ber of antennal joints, the entirely yellow face, and the partial coalescence of the ocellar and occipital spots.

Described from 3 females and 2 males (the type female, male, and paratypes *a*, *b*, and *c*) labeled Quaintance No. 5155, Siloam Springs, Ark., 9.26.08, S. W. Foster, collector, parasite of *Canarsia hammondi;* 2 females (paratype *d* and 1 other) labeled 440[01], issued Aug. 20, '90, Par. on *Pempelia hammondi* from Miss Murtfeldt; 2 females (paratype *e* and 1 other) from Champaign, Ill.; 3 males (paratypes *f* and *g* and 1 other) labeled Quaintance No. 5083, Siloam Springs, Ark., 6.26.08, S. W. Foster, par. of *Enarmonia prunivora;* 5 females and 2 males (paratypes *h–l* and 2 others) labeled Parasite of *Desmia funeralis*, Vienna, Va., Sept. 15, Quaintance No. 10622, J. F. Strauss, collector; 4 females (including paratypes *m* and *n*) Midvale, Pa., Sept. 1, 1913, Quaintance No. 6126, F. L. Simanton, Coll., parasite of *Lactilia coccidivora*.

This species is extremely variable in color, although the color within a series from an individual host is quite constant, varying, as a rule, only in minor details. The paratypes show all grades of variation, *e* being much paler and *k* much darker than the type female. In *e* the ocellar and occipital spots are entirely separated; mesoscutum entirely yellowish-testaceous except a narrow median line anteriorly and a suffused spot on each hind angle; scutellum pale throughout; propodeum somewhat lighter, especially laterally, where it is testaceous; legs pale, hind coxæ yellowish; stigmal spot occupying nearly half of the stigma; first tergite testaceous except triangle basally, second tergite yellow throughout; on the remaining tergites the light markings are somewhat more extensive and paler. Paratype *i* is smaller and much darker than the type, the thoracic markings practically obsolete and the color pattern of the abdomen very obscure, face with a median dark line which broadens out into a spot on the clypeus. In paratype *n* the ocellar and occipital spots are broadly joined.

**Habrobracon platynotae** n.sp.

*Female:* Length 3 mm. Head black with the face fuscous, the orbital ring, genæ, and a spot below each antenna yellowish; orbital ring broadly interrupted behind the eye with a small pale spot immediately behind the eye and not extending mesad behind the ocelli; mandibles colored like the face with black tips; antennæ black, long, 24-jointed, uniform in thickness, the basal flagellar joints about 1½ times as long as thick.

Thorax black, legs testaceous except that the apical joint of the front tarsi, the middle and hind tibiæ and tarsi, and the coxæ basally are infuscated; wings dusky with the apical third hyaline, the veins fuscous.

Abdomen testaceous somewhat infuscated especially beyond the second

tergite; first tergite testaceous with the anterior angle of the triangle somewhat infuscated, the furrows not crenulate, the areas shagreened; second tergite with the median embossed area distinct only basally its sides diverging rapidly, this and the base of the third tergite reticulately roughened, the third apically and the fourth and fifth entirely granularly roughened; exserted portion of ovipositor half as long as abdomen.

*Male:* Differs from female principally in its smaller size and in having the four anterior coxæ and femora largely blackish, and the embossed area of the second tergite indistinct.

A single female paratype agrees in all respects with the type.

*Host.*—*Platynota* sp.

*Type locality.*—Hollywood, Calif.

*Type* Cat. U. S. N. M. No. 18276.

Described from the above three specimens which were reared May 12, 1913, by J. E. Graf of the Bureau of Entomology.

**Habrobracon xanthonotus** (Ashm.)

*Bracon xanthonotus* Ashmead, Proc. U. S. Nat. Mus., XI, 1888, p. 618.

The only specimens of this species in the National Museum are the 14 females of the type series and two others. The type male is apparently lost. From its small size and the fact that it had fewer antennal joints than the female it must have been a dwarf and poorly developed specimen.

The only characters that I have been able to discover that will separate this from the following species are variable, and I believe that the two are conspecific, but hesitate to reduce *hopkinsi* Vier. to synonymy because of the paucity of intergrades between the two types. One of the specimens agrees with *hopkinsi* in facial markings.

**Habrobracon hopkinsi** Vier.

*Habrobracon hopkinsi* Vier., Proc. U. S. Nat. Mus., vol. 38, 1910, p. 380.
*Habrobracon mali* Vier., Proc. U. S. Nat. Mus., vol. 41, 1913, p. 611.

The character in which Viereck considered his *mali* to be allied with *xanthonotus*, as indicated in his description of *mali*, and in which it differs from *hopkinsi*, is found in a manuscript table to the species, and consists in the possession of testaceous markings on the mesoscutum. His description of the species consists of a statement of the differences between it and *xanthonotus*. All of the characters used are those which an examination of a large number of specimens of several of the other species of the genus shows to be subject to extreme variation. This is especially true of the color patterns of the thorax and abdomen and the number of antennal joints.

*H. hopkinsi* was described from a series of 18 specimens reared from *Notolophus oslari*. It is described as having the mesonotum entirely black, and yet, in the type series, there is one female that shows the testaceous markings in the position of the notauli quite distinctly. A careful examination of every specimen of the type material in both *hopkinsi* and *mali* together with another series of *mali*, reared by the writer from the same host and locality, and a large series of specimens mostly reared from *Clisiocampa pluvialis* and *C. constricta* in California, some of which resemble *hopkinsi* and some *mali*, has convinced me that the two are but variants of the same species. Aside from the mesonotal markings there is comparatively little variation in color in the species as at present limited, but in the number of antennal joints there is considerable variation. In the *hopkinsi* series the females have 24 to 25 antennal joints and the single male with complete antennæ has 25 joints; in the *Clisiocampa* series the females have 24 and the males 28 to 29 joints; and in the *mali* series the females 27 and the males 28 to 29 joints. Some of the specimens of the *Clisiocampa* series show a tendency toward *xanthonotus* in the color of the antennæ. In addition to the material mentioned above there are in the National Museum specimens from New Hampshire, California, Malden (Mass.?), and a series of 5 specimens from Yosemite, Cal., reared from a Noctuid (?) larva. The last differ from the type in being somewhat larger and in having the markings somewhat paler and more extensive, and agree with the type of *mali* in the number of antennal joints.

The *Bracon* n. sp. of Ins. Life, II, p. 349, parasitic on *Clisiocampa constricta* belongs here and is a part of the material examined.

The *Bracon gelechiæ* of New Hampshire Exp. Sta. Bul. 6, Tech. Ser., is undoubtedly this species.

**Habrobracon gelechiae** Ashm.

*Bracon gelechiæ* Ashmead, Proc. U. S. Nat. Mus., 1888, p. 623.
*Bracon notaticeps* Ashmead, loc. cit., p. 624.
*Habrobracon gelechiæ* Johnson, Ent. News, VI, 1895, p. 324.

The female of this species can at once be distinguished from *johannseni* Vier. by the greater width of the abdomen as compared to its length and to the width of the thorax and by the retraction of the terminal tergites. The male is at once distinguished by the color pattern of the abdomen, black bordered with yellow which extends nearly to the middle on the second tergite.

Comparison of the types of *notaticeps* (Ashm.) with those of *gelechiæ* proves the two species to be the same, the differentiating

characters as given by Ashmead in his description of the latter species, that is, the color of the legs and the number of antennal joints, being both very variable characters.

The only female of this species in the type series lacks entirely the yellow tergal color ascribed to the species by Ashmead in his description. Unfortunately also the head is missing. It is possible that the female and the males are of different species, the opposite sex of each of which has not been identified. The exact status in this respect can not be satisfactorily determined except by the rearing of more material under careful observation.

One female from Kansas collected by C. L. Marlatt and labeled by Ashmead *Bracon notaticeps*, which differs from the type in having the abdomen brown on the sides, has been provisionally referred to this species.

The *Bracon* n. sp. of Ins. Life, II, p. 349, parasitic on *Gelechia roseosuffusella* Clem. belongs here and is a part of the material examined.

**Habrobracon johannseni** Vier.

*Bracon* sp. Johannsen and Patch, Bul. 195, Maine Agr. Exp. Sta., 1912.
*Habrobracon johannseni* Viereck, Proc. U. S. Nat. Mus., vol. 42, 1913, p. 622.
*Habrobracon tetralophæ* Viereck, loc. cit., p. 623.

Redescription of type female.—Length 2 mm. Head black with a narrow interrupted line above and in front of the eyes dark testaceous; mandibles testaceous, black at tips; antennæ black, slender, uniform in thickness, 22-jointed.

Thorax black throughout, delicately shagreened; legs blackish, testaceous at the articulations, hind tibiæ and tarsi largely testaceous; wings hyaline with the veins brownish and the pubescence blackish, paler toward base of wing.

Abdomen black above narrowly bordered with testaceous posteriorly, about half as wide as long and about as wide as thorax, the sixth and seventh tergites extended; first tergite with the furrows narrow and not crenulate, its surface shagreened, sides beyond the spiracles straight and parallel; second tergite granularly and slightly reticulately roughened; tergites 3, 4, and base of 5 shagreened, 5 apically and 6 and 7 smooth; exserted portion of ovipositor half as long as abdomen.

This species was originally described from two specimens reared from an undetermined Tineid in pine cones at Orono, Me. In the same paper Viereck described *H. tetralophæ* from two females and a male reared at Lafayette, Ind., from *Tetralopha baptisiella*. The description of the latter species consists of a comparison with *johannseni*. The only characters used, length,

number of antennal joints, and color of hind femora, are all very subject to variation throughout the genus. The types of the two species differ also in the shape of the first tergite. In *johannseni* the sides of this segment beyond the spiracles are straight and parallel while in *tetralophæ* they are curved and slightly divergent. Examination of a large series of specimens from other sources shows that the shape of this tergite varies from the form shown in *johannseni* to those showing even more curvature and divergence than in the type of *tetralophæ*. In all of the males the first tergite is of the form exhibited by the type of *johannseni*.

Besides one of the type specimens of *johannseni* and three of *tetralophæ* the following material was examined: a large series reared by J. E. Graf at Los Angeles and El Monte, Calif., from *Phthorimea operculella* under Chittenden No. 2229; 3 specimens from the same host at Norfolk, Va., Chittenden No. 2721[a]; 12 females and 1 male from *Desmia funeralis* in Fairfax Co., Va., Quaintance No. 5569, J. F. Strauss; 2 females from the same host from the Ashmead collection; 1 female from Riley Co., Kans., Marlatt; 2 females from Champaign, Ill., 2 females from Oswego, N. Y.; 2 females from Salineville, Ohio; 1 female from Franklin Co., Ark., Webster; and 1 female from Agr. Coll., Mich. All the California parasites of *Phthorimea* resemble the type of *johannseni* in color except that the light margin of the abdomen is somewhat more distinct. In this series nearly all gradations in the shape of the first tergite are found. The Virginia parasites of *Desmia* agree in color of the legs with *tetralophæ* and show some variation in the shape of the first tergite, but are mostly somewhat larger than the types. The New York specimens agree with *tetralophæ* except that the orbital ring is somewhat paler and more distinctly defined. In the Kansas specimen the black color of the abdomen is replaced by brown, and the border is yellow, while all of the legs are pale. In the two specimens reared from *Desmia* without locality and the two Illinois specimens the reduction of the abdominal color is carried still further, while the mesopleuræ and pronotum laterally are more or less testaceous to yellowish. The number of antennal joints in the female varies from 19 to 36, the smaller specimens having the smaller numbers. In the males of the *Phthorimæa* series the antennæ are from 23 to 27 jointed; neither of the other males has the antennæ entire.

## Two Hundred and Seventy-Sixth Meeting, April 2, 1914.

The following program was presented:

Notes on Some Microlepidoptera on Forest Trees with Descriptions of New Species.....August Busck[1]
Descriptions of two Parasitic Hymenoptera.....S. A. Rohwer[2]
Aquatic Insect Life at Castle Hot Springs, Arizona.....E. A. Schwarz[1]
Notes on some Beetle Larvæ from Arizona.....Dr. Adam Böving[1]
Concerning some Aphelininæ.....L. O. Howard[3]
Descriptions of New Chalcid-flies.....A. A. Girault

### DESCRIPTIONS OF NEW CHALCID-FLIES.

By A. A. Girault.

#### Genus Anaphoidea Girault.

**Anaphoidea luna** new species.

*Female:* Length, 0.50 mm. Black, the scape, pedicel and proximal three tarsal joints dusky lemon yellow, the trochanters and knees pallid; wings obscurely, slightly fumated, subhyaline; cephalic tibiæ lighter.

Differs from the other European species, *diana* Girault, in being black instead of brown, in having the second funicle joint more than twice the length of the first and only slightly shorter than the third. In regard to the three North American species, it is most similar to *pullicrura* with which it may be confused; however, upon comparison of specimens, *pullicrura* is seen to differ in that the fore wings are more deeply infuscated and not quite so broad, their caudal margin more concavely curved and the scape and pedicel are darker. Also in *luna* the midlongitudinal line of discal cilia is longer and may include as many as eleven cilia. Otherwise I cannot distinguish between the two. It is distinct from other North American species. Of the Australian species (*harveyi, galtoni, linnæi*) it is distinct from all excepting *linnæi*, which it resembles closely. However, *linnæi* differs in that the proximal tarsal joints are longer, the legs lighter, the fore wings more deeply infuscated, the scape and pedicel dark. The Australian *linnæi* is thus allied with the North American *pullicrura* (from which it differs mostly in bearing longer proximal tarsal joints) and this European species, the three distinguishable only on very slight differences and yet undoubtedly distinct species.

From three specimens, two-third-inch objective, 1-inch optic, Bausch & Lomb.

[1] Will be published later.
[2] See page 141.
[3] Published in these Proceedings Vol. XVI, No. 2.

*Male:* The same but the scape and pedicel still lighter; antennæ nearly similar to those of male *pulticrura* but the flagellar joints lengthen slightly distad instead of shortening, funicular joints 3-6 subequal, each about a sixth longer than either joint 1 or 2.

From three specimens, similarly magnified.

Described from three specimens of each sex mounted together on a slide received for study from Prof. F. M. Webster through the kindness of Dr. L. O. Howard, the slide labelled "6655. Mymarid parasites of *Phytonomus* (from shipment from Italy by Fiske). Salt Lake City, April 8, 1911. T. H. Parkes."

*Habitat:* Europe, Italy (Portici); North America (imported)—Utah (Salt Lake City and Murray).

*Host: Phytonomus posticus* Gyll.

*Types:* Cat. No. 15452, United States National Museum, Washington, D. C., the above specimens—three males and three females.

My attention was drawn to the existence of this species by looking over Bull. No. 112, Bureau of Entomology, U. S. Department of Agriculture, where on page 35 it is stated that a Mymarid egg-parasite, *Anaphes* species, was found in seven shipments of the Phytonomus from Italy. On the preceding page (fig. 15) an enlarged figure of the male and the female antenna is given. At the time, the figure looked to me like *Anaphes pratensis* Foerster, the only European Mymarid recorded from North America. I was therefore anxious to receive specimens, and my application to Professor Webster, the author of the bulletin mentioned, resulted in the receipt of a slide bearing the six specimens of the foregoing species of *Anaphoidea*. Thus, if the figure is correct, there must be two distinct species of egg-parasites concerned. Having a North American (Urbana, Illinois, May 7, 1911) specimen of the *Anaphes pratensis* I compared it with the figure given in the bulletin and though I cannot be certain, the agreement of the figure of the female antenna with my specimen is perfect. The tarsi and wings, however, do not agree and if there has been no error in the figure, the latter represents a species of *Anaphes* different from *pratensis*.

## Genus Alaptus Haliday.

**Alaptus animus** new species.

*Female:* Length, 0.24 mm. Black suffused with dark brown, the legs and antennæ pale but touched in places with dusky, the antennal club black, contrasting. Fore wings subhyaline, dusky under the venation; posterior wings dusky, maculate with whitish. Fore wings narrow, with a mid-longitudinal line of from four to five discal cilia, the line rather short and

somewhat distad of the mid-distance between apex of venation and apex of wing. Antennæ with the proximal funicular joints more or less cylindrical, joint 1 short, barely longer than wide, somewhat shorter than funicular joint 3; joint 2 nearly longest, twice longer than wide but subequal to joints 4 and 5 which are cylindrical ovate; club long, slender, conic-ovate, subequal in length to the funicle. Pedicel somewhat longer than any of the funicular joints.

Of the Australian species, closest to *nortoni* Girault, from which it may be distinguished by its darker body coloration, the pale antennal funicle contrasting with the dark club and the comparatively great length of the latter.

*Male:* Not known.

Described from two females captured on windows in a private residence at Nelson, North Queensland, November 22, 1912, 16th-inch objective, 1-inch optic, Bausch & Lomb.

*Habitat:* Australia, Nelson (Cairns), Queensland.

*Types:* No. Hy. 1289, Queensland Museum, Brisbane, the foregoing specimen on a slide in xylol-balsam.

**Alaptus maccabei** new species.

*Alaptus immaturus* Perkins, *partim.*

*Female:* Length, 0.33 mm. Black suffused with some brown, the legs either pallid or dusky, the scape and pedicel pale yellowish. Like *immaturus* Perkins, as identified in the paper on Australian Mymaridæ (Girault, 1912)[1] but the body much darker and the line of ciliation in the disc of the wing is much longer, extending from apex to the venation. The thorax is somewhat paler.

*Male:* Not known.

Described from the two females from Nelson and Herberton, Queensland, identified as *immaturus* Perkins in my paper on Australian Mymaridæ (Part II, Australian Hymenoptera Chalcidoidea).[1] The species may be merely a variety of *immaturus;* the specimen of the latter, as identified by myself, had the head and abdomen dark brown, the thorax pale lemon yellow.

*Habitat:* Australia, Nelson and Herberton, North Queensland.

*Type:* No. Hy. 1290, Queensland Museum, Brisbane, one female in balsam (Herberton, Q., 28 Dec., 1911) mounted with the type female of *Litus schleideni* Girault.

Respectfully dedicated to Joseph McCabe, the former Roman Catholic priest, now writer on the philosophical questions of the time.

[1] Memoirs Queensland Museum, Brisbane, I.

PARANAPHOIDEA new genus.

This genus, captured quite accidentally, appears to me to be quite remarkable in its family, since it bears one or two unique characteristics. The venation is like that of *Stethynium*, the antennæ like those of *Anaphoidea* but the posterior wings are very broad for the family, nearly like those in the Eulophidæ yet distinctly pedicellate at base. The abdomen bears a distinctly exserted ovipositor. This genus, for the present, I consider allied with *Anaphoidea*.

*Female:* Head normal, the lateral ocelli distant from the eyes, the antennæ inserted about in the middle of the face, 10-jointed, the club obliquely divided, the pedicel as long as any of the funiclar joints which, excepting the small first, are all subequal and oval. Tarsi 4-jointed, the first joint long, the tibial spurs single, those of the cephalic legs, longest, long and very slenderly acute, straight, *not forming a strigil*. Fore wings shaped as in narrow-winged species of *Gonatocerus* but nearly truncate at apex, the venation like that in *Stethynium*, there being a foot-shaped stigmal vein, quite half as long as the marginal; marginal cilia very short. Abdomen as long as the thorax, oval, sessile but the phragma *apparently* absent; ovipositor very long, exceedingly fine and slender, inserted at extreme base of abdomen, exserted with its valves for a length equal to *half* that of the abdomen and curved. Posterior wings broad and knife-shaped, bearing about seven lines of sparse discal cilia, the blade over a third the width of the fore wings, before venation with a slender petiole. Parapsidal furrows complete; scutellum wider than long; axillæ not noticeably advanced, widely separated; pronotum not extending back to the tegulæ; mesopostscutellum as long as the scutum.

*Male:* Not known.

*Type:* The following new species.

**Paranaphoidea egregia** new species.

*Female:* Length, 0.70 mm., exeluding ovipositor. Black, uniquely marked with golden yellow as follows: The mesopostscutellum golden yellow with the exception of a prominent, long, elliptical black marking on each side of the median line and an oblique dash laterad; caudad, the scutum at the caudal margin and mesad with a V-shaped golden yellow marking; the face; on the vertex, a slender line of yellow runs over the cephalic ocellus from eye to eye, laterad widening caudad and cephalad, leaving in the centre of the vertex, two subrectangular areas, before and behind the cephalic ocellus; the margins of the axillæ; lateral portions of each parapside, irregular. Legs golden yellow, the tarsi dusky, also the middle of the caudal femora; antennæ yellow washed with black, the club darker. Wings hyaline; fore wings bearing about twenty-six lines of discal cilia, the ciliation dense, abruptly disappearing some distance out from the venation.

Posterior marginal cilia of caudal wings not as long as the blade's width but yet over twice longer than the longest cilia of the fore wing; distal club joint much longer than proximal.

From one specimen, $\frac{2}{3}$-inch objective, 1-inch optic, Bausch and Lomb.

*Male:* Not known.

Described from a single female specimen captured from a window pane in a private residence at Nelson, North Queensland, December 6, 1912 by Mr. Alan P. Dodd to whom I am indebted for the specimen.

*Habitat:* Australia, Nelson (Cairns), Queensland.

*Type:* No. Hy. 1291, Queensland Museum, Brisbane, the above described specimen on a slide in xylol-balsam.

## Genus Podagrion Spinola.

**Podagrion beneficium** new species.

*Female:* Length, 2.5 mm.; with ovipositor, 5.25 mm. Dark metallic green with aeneous and bright bluish tinges; the face brighter green; exserted portion of ovipositor black; antennæ black, excepting the dark metallic scape which is rufous laterad and centrad but sometimes wholly black; trochanters, knees, tibiæ and tarsi rufous, the coxæ and femora concolorous with the body, the caudal tibiæ blackish for distal four-fifths; distal tarsal joint black, the posterior tarsi often pallid yellowish. Oral area black. Wings hyaline, the venation dusky. Teeth of posterior femora black; immediate base of abdomen more or less slightly rufous especially ventrad at proximal half. Eyes and ocelli concolorous, garnet. Mandibles black at tip. Bright metallic blue especially on the abdomen and legs.

Lateral ocelli their own diameter from the eye margin. Head all over and dorsal thorax densely polygonally sculptured or punctate, the punctures moderate to fine, the abdomen, coxæ and femora polygonally reticulated, the sides of the pro- and meso-thorax more roughly so. Genal suture fine but distinct. Head, antennæ and thorax bearing short, greyish, moderate pubescence; also on the posterior segments of the abdomen and the legs. Posterior femora with six large teeth and a seventh minute one just proximad of the fifth tooth. Metathorax with a conspicuous v-shaped median carina whose apex is at the meson cephalad; the large area cephalo-laterad of each branch of the carina is densely punctuate nearly like the scutellum while the mesal area included by the two branches of the carina is the same but also traversed by an irregular, narrow median carina which sends off oblique shoots making the area rugose. Laterad there are no carinæ excepting a thin longitudinal one a slight distance laterad of the spiracle. The metathoracic spiracle is elliptical and slightly curved at one end, thus subreniform. A fovea is just caudad of it.

Marginal vein of fore wing long but shorter than the submarginal, the

post-marginal vein short but longer than the stigmal. Antennæ 13-jointed, with one ring-joint which is distinct; funicular joints shortening distad, the distal two distinctly wider than long, the first two subequal, a fourth longer than wide, each slightly longer than the pedicel; joint 3 quadrate; joints 4 and 5 subequal, slightly wider than long, while joints 6 and 7 are subequal, each slightly shorter than joint 5; club long, ovate, much wider than the funicle, its three joints subequal in length and as long as the proximal joint of the funicle. Mandibles dentate.

From many specimens, $\frac{2}{3}$-inch objective, 1-inch optic, Bausch and Lomb.

*Male:* The same but the funicular joints are all distinctly longer, the club shorter, not wider, or scarcely, than the funicle, its distal joint short; antenna lighter distad and the abdomen differs as it should for this sex in this genus. The proximal funicular joint is nearly twice longer than wide, longer than the second joint and none of the joints of the funicle are wider than long.

From many specimens, the same magnification.

Described from twenty-seven pairs reared at the same time from two common large mantid egg masses taken from trees in a forest near Nelson, N. Q., June 25, 1912. The young mantids and the parasites issued on July 4. The hosts were of the same species and the egg masses were of the usual form.

*Habitat:* Australia, Nelson near Cairns, North Queensland.

*Types:* No. Hy. 1170, Queensland Museum, Brisbane, two males, two females, on cardpoints, four pins. *Cotypes*—Cat. No. 15361, United States National Museum, Washington, D. C., two pairs on cardpoints.

This species is allied to *olenus* Walker but has a lateral carina on the propodeum and the median carina is divided at the immediate base of the segment.[1]

## Genus Asaphes Walker.

**Asaphes americana,** new species.

*Female:* Length, 2.00 mm. Dark metallic green, the coxæ concolorous, the legs yellow, pallid yellow at the tarsi; wings hyaline; antennæ black;

[1] The following notes comparing this species with *P. olenus* Walker are added at the request of the author. The cotypes sent were shipped in a vial together with a ball of cotton, just the size to roll back and forth in the vial so that the specimens were almost completely dismembered when they arrived.

In *P. olenus* Walker the antennæ are rufous with the pedicel much longer than the first joint of the funicle, there are usually six teeth (counting the apical one which is bidentate at apex, as two) on the hind femora and all about equal in size (in *beneficium* some of the medial teeth are much smaller than the rest); front and middle legs brown with no greenish tinge.

In the male cotypes sent the hind femora have only three teeth larger than in the female and so in this respect are not similar to the female.

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femora suffused with fuscous. Venation smoky brown. Marginal vein subequal to the long stigmal, the post-marginal vein somewhat longer. Cephalic tibial spur forming a strigil. Antennæ 13-jointed with 2 ring-joints the second of which is rather large, twice the size of the first, which is larger than the usual ring-joint; the funicular joints widening distad, all wider than long and shorter than the pedicel; joints 1–3 of the funicle subequal, each twice the size of the second ring-joint; funicular joints 4 and 5 subequal, somewhat larger, 6 still somewhat larger; club ovate, not wider than the last funicular joint, the 3 joints subequal, each somewhat longer than joint 6 of the funicle. Scape long and slender. Body polygonally sculptured.

From four specimens, $\frac{2}{3}$-inch objective, 1-inch optic, Bausch and Lomb.

*Male:* Length, 1.75 mm. The same but the abdomen is rounded and depressed, the antennal club more thickened and stouter, wider than the distal funicular joint; the flagellum is yellowish white, the pedicel dark, the ring-joints more or less dusky.

From one specimen, the same magnification.

