FOR THE INCREASE AND DIFFUSION OF KNOWLEDGE AMONG MEN
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SMITHSONIAN INSTITUTION
WASHINGTON 1846

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 66

A MONOGRAPHIC REVISION OF THE TWISTED WINGED INSECTS COMPRISING THE ORDER STREPSIPTERA KIRBY

BY

W. DWIGHT PIERCE
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WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM.

ISSUED DECEMBER 6, 1909.

ADVERTISEMENT.

The scientific publications of the National Museum consist of two series—the *Bulletin* and the *Proceedings*.

The *Bulletin*, publication of which was begun in 1875, is a series of more or less extensive works intended to illustrate the collections of the U. S. National Museum and, with the exception noted below, is issued separately. These bulletins are monographic in scope and are devoted principally to the discussion of large zoological and botanical groups, faunas and floras, bibliographies of eminent naturalists, reports of expeditions, etc. They are usually of octavo size, although a quarto form, known as the Special Bulletin, has been adopted in a few instances in which a larger page was deemed indispensable.

This work forms No. 66 of the Bulletin series.

Since 1902 the volumes of the series known as "Contributions from the National Herbarium," and containing papers relating to the botanical collections of the Museum, have been published as bulletins.

The *Proceedings*, the first volume of which was issued in 1878, are intended as a medium of publication of brief original papers based on the collections of the National Museum, and setting forth newly acquired facts in biology, anthropology, and geology derived therefrom, or containing descriptions of new forms and revisions of limited groups. A volume is issued annually, or oftener, for distribution to libraries and scientific establishments, and in view of the importance of the more prompt dissemination of new facts a limited edition of each paper is printed in pamphlet form in advance.

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution,
In Charge of the United States National Museum.

WASHINGTON, U. S. A., *October 30, 1909.*

PREFACE.

The preparation of a monograph of the Strepsiptera received its first impetus in 1903, when Mr. J. C. Crawford collected the type of *Crawfordia pulvinipes*. At that time I was engaged in a study of the habits of the Coleopterous family Rhipiphoridæ. The published statements of the similarity of the so-called "Stylopidæ" and Rhipiphoridæ led me to look into the literature immediately, and almost my first discovery was that the Strepsiptera or "Stylopidæ" were not Coleopterous.

A search through the Hymenopterous collections at the University of Nebraska gave good results, for several species were discovered. The check lists only gave two species to the United States. It was therefore with considerable zeal that I continued the work of investigating the group while at Agricultural College, Mississippi, in 1904, and later at the laboratories of the Southern Field Crop Insect Investigations of the Bureau of Entomology in Texas and at the U. S. National Museum and various libraries of Washington.

This bulletin has been gradually taking its present form since 1906, and was finally submitted for publication, through Dr. L. O. Howard, on March 1, 1909.

W. DWIGHT PIERCE.

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COMMON NAMES FOR STREPSIPTERA.

In order to accustom the readers to the many common names used in referring to this order the following list has been compiled. The strictly Latin names for the group may be found by reference to the synonymy preceding the characterization of the order. The greater part of these names mean "twisted-winged;" hence we may call them the twisted-winged parasites.

English and American writers use the nouns "strepsipter," "strepsipteran," "stylops," "stylopid," "rhipipter," "rhipipteran," and the adjectives "strepsipteral," "strepsipteran," "strepsipterous," "stylopid," "rhipidopterous," "rhipipteran," "rhipipterous," and speak of the host as being "stylopized." In Spanish the insects are known as "estrepsipteros," or "ripipteros." German writers use the terms "fächerflügler," "kolbenflügler," "rhipidopteron," "schmarotzende," "schraubenflügler," "strepsipteren," and "stylopiden," and speak of *Xenos* as "die Immenbreme." They speak of a host as "stylopisirt." The triungulinid is known as the "schmarotzerthierchen." French writers generally speak of the "strepsipteres," "rhipipteres," or "rhipidopteres," and call the host "stylopisé." In Scandinavian works are found the terms "strepsiptererne," and "viftevingedes." In Russian works the group is known as "вѣерокрылыхъ."

HISTORY.

The anomalous character of the Strepsiptera has led in the past to a great shifting of the groups from one place to another in the systems of classification. Rossi in the eighteenth century and Kirby in the first years of the nineteenth century each described a queer and entirely anomalous insect, seemingly without connecting links with any known forms. It was not until Kirby saw Professor Peck's new species (*Xenos peckii*) and heard of Rossi's description that it occurred to him that they belonged together and constituted the nucleus of a new order.

Kirby's decision was not to be received by even the majority for many years and is still rejected by many good authorities. Indeed, two authors writing in the same period seldom placed the group in the same place. It was given two distinct ordinal names—Strepsiptera and Rhipiptera (also spelled Rhiphiptera); it was placed in the Diptera as Rhipidoptera, and Phthiromyiæ, in the Neuroptera as Stylopidæ near the Phryganeidæ, in Hymenoptera near Ichneumon, but most generally in the Coleoptera as Stylopidæ at the end of the Heteromera. Westwood placed them between Hymenoptera and Lepidoptera; Hoeven placed them between Suctoria and Diptera; Menzel referred them to the Diptera (Müller, 1872).

A casual analysis of the placing of the order will reveal the fact that the careful systematists of the Continent soon recognized the ordinal nature of the Strepsiptera and have consistently maintained their views, while, on the other hand, the biologists and systematists of England and America have until recently classified the group as Stylopidæ, coleopterous. It may be said now, however, that the majority of American entomologists consider these insects as meriting full ordinal distinction. Six recent articles on the phylogeny and classification of Insecta, by Handlirsch (1903, 1904), Klapalek (1904), Boerner (1904), Sharp (1899), and Shipley (1904), place the Strepsiptera as an independent order, although all place it next to Coleoptera, Handlirsch holding it to be an offshot during the Tertiary age. In this article it is intended to summarize all of the arguments used on both sides and to show how the balance stands.

The three most recent classifications of the Coleoptera, by Lameere (1900), Kolbe (1901), and Ganglbauer (1903), are not unanimous with regard to the placing of the Strepsiptera. Lameere incorporated the group as a subfamily Stylopinæ in the family Melandryidæ, while Kolbe and Ganglbauer excluded the group entirely from the order. Lameere, later, in an answer to Ganglbauer, does not defend his placing of these insects, so it may be concluded that the opinion of these three authors is unanimous.

The writer in personal correspondence and conversation finds a great diversity of opinion. H. F. Friese, of Germany, and R. C. L. Perkins, of Hawaii, both experienced in the study of the group, incline toward retaining them in the Coleoptera. Dr. Filippo Silvestri, of Italy, who is a student of the Rhipiphoridæ, thinks them related to these beetles. Charles T. Brues, of Milwaukee, finds more evidence for separating them than for placing them with the Coleoptera. Charles Dury, of Cincinnati, desires to consider them Coleoptera, as a matter of sentiment. E. A. Schwarz, the coleopterist, considers the group a distinct order, and so did the late W. H. Ashmead, hymen-

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INTRODUCTION.

The writer presents, in monographic form, a grouping of the most important facts recorded concerning the insects of the order Strepsiptera Kirby, often known as the coleopterous family Stylopidæ Kirby, together with considerable new material bearing upon the classification, structure, and habits of the order. The manuscript has been completed up to March 1, 1909.

The importance of a more intensive and extensive study of the Strepsiptera is made manifest by a perusal of the large list of host species, among which are already recorded at least twenty-eight injurious species. The group is entirely composed of parasitic insects, and the insidious nature of their attack, which in few cases inconveniences the host, renders detection difficult. It is desired that this article may be the forerunner of much valuable information concerning them.

It is of great importance for interested students throughout the world to make themselves known to each other, in order that together they may hasten the understanding of these parasites, and also that in future publications the scattered notes, published and unpublished, from all lands may be brought together to form a more complete knowledge of their biology and structure.

ACKNOWLEDGMENTS.

The writer's personal acknowledgments are due to the U. S. National Museum and its entomological corps for their courtesy in according all possible facilities for the study of material there deposited and in accepting for publication this article; to Dr. L. O. Howard and Mr. W. D. Hunter for their assistance in facilitating the work; to Mr. E. A. Schwarz and to the late Dr. W. H. Ashmead for valuable suggestions and aid; to Prof. Lawrence Bruner in permitting the writer to extract all material from the collections of the University of Nebraska for study and to deposit all type material in the U. S. National Museum; to Mr. J. C. Crawford for very valuable aid throughout the entire work; to Dr. Henry Skinner for his courtesy in lending material from the Philadelphia Academy of Sciences; and to Mr. Charles T. Brues, Mr. Charles Dury, Mr. Henry L. Viereck, Dr. Sigmund Graenicher, Mr. Fred C. Bowditch, Miss Annette F. Braun, and Dr. A. Fenyes for the kind loan or donation of specimens and notes, and to Mr. Fred C. Bishopp, Mr. Charles R. Jones, Mr. F. C. Pratt, Mr. W. A. Hooker, and Mr. R. A. Cushman, the author's associates, for their zeal in procuring stylopized material for breeding and examination; finally to Mr. Karl Hofeneder, of Innsbruck, Austria, for valuable assistance during the past two or three months.

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Finally, a character which has been little used, but which seems to be of much value, may be used to show the wide gap separating the Strepsiptera from the orders with which it has been placed. It is that of the development of head and thorax and the aggluti-

nation of these parts, proposed in concrete form by John B. Smith (1899).

He presents a not altogether new table of the orders, which more normally represents the morphological relationships of the orders than any classification yet seen by the writer. In this table he divides the mandibulate orders into three parallel groups:

1. Prothorax mobile; head not free.
2. Prothorax immobile, well developed; head free, not on distinct neck.
3. Prothorax immobile, reduced; head on distinct neck.

The Coleoptera belong in the first, and the Hymenoptera and Diptera in the third.

Probably a more normal grouping of the essentially mandibulate orders would be as follows:

EXOPTERYGOTA, HEMIMETABOLA.

1. All thoracic segments subequal, not agglutinate; wings arising externally; head free, not on a distinct neck.
2. Thoracic segments subequal, meso- and metathorax agglutinate, prothorax free; wings arising externally; head not on distinct neck.
3. Thoracic segments unequal, agglutinate, prothorax reduced; wings arising externally, head free, on distinct neck.

ENDOPTERYGOTA, HOLOMETABOLA.

4. Thoracic segments subequal, meso- and metathorax agglutinate, prothorax free; wings arising internally; head not on distinct neck.
5. Thoracic segments unequal, not agglutinate, prothorax reduced, metathorax greatly developed; wings arising internally; head free, on distinct neck.
6. Thoracic segments unequal, agglutinate, prothorax reduced, metathorax greatly developed; wings arising internally; head free, on distinct neck.

In the first of these groups fall Isoptera, Mallophaga, Corrodentia. In the second fall Orthoptera and Plecoptera, also Thysanoptera. In the third fall Odonata and Ephemeroptera. In the fourth falls Coleoptera; in the fifth the Strepsiptera; in the sixth the Neuroptera, Trichoptera, Mecoptera, Lepidoptera, Diptera, and Hymenoptera. The orders are here used in the Comstockian sense, although the writer is disposed to regard the groupings of Handlirsch and Boerner as more nearly correct. It is not the function of this article to erect a classification of the Hexapoda.

In preparing this grouping, the division by Sharp of the pterygote insects into Exopterygota and Endopterygota (Sharp, 1899) suggested a better outline than could have been gained from Smith alone.

Handlirsch (1903 and 1904) and Boerner (1904) have gone extensively into the phylogeny of insects, and as a result of their work a fifth rule may well be added to Kirby's:

Rule V. *When insects formerly placed arbitrarily in some of the older orders are found by paleontology to be of a distinct line of descent from the order with which they have been ranked, and show decided differences from this order in structure or in metamorphosis, they should be separated out to form a new order.*

In converse also: *Insects which should be separated from an older order in accordance with any of the preceding rules, and yet which show a common origin, must also constitute a separate order.*

Mengea tertiaria, the only fossil insect yet found in the Strepsiptera, shows a nearer approach to other orders than any existent forms except the very recently discovered *Trioxocera mexicana*, in that the tarsi are five-jointed and two-clawed, but in other respects its characters are essentially different from those of any contemporary group, and indicate that the Strepsiptera have completely separated from whatever lineage they formerly belonged to.

Besides being isolated from all other orders by their morphology, and by phylogeny, they may also be shown to be separated by the anatomy of the alimentary, nervous, and reproductive systems at least, by their embryogeny, and by their biology (metamorphosis and reproduction).

Following may be considered some of the principal characteristics of the group upon which authors have based their conclusions that it is worthy of a distinct ordinal name. The authority for each point and the species studied are placed in parenthesis.

1. The order became separated from its nearest related group in or before the Tertiary age (Pierce, *Mengea tertiaria* Menge).

2. Absence of labrum in male and female; very feeble development of maxillæ in male and complete absence in female (Nassonow, 1892 *d*, *Xenos vesparum* Rossi (*rossii* Kirby).

3. Position of mouth opening (referring to the constricted part of the pharynx of the male) in the male and female at comparatively considerable distances from the mouth parts (Nassonow, 1892 *d*, *Xenos vesparum* Rossi). (See pl. 5, fig. 11.)

4. Antennal surface covered with an immense number of elevated sensory organs (Pierce, *Crawfordia pulvinipes*, *Acroschismus pallidus*, *pecosensis*, *bowditchi*, *hubbardi*).

5. Modification of anterior wings of males into club-like balancers (Nassonow, 1892 *d*). (See pl. 6, fig 7.)

6. Reduction of prothorax, sometimes to a mere cylinder surrounded by the mesothorax (Pierce, *Anthericomma barberi*). (See pl. 14, fig. 5.)

7. Unusual development of metathorax and the great distance between the last two pairs of legs. (See pl. 6, fig. 6.)

8. Freedom of movement of head and thoracic segments secured by elastic membranes (Pierce, *Acroschismus pallidus* Brues). (See pl. 5, fig. 7.)

9. The occasional presence of a mesostigmatal protecting lobe (Pierce, *Acroschismus* species). (See pl. 5, fig. 4.)

10. *a*, Wings in form of quadrant, folding longitudinally, veins radial. (See pl. 1, fig. 2.) *b*, The movement of wings and elytra in unison, as contrasted with the stationary character of coleopterous elytra during flight.

11. The permanent exsertion of the male genital organ (œdeagus), and the entire absence of female external genital organs (Pierce, *Crawfordia pulvinipes*, *Acroschismus* species, *Apractelytra schwarzi;* Perkins, 1905, *Halictophagus?* species, *Elenchus* species). (See pl. 2, fig. 6.)

12. Isolation of posterior and middle intestines in male and absence of latter in female (Nassonow, 1892 *d*, *Xenos vesparum* Rossi).

13. Nervous system formed of three ganglia, supraœsophageal, thoracic and ventral (Nassonow, 1892 *d*, *Xenos vesparum* Rossi). (See fig. 2, Nos. 14–17, p. 60.)

14. Absence of Malpighian vessels and cutaneous glands in male and female (Nassonow, 1892 *d*, *Xenos vesparum* Rossi).

15. Presence of unpaired sexual canals on the second to fourth, fifth, or sixth abdominal segments of the female, in the form of curved tubes, resembling the segmental organs of annelids (Nassonow, 1892 *d*, *Xenos vesparum* Rossi, 1893 *a*, *Stylops mellittæ* Nassonow not Kirby; Muir, 1906, *Elenchus tenuicornis* Muir not Kirby.)

16. Absence of ovaries (Nassonow, 1892 *d*, *Xenos vesparum* Rossi). The simultaneous development of all eggs (Brues, 1903, *Xenos peckii* Brues not Kirby).

17. The retention of the female in its unshed pupal skin (Meinert, 1896; Pierce, numerous species).

18. Two pupal instars and the retention of the puparium and first pupal skins by the second male pupa (Pierce, *Acroschismus pallidus*, *pecosensis*).

19. The fusion of head and thoracic segments to form a cephalothorax in the adult female (Nassonow, 1892 *d*, *Xenos vesparum* Rossi; Pierce, *Acroschismus pallidus* Brues).

20. Larviparous reproduction.

21. Hypermetamorphosis.

22. Permanent parasitism of female.

23. Fertilization probably by releasing spermozoa in the buccal cavity or else in the opening of the brood canal.

In rebuttal it may be advisable to show the fallacies of the classifications which called the Strepsiptera coleopterous.

Saunders (1872), following Schaum, and Lacordaire (1859) gave the following as the principal reasons for ranking the Strepsiptera as Stylopidæ, coleopterous:

1. Similarity of hexapod larvæ to those of Meloidæ (and Rhipiphoridæ).

2. "Metamorphosis nearer to that of Coleoptera" than of any other "elytrophorus order" (quoted from Kirby, 1813).

3. Same buccal organs in hexapod larvæ notwithstanding the differences of their respective habits.

4. Variation of buccal organs during metamorphosis of *Sitaris*, as great as differences between these organs in Stylopidæ and in Meloidæ.

5. Participation with several abnormal coleopterous groups in the divergence from conventional formularies of organization and distinguished by the same parasitic associations.

a. *Myodites*, having rudimentary elytra and radial wing venation.

b. *Macrosiagon*, *Myodites*, in the longitudinal folding of the wings.

c. *Rhipidius*, in the eyeless, apterous females.

d. With the males of all these in the highly developed ramose antennæ.

e. With *Meloe*, *Sitaris*, *Zonitis*, in the remarkable coarctate pupal metamorphosis and preliminary transformations.

In the appendix of the present article will be found a discussion of the fallacy of using such characters to bring together unallied groups. As to the metamorphosis, Mr. E. A. Schwarz says that it was probably reached by a line of development parallel with that of the Rhipiphoridæ, due to somewhat similar parasitic habits, because, he says, the Strepsiptera have "nothing in common with the Coleoptera."

The resemblance of the triungulinids of the two families Meloidæ and Rhipiphoridæ and the Strepsiptera is mainly superficial. The meloid hexapods have three claws on the tarsi; the rhipiphorid hexapods have one claw only and a sucker-like pulvillus, and are also provided with a caudal sucker; the strepsipterous hexapods have no tarsal claws, but do have the pulvilli, and instead of the anal sucker are provided with long bristles.

Since the Thysanura are probably the nearest approach to the primitive insects, it is reasonable to expect that where parasitic habits have brought about a hypermetamorphic type of development, the first stages should revert to the primitive Campodeoid type and that distant groups with similar habits should exhibit similar forms in these first stages.

The only genera in the Coleoptera which have been considered close to the stylopids are *Hornia* and *Leonidea* in the Meloidæ and *Rhipidius sens latum*, in the Rhipiphoridæ. The two former are very dissimilar in appearance, and the females have legs. The Rhipidiini differ in that the larvæ leave the host to pupate; the females are like the males, but wingless and with 11-jointed filiform antennæ. According to Mr. Frederick Knab the females also have eyes, legs, and a well-developed ovipositor. Thus it will be seen that there is no resemblance whatever to the Strepsiptera.

The very recent description by Dr. Filippo Silvestri of a female hypermetamorphic insect known as *Rhyzostylops inquirendus*, adds one more genus to those closely similar forms. This female has legs which are very simple in structure, is provided with short, simple antennæ, and lacks all but two pair of mouth parts, the pharynx being exposed, due to the absence of labrum and labium. There are no rudiments of wings; the abdomen is 10-jointed. The insect was found dead under shale or "tufa" at the side of its cluster of eggs. From the eggs, triungulinids were obtained. These had two tarsal claws and posteriorly were armed with stylets. In only two instances are there any resemblances to the Strepsiptera; namely, the rudimentary mouth parts of the adult and the possession of anal stylets by the triungulinid. The insect is anomalous and may or may not belong in the Rhipiphoridæ. If it does, it forms a new tribe below the Rhipidiini. The larva forms a new step in the series of first larvæ by having two tarsal claws.

In all coleopterous classifications containing the Stylopidæ they are arranged at the end of the Heteromera. As LeConte and Horn (1883) are the best authorities in the English language on the Coleoptera, the fallacy of thus locating the Strepsiptera may best be illustrated from their work. In subdividing the Coleoptera they define Isomera as "having the hind tarsi with the same number of joints at least as the others," and Heteromera as having the "front and middle tarsi 5-, hind tarsi 4-jointed." They place Stylopidæ with Heteromera, while they obviously would have to fall in Isomera if they belonged in the Coleoptera. It must be remembered that the Strepsiptera present four types of isomerous tarsi. The sole reason they had for placing the group in Heteromera was to place them at the end of a series of parasites with somewhat similar metamorphosis and other parallel characters as Saunders, Schaum, and Lacordaire had done.

Since the Strepsiptera are isomerous and the Rhipiphoridæ are heteromerous, it is evident that they belong to distinct lines of descent, which has been pointed out as probable. Being separated thus from the Rhipiphoridæ there is no coleopterous group with which they can possibly be allied.

In conclusion, then, the writer would place the Strepsiptera as a separate order, on a distinct line of descent from that of the Coleoptera, and nearer the Hymenoptera and Diptera, and as highly specialized as the highest insects in any of the orders.

The thoracic structure places the order near these other two because of the great development of the metathorax and the extreme reduction of the prothorax and mesothorax. It differs by having the parts not agglutinate except in the female and immature stages.

The mouth structure, consisting of mandibles and maxillæ, but not constructed for feeding on solid food, also draws the Strepsiptera away from the Coleoptera, toward the Hymenoptera.

The nervous system is reduced to a supraœsophageal, a thoracic, and a ventral ganglion from which nerves branch out to all of the segments. Such reduction is frequently found in the Diptera.

The larviparous reproduction is found in the Diptera, but not in the Coleoptera.

COLLECTION.

The building up of a large collection of stylopids is necessarily attended with great painstaking, for only occasional results can possibly attend indiscriminate collecting, but a systematic biological study must yield astonishing results. Furthermore, the work must henceforth be conducted in four orders—Orthoptera, Homoptera, Heteroptera, and Hymenoptera.

In Orthoptera (in the American sense) it is probable that the Blattoidea and Grylloidea will be the only groups parasitized. These insects inhabit damp places and frequently construct burrows. Parasites must be sought in the haunts of the hosts.

The only heteropteron known to be parasitized is a large scutellarid from the Orient. Very possibly more extensive examination in tropical regions will bring out other hosts.