Described from one male and four females mounted singly in balsam.

Received for identification from R. L. Webster of the Iowa Agricultural Experiment Station and labeled as follows: "Exp. 101, 12 and 13 June, 1912. From Hampton, Ia. R. L. Webster," 2 slides 1 ♂, 1 ♀; "Exp. 102. June 12, 1912. From Hampton, Iowa, R. L. Webster," 1 ♀; "Exp. 147, 27 June, 1912. Ames, Iowa. R. L. W.," 1 ♀; and "Exp. 164, 26 June, 1912. Ames, Ia. R. L. W."

*Habitat:* North America—Ames and Hampton, Iowa (U. S. A.).

*Types:* Cat. No. 15655, United States National Museum, Washington, D. C., the five slides as above.

This species differs from *vulgaris* Walker in having the legs light yellow instead of ferruginous with darker femora, and in having the pedicel shorter.

## Genus Elasmus Westwood.

**Elasmus proserpinensis** new species.

*Female:* Length, 2.00 mm. Like *flavipostscutellum* (the postscutellum whitish except along extreme base) but the abdomen is wholly shining black, the legs distinctly more colored, only the articulations and tibiæ pallid yellow; and the tegulæ and scape are pale yellow. Vertex rather densely umbilicately punctate; femora and coxæ sculptured. Antennæ 10-jointed, with the first ring-joint very short, hidden; differing from those of *flavipostscutellum* in that the proximal funicular joint is distinctly longer than the pedicel and the joints are all somewhat longer; the proximal club joint forms nearly half of that region. The mandibles bear seven teeth, three

outer (lateral) large ones and four small inner ones. Occiput wholly black. Wings hyaline.

From one specimen, $\frac{2}{3}$-inch objective, 1-inch optic, Bausch and Lomb.

*Male:* Not known.

Described from a single female specimen captured while sweeping foliage and grass on a forest-meadow near the town of Proserpine, Q., November 2, 1912.

*Habitat:* Australia, Proserpine, Queensland.

*Type:* No. Hy. 1278, Queensland Museum, Brisbane, the foregoing female on a tag, plus the head crushed in xylol-balsam.

In my table of the Australian species of the genus, this species falls in with its ally, *flavipostscutellum.*

**Elasmus cyanella** new species.

*Male:* Length, 1.50 mm. Like *cyaneus* but the postscutellum has a transverse yellowish line across it and the cephalic femora are as dark as the others, as are also the proximal tarsal joints. The fourth antennal joint of the female is very long, about twice the length of the club; the proximal club-joint forms half of the club. The mandibles are 5-dentate, three small inner teeth, two larger, unequal, outer ones, the second tooth longest.

From one specimen, magnified as above.

One male captured by sweeping grass in a forest near Proserpine, Q., November 3, 1912. This species may be the male either of *cyaneus* or else of *proserpinensis.* It nearly agrees with *cyaneus* in all excepting the yellow on the postscutellum and minor mandibular characters; it differs from *proserpinensis* in general body coloration and in bearing two less mandibular teeth.

*Habitat:* Australia, Proserpine, Queensland.

*Type:* No. Hy. 1279, Queensland Museum, Brisbane, the above male on a tag plus the head crushed on a slide in xylol-balsam.

**Elasmus flavipostscutellum** Girault.

This species was captured at Proserpine, Queensland, by sweeping grass in a forest, November 3, 1912; a female, also a male at the same time. On this male the band of the abdomen was lemon yellowish with a silvery tinge and the postscutellum had only a lemon yellow stripe across it near base, the caudal coxæ dark only along dorsal margins.

**Elasmus minnehaha** new species.

*Male:* Length, 1.20 mm. Dark metallic green the abdomen with a yellowish band around it just out from the base; cephalic legs pale yellow, including coxæ; all of tibiæ the same color; intermediate and caudal coxæ black except at tips; intermediate femora black except for some distance from each end; caudal femora black at distal half except at tip, pale yel-

low at proximal half or nearly, the proximal margin of the black cuneately scooped out. Tarsi dusky. Wings subhyaline. Fourth funicular joint longer than the club. Mandibles 5-dentate.

From one specimen, similarly magnified.

*Female:* Not known.

Described from a male captured by sweeping foliage and grass in an open forest at Proserpine, Queensland, November 3, 1912. Like *impudens* but differing in the coloration of the legs and abdomen, the band of the latter much broader; also somewhat like *minor* but differing in the coloration of the legs, especially the femora.

*Habitat:* Australia, Proserpine, Queensland.

*Type:* No. Hy. 1280, Queensland Museum, Brisbane, the above male mounted in xylol-balsam.

Later, a second male was found, collected at the same time; in this specimen the femora were nearly wholly black.

**Elasmus fasciativentris** new species.

*Female:* Length, 2.5 mm. Metallic green but very dark, the proximal two-thirds of the abdomen orange yellow, immaculate and extending farther caudad on the venter but along the dorsum crossed by four conspicuous broad blackish bands, the widest of which is at the base of the abdomen and is metallic; there are thus in the centre of the dorsum three broad black bands of about equal width and not extending into the dorso-lateral aspects. Tip of abdomen black for some distance (about distal third). Tegulæ, postscutellum, oral area broadly, scape and legs pale lemon yellow, the latter still paler, including the coxæ, the tarsi blackish, the caudal coxa with its proximal two-thirds metallic green, the caudal tibia with the usual arrangement of black spines. Flagellum blackish, the pedicel lighter. Wings subhyaline, the venation dark. Funicular joints subequal, longer than wide, the first somewhat longest, longer and stouter than the pedicel. Face with thimble punctures.

From one specimen, similarly magnified.

*Male:* Not known.

Described from a single female captured by sweeping grass and foliage in a forest at Nelson, N. Q., November 28, 1912 (Alan P. Dodd).

*Habitat:* Australia, Nelson (Cairns), N. Q.

*Type:* No. Hy. 1292, Queensland Museum, Brisbane, the above specimen on a tag.

*Elasmus australiensis* has the postscutellum wholly lemon yellow; also *vicinus;* the latter should therefore be grouped with *flavipostscutellum; insularis* has a narrow transverse yellow band across the base of the same sclerite.

## Ufensia new genus.

*Female:* The same as *Ufens* in all structures, but the abdomen is longer, pointed conic-ovate, longer than the thorax, the ovipositor long, inserted at base of abdomen and distinctly exserted, the valves projecting beyond the tip of the abdomen for a length equal to about a third or somewhat less, the abdomen's length. Marginal and stigmal veins short, the former nearly a third shorter than the latter which is well-developed. Strigils absent. Mandibles apparently tridentate. The funicle twisted, the club 3-jointed.

*Male:* Not known.

This genus is omitted from my table of Australian genera of the family now (October, 1912) in course of publication; it would fall near *Neobrachistella* Girault because of the exserted ovipositor.

*Type:* The following species.

**Ufensia pretiosa** new species.

*Female:* Length, 1.00 mm., including the ovipositor which is about 0.20 mm. long. Similar to the Australian species of *Ufens* (more nearly to *hercules*) but differing in specific details. Black, the head except occiput and the base of the abdomen in the centre of the dorsum, orange yellow. Antennæ dusky pallid, the club more or less obscurely banded by two pallid bars. Legs black, the articulations, knees, tips of tibiæ and proximal two tarsal joints white, the posterior tibiæ nearly all white, the proximal two-thirds obscurely dusky. Wings hyaline, the venation black. Ovipositor black.

Posterior wings with three long lines of discal ciliation, the fore wings bearing about nineteen lines. Marginal cilia of fore wing very short. Distal tarsal joint longest.

From a single specimen, $\frac{2}{3}$-inch objective, 1-inch optic, Bausch and Lomb.

*Male:* Not known.

Described from a single female captured by sweeping grass in a forest near Nelson, N. Q., October 10, 1912.

*Habitat:* Australia, Nelson near Cairns, Queensland.

*Type:* No. Hy. 1173, Queensland Museum, Brisbane, the foregoing female in xylol-balsam mounted with an *Oligosita*.

## Genus Prospaltella Ashmead.

*Prospaltella* bears an oblique, short but nonsessile stigmal vein; *Coccophagus* bears usually a short sessile one, at right angles to the marginal vein as in the Entedonini.

**Prospaltella nigrifemur** new species.

*Female:* Length, 0.75 mm., including ovipositor. Sooty black, the wings hyaline, the ovipositor exserted for a fourth (more or less) the length of the

abdomen. Legs pale whitish except coxæ, hind knees and femora and proximal portions of other femora. Antennæ dusky pallid, the funicular joints all about twice longer than wide, the club-joints a little shorter, the flagellum filiform; pedicel distinctly shorter than the funicular joints taken separately. Thorax finely reticulated. Hind wings with six lines of discal cilia, the lines in pairs—middle, caudal and cephalic—the hooklets distad of the middle of the blade, the caudal marginal cilia slightly shorter than the greatest width (at the hooklets). Fore wings with about fifteen lines of discal cilia, the longest marginal cilia distinctly shorter than the same cilia of the hind wing. Ovipositor white, the valves black. Terminal segment of abdomen shortly conical, the valves of the ovipositor extruded beyond it for about its own length (that is, the length of the terminal segment.)

*Male:* Not known.

Described from fifteen females "from *Aleurodes* sp. on *Ficus*, June 13, 1913."

*Habitat:* Passoeroean, Java.

*Types:* Seven females on a slide (Queensland Museum).

## Genus Trichogramma Westwood

**Trichogramma australicum** Girault.

A female agreeing with the description of this species from the eggs of *Grapholita schistaceana*, Passoeroean, Java, Sept. 15, 1913 (P. van der Goot). Also many specimens from *Diatræa striatalis*, Passoeroean, August 25, 1913 and from the eggs of *Chilo infuscatellus*, Passoeroean, August 20, 1913 (P. van der Goot).

In regard to some of these specimens van der Goot wrote: "These I am mainly sending you, because I can't make sure myself whether they ought to be ranged under *Trichogramma* or *Trichogrammatoidea*. I find very minute, little knoblike appendages on the funiculus and the four last antennal joints of all." In the specimens of *australicum* from *Chilo*, I also observed these organs quite as they occur in *Trichogrammatoidea*; they were on the female funicle. *Trichogrammatoidea*, thus, is not characterized by bearing these minute organs but solely by the different male antenna and the longer marginal fringes on the fore wing.

It strikes me that the occurrence of these organs is very rare in *Trichogramma*, since I have never seen them before. Are they conidial spores of fungi?

## Two Hundred and Seventy-Seventh Meeting, May 7, 1914.

The following program was presented:

On Parthenogenesis.....A. C. Baker[1]
The Cotton Boll Weevil in Cuba.....G. N. Wolcott
Classification of Cerambycid Larvæ Subfamily Prioninæ...F. C. Craighead[1]
The Present Status of Muscoid Taxonomy on the Basis of Reproductive Characters.....J. M. Aldrich[1]

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### THE COTTON BOLL WEEVIL IN CUBA.

By G. N. Wolcott, *Porto Rico Board of Agriculture.*

The earliest record of the boll weevil in Cuba was made by Suffrian[2] in 1871, at which time he recorded it from Cardenas and San Cristobal.

It was next recorded from the island by Gundlach[3] in 1891.

After the American occupation of Cuba the boll weevil began to attract considerable attention. In 1902 it became quite injurious to cotton at Cayamas. Mr. Schwarz visited this locality in 1903 and published his report in the Proceedings of this Society.[4]

The next notice of the insect's occurrence in the island was published by Mr. Cook[5] in 1906, at which time he reported it from Santiago de las Vegas, in addition to places previously reported.

While in Cuba during the winter of 1911–12 a few observations were made on the presence, or rather the absence of the cotton boll weevil. I was fortunate in meeting Mr. H. A. Van Hermann on the occasion of the visit and he told me that when he came to Cuba about a dozen years ago, there was a great increase in the acreage devoted to the cultivation of cotton, but that the boom was suddenly checked by a plague of boll weevils which entirely destroyed the crop for a series of years. His observations were made at the grounds of Estacion Agronomica at Santiago de las

[1] Withdrawn for publication elsewhere.

[2] E. Suffrian. Verzeichniss der von Dr. Gundlach auf der Insel Cuba gesammelten Rüsselkäfer. Archiv. f. Naturg., vol. 37, Jahrg. 13, pt. 1, pp. 130–131.

[3] Juan Gundlach. Contribucion a la entomologia Cubana, vol. 3, pt. 5, p. 285.

[4] E. A. Schwarz. The cotton boll weevil in Cuba. Proc. Ent. Soc. Wash., vol. 6, pp. 13–17. January 15, 1904.

[5] Mel T. Cook. Insectos y enfermedades del algodon. Primer Informe Anual de la Estacion Central Agronomica de Cuba, pp. 178–180, 1 fig. 1906.

Vegas, and at other points in Havana and Pinar del Rio provinces. Immediately following this serious outbreak of the boll weevil, the production of cotton became so unprofitable that none at all was planted, except for a few small plots at the Estacion. This alone would not have caused the extermination of the boll weevil, as numerous tree cotton plants remained, growing wild or in dooryards, which would furnish a constant food supply. A series of violent hurricanes, however, subsequently destroyed all the large cotton trees in western Cuba.

When Mr. P. P. Cardin arrived at the Estacion Agronomica in 1908 or 1909, he found no boll weevils on the cotton growing there and he has collected none in all the time he has been entomologist there. When I arrived in November, 1911, a thorough search was made for the weevil in the plants at the Estacion and they were examined every month thereafter until my departure in May, 1912, without success.

Mr. Van Hermann also told me of Sr. Lorenzo Sanchez who was attempting to grow cotton at Artemisa, Pinar del Rio Province and seemed to be having considerable success. I visited Mr. Sanchez' place, Finca Consolacion, a plantation of the Artemisa Tobacco Co., about a mile west of Artemisa, on May 3, 1912. Mr. Sanchez has been growing cotton for three years, each year putting in an increased acreage, and had never seen any boll weevils in his cotton. I was unable to find any, although a careful search was made. He said he knew of no tree cotton anywhere for miles around which might serve as food plants for the weevil during the years when no cultivated cotton had been grown in western Cuba. He stated that one of the errors of those who grew cotton years ago was to plant in May or June, with the beginning of the rainy season and to attempt to harvest the crop in the early months of the dry season, December or January. He had adopted an entirely different plan of cropping, as the cotton was planted towards the end of the rainy season, October or November, and harvested in the spring before the rains began. At the time I was there, most of the cotton had been picked out, his plants had dropped most of their leaves, had turned brown and there were very few immature bolls.

During January and February, 1914, I visited Cuba and again examined the cotton at Estacion Agronomica but found no boll weevils. On January 13th, I visited the Harvard Experiment Station, conducted by Mr. Robert M. Grey of Central Soledad, Cienfuegos, Santa Clara Province. Mr. Grey stated positively that he had known the boll weevil as long as he had been in Cuba (20 years) and that it was undoubtedly present in the vicinity of Cienfuegos at the present time. Neither of us were able to find any weevils, or any indications of their presence, on several bushes

of tree cotton and plants of cultivated (similar to Sea Island) cotton.

On February 13, 1914, at a scattering collection of houses and a "tienda" (country store) called Bejuquero, Central Chaparra, Oriente, I found in the dooryard of one of the houses, three cotton plants (similar to Sea Island) which had matured quite a number of bolls, but would probably mature very few more, as most of the squares had been punctured by the boll weevil. I collected eight adults, all but two of which were destroyed by "hormiga brava," *Solenopsis geminata*, a few days later. One cotton plant at Vedado, Central Chaparra, only about five miles from Bejuquero, examined February 20, showed no injury by the weevil and no adults were found. Some cotton plants in a dooryard in the village of Chaparra showed no injury by weevil and I found no adults. No cotton is grown commercially at Chaparra, so far as I was able to learn, although I enquired specifically regarding this point of Mr. Pupo, who has charge of all the sugar cane field inspection work, and I saw no other volunteer cotton plants during my stay of over three weeks at Central Chaparra.

I also visited the island of Jamaica during March, 1914. I found no boll weevils on any of the varieties of cotton grown at Hope Gardens, Kingston. Haytian cotton was most abundant, although I examined plants of Sea Island, or what was possibly Cuban commercial cotton, and of the ordinary upland variety of the South. I was informed that this was the only cotton on the island of Jamaica.

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## NOTES ON THE CHALCIDOID FAMILY CALLIMOMIDAE.

By J. C. Crawford, *U. S. National Museum.*

Since a new subfamily is described I have given, to locate this as well as two others characterized since the publication of Dr. Ashmead's monograph, a table based on his but much abbreviated. For additional characteristics his table should be consulted. Attention is again called to the fact that the Megastigminæ possess two well developed apical spurs on the hind tibiæ. No specimens of either the Pulvilligerinæ or the Eutanycorminæ have been seen and they are placed in this table solely from the original descriptions.

TABLE OF SUBFAMILIES.

1. Mesothoracic furrows not well defined, the scapulæ scarcely or indistinctly separated; abdomen in female conically pointed, ovipositor not exserted ..... Ormyrinæ
   Mesothoracic furrows well defined ..... 2
2. Hind tibiæ with one apical spur ..... Erimerinæ new subf.
   Hind tibiæ with two apical spurs ..... 3
3. Stigmal knob greatly dilated ..... 4
   Stigmal knob not greatly dilated ..... 5
4. Male antennæ with whorls of hair ..... Pulvilligerinæ
   Male antennæ without whorls of hair ..... Megastigminæ
5. Antennæ densely pilose; no postmarginal vein ..... Eutanycorminæ
   Antennæ not densely pilose; postmarginal vein developed ..... 6
6. Posterior margin of mesepisternum incised ..... 7
   Posterior margin of mesepisternum straight ..... 8
7. Stigmal vein long ..... Idarninæ
   Stigmal vein short, the stigmal knob subsessile ..... Callimominæ
8. Hind femora not much swollen, their tibiæ not arcuate. Monodontomerinæ
   Hind femora much swollen, their tibiæ arcuate ..... Podagrioninæ

## ERIMERINAE NEW SUBFAMILY.

### ERIMERUS new genus.

Hind tibiæ with only one apical spur, this very well developed; antennæ 13 jointed, the ring joint distinctly longer than broad, but narrower than the first joint of the funicle; parapsidal furrows well defined; mesepisternum not excised on posterior margin; scutellum without a cross furrow; propodeum longitudinally rugulose; the postmarginal vein almost as long as the marginal which is short; stigmal knob subsessile, with two appendiculations; basal abdominal segment not excised medially at apex.

Type of the genus: *Torymus wickhami* Ashmead.

In addition to the two type specimens there are in the collection three females from Central, Utah, bred July 13, 1911, by Mr. C. N. Amslie [under Webster no. 5010 (Bureau of Entomology, U. S. Department of Agriculture)] from galls on *Hilaria*.

TABLE OF GENERA OF THE MONODONTOMERINAE.

1. Antennæ with 2 ring joints ..... 2
   Antennæ with only 1 ring joint ..... 4
2. Front femora much swollen, pronotum very long *Plesiostigmodes* Ashm.
   Not as above ..... 3

3. Spiracles at extreme base of propodeum.....*Dimeromicrus* Cwfd.
Spiracles about their own length caudad of base of propodeum
*Idiomaeromerus* new genus
4. Scutellum with a cross-furrow before apex..... 5
Scutellum without a cross-furrow before apex..... 8
5. Apical margin of first abdominal segment deeply incised medially.. 6
Apical margin of first abdominal segment not deeply incised medially 7
6. Spurs on hind tibiæ apical.....*Monodontomerus* Westw.
Spurs on hind tibiæ much before apex.....*Perissocentrus* Cwfd.
7. Hind femora with 2 large teeth.....*Physothorax* Mayr
Hind femora with 1 large tooth.....*Plesiostigma* Mayr
8. Metathorax with spiraclar sulci.....*Hemitorymus* Ashm.
Metathorax without spiraclar sulci..... 9
9. Occipital foramen surrounded by a carina..... 12
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17. Hind femora basad of large tooth distinctly serrate.*Websterellus* Ashm.
Hind femora basad of large tooth not with small teeth or serrations
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## Idiomacromerus new genus.

Occipital foramen margined, first abdominal segment incised medially at apex; hind femora on lower margin excised at apex; marginal vein much shorter than submarginal; postmarginal vein about half as long as marginal; stigma knob not subsessile, the stigmal vein almost as long as postmarginal; eyes hairy.

Type of the genus: *Idiomacromerus bimaculipennis* Crawford.

**Idiomacromerus bimaculipennis** n. sp.

*Female:* Length about 3.5 mm.; ovipositor 1.75 mm. Brilliant coppery with greenish in places, head and thorax rugoso-punctate, antennæ brown,

the scape and pedicel testaceous; first ring joint subquadrate, second transverse; funicular joints subquadrate; propodeum basally with short rugæ so the base appears as if with a row of pits; wings hyaline, with an irregular ovoid fumated spot at base of marginal vein and a fumation at postmarginal vein, this extending almost half way across wing and, turning centrad extends with decreasing intensity as far centrad as the base of the other spot, there being a narrow subhyaline space between them; legs coppery with the tips of femora, the tibiæ and tarsi, entirely testaceous.

One specimen labelled "23.6" (June 23). Type specimen Cat. No. 18168 U. S. N. M. Type locality: American Fork Canyon, Utah.

ANTISTROPHOPLEX new genus.

Eyes bare; marginal vein short, the stigmal knob almost subsessile, postmarginal vein about half as long as marginal; hind tibial spurs rather short, the longer not half as long as the first joint of the tarsi.

*Type: Antistrophoplex bicoloripes* Crawford.

**Antistrophoplex bicoloripes** n. sp.

*Female:* Length about 3 mm.; ovipositor about 2.5 mm. Head and thorax bronzy-green, finely rugoso-punctate, antennæ brown, the scape reddish-testaceous, the pedicel greenish with the apex testaceous; pedicel longer than the first joint of the funicle, the funicular joints subquadrate; propodeum faintly reticulately aciculate; wings hyaline, marginal vein short, the postmarginal vein almost as long as the marginal, the stigmal shorter than postmarginal; coxæ and about the basal half of all femora greenish, apical half of femora and all of tibiæ reddish-testaceous; tarsi more whitish; abdomen greenish, dorsally and basally brown with a greenish reflection.

Type locality: Garden City, Kansas. Bred from galls of *Antistrophus* species. Type-specimen, Cat. No. 18169 U. S. N. M.

Described from six females received from the Bureau of Entomology, U. S. Department of Agriculture, under Chittenden No. 84, with the additional record, "bred from galls on a composite, collected September 14, 1913, by C. H. Popenoe."

ZAGLYPTONOTUS new genus.

Marginal vein about two-thirds as long as submarginal, stigmal knob subsessile; postmarginal short, hardly one-third as long as marginal; posterior tarsi about one-third longer than hind tibiæ, the first tarsal joint not quite as long as 2-5 combined; hind tibial spurs long, the longer as long as the first joint of the tarsus; hind femora with a minute tooth on lower margin near apex and excised beyond this.

*Type: Zaglyptonotus schwarzi* Crawford.

**Zaglyptonotus schwarzi** new species.

*Female:* Length about 3 mm.; ovipositor about 3.5 mm. Green with a brassy tinge; antennæ brown, the scape and pedicel green; vertex and dorsum of mesothorax rugoso-punctate on front of mesoscutum and parasidal areas the sculpture aciculate in somewhat diamond shapes as in many species of *Monodontomerus;* wings hyaline; legs green, the tibiæ brown, with only a slight greenish tinge, the tarsi testaceous.

*Type locality:* San Diego, Texas. Type specimen, Cat. No. 18178 U. S. N. M. Described from three females labelled "24.4" (April 24) E. A. Schwarz, collector.

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## DESCRIPTIONS OF TWO NEW SPECIES OF STREPSIPTERA PARASITIC ON SUGAR CANE INSECTS.

By W. Dwight Pierce, *Bureau of Entomology.*

Although the order Strepsiptera is composed entirely of parasitic insects, the majority of the species of which the hosts are known attack insects of no great economic importance. For a number of years the entomologists of Hawaii sought in various parts of the world parasites of the sugar cane leaf hoppers, including the Strepsiptera in their searches. They brought to light several interesting species, parasitic on different leaf hoppers (Homoptera).

I am now able to describe two additional species of Halictophagidæ important as enemies of sugar cane leaf hoppers from the two hemispheres. One was obtained in very large numbers by Mr. Thomas H. Jones of Porto Rico at Rio Piedras, as a parasite of the destructive *Stenocranus saccharivorus* Westwood, the other was found by Mr. C. S. Misra, at Pusa, India, as a parasite of the sugar cane fly of India, *Pyrilla* sp. The sugar cane leaf hopper of Fiji, *Perkinsiela vitiensis* Kirkaldy has already been recorded as commonly parasitized by an Elenchid, *Elenchoides perkinsi* Pierce.

The genus *Stenocranus* belongs to the Fulgorid family Delphacidæ, and the genus *Pyrilla* belongs to the Fulgorid family Lophopidæ.

### Family **Halictophagidae.**

#### Subfamily ANTHERICOMMINAE.

#### Stenocranophilus new genus.

*Male:* Head excavated behind, seen from above consisting of a narrow arcuate rim supporting the eyes and produced considerably in front of these

to form the tip of the sulcate frontal projection, at the sides of which the antennæ are inserted. Eyes very large, convex, reaching and touching the base of the elytra. Mandibles very short, broad and blunt, not reaching within their own length of each other. Maxillæ a little longer, two jointed, cylindrical, the first joint almost twice as thick as the second, and neither quite as long as the mandibles. Antennæ elongate, seven jointed, flattened foliaceous, with large sensory pits; first two joints simple, third to sixth moderately elongate, each produced just before the attachment of the succeeding joint into a broad flattened lamina not much more than twice as long as the main stem; seventh joint also produced, laminate. Pronotum subquadrate, cut off at sides by head. Mesonotum band-like, also included within the cavity of the head. Elytra elongate. Metanotum with præscutum elongate, convex at base, sides roundingly approximate toward apex, where they almost meet; scuti narrow, elongate, only a little longer than præscutum; scutellum broad, quadrate, basally convex, apically bisinuate, not much longer than postlumbium; postlumbium at least two-thirds as long as wide; postscutellum long, broad; femoralia reaching to middle of postscutellum. Wings with radial vein meeting the costal margin beyond the middle, a small detached cloudy vein behind the tip of the radius, medius strong, with a long anterior cloudy branch, cubitus missing, first anal merely a cloudy vein, second anal strong, third anal missing. Tarsi three-jointed, the first joint of different shape from the following; claws absent. Œdeagus strongly bent; the under side being twice bent and the upper thrice; the last bend being a very strong reflexion at apical fourth; apex very acute.

The generic name is derived from *Stenocranus* (the host genus) + φίλος (loving), signifying a parasite of *Stenocranus*.

Type of genus, *quadratus* n. sp.

**Stenocranophilus quadratus** new species.

Described from one type and five paratype males bred by T. H. Jones, October 19, 1912 from two female and four nymphal *Stenocranus saccharivorus* Westwood collected October 14, and 16, 1912 from sugarcane at Rio Piedras, Porto Rico, and bearing the Porto Rico Sugar Planter's Association accession number "847–1912." One paratype was returned to the association. The specific name is intended to draw attention to the quadrate form of the pronotum and the scutellum. This form of scutellum has not heretofore been found in the Halictophagidæ.

*Male:* Length 0.9 mm., wing expanse 2 mm. Color golden brown. Very few points not mentioned in the generic description remain to be noted. The first tarsal joint is broad, apically broadest and somewhat acute on outer angle, the point of attachment of the second is subapical at the inner angle; the point of attachment on the second joint is dorsal and very near

its base, this joint and the third are both slender at base, gradually enlarged, pulvillate beneath, apically truncate. The antennæ are quite long, the stem portions of the joints being longer than usual. The last joint reaches as far back as the scutellum. The length of the præscutum and scutellum about equals that of the postlumbium and postscutellum.

*Female:* Cephalothorax about 0.2 mm. long, golden yellow, not much darker behind the opening of the brood canal; almost one quarter longer than wide; sides constricted at base, parallel at middle, angulate and convergent from anterior third, sinuate at apex. Mandibles large, obtuse with outer edges marginal; front convex extending beyond mandibles and separating them by a little more than their width. Opening of brood canal broad, trapezoidal. Spiracles ventral, close to margin.

Type, four paratype males, and allotype female in U. S. Nat. Mus., Cat. No. 18813.

### Subfamily HALICTOPHAGINAE.

### Pyrilloxenos new genus.

*Male:* Head not conspicuously excavated behind. Eyes large, convex with very large facets. Mandibles short, triangular, glabrous. Antennæ short, seven-jointed, flattened foliaceous, with large sensory pits; first two joints simple, the second shorter; the remaining five joints crowded, each broadened laterally in a broad lamina, the apices of which are about even with each other, the entire antennæ not longer than width of head.

Pronotum very short, transverse bandlike. Mesonotum a little longer, also bandlike. Elytra pedunculate, spatulate, sensitive, pubescent. Metanotum with præscutum rounded, keystone-shape, truncate, sinuate at apex, longer than scutellum and postlumbium together; scuti oblique, considerably surpassing præscutum at outer angles and supporting it by a tiny projection at inner angles; scutellum broad, irregular in outline, narrower at base than præscutum, broadening in a concave line behind scuti, with anterior angles rounded, almost rectangular, and posterior angles diagonally produced as quadrate peduncles, apex otherwise truncate; postlumbium short, transverse, fitting in between and scarcely surpassing the posterior peduncles of the scutellum; postscutellum large, convex, broadly rounded.

Tarsi three-jointed, the first joint mucronate; claws absent. Eighth ventral segment acutely produced beneath ninth. Anal segment small, flaplike. Œdeagus strongly bent, broad near base, rectangularly bent near apex, apical process slender and very acute.

The generic name is derived from *Pyrilla* (the host genus) + *Xenos* (the typical Strepsipterous genus), signifying a Strepsipterous parasite of *Pyrilla*.

Type of genus, *compactus* n. sp.

**Pyrilloxenos compactus** new species.

Described from a type female, and allotype male, and two paratype females from Pusa, Behar, India, collected by C. S. Misra.

The material was collected in August, 1907, March 15, 1913 and May 23, 1914. The host is an undetermined species of *Pyrilla*. The specimens collected in August, 1907 consist of allotype male, male pupa cephalotheca, and three paratype females with trungulinids. This material is the property of the Entomological Section, Agricultural Research Institute, Pusa. The type is deposited in the United States National Museum, and a paratype female is in the author's collection. The author is indebted to Mr. T. Bainbridge Fletcher, Imperial Entomologist, for the material. The specific name is intended to draw attention to the compact appearance of the antennæ.

*Male:* Length 1.5 mm. The tarsi are very small. The anterior tibiæ are very robust and shorter than on the other legs. The antennæ are much more compact than is usual in this family. The mandibles can not meet. The remainder of the description is to be drawn from the generic description. The specimen was unfortunately boiled in caustic potash and is therefore very hard to study.

*Female:* Cephalothorax, golden yellow to brownish, broader than long; constricted behind spiracles; sides quite evenly rounded; apex sinuate. Mandibles obtuse, separated by almost three times their width. Front convex. Spiracles just touching margin.

Type in U. S. Nat. Mus.—Cat. No. 18814.

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## A NEW TACHINID PARASITE OF DIAPHEROMERA FEMORATA SAY.

By W. R. Walton, *Bureau of Entomology.*

Two species of Tachinidæ parasitic upon the Phasmidæ are at present known to science. The first species was described by Pantel[1] in 1898 as having been reared from *Leptynia hispanica* Bal. in Europe. The second has been recently described by Mr. C. H. T. Townsend[2] reared by the brothers Severin from *Diapheromera femorata* Say. in Wisconsin. A third parasite of this same host is herewith described. It is generically closely related to *Hallidaya* Egger, but is apparently distinct because of the position of the antennæ above the center of the eye and of the greater

[1] La Cellule XV-290.
[2] Annals Ent. Soc. Am. Vol. II, p. 243.

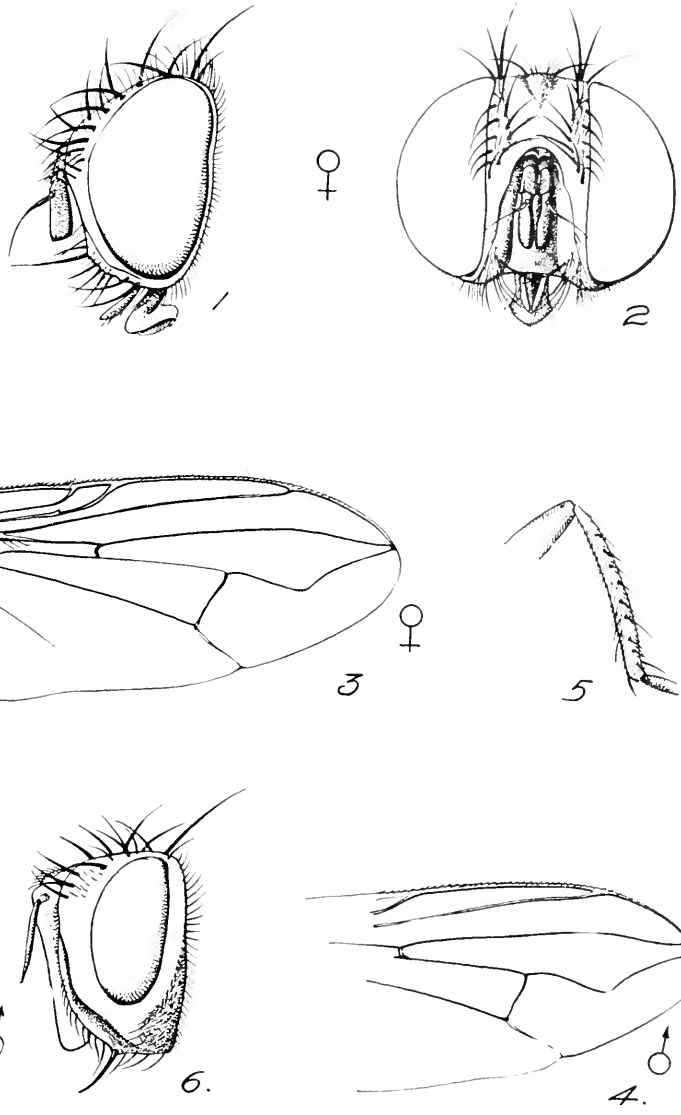
length of the same in *Euhallidaya*. It seems remarkable that the three known parasites of the Phasmidæ should prove to be widely separated generically.

### Euhallidaya new genus.

Palpi present, well developed, proboscis short, fleshy. First longitudinal vein bare, sides of face on lower half bare. Apical cell ending close to wing tip, fourth vein without trace of appendage at its bend, beyond bend curving distinctly inward. Second aristal joint about as long as broad. Arista incrassated on its basal third, eyes bare. Lowest frontal bristles about opposite apex of second antennal joint. Ocellar bristles present pointing obliquely forward. Posterior orbit and occiput linear, cheeks nearly so, bearing on the lower edge a row of strong bristles pointing obliquely forward. Orbital bristles in both sexes consisting of six or more pairs of strong, proclinate, curved macrochætæ reaching nearly to the apex of second antennal joint. Lowest frontal bristles nearly perpendicular to front, upper frontals curving backward. Anterior claws short in both sexes. Type *Euhallidaya severinii* n. sp.

**Euhallidaya severinii** new species.

Length 4 mm., brownish, compact, wings hyaline. *Female:* Frontal vitta opaque dark brown, scarcely distinguishable from parafrontals, occupying two thirds width of front. Parafrontals slightly silvery pollinose, more apparent near base of antennæ. Ocellar triangle somewhat shining, ocellar bristles strong, placed slightly in advance of anterior ocellus being about as far removed therefrom as it is from the posterior ocelli. Parafacials fuscous, slightly gray pollinose. Antennæ blackish, thinly pollinose, third joint a little more than twice as long as second, sides straight nearly parallel, anterior apical corner right angled, posterior corner gently rounded. Palpi and proboscis clear, yellowish. Occiput, viewed from side, linear, thinly clothed with black hairs. Dorsum of thorax thinly silvery pollinose, more pronounced anterior to suture. Four dorsal vittæ, wide, indistinct posterior to suture. Dorso-central bristles three, sterno-pleurals three. Scutellum dark brown, thinly pollinose, marginal macrochætæ long, in three pairs, apicals vestigial. Discals irregular in number and position. Abdomen ovate, black, pseudomaculate on bases of second, third and fourth segments, pollen bordering spots and on lateral margins of segments silvery, remainder of pollen brownish. Posterior margins of segments black, shining, marginal macrochætæ borne somewhat before posterior edge of all segments. No true discal macrochætæ present. Abdomen clothed with coarse, black, reclinate hairs. Calypters yellowish. Wings hyaline. A line of three bristles at base of third vein. First posterior cell barely closed in margin of wing. Legs black, middle tibiæ bearing a single stout macrochæta, on the front side near the middle. Hind tibiæ, subciliate on post-exterior edge.




EXPLANATION OF PLATE.

Fig. 1. *Euhallidaya severinii*, head of female, lateral view.
Fig. 2. Head of female, front view.
Fig. 3. Wing of female.
Fig. 4. Wing of male.
Fig. 5. Right hind tibia.
Fig. 6. *Phasmophaga antennalis*, head of male.

*Male:* Very similar to female differing as follows: Front distinctly narrower, third joint of antennæ slightly shorter, about twice the length of second and slightly rounded on front apical corner. Several pairs of short bristles borne below true vibrissæ at lower edge of oral margin. Apical cell widely open in margin and bend of fourth vein consequently nearer posterior margin of wing.

Described from two specimens male and female reared from the common walking stick *Diapheromera femorata* Say by H. H. Severin, Milwaukee, Wisconsin, 1912, in honor of whom the species is named.

*Type:* A female deposited in the U. S. National Museum, Washington, D. C.

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## THE EARLY STAGES OF METRIOCNEMUS LUNDBECKI JOHANNSEN.

By J. R. Malloch, *Urbana, Illinois.*

The genus *Metriocnemus* of the Chironominæ is represented in the North American fauna by 11 species which with one exception are undescribed in either larval or pupal stages. The only previously described species, *M. knabi* Coquillett, has been taken in the larva stage in flowers of *Sarracenia*. It is represented in the collection of the Illinois State Laboratory of Natural History by a number of larvæ from Wisconsin. A drawing of the labial plate of this species is given herewith, fig. 9, to indicate the distinctions between it and that of *lundbecki* and also to correct some slight errors in the original figure.

The genus *Metriocnemus* may be distinguished from all other Chironomidæ by its possession of the following characters: Antennæ of male 2–13 jointed, of female 2–6; palpi, 4 jointed; proboscis poorly developed. Thorax projecting anteriorly, the head half hidden under its anterior portion; no strong thoracic bristles. Hypopygium without well developed superior and inferior processes in the male, the apical portion of lateral arm generally slipper-shaped, recurved. Fore tarsus with tarsal joint shorter than fore tibia; empodium present; claws of males generally digitate apically, of female simple. Wings without the mediocubital cross vein; surface hairs distinct.

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**Metriocnemus lundbecki** Johannsen.

*Chironomus nanus* Lundbeck (*nec* Meigen), Vidensk. Meddel., 1898, p. 285.

*Metriocnemus lundbecki* Johannsen, Bull. 85, N. Y. State Mus., 1895, p. 302.

*Larva:* Length, 4–5 mm. Yellow, or buff-colored. Head deep yellow, slightly longer than broad, tapering slightly on anterior half; antenna rather slender, its entire length about equal to one-half the width of head (fig. 1); mandibles stout (fig. 2), heavily chitinized, yellow at base, becoming gradually darker towards middle, the apical half, including all the teeth, almost black, 4 weaker, rounded, almost equal-sized teeth along inner margin; two long and rather strong hairs at base of mandible on ventral surface; two slightly weaker hairs on under surface of mandible near middle; lateral arm of epipharynx long, ending in three or four incurved teeth; labium with its anterior half blackened, marginal teeth as in fig. 3; two long hairs situated near to eye spots. Anterior pseudopods armed at apices with weak hairs; a weak lateral hair on each of the thoracic segments; posterior pseudopods with strong apical claws which have produced bases; no ventral respiratory organs on eleventh segment, the two dorsal pairs on twelfth short; anal tuft consisting of six sensory hairs, the basal process about twice as long as its diameter.

*Pupa:* Length, 3 mm. Greenish yellow. Frontal tubercles indistinguishable; 2–3 hairs on the anterior margin of thorax on each side; respiratory organs shaped as in fig. 4; anterior to and in line with these organs are four hairs, a pair on each side; abdominal segments, except segment one, covered on the dorsum with very minute stout setæ which become much stronger posteriorly and form a distinct comblike transverse row on the posterior margin of each segment, as indicated in fig. 5; the membranous portion of segment between the setulose margin and apex of the succeeding segment presents a distinctly reticulated or honeycombed appearance, the intersecting lines clear, the central portions fuscous; ventral segments very similar to those of the dorsum; anal appendages as in fig. 5.

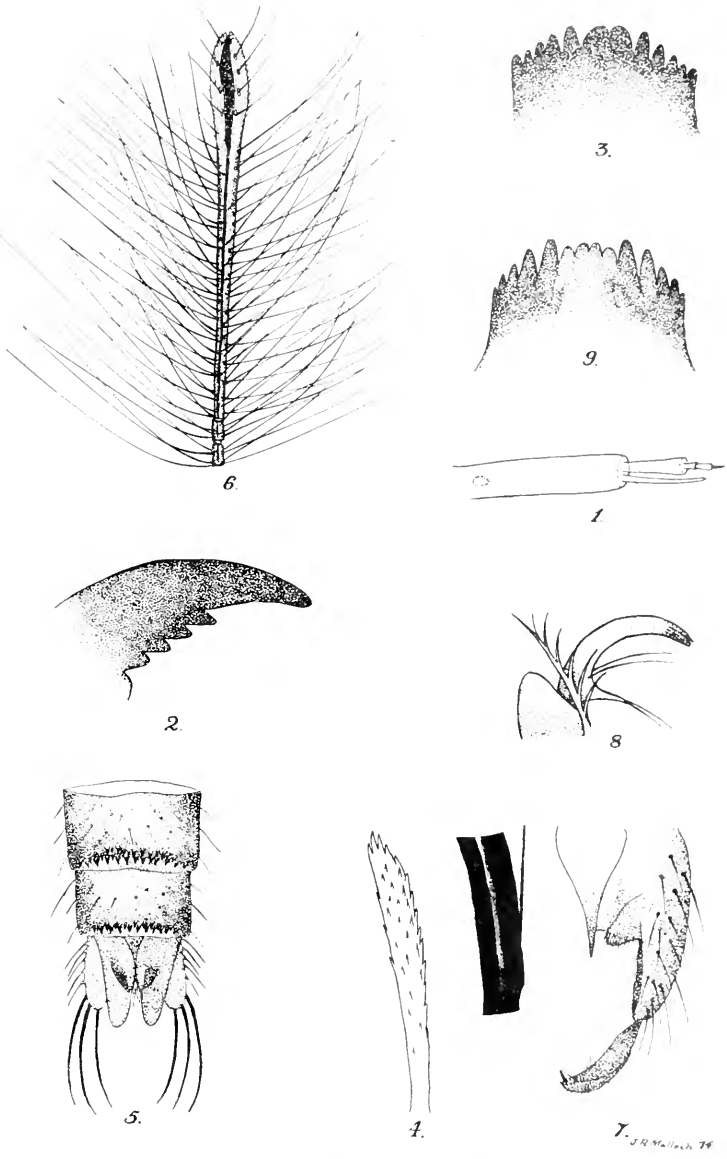
*Male:* Yellow, slightly shining; mesonotum trivittate, the central vitta divided longitudinally by a distinct yellow line, and posteriorly abbreviated, the lateral vittæ abbreviated anteriorly; color of vittæ reddish; pleuræ brownish on lower half; scutellum yellow; postnotum brown. Abdomen yellow, the apical 2–3 segments obscurely brownish. Legs yellow, the apices of tarsi slightly infuscated. Wings clear, veins yellow. Halteres yellow.

Antenna slightly longer than head and thorax together, last joint subequal in length to the remainder, distinctly cleft, as shown in fig. 6, the other joints of flagellum also cleft, but not so distinctly. Apical portion of lateral arm of hypopygium slipper-shaped, turned back on inner side of basal portion, its apex with a short thornlike bristle which is directed at right angles to the long axis of the arm (fig. 7). Fore metatarsus nearly three-fourths as long as fore tibia; no long hairs on tarsi, those on mid and hind legs barely longer than diameter of the joints upon which they are situated; fourth joint of fore tarsus one and a half times as long as fifth, fourth and fifth joints of mid and hind legs subequal; empodium present

(fig. 8), the claws of male distinctly divided at apices as shown in the figure, base sharply produced. Posterior branch of cubitus distinctly deflected near its apex, then running straight to margin of wing; posterior margin of wing with a distinct fringe, which is very long at anal angle but becomes gradually shorter as it nears the apex; the cubitus forks very slightly beyond the vertical line of the cross vein. Length, 2.5–3 mm.

Three larvæ of this species were taken March 16, 1914, in a small stream which enters Salt Fork near St. Joseph, Ill. They were placed in glasses containing water from the city supply, mixed with a little creek water in which they had been brought to the office. They were for some time unable to accustom themselves to the new conditions, there being evidently an excess of oxygen in the city water,[1] and, along with some larvæ of *Orthocladius nivoriundus* Fitch, they repeatedly came to the surface, where they remained partly above the water film. I considered that this coming to the surface was due to an abnormal buoyancy caused by the formation of air bubbles on parts of the bodies of the larvæ which made it impossible for them to remain below water. This was undoubtedly partly the reason, since whenever the body became coated with a number of the bubbles the specimen came to the surface without any apparent effort on its part, and seldom succeeded in diving below upon being touched, as they very readily do under normal circumstances. Even when the surplus oxygen was no longer visible in the form of bubbles the larvæ were restless and almost as often at the surface as beneath the water; but gradually they either became accustomed to the conditions or the conditions changed sufficiently to suit them, for they settled down in the mud and dead leaves which had been placed in the glasses. Here they formed burrows which they never left unless disturbed. They fed upon the decaying leaf tissue, generally, by protruding the anterior half of the body from either end of the burrow, evidently being able to turn around within it. Pupation took place within the burrow, but soon after the transformation the anterior half of the pupa was protruded, and thus remained until shortly before the emergence of the imago, when it was released entirely and, coming to the surface, after a few quick jerky motions the fly rapidly emerged. One specimen of *lundbecki* remained from Monday till Thursday morning in the larval stage, emerging from the pupa on Saturday morning. Emergence took place very quickly, occupying not more than three seconds. The other specimen which I succeeded in rearing was rather longer in the pupal stage, pupating on Friday and emerging on Monday morning. Both the specimens reared are

[1] This is, I believe, abnormal, as this water is generally deficient in oxygen.




EXPLANATION OF FIGURES.

Fig. 1. *Metriocnemus lundbecki*, antenna of larva.
Fig. 2. *Metriocnemus lundbecki*, mandible of larva.
Fig. 3. *Metriocnemus lundbecki*, labium of larva.
Fig. 4. *Metriocnemus lundbecki*, thoracic respiratory organ of pupa.
Fig. 5. *Metriocnemus lundbecki*, apical 3 segments of pupa.
Fig. 6. *Metriocnemus lundbecki*, apical 3 joints of antenna of male.
Fig. 7. *Metriocnemus lundbecki*, one side of hypopygium of male, dorsal view.
Fig. 8. *Metriocnemus lundbecki*, tarsal claw of male.
Fig. 9. *Metriocnemus knabi*, labial plate of larva.

males and are in the collection of the Illinois State Laboratory of Natural History under No. 45690, one mounted on card point, the other, with the cast larval and pupal skins, on a slide in Canada balsam. The larval skin of the dry-mounted specimen was not found, but the pupal skin is mounted on a separate slide under the above number.

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## A NEW SPECIES OF NORTH AMERICAN TINGITIDÆ.

By Otto Heidemann, *Bureau of Entomology.*

**Gargaphia solani** new species

Body rather flat, dark brown; the angulated, yellow rim of the rostral groove very distinct at base of metasternum. Head dark, deeply punctured; at the frontal part three small, slender spines, the upper one more prominent, two others near to the eyes a little longer. Antennæ quite long, hairy; basal joint comparatively thick, black and somewhat longer than the terminal joint, which is fusciform and black at the apex; second joint the shortest, testaceous; third more than four times as long as the fourth joint, yellowish-white; bucculæ moderately expanded, yellowish, with one row of minute areoles.

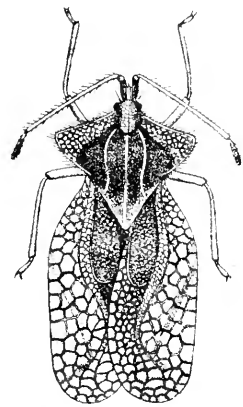

Fig. 1.

Pronotum feebly convex, black, with three low, yellowish carinæ, the median one a little higher before the middle, tapering toward the pale apex of the triangular, posterior portion of pronotum; the lateral membranous part of the pronotum angularly expanded, with two to five series of irregular areoles, the edge somewhat broadly reflexed, some of the nervures exteriorly blackish. Head, pronotum and the edge of the membra-

nous dilation densely covered with very fine, soft hairs; pronotal hood rather large, much longer than wide, covering the hind part of the head, leaving the eyes free; surface yellowish-white, opaque, with a few minute areoles. Hemelytra extending about one third beyond the abdomen; oblong-oval, broadly rounded at the end, feebly sinuate toward the base; the discoidal areas pyriform, reaching to about the middle of the elytra, reticulated, blackish at base and at apex, a pale stripe across the middle; the subcostal biseriate, yellow; costal margin yellowish-white, translucent, with four or five series of medium sized areoles at the widest part, those toward the base smaller; five transverse oblique nervures black at the costal area and all nervures at the apex more or less blackish. Legs pale, yellow. Length, 4 mm.; width, 2 mm.

Described from several specimens, males and females. Kirkwood, Mo., August 10 (Riley, Pergande) found on *Solanum carolinense* and *Solanum elæagnifolium;* Lavaca Co., Texas, June 21; Columbus, Texas, July 29, 1879 (Riley collection) on coffee weed and *Solanum;* El Reno, Okla., July 12, 1909; Norfolk, Va., June 12, 1914 (Fink). It is recorded as found on egg-plants and potatoes in great abundance.

*Type:* No. 18810 U. S. National Museum.

This new species resembles *Gargaphia angulata* Heid. in the general outline, but differs considerably by the larger size and by the prominence of the hood, being much longer. It belongs to a group of *Gargaphia* species which have the membranous dilation of the pronotum angularly expanded instead of roundly dilated, as in *G. tilia* Walsh; *G. patricia* Stal; *G. opacula* Uhler and others. Judging from the localities already known, this species seems to have a wide range of distribution, from the Atlantic coast to the Southwestern States.

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## FORCIPOMYIA PROPINQUUS WILLISTON, A CORRECTION.

By J. R. Malloch, *Urbana, Illinois.*

In a footnote in an article on Ceratopogoninæ ante p. 63 of these Proceedings it is stated that the figures of the tarsus and the wing of *Forcipomyia propinquus* given by Williston are those of the female and not the male. I considered that the statement was an error because the single specimen described by Williston, in addition to being indicated as a male, is from the description obviously of that sex. The figure of the tarsus is also clearly that of a male, possibly of *eriophorus,* though the wing is drawn too blunt and short. The description of *eriophorus* is that of the female, an error being made in the insertion of the sex symbol.

I have received, in reply to an inquiry, a letter from E. E. Austen who has charge of the collections in the British Museum, and who is qualified to give authentic information, stating that the above facts as to type are correct.

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## NEOCELATORIA FEROX WALTON A SYNONYM OF CHAETOPHLEPS SETOSA COQ.

By W. R. Walton, *Bureau of Entomology.*

I am indebted to Dr. J. M. Aldrich for calling my attention to the probability of the above mentioned synonymy. A comparison of the types shows them to be identical. Mr. Coquillett did not describe the peculiar armature of the female abdomen in his original description of the genus or species.

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## A NEW ORTALID FLY.

By Nathan Banks, *Bureau of Entomology.*

**Pseudotephritis appoximata** new species.

Similar to *P. vau* Say, but larger and marks on the wings different. Head and thorax marked as in *P. vau*, the same large brown spots, but on thorax the minute brown marks are rather more numerous. On abdomen the third segment is mostly pale, with only minute dark spots, the following segments wholly dark; legs marked as in *P. vau*. In wings the marks on costa and at tip are black, the others fainter, more yellowish brown; the clouds over cross-veins not connected, that over posterior cross-vein extending toward the cloud below preapical costal spot; and that over the discal cross-vein extending to the middle costal spot, the outer margin of the broad sub-basal cloud is much interrupted at the fourth vein. The posterior cross-vein is as near the outer margin as to the anterior cross-vein. The macrochætæ of head and thorax are as in *P. vau*. Length, 7.5 mm.