At the present writing the most important order parasitized is the Homoptera. Perkins (1905) has recorded parasites in the Asiracidæ, Issidæ, and Tetigoniidæ, and says that they are sometimes quite abundant. This, then, opens a new field for the economic entomologists. Although it is possible to collect parasites by beating in the grass as Templeton (1838) did when he took *Elenchus tenuicornis*, the best method must be to follow in the steps of Koebele and Perkins (Perkins, 1905) and breed the parasites in breeding cages. The same method will hold with Heteroptera. Mr. Koebele for several years has been endeavoring to introduce American, Vitian (Fijian), and Australian Elenchidæ into Hawaii as parasites of the injurious cane leaf-hoppers. The method used was to collect parasitized Homoptera in large quantities and ship them in cages with a mesh fine enough to prevent the leaf-hoppers from escaping. This mesh would give plenty of room for the triungulinids to get out and attack other hosts. Up to date no success has been recorded in this attempt; in fact, there seems to be no chance of success. Probably the reasons are that the Hawaiian leaf-hoppers are different species or genera and the parasites will not change their host relations.

The collecting and study of the hymenopterous parasites is by no means as difficult or as exacting a work as that with homopterous parasites. The hosts in this order belong to the families Formicidæ in Formicoidea; Eumenidæ, Vespidæ, and Masaridæ in the Vespoidea; Sphecidæ, Stizidæ, and Bembecidæ in the Sphecoidea; and Anthophoridæ, Panurgidæ, Andrenidæ, and Prosopidæ in the Apoidea. These families include social ants, social wasps, solitary wasps, digger bees, gall-dwelling bees, and stem-dwelling bees.

The Hymenoptera campaign should consist of several features: 1. A systematic search of all flowers blooming in the locality studied at all times of the year. 2. A careful record of the host plant, time of appearance and disappearance of each species of bee and wasp. 3. A systematic search for the dwellings of the bees and wasps and sweeping in their vicinity. 4. A study of the interior conditions of the dwellings of each species. 5. Studies of ants' nests.

On the other hand, a systematic study of the Strepsiptera must also yield to the world—

1. A fuller knowledge of the biology of the host insects.
2. An increase in the knowledge of inter-relationships of insects.
3. An addition to the recorded knowledge of the other parasites of the same hosts (as, for instance, Rhipiphoridæ, Meloidæ, Braulidæ, etc.).

The collection of males on the wing would seem to be attended by considerable difficulties, because of the rapidity of flight and the minute size of the insects. The best results must come from breeding the hosts. In the study of *Acroschismus pallidus* the writer found a very convenient arrangement in the shape of an ordinary broad lamp chimney. A pasteboard box was arranged as a support in order to keep the globe in one position and yet horizontal. The ends were merely covered with cheese cloth. A wire screen divided the globe into two compartments, in the upper of which were the wasps and into the lower of which the parasites dropped when exhausted. One end was closed by pasteboard with a hole cut in the middle, through which with a dropper sugar or water could be admitted to a pill box placed on the screening. The pasteboard end was covered with a cheese cloth also. It is not advisable to crowd a cage with wasps. They can be admitted through the same hole intended for the food passing. The parasites can be removed with a camel's-hair brush, but the student must take great precautions, as they are so quick of flight.

One of the desiderata in working with Strepsiptera is to get the triungulinids as well as the adult male and female; hence arrangements must be perfected by the student to keep the hosts alive until time for the triungulinids to emerge.

In the preservation of specimens the writer finds it very inadvisable to mount dry, as the specimens invariably shrivel up, and also because so many of the best characters of the Strepsiptera are microscopic.

Hence two very feasible methods may be suggested. Very fine balsam mounts can be made by supporting the cover glass with broken slivers of a glass slide. This prevents the specimen from being crushed. Glass rings serve the same purpose, but are more expensive. If not desired to make permanent mounts, the specimens may be kept in alcohol and examined under a high-power microscope as follows: Glue a glass ring on a slide with some substance unassailable by alcohol, fill the cell with alcohol, and, after placing the specimen in position, carefully slide a cover glass over it. This will give opportunity to use quite a high power on the object and takes but a minute or two to transfer from the bottle to the slide and back again. Slides with permanent cells may be purchased.

BIOLOGY.

The life history of the Strepsiptera is of so much interest that it appears well to introduce the more specialized treatise of the biology by a brief summary of the most important elements in it.

These insects are called in common parlance "stylops," and students, when speaking of a parasitized insect, usually say that it is "stylopized." The "stylops" is known to most collectors only as a disk-like or acarus-like plate protruding from between the abdominal segments of various bees and wasps. Few, indeed, are they who have seen the adult winged males, although most collectors have marveled at the pictures of them. In fact, many a careful collector would never even notice the foreign body in the abdomen of his specimen.

If this disk-like plate is flat the parasite is an adult female, and the part seen is the cephalothorax, a character not appearing in other insects. The part unseen is merely the grub-like white abdomen which often almost fills the body of the host. If instead of a disk the part exserted is the tuberculate rounded end of a cylindrical body the collector may know that he has a male pupa, from which an adult active male will emerge if he keeps the host alive.

With the grub-like female the discussion of the life history may commence. Dissect it out, and you will usually notice that just where it protrudes its cephalothorax there is some kind of firm connection with the body of the host, which sometimes happens to be a tube. These insects draw their nourishment from their host by osmosis, which is the most degraded manner of alimentation. The body of the female is a great sack full of eggs, all of which develop at the same time, and not in ovaries but loose in the body cavity. The real female never sheds its last skin. It has lost all instinct, except that which causes it to force its chitinized cephalothorax out through the abdomen of its host. Yet in spite of this its nervous system is as highly developed as the male's.

[illegible]

... The adult male is a most peculiar insect with one pair of large, fan-like wings, shaped as a quadrant of a circle, with a short transverse head; with large eyes on stalks, composed of many separate hexagonal facets divided by hairy partitions, with antennae branched and covered with delicate sense organs, with rudimentary mouth parts, and with little paddle-shaped halteres on the mesothorax.

These insects fly like a flash, darting here and there, and with the halteres vibrating in unison with the wings and making quite a loud hum for such little creatures (for the largest known is but a quarter of an inch long). Their sole purpose in life is to fertilize the females, which act is accomplished by setting loose of the semina either in the brood canal or oesophagus of the female. They live but a few hours, five being the longest recorded, with one exception, when Pierce had a male *Stylops* live sixty two hours (Frie-

RELATIONS TO HOST.

The subject which deals with the relationships of these parasites to their hosts is many sided and complicated, but it certainly contains many points of great interest to the student of parasitism. A division, therefore, into the main groups of relationships will probably make the discussion more coherent. These divisions are:

1. The actual relationships of the host to the parasite.
2. The effects of parasitism upon the individual hosts.
3. The effects of various host conditions upon the parasites.
4. Seasonal conditions and the biology of the hosts as influencing the biology of the parasites.

1. ACTUAL RELATIONSHIP TO THE HOST.

When the young triungulinids leave the body of the parent they find themselves crawling over the body of the parent's host. They are restless for they must reach some new host. The insect, then, which now bears them, and which for convenience will be known hereafter as the maternal host, becomes the first agency of transfer of the minute triungulinids. There are obviously several ways in which the parasites may reach new hosts, and probably all are followed in actual life.

They may be carried direct to the nest of the maternal host, where they may find new hosts immediately. This is especially possible in the case of colonial insects, for there the parasites may pass from one cell to another until a proper host is found. But if the maternal host is a male solitary insect, or if the hosts are not nest builders (in the case of Orthoptera, Homoptera, Heteroptera) then this is not the method of transfer.

It is, however, almost out of the question that the host should carry the triungulinids to its own young, because the observation of Perez that there is a loss of function in parasitized females would indicate that there is no nest building by affected individuals. Perez (1886) looks at the matter in this light: "Il devrait par conséquent exister dans chaque espèce d'abeilles nourissant ces parasites, une lignée, une race exclusivement affectée, à leur entretien, ce que, à priori, est absolument improbable."

They may leave the maternal host at some place frequented by other individuals of the same species. In case of bees this will be a flower of a certain species, which flower or rather plant may be known as the host plant. The opportunities of reaching a new host are many. Among bees all individuals mature during more or less definite periods and frequent a limited number of flower species, although the males may visit several species of flowers not visited by the females. The little triungulinids may be picked up in a mass of pollen, or they may reach this new host, which must be known as a

The eggs mature within the body cavity, and the young (of which the writer once counted 2,100 to one female) (Pierce, 1904), find exit from the body of the parent through from three to five median canals opening in the 2d to 4th, 5th, or 6th segments (such canals are nowhere else found in Insecta, but occur in the Annelida). They have passed into a larger passage formed between the venter of the female and its uncast pupal skin, in which they pass forward and find exit through a slit between the head and prothorax on the cephalothorax. The female reposes with its venter upward, so when the young come out they crawl all over the body of the host. These young look like the primitive thysanuran *Campodea*, being very lively little hexapods, with two bristles from the caudal end, and with padded, clawless feet. The name given by Chobaut is triungulinid, because of the resemblance to the meloid triungulins.

The triungulinid remains upon the body of the host until it gets a chance to slip off or is brushed off into a nest or flower. In the latter case it waits until another host comes along and takes passage with it, and is carried to a nest finally. When it reaches a nest it hunts around until it finds a larval host, into which it quickly burrows.

Inside its host parasitic life quickly causes it to lose its legs, and the eyes to disappear, and it is soon entirely grub like; then the segments of the head and thorax fuse. The male and female, after the second molt, appear different, the female becoming as just described, while the male becomes cylindrical and in the later stages shows a patch of eyes, resembling the primitive collembolan eye patches but more regular. The anterior portion hardens and is pushed outward, resembling a dipteran pupa case, with tuberculate head and a little cap at the tip of the cylinder. Within this skin a real pupa, like the hymenopterous pupa, forms, and then another pupa forms within this, and finally the adult develops inside of these three skins and emerges by casting the cap from each skin. The adult male is a most peculiar insect with one pair of large, milky white wings, shaped as a quadrant of a circle; with a short transverse head; with large eyes on stalks, composed of many separate hexagonal facets divided by hairy partitions; with antennæ branched and covered with delicate sense organs; with rudimentary mouth parts, and with little paddle-shaped balancers on the mesothorax.

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They may leave the maternal host at some place frequented by other individuals of the same species. In case of bees this will be a flower of a certain species, which flower or rather plant may be known as the host plant. The opportunities of reaching a new host are many. Among bees all individuals mature during more or less definite periods and frequent a limited number of flower species, although the males may visit several species of flowers not visited by the females. The little triungulinids may be picked up in a mass of pollen, or they may reach this new host, which must be known as a temporary host, by their own volition. Saunders (1853) proved that they have remarkable saltatorial power, which power, together with the aid of the sucker-like pads of the tarsi, will enable them to reach an insect which may pause but a second at the flower. In such manner there may possibly be several temporary hosts in some cases before the triungulinid reaches the nest. In connection with the part the maternal host fulfills in the destiny of the parasite, Newport (1851) makes the significant remark that the bees live long enough to perpetuate the enemies of their race and to serve the young Strepsiptera as a means of transportation to their hosts.

The triungulinids may be forcibly removed by the bee, as was observed by Smith (1859) with regard to *Andrena trimmerana.* He says: "She was covered with hundreds of larvæ of *Stylops* and her brushing and excitement were caused by efforts, on her part, to free herself from the annoyance which the host of larvæ evidently occasioned her."

The writer can now add another link in the chain of evidence which has been produced to strengthen the flower-transfer hypothesis. On July 21, 1906, at Dallas, Texas, Mr. W. A. Hooker collected from *Helenium tenuifolium*, a *Leionotus verus* Cresson containing two female parasites which had produced triungulinids, and also an *Agapostemon texanus* bearing two triungulinids of the identical species on the last ventral segment. Thus it may be seen that the triungulinids are actually left at the host flowers and also that many climb upon the wrong host, just as the writer formerly showed to be the case with the triungulinids of *Myodites solidaginis.*

Perez (1886) suggests that in seeking shelter overnight or in stormy periods in the nests of other individuals, the maternal host or an intermediate carrier may leave triungulinids in position to find permanent hosts.

In case of the social and solitary wasps the places frequented are little puddles of water, posts, and often flowers. In the case of Homoptera the triungulinids are very likely scattered throughout the grass over which the young leaf-hoppers are feeding. With *Gryllotalpa* the agency of transfer must be some damp locality where these insects congregate. The actual transfer agency must at present be a matter of conjecture in all such insects. Suffice it that either the maternal hosts or some temporary hosts transfer the young to the places where they can find their permanent hosts.

The triungulinid immediately attacks its host when it finds the proper one. Saunders (1853) found that *Xenos* larvæ would not attack soft *Polistes* pupæ nor eggs, but that they would burrow immediately into a larva, being completely inside in a space of three hours. He found that triungulinids of *Hylechthrus* were unable to effect an entrance through the pellicle of *Polistes* larvæ.

The parasites do not penetrate the vital organs of the hosts, but adjust themselves between the organs and crowd these out of position or crush them. The nourishment seems to be by osmosis—that is, by absorption of the juices of the host, although this point is not definitely established. Sometimes the number of parasites becomes so great that the host becomes seriously injured and death results.

The location of the parasites in the body of the host is as a general rule indifferent, although the males generally occupy the basal segments and the females the apical segments. These remarks are based primarily upon a study of *Polistes annularis.* A notable exception was found in *Andrena crawfordi,* in 92 parasitized individuals, of which every parasite was located between the fourth and fifth segments.

With Homoptera there seems to be more definite location for the parasites, according to Perkins (1905). He treats this subject as follows:

It is perhaps worthy of notice that the male puparia of the species of *Halictophagus* (?), parasitic on jassids, pierce the dorsum or even the venter of the abdomen of these leaf-hoppers, but the head of the female is always, or nearly always, thrust through the pleura. On the contrary, in *Elenchus* and *Deinelenchus,* parasitic on fulgorids, the male puparium (as well as the head of the female parasite) is exserted from the pleural region only.

In the case of the Halictophaginæ we found only mature leaf-hoppers to contain mature female parasites and puparia; but in the case of *Elenchus tenuicornis* the nymph or adult delphacids will alike produce mature parasites of either sex.

In the following pages are brought together definite statistics, published and original, on the percentage of infestation of several species and on the location of the parasites in the bodies of the host.

POLISTES ANNULARIS Linnaeus.

At Rosser, Texas, on September 23, 1905, Mr. F. C. Bishopp and Mr. C. R. Jones, both of the U. S. Department of Agriculture, collected two large nests of *Polistes annularis,* abundantly parasitized by *Acroschismus pallidus* Brues.

The nests contained, respectively, 1,575 and 1,212 cells, or a total of 2,787 cells, from which at the time or by subsequent breeding 1,553 wasps were obtained.

On these wasps the following data were obtained, as tabulated:

1,311 male wasps,	1,052 unparasitized,	259 parasitized.
242 female wasps;	235 unparasitized,	7 parasitized.
1,553 wasps;	1,287 unparasitized,	266 parasitized.

84.4 per cent of the wasps were males, 15.6 per cent females.
97.3 per cent of the parasitized wasps were males, 2.7 per cent females.
80.3 per cent of the male wasps were unparasitized, 19.7 per cent parasitized.
97.2 per cent of the female wasps were unparasitized, 2.8 per cent parasitized.
82.8 per cent of all the wasps were unparasitized, 17.2 per cent parasitized.

The following data give more specifically the extent of parasitism found in these wasps, bringing out the percentage of sexes of the parasites and their relations to each other:

1 male wasp with	15 male parasites =	15 parasites.
1 male wasp with	5 male parasites =	5 parasites.
1 male wasp with	4 male parasites =	4 parasites.
6 male wasps with	3 male parasites =	18 parasites.
17 male wasps with	2 male parasites =	34 parasites.
112 male wasps with	1 male parasite =	112 parasites.
138 male wasps with		188 male parasites.
4 female wasps with	1 male parasite =	4 parasites.
142 wasps with		192 male parasites.
11 male wasps with	2 female parasites =	22 female parasites.
47 male wasps with	1 female parasite =	47 female parasites.
58 male wasps with		69 female parasites.
2 female wasps with	1 female parasite =	2 female parasites.
60 wasps with		71 female parasites.

				Parasites.
1 male wasp with	5 male, 2 female (7) parasites =	5 male,	2 female =	7
1 male wasp with	2 male, 5 female (7) parasites =	2 male,	5 female =	7
2 male wasps with	5 male, 1 female (6) parasites =	10 male,	2 female =	12
1 male wasp with	4 male, 2 female (6) parasites =	4 male,	2 female =	6
1 male wasp with	3 male, 3 female (6) parasites =	3 male,	3 female =	6
2 male wasps with	2 male, 4 female (6) parasites =	4 male,	8 female =	12
1 male wasp with	3 male, 2 female (5) parasites =	3 male,	2 female =	5
5 male wasps with	3 male, 1 female (4) parasites =	15 male,	5 female =	20
5 male wasps with	2 male, 2 female (4) parasites =	10 male,	10 female =	20
2 male wasps with	1 male, 3 female (4) parasites =	2 male,	6 female =	27
9 male wasps with	2 male, 1 female (3) parasites =	18 male,	9 female =	27
5 male wasps with	1 male, 2 female (2) parasites =	5 male,	10 female =	15
28 male wasps with	1 male, 1 female (2) parasites =	28 male,	28 female =	56
63 male wasps with		109 male,	92 female =	201
1 female wasp with	1 male, 1 female (2) parasites =	1 male,	1 female =	2
64 wasps with		110 male,	93 female =	203

The highest amount of parasitism then in the author's study was 15, which number is exceeded by the record of 31 larvæ in one larval host. (Brues, 1903.)

In summarizing these figures the following totals and percentages are obtained, which bear directly upon the question of survival of the parasites.

138 male wasps with	192 male parasites		=192 parasites.
63 male wasps with	109 male,	92 female parasites	=201 parasites.
58 male wasps with		69 female parasites	= 69 parasites.
259 male wasps with	301 male,	161 female parasites	=462 parasites.
4 female wasps with	4 male parasites		= 4 parasites.
1 female wasp with	1 male,	1 female parasite	= 2 parasites.

2 female wasps with		2 female parasites=	2 parasites.
—	—	—	—
7 female wasps with	5 male,	3 female parasites=	8 parasites.
==	==	==	==
266 wasps with	306 male+	164 female parasites=	470 parasites.

65.1 per cent of parasites are males.
34.9 per cent of parasites are females.

Of the 164 female parasites only 71, or 42.6 per cent, occurred in hosts containing no male parasites. Brues (1905) has pointed out that hosts from which male parasites have emerged can not pass through the winter. Furthermore, it seems that few male wasps ever endure the winter season. This reduces the number of females, then, which would have survived to reproduce their species, to 2, or .2 per cent, of the total number of females.

These figures lack one powerful coefficient, however. It is not known how many parasitized female wasps had left the nest at the time it was taken.

The location of the parasites may be summarized as follows:

1 male protruding from the first segment, dorsal; total, 1.
21 males protruding from the second segment, dorsal } total, 26.
5 males protruding from the second segment, ventral }
132 males protruding from the third segment, dorsal } total, 146.
14 males protruding from the third segment, ventral }
85 males protruding from the fourth segment, dorsal } total, 101.
16 males protruding from the fourth segment, ventral }
29 males protruding from the fifth segment, dorsal } total, 30.
1 male protruding from the fifth segment, ventral }
2 males protruding from the sixth segment, dorsal; total, 2.
2 females protruding from the third segment, dorsal } total, 4.
2 females protruding from the third segment, ventral }
29 females protruding from the fourth segment, dorsal } total, 32.
3 females protruding from the fourth segment, ventral }
106 females protruding from the fifth segment, dorsal } total, 115.
9 females protruding from the fifth segment, ventral }
10 females protruding from the sixth segment, dorsal; total, 10.

These figures show that the majority of the males protrude from behind the third and fourth segments, while the females mainly find exit behind the fifth segment.

Brues (1905) at Paris, Texas, took in July 36 female wasps, from which he secured 91 male parasites and 3 female parasites; 35 wasps contained males, while 3 wasps contained females. Both sexes were found in only one wasp. On October 3, from 36 female wasps he took 81 male parasites and 44 female parasites; 25 wasps contained males, 27 contained females, 3 contained larvæ; 8 wasps contained males only, 10 contained females only, 17 contained both sexes, and 1 contained a larva only.

At Orlando, Florida, Mr. W. A. Hooker found, on November 28, 1906, 1 dead male wasp which contained 3 male exuvia located in the third dorsal, third ventral, and fourth ventral, and 3 females located in the fourth dorsal, fifth dorsal, and fifth ventral. On December 7 he found in hibernation in a house 60 wasps of which 6 were parasitized. These were females.

2 wasps contained 1 female each.
1 wasp contained 1 female and 1 male exuvium.
1 wasp contained 1 female, 1 exuvium, and 1 puparium.
1 wasp contained 2 females and 2 exuvia.

The location of the parasites in all wasps taken by Mr. Hooker is as follows:

Location.	Dorsal.	Ventral.	Total.
Second segment	1 male	1 male	2 males.
Third segment	3 males	2 males	5 males.
Fourth segment	2 females	1 male	1 male, 2 females.
Fifth segment	6 females	1 female	7 females.

Probably the most interesting feature is the hibernation of wasps containing male exuvia.

At the same place on December 31 Mr. J. C. Crawford took one female containing a male exuvium.

At Plummers Island, Maryland, February 24, 1903, Mr. W. V. Warner collected a female bearing a male exuvium. This is undoubted hibernation with the empty case. At the same place in December, 1906, Mr. H. S. Barber collected 35 hibernating wasps. These were killed January 3, 1907, and 2 were found parasitized by a single female each. The wasps were all females. In November, 1907, Mr. McAtee also collected 10 unparasitized male wasps, 89 unparasitized females, and 6 parasitized females, containing 3 male and 12 female parasites. At the same place on November 9, 1907, Prof. W. P. Hay collected 54 wasps, of which 4 contained 6 parasites in all.

POLISTES GALLICUS Linnaeus.

Rosenhauer (1842) records from 77 wasps 81 male parasites and 44 female parasites; 56 wasps contained males and 32 contained females; 45 wasps contained males only, 21 contained females only, while 11 contained both sexes. Siebold (1843) questions whether Rosenhauer knew the sex of these parasites.

POLISTES, new species, near MINOR.

At Victoria, Texas, September 25, 1906, Mr. J. C. Crawford collected four nests in one tree. Two nests were entirely unparasitized. In one nest 25 female wasps were unparasitized and one male contained a male puparium. The fourth nest contained 133 female and 52 male wasps unparasitized; and 2 females and 3 male wasps parasitized.

At Dallas, Texas, October 11, 1906, Mr. R. A. Cushman and the writer collected two nests. In the first 13 male and 4 female wasps were unparasitized and 1 male was parasitized, while in the second the 9 males and 1 female were all unparasitized.

POLISTES METRICUS Say.

Austin (1882) at Readville, Massachusetts, on August 20, 1879, took *Polistes metricus* parasitized as follows:

14 male wasps taken, 2 parasitized.
36 female wasps taken, 7 parasitized.
1 female wasp contained 7 male parasites.
1 female wasp contained 2 male parasites.
1 female wasp contained 1 male parasite.
1 female wasp contained 1 female parasite.

According to note 3513, U. S. Department of Agriculture, Bureau of Entomology, a specimen of this wasp bearing 8 fully grown females was taken September 4, 1884, near Washington, D. C. Other wasps taken on the same date bore empty puparia.

POLISTES PALLIPES Lepeletier.

At Marion, Massachusetts, on September 2 and 12, 1902, Mr. Fred. C. Bowditch took 10 *Polistes pallipes* parasitized by *Acroschismus bowditchi* Pierce.

Five adult males were bred, and these have been studied by the author. In the 4 male wasps are 16 male pupæ. In the 6 female wasps are 4 female parasites, 1 male pupa, and 9 empty puparia; that is, each male averaged 4 parasites and each female 2.33 parasites. The parasites were in the proportion of 26 males to 4 females, or only 13.3 per cent females. The highest number of parasites to an individual was 10, all pupæ, in a male wasp.

The record of parasitism was thus:

	2 female	wasps with	1 male, 1 female	=	4 parasites.
	1 female	wasp with	1 male, 2 female	=	3 parasites.
1 male,	2 female	wasps with	1 male only	=	3 parasites.
1 male		wasp with	2 male	=	2 parasites.
1 male		wasp with	3 male	=	3 parasites.
	1 female	wasp with	5 male	=	5 parasites.
1 male		wasp with	10 male	=	10 parasites.
4 male,	6 female	wasps	with		30 parasites.

The location of the parasites was as follows:

Location.	Dorsal.	Ventral.	Total.
Second segment	3 male		3 male.
Third segment	7 male	5 male	12 male.
Fourth segment	6 male, 2 female	2 male	8 male, 2 female.
Fifth segment	1 male, 2 female	1 male	2 male, 2 female.
Sixth segment	1 male		1 male.

At Cincinnati, Ohio, Mr. Charles Dury took 15 *Polistes pallipes* parasitized by *Acroschismus bowditchi.*

Four adult males were bred, and these have been studied by the author. In the 4 male wasps were 12 male parasites and 1 female parasite. In the 10 female wasps were 23 male parasites and 1 female parasite. In the remaining mutilated specimen was 1 male parasite. Each male, therefore, averaged 3.25 parasites, and each female 2.4 parasites. The parasites were in the proportion of 36 males to 2 females, or only 5.2 per cent females. The highest number of parasites to an individual was 9, all pupæ, in a female wasp. The wasp was so feeble it could hardly move.

The record of parasitism was thus:

					Male pupæ.		Male exuvia.		Parasites.
June 15, 1900:		1 female		wasp with	2				= 2
July 3, 1901:		1 female		wasp with	4				= 4
Aug. 24, 1905:		2 female		wasps with	1				= 2
Aug. 24, 1905:		1 female		wasp with			2		= 2
Aug. 24, 1905:		1 female		wasp with	9				= 9
Aug. 25, 1905:		1 female		wasp with				1 female	= 1
Aug. 25, 1905:		1 female		wasp with	1				= 1
Sept. 13, 1900:	1 male			wasp with			4		= 4
Sept. 16, 1905:			1 ?	wasp with		1 male			= 1
Sept. 16, 1905:	1 male			wasp with		1 male			= 1
Sept. 16, 1905:	1 male			wasp with		1 male		1 female	= 2
Sept. 16, 1905:	1 male			wasp with		1 male	5		= 6
Sept. 22, 1905:		1 female		wasp with	1				= 1
Sept. 27, 1900:		1 female		wasp with			2		= 2
	4 males,	10 females,	1 ?	wasp with	19,	4 males,	13	2 females	=38

The location of the parasites was as follows:

Location.	Dorsal.	Ventral.	Total.
Second segment	3 male		3 male.
Third segment	17 male, 1 female	2 male	19 male, 1 female
Fourth segment	7 male	3 male	10 male.
Fifth segment	1 male, 1 female	3 male	4 male, 1 female.

POLISTES RUBIGINOSUS Lepeletier.

A nest of *Polistes rubiginosus* was collected by Mr. Bishopp and Mr. Jones at Rosser, Texas, September 23, 1905, containing 377 cells; 171 wasps were procured, 137 being males and 34 females. Not one was parasitized. The same gentlemen at Mineola, Texas, July 19, 1906, examined 21 specimens taken at a nest and none were parasitized.

POLISTES TEXANUS Cresson.

Skinner (1903 *a*) cites the capture of two nests of this species at Pecos, Texas, on September 25, 1901, by Mr. A. E. Brown, from which 144 wasps were obtained, 34 being parasitized.

POLISTES VARIATUS Cresson.

On October 18, 1903, Mr. Crawford took at West Point, Nebraska, 200 wasps of this species, all unstylopized, of which only 2 were males.

NECTARINA LECHEGUANA Latreille.

In December, 1905, Mr. A. C. Morgan took a nest of *Nectarina lecheguana* at Hidalgo, Texas, and from this nest Mr. Crawford examined about 2,500 wasps for parasitism without finding a single case. Du Buysson (1905 *a*) states that he has never met a case of stylopization in *Nectarina*.

PROSOPIS, species.

Saunders (1852) took 22 specimens of *Prosopis*, in which he found 32 male and 17 female parasites; 14 bees contained male parasites and 8 contained female parasites. No bee was found containing both sexes.

ANDRENA CRAWFORDI Viereck.

Between April 26, 1906, and May 23, 1906, at Dallas, Texas, a large number of this species of bee were collected by Messrs. Crawford, Bishopp, Jones, Pratt, and the writer from the flowers of *Sitilias caroliniana*, *Serinea oppositifolia*, *Lindheimera texana*, and *Engelmannia pinnatifida*. Following is a table of the captures for the entire period. All parasites were beneath the fourth segment.

151 male bees;	120 unparasitized,	31 parasitized.
115 female bees;	54 unparasitized,	61 parasitized.
266 bees;	174 unparasitized,	92 parasitized.

56.7 per cent of the bees were males, 43.3 per cent females.
33.6 per cent of the parasitized bees were males, 66.4 per cent females.
79.4 per cent of the male bees, unparasitized; 20.6 per cent parasitized.
46.9 per cent of the female bees, unparasitized; 53.1 per cent parasitized.
65.4 per cent of all the bees unparasitized; 34.6 per cent parasitized.

The following table gives more specifically the extent of parasitism, bringing out the percentage of sexes of the parasites and their relation to each other:

	1 female bee	with 3 female parasites	= 3 parasites=		3 females.
1 male,	6 female bees	with 2 female parasites	=14 parasites=		14 females.
23 males,	17 female bees	with 1 female parasite	=40 parasites=		40 females.
7 males,	37 female bees	with 1 male parasite	=44 parasites	=44 males.	
31 males,	61 female bees	with	101 parasites	=44 males,	57 females.

43.5 per cent of all parasites were males.
56.5 per cent of all parasites were females.

ANDRENA LAPPONICA Zetterstadt.

Theobald (1892) gives a few imperfect records of his observations in this species. The collecting was done at St. Leonards-on-Sea, England.

In 1887, 105 bees out of 180 taken were parasitized=52.7 per cent.
In 1888, 54 bees out of 60 taken were parasitized=90.0 per cent.

The following table is based on the collection of 1888:

	2 female bees	with 3 parasites each	= 6 parasites.
3 male,	6 female bees	with 2 parasites each	=18 parasites.
18 male,	25 female bees	with 1 parasite each	=43 parasites.
21 male,	33 female bees with		67 parasites.

ANDRENA NIGROÆNEA Kirby.

Theobald (1892) also gives similar data concerning this species, but does not state the source of his material. He found

1 male,	3 female bees	with 3 parasites each	=12 parasites.
5 male,	3 female bees	with 2 parasites each	=16 parasites.
12 male,	16 female bees	with 1 parasite each	=28 parasites.
18 male,	22 female=40 bees with		56 parasites.

ANDRENA OVINA Klug (PRATENSIS Nylander).

Friese (1883) made numerous records on the parasitism of *Andrena pratensis*. His records tabulated are as follows:

							Parasites.
October 9:	2 female	bees	with 1 male		= 2 males		= 2
December 11:		1 male bee	with 1 male		= 1 male		= 1
December 11:		1 male bee	with	1 female =		1 female	= 1
December 14:	2 female	bees	with 1 male		= 2 males		= 2
December 14:		2 male bees	with 2 males		= 4 males		= 4
December 14:	1 female,	1 male bee	with	1 female =		2 females	= 2
December 14:	1 female	bee	with 1 male,	1 female =	1 male,	1 female	= 2
February 26:	2 female,	3 male bees	with 1 male		= 5 males		= 5
	5 female,	5 male bees	with	1 female =		10 females	=10
	1 female,	2 male bees	with	2 females=		6 females	= 6
	2 female	bees	with 1 male,	1 female =	2 males,	2 females	= 4
	1 female	bee	with 2 males,	1 female =	2 males,	1 female	= 3
	17 female,	15 male=32 bees with			19 males,	23 females	=42

In other words, the 15 male bees contained 19 parasites and the 17 female bees contained 23 parasites; 6 male and 6 female bees contained males only, 9 males and 7 female bees contained females only, while 4 female bees contained both sexes.

ANDRENA TIBIALIS (ATRICEPS) Kirby.

Enock (1875) on April 5 and 6 took, on Hampstead Heath, England, 45 stylopized and 27 unstylopized specimens of *Andrena tibialis* (*atriceps*). His records tabulated are as follows:

	1 male bee	with	3 females=		3 females	= 3 parasites.
	1 male bee	with 1 male,	2 females=	1 male,	2 females	= 3 parasites.
	1 male bee	with 1 male,	1 female =	1 male,	1 female	= 2 parasites.
1 female,	6 male bees	with	2 females=		14 females	=14 parasites.
	2 male bees	with 2 males,	=	4 males		= 4 parasites.
6 female,	14 male bees	with	1 female =		20 females	=20 parasites.
1 female,	12 male bees	with 1 male	=	13 males		=13 parasites.
8 female,	37 male=45 bees with			19 males,	40 females	=59 parasites.

TETIGONIA, species.

Perkins (1905) cites a pair in copula taken in Hawaii, of which the male bore 2 male pupæ and 2 females, and the female bore 3 or 4 parasites.

The foregoing data may be summarized as follows:

Sex of hosts.

Polistes annularis (Pierce, October), 1,553 wasps; 84.4 per cent males, 15.6 per cent females.
Polistes annularis (Barber, December), 35 wasps; 100 per cent females.
Polistes annularis (McAtee, November), 105 wasps, 9.5 per cent males, 90.5 per cent females.
Polistes, new species (Crawford, September), 216 wasps; 26 per cent males, 74 per cent females.
Polistes, new species (Cushman, October), 28 wasps; 82.2 per cent males, 17.8 per cent females.
Polistes metricus (Austin), 50 wasps; 28 per cent males, 72 per cent females.
Andrena crawfordi (Pierce), 266 bees; 56.7 per cent males, 43.3 per cent females.

Sex of parasitized hosts.

Polistes annularis (Pierce, October), 266 parasitized; 97.3 per cent males, 2.7 per cent females.
Polistes annularis (Hooker, December), 6 parasitized; 100 per cent females.
Polistes annularis (McAtee, November), 6 parasitized; 100 per cent females.
Polistes, new species (Crawford, September), 6 parasitized; 66.6 per cent males, 33.4 per cent females.
Polistes pallipes (Bowditch), 10 parasitized; 40 per cent males, 60 per cent females.
Polistes pallipes (Dury), 14 parasitized; 28. 5 per cent males, 71.5 per cent females.
Polistes metricus (Austin), 9 parasitized; 22.2 per cent males, 77.8 per cent females.
Andrena crawfordi (Pierce), 92 parasitized; 33.6 per cent males, 66.4 per cent females.
Andrena lapponica (Theobald), 54 parasitized; 38.8 per cent males, 61.2 per cent females.
Andrena nigroænea (Theobald), 40 parasitized; 45 per cent males, 55 per cent females.
Andrena pratensis (Friese), 32 parasitized; 46.8 per cent males, 53.2 per cent females.
Andrena tibialis (Enock), 45 parasitized; 82.2 per cent males, 17.8 per cent females.

Parasitism of male hosts.

Polistes annularis (Pierce), 1,311 males; 19.7 per cent parasitized.
Polistes, new species (Crawford), 56 males; 7.1 per cent parasitized.
Polistes, new species (Cushman), 23 males; 4.3 per cent parasitized.
Polistes metricus (Austin), 14 males; 14.2 per cent parasitized.
Andrena crawfordi (Pierce) 151 males; 20.6 per cent parasitized.

Parasitism of female hosts.

Polistes annularis (Pierce), 242 females; 2.8 per cent parasitized.
Polistes annularis (Barber), 35 females; 5.7 per cent parasitized.
Polistes annularis (McAtee), 95 females; 6.3 per cent parasitized.
Polistes, new species (Crawford), 160 females; 1.2 per cent parasitized.
Polistes metricus (Austin), 36 females; 19.4 per cent parasitized.
Andrena crawfordi (Pierce), 115 females; 53.1 per cent parasitized.

Percentage of parasitism according to species.

Polistes annularis (Pierce), 1,553 wasps; 17.2 per cent parasitized.
Polistes annularis (Hay), 54 wasps; 7.4 per cent parasitized.
Polistes annularis (Barber), 35 wasps; 5.7 per cent parasitized.
Polistes annularis (McAtee), 105 wasps; 5.7 per cent parasitized.
Polistes new species (Crawford), 216 wasps; 2.7 per cent parasitized.
Polistes, new species (Cushman), 28 wasps; 3.5 per cent parasitized.
Polistes metricus (Austin), 50 wasps; 18 per cent parasitized.
Polistes texanus (Skinner), 144 wasps; 23.6 per cent parasitized.
Andrena crawfordi (Pierce), 266 bees; 34.6 per cent parasitized.
Andrena lapponica (Theobald, 1887), 180 bees; 52.7 per cent parasitized.
Andrena lapponica (Theobald, 1888), 60 bees; 90 per cent parasitized.

Sex of parasites.

Polistes annularis (Pierce, October), 470 parasites; 65.1 per cent males, 34.9 per cent females.
Polistes annularis (Hooker, December), 17 parasites; 47 per cent males, 53 per cent females.
Polistes annularis (McAtee, November); 20 per cent males, 80 per cent females.
Polistes annularis (Brues, July), 94 parasites; 96.7 per cent males, 3.3 per cent females.
Polistes annularis (Brues, October), 125 parasites; 64.8 per cent males, 35.2 per cent females.
Polistes gallicus (Rosenhauer), 125 parasites; 64.8 per cent males, 35.2 per cent females.
Polistes pallipes (Bowditch, September), 30 parasites; 86.6 per cent males, 13.4 per cent females.
Polistes pallipes (Dury), 38 parasites; 94.7 per cent males, 5.3 per cent females.
Prosopis, species (Saunders), 49 parasites; 65.3 per cent males, 34.7 per cent females.
Andrena crawfordi (Pierce, May), 101 parasites; 43.5 per cent males, 56.5 per cent females.
Andrena pratensis (Friese), 42 parasites; 45.2 per cent males, 54.8 per cent females.
Andrena tibialis (Enock, April), 59 parasites; 32.2 per cent males, 67.8 per cent females.

Maximum parasitism per individual.

Polistes annularis (Pierce), 1 male wasp with 15 male parasites.
Polistes annularis (Hooker), 1 male wasp with 3 male, 3 female parasites.
Polistes annularis (Brues), 1 wasp larva with 31 larval parasites.
Polistes metricus (Austin), 1 female wasp with 7 male parasites.
Polistes pallipes (Bowditch), 1 male wasp with 10 male parasites.
Polistes pallipes (Dury), 1 female wasp with 9 male parasites.
Andrena crawfordi (Pierce), 1 female bee with 3 female parasites.
Andrena lapponica (Theobald), 2 female bees with 3 parasites each.
Andrena nigroaenea (Theobald), 3 female, 1 male bee with 3 parasites each.
Andrena pratensis (Friese), 1 female bee with 2 male, 1 female parasite.
Andrena tibialis (Enock), 1 male bee with 3 female parasites.
Andrena tibialis (Enock), 1 male bee with 1 male, 2 female parasites.
Tetigonia, species (Perkins), 1 pair $\begin{cases}\text{male leafhopper with 2 male, 2 female parasites.}\\ \text{female leafhopper with 3 or 4 parasites.}\end{cases}$

In studying these figures, which are gathered under various conditions and by different observers, there are certain conclusions which may be drawn with safety.

1. A large series of observations is always necessary in order to draw valid conclusions. Previous statements that wasps could not

live many days after the exit of the male are now disproven by the hibernation records on *Polistes annularis*.

2. In most cases the largest percentage of parasitized hosts are females. Only a small percentage of the males of any species have been found parasitized. Parasitism of females sometimes becomes very high—53.1 per cent. The highest percentage of parasitism recorded is 90 per cent for *Andrena lapponica*. Next to this must come *Andrena crawfordi*. Of 145 bees taken between April 26, 1906, and May 2, 1906, 81, or 55 per cent, were parasitized, and of the 65 females, 57, or 87 per cent, were parasitized, while only 24, or 30 per cent of the 80 males were affected. The percentage in *Andrena lapponica* for 1887 is also worthy of note—52.7 per cent of 180 bees.

3. In the majority of cases there are a great many more male than female parasites. The only two exceptions—*A. pratensis* and *A. tibialis*—were winter and early spring records.

4. Male parasites were found in all parts of the hosts' abdomen except the ultimate or genital segments. Female parasites seldom occur before the fourth segment, although they are sometimes found in the third. The third segment is the normal location of the males, and the fifth the normal location of the females. A parasite will find exit any place around the periphery of a segment where it can get sufficient room. According to Perkins (1905) this does not hold in the case of Homopterous hosts.

5. Both sexes of parasites are often found together in the same individual.

6. A host will nourish as many parasites as can find room in its body. The largest number of larval parasites found in a host is 31, while the largest number of male pupæ found exserted from the body of a host is 15. The host in this case (*P. annularis*) lived several days; it was taken with the nest or may have hatched after the nest was captured. Mr. Bowditch took a male *P. pallipes* in the field, bearing 10 male pupæ, and Mr. Dury took a female bearing 9 pupæ, which was so feeble that it could hardly move around. The latter also took a wasp in the field from which 5 males had emerged.

2. EFFECTS OF PARASITISM ON THE HOST.

1. *Extermination of race or species.*

Although the parasite lives within the body of the host without actually destroying any of its organs, the latter is extremely disabled by the extraction of its body juices through the absorptive power of the parasite. The result is that the host dies without being able to reproduce. When conditions are such that the parasites can not readily be transferred from race to race of hosts, or are by conditions concentrated against the individuals or colonies in a limited locality the possibility is that the race of host and parasites both will become exterminated, the former for the lack of ability to reproduce, the second because of the extermination of their means of livelihood. Theobald (1892) cites the case of *Andrena lapponica*, at St. Leonards-on-Sea. The bees were found in four localities, but extremely local in 1886. In 1887 he took 180 specimens of which 105 were stylopized. In 1888 they were much scarcer, although the climatic conditions were much the same, and the colonies undisturbed; of 60 specimens taken, 54 were badly attacked. In 1889 a few were taken, and in 1890 they had entirely gone. Although the evidence in this case is strongly in favor of the supposition that the stylops was the cause of the extinction of the colony, it must not be overlooked that perhaps Mr. Theobald and other zealous collectors also contributed greatly to the same end.

Only one other definite record of excessive parasitism is on record—that of *Polistes texanus* collected at Pecos, Texas, by A. E. Brown on September 25, 1901 (Skinner, 1903, *a*, *b*), in which 23 per cent of the wasps were parasitized. Only 17 per cent of the *Polistes annularis* studied by the author was parasitized.

The very recent study of *Andrena crawfordi*, however, has added another important instance under this heading. The extent of parasitism in this species has been cited in the conclusions just preceding and need not be further considered at this point.

It is of course undeniable that certain influences act upon each other in such a manner as to prevent the extermination of a species under ordinary circumstances. In order to explain this fact Marchal (1897 *a*) imagines a line or curve of numerical evolution for each species of insect. As the curve of the parasite increases it interferes with the corresponding curve of the host, causing a disturbance of the numerical equilibrium of the latter and consequently upsets the equilibrium of the parasite. Unless some external cause stops the downward curve of the two species by partially arresting the development of the parasite, the two species become extinct. In a state of nature this downward curve may be either checked or not, and hence the rising and falling curves will continue until there cease to be the proper external factors for retarding the downward curve. In other words Marchal wishes to show that the various organisms of nature are mutually dependent and that extraordinary circumstances will cause the extinction of numerous forms by removing some of the elements which naturally operate with or against each other.

2. *Loss of vitality by host.*

It is of course naturally to be expected, at least in cases where several parasites have attacked one individual, that the host should be greatly enfeebled. Hubbard (1892) in writing of *Polistes* (*amer-*

icanus) *crinitus*, says these wasps, which are active and belligerent, when overburdened with parasites "were lacking in vitality, and appeared to be on the sick list, as they rarely left the shelter of the nest." Brues (1903) states that the infested *Polistes annularis* are not as active as normal individuals but are often seen feeding at flowers. Mr. Dury on August 24, 1905, took a female *Polistes pallipes* so laden with parasites that it could hardly move. It contained 9 male pupæ.

Although these observations show a great loss of vitality, it must not be supposed that death occurs quickly in all cases. There are two periods in the biology of the parasites which are particularly grievous to the hosts. One is the period of hatching, when the triungulinids are crawling all over the body of the maternal host; and the other is the period of activity of the male, striving to release itself from its enshrouding envelopes. On a preceding page it has been shown that individuals of *Polistes annularis* lived between thirteen and sixteen days after the exit of males from their bodies and also were found hibernating thus. Brues (1905) found seven *P. annularis* in the field with empty puparia. Mr. Dury has kept *P. pallipes* as long as twenty-one days after the emergence of the parasites. On July 19, 1906 Messrs. Bishopp and Jones took a *Polistes rubiginosus* with six empty puparia.