From Falls Church, Virginia, July 15.

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## NOTE ON A CLASSIFICATION OF SEXUAL CHARACTERS.

By Charles H. T. Townsend.

Sexual characters have long been distinguished as either primary or secondary. The writer believes that the so-called "secondary sexual characters" may profitably be classed as *secondary* and

*tertiary*, and hereby proposes these terms with definitions of the three resulting classes.

*Primary sexual characters* are those which relate to the true organs of generation—the internal reproductive system and the external genitals.

*Secondary sexual characters* are those which relate to the external structures immediately accessory to the true organs of generation. They include in the muscoid flies the hypopygium of both sexes in its widest sense, being such structures as the ovipositor, piercer, ventral carina, hypopygial clasping organs—all extra-primary structures directly functional in copulation, oviposition and larviposition, or specially designed for the reception of such structures during rest.

*Tertiary sexual characters* include all others that are ever distinctive of sex and may be defined as those which pertain to structures not directly functional in either copulation, oviposition or larviposition, nor adapted for reception of organs directly concerned in these functions. For example, the elongated claws of certain male flies are indirectly functional in copulation, but so are the legs and the whole body for that matter. Neither is to be considered as immediately accessory to the true organs of generation.

The mass of sexual characters in the muscoid flies are to be classed as tertiary. A great number of external anatomical structures are here involved, representing nearly all parts of the body. The tertiary sexual characters are not at all uniform as to the structures that they affect, but vary greatly in different groups of these flies. A detailed enumeration of them is already in manuscript, and will be published in due time.

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## CERATOPOGONINÆ SUCKING THE BLOOD OF OTHER INSECTS.

By Frederick Knab, *Bureau of Entomology.*

In discussing Ceratopogoninæ as enemies of other insects in a recent number of this journal,[1] observations by two different authors were cited of these midges sucking the body-fluids of *Anopheles* mosquitoes. I find that I overloooked a third note on this subject by Dr. A. T. Stanton, which calls attention to an earlier record by Capt. C. J. Fearnside and adds observations made by himself in the Malay Peninsula.[2]

[1] Ceratopogoninae sucking the blood of caterpillars. Proc. Ent. Soc. Wash., vol. 16, p. 63-66, 1914.

[2] A Ceratopogon parasitic upon anopheline mosquitos. Paludism, no. 5, p. 64, 1912.

Captain Fearnside gives a figure of one of the flies observed attacking mosquitoes and this shows that the insect belongs to the genus *Culicoides*. In this case the midges were found attached to common house mosquitoes, presumably *Culex quinquefasciatus* (= *fatigans*).

If blood-fed mosquitos (i.e., culex) are collected from the dark corners of rooms, godowns, &c., one occasionally meets with a small fly fixed to the undersurface of the abdomen of the host . . . . When it has fed, there is an oval brown mass in the centre which is decomposed blood extracted from the mosquito's stomach.[1]

Dr. Stanton's observation is as follows:

During the past year I have been engaged in the examination of anopheline mosquitos taken in the Pudoh Gaol, Kuala Lumpur. On six occasions I have found a species of Ceratopogon with its proboscis, as shown in the specimen, deeply embedded in the abdomen of female anophelines which had previously fed on blood, presumably that of prisoners. The anophelines were of the following species *N. fuliginosus*, *N. karwari* and *M. sinensis*. The flies were in every case attached to the under surface of the abdomen, generally about the fourth or fifth segment. Twice the anopheline carried two specimens of the fly. In every case the stomach of the Ceratopogon contained blood.

Recently the writer has examined a preparation sent by Mr. A. Rutherford of Paradeniya, Ceylon, in which there is a specimen of *Culicoides* attached to a female *Anopheles*. In this case the midge has its proboscis inserted in the anterior thoracic region of the mosquito, just above the fore coxæ, and there is nothing to indicate that it might have been extracting the contents of the mosquito's digestive tract. The reference given in my previous article, on p. 64, for F. H. Gravely's note is incorrect; the article appeared in vol. 6, p. 45, of the Records of the Indian Museum.

It appears that the statement made by myself on p. 65, that blood is absent from the wings of mature Lepidoptera, is erroneous. In this I was only sharing a common impression that there is no circulation in the hardened wings of most insects. I need hardly add that I was perfectly familiar with the more obvious cases, such as certain Coleoptera, in which there is a plain and abundant circulation during life. The question has been very ably discussed recently by Mr. R. Bervoets and his careful investigations have resulted in the demonstration of an active circulation in the wings

[1] Parasites found on mosquitos. Indian Med. Gazette, vol. 35, p. 129-130, 1900.

of representatives of the more important orders of insects.[1] Regarding the Lepidoptera, he gives the following observation.

The hind wing of a pierid, examined with a hand lens, shows all its veins filled with a pale green liquid; if one sections this wing, one sees this liquid issue in abundance, above all if one exercises a gentle pressure.

It follows, then, that the *Ceratopogon* observed by Mr. Kryger could have obtained blood from the wings of the moth in any case and that it was quite unnecessary to assume that the latter was immature.

## DESCRIPTIONS OF TWO PARASITIC HYMENOPTERA.[2]

By S. A. Rohwer, *Bureau of Entomology.*

**Sympherta mnemonicæ** n. sp.

This species is readily distinguished from the other species which have been referred to the genus, by the color. It differs from the genus according to the characters given in the generic tables by the shorter tergites.

*Female*: Length 3 mm.; length of antennæ 2.5 mm. The anterior margin of the clypeus truncate, ventrally convex, front finely granular and with a number of widely separated, distinct punctures; area immediately below the antennæ slightly convex, vertex and occiput sculptured like the face; intra-ocellar area slightly raised, the surface without any punctures, with fine granulations and parted posteriorly by a median furrow; antennæ 28-jointed, the third joint sub-equal with the fourth; mesoscutum rather coarsely granular posteriorly, anteriorly more finely granular and with separate punctures; scutellum more finely sculptured than the scutum; dorsal aspect of the propodeum similar to the scutellum, with a median triangular areola which is petiolate; posterior face completely areolated; mesepisternum except the shining foveæ and middle dorsal margin, finely granular; first tergite with a short petiole broadening beyond the spiracles, it and the second with coarse granulations; second tergite decidedly wider than long; relative width and length of the tergites becomes greater posteriorly; third and following tergites shining, finely coriaceous; nervellus broken decidedly below the middle. Black; anterior margin of the clypeus, mandibles except the piceous apices, scape and most of the flagellar joints beneath, tegulæ and legs *testaceous* or *rufo-testaceous*; wings hyaline, iridescent, venation dark brown; costa testaceous.

[1] Notes sur la circulation du sang dans les ailes des insectes. Ann. Soc. Ent. Belg., vol. 57, p. 184–190, 1913.

[2] Contribution from the Branch of Forest Insects. Bur. of Ent., U. S. Dept. of Agric.

*Male*: Length 4 mm. Antennæ 26-jointed. Differs from the female in having the face below the antennæ, the inner margins of the eyes to the level of the anterior ocellus, cheeks, two spots on the scutum, small lateral spot on the first and third tergites, *yellow*; the third antennal joint is slightly shorter than the fourth.

Falls Church, Virginia. Described from three females, one type, and one male, allotype, recorded under Bureau of Entomology Number Hopk. U. S. 11133*e* and *f*, which refer to notes stating that these are primary parasites on *Mnemonica auricyanea* Walsingham, feeding on chestnut and oak. Material collected and reared (March 7, 1914) by Carl Heinrich.

*Type*: Cat. No. 18316, U. S. N. M.

The material was collected in the larval condition and kept in the rearing cages so oviposition must occur within the feeding larva, or the egg.

The parasite is referred to the genus *Sympherta* but the type of this genus is not available for comparison, and it is not unlikely that when the genera belonging to this group are more properly classified the above new species will be referred to a new genus.

**Podogaster evetrivorus** n. sp.

*Female*: Length 7.5 mm. Head below the antennæ shining, with only setigerous punctures, above the antennæ shining, but with distinct well defined, well separated punctures; postocellar line twice as long as the ocellocular line; occiput deeply emarginate, strongly margined; mesoscutum with distinct, well defined punctures which in the region of the notauli become confluent; in the posterior middle the punctures are closer; scutellum sculptured similarly to the scutum; propodeum with a median row of hexagonal foveæ which become smaller posteriorly, laterally coarsely reticulate; abdomen shining, impunctate. Black; head below the antennæ and the orbits to the vertex, posterior orbits broadly, scape beneath, dorsal posterior angles of the pronotum, tegulæ, four anterior legs (femora and tibiæ reddish) *yellow*; abdomen piceous and the third and fourth segments rufous; posterior legs black with the base of the tibiæ and the second trochanter yellow; wings hyaline, venation dark brown.

*Male*: Length 8 mm. Agrees with the above characters of the female.

Fort Bayard, New Mexico. Described from one female, type, one male allotype and three female paratypes recorded under Bureau of Entomology Number Hopk. U. S. 12101*c* which refers to a note stating that this is a parasite of *Evetria* species working in *Pinus ponderosa*, material reared by Carl Heinrich, adults emerging November and December.

*Type*: Cat. No. 18997, U. S. N. M.

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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XVI 1914 No. 4

## DESCRIPTIONS OF NEW MICROLEPIDOPTERA OF FOREST TREES.[1]

(With Plates VII and VIII)

By August Busck, *Bureau of Entomology.*

**Sesia brunneri** n. sp.

Labial palpi orange red with a broad black lateral streak exteriorly. Face dark metallic blue. Head deep black. Antennæ bluish black. Collar metallic blue. Thorax bluish black with the anterior sides sprinkled with red and with patagia dark orange red. Forewings alike in both sexes, transparent with broad purplish blue edges and a broad, perpendicular streak at the end of the cell; extreme costal edge narrowly orange; underside of the apical and especially of the costal edging sprinkled with orange red. Hindwings transparent, with narrow blackish blue edges and veins; costal edge dusted with red, especially on the underside. Abdomen dark metallic blue with distinct, red, transverse streaks on second and on fourth segments and sometimes with traces of red also between the other segments. Anal tuft with dark metallic blue center, edged with brick red; under side red. Legs dark metallic blue, liberally sprinkled and banded with red; tarsi blue. Alar expanse: male, 24–25 mm.; female, 26–27 mm.

*Foodplant:* *Pinus ponderosa.*

*Habitat:* Camas, Montana, Josef Brunner, collector.

*Type:* Cat. No. 18238, U. S. N. M.

This species is named in honor of Mr. Brunner whose observations of the life history enabled the differentiation of this species from the very similar *Sesia novaransis* Hy. Edw., which lives in Douglas fir.

This species differs from the somewhat more robust *Sesia novaransis* in the blue, not black, ground color and in the much less extensive red abdominal coloration.

[1] Presented at meeting of April 2, 1914.

*Sesia piceæ* Dyar, a third species of this group may be differentiated by the entirely black abdomen.

**Recurvaria milleri** n. sp.

Labial palpi white, second joint with two black bars externally; terminal joint with an incomplete black annulation at base. Antennæ white annulated with black. Face white. Head white sparsely sprinkled with dark fuscous. Thorax white strongly suffused with dark fuscous. Forewings white, strongly and irregularly suffused with black, especially on costal and apical parts; a large, poorly defined, black spot on costa beyond the middle and a smaller one just before the middle; opposite the former is an even less well defined dorsal black spot; four small tufts of raised black scales, one on the middle of the cell, one at the end of the cell and two below these on the fold; scattered black dots around apical edge; all of the black markings are fugitive and easily lost in flown specimens. Cilia ochreous white, dusted with black. Hindwings whitish fuscous; cilia slightly ochreous. Abdomen silvery white with a large, bluish black poorly defined spot on the upper side and shaded with black on the under side; the males have a large, conspicuous, ochreous hair pencil on thorax underneath the base of the hindwings. Legs white, barred and annulated with black. Alar expanse: 12–15 mm.

*Habitat:* Yosemite National Park, California, John M. Miller, collector.

*Foodplant: Pinus murrayana.*

*Type:* Cat. No. 18438, U. S. N. M.

The species is named in honor of the collector. The larva is a needle miner like that of *Recurvaria pinella* Busck, in Colorado, and that of *Paralechia pinifoliella* Chambers, in the East.

Mr. Miller found this species exceedingly abundant, in the larval state, on June 26. From a shipment of needles from him, received on July 16, about a hundred moths issued en route and many more the following days.

**Evetria bushnelli** n. sp.

Labial palpi whitish dusted with fuscous; terminal joint fuscous. Face and head white, strongly mottled with fuscous, each scale being white at base and tip, with a dark fuscous median part. Antennæ white, irregularly annulated with dark brown. Thorax light gray, mottled with white and fuscous; base of patagia light reddish brown. Forewing deep reddish brown graduating into light ochreous on outer two-thirds of dorsal part of the wing. A blunt, triangular, ochreous spur runs up into the costal darker color. Beyond the cell and on apical third of dorsum is a small round spot of the dark brown ground color. Entire basal third of the wing brown with a superimposed, poorly defined, transverse fascia of silvery iridescent scales. At basal third, terminating this basal area is a broad, straight, transverse fascia of silvery or hyaline scales. This fascia begins in the

costal edge in two, small, indistinct, geminate, white streaks. From two similar costal streaks just beyond the middle of the wing runs a narrow, outwardly angulated, fascia of shiny hyaline scales across the wing. At apical third is a similar, but nearly straight, transverse fascia. The two latter fasciæ contain on the middle of the wing a few black scales. Before the apex are two small, silvery, costal streaks and the terminal edge is rather broadly suffused with similar silvery scales. All of the silvery markings appear to be slightly raised. Cilia bluish white with two transverse, blackish lines. Hindwing light fuscous; cilia whitish with a fuscous basal line. Abdomen silvery fuscous. Legs silvery fuscous; tarsi with indistinct, blackish brown annulations. Alar expanse: 12–19 mm.

*Habitat:* Fort Bayard, New Mexico, G. E. Bushnell, collector.
*Foodplant:* *Pinus ponderosa* and other pines.
*Type:* Cat. No. 18439, U. S. N. M.

This species is named in honor of the collector, Colonel G. E. Bushnell, to whom is due credit for all the information we have on its biology.

The larvæ feed gregariously in the terminal twigs of *Pinus ponderosa* and other pines and appear to be severely injurious to these trees.

The full grown larva is 14 mm. long; body of a reddish yellow color; tubercles not distinguishable; hairs short, white. Head light yellowish brown with black eyespots; thoracic shield small, darker brown. Feet normal, abdominal feet small with a single, complete circlet of uniform hooks.

The moths from overwintering pupæ produce an early summer generation, the adults of which issue about July first.

The species, which may have been introduced into New Mexico with the trees, is very close to the eastern *Evetria frustrana* Comstock, but averages considerably larger and differs in the details of ornamentation, and in the character of its work. It is the same species which for several years has been excessively injurious to the pine plantations of the U. S. Forest Service at Halsey, Nebraska. (See Forestry Quarterly, Dec. 1910.)

**Evetria virginiana** n. sp.

Labial palpi, face and head light whitish yellow. Antennæ reddish white with a thin, longitudinal, black line anteriorly. Thorax reddish brown, with a central transverse band suffused with white scales and with the posterior tip and the tips of the patagia white. Forewings broad and ample, rich reddish brown with a number of irregular, pearly white, transverse, forked and anastomizing lines with violet sheen, which terminate in five small, geminate, white costal streaks. The narrow areas surrounded by these transverse lines are of a somewhat lighter yellowish brown. This is particularly the case with one on the middle of the wing and one near tor-

nus. Cilia whitish brown. Hindwing very light, nearly white, slightly suffused with brown, especially toward tip; cilia white. Abdomen light brown, each joint edged with white. Legs white, suffused with brown; anterior tibiæ reddish brown. Alar expanse: 23 mm.

*Foodplant: Pinus virginiana.*

*Habitat:* Falls Church, Virginia. Reared by Carl Heinrich.

*Type:* Cat. No. 19036, U. S. N. M.

A very distinct, large, broadwinged species, nearest to *E. comstockiana* Fernald, but larger, more simple in its pattern, with darker thorax and more whitish hindwings. The species feeds in the young branches of *Pinus virginiana* and makes a large globular pitch-nodule (pl. VII, fig. 1), from which the imago issues early in May.

**Evetria taxifoliella** n. sp.

Labial palpi brown, mottled with fuscous. Terminal joint blackish. Face, head and thorax black, liberally dusted with white. Forewings grayish brown, transversely striated with white and black atoms, at basal third there is a poorly defined, dark brown, black edged, zigzag band across the wing, followed by a light gray and white area. Through the middle of the wing from the base runs a poorly defined, brown streak, enlarged into an irregular blotch at the end of the cell. On the costal edge there is a series of blackish spots with white dusted intervals, at tornus an oval, white, black dusted spot, with a short perpendicular, black line in the center. Apical and terminal edge dark golden brown with a black line along the extreme edge before the dark fuscous cilia. Hindwing blackish fuscous. Abdomen dark fuscous. Legs fuscous; anterior tarsi annulated with black. Alar expanse: 13-14 mm.

*Habitat:* Missoula, Montana, Josef Brunner, collector.

*Foodplant: Pseudotsuga taxifolia.* Reared by Mr. Brunner from cones.

*Type:* Cat. No. 18440, U. S. N. M.

This species is nearest and very similar to *Evetria siskiyouana*, Kearfott, but is only about half the size of that form.

**Evetria metallica** n. sp.

Second joint of labial palpi dirty white sprinkled exteriorly with black; terminal joints blackish fuscous. Face, head, and thorax bluish fuscous irrorated with white, each scale being tipped with dirty white so as to produce a rather light gray effect. Forewing strongly overlaid with bluish metallic scales in many broad, transverse, wavy lines, the intervals between the metallic scaling is rich dark brown liberally sprinkled with black scales. The metallic lines on the outer half of the wing originate in small whitish geminate costal spots. Cilia dark blue, whitish at the base and with a dark basal line. Hind wing dark fuscous. Abdomen dark blue, each joint broadly tipped with silvery fuscous; anal tuft silvery with blue center.

Legs dark silvery fuscous; tarsal joints with narrow dirty white annulations. Alar expanse: 20 mm.

*Habitat:* Missoula, Montana, Josef Brunner, collector.

*Type:* Cat. No. 18443.

The following note is by Mr. Brunner: "Larvæ on yellow pine, *Pinus ponderosa*, on which it makes a pitch tube on tip branchlets. Pupated April second, imago issued May seventh."

**Evetria montana** n. sp.

Labial palpi dark fuscous mixed with reddish brown exteriorly. Face and head light reddish ochreous. Thorax dark fuscous; base of patagia reddish brown. Forewings dark fuscous; base, a broad, transverse fascia just before the middle of the wing, and a narrower fascia beyond the middle, irrorated with white, each scale being broadly white-tipped. Outer half of the wing overlaid with brown and brownish ochreous and violaceous scales, more intensely so towards the very oblique terminal edge. Cilia fuscous, tipped with red. Hindwings shiny dark fuscous with lighter cilia. Abdomen and legs dark fuscous; tarsal joints with narrow, lighter annulations. Alar expanse: 20 mm.

*Habitat:* Elliston, Montana, Josef Brunner, collector.

*Foodplant: Pinus contorta.*

*Type:* Cat. No. 18442, U. S. N. M.

The following note is by Mr. Brunner: "The larva is found in buds which would be the terminals the succeeding season if not infested and destroyed by this insect. Adult moth issued in captivity December 10, from larva collected July 29."

The species is nearest and very similar to *E. neomexicana* Dyar, which, however, differs in the more uniform coloration of both the basal and apical part of the wing, and by having a longitudinal black streak to the middle of the termen.

**Evetria albicapitana** n. sp.

Labial palpi ochreous white, second joint shaded externally with light reddish brown; terminal joint sprinkled with black. Face and head white. Antennæ gray with narrow black annulations. Thorax reddish gray with a reddish brown, transverse band and with brown posterior tip. Patagia light reddish brown. Forewing light reddish brown with sparse black dusting and with silvery metallic cross-lines. Extreme costal edge blackish with three small, geminate, white spots on basal half and with four similar white spots on outer half; from each of these geminate costal spots originates a broken, transverse, silvery line which runs in an irregular zigzag course across the wing, without, however, reaching the dorsal edge. The three basal lines run in an outwardly oblique direction and nearly unite on the fold; the fourth line is quite short and leaves a large circle at the end of the cell without metallic scales; the fifth silvery line is nearly transverse and straight with but a single small interruption. Three, small,

yellowish white dashes on the terminal edge. Cilia gray with a black basal line. Hindwing dark fuscous with whitish cilia. Abdomen dark fuscous, each joint edged with white. Male claspers very large, covered on the outside with whitish scales, on the inside with long light brown hairs. Legs silvery white with broad blue bars and annulations. Alar expanse: 16–19 mm.

*Habitat:* MacDowell, Saskatchewan, Canada, J. C. Blumer, collector; Boulder Junction, Wisconsin, S. A. Rohwer, collector.

*Foodplant: Pinus divaricata.*

*Type:* Cat. No. 18444, U. S. N. M.

The larvæ bore in the young branches and make small, round resin nodes about two-thirds of an inch in diameter, (pl. VII, fig. 2). When full-grown the larva is about one-half inch long, of reddish color with a light brown head and thoracic shield; tubercles small, shiny.

Imago issued in captivity at Falls Church, Virginia, in early March, undoubtedly considerably earlier than is the case in nature.

**Swammerdamia castaneæ** n. sp.

Labial palpi dark fuscous with base and extreme tip white. Face and head white. Antennæ dark fuscous annulated with white and with white basal joint. Thorax white, sometimes slightly dusted with fuscous and with posterior tip suffused with fuscous. Forewings dark fuscous with strong bluish sheen, irregularly sprinkled with white and black scales, the latter tending to form indistinct, interrupted rows of black dots; a blackish costal dash just above apex; apical edge and cilia strongly dark golden cupreous. Hindwings dark fuscous; cilia lighter ochreous fuscous. Abdomen dark fuscous with ochreous anal tuft. Legs fuscous, tarsi annulated with white. Alar expanse: 11–12 mm.

*Habitat:* East River, Connecticut, Chas. R. Ely, collector, and Charter Oak, Pennsylvania, W. S. Fisher, collector.

*Foodplant: Castanea dentata.*

*Type:* Cat. No. 18441, U. S. N. M.

The species is close to the European *S. pyrella* and was wrongly identified by the writer as that species from New Hampshire (Proc. Ent. Soc. Wash. XIII, p. 80, 1911), but is somewhat larger and at once distinguishable by the white thorax.

The following are Dr. Ely's notes, which he with his usual liberality has asked me to utilize:

"Larva green, 10 mm. long. Forms a very loose, open web, much like that of a spider, on the upper side of chestnut leaf. The larva appears to the naked eye to be marked by transverse bands of darker green by reason of the darker shade at the points of the segments. Each segment has an indistinct dorsal streak

darker than the ground color. The tubercles are very dark surrounded by pale yellowish. The first two tubercles on the side of each segment are in a line, thus giving the appearance of a narrow, broken, subdorsal band. The head is yellowish and the cervical shield is pale spotted with the same color as the abdominal tubercles. The first larva spun its cocoon by July 17. The cocoon is white, silky, spindle-shaped and is suspended within the web. The larva eats off the tip of the leaf under the web. Adults emerged August 6."

**Ectœdemia heinrichi** n. sp.

Face and head deep black; mouthparts yellowish; antennal eye-caps large, creamy white; remainder of the antennæ black with narrow yellow annulations. Thorax light yellow sprinkled with black scales. Forewings light ochreous profusely and irregularly sprinkled with blackish fuscous scales; there are two, faint, poorly defined transverse fasciæ on which the dark scaling is less pronounced, one at basal third and one at apical third. Apical cilia creamy white with a black basal line. Hindwing and underside of all wings dark steely fuscous; cilia yellowish. Abdomen dark yellowish fuscous, underside silvery. Legs golden yellow, posterior tibiæ with strong golden spines above. Alar expanse: 9–10 mm.

*Habitat:* Falls Church, Virginia.
*Foodplant: Quercus palustris.*
*Type:* Cat. No. 19039, U. S. N. M.

Named in honor of my friend and assistant Carl Heinrich, who has ascertained the life history of this interesting species, which makes a characteristic mine in the bark of young branches of *Quercus palustris.* The mine is a narrow linear track, winding closely upon itself in an oval spiral much like a compressed watch spring, and showing very plainly in the bark (fig. 4). Old work cracks and leaves the inner bark exposed. The work was found only in this species of oak and mostly in the young saplings, although a few mines were found on the outer branches of larger trees.

The larva is very similar to *Ectœdemia castaneæ* Busck, but rather larger and with more pronounced ventral processes. These larvæ become mature in late fall and were observed leaving their mines from October 24 to November 5; they fall to the ground and spin a small reddish brown, oval, flattened cocoon 2–2½ mm. broad and 3–4 mm. long; forced cocoons yielded moths in the latter part of March.

The imagoes are very near to *E. obrutella* Zeller, but with much darker dusting and with darker hindwings.

EXPLANATION OF PLATES.

PLATE VII. Fig. 1, pitch nodule on *Pinus virginiana* caused by *Evetria virginiana* Busck; fig. 2, pitch nodules on *Pinus divaricata* caused by *Evetria albicapitana* Busck.

PLATE VIII. Fig. 3, chestnut leaves injured by *Eucosma haracana* Kearfott; fig. 4, twigs of *Quercus palustris* showing spiral mines of *Ectædemia heinrichi*, Busck.

## LIFE HISTORY OF EUCOSMA HARACANA KEARFOTT.[1]

BY AUGUST BUSCK, *Bureau of Entomology.*

*Protopteryx haracana* Kearfott, Trans. Am. Ent. Soc. Phila., vol. 33, p. 44, 1907.

*Protopteryx resoluta* Meyrick, Ent. Mo. Mag., vol. 23, p. 34, 1912.

During May and early June many leaves of the chestnut in the vicinity of Washington, D. C., are found to be rolled inwards and downwards, as shown in the accompanying photograph, (pl. VIII, fig. 3). These very common and conspicuous rolls are produced by the larvæ of the above species, the life-history of which has hitherto been unknown.

The young larvæ of this species are yellowish white with jet black head and thoracic shield and with black thoracic feet; tubercles small and inconspicuous, hardly darker than the rest of the body and with short white hairs; prolegs normal with a complete circle of small hooks. The full grown larvæ have light yellow head with black eyespots, yellow thoracic shield and feet; length 14 mm. When full grown the larvæ leave the rolls and let themselves down to the ground, into which they burrow and make a tough, parchment-like oval cocoon, in which they remain as larvæ until late fall. In a warm room the moths began to issue early in February; outdoors under natural conditions issuance does not take place before April.

Presented at meeting of April 2, 1914.

Fig. 2.



Fig. 1.

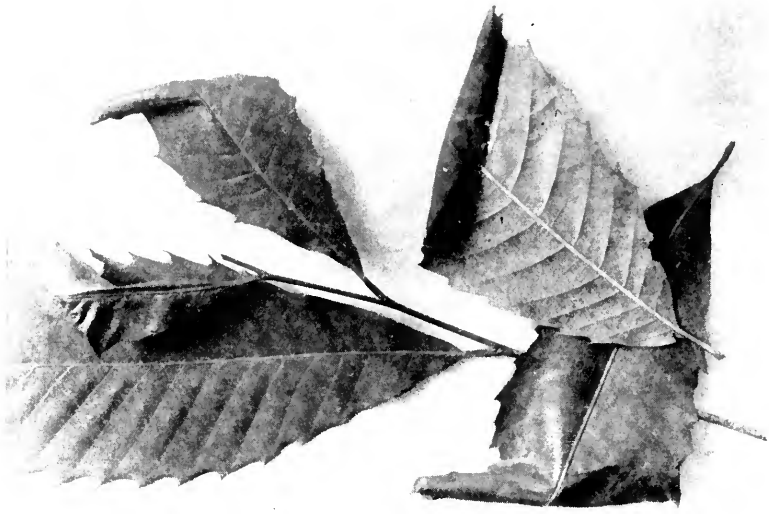


Fig. 3.

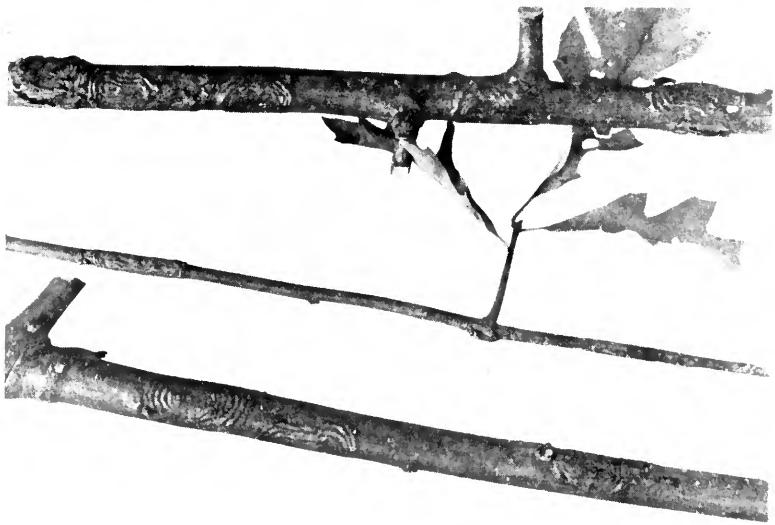


Fig. 4.

## ON MNEMONICA AURICYANEA WALSINGHAM.[1]

(With Plates IX–XVI)

By August Busck and Adam Böving, *Bureau of Entomology.*

*Micropteryx auricyanea* Walsingham, Trans. Am. Ent. Soc. Phila., p. 204, 1882.
*Eriocrania auricyanea* Walsingham, Entom. Record, London, x, p. 162, 1898.
*Eriocephala auricyanea* Dyar, List N. A. Lep. no. 6018, 1903.
*Mnemonica auricyanea* Meyrick, Genera Insectorum fasc. 132, p. 5, 1912.

The only published note on the biology of any American species of the superfamily Micropterygidoidea is by Wm. D. Kearfott (Entom. News, p. 129, 1902). He discovered the mine and the larva of what was presumably this species in the leaves of chestnut, and obtained pupæ, but did not succeed in rearing the imago.

One of the authors (Busck) for several years has collected and studied these larvæ and succeeded last spring in the rearing of a large number of the exquisite moths. As the American literature on this group is so scant, it is deemed worth while to give the following notes on the life-history, and on the remarkable structure of this American species, although most of the facts have long been known from closely allied European species.

*Mnemonica auricyanea* is a small (12–14 mm. alar expanse) strongly iridescent, golden bronze moth, sprinkled with scintillating, bright metallic purple scales. The entire life of this little insect above ground, covers but a few weeks. All the rest of its life, more than eleven months, is passed under ground confined within its cocoon.

The imago issues in April and lays its eggs singly on the opening leaves of the Cupuliferæ, (chestnut, oak and chinquapin). In May the larva makes a large, bulgy blotch mine in the leaf. It feeds up rapidly, within a week or ten days, falls to the ground and burrows down into the soil to a remarkable depth in proportion to the size of the insect, sometimes as deep as a foot. It spins a small, very tough, oval cocoon of silk, within which it remains curled up as a larva during the summer and fall. During the winter the larva transforms into a most remarkable pupa, which possesses long, arm-like, toothed, movable mandibles, with which it cuts the tough cocoon in early spring and with which it digs its way like a mole up to the surface of the ground, where the imago issues.

The egg is rather large, oblong, 0.5 mm. by 0.2 mm., soft, white, finely sculptured with minute dots. The female has a short, horny ovipositor and inserts the eggs singly into the young leaf near the edge, generally on the outer half. Dissection of the

[1] Presented at meeting of April 2, 1914.

female abdomen shows that the number of eggs laid by a single female is about forty.

The mine, (figs. 38–39), begins as a narrow line which runs out towards the edge of the leaf. This early part of the mine is normally obliterated and makes a fissure in the leaf as this grows. This fissure is a very characteristic feature of infested leaves. After this short linear part the mine broadens out into a large bulgy blotch, which always runs out to the edge of the leaf, and normally involves the tip or one or more of the lobes. The mine is suggestive of a beetle or a sawfly mine. The entire parenchyma of the leaf is eaten out and the mine is equally visible from both sides of the leaf. It is semi-transparent, so as to show plainly the larva and the black frass, which is voided in long, irregularly curled threads, lying loosely within the mine.

The full grown larva (fig. 1), is 9–10 mm. long, apodal, whitish in color, somewhat flattened. Head small, flat, horizontal, light yellow with dark brown trophi. Thoracic segments large and bulging, first segment with lightly chitinized but rather strongly pigmented, dark brown thoracic shield and sternal plate. Abdominal segments evenly tapering to the last joint. The skin is shagreened, due to numerous minute, closely set, spine-like projections (fig. 3), all directed backward and probably used in the locomotion. One pair of thoracic and eight pairs of abdominal spiracles.

In the head (figs. 6–7), the two halves of the epicranium are dorsally strongly prolonged backwards, separated by the very deep upper portion of the occipital foramen; ventrally also they are prolonged backwards, but only half as far as on the upper side. Ventrally on the inner margin of each side of the epicranium is a large triangular piece, the hypostoma,[1] which supports the transverse bridge-shaped part of the tentorium.

On the upper side of the epicranium is found one long anterior seta, three minute setæ and several sensorial punctures, somewhat asymmetrically arranged. On the under side are found one large and five small setæ. No true ocelli, but only a large, strongly pigmented, ventral eyespot on each side near the antennal base.

The front[2] is nearly triangular, but the converging edges do not quite meet posteriorly at the occipital foramen. These edges are strongly chitinized and interiorly developed into the endoskeletal frontal ridges. The front contains two pairs of sensorial punctures but bears no setæ.

[1] This is probably the post-gena of Kellogg, Kansas Univ. Quarterly, vol. II, p. 53, 1894.

[2] We employ this term which was first used by Lyonet, (*Traité anatomique de la chenille qui ronge le bois de saule*, p. 34, 1762), and which has been adopted by Wm. T. T. Forbes, (A Structural Study of Some Caterpillars, Ann. Ent. Soc. America, vol. III, p. 96, 1910).

From the posterior end of the front runs on each side a curved translucent line to the outside of the antennal base, limiting a large, triangular area which may be homologous to the so-called adfront of Forbes; each of these areas contains two small setæ posteriorly.

The epistoma[1] is well developed and bears two pairs of minute setæ.

The epistoma is connected with the labrum by a large soft-skinned part, the post-labrum of Lyonet, (the "clypeus" or "anteclypeus" of Packard, Sharp and others).[2]

The labrum (fig. 4) is large and well chitinized, bilobed, the anterior edge rounded and slightly emarginate; on the upper side it bears one central pair of strong setæ and along the edge five pairs of smaller setæ. On the under side of labrum and slightly projecting in front of it, is the fleshy epipharynx (fig. 5) armed along the anterior margin with a series of spines and bearing on each side a large tuft of long hairs. It also has a pair of sensory pits, and two pairs of small, symmetrically arranged, elongate, elliptical, chitinous plates,[3] the proximal ones with a little tooth. The margin of the epipharynx is strengthened by lateral rod-shaped sclerites.

The antennæ (fig. 11), are short, three-jointed;[4] the basal joint is large, membranous, without spines. The second joint is well developed and well chitinized. It bears two large spines and two sensory processes. The third joint is much smaller and bears one seta and two sensory processes, the larger one of which is slightly chitinized around its base.

The mandibles (fig. 10), are strong and placed horizontally. They have three, large, pointed teeth, and a fourth, small rudimentary tooth, indicated only on the ventral side. The large, bluntly terminating cutting edge is separated from the teeth by a small incision. The outer edge bears two strong setæ, the apical one of which is on the base of the fourth rudimentary tooth. At the base of the cutting edge is a bunch of long branched hairs.

[1] Epistoma is the chitinized marginal area between the two processes on which the fossæ of the mandibles articulate. This part Forbes calls "clypeus," (l.c. p. 96, footnote), on the supposition "that this name agrees better with its homology in other orders."

[2] Forbes does not give it any name at all, and applies, as mentioned, the term "clypeus" to the epistoma.

[3] Compare the similar structure in Coleopterous larvæ mentioned by Geo. H. Carpenter and Mabel C. MacDowell in, "The Mouthparts of Some Beetle Larvæ, With Especial Reference to The Maxillulæ and Hypopharynx," The Quarterly Journal of Microscopical Science, vol. 57, 1912, pp. 373-393, figs. 10, 191, 24, and 25.

[4] We accept with reservations, Trægaardh's interpretations, (in his valuable paper, Arkiv. for zoologi, vol. 8, 1913. Stockholm). Possibly his first joint is but a basal membrane and the terminal sensory process a true joint.

The maxillæ, labium, mentum and submentum[1] are inserted in the deeply curved hypostoma.

The maxillæ (figs. 8–9), are large. The cardo is separated from the lower part of the stipes by a transverse separating line which can be seen by a careful examination. The cardo is without any setæ but terminates basally in a more strongly chitinized part. The stipes is large and bears one strong and one small seta. The palpiger is free and bears a long seta. It is fused with the subgalea and the maxillary lobes: the flat lacinia and the more joint-like galea.[2] The lacinia on the dorsal side is furnished with long stiff spines and soft hairs. The maxillary palpus is two-jointed, the basal joint having a fine transverse line and four strong spines on the dorsal side, and the terminal joint several small sensory processes.

Along the margin towards the labium the palpiger has a rod-like chitinization, which at the base is connected with a similar structure along the margin of the hypopharynx. From the connecting point starts first a staff-like thickening along the stipes, second, a similar thickening around the lateral border of the epipharynx and third, a free, rod-like prolongation to the carinated frontal suture.

The labium is somewhat broader than long with two pairs of sensory punctures; the labial stipites form an incomplete chitinous basal ring. The labial palpi have a broad short basal joint, an elongated, narrow second joint with a single seta and a minute apical joint also bearing a seta. The spinneret (the fused labial lobes) protrudes beyond the palpi and is placed ventrally, well within the anterior margin of the labium. The mentum (fig. 9), is large and unchitinized, at the base separated from a short submentum by a bow-shaped transverse line. It has a single pair of sensory punctures. The submentum is also unchitinized. On the dorsal side of the labium towards the mouth cavity, the hypopharynx is provided with a series of long branched hairs. Further down is found a chitinized plate with the rudimentary third pair of maxillæ, the socalled maxillulæ (fig. 8). They are provided with short spines and correspond exactly to homologous elements described in the beetle larvæ by Carpenter and Mabel MacDowell, (l. c. p. 375).

The body tubercles (figs. 2–3) are only discernible by their setæ, which are themselves rather small. The arrangement

[1] Forbes, (l.c. p. 96), states, "The lower lip in caterpillars is formed of the maxillæ as well as the labium," but this is a confusion of terms, as the term labium and lower lip hitherto have been regarded as synonyms.

[2] This may be more correctly interpreted as the digitus laciniæ figured by Comstock in a Coleopterous maxilla, fig. 605, in his Manual, 1895. If so, the galea is absent.

is primitive. Utilizing Dyar's numbers, these setæ may be interpreted as follows: I, II, IV, V, and VII, nearly in a line on the posterior annulet of the segment; VI small and a little in front of this line; III obliquely above and behind the spiracle, with a minute IIIA obliquely before the spiracle. Besides these, there are two minute spines (*x*) on the dorsal half of each joint. Thoracic legs and abdominal prolegs are wanting.

The larva is full grown about ten days after the hatching of the egg. It then cuts a small semi-circular slit in the upper epidermis of the leaf, and leaves the mine, dropping to the ground, where it at once digs down until it finds a suitable place in which to make its cocoon. Normally this is attained within a few inches or even less from the surface of the ground, often next to a stone, but in the breeding jars[1] some went down six to eight inches and there are records of even greater depths, depending presumably upon the nature and humidity of the soil. There the larva bends itself into a circle and pushes the soil aside to make a small firm cell in which it then spins its oval cocoon.

The cocoon is so tight fitting around the larva and is made of so closely woven tough silk that it is difficult to cut it open with dissecting needles without injuring the larva within. The cocoon is about 2 mm. by 4 mm., of whitish silk and with small grains of earth and sand firmly incorporated in its surface. The larva remains within this cocoon apparently unchanged during summer and fall, and not before sometime during the winter does it transform into a pupa, which also very nearly fills out the cocoon.

The pupa (figs. 19–20–21) is most extraordinary, unlike any other Lepidopterous pupa, and reminding one much more of those of Trichoptera. It has all appendages free and unfused and all the body segments movable. The head especially can be moved up and down and sideways. There is, of course, no room within the narrow confines of the cocoon for these movements, but if a pupa is taken out and lightly touched with a brush, it responds with the most grotesque nodding of its head and with the swinging out of the enormous mandibles in a deliberate manner. While all of the other appendages are loose, not glued together as is normal in a Lepidopterous pupa, it is mainly the head and the mandibles and abdominal segments, which are movable and which

[1] Common large flower pots were used. These were filled with clean sand and sifted soil, liberally mixed with small pieces of rock, and the mined leaves were laid on top thereof. As soon as the larvæ had left the leaves, these were taken away. The pots were then buried flush with the ground, inside an unheated breeding house, where they were sheltered from sun and rain, but still exposed to nearly outdoor temperature during the winter. The pots were watered half a dozen times from May to the following January, and were then placed within breeding cases for the emergence of the moths.

are utilized in locomotion, when the pupa digs up through the earth. The legs are rather feeble and immovable and are not used for this purpose as has been asserted.[1]

The pupal skin is very thin and transparent, so that the imaginal hairs and scales, as well as the eyes and ocelli can be plainly seen through it. The only part of the pupa which is strongly chitinized, besides the large mandibles, is the supporting mouthframe (figs. 14–18) formed by epistoma, pleurostoma and hypostoma.

From the front projects downwardly a large, peculiar, beaklike, soft process, reaching above and beyond the base of the labrum. On the upper part of the front are two pairs of long, curved, stiff hairs, the same which persist on the head of most Lepidopterous pupæ (fig. 16).

The eyes are large. The antennæ are free throughout their entire length and run in a broad curve over the base of the wings and rest on the costal edge of the wings, reaching nearly to their tips. The first joint is large and elongate, four times as long as the succeeding joints. The tufts of hairs on the imaginal joints are plainly visible through the pupal sheath.

The labrum is large, subquadrate, with incurved front margin. It is rather firm and bears six pairs of long stiff bristles.

The most conspicuous of the mouth parts are the very long, stout, curved, armlike mandibles (fig. 15). These are strongly chitinized and dark brown in color. Their fossa and condylus are strongly developed and firmly jointed to the mouth frame. Their inner edge is sharply serrated nearly to the end and the apex is broadened out into a formidable club, which is abruptly cut off with a flattened, somewhat hollow end, the edges of which are armed with several strong teeth. They are capable of a strong outward swinging movement, which is used to tear the tough cocoon and afterwards to dig up through the soil.

The mandibles are moved by strong muscles (fig. 18), identical with the abductor and adductor mandibulæ found in insects with biting mouthparts, and the minute imaginal mandibles can be found within their base by dissection (fig. 14). In this connection we refer to Chapman's peculiar statement in his otherwise very lucid account of an "*Eriocranid*" pupa.[2]

[1] Sharp, in his textbook, p. 327, 1909.

[2] "That a Lepidopterous pupa should have jaws is remarkable enough; that they should be of such immense size proportionately to the insect and should be functionally active seems at first sight incredible; but the still more remarkable fact remains, that active and powerful as they are, there are no visible means of working them, as they are pupal structures, used only immediately before the emergence of the imago and have no corresponding imaginal parts attached to them.

"The whole question, how these jaws are worked, will form an interesting

The maxillary palpi (fig. 17), are bent upon themselves in five sharp curves, with the last joint pointed downwards and forwards.

The two halves of the proboscis are widely separated and outwardly curved, with their tips nearly meeting in the middle line forming a heart-shaped figure.

The labium and its three-jointed palpi are pointed downwards in two straight, divergent staffs, reaching beyond the curved proboscis.

The strongly angulated patagia,[1] (fig. 19), overlap the base of the wings behind.

The legs are folded loosely along the body, the posterior tarsi reaching beyond, and curved around the tip of the abdomen.

On the back of the pupa is a peculiar structure, the morphology and function of which is not clear to us. It consists of an unpaired, thin-walled, strap-like, longitudinal band (fig. 21, *x*), made up of three separate appendages in prolongation of each other and attached to the middle line of respectively the second and third thoracic and the first abdominal segments.

Each abdominal segment bears two lateral pairs of strong stiff spines. The spiracles are small and circular.

In early spring when the pupa is mature and ready for the emergence of the adult, the cocoon is split open by an outward movement of the mandibles which tears through the tough silk. The pupa then wriggles out of the cocoon and laboriously digs upward through the earth by the help of the mandibles, swung from the exceedingly movable head and pushed on by the movements of the abdomen. When it finally has made its way to the surface, it lies immovable for some time, during which the last acts of the transformation to adult take place. The mandibles become immovable through the withdrawal of the imaginal skin and mandibles, together with the strong muscles which remain in the imaginal head. The pupal skin now splits open on the median line of the first and second thoracic segments. The long-haired head and thorax of the imago appear in the slit and the fully developed moth issues. It at once seeks some support from which to hang with backwardly extended wing, as is usual with freshly emerged moths, but it is very quickly in condition for active flight. It is interesting to note that if the cocoon is taken out of the sand and placed on the surface for observation, as was done

research for some microanatomist. I fear my own training leaves me unequal to carry the matter much further. I am however, thoroughly satisfied on two points: first, that there are no muscles attached to these jaws, second, that there are no imaginal jaws within them, whose movements compel those of the pupal ones." Chapman, Trans. Ent. Soc. Lond. 1893, pp. 255–263.

[1] The patagina of Busck, by mistake.

with several, the pupa has a period of rest after emergence from the cocoon, during which the mandibles and the head work furiously at the least irritation with a hair-pencil, or even without such. This period evidently corresponds to the time it normally takes the pupa to work its way through the soil to the surface. Later on comes the period of immovability of the mandibles, which fail to respond even if sharply irritated. This corresponds to the resting period when the pupa under normal conditions has reached the surface.

The imago has the head (fig. 22) and face strongly tufted with long gray, brown and white hairs, which obscure the eyes and mouthparts. The antennæ are simple, dark brown, with two longitudinal light yellow lines throughout their length. Thorax strongly haired, the long brown and gray hairs arranged in three large whorled tufts, two over the patagia and one posteriorly. Forewings elongate elliptical, thickly covered with large golden scales, evenly interspersed with numerous single purplish blue metallic scales: cilia light golden brown. Hindwing dark golden brown, with a purple sheen, semitransparent at base; cilia gray. Abdomen brownish gray, in the female terminating in a short, stout, brown, horny ovipositor. Legs dark gray sprinkled with purple scales; posterior tibiæ with long, sparse thin hairs on the upper side and with two pairs of well developed spurs. Alar expanse 10–13 mm. The venation is given in figures 12–13.

From the several clearly primitive characters which they possess in common, more especially in the neuration and the mode of keeping the wings together by the so-called jugum (the clavus of Spuler), there can be no doubt that the Eriocraniдæ and the Micropterygidæ represent the most ancestral group of Lepidoptera. This has been generally recognized by all modern Lepidopterists, but there has been considerable difference of opinion as to the relative systematic value of these groups. Some authors have considered the active biting mouth parts of the adult Micropterygidæ of sufficient systematic value to separate this group as a distinct superfamily or even subclass. On the other hand, Meyrick regards the passage to sucking mouth parts in the Eriocranidæ as a purely biological change of structure of much less systematic significance, and he treats the two groups as closely allied subfamilies.

The actual presence of rudimentary but unmistakable mandibles also in the Eriocranidæ tends to support Meyrick's opinion of close correlation, but his description (Genera Insectorum), contains some misstatements and omissions in the anatomy of the head structures in the two groups. We consider that the differences both in the mouth parts and in the venation, as well as of

the larvæ, justify separate family rank for the Eriocranidæ and the Micropterygidæ of which the latter are by far the more ancestral, as shown in the following comparison of their head structure.

The adult Micropterygid (*Micropteryx ammanella* Hübner, is used in this comparison), has true, well developed, strongly chitinized, functional mandibles (fig. 35). These are in a general way similar to those just described in the Eriocranid pupa, but are much contracted. They have well developed fossa and condylus, jointed on the mouth-frame and are moved by strong abductor and adductor muscles. Their outer end is sharply cut off and palmate as in the Eriocranid pupa and toothed on the edges. The upper one of the outer teeth is more pointed and larger than the rest.

In the adult Eriocranid (*Mnemonica auricyanea* Walsingham) are found by dissection similar but rudimentary and unchitinized mandibles (figs. 27, 31, 33). These have not the palmate apex, and the fossa and condylus are hardly discernible, while the ligament connecting them to the mouth frame is large and cushion-like. In the pupa these mandibles are plainly visible within the base of the pupal mandibles (fig. 14), and they possess strongly developed abductor and adductor muscles (fig. 31), identical with those in the pupa. These muscles and the development within the corresponding pupal structure definitely prove the mandibular nature of these organs.[1] The presence of true biting mandibles in the Micropterygidæ is therefore not of such fundamental importance as Sharp, Tutt, and others have assigned to it, the less so as rudimentary mandibles may be distinguished in certain much higher Lepidoptera.[2] But the further presence of all the

[1] Compare Chapman's statement, above quoted, in footnote, page 156–7, which has been accepted by subsequent writers, as Sharp and Meyrick. The former states, page 308 in his textbook, (The Cambridge Natural History, vol. VI, Insects, part II, 1899), "The opinion entertained by Walter that Micropteryx proper, (his 'höhere Micropteryginen,' Meyrick's 'Eriocranianæ') also possesses rudimentary mandibles is considered by Chapman, no doubt with reason, to be erroneous." Further in the same manual, p. 437; "All the information we possess points to profound distinctions between *Micropteryx*, (our 'Eriocranidæ'), and *Eriocephala*, (our 'Micropterygidæ,' Walter's 'niedere Micropteryginen') for whereas, in the former the mandibles drop off from the pupa, so that the imago has no mandibles, in the latter, the mandibles exist." Meyrick, in his monograph of the Micropterygidæ (*Genera Insectorum*, 912, p. 3), simply states in the diagnosis of his subfamily *Eriocraninæ*, "No mandibles." On the other hand, it should be noted that Alfred Walter in his excellent work on the morphology of the Lepidoptera, (Jenaische Zeitschrift für Naturwissens., Bd. 18, 1884, neue Folge Bd. II, p. 751–807, 2 plates), has correctly interpreted these structures in what he calls the "höhere Micropterygidæ."

[2] The weak and functionless mandibles have been recognized later by Kellogg, (The Mouthparts of the Lepidoptera, Am. Nat. vol. 29, p. 546, 1895), by Packard, (On a new Classification of the Lepidoptera, Am. Natur.

other trophi also identical with those found in insects with biting mouth parts, and even maxillulæ lobes on hypopharynx (fig. 37), proves the Micropterygidæ a much more ancient group than the Eriocranidæ, which possess none of these characteristics but has a true sucking mouth.

In the Micropterygidæ the maxillæ consist of a well developed cardo and stipes (figs. 36–37), a palpiger which carries the six-jointed palpus, and a subgalea which carries a distinct, well chitinized lacinia with a few setæ, and a two-jointed galea, the basal joint of which is short and well chitinized, while the terminal joint is soft and leaf-shaped, with a longitudinal series of setæ.

The Eriocranidæ (figs. 29–30), also possess distinct cardo and stipes, as well as a six-jointed palpus, and the galea is also two-jointed, but they lack altogether the lacinia, and the terminal joint of the galea is developed into one of the hollow sheaths of a true proboscis, is curved, has the typical serrations (figs. 25–26), which serve to connect it with the other half of the proboscis, and has the usual parallel ring structure and surface cilia placed in transverse lines.

Both the Micropterygidæ and the Eriocranidæ possess a labium with a well developed, three-jointed palpus, the apical joint with the usual sensitive groove,[1] represented merely by a depression containing the rows of sensitive cones. But in the Micropterygidæ is found a setæ-bearing lobe, corresponding to the galea of the maxillæ, issuing from the so-called basal joint of the palpus, which should rather be interpreted as stipes labii. Of this setæ-bearing lobe there is no vestige in the Eriocranidæ. Finally, only the Micropterygidæ, as already mentioned possess the two maxillulæ lobes, lateral to the hypopharynx.[2]

The authors are under great obligations to their friend Rev. J. DeGryse, for the several excellent figures (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 19, and 21), of the larval and pupal structures, which he has studied most diligently and carefully, thus contributing very considerably to the value of this paper.

The other figures, except the venation, were drawn by Adam Böving.

vol. 29, p. 636, 1895) and by Francis X. Williams, (A New Eriocrania from the Pacific Coast, Ent. News, p. 14, 1908).

[1] Pointed out by O. Von Rath: Zool. Anzeiger 1887, p. 627; Zeitschrift f. Wissensch. Zoölogie, Bd. 46, 1888.