It is well known that bees usually travel great distances in search of the flowers they are accustomed to visit, the localities convenient for nesting seldom being in close proximity to the flowers. Hence it may be seen that the bees bearing parasites must often have considerable vitality remaining in order to visit the flowers, for in going to and from the flowers they must at one time or the other fly in the face of the wind. When heavily laden with a parasite this would be a rather difficult undertaking. It may be possible that parasitized bees do not return to the vicinity of the nests at night, but remain near the flowers. All parasitized bees taken in North America up to the present time and known to the author have been taken at flowers.

In the study of the parasitism of *Andrena crawfordi*, Mr. Crawford and the writer have made very close observations on all points possible. A diligent search for the nests of this species was made without avail. During April and May this bee is the most common species of the Andrenine bees and the flowers it frequents are the predominant flowers at Dallas, Tex. In past studies it has been found by them that dominant bees generally nest in communities or semi-communities—that is, that the nests are close enough together to be remarked. So far, in spite of very frequent excursions with this object in view no such conditions could be found. The effort was made to ascertain the direction of flight, but this led to nothing.

Two focal points were found around which the highest percentages of parasitism were noted; beyond this no more has yet been worked out.

The dominant flower is *Sitilias caroliniana;* it is everywhere. It opens about 7 a. m., and closes shortly after 9 a. m.; hence the collecting was all done between these hours. The flowers open in all kinds of weather and the bees visit them notwithstanding; on clear, sunny days they are very alert and fly easily, being disturbed by the slightest shadow, while on cloudy days they may be approached easily, and on damp, misty, or rainy days they rise with difficulty and fly slowly. It was always noticed that parasitized bees, especially those which had contained males, did not start easily, and were of a heavier flight, as though burdened and unbalanced.

3. Acceleration or retardation of development.

Whether the presence of the parasite actually influences the time of development of the host is as yet a matter of some conjecture. Saunders (1850), with regard to *Prosopis rubicola* bred in 1847, records "those bees which produced parasites being always observed in the imago state before others not parasitically affected," and in an unpublished notation opposite this remark Saunders has added: "Instance of this precocity exhibited also in the first reared in 1851. Exceptional, however."

The writer has observed, as recorded under the examinations of parasitized *Polistes annularis*, that the immature wasp larvæ which remained longest in the nest were unparasitized. These young were probably immune because no female parasite taken showed a sufficient development of eggs to have produced triungulinids in time to attack them.

In the case of *Andrena crawfordi* the evidence points decidedly toward acceleration. The first flowers of *Sitilias caroliniana* appeared about April 24; *Serinia oppositifolia* had been in flower a week longer. On April 26 the first *Andrena* were taken. On this and the two following days 74 bees were collected and 59 or 79 per cent were infested; 68 per cent of the parasites were males, and in only three cases were these still in the pupa state. After April 28 the per cent of parasitism rapidly decreased.

4. Alteration of general features.

Perez has contributed several very valuable articles on the effects of parasitism in *Andrena* and the author has established the groundwork of the following paragraphs on his work (Perez, 1886). A few observations by Mr. Crawford have been kept separate and inserted after section 5 (p. 34).

a. Abdomen.—In *Andrena trimmerana* the abdomen becomes sensibly shortened and inflated, and more or less globulose. The attenuation of the posterior segments becomes diminished and the terminal segments of the female become more pointed than normally. The teguments of the abdomen contract irregularly and often fold in drying after death, and assume a scarious appearance (Perez, 1886).

On July 3, 1906, at Dallas, Tex., Mr. W. A. Hooker collected a male *Leionotus annulatus* Say (fig. 1), at *Helenium tenuifolium*, containing one female *Leionotoxenos hookeri* Pierce. It seems that in pushing itself out between the segments the parasite completely split the dorsal tergites of segments three, four, and five, and split segment two halfway to the base. The parasite was located behind segment three. This is the first case known to the author of an actual injury to the body of the host.

The accident and subsequent recovery of the host is in itself remarkable, but the most curious part relates to the reparation of the wounded parts. The broken surface of segment two fused solidly to segment three and a portion of segment four, the line of fusion being shown by the difference in the puncturation. The right broken edge of segment three, continuing the fusion with segment two, fused solidly to the left broken edge of segment four, leaving a loose unconnected flap of segment three above. Thus the parasite's cephalothorax protrudes under the ledge formed by fusion of segments three and four and overlaps the right broken piece of the latter segment. Only a small piece of segment five is to be found. The right flap of the terminal segment is greatly developed in comparison to the left. As a consequence of the strange fusion the color pattern is greatly jumbled.

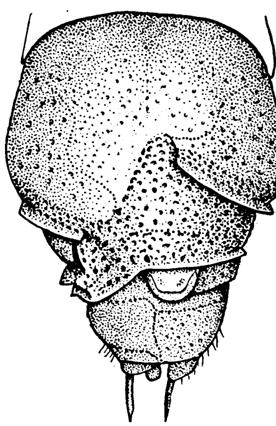

FIG. 1.—DISTORTED ABDOMEN OF LEIONOTUS ANNULATUS CONTAINING LEIONOTOXENOS HOOKERI.

With the inconsiderable amount of literature at hand, the writer can find only one reference to reparation of chitin. Packard (1898, 30) writes: "The reparative nature of chitin is seen in the fact that Verhoeff finds that a wound on an adult *Carabus*, and presumably on other insects, is speedily closed, not merely by a clot of blood but by a new growth of chitin."

This case is remarkable in that the insect recovered from wounds inflicted from within by the struggles of a parasite very nearly filling its abdomen, and inflicted at the time of metamorphosis while the body was still tender. There is no evidence whatever of parasitism causing a loss of vitality in this specimen. It is an interesting case in that it ably illustrates the power of chitin to fuse and protect the body in case of accident.

b. Head.—In *Andrena trimmerana* the head of the stylopized individuals is usually smaller than that of normal individuals. This condition is due to the turning of the nutritive elements to the abdomen where they are needed by the parasite (Perez, 1886).

c. Color.—Dr. W. M. Wheeler has found that parasitized *Polistes metricus* are much altered in coloration and has in preparation a series of notes on these color changes. *Prosopis gibba* occasionally exhibits irregular rufous patches on the abdomens of affected individuals (Saunders, 1850). *Prosopis rubicola* exhibits color change regularly. "The nymphs of those Hylaei which are likely to produce the pale-colored specimens (*H. versicolor*), which prove, as anticipated, to be only a variety of the *H. rubicola* consequent upon parasitic absorption, may usually be identified within one or two days of their final metamorphosis by assuming a yellow tinge, and may be set apart as certain to produce male parasites" (Saunders, 1852).

d. Villosity.—According to Perez the villosity of the abdomen of a stylopized *Andrena* is much more dense, especially on the last segments and its coloration is altered. In general the stylopized bee has the hairs of the last segments, more abundant, longer, more silky, both on the marginal fringes and the disk of the segments, and the color becomes lighter reddish or golden. As examples Perez (1886) cites *Andrena piceicornis* (stylopized) *isolita* Dufour, and *A. labialis* (stylopized) *separata* Smith. Note Mr. Crawford's observations on *Andrena crawfordi* beyond (p. 34).

The villosity of the thorax in species having scaly, short, appressed hairs covering the tegument may be altered by the elongation and redressing of the scaly hairs and giving them more of the appearance of ordinary hairs. As example Perez cites *Andrena aeneiventris* Moraw.

e. Punctuation.—The punctuation becomes finer, more superficial and closer, as for instance *Andrena trimmerana* Kirby, *Andrena fulvescens* Smith. Note the contrary observation by Mr. Crawford on *Andrena crawfordi* (p. 34).

5. *Alteration of external sexual characters.*

Secondary sexual characters.—a. Color of clypeus.—In the genus *Andrena* the color of the clypeus in many species is used to distinguish the two sexes, the males having a yellow or white clypeus while the females have the same black. It was found by Perez (1886) that when these species are parasitized the color of the clypeus tends toward the normal coloration in the opposite sex. To exemplify this point he cites the following species: *A.* (*variabilis*) *fimbriata* Brullé, *A. leucolippa* Perez, and *A. labialis* Kirby. Certain species were found to vary more readily on certain parts of the face than on other parts. Thus *A. decipiens* Schenck has the clypeus more frequently colored than the cheeks, and *A.* (*schencki*) *labiata* Schenck has the color more persistent on the cheeks than on the clypeus. Chitty (1902) found a specimen of *A. chrysosceles* Kirby, in which the clypeus lacked its usual conspicuous white color. In all females of *A. bipunctata* Cresson seen by the author there have been noticed the presence of yellow markings on the clypeus, which should not normally occur. One female had five yellow spots irregularly placed, while two others had a solid irregular blotch of yellow. One female of *A. cressoni* which normally has the clypeus black in that sex had yellow markings.

b. The fovea (*striga frontalis*), which in certain species is characteristic of the female only, is found to some extent in the stylopized male and suffers diminution in the stylopized female. Perez cites as examples *A. trimmerana* Kirby and *A. nigroaenea* Kirby.

c. The anal fimbria of the stylopized female sometimes entirely disappears, or the length and number of hairs is considerably reduced. On the other hand in the male the fifth and sixth segments of stylopized individuals sometimes become clad with long hairs so that the individual may be mistaken for a female. As exemplary of this change Perez cites *Andrena nigroeaenea* Kirby.

d. In the antennæ the relative lengths of the second and third joints of the funicle in the stylopized bee tend toward the characters of the opposite sex. This change is very clearly shown in *Andrena trimmerana* Kirby by Perez's figures (1886).

e. Organs of work tend to assume the form found in the other sex. The female tibia becomes slender, and less enlarged outwardly; the hairs diminish in development and number; the tibial brush disappears. The coxal and metathoracic scopa (*houppes*) suffer a diminution in number, size, and curve of hairs. The female metatarsal brushes become diminished by the lessening of the strength and number of hairs and the enlargement of the joint is diminished. The males on the contrary sometimes show an enlargement of this joint and a marked developement of the brush, as for instance *A. trimmerana* Kirby (Perez, 1886). Mr. Crawford also noticed in several stylopized *Andrena* in the writer's collection, a diminution in the size of the tibiæ, but as no normal specimens were procurable at the time more definite data can not be given at this writing. Note his statement concerning *Andrena crawfordi* (p. 34).

Primary sexual characters.—*a. Ovipositor.*—In stylopized females the ovipositor becomes shortened. Perez records a female *A. afzeliella convexiuscula* with this organ shortened one-third.

b. In stylopized male bees the copulatory apparatus becomes diminished in length, width, and curvature.

c. Stylopized leafhoppers can hardly be determined on account of alterations of the genitalia according to Prof. E. D. Ball.

That parasitism does not entirely prohibit copulation is evidenced by several records. Mr. Dury took a female *Leionotus foraminatus* Saussure, containing a female parasite in the third segment, while in copulation on August 10, 1901, at Cincinnati, Ohio.

Perkins (1891) showed that males containing female stylops were "apparently capable of reproduction." He also cites (1905) Piffard as collecting a stylopized male bee copulating, but probably the most conclusive record of all is that of a male *Tetigonia*, "bearing two great male puparia and two mature female parasites, which was in copula with a female carrying three or four parasites."

On April 27, 1906, Mr. Crawford took a male and female *Andrena crawfordi* in copula, each of which bore an empty male puparium. On April 28 he took a pair in which the male was unparasitized and the female bore two female parasites. On April 30 the author took a pair in which the male bore a female parasite and the female was unparasitized.

Owing to Mr. Crawford's knowledge of the available characters in Apoidea, the writer has submitted all of his parasitized material to him for examination. The results of Mr. Crawford's observations upon *Andrena crawfordi* are given below, and the writer feels it incumbent upon him to acknowledge the services of Mr. Crawford in this respect and upon this point.

1. Puncturation of abdomen less strong, punctures finer and sparser; especially noted on second segment.

2. In females with male parasites the basal joint of the hind tarsi is narrower, approaching the shape of the corresponding joint of the male tarsi; this joint not noticeably narrowed in female with female parasites.

3. Scopa of parasitized female thinner, plumosity shorter, not so silky.

4. Out of 6 males with male parasites 2 show the second transverse cubital gone in both wings; 1 has stubs at each end, however, in right wing; 1 has the first transverse cubital slightly interrupted in both wings. Out of about 110 nonparasitized males none show any variation.

5. Out of 38 females with male parasites 1 has the left wing with 3 submarginals, the right wing with 2 submarginals; 1 has 2 submarginals in both wings but right wing with a stub of the nervure; 1 has first transverse cubital of the left wing one-half gone; 45 nonparasitized females show no variation.

None of the other salient alterations found by Perez could be expected in this species because of the close resemblance of the two sexes. *Andrena crawfordi* is a very generalized bee.

The left wing of the only parasitized specimen of *Andrena advarians* in the writer's collection has a spurious nervure in the third discoidal cell. Whether due to parasitism or not, such an aberration is of interest. The results of wing examination in *Andrena crawfordi* would lend credence to the assumption that parasitism does affect the tracheation of the wings. A larger series is necessary to prove this point.

Mr. Crawford has furnished the following list of *Andrena* which are known to lack the second transverse cubital vein at times. It would be interesting to know whether parasitism was invariably the cause.

Andrena arabis Robertson.
crawfordi Viereck.—A known stylopized species.
geranii Robertson.
illinoiensis Robertson.—A known stylopized species.
platyparia Robertson.
Opandrena bipunctata Cresson.—A known stylopized species.
personata Robertson.
robertsonii Dalla Torre.—A known stylopized species.
Pterandrena asteris Robertson.
krigiana Robertson.
solidaginis Robertson.—A known stylopized species.
Trachandrena claytoniæ Robertson.—A known stylopized species.
forbesii Robertson.
hippotes Robertson.—A known stylopized species.

6. *Synonymy due to stylopization.*

Stylopization may so change a species that it can not be identified unless one understands the direction of the changes under such conditions. A stylopized male or female is a male recovering the characters of the female, or a female borrowing the attributes of the male (Perez, 1886).

Notable examples of forms based on stylopized individuals are:

Andrena afzeliella (stylopized) *convexiuscula* Kirby.
Andrena nigroænea (stylopized) *aprilina* Smith.
Andrena, sp.? (stylopized) *picicrus* Schenck.
Andrena solidula (stylopized) *junonia* Viereck.
Andrena subtilis (stylopized) *angustitarsata* Viereck.
Andrena tibialis (stylopized) *mouffetella* Kirby.
Andrena trimmerana (stylopized) *picicornis* Kirby.
Andrena trimmerana (stylopized) *picipes* Kirby.
Prosopis rubicola (stylopized) *versicolor* Saunders.

It is very probable that most of the complicated synonomy in *Andrena* in Europe is due to stylopization.

Two of the above instances are on the initiative of the writer with the support of Mr. Viereck, the describer. The latter stated (Viereck, 1904, 222) concerning his *Andrena junonia*—

This may be *solidula* altered by *Stylops*.

The species were separated thus:

♀ Face with ochreous hairs; first recurrent nervure received beyond the middle of the second submarginal cell; pleura with pale pubescence—*solidula*.

Face with ochreous hairs; first recurrent nervure received before the middle of the second submarginal cell; pleura with pale pubescence—*junonia*.

Both *junonia* and *solidula* are parasitized by *Stylops solidulæ*.

Andrena angustitarsata was described thus:

♀ 9 mm. Pubescence ochreous; fovea ochreous. This is a stylopized specimen and may be an aborted *A. subtilis*, the abortion due to the presence of the stylops.

The species is separated from *subtilis* as follows:

♀ Metatarsus of posterior legs one-half as wide as the tibiæ at apex; inclosure smooth; abdomen indistinctly fasciate—*angustitarsata*.

Metatarsus of posterior legs more than one-half as wide as the tibiæ at apex; inclosure smooth; abdomen fasciate; clypeus indistinctly punctured, dull, pubescence sparse—*subtilis* (Viereck, 1904-1906).

Several interesting points in nomenclature have been worked out, among which probably the most interesting is as follows:

Andrena convexiuscula and *Andrena afzeliella* were both described by Kirby on the same page, the former being placed first. Smith (1855, 103) found that *convexiuscula* was a form entirely due to parasitism and only existed as parasitized individuals, which according to Perez (1886) are usually unable to reproduce. Perez found that *afzeliella* is the normal, unparasitized form of the same species, although certain unmodified individuals were found parasitized. He therefore wrote the species *Andrena afzeliella convexiuscula* Kirby (Perez, 1886). Dalla Torre (1896), following a strict interpretation of the rules of priority, wrote the species *Andrena convexiuscula* (stylop.) *afzeliella* Kirby in which he incorrectly stated the case. Alfken on the other hand in 1899 reversed the matter and restored Perez's manner of naming it. In order to be certain on this matter the writer placed the question before Dr. C. W. Stiles, who decided that the first decision, that of Perez, should stand.

In the list of hosts in the genus *Andrena* several forms of nomenclature will be noted:

1. "*Andrena bicolor* Fabr. form *gwynana* K. (æstival)," indicating that the two generations of this species are dissimilar and have received different names.
2. "*Andrena afzeliella* K.," indicating a typical species.
3. "*Andrena afzeliella* K. (stylop.) *convexiuscula* K.," indicating a form due entirely to stylopization.

4. "*Andrena afzeliella fuscata* K.," indicating a normal variation.
5. "*Andrena tibialis* K. (*atriceps* K.)," indicating a synonym which has been used in the literature on the subject.

7. *Injury to internal organs.*

a. Alimentary system.—Newport (1851) found in *Andrena trimmerana* Kirby the intestine of a parasitized bee to be almost entirely empty and thrust out of its usual position.

b. Nervous system.—The same entomologist found the ganglia of the abdominal portion of the nervous cord to have been atrophied and smaller than usual.

c. Respiratory system.—Newport likewise found the organs of respiration to be small and imperfectly developed, and retaining more the tracheal condition of the bee larva than that of the adult insect, the vesicles being few and imperfect.

d. Secretion.—Newport found the secretory tubes and poison glands reduced. Saunders (1850) writes as follows of *Prosopis rubicola* Saunders:

> Having noticed two pupæ exhibiting on the right side only, the dark markings which usually precede the development of the bee, I found, on their pupa-pellicles being discarded the next day, that strepsipterous parasites ready to burst forth, had become conspicuously prominent on the opposite side, where their hitherto concealed presence would seem to have had the effect of exhausting the ordinary secretions within.

e. Reproduction.—As a result of stylopization an arrest to the development occurs, effecting an atrophy of the ovary. In stylopized females the largest eggs are smaller than their vitellogenous cells, but the contents of the cells are unchanged. A parasitized female with pollen on its brush showed the external signs of parasitism and likewise had the eggs very far from development. Perez found such conditions in *Andrena flessæ* Panzer, *A. labialis* Kirby, *A. decipiens* Smith, *A. ranunculi* Perez.

8. *Effects upon normal functions.*

Perez has pointed out that before a female becomes conscious of its functional duties, incident to the development of eggs, it will not perform any of its usual functions, and that in cases where the development of the ovary is arrested there is seldom any attempt to carry pollen, or build, or furnish nests. The case of the bee just cited may possibly be an exception, but the writer finds that a great many of the females of *Andrena crawfordi* which are parasitized have considerable pollen on their legs.

9. Effects subsequent to exit of male.

The exit of the male does not necessarily premise death to the host, as has been shown in a previous paragraph. There are, however, external conditions which take advantage of the cavity left by the male and cause death. Brues (1903) believes that a drying of the viscera is incident to the escape of the male because of the admission of air through the often broken pupal envelope. Perkins (1905) asserts that the leafhoppers generally die within a few hours or days after the exit of the male parasite and attributes this to drying and the access of light. He holds that insects parasitized by males are weaker than those containing females, so they are probably even more susceptible on this account.

An after effect recorded only by Perkins is that of fungus attack, regarding which he says:

> Again in the case of leaf-hoppers, at least at certain seasons, no sooner does the male parasite emerge than a fungous disease at once starts its attack in the opening thus made, the results of which are absolutely deadly. Sometimes, but much more rarely, one will find the fungus has developed at the point of protrusion of the female parasites. This fungus disease seems to be a constant concomitant of stylopid attack on leaf-hoppers, both in America, Australia, and Fiji.

The records under *Polistes annularis* indicate a strong possibility that some wasps from which a male parasite has escaped can successfully pass through hibernation.

3. EFFECTS OF VARIOUS HOST CONDITIONS UPON THE PARASITES.

This section is somewhat difficult of treatment, as but few instances can be found upon which to base the discussion.

1. The parasites are dependent upon light in effecting their freedom. Saunders (1850) writes:

> So long as the Hylæi remained in the dark the parasites, deprived of those external influences which under ordinary circumstances would serve to stimulate their dormant energies, made no attempt to abandon their pupa tenements; as an incentive to which light appears to be absolutely essential in order that their perceptions may be awakened to an intuitive consciousness of the bees having quitted their cells.

2. The death of the host does not occasion the death of a male parasite in the pupa stage. Saunders (1852) found an *Hylechthrus* alive five days after the death of the bee. Regarding this record a manuscript note by him in the author's personal copy reads:

> Produced in 1851 from a dead *Hylæus* on placing merely in the window, under the influence of a strong light, but without additional warmth from the sun.

Mr. Dury hatched a male *Ophthalmochlus duryi* from *Priononyx atrata* on August 19, at Cincinnati, Ohio, three days after the death of the host.

3. The enmity of ferocious hosts may result in the death of some males, as is evidenced by Hubbard's records of *Polistes* (*americanus*) *crinitus*.

4. An accidental event was noted by Mr. Dury of a male breaking its pupa-case and emerging into the body cavity of the host, where it died.

5. Fungus attack, in the case of Homoptera, following the exit of a male parasite means death to the remaining parasites.

6. Perez noted a case of the exclusion of a parasite, which had forced its cephalothorax through the pellicle of the pupa at the time of transformation.

7. The sex of the host in a measure determines the mortality of the parasites. In the case of *Polistes* at least the males do not hibernate, while a fair per cent of the females do. By a glance at the paragraphs on extent of parasitism it will be noted that in the autumn the greatest per cent of the parasites were found in the male hosts and that not more than 1 per cent of the female parasites could be expected to exist through the winter, as only such hosts as contained females alone can as a rule stand the rigor of the winter season. (*See Polistes annularis* on pp. 17–20.)

4. BIOLOGY OF THE HOST AS INFLUENCING THE BIOLOGY OF THE PARASITE.

1. Biology of the host.

a. In order to invite attack the host must be in the larval state as demonstrated by Saunders (1852) with *Polistes* larvæ.

b. The development of host and parasite is generally parallel, the exsertion of the puparium of the parasite occurring very shortly after maturity, and being followed in a few days by the exit of the adult. This point will be discussed more fully under the biology of the male parasite. In Homoptera, however, the reverse may often occur. Perkins (1905) writes:

> In the case of the Halictophaginæ we found only mature leaf-hoppers to contain mature female parasites and puparia, but in the case of *Elenchus tenuicornis* the nymph or adult delphacids will alike produce mature parasites of either sex.