[2] These investigations of the maxillary, labial, and maxillulary structures fully substantiate the writings of Dr. Walter, who has already pointed out most of the above mentioned characters in his excellent paper. In the middle of the hypopharynx is plainly seen in our slides, both of the Micropterygidæ and the Eriocranidæ, the opening of the salivary glands, which Walter was not able to discern on account of the condition of his material.

EXPLANATION OF PLATES.

PLATE IX. *Mnemonica auricyanea* Walsingham, larva.

Fig. 1, lateral view of full grown larva.

Fig. 2, lateral view of flattened larval skin; SP, thoracic spiracle; *sp*, abdominal spiracles.

Fig. 3, details of the sixth abdominal segment, lateral view; *x*, small unnumbered setæ.

PLATE X. *Mnemonica auricyanea* Walsingham, larva.

Fig. 4, dorsal view of epipharynx, labrum and post-labrum; *ex*, epipharynx; *lr*, labrum; *pl*, post-labrum; *mb*, median bristles.

Fig. 5, ventral view of epipharynx; *ch*, hairtuft; *ep ext*, exterior epipharyngeal plate; *ep int*, interior epipharyngeal plate; *er*, rod along the margin; *es*, sensory puncture; *ex*, epipharynx.

Fig. 6, dorsal view of head, *a*, (on detail A), dorsal mandibular articulation; *af*, adfront; *afl*, adfrontal line; *an*, annulus around the antennal base; *c*, (on detail A), carinated lateral margin of front; *e*, (on detail A), epistoma; *epc*, epicranium; *f*, front; *of*, occipital foramen; *pl*, post-labrum.

Fig. 7, ventral view of head; *epc*, epicranium; *h*, hypostoma with *i*, impression where tentorium is attached; *m*, mentum; *ocl*, eyespot.

PLATE XI. *Mnemonica auricyanea* Walsingham, larva and wing venation of the imago.

Fig. 8, maxillæ, hypopharynx and maxillulæ; *bb*, branched bristles; *ds*, duct of salivary glands; *epc*, margin of epicranium; *g*, galea or digitus lacinia; *hr*, chitinous rod of hypopharynx; *hx*, hypopharynx; *l*, lacinia; *mp*, basal joint of maxillary palpus; *mxl*, maxillulæ; *spr*, spinneret.

Fig. 9, ventral view of maxillæ and labium; *cr*, cardo; *crr*, chitinization along inner edge of cardo; *lp*, basal joint of labial palpus; *lst*, labial stipes; *m*, mentum; *mpI*, basal joint of maxillary palpus; *mpII*, terminal joint; *plg*, palpiger; *sm*, submentum; *r*, chitinous rod along the inner margin of lacinia; *st*, maxillary stipes; *str*, chitinous rod along the margin of maxillary stipes.

Fig. 10, left mandible, ventral view.

Fig. 11, dorsal view of right antenna; *an*, annulus around antennal base; *at*, large papilla or terminal joint.

Fig. 12, venation of forewing.

Fig. 13, venation of hindwing.

PLATE XII. *Mnemonica auricyanea* Walsingham, pupa.

Fig. 14, labrum and mandibles of the imago within the labrum and mandibles of the pupa; labrum and mandibles of the pupa indicated with dotted lines; *mf*, mouthframe.

Fig. 15, ventral view of left mandible.

Fig. 16, dorsal view of head; *ant*, antenna; *fs*, frontal setæ; *lp*, labial palpus; *lr*, labrum; *md*, mandible; *mf*, mouth frame; *mp*, maxillary palpus; *bk*, beaklike prolongation of front; *pr*, proboscis.

Fig. 17, ventral view of head; *epc*, epicranium; *h*, hypostoma; *lp*, labial

palpus; *m*, mentum; *md*, mandible; *mp*, maxillary palpus; *ofI*, anterior part of occipital foramen; *ofII*, posterior part of occipital foramen; *oc*, compound eye; *pr*, half part of proboscis; *sm*, submentum; *tb*, bridge of tentorium; *st*, stipes.

Fig. 18, mouth frame and mandible with musculature, dorsal view; *ab*, abductor muscle of mandible; *ad*, adductor muscle of mandible; *d*, dorsal process of mouth frame on which fossa of the mandible articulates; *mf*, mouth frame; *t*, tendon; *v*, ventral socket of mouth frame on which condylus of mandible articulates.

Plate XIII. *Mnemonica auricyanea* Walsingham, pupa.

Fig. 19, lateral view; *pt*, patagium.

Fig. 20, ventral view.

Fig. 21, dorsal view; *x*, thin-walled dorsal appendices.

Plate XIV. *Mnemonica auricyanea* Walsingham, imago.

Fig. 22, lateral view of head; *ant*, antenna; *e*, epistoma; *epc*, epicranium; *f*, front; *lp*, labial palpus; *l*, labrum; *md*, mandible; *mf*, mouth frame; *mp*, maxillary palpus; *ocl*, ocellus; *pl*, post-labrum; *pr*, proboscis.

Fig. 23, epipharynx and hypopharynx; *mm*, membrane of mouth; *ex*, epipharynx; *hx*, hypopharynx; *pap*, sensory papilla; *ph*, pharynx; *sc*, scales; *w*, sensory wart.

Fig. 24, dorsal view of head; *an*, antennal ring; *epc*, epicranium; *f*, front; *oc*, compound eye; *ocl*, simple eye; *ha*, hair-bearing area.

Fig. 25, apex of right half of proboscis from inner side.

Fig. 26, base of right half of proboscis from inner side; *ci*, cilia belonging to the external parallel series; *fri*, stiff connecting fringes of ventral margin; *th*, transverse ring-structure.

Fig. 27, ventral view of head; *ex*, epipharynx; *h*, hypostoma; *hx*, hypopharynx; *m*, attachment of mentum; *md*, mandible; *mx*, attachment of maxilla; *ofI*, anterior portion of occipital foramen; *ofII*, posterior portion of occipital foramen; *tb*, bridge of tentorium; *v*, ventral mandibular articulation.

Fig. 28, ventral side of labium; *lp*, labial palpus; *m*, mentum; *VR*, organ discovered by Von Rath.

Fig. 29, buccal surface of left maxilla; *c*, cardo; *gI*, basal joint of galea; *gII*, terminal joint of galea developed as left half of proboscis; *h*, hypostoma; *mp*, maxillary palpus; *plg*, palpiger; *sgl*, subgalea.

Fig. 30, ventral side of right maxilla; *c*, cardo; *gI*, basal joint of galea; *gII*, terminal joint of galea; *mp*, maxillary palpus; *plg*, palpiger; *sg*, subgalea; *st*, stipes.

Plate XV. *Mnemonica auricyanea* Walsingham, imago, figs. 31–33.

Fig. 31, ventral view of right mandible; *ab*, abductor muscle; *ad*, adductor muscle; *t*, tendon.

Fig. 32, frontal view of head; *ant*, antenna; *epc*, epicranium; *e*, epistoma; *f*, front; *lr*, labrum; *lp*, labial palpus; *m*, mentum; *md*, mandible; *mp*, maxillary palpus; *pl*, post-labrum; *plg*, palpiger; *pr*, proboscis (= terminal joint of galea); *sm*, submentum.

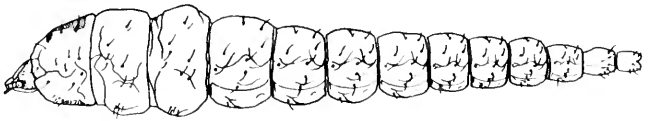


Fig 1

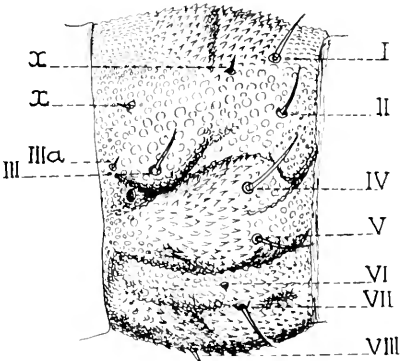



Fig 3

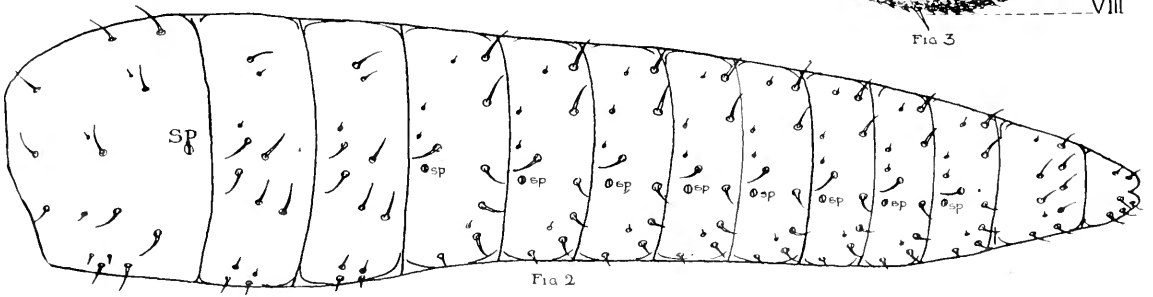



Fig 2

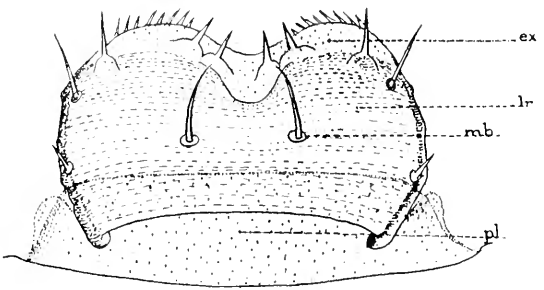



FIG. 4

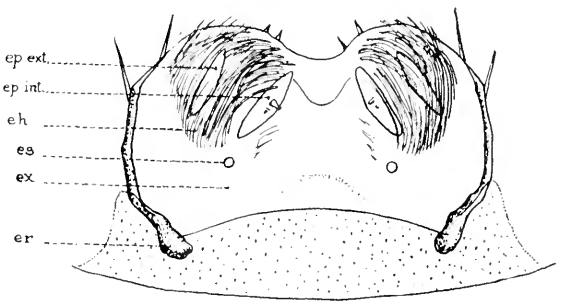



FIG. 5

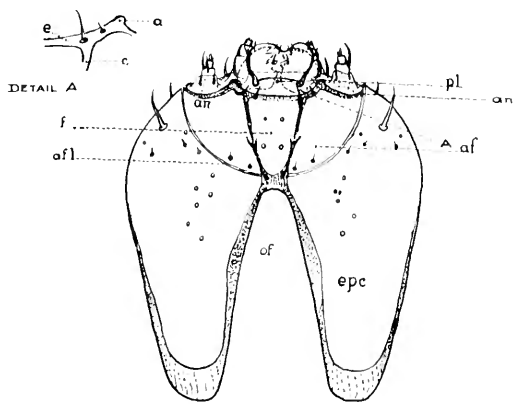
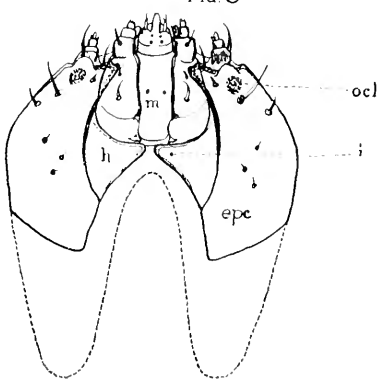



FIG. 6

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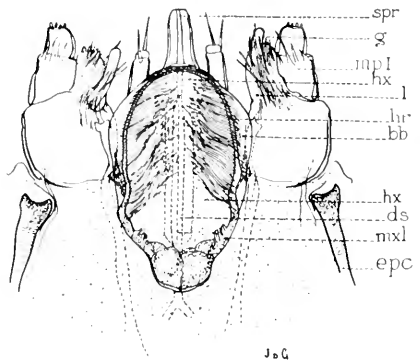
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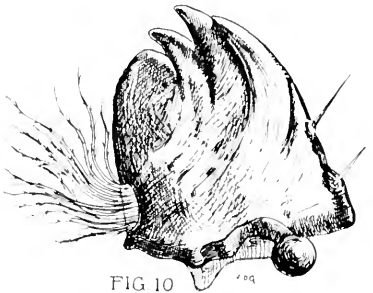
FIG. 8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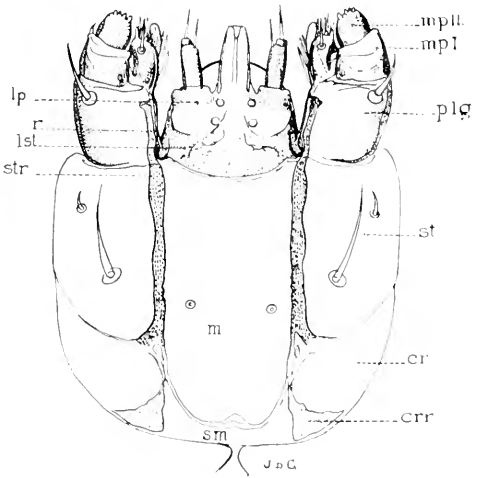
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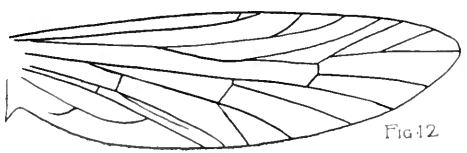
FIG. 9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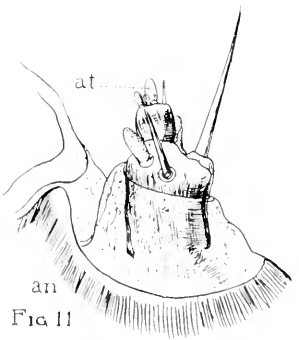
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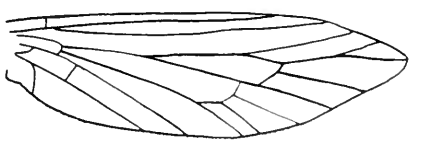
FIG 13

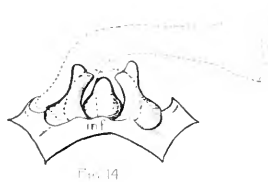


Fig. 14

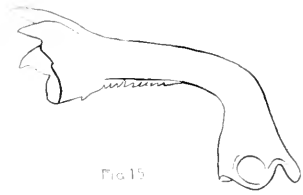

Fig. 15

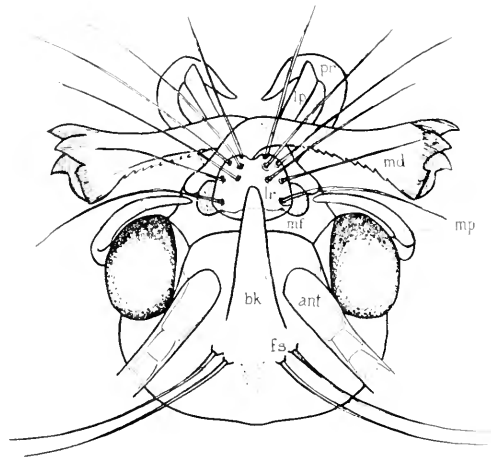


Fig. 16

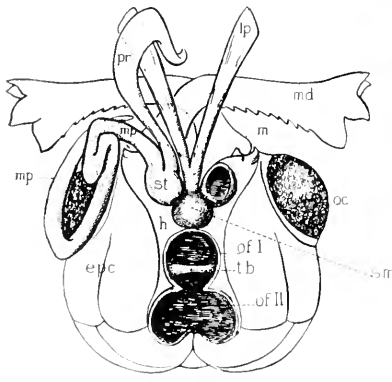


Fig. 17

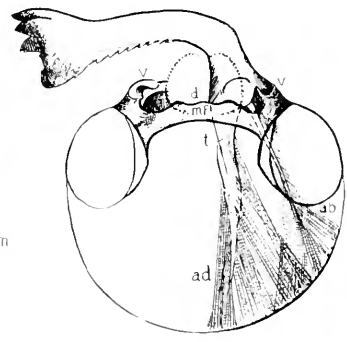


Fig. 18

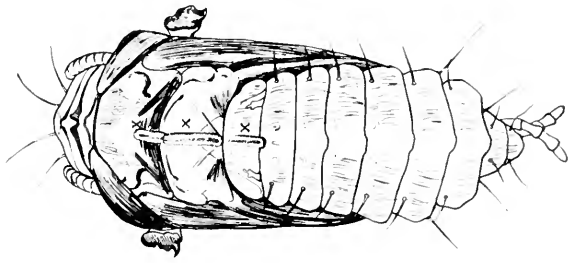

FIG. 21

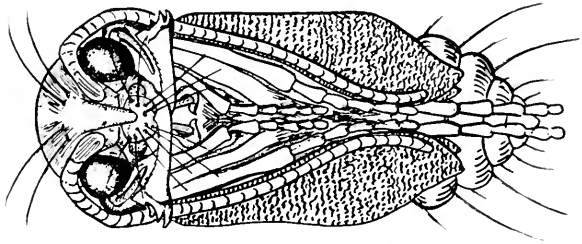

FIG. 20

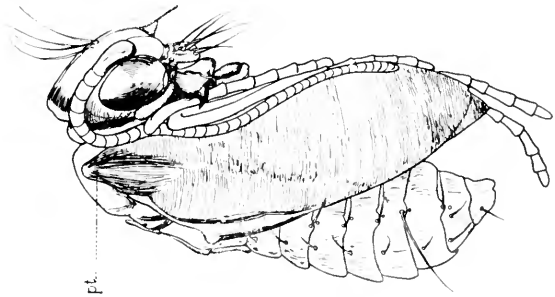


FIG 19

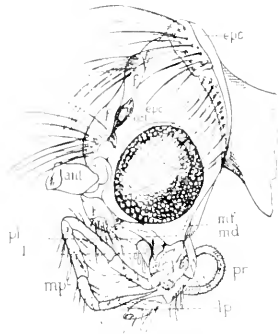


Fig. 22

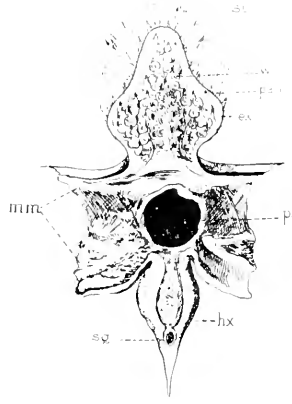


Fig. 23

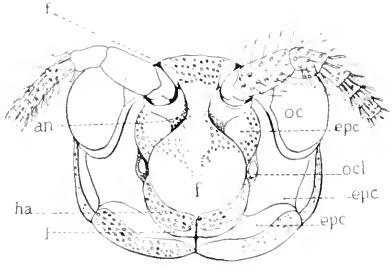


Fig. 24

Fig. 25


Fig. 26

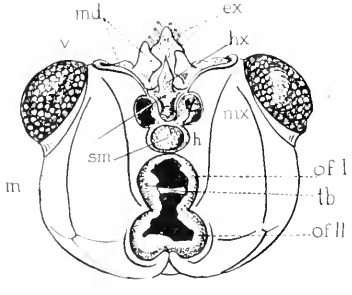


Fig. 27

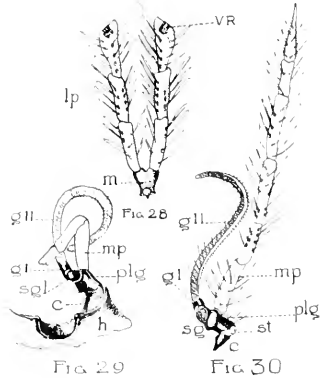


Fig. 28

Fig. 29

Fig. 30


Fig. 31

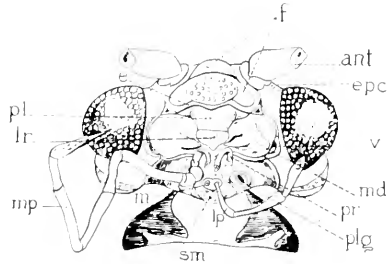


Fig. 32

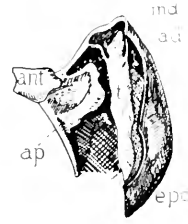


Fig. 33

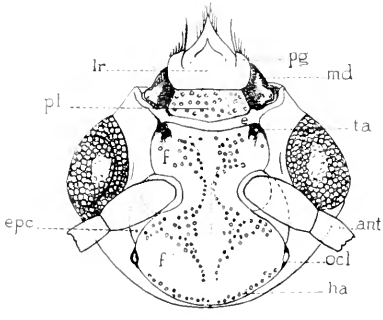


Fig. 34

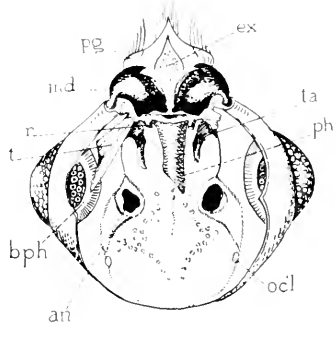


Fig. 35

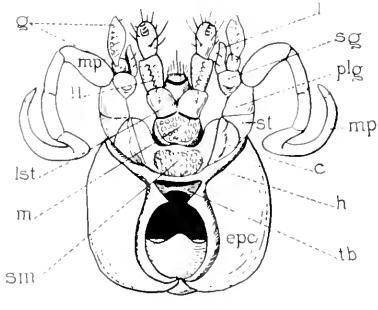


Fig. 36

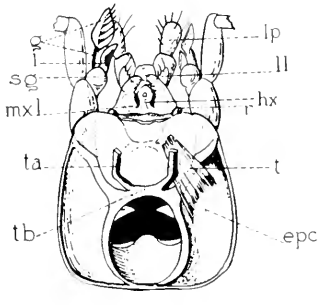


Fig. 37

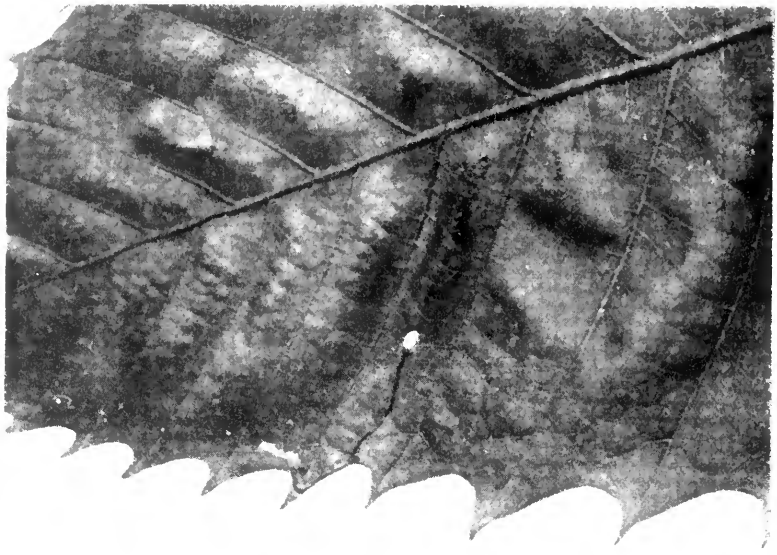

Fig. 38.

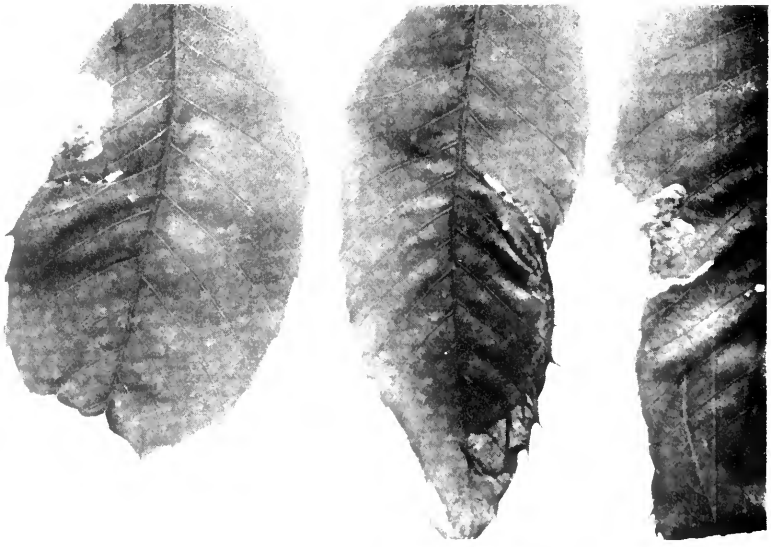

Fig. 39.

Fig. 33, interior view of a piece of the head of a dry specimen; *ad*, adductor mandibuli; *epc*, epicranium; *md*, mandible; *t*, tendon; *ap*, process to which antennæ muscles are attached.

*Micropteryx ammanella* Hüber, imago, figs. 34–37.

Fig. 34, dorsal view of head; *ant*, antenna; *epc*, epicranium; *ha*, hair-bearing area; *lr*, labrum, *md*, mandible; *ocl*, ocellus; *pg*, pilifer; *pl*, post-labrum; *ta*, spot indicating the interior attachment of tentorial arm.

Fig. 35, upper portion of head from inner side; *an*, antennal ring; *ex*, epipharynx; *md*, mandible; *ocl*, ocellus; *pg*, pilifer; *ph*, pharynx; *r*, endoskeletal rod; *t*, tendon of mandible; *ta*, tentorial arm.

Fig. 36, ventral view of head; *c*, cardo; *epc*, epicranium; *g*, galea; *h*, hypostoma; *l*, lacinia; *ll*, labial lobe; *lst*, labial stipes; *m*, mentum; *mp*, maxillary palpus; *plg*, palpiger; *sg*, subgalea; *sm*, submentum; *st*, stipes; *tb*, tentorial bridge.

Fig. 37, lower portion of head from inner side; *epc*, epicranium; *g*, galea; *hx*, hypopharynx; *l*, lacinia; *ll*, labial lobe; *mxl*, maxillula; *lp*, labial palpus; *r*, endoskeletal rod; *sg*, subgalea; *t*, tendon of mandible; *ta*, tentorial arm; *tb*, tentorial bridge.

Plate XVI. *Mnemonica auricyanea* Walsingham.

Fig. 38, young mine and egg puncture in chestnut leaf.

Fig. 39, old mines.