2. Social economy of hosts.

The economy of the parasites is directly related to the economy of the hosts. It is somewhat remarkable that among the latter are found very nearly all of the important conditions of social economy known among insects. As the general subject falls under several distinct heads, the exact bearing on the present problem may be better shown by so dividing the discussion.

a. Interrelationship of hosts.—Gregarious insects.—Very little is known of the parasitism in the Gryllotalpidæ and Scutellaridæ, but our knowledge of the elenchid and halictophagid parasites of the Homoptera is constantly on the increase, thanks to the zeal of Mr. Koebele and Mr. Perkins. The Homoptera may very truly be said to be gregarious, for, to quote Osborn and Ball (1897), there are "numerous species of Jassidæ which swarm, often by millions to the acre, upon various species of grass." Under such conditions the minute triungulinids swarming over the grass should have little difficulty in reaching a host, and males should have but a slight distance to travel in order to find a female.

Solitary insects.—Under this grouping fall all of the Sphecoidea, the Eumenidæ, and all of the Apoidea except *Halictus,* which are listed as hosts. The Sphecoidea include ground dwellers and mud daubers, among which the bembecids often dwell in large communities. The writer has observed only two such communities at Lincoln, Nebraska; but Hartman (1905) writes:

> *Microbembex* and *Bembex* are both common in the sandy woods, where they often form large mixed colonies, building their nests side by side in great numbers. When a novice first comes upon one of these populous colonies on mid-day, when business is at its height, he is bewildered by the great number of wasps engaged in the general hubbub around the many holes that riddle the ground.

The Sphecidæ are not communal, being somewhat averse to sociability. Hartman (1905) recalls a fierce combat of two *Ammophila* which happened to dig their nests near each other. The nests of *Sphex* (*Ammophila*), *Chlorion* (*Sphex*) and *Priononyx* are dug in the ground, the parents being very particular as to the location. But one egg is laid in a hole. *Sceliphron* (*Pelopæus*) is a mud dauber and builds several cells adjacent to each other.

The Eumedidæ are solitary workers, constructing a series of loose cells at the base of grass clumps, constructing tubes in holes in wood, in stems of plants, or cementing neat little pots on twigs.

Among the Apoidea a great diversity of nesting habit occurs. As far as the writer knows, *Panurginus,* though dwelling in the ground, (Pierce, 1904) is not communal in habit. *Halictoides, Andrena,* and *Halictus* are ground dwellers. Mr. Crawford has found large numbers of *Andrena pulchella* and *Halictoides marginatus* dwelling in one community at Lincoln, Nebraska. *Halictus* is also found often in communities. *Prosopis* nests in galls and constructs galleries in briars.

Among these solitary insects may be noted two conditions—those that are strictly solitary and those that are semisocial, and live in communities. It may be surmised without much doubt that under the latter condition it is easier for male parasites to find females, since the hosts are generally in swarms. Likewise triungulinids from feeble hosts can more readily reach new hosts in a community than where the hosts are widely separated. *Halictus* is really semisocial, as several females use the same hole.

Social insects.—The remainder of the vespoid hosts fall under this category. They build large nests and observe a division of labor. Triungulinids may with ease pass from their maternal host to the cell of a new larva. Fertilization of the parasites probably takes place among the swarm at the nest.

Here also fall the formicid hosts, which practice division of labor in subterranean nests. Since little is known of the parasitism of ants, the discussion can go no farther.

b. Food habits of adult hosts.—*Spermophagous insects.*—Among the seed-eating insects may be noted only the ants. As the transfer of the triungulinids probably occurs on the ground or in the nests no significance is noticed in the food habit.

Predaceous insects.—The ants belong also under the head of predaceous insects. Here also may be classed all of the Sphecoidea and the Eumenidæ. These wasps are all philotropic and will be more fully discussed under that heading.

Herbivorous insects.—This group includes the Gryllotalpidæ, Scutellaridæ, and Homoptera. Apropos of the Homoptera, Osborn and Ball (1897) write:

> The species of Jassidæ have, as a rule, a decided limitation as to food plant, usually holding closely to one species of plant, almost invariably limited to one plant for breeding, but feeding more indiscriminately in mature stages.

This statement may be applied to most, if not all, of the homopterous hosts thus far recorded. It may be readily seen that where an insect is confined to certain definite food plants the transfer of triungulinids can be much more easily accomplished than where the hosts are indiscriminate feeders.

Philotropic insects.—The majority of the hosts known are flower frequenters, and as such are classed as oligotropic when visiting a single species, genus, or family of flowers, and polytropic when visiting many genera or families of flowers. It is very reasonable to infer that the most ordinary method of transfer of triungulinids takes place at flowers, because of the analogous forms of strepsipterous and rhipiphorid triungulinids. Most of the wasps are flower visitors, because they may quench their thirst in the nectarine liquids. They are consequently polytropic; but the bees are more highly developed and often specially adapted for particular flowers, hence many of them are oligotropic. In this connection the following table may be introduced, giving the range, season, and flower records of the most important hosts of *Stylops* in North America. The list is compiled from the writings of Charles Robertson, Sigmund Graenicher, T. D. A. Cockerell, and Henry L. Viereck, and from records of J. C. Crawford, and host records in possession of the writer, referred to at numerous places in the text. The species are arranged according to season.

Genus *Andrena* sg. *Andrena*.	Genus *Stylops*.	Range.	Season.	Flowers.
hartfordensis Cockerell.	*hartfordensis* Pierce.	Wisconsin, Connecticut, Georgia.	Mar. 27 to June 2.	*Angelica*, *Symphoricarpos*, *Taraxacum*, *Thaspium*, *Vagnera*, *Viburnum*.
illinoiensis Robertson.	*bruneri* Pierce	Washington, Nebraska, Wisconsin, Illinois.	Apr. 2 to May 7.	*Amelanchier*, *Erigenia*, *Geranium*, *Salix*, *Stellaria*.
vicina Smith	*vicinæ* Pierce	British Columbia, Washington, Oregon, New Mexico, Wisconsin, Massachusetts, Connecticut, New Hampshire, Canada.	Apr. 15 to June 18.	*Caltha*, *Erythronium*, *Prunus*, *Ribes*, *Rosa*, *Salix*, *Sanguinaria*.
polemonii Robertson.	*polemonii* Pierce	Colorado, Illinois	Apr. 20 to Apr. 28.	*Polemonium*.
nivalis Smith	*graenicheri* Pierce	Wisconsin, Hudson Bay.	May 9 to June 27.	*Cornus*, *Geranium*, *Heracleum*, *Ribes*, *Rubus*, *Thaspium*, *Vagnera*.
corni Robertson	*cornii* Pierce	Illinois, Wisconsin.	May 27 to July 9.	*Angelica*, *Cornus*, *Rhus*, *Rubus*, *Rosa*, *Sanicula*, *Viburnum*.
multiplicata Cockerell.	*multiplicatæ* Pierce.	Wisconsin	May 29 to July 30.	*Ceanothus*, *Cornus*, *Rhus*, *Spiraea*, *Symphoricarpos*, *Thaspium*, *Veronica*.
nubecula Smith	*nubeculæ* Pierce	Colorado, Nebraska, Illinois, New York, New Hampshire, Nova Scotia.	July 26 to Oct. 9.	*Aster*, *Solidago*.
sg. *Pterandrena solidaginis* Robertson.	*swenki* Pierce	Nebraska, Illinois, Wisconsin, Pennsylvania.	Aug. 22 to Oct. 11.	*Aster*, *Boltonia*, *Poligonum*, *Solidago*.
crawfordi Viereck.	*crawfordi* Pierce	Texas	Apr. 26 to May 23.	*Sitilias*, *Serinea*, *Lindheimera*, *Engelmannia*.
sg. *Opandrena bipunctata* Cresson.	*bipunctatæ* Pierce	Nebraska, Texas, Wisconsin, Illinois, Indiana, New York, Alabama.	Apr. 5 to June 17.	*Amelanchier*, *Angelica*, *Claytonia*, *Cornus*, *Cratægus*, *Erigenia*, *Prunus*, *Salix*, *Staphylea*, *Stellaria*, *Symphoricarpos*, *Viburnum*, *Zanthoxylum*.
cressonii Robertson.	*cressoni* Pierce	Vancouver, British Columbia, Oregon, Wisconsin, Illinois, Maine.	Apr. 5 to July 5.	*Acer*, *Amelanchier*, *Claytonia*, *Cornus*, *Geranium*, *Heracleum*, *Hydrophyllum*, *Pastinaca*, *Pimpinella*, *Polytænia*, *Prunus*, *Salix*, *Sanicula*, *Stellaria*, *Vagnera*, *Zanthoxylum*, *Zizia*.
robertsonii Dalle Torre.	*robertsoni* Pierce	Illinois, Wisconsin, Ohio.	June 26 to July 16.	*Ceanothus*, *Krigia*, *Rhus*.
sg. *Ptilandrena erigeniæ* Robertson.		Illinois, Wisconsin.	Mar. 26 to May 14.	*Claytonia*, *Erigenia*, *Hydrophyllum*.
sg. *Trachandrena claytoniæ* Robertson.	*claytoniæ* Pierce	Illinois, Wisconsin, Georgia.	Mar. 21 to June 4.	*Amelanchier*, *Antennaria*, *Cercis*, *Claytonia*, *Heracleum*, *Salix*, *Zizia*.

Genus *Andrena* sg. *Andrena:*	Genus *Stylops.*	Range.	Season.	Flowers.
salicifloris Cockerell.	*salicifloris* Pierce..	Vancouver, British Columbia, Washington.	Apr. 4 to June 3.	*Ribes, Salix.*
hippotes Robertson.	*hippotes* Pierce....	Washington, Oregon, Wisconsin, Illinois, Ohio.	Apr. 21 to June 26.	*Angelica, Celastrus, Salix, Spiræa, Prunus, Viburnum.*

Since *Andrena crawfordi* is a new species, and the material belonging to Mr. Crawford and the author is typical, it may be of interest to introduce the records taken to date. *Sitilias caroliniana* is the typical flower. During 1905 none were collected on anything else. During 1906 104 male bees and 100 female bees were taken at this flower; 9 male bees and 9 female bees were taken at *Serinea oppositifolia;* 34 male bees and 5 parasitized female bees were taken at *Lindheimera texana,* 3 male bees at *Engelmannia pinnatfida,* and 1 male at a species of *Aplopappus.*

A few characteristics have been provisionally set down for the divisions of the old genus *Andrena,* some of which may be of interest. *Ptilandrena* is supposed to be generally oligotropic and vernal; *Opandrena* and *Trachandrena* are vernal; *Andrena* is vernal with the exception of *A. nubecula; Pterandrena* is autumnal with a few exceptions. *Pterandrena* and *Opandrena* are characterized by yellow face markings in the males, and hence here are to be found those species which will show color variation on the clypeus of parasitized individuals. By vernal is meant that the bees finish their flight before July 30.

c. Food habits of immature hosts.—The manner of feeding the young or of starting them into life has a very direct bearing on the economy of the parasites. For purposes of convenience this subject is divided into three groups.

Autophagous larvæ.—Those larvæ which are entirely self-feeding and not dependent upon the parent for more than the deposition of the egg in a proper place may be known as autophagous (from *αὐτός* = self + *φαγεῖν* = to feed). The homopterous, heteropterous, and orthopterous hosts are all autophagous, and furthermore are open-air feeders, thus enabling the triungulinids to attack them at any time during their larval period.

Chilophagous larvæ.—Those young which feed upon stored up or foraged provisions are here designated as chilophagous (from *χιλός* = forage + *φαγεῖν* = to feed). Under this group may be placed the Sphecoidea with the exception of some Bembecidæ, and the Apoidea. All hosts which store food for their young, that is trophapothetic insects (from *τροφή* = food + *ἀπόθεσις* = storing), which seal the nests up as soon as sufficient food is stored for the nourishment of the larva, belong under this grouping. It is needless to say that in such cases there is but the brief period of about a day during which the triungulinids may reach their prospective hosts, and that they must in some cases wait several days for the host larva to leave the egg stage.. When the hosts are predaceous the chances are that they seldom visit flowers during the nest building period, and it may be necessary for a triungulinid to remain for days on a flower or on a secondary host while it awaits an adventitious moment for furthering its search of a permanent host.

When the hosts are pollen-gatherers it is probable that multitudes of triangulinids may be swarming over the nest builders awaiting an opportunity to settle in newly made nests.

Heterophagous larvæ.—Those young which require to be fed by others have been called heterophagous (from ἕτερος = another + φαγεῖν = to feed). Under this grouping belong the Formicoidea, Vespoidea and *Bembex* and *Monedula* in the Bembecidæ. Concerning these latter genera, Hartman (1905, 25) writes that "*Microbembex,* contenting herself with any insect she finds, has an advantage over *Bembex,* her nearest relative, and *Monedula,* both of which feed their larvæ from day to day." Peckham and Peckham in "The Solitary Wasps," page 67, corroborate this statement, but Hartman shows (1905) that *Bembex belfragei* after storing the hole closes it up.

As these larvæ are accessible to triungulinids throughout this period of their existence it is reasonable to expect that parasitism among them should reach a very high percentage.

d. Life cycle of hosts.—*Homoptera.*—Concerning the leaf hoppers, Osborn and Ball (1897, 613) state that:

> There is a wide difference in life histories, some having one brood, the majority of the grassfeeding species two, and still others three in a season, and the successive stages occurring at widely different times.
>
> Except in the case of adult hibernation the ordinary life of a brood of adults does not exceed two months, and for the individuals of a brood rarely over one. The males appear a week or ten days before the females and disappear as much earlier. In general one brood of adults will have disappeared before the larvæ of the next have matured, so that individuals collected at any time may be referred with assurance to a particular brood.

This summary is very useful, as it indicates in a few words the exigencies of parasitic life among the Elenchidæ and Halictophagidæ. There must be one to several broods of parasites, according to the number in the host species. It is probable that adult fertilized females hibernate in adult hosts. The period between broods must be bridged by the triungulinids in waiting unless an alternation of hosts takes place. Systematic studies do not at present support the theory of alternation of hosts. The epoch of parturition must be rapid.

The other prominent conditions of host biology may be best glanced over by quoting four paragraphs from Saunders (1850), in which he discusses the bearing on the parasites.

Polistes.—

It is well known that among wasps neuters alone are produced up to a certain period, upon which the duty subsequently devolves of preparing the cells set apart for females; and the *Xenos* being essentially dependent upon the hibernation of the latter the female parasite of the preceding year must either await the occasion when the cells of the female wasps are so prepared for the reception of ova, or otherwise, transmitting her posterity to these females through the intermedium of neuters in the first instance, the *Xenos* would thus prove to be double-brooded.

The statistics previously quoted concerning parasitism of *Polistes annularis* would amply bear out this conclusion, or rather that there is almost continuous breeding of the parasites throughout the summer.

Under the peculiar embryogenous and metamorphotic conditions affecting the continuations of the species it is manifest that these parasites could not perpetuate their existence in company with the social Vespidæ unless the epoch of parturition were thus protracted until the following year, so as to enable them to transfer their hexapod progeny to the succeeding colony of wasps.

This conclusion is proven by the breeding of male parasites from *Polistes annularis* in October and the fact that all of the fall female parasites were but just mature and that the eggs had just begun to form. Male parasites are probably rarely carried through the winter on account of the unusual debilitating influences felt by the hosts bearing them.

Andrena.—

In the case of *Stylops*, * * * the necessity exists for the rapid development of the ova, the Andrenæ enjoying but a limited term of existence at large, and it being therefore essential that within the brief period of a few weeks the female parasite should fulfill the part assigned her and the young hexapods be ready to occupy their appointed stations in the larva cells of the bee, soon about to be closed.

In the case of *Andrena* hibernation is probably mainly in the immature stage in both host and parasite.

Prosopis.—

A corresponding urgency is imposed upon these parasites on *Hylæus*, although the larva state of the latter continuing throughout the winter and spring involves the necessity of a suitable conformity of habit in the parasite.

BIOLOGY OF THE PARASITE.

FERTILIZATION.

The differentiation of sexes in this order renders the subject of biology one of great interest. The helpless female must lie motionless in the body of its host with only the cephalothorax protruding and await the coming of the active, nervous male.

That the female must be fertilized can hardly be doubted, and yet the nature of the act and the fact itself has been but slightly proven.

Saunders (1850) states that the presence of eggs has never "been detected in any vermiform strepsipterous insect obtained from a bee or wasp not taken at large." In 1852 Saunders records having placed a *Prosopis rubicola* Saunders bearing a female which had just transformed with a male *Hylechthrus rubi* Saunders on June 25, and that the male took no notice of the female. On the 26th the experiment was tried with other males without result. On the 27th it was placed with a male which had just quitted its pupa case, the latter immediately settling "upon the abdomen of the bee, quivering his expanded wings, while recurving the abdomen considerably in the direction of his secluded partner, and returning on several occasions to repeat the process." Sagemehl (1882) took a male stylops in copulation on *Andrena parvula* Kirby.

When Mr. Crawford collected the unique male of *Crawfordia pulvinipes* Pierce he did so by accident. He had just bottled a *Panurginus* which was new to him, and on looking at it in the tube he noticed a commotion on the abdomen. The male parasite was attached to the female in the bee's body. It was in an erect position, with the head pointing forward. This would indicate that the abdomen was doubled forward. Fertilization was probably effected by the release of the semina in the brood chamber or in the alimentary canal.

The most recent work on the subject has added an interesting observation on this point. Muir, in speaking of the activity of males of *Elenchoides perkinsi* Pierce (*Elenchus tenuicornis* Muir not Kirby), writes:

> If the hopper bears a mature female parasite, the male settles about half an inch away and crawls toward the hopper, vibrating its wings all the time. This generally disturbs the hopper and it moves off, the *Elenchus* following till it gets a chance to spring upon its back and attach itself to the female. This action disturbs the hopper and it flicks its abdomen to shake off the parasite. * * * I have never seen the male *Elenchus* retain its hold of the female for more than six seconds; generally it is attached only two or three seconds. I am unable to say if fecundation takes place during this time, or exactly how copulation takes place; evidently the tip of the abdomen is inserted into the brood chamber.

OOGENESIS.

This subject has been handled very ably and to considerable length by Brues (1903), and it is therefore only necessary to quote his summary:

> Oogenesis is peculiar and does not resemble that of other insects. Very small larvæ show strings of spherical primitive eggs on each side of the gut. These grow and later break up, giving rise to eggs, each of which consists of a mass of nurse cells bearing a polar cap of cells derived from a primitive egg attached to it. Yolk is formed from the contents of each egg, and when ripe the eggs are scattered about all through the body cavity and lie embedded in the fat body. Maturation seems to occur through the fusion of the second polar body with the pronucleus of the egg. All of the cleavage cells when formed go to make up the blastoderm, which does not cover the whole

egg at first and later draws up to one pole to give rise to the rudiment of the germ-band by a rearrangement and multiplication of its cells. Older embryos are of the usual generalized type, although on account of their length they are curled up in the egg in a peculiar manner.

The foregoing is the oogenesis of *Acroschismus wheeleri* Pierce (*peckii* Brues). Whether this process is the same throughout the order will probably remain for some time a matter for conjecture.

LARVIPAROUS REPRODUCTION.

There is no possibility of oviposition in this order. The period of parturition is passed in the body of the parent, and the young hexapods reach the open air by passing from the body cavity of the parent into a canal formed between the parent's skin and its uncast pupal skin, and thence through a slit opening on the ventral or uppermost side of the cephalothorax, between the head and thorax. The young swarm over the parent's body in immense numbers. Newport (1851) computes that more than 7,000 triungulinids were produced by one female *Stylops aterrima* Newport in *Andrena trimmerana* Kirby. The writer (1904) counted 2,252 young of *Stylops swenki* Pierce (*Xenos?* species) from *Andrena solidaginis* Robertson, omitting all consideration of multitudes of undeveloped eggs. These young reach a new host in one way or another, already described, and immediately commence the attack. Saunders (1852) found that *Xenos* larvæ became completely buried in the body of *Polistes* in three hours, and the next day were completely out of sight.

METAMORPHOSIS.

The discussion of this subject must be confined almost exclusively to *Xenos vesparum*. After the triungulinid has entered its host it commences a development which involves some of the most interesting phenomena known among insects. The campodeoid hexapod grows so rapidly that it soon loses all semblance to its former self and the body grows out of all proportions to the legs. From this point in the biology of these larvæ Nassonow (1892 *e*) must receive all of the credit, and reference to his plates will be of much value. The second instar is devoid of legs and scarabæidoid in form. In the first part of this instar the head, three segments of the thorax, and ten segments of the abdomen are distinct and ventrally flattened, the abdominal segments being shorter than the thoracic (Nassonow, 1892 *e*, pl. 1, fig. 5). During the latter portion of the instar the body becomes cylindrical, and the abdominal segments become as long as the thoracic (Nassonow, 1892 *e*, pl. 1, fig. 6). From this point the development of the male and female is radically different, and it will be best therefore to compare them in parallel columns.

Male.	*Female.*
The third instar shows a partial fusion of the first two thoracic segments with the head still separate. Last abdominal segment fused with the preceding, the segment appearing longer and posteriorly narrowed (fig. 13).	The third instar shows a partial fusion of the first two thoracic segments, with the head still separate. Last abdominal segment fused with the preceding, the segment thus appearing obtuse (fig. 7).
In the fourth instar the anterior end of the head is more pointed, and the eye-spots are smaller; the segments of the thorax are fused; and the rudiments of the legs become more distinct (fig. 14).	In the fourth instar the anterior end of the head is more pointed, the head is shorter, with the eye-spots at the posterior edge; the thorax is differentiated from the abdomen and the segments are fused (fig. 8).
In the fifth instar the head and thorax fuse into acone-like cephalothorax, with a distinct ring suture (fig. 15).	In the fifth instar the head fuses with the thorax forming the cephalothorax, but with the suture discernible (fig. 9).
In the sixth instar the cephalothorax is more differentiated from the abdomen. The anal pore on the tenth and the genital pore on the ninth segments are both distinct (figs. 16, 17).	In the sixth instar the eyes are not perceptible; the cephalothorax is markedly differentiated from the abdomen, flattened dorsally, and somewhat widened; the sutures between the segments completely disappear (fig. 10).
The seventh instar is passed within the skin of the sixth and is really a pupa. The appendages become strongly developed. During this stage the puparium is pushed outwards (figs. 18, 19).	In the seventh instar the cephalothorax is strongly flattened dorsally, depressed and chitinized. The cephalothorax is exserted at this time (figs. 11, 12).
The second or real pupa forms within the skin of the seventh instar. It is essentially similar to the Hymenopterous pupæ (fig. 22).	
The adult male breaks forth from the two pupal skins and thrusts off the cap, or operculum, of the puparium, which was the head of the sixth instar.	The adult female is closely inclosed by the integument of the preceding instar.

ALIMENTATION.

In various places mention has been made that alimentation is probably by osmosis. All evidence points toward this conclusion, as the internal organs of the host are not injured in any way except by crowding and exhaustion of the juices. The mouth parts may or may not play some part in the function. Osmosis probably occurs equally through all portions of the skin.

An important observation by Westwood (1840) calls for more extensive studies in the future. He noticed a cord attaching the base of the abdomen to the integuments of the host and suggested that this was a tube through which food was taken by the parasite.

The writer has frequently noticed some kind of an attachment in specimens extracted by him. The female of *Halictoxenos crawfordi* has a long tube evidently arising from the base of the abdomen.

This same tube is evident in other specimens also. In Xenidæ the attachment seems to be more general and to extend some distance around the base of the abdomen. No definite conclusions may be drawn at this time.

BIOLOGICAL NOTES.

Although the complete biology of no species besides *Xenos vesparum* Nassonow, not Rossi, has been worked out, there are numerous notes which contribute greatly to the biology of the various species. These will be given by species.

MYRMECOLAX NIETNERI Westwood.

Westwood (1858) quotes John Nietner concerning this species as follows:

> The only individual hitherto met with was taken by me at an elevation of 3,880 feet in the hills of Ramboddo, Ceylon, in the act of issuing from the abdomen of a neuter of a species of ant, which had ascended a tuft of grass on an extensive pattena, or meadow, the parasite making its exit back to back from the ant. The capture was effected on the rainy afternoon of the 29th April last (1858). This being about the change of the monsoon and the beginning of continued wet weather, I consider the individual taken a late one, feeling certain that so tender an insect could, as a rule, not well make its appearance during a wet and clammy season, but rather during the preceding four months, which are dry and hot.

STYLOPS ÁTERRIMA Friese, not Newport.

Friese records this species from *Andrena ovina*. On December 11 at 6 p. m. a male hatched and was still alive at 8 a. m. on December 14, although dead at noon of this day, thus giving a minimum length of life of 62 hours (Friese, 1883). On February 26, 1882, at Merseburg, Germany, he took males flying about the Andrena holes between 12 and 12.30 at noon, with the temperature 8° to 9° R. (50° to 52° F.). Concerning this record he says:

> Die Thiere schwirrten mit der ihnen eigenen flatternden Bewegung an dem gegen kalte Winde geschützten Abhange der Andrena-Kolonie in langsamen Fluge hin und her, ohne dass es bei der kurzen Zeit ihres Vorhandenseins zu entdecken war, was ihr Vorhaben war, wenn es sich auch leicht vermuthen liess.

STYLOPS CRAWFORDI Pierce.

Triungulinids of this species were not taken. Although no adult males were found, male exuviæ were taken frequently between April 26, 1906, and May 1, 1906. Male pupæ were taken April 27, and 28, 1906, and from one of the two taken on the latter date an adult male was extracted.

The chronology of the collecting of this species is as follows:

Date.	Bees.		Bees parasitized.		Bees, per cent parasitized.		Parasites.				Parasites, per cent.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male pupæ.	Male exuviæ.	Female.	Total.	Male.	Female.
1906-												
April 26	0	6	0	5	0	83	....	3	3	6	50	50
April 27	8	5	3	5	37	100	1	7	0	8	100	0
April 28	19	36	12	34	63	94	2	29	16	47	65	35
April 30	15	2	4	0	26	0	....	....	4	4	0	100
May 1	20	12	4	9	20	75	....	2	17	19	10	90
May 2	18	4	1	4	5	100	....	....	5	5	0	100
May 3	32	5	4	1	12	20	....	....	6	6	0	100
May 5	18	7	2	0	11	0	....	....	2	2	0	100
May 8	1	12	0	0	0	0	....	....	......	......	......	......
May 9	11	11	1	2	9	18	....	....	3	3	0	100
May 17	4	1	0	0	0	0	....	....	......	......	......	......
May 22	3	3	0	0	0	0	....	....	......	......	......	......
May 23	2	11	0	1	0	9	....	....	1	1	0	100

STYLOPS DOMINIQUEI Pierce.

Dominique records an *Andrena flessæ* at Nantes, France, in April which contained four specimens of this species (Dominique, 1891).

STYLOPS MELITTÆ Kirby (Champion).

Between April 24 and May 5, 1900, and on May 7, 8, 12, and 13, 1899, between 7.30 and 9.30 a. m., in his garden at Woking, England, Champion took males of this species all flying in the hot sun. "Its white wings and sooty black body, as well as its peculiar rapid hovering flight, make it a conspicuous object" (Champion, 1899, 1900).

STYLOPS MELITTÆ Kirby (Chitty).

On May 2, 1900, at Faversham, England, Chitty took a male in his garden (Champion, 1900). About 10 a. m., May 21, 1902, he collected another, and records having found a bee with male exuvium in March. Concerning the flight he says: "My specimen rose and fell up and down the hedge, its wings never ceasing to vibrate until it was bottled."

STYLOPS PACKARDI Pierce.

On April 29, 1864, at Salem, Massachusetts, Packard took a male flying briskly in company with a stylopized *Andrena placida* Smith at the flowers of *Mezercon.*

STYLOPS SPENCII Pickering.

After keeping specimens of *Andrena tibialis* (*atriceps*) for twenty days in a breeding cage Smith (1875) found one that contained a male *Stylops* which shortly afterwards emerged. Enock (1875) collected

14 males and 1 female bee at Hampstead Heath, England, on April 6, containing in all 17 male *Stylops*. The captures were made between 9.40 a. m. and 12.20 p. m. The wind was southwest, the day warm; the sun was out between 10 and 11.30. He gives us the following very interesting note on flight:

At a little before half-past 11 I saw something flying in a very peculiar manner over a broom-brush. I captured it with my net. It proved to be a male of *Stylops*. I think I should know a *Stylops* on the wing the moment I saw it. Its flight is different to anything else I have ever seen—a very peculiar, unsteady flight, something like an *Ephemera*, what I should call an uncomfortable flight, up and down, this way and that way, in fact at all angles, not keeping in one direction more than a few inches, perhaps for about 6 or 7.

STYLOPS VICINÆ Pierce.

On June 18 Packard (1864) took at Salem, Massachusetts, a stylopized *Andrena vicina* Smith, from which triungulinids were issuing to the number of 300, according to his estimate. "In their movements these infinitesimal larvæ were very active as they scrambled over the surface of the body of the parent, holding their caudal setæ nearly erect."

STYLOPS, species.

Smith (1874) recommended searching for stylopized bees between the hours of 9 and 12 in the morning, as according to his experiences the stylops always emerged from the body of the bee on the day on which the latter first quitted its nest, should the day be bright and sunny, and he also mentioned the fact of his never having captured a bee which had a male stylops remaining in its abdomen at a later hour than 12 m. He had himself bred stylops five or six times and had never done so later than the month of April, always having captured the attacked or infested bees early in the day. Saunders (1874) remarked that he had once found a number of bees in the afternoon at dusk, some of which contained male stylops, but that on that occasion the morning had been wet and dull, and therefore the bees had probably only just made their appearance.

Friese (1906) records capturing male stylops on the wing at Strassburg, Germany, April, 1888; Bozen, Germany, July 8, 1896; and three individuals at Schwerin, Germany, on May 4, 1885.

Thwaites (1841) says:

On May 6, '38, caught a *Stylops* flying, and on the Tuesday following saw at least twenty flying about in a garden at Kingdown near Bristol, but so high from the ground that I could capture only about half a dozen. Since that time they have become gradually more scarce, and to-day, May 12, I have not been able to see one.

He says further:

The little animals are graceful in their flight, taking long sweeps, as if carried along by a gentle breeze, and occasionally hovering at a few inches above the ground. Their term of life seems to be very short, none of those I have captured living above five hours.

HYLECHTHRUS RUBI Saunders.

Concerning this species Saunders (1852) contributes a very valuable description of the exsertion of the head of the male from *Prosopis rubicola versicolor:*

I have not unfrequently been enabled to detect the eye shades of the parasite before the *Hylæus* nymph has discarded its pellicle, working to and fro beneath the dorsal tegument; although more conspicuous when the bee first attains the imago form, the head of the parasite being then seen turning from side to side, and steadily pressing all the while upon the rostrum, as the axis about which it revolves, in the ratio of one-eighth of a circle, for the purpose of introducing this between the abdominal folds. Thus when one eye shade advances the other recedes, both being carried deeper below, when the great strain appears to operate upon the upheld rostrum. As soon as the lodgment is effected, this is gradually pushed forward by a continuation of the same process, until sufficiently advanced, the entire operation occupying from one hour in some cases, to two hours in others, and immediately following the ultimate transformation of the bee in its then moist state; after which the parasite remains perfectly motionless. I have sometimes seen parasites thus engaged simultaneously within the same *Hylæus;* and should the attempt not prove successful, the locality is changed for the segmental division next in succession; or, if foiled again here, the parasite sometimes remounts to the preceding one. These efforts have been continued for upward of an hour after a newly developed imago *Hylæus*, within which the eyeshades were discerned, had been emersed in spirits, until at length the parasite appeared to have attained the extreme verge of the segmental threshold ere its career was finally arrested.

At the moment of protrusion the male head is white except the eye shades, but in a few hours the puparium assumes a light castaneous hue. The ordinary period for quitting the pupa-case would appear to be the eighth day after the first protrusion.

After the first burst, produced apparently by the parasite pressing forcibly against the operculum, the head and shoulders being instantaneously protruded on this falling off, a slight effort suffices to liberate the pseudelytra and first pair of legs; when all these organs idly beating the air and agitating incessantly, much exertion is made to effect a passage for the second pair of legs, where the principal detention occurs; after which a few jerks up and down speedily serve to release the metathorax and abdomen; the imago forthwith winging its flight toward the light.

Saunders never succeeded in keeping the males alive beyond the day of exit and rarely more than two or three hours. However, during this brief life they may exert great strength, for one male was seen to draw around the body of its dead host and two other males which later came out.

HYLECHTHRUS QUERCUS Saunders.

In an unpublished manuscript Saunders estimates the term of gestation at from three to four weeks. He found triungulinids on June 3.

HYLECHTHRUS SIEBOLDII Saunders.

Saunders records triungulinids on July 5.

HYLECHTHRUS, species.

The males emerged from the pupa case with the dorsal side up. The puparium is oriented in the same manner (S. S. Saunders, 1852).

ACROSCHISMUS BOWDITCHI Pierce.

Mr. Dury raised a male from a male host in capitivity ten days on September 16, 1905, at 7 a. m., and on September 22, 1905, one emerged from a male host which had been in captivity two weeks. His records show that 2 males emerged prior to August 24, 4 prior to September 13, 5 prior to September 16, 3 on September 16, 1 on September 22, 2 prior to September 27. He also took 2 male pupæ on June 15, and 4 on July 3.

ACROSCHISMUS PALLIDUS Brues.

The time required for males to reach maturity after the wasp emerged varied from about ten to seventeen days, the pupa cases not being protruded between the abdominal segments until several days after the latter left its pupal cell. Brues (1903) bred 24 males in May.

Data were also gathered by the writer concerning the stage of development of this species. On September 23, 241 parasitized wasps were killed by an overdose of anæsthetics in collecting the nests. These wasps had 338 parasites, of which 26 had emerged, 76 females were mature, 188 males were in the pupal stage, 40 female larvæ and 8 male larvæ were in the bodies of the hosts.

On October 9, 16 dead male parasites and 10 alive males were found in the breeding cage; 9 parasitized wasps were dead, from which 3 males had emerged, and in which were 10 adult females and 25 male pupæ.

On October 10, 1 male matured; on October 12, 1 male; October 13, 3 males. On this last date 5 wasps were dead, from which 8 male parasites had emerged, and in which were 2 adult females and 1 male pupa.

On October 14, 3 males matured. On October 16, 2 wasps were dead, from which 3 male parasites had emerged, and in which was 1 female adult.

Of the wasps kept alive since September 23, 34 male parasites have emerged, and yet on October 16 all of the wasps which have died have had but 19 empty puparia.

On October 27 a final count was made of the dead and alive wasps. Eighteen wasps were dead, from which 21 male parasites had emerged, and which contained 23 adult females and 2 male pupæ; 11 parasitized wasps were still alive, from which 5 male parasites had emerged, and in which were 10 adult females. These wasps lived at least a week longer (but were not carefully observed). From five, it appears that the male parasites had been out thirteen or fourteen days.

A summary now shows that since September 23, 34 parasites emerged, and yet the wasps contained 43 empty puparia, which indicates that the wasps containing 4 of these empty puparia lived thus from before September 23 until about October 9, while those containing the remaining five died between October 9 and October 13, thus showing a possibility of living over sixteen days with an empty puparium in the abdomen. Brues (1905, 293) comments on the remarkable fact that 7 wasps were captured in the field with empty puparia. These data given above should dispel any further doubts as to the ability of the wasps to live after the exit of the parasites.

An examination of 2 wasp larvæ on September 28 showed no parasites; in 10 wasp pupæ but 1 female parasite was found; in 10 teneral adults 2 female parasites were found. It would seem that the parasitized wasps had developed most rapidly, or that the period of triungulinid activity ceased before the last eggs were deposited.

An attempt to hatch male parasites from dead wasps failed. A pupa removed from its host remained alive at least two days, but the adult did not mature. This experiment demonstrated the presence of a liquid surrounding the pupa in its puparium.

As to the time of day, the author had one emerge at 2.32 p. m. on October 10; one in the p. m. October 12; at 12.10, 12.20, and 12.26 on the 13th, and at 8.50, 9, and 10.5 on the 14th.

Several observations were made upon the longevity of this species. One found at 2.32 lived until 4.13; one found at 12.26 immediately after emergence lived until 3.15; one found at 9 a. m. lived until 2 p. m., and one lived from 10.05 until 2. Thus five hours was the longest any were kept alive. In this period a great distance could be covered and there can be little doubt but that most of the males fulfill their mission.

On October 13, 1905, the writer had an opportunity of watching the activities of a male almost from the moment of its exit. None were ever seen in the act of emerging, however. The life of the insect was divided into distinct periods: First was the period of violent, feverish activity, succeeded by an even longer period of nervous quietude, then by a few minutes of violent struggle, and finally a collapse and a diminishing nervous quivering.

During the period of activity the buzzing was very distinct at several inches distance. The wings and elytra are in constant and very rapid vibration even when the insect is not flying. The noise is made by the elytra. The antennæ move constantly, the two branches being capable of separate movement. The abdomen moves a great deal, bending down and forward (thus giving added weight to my comment on fertilization). The entire body is a-quiver, especially the tarsi. During this period I noticed no movement of the mouthparts.

Before it had lived an hour the sound became very diminutive, and finally the wings ceased to vibrate. Occasionally, however, considerable movement was manifested.

When about two and a half hours old a violent movement took place for several minutes, which involved mainly foot action. The antennæ, mouthparts, elytra, and body were combed in quick succession by the legs, and finally the insect lost all power of retention of its foothold. It partially regained this, however. It was then that I was able to see a distinct movement of one of the mandibles, and to observe that each part of the thorax was capable of movement by virtue of the elastic yellow commissures uniting the chitinous parts. This was especially true of the prothorax. The abdomen at the end of this period had shrunk to one-half of its original length.

The final period consists of a faint quivering of legs and antennæ, the insect being upon its back.

From these observations several important points may be deduced.

1. The independent movement of the antennal branches indicates that the antennæ form a very important function in the life of the insect.

2. The downward and forward movement of the abdomen indicates that the fertilization takes place with the male in an erect position as recorded for *Crawfordia pulvinipes*.

3. Although not stated in the preceding paragraphs, it was noted that the last two pair of legs assumed the greater part of the burden of supporting the body.

4. The reason for the insects keeping up a constant buzzing sound throughout the active portion of its life must remain unexplained.

5. The presence of innumerable sense bodies on the antennæ indicate to the writer the probability that these organs can detect the presence of the host insect by its sound, or perhaps of the female parasite by its odor.

6. The violent combing of antennæ, mouthparts, elytra, and body would indicate a highly sensitive integument, and suggest that perhaps the maxillary palpi at least also serve as sensory organs.

7. The movement of the mandibles proves them to be not entirely useless. The palpi must have some function, as they are never in two specimens placed in the same attitude.

8. The presence of elastic commissures between the head and three thoracic segments would indicate a line of descent direct from the Thysanura with all of the antecedents lost. This point is strengthened by the passing through the Campodeoid type in the larva. The

immense reduction of the prothorax in *Anthericomma barberi* shows how far specialization has gone within the order itself.

ACROSCHISMUS HUNTERI Pierce.

Triungulinids of this species were found in a parent collected at Victoria, Texas, June 26, 1906, by C. R. Jones. An adult male in its puparium was found September 25, 1906, by J. C. Crawford.

XENOS VESPARUM, Authors.

Nassonow (1893) writes that he found triungulinids in the nests of *Polistes gallica* at Cairo, Egypt, in the middle of March. Saunders (1852) took a female wasp with three prolific female parasites about the middle of July. The same author found that the triungulinids "are enabled to leap to the distance of full half an inch, but by what means this movement was effected" he could not determine. They refused to attack either ovum with inactive embryo or ovum with larvæ attempting to escape, but very readily attached themselves to larvæ of moderate dimensions, affixing both head and tail like leeches. Experiments with three triungulinids fixed the limit of the hexapod stage.

Date.	Larva 1.	Larva 2.	Larva 3.
July 18, 2 p. m.	Affixed	Affixed	
July 18, 3 p. m.			Placed on host.
July 18, 5 p. m.	Completely buried		Half buried.
July 19, a. m.	Completely out of sight	Completely buried	Completely out of sight.
July 19, p. m.		Out of sight	
July 24	Hexapod still	Hexapod still	Had just molted—apodous.

Thus the hexapod stage parasitic is approximately six days.

When in the host the males have the ventral side turned away from the body of the host.

EUPATHOCERA LUGUBRIS Pierce.

A male was bred by Mr. Dury at Cincinnati, Ohio, from *Sphex extremitatus* on August 30, 1905. On September 3, 1905, this species or a close congeneric species was bred by him from *Sphex fragilis* at 1 p. m. On October 2, 1901, a female wasp was taken with an empty puparium.

OPHTHALMOCHLUS DURYI Pierce.

Mr. Dury bred males of this species from *Priononyx atrata*, at Cincinnati, Ohio, on August 16 and 19, 1901. In the latter case the host had been dead three days. As late as September 21, 1901, he took a wasp with a male pupa. A female parasite was taken on June 17, 1900, and on September 21, 1901, a female with triungulinids was captured. Thus the inference may be drawn that there is a continuous series of breeding through the summer, or at least a double brood.

PSEUDOXENOS HEYDENII Saunders.

Saunders (1852) records triungulinids of this species on July 13 and August 9. These young he found to have distinct saltatorial powers. The males emerge from the puparium with the ventral side up, although the puparium is oriented, as in *Hylechthrus*, with the dorsum up. The only date of maturity for the male is July 13.

ELENCHUS, species.

Green (1902) captured a male corresponding almost exactly to the figure of *Elenchus tenuicornis* at night in an acetylene-gas moth trap at Paradeniya, Ceylon. This record is worthy of thoughtful consideration.

ELENCHOIDES PERKINSI Pierce.

Muir (1906) says the males hatched out in the breeding jars between sunrise and 7 a. m. and were dead by noon.

> They are very feeble upon their legs and keep their wings in rapid vibration all the time they are walking. When on the wing they take up a perpendicular position with their antennæ erect and the tip of their abdomen turned slightly under. Sight seems to be the chief sense by which they detect the presence of the leaf hoppers, as I have seen one hovering along one side of a leaf with half a dozen stylopized hoppers on the other side, only a quarter of an inch away, and apparently not knowing of their presence, but should a hopper but show its antenna over the edge of the leaf the *Elenchus* darts toward it and hovers over its back.

INTERNAL STRUCTURE.

In their internal structure the Strepsiptera exhibit several striking peculiarities, and throughout show high specialization. This part of the paper must necessarily be drawn mainly from the excellent articles by Nassonow, which, being in Russian, are inaccessible to most English-speaking entomologists. So well, however, has his work been done that one not cognizant with the language may yet gain much information from the plates. The writer has fortunately had access to a complete English translation of one of the articles and with the aid of a dictionary has been able to gather the meaning of his other plates and in some places of his text. If important observations are overlooked or the plates misinterpreted, it is due to the writer's inability at present to grasp the science of the Russian language.

ALIMENTARY SYSTEM.

The triungulinid is so minute that the character of the intestinal canal could not be studied, but in the first parasitic instars it may be observed. It is then a straight tube passing through the body and consisting of a short gullet, passing into an œsophagus, which dilates into a crop. Thence it is greatly extended as the stomach and terminates in the very short intestine. At about the fourth instar the *gullet* lies nearer the ventral surface of the head as a short, somewhat flattened tube, coated inside with chitin. The walls are lined with strong muscles, circular, longitudinal, and others directed to the walls of the head. The longitudinal muscles pass along the dorsal side only. Four dorsal muscles distend the gullet and are directed sideward and forward, being counteracted by two of the more numerous ventral muscles, which extend sideward and backward. A large number of fibers extend forward to the anterior region of the head. The *œsophagus* has a very slightly developed longitudinal and circular musculature, and on its external surface bears numerous one-celled glands, probably salivary. The *crop* is expanded cone-shape posteriorly, its walls consisting of cylindrical epithelium coated inside with chitin. On the outside a continuation of a weakly developed muscular layer from the œsophagus is observed. As the larva develops the gullet expands and the crop contracts, no longer forming a separate section. The *stomach*, or *middle intestine*, extends from the second thoracic to the eighth or ninth abdominal, but is not distinctly demarked from the crop. At its beginning the stomach is somewhat narrowed. Then it forms a cylindrical tube, which is strongly narrowed posteriorly, ending blindly. The musculature is very slightly developed and consists of ramified fibers sparsely situated on the surface of the stomach in the slightly developed membrane of connective tissue. The epithelium consists of very large cells, which stand out into the cavity of the intestine in the form of hemispheres, or sometimes flask shaped, narrowed at base. Each cell has large-grained protoplasm with nucleus and nucleolus, and is in texture fibrous to reticulate. As the larva develops smaller cells arise at the bases of these large cells, also bearing nucleus and nucleolus. The large cells dwindle, disintegrate, and finally drop out into the intestine. At the same time the small cells increase. In the pupal stages none but minute cells remain. The *posterior intestine* is very short and of very simple structure. At the first it has a conical form, is somewhat flattened from the ventral side to the dorsal, and opens outside on the dorsum of the last segment with an anal opening in the form of a transversal slit. Its walls consist of cylindrical epithelium and are coated inside with chitin. Toward the end of the larval life the intestine somewhat increases in length and assumes a cylindrical form, slightly narrowed at the anterior end. It is cylindrical in the pupa also (Nassonow, 1892 *e*, pl. 1, fig. 23; pl. 2, figs. 1, 2, 4, 6).