## AQUATIC BEETLES, ESPECIALLY HYDROSCAPHA, IN HOT SPRINGS, IN ARIZONA.[1]

By E. A. Schwarz, *Bureau of Entomology.*

In 1891 on the occasion of the meeting of the A. A. A. S. at Washington, D. C., I prepared for publication a letter just received from our lamented friend and former president of this Society, Mr. H. G. Hubbard, relating to insect life in the hot springs of the Yellowstone National Park. This letter has been published in the Canad. Ent., vol. 23, pp. 226–230. At the same time I made myself a little acquainted with the literature on insect life in hot water and found that in America there is only one paper referring to this subject, namely by Dr. A. S. Packard, published in the American Naturalist on a Stratiomyid (Diptera) larva found in Wyoming. (This same paper is mentioned by Dr. Sharp in the Cambridge Nat. History.) In this instance the Dipterous larva was found in hot water *estimated* only 20 or 30° below the boiling point. In the case of Mr. Hubbard's observations in the Yellowstone Park he expresses his regrets at not

[1] Presented at meeting of April 2, 1914.

having a thermometer at his disposal, but at one place he found semi-aquatic insect life close to springs and creeks the water of which is close to the boiling point. The European literature on the subject is very meager and like the American references only proves that there are no genera or even species of true insects which exclusively live in hot water, but that there are insects that are very fond of living and even developing in or near hot or very warm water but which are at the same time found in or near water of moderate or even cold temperature. On the other hand it cannot be denied that many aquatic insects are very particular in the selection of their habitat as you can easily see even in the vicinity of Washington. Some insects live exclusively in very cold springs, others live only in the shaded, small creeks emptying into the Potomac or Rock Creek; others live in the broader and more sunny creeks such as the Eastern Branch, while the fauna of the Potomac River and its immediate shore has many peculiarities of its own.

Knowing all this and with the expectation of not finding anything of special interest in the creek at Castle Hot Springs in Arizona, Mr. H. S. Barber and I visited that place at the end of June in 1901.

The little resort of Hot Springs is situated in Castle Creek canyon, Yavapai County, Arizona, near the southern end of the Wickenburg Mountains at an altitude of 1970 feet. Steep and high cliffs rising to about 3000 feet elevation surround the place on all sides. The country is extremely arid but its scanty vegetation with its giant cactus, various other species of the same family, its acacias, mesquite, etc., is not much different in general aspect from that at numerous places in southern Arizona. The hot springs themselves originate at the head of a little gorge about 150 feet above the bottom of the canyon. Where the water comes out of small crevices in the solid rock its temperature is 115° Fahrenheit (apparently not varying throughout the year). It falls then into an upper basin where the temperature is but little lower than at the spring itself. This basin is surrounded by steep rocks and there is no vegetation in the water except a bluish green alga, and on the wet marginal rocks a brownish yellow alga containing much calcareous matter. Thence there is a waterfall of several feet and the hot water meanders as a small creek over rocks and stones through the middle part of the gorge. Here the temperature of the water is already considerably lower, perhaps less than 100°, and the creek is lined with a dense growth of tall reeds, the rootlets of which, mingled with the same green alga, form a swampy but quite warm breeding place for insects. Arrived at the bottom of the gorge the water has (in summertime) a temperature of 94°. It is used for drinking purposes, sup-

plies two little fountains and irrigates a tiny garden. The creek is here lined with willow bushes, grass and other green vegetation. Beyond this place the creek disappears in the thirsty sand of the canyon.

The following aquatic or semi-aquatic insects were found by Mr. H. S. Barber and myself in or near this creek during a short visit at the end of June 1901, but a large part of our collection, including the entire alcoholic material was lost in the conflagration which destroyed the city of Williams, Arizona, on July 2, 1901. In December 1913 we again visited the place but either on account of the cold weather or on account of the various "improvements" in the bed of the creek, insect life was much scantier than in the summer of 1901.

In the upper basin and at the head of the spring the following species occurred:

*Helochares normatus.*
*Hydroscapha natans.*
A water mite (Hydrachnid).

In or along the middle course of the creek:

*Bidessus subtilis.*
*Laccophilus pictus.*
*Helophorus obscurus.*
*Epimetopus* nov. spec.
*Helochares normatus.*
*Chatarthria minor.*
*Creniphilus subcupreus.*
*Berosus* sp.
*Hydroscapha natans.*
Larva of a Cyphonid (*Scirtes?*)
*Simulium* sp. (larvæ and pupæ)
Two species of minute aquatic Dipterous larvæ (Chironomidæ).

On the muddy banks of the creek occurred also quite a fauna of riparian Coleoptera of the genera *Schizogenius, Bembidium, Tachys, Tanygnathus, Actobius, Stenus, Sunius, Medon, Apocellus,* and various *Aleocharinæ*. On the tall reeds a species of Aphididæ occurred which was fed upon by *Seymnus flebilis* and its varieties.

In the lower part of the creek the same aquatic Coleoptera were found with the exception of the *Epimetopus* but there was a species of *Dryops* and additional riparian species.

An opportunity to compare the hot water fauna with that of cold water in the same region presented itself in what is called the "Four Tanks" which are merely enormous "potholes" or round waterworn basins cut in the rock by the drainage of a small valley descending the abrupt wall of the canyon through a narrow

cleft. These four reservoirs are situated one above the other almost as gigantic steps, the lower broken so that water does not stand in it, and only the second is accessible by ladder and contains two to six feet of water. In this water the following insects were taken in June 1901:

*Cnemidotus (Peltodytes) simplex.*
*Desmopachria* n. sp.
*Desmopachria mexicana.*
*Laccophilus terminatus.*
*Laccophilus lateralis.*
*Laccophilus ellipticus.*
*Bidessus cinctellus.*
*Bidessus subtilis.*
*Hydroporus corvinus.*
*Thermonectes marmoratus.*
*Hydrochus vagus.*
*Hydræna* sp.
*Berosus* n. sp.
*Helochares normatus.*
Odonate larvæ (Dragon flies), various species.

It will be seen that the interest in the insects found in the Hot Springs of Arizona centers in two species of Coleoptera, viz., the Hydrophilid, *Epimetopus* and the little *Hydroscapha* which is, according to all authorities the representative of a separate family. A description and figure of the new *Epimetopus* will be furnished at some future time but the occurrence of the genus *Hydroscapha* so remote from its type locality, and moreover the discovery of its earlier stages present a peculiar interest so that I feel justified in presenting a bibliography of the genus and a short account of the circumstances under which the genus has been found in Arizona. These notes are intended solely as an introduction to the following important paper by Dr. Böving. Whether or not the Arizonan species of *Hydroscapha* is different from the Californian species (*natans*) can not be ascertained at present since specimens of the latter are not at hand for comparison.

BIBLIOGRAPHY OF HYDROSCAPHA.

1874. LeConte, (Trans. Am. Ent. Soc. v, pp. 45–46) in erecting the family *Hydroscaphidæ*, with *H. natans* Lec. as the only species, says: "[This insect] seems to me another of the synthetic types gradually becoming known to us among the smaller and more obscure forms, connecting several different families of the Clavicorn series, in this instance the Hydrophilidæ, Scaphidiidæ, and perhaps the Trichopterygidæ. In the accepted arrangement of Coleoptera it must be considered as indicating a new family."

*H. natans* Lec., the type species, was found by Mr. G. R. Crotch abundantly at Los Angeles in the river. LeConte says: "Mr. Crotch informs me that this very singular insect resembles in appearance some of the species of *Limnebius*."

1874. D. Sharp, On a new family of European Coleoptera, (Ent. Mo. Mag. vol. XI, 1874, pp. 101–104). Reproduces LeConte's article in full; corrects LeConte's statements regarding number of tarsal joints (only 3-jointed) and number of antennal joints (only 8 joints). He becomes aware that several species of this genus occur also in Europe and describes *H. crotchii* from Madrid, Spain, which had hitherto been considered a species of *Limnebius*.

1876. Rev. A. Matthews, (Essay on the genus Hydroscapha Lec. London, 20 pp., 1 plate). This paper I have not seen but it is referred to by LeConte and Horn (1883).

1877. In the second edition of the Catalogus Coleopterorum Europæ the authors in ignorance of American literature credit the genus *Hydroscapha* to Dr. Sharp and place it as a kind of subfamily in the Scaphidiidæ.

1883. In the third edition of the same Catalogus, the genus *Hydroscapha* is again credited to Dr. Sharp but placed between the Sphæridiidæ and Trichopterygidæ as a kind of subfamily.

1883. Cl. Rey, Sur le genre Hydroscapha. (Rev. d'Entom. II, p. 84) Gives parallel descriptions of the genera *Limnebius* and *Hydroscapha*, and comes to the conclusion that *Hydroscapha* is closely allied to Limnebius of the family Hydrophilidæ.

1883. David Sharp, Un mot sur le genre Hydroscapha. (Revue d'Entomol. II, p. 117) Replies sharply to Mr. Rey and accuses him of total ignorance of the literature on *Hydroscapha*. The latter should be considered either as a new family or as an aquatic tribe of the Trichopterygidæ.

1883. LeConte and Horn, (Classification of the Coleoptera of North America, p. 180) place the family Hydroscaphidæ between the Trichopterygidæ and Sphæriidæ, and refer as follows to Matthews' (1876) paper. "The Rev. A. Matthews has since published a memoir on the genus in which he shows that the affinities are strongly towards Trichopterygidæ with tendencies as indicated by Dr. LeConte toward Hydrophilidæ."

1884. Rev. A. Matthews, Synopsis of the North American Trichopterygidæ (Tr. Am. Ent. Soc. XI, pp. 115–116) gives a description of the genus *Hydroscapha* and the species *H. natans* Lec. among the family Trichopterygidæ.

1889. Flach, (Verh. Zool. Bot. Ges. Wien. vol. XXXIX, p. 523). I failed to see this reference.

1899. L. Ganglbauer, (Die Käfer von Mitteleuropa, III, part 1, pp. 332–335) Recognizes LeConte's genus *Hydroscapha* as a separate family

which he places between the Trichopterygidæ and the Scaphidiidæ. Rejects Rey's conclusion that *Hydroscapha* is closely allied to *Limnebius*. Has not seen Matthews' (1876) article.

1901. H. C. Fall, The Coleoptera of Southern California (Occas. papers of the Calif. Ac. Sc. VIII, 1901, p. 80) says: "*H. natans* is probably not a rare insect, though very seldom taken; when one is discovered a considerable number may usually be obtained by patient search. I have taken it close to the bank in a mountain stream, and also in a muddy spot in a cow pasture near Pomona."

1906. In the latest edition of the Europ. Coleopt. Catalogue by L. V. Heyden, E. Reitter and J. Weise the genus *Hydroscapha* is finally accredited to LeConte and placed as a full-fledged family between the Trichopterygidæ and Scaphidiidæ.

[References to the European species of Hydroscapha are omitted from this list.]

In the year 1901 Mr. Barber found it commonly in the fountain at the mouth of the gorge, while in December 1913 the beetle did not occur at the same place, the water at that time being much colder, but on both occasions it occurred at the head of the spring and in the middle course of the creek. It is not a swimming beetle but always occurs among the algæ growing on the rocks at the very edge of the water. They were much more abundant where the flow from the spring itself was so shallow on the algæ that the beetles could crawl freely with their backs at the surface, and under these circumstances the water did not wet the middle part of the elytra, but the larvæ among the adults were completely submerged. The beetle itself is quite conspicuous in spite of its small size; its movements while by no means rapid are quite perceptible, in fact its whole behavior and appearance with its extended abdomen reminds one forcibly, except for the aquatic habit, of the Staphylinid genus *Erchomus*. The specimens are difficult to secure and in some instances they disappear suddenly, apparently taking flight. The larvæ as found by Mr. Barber are of the same color as the rocks and difficult to observe although fully exposed and not covered by the algæ.

A box filled with algæ containing larvæ and imagoes of *Hydroscapha* was at once mailed to Washington, where in the course of time Dr. Böving not only was able to make a thorough study of the larvæ but also discovered eggs and the pupa. He also pointed out the conspicuous air reservoir showing through the elytra of the living adults and extending behind the elytral apices on account of rather long projecting ciliæ. Thus the biology of another family of Coleoptera of uncertain position has been ascertained.

# NOTES ON THE LARVA OF HYDROSCAPHA AND SOME OTHER AQUATIC LARVÆ FROM ARIZONA.[1]

(With Plates XVII and XVIII.)

By Adam Böving, Ph.D., *Bureau of Entomology.*

In the material brought home by Mr. E. A. Schwarz and Mr. H. S. Barber from Arizona are four hitherto unknown aquatic Coleopterous larvæ, collected in December, 1913, in the hot water at the Castle Hot Springs. Mr. Schwarz and Mr. Barber have been so kind as to ask me to determine these larvæ.

Two of the forms are undoubtedly Hydrophilid larvæ, namely: those of *Helochares normatus* Lec. and *Creniphilus subcupreus* Say.

A European larva of the genus *Helochares* (*H. lividus* Forst.) has recently been described with a good figure in the excellent work of A. d'Orchymont[2] and I am well acquainted with this larva which has been reared by Mr. Wm. Schlick (May 21, 1889, and Mr. E. Rosenberg May 12, 1895) in Denmark.[3] The American species conforms exactly with the European generic type and the specific determination cannot be in doubt because *Helochares normatus* Lec. is the only species of the genus found in the locality.

The second Hydrophilid larva, *Creniphilus subcupreus*, was also collected in connection with the adult; it belongs to the *Hydrobius* group, which is well known from Schiödte's description and figure of *Hydrobius fuscipes*.[4]

The third larva (fig. 1) cannot be definitely determined. Without doubt, however, it belongs to the Helodidæ of the *Cyphonid* or *Microcara* type, with which family it agrees in the remarkable shape of the hairy mouth-parts, the hypopharynx and epipharynx and in the presence of anal gills. Unfortunately the antennæ have been broken in both of the specimens of which the material consists.[5] The Helodidæ are represented as adults in the material by specimens of a new species of *Scirtes*, (cf. the preceding paper by Mr. E. A. Schwarz.)

[1] Presented at meeting of April 2, 1914.

[2] Contribution a l'étude des larves Hydrophilides, "Annales de Biologie lacustre, Tom. VI, 1913, p. 200."

[3] I take the opportunity to mention that the larva described by M. d'Orchymont as *Laccobius* (?) does not belong to this genus. The larva of *Laccobius* has been bred in Denmark from eggs, by Mr. Wm. Schlick and has later been followed through all stages by Dr. Wesenberg Lund.

[4] This figure, by the way, is not quite correct because it shows the anterior edge of what Schiödte calls the clypeus, straight, and not asymmetric, as it is in this entire group.

[5] Compare the very interesting statement about the dimorphism of the antennæ by P. de Peyerimhof: "Le double type larvaire de *Prionocyphon serricornis* Müll." Bulletin de la Soc. Ent. de France, 1913, No. 6, p. 148.

The fourth larva is that of *Hydroscapha natans* Lec. and is by far the most interesting of them (figs. 2–13). The species is represented in all stages, from egg to imago. The eggs are in proportion remarkably large, oval, smooth, dark brown, without sculpture. I observed them first in numbers, attached to the algæ with which they were received, and found them afterwards within the female. Only one egg is developed at a time, and this occupies nearly one-fourth of the abdomen, (fig. I). A single pupa only was found and this is in too poor condition to describe properly. I give a mere outline of the form in figure II.

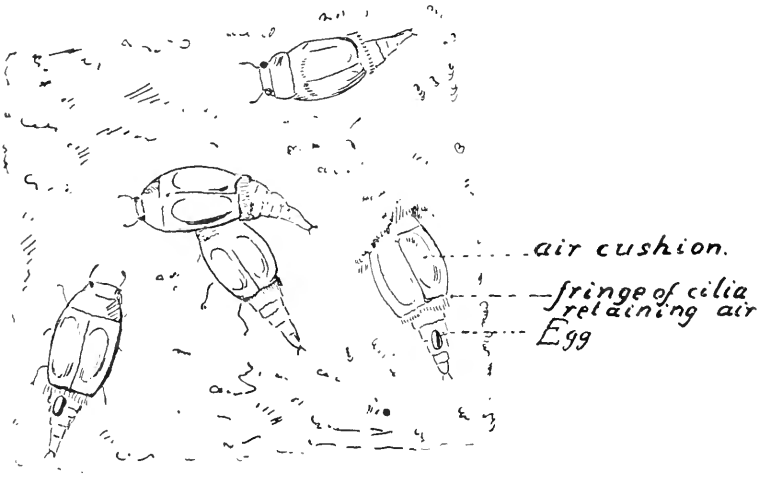


Fig. I. *Hydroscapha* in natural positions.

Three larval stages are in the material and evidently no more occur. The first stage is, as is often the case in Coleopterous larvæ, somewhat different from the two following, and especially is the pair of peculiar appendices on the eighth abdominal segment (*fi*, fig. 7) relatively longer than in the two later stages. The full grown larva (figs. 2, 4) is 1.5 mm. long, dark grey, with the anterior and posterior portion of each segment whitish and soft skinned; the number, arrangement, form and length of the setæ and the sensorial punctures on the different parts of the body are shown on the figures (figs. 2, 4). The head is bent

downward. There are five ocelli in a whitish area as shown on the figure (fig. 4). The labrum (*lr*, fig. 5) is large and broad like an eyeshade; it covers and protects the mouth-parts, but works at the same time as a scraper; it is firmly connected with the front, no clypeus intervening but a suture (*c.s.*) is easily observed. The front (*f*) is nearly triangular, the interior angles (*i*) being very obtuse; the exterior angles (*e*) are acute and the posterior angle (*p*) is approximately 60°; the frontal sutures (*f.s.*) are slightly inwardly curved. The dorsal portion of the epicranium is flat and large, the epicranial suture (*es*) short, and on the ventral side the epicranial margin is strengthened by a hypostomal chitinization (*h*, fig. 6). The anterior portion of this margin forms a deep and broad curve, within which are placed the second and third pair of trophi. The posterior portion is one-fourth as long as the anterior and borders on a broad gula (*gu*, fig. 6). The antennal ring (*a*, fig. 5) is large and somewhat triangular, and the connect-

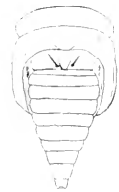

Fig. II. Pupa of *Hydroscapha*.

ing membrane is also large. The antenna itself consists only of a small basal piece (*b*, fig. 5) which carries two long, slender processes, one of which is possibly the second antennal joint, the other a sensitive papilla. On the end of the supposedly second joint a very diminutive third joint seems to be present.

The mouth-parts are well adapted to chew off and force into the pharynx the jelly-like algæ on which the larva subsists. The mandibles (fig. 9) have a very large, broad and depressed molar part (*mo*) and a slender, upright, terminal part (*t*); the tip of which is produced into a little hand-like rake; a pectinate lacinia mobilis (*lm*) is inserted between the molar and the terminal parts. The form of the maxillæ (fig. 6) is very characteristic: they have a large cardo (*ca*) and a well developed stipes (*st*), and a flat chitinized lacinia (*la*) with a series of large, flattened setæ and a spine-like galea (*g*) close to the lacinia. The maxillary palpus is three-jointed, the basal joint with a little process on the outside. The labium (fig. 6) has short, two-jointed labial palpi and a fleshy ligula (*li*). Both mentum (*m*) and submentum (*sm*) are well developed, almost quadratic. The large connecting lobe (*mc*) be-

tween the submentum and the maxilla is indistinctly separated from the submentum.

The thoracic segments (fig. 2) are nearly twice as broad as the middle abdominal segments. The chitinized upper side is rounded and protects the soft ventral part as a shield. The stout curved legs (figs. 4, 8) can be drawn in under the edges of this shield. The coxa (*cx*) is large and mobile, and the femur (*fe*) and tibia (*ti*) are approximately of equal size, and only half as thick and long as the coxa. The tarsus (*ta*) is large and unguliform, without claws.

The abdomen (figs. 2, 4) is ten-jointed; the chitinized portion of each abdominal segment forming a continuous closed ring without any soft lateral zone. The soft-skinned portion between the rings is broad and the segments can be telescoped to a considerable extent. On the eighth abdominal segment is a pair of cercilike filaments (*fi*, figs. 4, 7) but true cerci, which always belong to the ninth abdominal segment, are entirely absent. The filaments are two-jointed, and consist of a cylindrical, well chitinized base with a few long setæ, and an apical thin-skinned, cylindrical piece which is entirely filled by an enlargement of the trachea. These filaments are undoubtedly organs of respiration. A pair of similar, but smaller formations are found on the posterior edge of the prothorax (figs. 2, 3, 4), and another pair on the posterior edge of the first abdominal segment. I believe that they correspond morphologically to the filaments on the larva of *Berosus*[1] which are not direct formations from the spiracle, but developments from the integument near the spiracle, provided with very strong tracheæ. In *Berosus* the spiracles are small but easily seen, while in *Hydroscapha* they are so reduced that even the spiracle opening cannot be seen, and only some of the very fine tracheæ of the spiracles which reach out to the surface are visible. The filaments of *Hydroscapha* resemble greatly the peculiar flattened hairs at the edges of the segments (fig. 3), but whether or not they really are to be regarded as modified hairs may be disputable. The tenth abdominal segment is directed downwards and carries two pencil-shaped appendices (*pap* fig. 7). Ventrally it is developed as a sucker (*su*).

The systematic position of *Hydroscapha* has been much discussed but the larva has hitherto not been known, and, its discovery by Messrs. Schwarz and Barber is therefore very important.

The entire larval structure shows that *Hydroscapha* must be referred to the Hydrophilidæ as a new subfamily, the Hydroscaphinæ, closely allied to the small, remarkable subfamily, Limnebiinæ, which has recently been defined by A. d'Orchymont.[2]

[1] Described by Schiödte in "de metamorphosi eleutheratorum observationes," Naturh. Tidskr. 3 Ser., vol. I, 1862, p. 213, pl. v, VII.

[2] Contribution a l'étude des larves Hydrophilides, "Annales de biologie acustre, Tom. VI, 1913, p. 181."

The Hydroscaphinæ agree with the Limnebiinæ (represented by *Ochthebius pygmæus* F., (figs. 10–17) in many important characters. They have the same general shape of the body, downward bent head, broad gula (*gu*, figs. 6, 17), the same number of ocelli, exactly the same unusual shape of all the mouth-parts (figs. 5, 6, 10, 11, 12, 16, 17), the same deeply curved hypostoma (*h* figs. 6, 17), homologous processes on the last abdominal segment (figs. 7, 14), and similarly formed legs (figs. 8, 13). But the two larva-types differ in the antennæ which are very short in the Hydroscaphinæ (fig. 5), and rather long in the Limnebiinæ (fig. 16). The Hydroscaphinæ lack the clypeus (fig. 5) which is distinctly developed in the Limnebiinæ (fig. 16). The Hydroscaphinæ have no spiracles while the Limnebiinæ have well developed circular spiracles (fig. 15) laterally placed on the mesothorax and on the first eight abdominal segments. The Hydroscaphinæ have the above described filaments on the prothorax, and the first and the eighth abdominal segments, but no cerci on the ninth. The Limnebiinæ, on the other hand, have not these filaments, but have cerci on the ninth abdominal segment (*cer*, fig. 14). It should be noted, however, that the characters of the last abdominal segments in these two forms seem so similar that it is difficult not to consider them homologous. The true explanation may be that the first abdominal segment in *Hydroscapha* has become obliterated under the strongly developed thorax and that thus what I have cautiously determined in this larva as the first abdominal segment is really the second and that the filaments described as belonging to the eighth abdominal segment belong to the ninth, and that what has been described as the ninth and tenth abdominal segments is merely the divided tenth segment. The absence of the spiracles in *Hydroscapha* makes the interpretation very difficult but the arrangement of the spines and sensory punctures makes it evident, that if any segment is absent it must be the first; it is however possible that it is the eighth and ninth segments which have become amalgamated.

It is worth noting that the larvæ of the Limnebiinæ and the Hydroscaphinæ are very similar to the larvæ of the small Staphylinidæ of the *Tachinus-Tachyporus* group. In fact these three forms seem to be more closely related to each other than the small Staphylinids are to the normal Staphylinid type and than the Limnebiinæ and the Hydroscaphinæ are to the typical Hydrophilidæ.

All figures are camera lucida drawings by the author.

EXPLANATION OF PLATES XVII AND XVIII.

*a*, antennal ring; *b*, basal joint of the antenna; *c*, clypeus; *ca*, cardo; *cer*, cereus; *co*, condyle of the mandible; *cs*, clypeal suture; *cx*, coxa; *e*, exterior angle of front; *ecr*, epicranium; *ep*, epistoma; *es*, epicranial suture; *f*, front; *fc*, femur; *fi*, filament; *fo*, fossa of the mandible; *fs*, frontal suture; *g*, galea; *gu*, gula; *h*, hypostoma; *ha*, hook-shaped appendix of last abdominal segment of *Ochthebius* larva; *i*, interior angle of front; *l*, stipes labii; *la*, lacinia; *li*, ligula; *lm*, lacinia mobilis mandibuli; *lr*, labrum; *m*, mentum; *mc*, connecting lobe between maxilla and submentum; *md*, mandible; *mo*, molar part of the mandible; *oc*, ocellus; *p*, posterior angle of front; *pap*, pencil-shaped appendix of last abdominal segment of the *Hydroscapha* larva; *sm*, submentum; *st*, stipes maxillæ; *su*, sucking portion of last abdominal segment of the *Hydroscapha* larva; *t*, terminal part of the mandible; *ta*, tarsus; *ti*, tibia.

Fig. 1, *Helodid*. [Possibly *Seirtes* n. sp.] Lateral view of the larva; antennæ broken in the specimen. (The natural size of the larva is 5 mm.)

Fig. 2, *Hydroscapha natans* Lec. Dorsal view of the larva. (The natural size of the larva is 1.5 mm.)

Fig. 3, *Hydroscapha natans* Lec. Larva. Prothoracic filament; leaf-shaped hairs; and a long seta.

Fig. 4, *Hydroscapha natans* Lec. Lateral view of the larva.

Fig. 5, *Hydroscapha natans* Lec. Larva. Dorsal view of the head.

Fig. 6, *Hydroscapha natans* Lec. Larva. Ventral view of the head.

Fig. 7, *Hydroscapha natans* Lec. Larva. Ventral view of the end of abdomen.

Fig. 8, *Hydroscapha natans* Lec. Larva. Left mesothoracic leg.

Fig. 9, *Hydroscapha natans* Lec. Larva. Left mandible seen partly from the buccal cavity, partly from below.

Fig. 10, *Ochthebius pygmæus* F. Larva. Right mandible; dorsal view.

Fig. 11, *Ochthebius pygmæus* F. Larva. Left mandible; ventral view.

Fig. 12, *Ochthebius pygmæus* F. Larva. Left mandible from the buccal cavity.

Fig. 13, *Ochthebius pygmæus* F. Larva. Left mesothoracic leg.

Fig. 14, *Ochthebius pygmæus* F. Larva. End of the abdomen from the side and a little from above to show both abdominal hooks.

Fig. 15, *Ochthebius pygmæus* F. Larva. Lateral view. (The natural size of the larva is 3.5 mm.)

Fig. 16, *Ochthebius pygmæus* F. Larva. Dorsal view of the head.

Fig. 17, *Ochthebius pygmæus* F. Larva. Ventral view of the head.

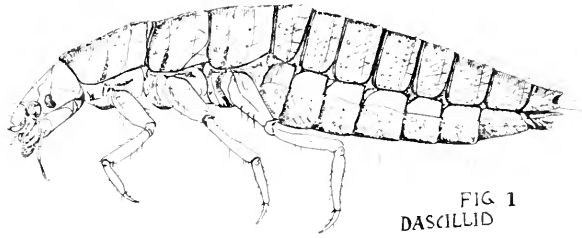

FIG 1
DASCILLID

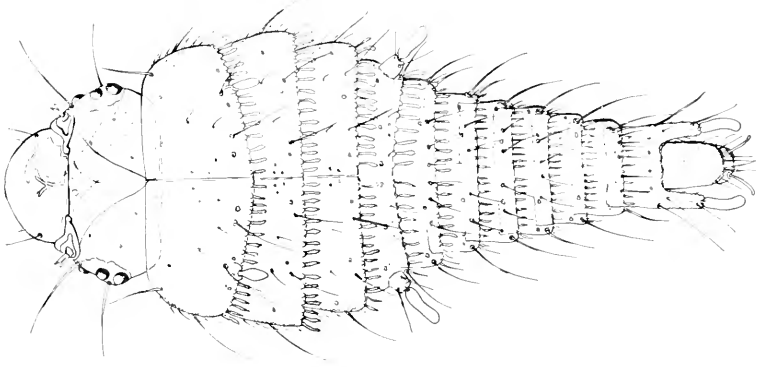

FIG 2
HYDROSCAPHA

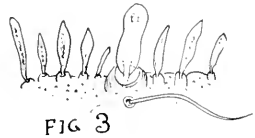

FIG 3

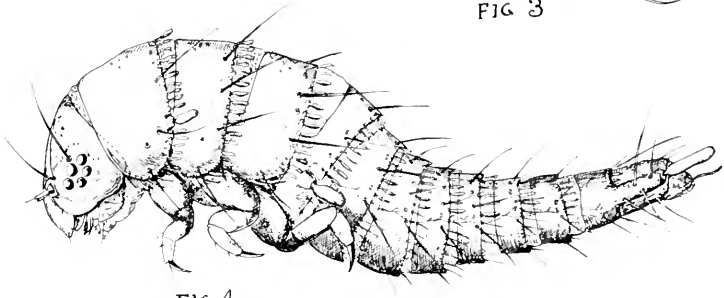

FIG 4
HYDROSCAPHA

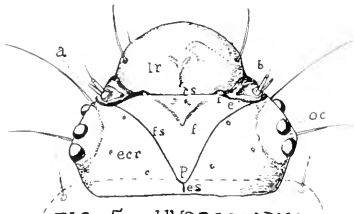


FIG. 5 HYDROSCAPHA

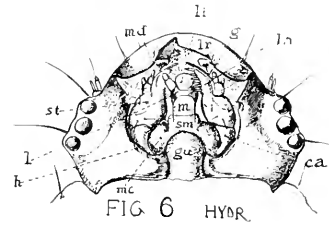


FIG 6 HYDR.

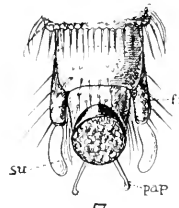


FIG. 7 HYDR

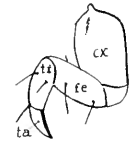


FIG. 8 HYDR.


FIG. 9 HYDR.


FIG. 10 OCHT.


FIG. 11


FIG. 12


FIG. 13 OCHT.

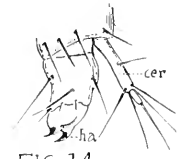


FIG. 14 OCHT.

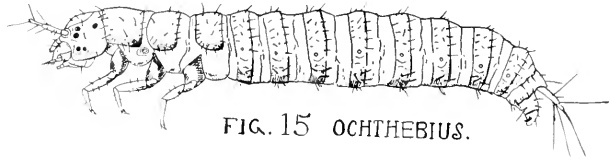

FIG. 15 OCHTHEBIUS.

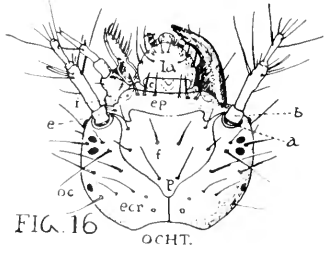


FIG. 16 OCHT.

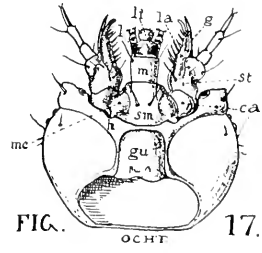


FIG. 17. OCHT.

## NOTE ON RHIPIDANDRI—A CORRECTION.[1]

By E. A. Schwarz and H. S. Barber, *Bureau of Entomology.*

An injustice seems to have been done to Motschulsky's memory by the junior writer in his former notes on this group (Proc. Ent. Soc. Wash., 1913, vol. xv, p. 189), and by other writers also, owing, probably, to the similarity of the names *Xyloborus* and *Xyleborus*. Thus Gemminger and Harold 1872 (Cat., p. 2685), Hagedorn 1910 (Coleopt. Catal. Junk, Ipidæ, p. 101), Barber 1913 (Proc. Ent. Soc. Wash., xv, p. 189–190) and Kleine 1914 (Berl. Ent. Zeitsch., vol. 58, 1913, p. 160) have all been wrong in considering that he had described his species as a Scolytid, and in failing to recognize his generic name. The only writer who seems to have noticed the distinction seems to be Arrow 1904 (Ann. Mag. Nat. Hist. (7), vol. 14, p. 30–33) who for some reason did not make use of Motschulsky's generic name. It is also worthy of record in this connection that cotypes of some foreign species have been added to our National Collection. We append some omitted or subsequent bibliographical references for addition to the list of notices previously given.

The name *Xyloborus* appears among Heteromerous genera in the Dejean Catalogue (1833, p. 201, and 1837, p. 222) with an undescribed species from Buenos Ayres and is therefore a *nomen nudum*, but Motschulsky in 1858 described a related species, *crenipennis*, from Burma using the generic name of Dejean and referring to the South American species, thus validating the generic name, for which his species automatically becomes the type. That he was dealing with a Heteromerous instead of with a Scolytid genus is evident from the remarks following his specific diagnosis and which also mention some generic characters. Moreover the name *Xyleborus* was not used for the genus in the latter family until six years later. *Xyloborus* is thus an older name than any of the other generic names of the group, if *Eledona* be excluded, but it is necessary to examine the status of the genus in which the still older species (*flabellicornis*) had been placed. Sturm, 1826, evidently intended to write *Xyletinus* instead of *Xylotinus* on page 59 of his Catalogue, for on page 206, and on plate 1, figure 7, the name is correctly spelled. This typographical error should not be perpetuated to supersede *Rhipidandrus* LeConte 1857. The type of *Xyletinus* Latr. 1890, cannot be *pectinatus* as stated by Westwood, for it is not one of the three originally included species. Two of the three are now listed in *Lasioderma* leaving only *bucephalus* Illiger as the logical type.

[1] Presented at meeting of June 4, 1914.

Cotypes and other specimens of some of the foreign species have been received recently by the National Museum from the British Museum, through the kindness of Mr. Arrow, and from Mr. H. Gebien and M. René Oberthür, as follows:

*Rhipidandrus mexicanus* Sharp cotype. Yzabel, Guatemala (Sallé).
*Rhipidandrus sulcatus* (Gorham) cotypes. St. Vincent, W. I. (H. H. Smith).
*Eutomus cornutus* (Arrow) cotypes. St. Vincent, W. I. (H. H. Smith).
*Eutomus cornutus* (Arrow). Guadeloupe, (one of Sallé's specimens which were called by him *micrographus*).
*Eutomus walkeri* (Waterhouse). Matabello Isl. (A. R. Wallace).
*Eutomus* sp. (possibly ? *peruvianus* Cast.). Paraguay.
*Xyloborus crenipennis* Mots. Andamans (Roepstorff).
*Xyloborus nudus* (Gebien) cotypes. Banguey, B. Borneo.
*Bolitolacmus fomiticola* Geb. cotype. East Usambara, Deremas. (Eichelbaum).

Gen. nov.? Brunnei Borneo. Two damaged specimens of an inconspicuous form looking like a robust Cioid but having one of the mandibles bifid so as to receive the point of the other, and having 11-jointed antennæ with 5-jointed club preceded by 4 small joints, were sent by M. René Oberthür, but the material is insufficient for dissection and careful study. Superficially they appear to form an interesting connecting link between the Cioidæ and Rhipidandrini, which well deserves closer examination.

A number of references to members of this group have been omitted from the former chronological bibliography. The following may be added to the list:

1833. Dejean (Cat. Coleop., p. 201) lists *Xyloborus costatus* Dej. from Buenos Ayres, not far from *Eledona* in the series he calls "Taxicornes" most of which are now included in the Tenebrionidæ. This species has never been described and the genus was invalid until used by Motschulsky in 1858. Among the Xylophages (Ipidæ) (l.c., p. 306) Dejean has placed *Eutomus micrographus* Lacordaire, which remained a *nomen nudum* until validated by Lacordaire in 1866.

1837. Dejean (Cat. Coleop., p. 222 and 306) same as in 1833.

1886. Champion (Biol. Cent. Amer. Coleop., vol. IV, pt. 1, p. 223) excludes "*Eutomus* Lac. (*Rhipidandrus* Lec.)" from the Bolitophagides on account of the 4-jointed tarsi, and antennal structure.

1895. Blandford (Biol. Centr-Amer. Coleop., vol. IV, pt. 6, p. 118) refers to the exclusion of the Eutomides from the Scolytidæ and assignment to the vicinity of *Cis*.

1911. Tredl and Kleine (Uebersicht über die Gesamtliterature der Borkenkäfer, Beilage zu den Ent. Blättern, 7 Jrg., p. 45) wrongly include *Xyleborus crenipennis*, under the Scolytids described by Motschulsky.

1912. Pic (Coleop. Cat. Junk. Anobiidæ, p. 48) still includes *flabellicornis* Sturm as a valid species in *Xyletinus*.

1914. Kleine (Berl. Ent. Zeits., 58, 1913, p. 160) lists *crenipennis* Mots., from the East Indies as a valid species in the Ipid genus *Xyleborus*.

1914. Dury (Journ. Cincinnati Soc. Nat. Hist., p. 168) describes *Rhipidandrus fulvomaculatus* n. sp., from Alabama and Florida, which is apparently a small species of *Eutomus*.

1914. Dury (Journ. N. Y. Ent. Soc., xxii, p. 173) defines the Cioidæ so as to exclude "the Rhipidandrinæ which form a tribe in the family Tenebrionidæ."

1914. Leng and Mutchler (Bull. Am. Mus. Nat. Hist., xxxiii, pp. 461–462) cite the two West Indian species under three generic and four specific names under which they have been recorded by Sallé, Arrow and Gorham.

(1914? Gebien in a letter mentions descriptions of new forms in this group that were to appear shortly in the Bulletin of the Sarawak Museum, but the writers have not yet seen this journal.)

The position of the Rhipidandri still appears very vague. Sharp was probably mistaken about the front tarsal joints, for the writers can find but four joints, as in the Cioidæ, in all tarsi of *Rh. flabellicornis*, *Eu. cornutus*, *peninsularis* and *fuscomaculatus*, while the tarsi of *Eledona* are typically heretomerous. The value of this character may have been overestimated The antennæ do not differ essentially, and it is interesting to note that Sharp & Muir (Tr. Ent. Soc. Lond. 1912, p. 3, p. 618 and 619) have tentatively grouped a number of "Heteromerous" families with the *Cioidæ* in the superfamily *Cucujoidea*, but say the ædeagus in *Cis* is not similar to anything else. The Rhipidandri appear to be intermediate between *Eledona* and the Cioidæ in many of their characters and are probably worthy of family rank, but the undescribed genus from Borneo, above referred to, seems to link them more closely with the latter than does *Bolitolæmus* to *Eledona*. It is to be regretted that no larvæ of any member of this group are at hand. The only description of the immature form is by Friedenreich and has been abstracted by Arrow.

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At the meeting of November 1, 1914 a special committee consisting of A. Busck, E. A. Schwarz and N. Banks presented the following which was ordered printed.

## THEODORE N. GILL.

There is no need in this brief notice to attempt any eulogy of Dr. Gill. As one of the greatest naturalists of the age his accomplish-

ments and connection with various scientific societies are known to all throughout the world. We wish more especially to record his relations with our Society which date back more than twenty-five years, when upon invitation of a member he attended one of the meetings. He was so interested in the discussion, that in 1891 he became an active member, and thereafter the Society was highly honored by his regular attendance. He read but few formal papers before the Society, but very frequently took part in the discussions, and with his inexhaustible knowledge of taxonomy and comparative anatomy was able to present the broader view of many questions. His extemporaneous remarks were often so thorough and extensive as to constitute a general zoological review of the entire matter. Among the more important matters touched upon by Dr. Gill may be mentioned the following:

The Larva of Insects, An Intercalated Stage. Ent. Soc. Wash. Pro., vol. II, p. 304, 1892.

On a Remarkable New Family of Crabs from the Coast of Coromandel at a Depth of 150–200 Fathoms, Proposing new generic name *Retropluma* and the new family *Retroplumidæ*. Ent. Soc. Pro., vol. III, p. 182, 1894.

Relative Value of Different Groups of Animals from the Faunistic Standpoint. Ent. Soc. Pro., vol. IV, p. 194, 1897.

On the Evolution of Genus Making. Ent. Soc. Pro., vol. IV, p. 345, 1898.

Note on Micropterous Island Insects. Ent. Soc. Pro., vol. IV, p. 488, 1898.

On the Fauna of Hawaii. Ent. Soc. Pro., vol. IV, p. 491, 1898.

On the Character of the Philippine Island Fauna. Ent. Soc., Pro. vol. VI, p. 174.

On Taxonomic Groups. Ent. Soc. Pro., vol. XIII, p. 181.

On Secondary Sexual Characters. Ent. Soc. Pro. vol. XIV, p. 204.

Dr. Gill's uniform kindness in aiding his fellow members not only in zoological but in linguistic and bibliographic matters will never be forgotten by the many of us who personally benefited thereby. No one will ever know how many generic and other names credited to various entomologists really originated with Dr. Gill.

Dr. Gill's genial presence added greatly to the scientific and social success of our meetings and the loss of our most notable member will be deeply felt by all of us.

## NOTES ON THE DIPTEROUS GENUS CHYROMYA R-D.

By J. R. Malloch, *Urbana, Ill.*

This genus has undergone several nomenclatorial changes since 1830 as indicated by the synonymy given below.

*Chyromya* R-D., Essai Myode., p. 621 (1830).
*Pelithophila* of authors, not Hagenbach, Symbol. Faun. insect. Helv., p. 48, (1822).
*Lisella* R-D., Essai Myod., p. 649 (1830).
*Sapromyza* part Fallen, Zetterstedt and Meigen.
*Scyphella* R-D., Essai Myod., p. 650 (1830).
*Thyrimyza* Zetterstedt, Dipt. Scand., vol. 6, p. 2336 (1847).

In addition to these we have the misspelled names *Chrymomyia* and *Peletophila* by Becker[1] and the emendation to *Chiromyia* by Melander[2] following Scudder.[3]

The name *Pelethophila* cannot be used as the only species originally included in the genus is a true *Psila* (*fimataria* Linne).

The position also of the genus has been subject to some changes. The older authors placed it in Sapromyzidæ while some recent authors have placed it in Opomyzidæ. The latest arrangement regulates it to Opomyzinæ a subfamily of Geomyzidæ.

The generic characters are as follows: Post-vertical bristles convergent; ocellar bristles divergent; ocellar triangle and orbits poorly defined; usually 3 pairs of orbital bristles, the anterior pair convergent; antennæ small, the third joint not elongated, apically rounded, arista almost bare; face slightly receding; cheeks about half as high as eye, vibrissæ weak; proboscis fleshy; palpi normal. Thorax with 2–4 pairs of dorso-central bristles and distinct and rather numerous discal setulæ; mesopleura with usually 2 bristles; sterno-pleura with 1 bristle. Legs without preapical bristle. Wings with costa twice broken; auxilary vein indistinct, incomplete, or joining costa; costa unspined; discal cell elongate; outer cross vein beyond middle of wing; anal cell complete; anal vein reaching almost or quite to margin.

### Synopsis of North American Species of Chyromya.

1. Fore and hind femora of male much swollen; large species, 3–3.5 mm. *femorella*
   Fore and hind femora of male not swollen ..... 2
2. Thorax with 4 pairs of dorso-central bristles ..... 3
   Thorax with 2–3 pairs of dorso-central bristles ..... 4

[1] Zeitschr. für Syst. Hymen. u. Dipt., vol. 4, 1904, p. 129.
[2] Jour. N. Y. Ent. Soc., vol. 21, p. 300 (1913).
[3] Nomen. Zool.

3. Larger species, 2–3 mm.; scutellum with setulæ in addition to the 4 marginal bristles ..... *flava*
   Smaller species, 1.5–1.75 mm.; scutellum with only the 4 marginal bristles ..... *minima*
4. Last joint of mid tarsi of male black; of the female slightly brownish ..... *nigrimana*
   Last joint of mid tarsi yellow ..... *concolor*

**Chyromya femorella** Fallen.

*Sapromyza femorella* Fallen, Dipt. Suec., Ortalid..34, 15 (1820).

This species like all the others in the foregoing table except *nigrimaria* is yellow in color with a black ocellar spot. The mesonotum has four pairs of strong dorso-central bristles and about six irregular rows of setulæ between them. The femora of the female are less distinctly thickened than those of the male but still appreciably thicker than those of *flava*.

I have seen both sexes of this species from Algonquin, Ill., W. A. Nason. Male swept from low herbage along creek; most of the females taken on windows, but a few on flowers. May to June.

**Chyromya flava**. Linne.

*Musca flava*, Linne, Fauna Suec. 1869 (1761).

*Scyphella flavicornis* R-D., Essai Myod., p. 650, sp. 1 (1830).

I have not as present before me specimens of this species, but believe that Professor Melander has correctly recorded it as occurring in America.

I have taken the species commonly in Scotland on windows where it occurred along with *lutea*. The latter is distinguished from *flava* by the black third antennal joint and very probably occurs in America also.

**Chyromya minima** Becker.

*Peletophila minima* Becker, Zeitschr. fur. Syst. Hymen. u. Dept., vol. 4, p. 133 (1904).

Becker describes this species as follows: "Matt, blassgelb. Thorax mit 4 deutlichen Dorso-centralborsten und dazwischen unregelmassig in ca. 4 Reichen gestellte Akrosti-kalborsten. Schildchen ausser den 4 Randborsten nackt. Borsten und Haare auf dem Thorax und Kopf gelb. Augen querliegend. Punctaugenhocker nicht geschwarzt. Hinterrücken und Hinterlieb gelb; bei den Manichen ist derselbe, namentlich gegen das Endchin deutlich, bei den Weibchen weniger deutlich, fein schwarz behaart. Schenkel nicht verdickt. Flugel wie bei den übrigen Arten. $1\frac{1}{2}$–$1\frac{3}{4}$ mm. lang."

Professor Melander records this species from Washington and California.[1]

[1] Jour. N. Y. Ent. Soc., vol. 21, p. 300 (1913).

I have not seen the species. The meso-pleura is stated by Melander to be "not setulose," a character not mentioned by Becker.

**Chyromya nigrimana** n. sp.

*Male:* Yellow, and slightly shining. Head whitish yellow, cheeks almost white; arista brown, base yellow; ocellar region black, Pleuræ whitish. Legs yellow, last tarsal joint of middle legs black. Wings clear, veins yellow. Halteres yellow. Bristles and hairs yellow.

Frons one-third the width of head at vertex, distinctly narrowed anteriorly; 3 pairs of orbitals present; of almost equal length; center stripe with a few microscopic surface hairs; arista almost bare; cheek at middle half as high as eye; eye as high as long; its long axis diagonal to the longitudinal line of body. Mesonotum with 2 pairs of strong and usually 1 pair of weak dorso-centrals; about 8 rows of setulæ between dorso-centrals; mesopleura with a few weak hairs in addition to the usual bristles; scutellum with 4 marginal bristles. Hypopygium large and knob-like. Legs without bristles, except on the postero-dorsal surface of fore femora. Wings with inner cross vein at two-fifths from apex of discal cell; penultimate section of fourth vein about one-fourth the length of ultimate section and subequal with ultimate section of fifth.

*Female:* Similar to male except that the last joint of mid tarsus is slightly brownish instead of black. Abdomen slightly pointed at apex.

Length: 1.5 mm.

Type locality: Urbana, Ill., May 20, 1914 (C. A. Hart and J. R. Malloch). Taken by sweeping vegetation along the bank of Salt Fork at the Fair Gounds.

Paratypes: St. Joseph, Ill., May 3–17, 1914 (J. R. Malloch). On bank of Salt Fork.

**Chyromya concolor** n. sp.

*Male* and *female:* Entirely yellow with the exception of the black ocellar spot.

Differs from the preceding species in having the eyes more elongate and nearly in line with the long axis of the body; the dorso-central bristles stronger, the third pair generally distinct, and the inner cross vein nearer to middle of discal cell (in type at middle).

Length: 1.5–1.75 mm.

This species is evidently very close in general appearance to *minima* but unless Becker erred in his description it cannot possibly be that species.

Type locality: Monticello, Ill., June 21–28, 1914 (C. A. Hart and J. R Malloch). Taken by sweeping vegetation on bank of Sangamon River.

Paratypes: Muncie, Ill., May 24, 1914 (C. A. Hart and J. R. Malloch); Algonquin, Ill., June 1–10, 1894 (W. A. Nason).

## HABITS OF SOME TACHINIDAE.

By R. C. Shannon, *Bureau of Entomology.*

It appears from recently collected Tachinids that nocturnal habits may be more common in this family than we have supposed. Mr. Walton has spoken at a previous meeting of the society of *Eutrixa exile* Coq. as probably being nocturnal, he having seen two specimens from Ithaca, N. Y., collected at light and knowing that they are parasitic upon nocturnal beetles (*Lachnosterna*). Another specimen of this species was taken at light at Plummer's Island, Maryland, in April, 1914. There are three specimens in the National Collection which were bred from adult *Lachnosterna arcuata* by Mr. Theodore Pergande in March, 1895. Other nocturnal Tachinids have recently been collected at light at Forest Glen, Maryland, by Mr. Otto Heidemann. One specimen is *Cryptomeigenia theutis* Walker, a well known parasite of adult *Lachnosterna*, and four specimens are of an apparently new species of *Neophyto*, which will be described later by Mr. Walton. This latter species is probably parasitic upon some nocturnal beetle, since its close relatives have such habits. It may be that this species hides during the day, which would perhaps account for it remaining unknown hitherto. The nocturnal habit of these flies is clearly an adaptation to the nocturnal habit of their hosts.

The genus *Trichopoda* has been known to be parasitic on Hemiptera and recently has been bred on various occasions. Last year several parasitized adults of the Coreid, *Metapodius terminalis* were collected near Washington by Mr. Frederick Knab and from one of these an adult *Trichopoda* was bred while another on dissection disclosed a larva in the base of the abdomen. A parasitized specimen of *M. instabilis* was found by the writer at Dead Run, Fairfax County, Virginia, May 2, of this year and from it a fine specimen of Trichopoda was bred. The larva left its host and pupated on May 15, while the imago issued on the 29th. Parasitized specimens can be recognized at a glance since the externally laid egg is white and is in strong contrast with the body color of the host. Often more than one egg is laid upon a single victim, Mr. Knab having in one case seen as many as five. They are usually laid upon either the head or thorax, above or below, but sometimes are even attached to the tegmina.

Another genus of Tachinids has been bred from a different genus of Hemiptera. A specimen of *Reduviolus roscipennis* Reuter, in which the abdomen was swollen much beyond normal size, was found on Plummer's Island, Maryland, May 10, 1914, and was placed in an isolation vial, where, about a week later, it was found dead with a dipterous puparium beside it. This latter was placed in a suitable cell where the adult issued ten days later. Mr. Walton determined it as *Leucostoma atra* Towns. No host record of this Tachinid has hitherto been published.

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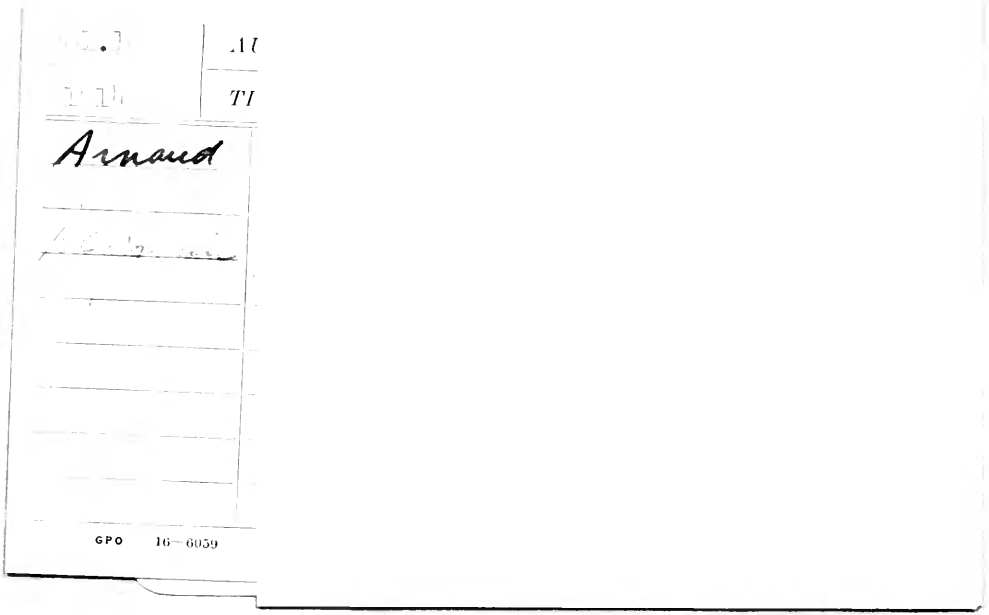
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