In the female the canal has at first the same structure as that of the male. It later differs by the intestine becoming atrophied and the posterior end of the stomach being connected with the outer coverings of the last abdominal segment by means of an epithelial band at the point corresponding to the position of the anal opening. Subsequently this band is apparently resorbed. The anterior intestine becomes flattened from the ventral side to the dorsal and is of uniform bore. The stomach becomes narrowed, and laterally flattened, and a change of epithelium takes place as in the male (Nassonow, 1892 *e*, pl. 2, fig. 17; 1892 *c*, pl. 1, fig. 9).

Malpighian vessels have not been observed in the larval stage, although rudiments probably corresponding to these vessels were found at the end of the male larval stage. At the anterior end of the intestine of the larva protrudings from the dorsal wall begin to form, three in number, spherical, and situated in one row. (Nassonow, 1892 *e*, pl. 2, figs. 9 *e*, 14 *e*.) They are close together and afterwards fuse at their bases and communicate with the cavity of the intestine by one opening, at the same place elongating into blind excrescences (Nassonow, 1892 *e*, pl. 2, fig. 10 *e*). These excrescences become larger at the pupal stage, split up, and appear as if anastamosing with one another. Thus the place of the connection of the excrescences also increases in length and forms a canal by whose means the cavities of the ramification communicate with the cavity of the intestines. This common canal is somewhat expanded at the middle (Nassonow, 1892, pl. 2, figs. 7, 11).

Nassonow assumes that these formations may correspond to the Malpighian vessels by reason of the mode of origin and location.

NERVOUS SYSTEM.

The nervous system in the first days of the parasitic life is very strongly concentrated. The brain, consisting of two large ellipsoid ganglia, extending longitudinally, lies in the first and second thoracic segments. The commissures pass off from the anterior ends of the lobes and extend ventrally to the abdominal mass of ganglia. Optic nerves pass to the ocelli from near the same point. No optic lobes are differentiated. The abdominal mass consists of a fusion of the subœsophageal, thoracic, and abdominal ganglia into one large mass situated in the thoracic and first three abdominal segments (Nassonow, 1892 *e*, pl. 2, figs. 1, 2, 3, 4).

As the larva develops the lobes of the brain tend to become transverse, the ocular lobes begin to form, and the ocelli gradually disappear. The circumœsophageal commissures become more slender while the abdominal ganglion lengthens and becomes constricted at its middle. This constriction becomes greater until the huge ganglion is divided into two smaller ones, the first or "thoracic" lying partly in each of the three thoracic segments, and the second or "ventral" lying in the second and third abdominal segments, and later only in

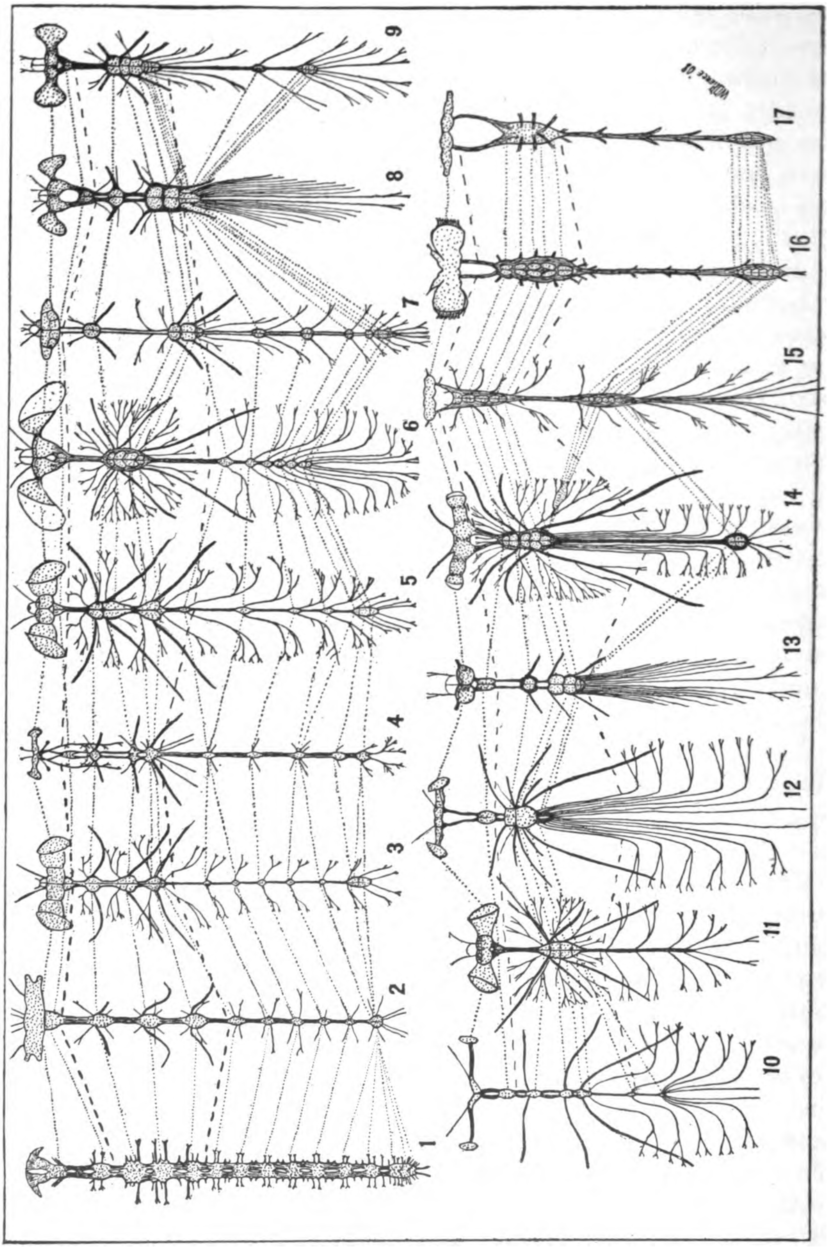

Fig. 2.—Diagram comparing nervous system of Strepsiptera with that of other orders.

1. *Machilis maritima.*
2. *Termes*, species.
3. *Chironomus plumosus.*
4. *Melanoplus spretus.*
5. *Empis stercorea.*
6. *Tabanus bovinus.*
7. *Formica rufa.*
8. *Acilius sulcatus.*
9. *Syrphus ribesii.*
10. *Lucanus dama.*
11. *Sarcophaga carnaria.*
12. *Lachnosterna fusca.*
13. *Melolontha vulgaris.*
14. *Stylops melittæ.*
15–17. *Xenos vesparum.*

(These figures are borrowed from Packard, Brauer, and Nassonow and for detailed information see list of Illustrations.)

the third segment. From the thoracic ganglion nerves pass to the three thoracic segments and first abdominal. The second, third, and fourth abdominal are reached by nerves from the sides of the ventral ganglion and the remaining segments by nerves passing back from the apex of this ganglion (Nassonow, 1892 *e*, pl. 2, fig. 16) (fig. 2, no. 15, p. 60).

In the adult male the central nervous system has been worked out for two species. In *Xenos vesparum* Rossi (Nassonow) the brain seems to be composed of four prominent lobes or divisions. The lateral or optic lobes are constricted at base and almost spherical; the inner or antennal lobes are also constricted in front, and point diagonally outward. From behind the antennal lobes arise the circumœsophageal commissures, which pass down and back to the thoracic mass, which is formed by the fusion of the three thoracic and first two abdominal pairs of ganglia. From this mass pass out nerves to the three thoracic segments and to the first three abdominal segments. From the abdominal commissure pass off nerves to the following four segments. The ventral mass is composed of seven distinct pair of ganglia, and from it pass off nerves to the last three abdominal segments (Nassonow, 1892 *c*, pl. 2, fig. 16) (fig. 2, no. 16, p. 60).

In the male of *Stylops melittæ* Brandt, not Kirby, the brain consists of a very transverse mass, one-third of which on each side is the ocular lobe in the form of a cylinder slightly enlarged toward its apex. The two central or antennal lobes are more globose, but not prominent. From these pass the antennal nerves in front and the circumœsophageal commissures behind. The thoracic mass is composed of five pair of ganglia, from which pass large nerves to the legs. This mass is located in the last two thoracic segments. From the back of the thoracic mass four pair of independent nerves pass to the first four abdominal segments. The ventral mass is located in the fourth and fifth segments and, according to Brandt, is composed of only two distinct pair of ganglia. From this mass the remaining segments are supplied (Brandt, 1878) (fig. 2, no. 14, p. 60).

In the female of *Xenos vesparum* (Nassonow) the nervous system does not traverse as much of the body as in the male. The cephalic ganglion is narrow and transverse and apparently of six lobes tapering toward the ocular lobes, which reach only halfway to the sides of the head. The thoracic ganglion lies in the posterior half of the cephalothorax and gives off two pairs of nerves to the thorax and one pair to the abdomen. One pair of nerves arises at the apex of this ganglion and three other pair arise from the ventral commissure. The ventral mass, consisting of at least six pair of ganglia lies in the third and fourth segments and from it pass off nerves to the remaining segments (Nassonow, 1892 *c*, pl. 1, figs. 9, 10, 14; Nassonow, 1897) (fig. 2, no. 17, p. 60).

TRACHEAL SYSTEM.

So far as known the Strepsiptera have one pair of spiracles located in the posterior part of the metathorax, on its dorsal surface, in young male larvæ, but moving forward with increasing age. In *Acroschismus* the spiracles seem to be located in the mesothorax on the pleuræ (see Mesostigmatal lobe, p. 65.) In male pupæ they are arranged on a separate elevation (Nassonow, 1892 *e*, pl. 1, fig. 27 *b*). In the females the spiracles are often very prominent and under a microscope the direction of the tracheæ can be traced. The stigmatal trachea is short, being divided in the first abdominal segment into three main tubes. The first tube to branch off is the cephalothoracic, which passes forward and unites with that on the other side under the intestinal canal and behind the brain. The side branches of this tube supply the legs, wings, thoracic muscles, anterior intestine, and thoracic ganglion. The connecting tube supplies the muscles of the head and the brain.

The abdominal main tubes arise from the main stigmatal trachea and pass backward, one dorsal and the other ventral. The first abdominal segment is supplied by tubes arising at the separation of these two main trunks. The two tubes supply the abdominal muscles, and all organs lying in the second to eighth segments. The two tubes are reunited between the seventh and eighth. The ninth and tenth segments are supplied by two tubes arising at the union of the main tubes (Nassonow, 1892 *e*, pl. 2, fig. 16; Nassonow, 1892 *c*, pl. 1, fig. 14).

REPRODUCTIVE SYSTEM.

In the larvæ the sexual organs are practically alike in both sexes, consisting of longitudinal cylinders lying in the abdominal segments along the sides of the intestinal canal nearer to the ventral surface of the body. From the apices of these glands arise mesodermic bands directed to the lower side of the outer covering of the ninth abdominal segment (Nassonow, 1892 *e*, pl. 2, figs. 2, 4, 16).

In the male this mesodermic band becomes hollow and funnel shaped at its base, although cut off from the gland by a layer of cells. The two bands approach, and form a pear-shaped blind sac which later finds an exit through the ninth segment. During the pupal stage the partition between the glands and ducts is resorbed. The development continues by reducing the length of the ducts until, in the adult, the vesicles empty almost directly into the ductus ejaculatorius (Nassonow, 1892 *e*, pl. 2, figs. 8, 9, 10; Nassonow, 1892 *c*, pl. 2, fig. 11).

In the female the rudimentary glands become broken up and the egg masses lie throughout the body cavity. Median invaginations of the ventral surface occur in the female beneath the cuticle of the pupa on the second to the fourth, fifth, or sixth segments. These invaginations deepen until they become long, funnel-like tubes, and finally the inner end breaks, and through the canals thus formed the triungulinids find exit into the brood canal which opens between the head and thorax on the cephalothorax (Nassonow, 1892 *e*, pl. 2, figs. 18, 19, 20, 21; Nassonow, 1892 *c*, pl. 1, figs. 9, 11, 12). The number of these median canals seems to be variable. In *Xenos vesparum* (Nassonow) Nassonow found four only (Nassonow, 1892 *c*, pl. 1, figs. 2, 9). In *Stylops melittæ* (Nassonow) he found five (Nassonow, 1893 *a*, pl. 1, fig. 2; pl. 2, figs. 1, 6, 9). Muir found only three in *Elenchoides perkinsi* Pierce (Muir, 1906).

EXTERNAL STRUCTURE.

MALE.

The integument of the male Strepsiptera is of a very thin chitin, in many parts transparent, and very soft in all parts except the mandibles and œdeagus.

The head is transverse, with the eyes more or less stalked. The eyes are composed of numerous hexagonal or circular ommatidia separated from each other by densely ciliate walls. Such a condition occurs also in *Æolothrips* (Thysanoptera) and in *Trichobius* (Pupipara) and in common parlance might be known as a "raspberry eye." The eye partitions extend inward and separate the ommatidia as far as the brain (Nassonow, 1892 *c*, pl. 1, fig. 16). Ocelli are absent (see pl. 1, fig. 9).

The antennæ arise in front of the vertex between the eyes. They are invariably flabellate in the third joint, and may or may not have the succeeding joints produced. The entire structure of the antennæ is very sensitive and may be described as follows: The surface is divided off into somewhat circular areas by stout, curved bristles, with broad bases, which fence into each area a subcylindrical tent of very transparent membrane surmounting a circular opening into the interior of the antennæ. These tents are evidently highly sensitive organs for communicating the necessary impressions to the transient male. In Xenidæ the areas are much denser and more closely guarded than in the Elenchidæ. In the Mengeidæ the tents are not as delicate, resemble tubercles, and bear the spines instead of being circled by them. (See fig. 3 on p. 69, nos. 2, 4, 6, 7, 8, 10, 12, 14, 16.)

The mouth parts are still very difficult of elucidation. A view of the face shows a triangular or circular opening bounded by the narrow genæ and the vertex but open behind. At the base of this pit is a narrow, transverse strip adjoining the prothorax and covered at each side by the overhanging genæ. This strip, it seems to the writer, must be all that remains of the base of the occiput, gula, and labium.

In front of this there arises under the gena, at each side, a generally two-jointed appendage. This can be no other than the maxilla, of which the first joint is the palpiger and the second the palpus. This is as held by Savigny (Newman, 1850). In *Crawfordia pulvinipes* the maxilla is three jointed, the first two joints being somewhat slender, and the third elongate and broadly flattened, paddle-shape. In front of the maxillæ arise the mandibles, slender, curved, scimitar-like appendages, generally transparent, chitinous, but in Halictophagidæ membranaceous, villous, and very short. Beneath these appendages is an integument which arises crater-like in front of the crossed mandibles and forms the mouth opening. In the mind of the writer all of this flared surface is the pharynx, which lies exposed in the absence of labrum and labium and of broad appendages to cover it. It can hardly be called the labrum and labium mortised together because the appendages arise above it and below the genæ. (See pl. 5, fig. 11; pl. 13, figs. 10, 13.)

The thorax is by far the largest part of the body. The prothorax is never more than a narrow ring sufficient to bear the legs, and yet in *Anthericomma barberi* this part is resolved externally into a pronotal and prosternal disc around which the mesothorax has grown and become contiguous with the head laterally. The prothorax is connected with the head by an elastic band. It is composed of two more or less distinct transverse dorsal pieces, a very narrow pleural piece on each side and two ventral pieces feebly separated on the median line. From the latter the legs arise with the cavities open behind (Nassonow, 1892 *c*, pl. 2, figs. 2, 3, 4). (See pl. 14, fig. 5.)

The mesothorax is likewise separated from the prothorax and its component parts are more or less separated by elastic commissures. Dorsally the chitinous part consists of a narrow transverse band, a larger arched band inclosing posteriorly another curved band. The pleural piece is somewhat oblique and bears the elytra. These appendages are nothing more than bulbous clubs, sometimes ladle-shaped. The mesosternum consists of a broad piece behind which lies a spindle-shaped piece divided on the median line. The legs are attached to the apical side of this with the coxal cavities open behind.

Below the elytra on the mesopleuræ, or outer edges of the mesosternum, in species of the genus *Acroschismus*, a small but prominent lobe arises which protrudes from the sides of the body, inclining forward. This lobe is rather oblong, rounded, and in length about equal to the breadth of the elytron at its base. The upper or dorsal surface is convex, the ventral surface excavated and channelled inward to an opening into the body. This opening the writer takes to be the stigma, after consultation with Doctor Ashmead, Mr. Schwarz, and Mr. Heidemann. The entire structure seems to be analogous to the metasternal groove found in Heteroptera, which Stal, in the "Enumeratio Hemipterorum," in his classification of the Pentatomidæ, calls the "sulcus;" which Uhler, 1878, in his "Summary of the Cydnidæ of North America," calls the "ostiolar canal;" which Signoret, 1883, in his "Group des Cydnides," calls the "canal ostiolaire;" and which Schouteden, in the "Genera Insectorum," speaks of as the "orifice" in the Pentatomidæ. This organ may be known as the mesostigmatal lobe. (See pl. 6, fig. 4.)

While observing the activities of a male *Acroschismus pallidus* the writer noted that the characteristic buzz continued as long as the elytra were in motion and ceased when they became quiet. At the ventral base of the elytra is a hook-like projection which is very close to the mesostigmatal lobe. Whether this lobe and hook play some part in the noise-making is of course merely conjectural, but perhaps possible.

The metathorax is much more complex and occupies nearly one half of the length of the body. On the dorsal median line may be differentiated four distinct parts. The basal piece is subtriangular or keystone shaped. It is the *præscutum* of Audouin and Westwood, and known to Kirby and Saunders as the "scutellum." The second piece is similar in shape but reversed so that the two form a sort of spindle. This is the *scutellum* of Westwood, known to Audouin as the "scutum," and to Kirby and Saunders as the "interlumbium." The third piece is oblique or vertical, transverse, and corneous or membranaceous. It is the *postlumbium* of Kirby, Westwood, and Saunders, and the "scutellum" of Audouin. The apical piece is produced conical, convex, covering the base of the abdomen and beneath concave. It is *postscutellum* of Audouin and Westwood, and the "proscutellum" of Kirby and Saunders. Very unfortunately the writer did not translate the explanation of Nassonow's plate (Nassonow, 1892 *c*, pl. 2) dealing with these structures, otherwise these parts might be named more correctly. At the sides of præscutum and scutellum are the *lumbi* which together form the *scutum*. These were known to Audouin as "epimera." Behind the lumbi and at the side of the postscutellum are the *femoralia*. Kirby and Saunders have distinguished below the lumbi a longitudinal, sublanceolate piece, the *pleura;* a second parallel piece to the base of which the wing is attached, the *parapleura;* this piece lying between the base of the wing and a small piece known as the *scapula*. The metasternum is also variously divided, but no particular names have been given the parts. (See pl. 6, figs. 6, 7.)

The wing venation is simple, radial. The wings folded longitudinally only. A node is sometimes present on the costal margin, as, for instance, *Apractelytra schwarzi*. The most generalized wings immense reduction of the prothorax in *Anthericomma barberi* shows how far specialization has gone within the order itself.

ACROSCHISMUS HUNTERI Pierce.

Triungulinids of this species were found in a parent collected at Victoria, Texas, June 26, 1906, by C. R. Jones. An adult male in its puparium was found September 25, 1906, by J. C. Crawford.

XENOS VESPARUM, Authors.

Nassonow (1893) writes that he found triungulinids in the nests of *Polistes gallica* at Cairo, Egypt, in the middle of March. Saunders (1852) took a female wasp with three prolific female parasites about the middle of July. The same author found that the triungulinids "are enabled to leap to the distance of full half an inch, but by what means this movement was effected" he could not determine. They refused to attack either ovum with inactive embryo or ovum with larvæ attempting to escape, but very readily attached themselves to larvæ of moderate dimensions, affixing both head and tail like leeches. Experiments with three triungulinids fixed the limit of the hexapod stage.

Date.	Larva 1.	Larva 2.	Larva 3.
July 18, 2 p. m.	Affixed	Affixed	
July 18, 3 p. m.			Placed on host.
July 18, 5 p. m.	Completely buried		Half buried.
July 19, a. m.	Completely out of sight	Completely buried	Completely out of sight.
July 19, p. m.		Out of sight	
July 24	Hexapod still	Hexapod still	Had just molted—apodous.

Thus the hexapod stage parasitic is approximately six days.

When in the host the males have the ventral side turned away from the body of the host.

EUPATHOCERA LUGUBRIS Pierce.

A male was bred by Mr. Dury at Cincinnati, Ohio, from *Sphex extremitatus* on August 30, 1905. On September 3, 1905, this species or a close congeneric species was bred by him from *Sphex fragilis* at 1 p. m. On October 2, 1901, a female wasp was taken with an empty puparium.

OPHTHALMOCHLUS DURYI Pierce.

Mr. Dury bred males of this species from *Priononyx atrata*, at Cincinnati, Ohio, on August 16 and 19, 1901. In the latter case the host had been dead three days. As late as September 21, 1901, he took a wasp with a male pupa. A female parasite was taken on June 17, 1900, and on September 21, 1901, a female with triungulinids was captured. Thus the inference may be drawn that there is a continuous series of breeding through the summer, or at least a double brood.

PSEUDOXENOS HEYDENII Saunders.

Saunders (1852) records triungulinids of this species on July 13 and August 9. These young he found to have distinct saltatorial powers. The males emerge from the puparium with the ventral side up, although the puparium is oriented, as in *Hylechthrus*, with the dorsum up. The only date of maturity for the male is July 13.

ELENCHUS, species.

Green (1902) captured a male corresponding almost exactly to the figure of *Elenchus tenuicornis* at night in an acetylene-gas moth trap at Paradeniya, Ceylon. This record is worthy of thoughtful consideration.

ELENCHOIDES PERKINSI Pierce.

Muir (1906) says the males hatched out in the breeding jars between sunrise and 7 a. m. and were dead by noon.

> They are very feeble upon their legs and keep their wings in rapid vibration all the time they are walking. When on the wing they take up a perpendicular position with their antennæ erect and the tip of their abdomen turned slightly under. Sight seems to be the chief sense by which they detect the presence of the leaf hoppers, as I have seen one hovering along one side of a leaf with half a dozen stylopized hoppers on the other side, only a quarter of an inch away, and apparently not knowing of their presence, but should a hopper but show its antenna over the edge of the leaf the *Elenchus* darts toward it and hovers over its back.

INTERNAL STRUCTURE.

In their internal structure the Strepsiptera exhibit several striking peculiarities, and throughout show high specialization. This part of the paper must necessarily be drawn mainly from the excellent articles by Nassonow, which, being in Russian, are inaccessible to most English-speaking entomologists. So well, however, has his work been done that one not cognizant with the language may yet gain much information from the plates. The writer has fortunately had access to a complete English translation of one of the articles and with the aid of a dictionary has been able to gather the meaning of his other plates and in some places of his text. If important observations are overlooked or the plates misinterpreted, it is due to the writer's inability at present to grasp the science of the Russian language.

ALIMENTARY SYSTEM.

The triungulinid is so minute that the character of the intestinal canal could not be studied, but in the first parasitic instars it may be observed. It is then a straight tube passing through the body have eight primary veins (Xenidæ), which become reduced in number to five in the Elenchidæ. As Saunders worked out a system of nomenclature for the veins his names will be given in parenthesis following those herein adopted. The *costa* (*neura costalis*) arises at the base and follows the edge, being sometimes interrupted by the node. The *subcosta* (*neura mediastina*) is a light vein immediately beneath and terminating at the node. The *radius* (*neura postcostalis*) is often very stout. It is sometimes interrupted at the node, and in one case a very fine vein was noticed branching off at this point of interruption (*Apractelytra schwarzi*). This little vein is evidently the first branch of the radius, and the one most ordinarily seen is the second branch of the radius. The *costal area* (*area costalis*) lies between the radius and costa and is very much more heavily pubescent than the remainder of the wing. The next primary vein is the *medius* (*neura externomedia*) and it is the last arising from the costal stalk of the trachea. Between the radius and medius there often occur one or two detached veins evidently belonging to the medius. These are the *first and second branches of the medius* [*neura 1a insulata* (*apicalis*) and *neura 2a insulata* (*discoidalis*)]. In some cases the fourth branch of the medius is found below the medius and entirely unattached. The *median area* (*superior*) lies between the medius and cubitus. The *cubitus* (*neura subexterno media*) arises from the anal stalk. This is followed by the *first anal* (*neura internomedia*), *second anal* (*neura subinterno-media*), and *third anal* (*neura analis*). One or more of these are often absent. The *anal area* (*inferior*) is comprised between the cubitus and posterior edge (*margo analis*). Saunders called the part between the third anal and anal margin the area analis.

The legs are isomerous. The front and middle coxal cavities are open behind, while the posterior are closed. The anterior and median trochanters are long and transverse and the posterior rather short. The femora are rather stout, the tibiæ slender. The tarsi are two to four jointed and without claws or five-jointed and with two claws (Mengeidæ). Each tarsal joint is provided beneath and appendaged apically with a delicate adhesive pulvillus clad with curved hairs, except in the Mengeidæ and Myrmecolacidæ, in which the first two or three joints are cylindrical. (See fig. 3, on p. 69, nos. 1, 3, 5, 9, 11, 13, 15.)

The abdomen is composed uniformly of ten segments, although the form of some of these segments is subject to variation. Nassonow (1893) first worked out the true relations of the abdomen by following the younger stages up. He found that the tenth segment bearing the anal pore was ventrally surpassed by the ninth segment bearing the genital pore. The writer's study of *Acroschismus hubbardi* results in the following description: The tenth segment (the *podex* of Kirby) as a sort of suranal flap overhangs the projecting, concave ninth segment (*hypopygium* of Brues), which at its apex is cleft, forming a claw on each side of the base of the oedeagus or genital sheath; the genital sheath is formed by the complete fusion of the paramera into a sinuate tube, reflexed and lying within the concavity of the segment, and with its tip sharply turned upward; near the base of the last curve on the inner angle of the oedeagus is a little pore through which the very slender penis may be exserted. Such a condition is very nicely illustrated on a slide in the author's collection. (See pl. 5, fig. 8; pl. 6, fig. 9.)

The shape of the oedeagus must be considered of generic and specific value, as it is one of the very few chitinous organs of the body which are not subject to change on drying. In *Crawfordia* it is slender at base, then suddenly inflated, and as suddenly reflexed and narrowed, apically acute. In *Stylops crawfordi* it is peculiarly notched. In *Apractelytra* it is a sinuate tube of about equal length almost to the tip, which is obtusely angled. In *Acroschismus*, *Pentoxocera*, *Trioxocera*, *Mecynocera*, and *Elenchus* the tube is somewhat enlarged basally, suddenly turned, at various angles, apically, and very acute.

The tenth abdominal segment is large in *Acroschismus* and very small in *Pentoxocera* and *Anthericomma*.

In studying characters of such interest it is always important to find analogies among other insects. In this the writer relied upon the vast storehouse of information possessed by his honored preceptor, E. A. Schwarz. The Psyllidæ as shown by Witlaczil and Löw (1876, and numerous other papers) have the eighth, ninth, and tenth segments placed in relatively the same manner as in the genus *Acroschismus*, but with the penis lying free between the ninth and tenth and not attached to the ninth to its apex as in Strepsiptera. The "*genital zange*," or claspers are greatly developed. The penis in Psyllidæ is two jointed. It is not known definitely whether this organ is really the penis or only the oedeagus. The genus *Corphyra* Say, formerly of the Anthicidæ, is shown by Horn (1883) to have the exposed oedeagus composed of partly or entirely separated paramera between which lies the penis. These paramera take various forms. Mr. Schwarz showed the writer how the specialization of the abdominal segments is carried to a remarkable extent in the genus *Malthodes* of the Telephoridæ.

FEMALE.

So little is known of the female Strepsiptera that it is very difficult to discuss this general question. It is not because they are scarce, because the females are the most generally met with, but because they lack salient features. In the descriptive matter to follow will be found the main results of the writer's study of this subject, which by force of circumstances has been the last to be studied. (See pls. 3, 4, 9, 11, and 12.)

The stylopid, xenid, and hylechthrid heads occupy only a small apical portion of the cephalothorax. The mandibles in all three families are somewhat prominent. In the Stylopidæ rudiments of another pair of mouth parts are discernible. The shape of the mandibles furnishes a good character in these families. The transverse slit is generally curved with the bow forward. It is never very wide. The shape of the entire cephalothorax is a valuable character. The character of the metasternal spiracle also furnishes great aid.

The Halictophagidæ and Elenchidæ form another grouping. In these the mandibles do not appear at all. The cephalothorax appears as a disk with several lobes and a transverse slit. In Halictophagidæ the lobes are still apical. The transverse slit is much farther back than in the preceding families and in most of the genera is merely a slit, but in *Agalliaphagus* a very considerable area is depressed, causing a deep emargination of the head. In the Elenchidæ the lobes are all ventral and considerably removed from the apex. In *Deinelenchus* these areas are very prominent and the transverse slit is narrow transverse. In *Mecynocera* the areas are obsolete and the transverse slit becomes a very large area, causing a deep emargination of the thorax. A thin transverse veil extends forward over the cavity from the thoracic edge of the slit.

CLASSIFICATION.

The writer has based his system of classification upon the following considerations:

1. Four types of tarsi and seven types of antennæ occur in the order as known at present. Each of these types of antennæ the writer considers of family value. At first it seemed that the antennæ should be used as the first character, because of the importance of their function in perpetuating the species. The coordination of characters finally compelled an alteration of the scheme, following Perkins's (1905) lead.

2. It was found that as the number of tarsal joints decreased the females became likewise more degenerated or differentiated from the typical form; hence these two characters are the basis of the superfamilies. The specialization of characters is also paralleled in the reduction of the number of veins in the wings. Biologically the difficulty of gaining access to new hosts becomes greater in the progression of the superfamilies.

3. The subfamily when used designates a difference in the character of mouth parts. The character of the number of median genital tubes in the female is also of subfamily value.

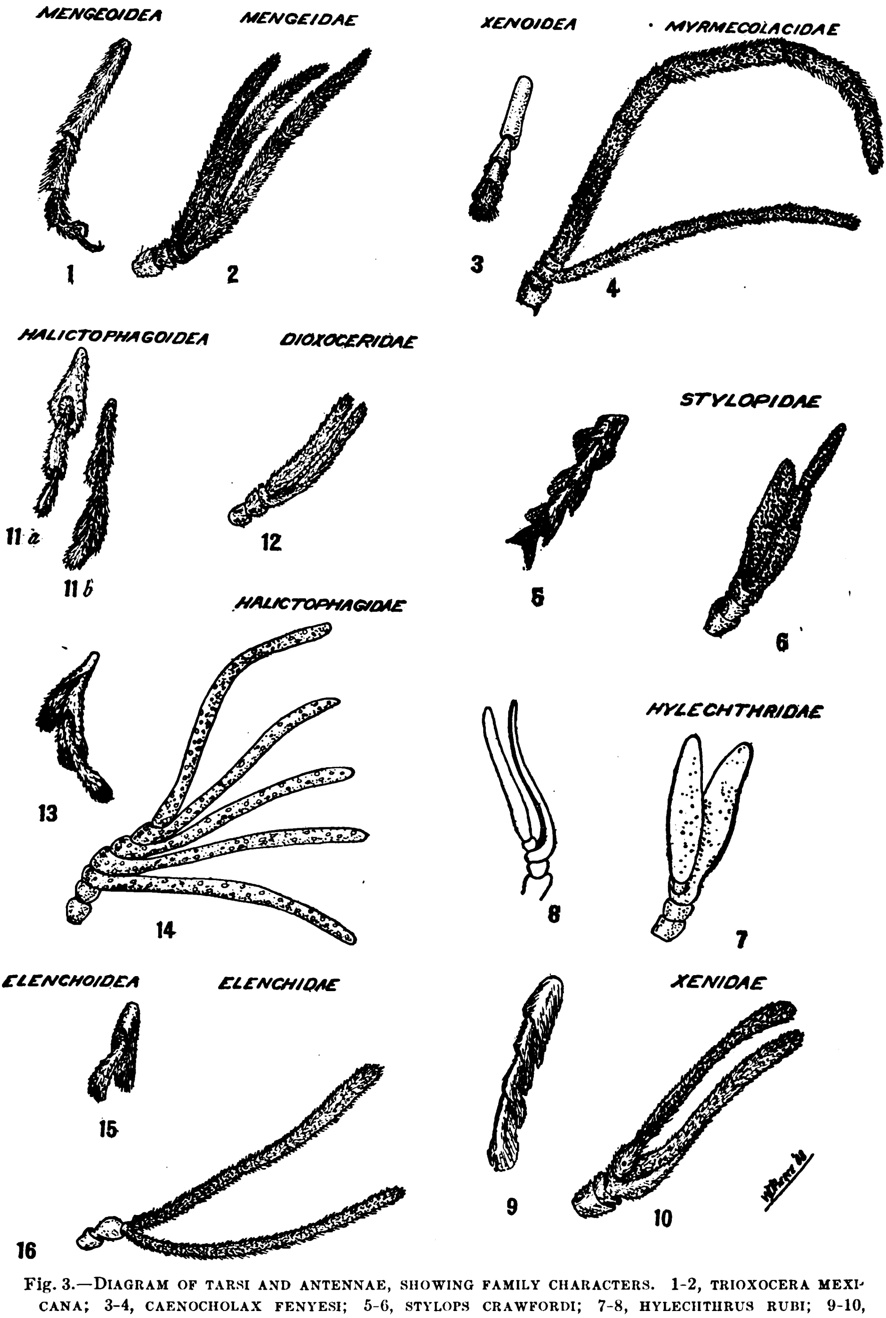

Fig. 3.—Diagram of tarsi and antennae, showing family characters. 1-2, Trioxocera mexicana; 3-4, Caenocholax fenyesi; 5-6, Stylops crawfordi; 7-8, Hylechthrus rubi; 9-10, Acroschismus pallidus; 11-12, Dioxocera insularum; 13-14, Anthericomma barberi; 15-16, Mecynocera koebelei.

4. The tribe is a division of convenience at present, separating genera confined to a single family of hosts.

5. The genera are based on the characters of the mouth parts, genitalia, wing venation, and thoracic structure. They are found to be confined to single genera of hosts.

6. The species are based on proportionate lengths of mouth parts, width of head, wing venation, the shape of the œdeagus, position of genital pore and coloration in the male; and on the shape of the cephalothorax and mandibles in the female. They are as a rule confined to single species of hosts.

MALES.

Table of superfamilies and families based on males.

Winged, elytrophorous.
- Tarsi with five joints and two tarsal claws.....Superfamily MENGEOIDEA Pierce.
- Tarsi with four joints; antennæ with third joint laterally produced. Superfamily XENOIDEA Pierce.
- Tarsi with three joints..................Superfamily HALICTOPHAGOIDEA Pierce.
- Tarsi with two joints..........................Superfamily ELENCHOIDEA Pierce.

Superfamily MENGEOIDEA Pierce.

Antennæ seven-jointed, third and fourth joints laterally produced. I. MENGEIDÆ Pierce.

Superfamily XENOIDEA Pierce.

Antennæ seven-jointed, fourth joint short, others beyond elongate. II. MYRMECOLACIDÆ Pierce.

Antennæ six-jointed, the last three joints not much surpassing the flabellum of the third .... III. STYLOPIDÆ Kirby.

Antennæ five-jointed, with fourth joint very short, and fifth elongate. IV. HYLECHTHRIDÆ Pierce.

Antennæ four-jointed, with flabellum of third, and fourth joint elongate, subequal. V. XENIDÆ Semenov.

Superfamily HALICTOPHAGOIDEA Pierce.

Antennæ seven-jointed, with the third, fourth, fifth, and sixth joints laterally produced, and the seventh elongate .... VI. HALICTOPHAGIDÆ Pierce.

Antennæ four-jointed, with the flabellum of the third, and fourth joint elongate, subequal .... VII. DIOXOCERIDÆ Pierce.

Superfamily ELENCHOIDEA Pierce.

Antennæ five-jointed, with the third laterally produced, and the fourth and fifth elongate .... VIII. ELENCHIDÆ Pierce.

Table of genera.

1. Family MENGEIDÆ Pierce.

Mandibles, maxillæ and maxillary palpi present, labial palpi absent; wings having eight primary veins from base, with one distal unattached vein between subcosta and radius and with the first and second anal apically united.... 1. *Mengea* Grote.

Mandibles apparently absent; wings with seven primary veins from base, with one distal detached vein beyond the tip of the radius, another above the radius, medius with two superior branches; third anal lacking......... 2. *Trioxocera*, new genus.

2. Family MYRMECOLACIDÆ Pierce.

Wings with all eight primary veins from base, the medius curved upward and branched at right angles.. 3. *Myrmecolax* Westwood.

Wings having only six primary veins, the cubitus and third anal being missing, with a short detached vein just below the apex of the radius, medius short and continued by a long detached vein beginning behind it and shortly before its apex. 4. *Cænocholax*, new genus.

3. Family STYLOPIDÆ Kirby.

Wings with eight primary veins from base, with two distal detached veins between the radius and medius; antennæ short and robust............... 5. *Stylops* Kirby.

Wings with seven primary veins from base, cubitus missing, costal margin with distinct stigma, subcosta and radius apically united, a detached branch of radius immediately posterior to that vein, a detached branch of medius between radius and medius; third anal very short; antennæ more attenuate. 6. *Parastylops* Meijere.

Males unknown .... 7. *Halictostylops* new genus.

4. Family HYLECHTHRIDÆ Pierce.

Wings with seven primary veins from base, with two distal detached veins between the radius and medius, which are basally united, and with the cubitus appearing as a detached vein.. 8. *Hylechthrus* Saunders.

5. Family XENIDÆ Semenov.

Maxillæ simple, two-jointed.

Scutellum of metathorax pedunculate anteriorly, postlumbium short and transverse; œdeagus inflated at basal angle........................ *Xeninæ* Pierce.

Scutellum of metathorax not pedunculate anteriorly; postlumbium more than half as long as wide; œdeagus not conspicuously inflated at basal angle. *Halictoxeninæ* Pierce.

Maxillæ three-jointed, apparently.

Scutellum of metathorax pedunculate anteriorly; postlumbium short and transverse (if Westwood saw the mouth parts wrongly this group must become a part of the Xeninæ).. *Homilopinæ* Pierce.

Scutellum of metathorax not pedunculate anteriorly; postlumbium more than half as long as wide; œdeagus beginning as a narrow tube, then greatly inflated, bent at right angles and produced as a very slender process; (in previous publications the writer interpreted the mouth parts incorrectly to include a third pair).. *Crawfordinæ* Pierce.

Subfamily Xeninæ Pierce.

Wings having eight primary veins.

Wings with two distal detached veins between the radius and medius, and one detached vein between the medius and cubitus; postlumbium very short, transverse and not differing in consistency from the scutellum or postscutellum. 19. *Eupathocera* Pierce.

Wings with two distal detached veins between the radius and medius.

Antennæ foliaceous, bluntly rounded at tips of ramæ (œdeagus not bounded at base by two apical lobes, simple, sinuate, reflexed).

Palpi with basal joint short, robust, second elongate, subcylindrical, deflexed; œdeagus longitudinally ridged...... 13. *Pseudoxenos* Saunders.

Palpi with basal joint crassate, arcuate, second cylindrical, deflexed. 16. *Paraxenos* Saunders.

Antennæ tapering to tips of ramæ, short, hardly longer than head is wide, ramæ equal, deflexed, compressed somewhat ensiform; œdeagus arising between two reflexed lobes, broad at base, strongly reflexed toward apex, apically acute .... 9. *Xenos* Rossi.

Wings having seven primary veins, third anal missing.

Wings with one distal detached vein between radius and medius, and one between medius and cubitus; œdeagus considerably dilated at base, arising between two reflexed lobes .... 10. *Acroschismus* Pierce.

Œdeagus cleft at apex .... 11. *Schistosiphon* Pierce.

Wings with two distal detached veins between radius and medius, and one between medius and cubitus .... 18. *Ophthalmochlus* Pierce.

Males unknown .... 12. *Vespæxenos*, new genus. 14. *Leionotoxenos*, new genus. 17. *Sceliphronechthrus*, new genus. 15. *Monobiaphila*, new genus.

Subfamily Homilopinæ Pierce.

Genitalia consisting merely of a two-jointed plate-like exserted appendage (ninth and tenth segments), œdeagus not visible (according to Templeton).
20. *Homilops* Pierce.

Subfamily Crawfordinæ Pierce.

Œdeagus not reflexed, nor bounded at base by lobes, very narrow at base, vesiculate and bent at middle, tenuate and very acute at apex; wings having six primary veins from base, second anal appearing as a branch of the first anal. 23. *Crawfordia* Pierce.

Subfamily Halictoxeninæ Pierce.

Maxillæ with first joint longer than the second; œdeagus strongly arcuate beneath at middle .... 21. *Halictoxenos* Pierce.

Maxillæ with first joint shorter than the second; œdeagus not strongly arcuate beneath at middle; wings with two detached branches of radius, and two of medius between the radius and medius .... 22. *Apractelytra* Pierce.

6. Family HALICTOPHAGIDÆ Pierce.

Prothorax band-like, not interrupted.

Prothorax simple, not arched forward; wings having seven primary veins from base, with two distal detached veins between the radius and medius, cubitus lacking.

Medius simple .... 25. *Pentacladocera* Pierce.

Medius broken, or with detached vein commencing just before the apex on its anal side .... 24. *Halictophagus* Dale.

Prothorax and mesothorax arched forward, fitting into excavation of head; wings having seven primary veins from base, the radius meeting the costal margin, a detached branch of medius immediately below that vein, medius with a branch in front and one behind, both as a rule detached but arising close to the medius.

Œdeagus large at base, acute and greatly reflexed at apex; antennæ with the third joint very short and flat; maxillæ with first joint very slender and over half as long as the second, ... 26. *Pentoxocera* Pierce.

Œdeagus more slender, but with reflexed apex proportionately shorter and less acute than in preceding genus; antennæ with the third joint cylindrical and as long as the preceding; maxillæ with first joint very short and stout, and only about one-third as long as the second; radius and medius basally united for a short distance .... 29. *Neocholax*, new genus.

Prothorax represented by a pronotal and prosternal disc placed in the excavation of the head and mesonotum; wings having six primary veins from base, with one distal detached vein between the radius and medius and with the medius branched above and below, the branches slightly separated from the main vein, cubitus and third anal veins lacking .... 30. *Anthericomma* Pierce.

Males unknown .... 27. *Agalliaphagus* Pierce. 28. *Megalechthrus* Perkins.

7. Family DIOXOCERIDÆ Pierce.

Thorax normal.. 31. *Dioxocera* Pierce.

8. Family ELENCHIDÆ Pierce.

Mouth parts consisting of mandibles and two-jointed maxillæ.
  Species large; first antennal joint elongate, second very short and transverse; frontal process not prominent; oral cavity broad, semicircular.
36. *Deinelenchus* Perkins.
  Species small; first two antennal joints subequal; frontal process prominent; oral cavity triangular; wings having five primary veins from base, with one distal detached vein between the radius and medius, and two brief basal veins representing the cubitus and first anal........................ 32. *Elenchus* Curtis.
Mouth parts consisting of mandibles and two-jointed maxillæ, bearing on the first joint an elongate, knobbed, linear, chitinous filament; species small; oral cavity triangular; wings as in the preceding, but without traces at base of cubitus and first anal.. 34. *Mecynocera* Pierce.
Males unknown.................................. 37. *Colacina* Westwood. / 33. *Elenchoides*, new genus. / 35. *Pentagrammaphila*, new genus.

Artificial key to genera based on wing venation.

1. Eight primary veins from base (costa, subcosta, radius, medius, cubitus, three anal). (The costa is always a very short, inconspicuous vein at the base and is merged with the subcosta).
  a. One distal detached vein between the subcosta and radius; first and second anal veins apically united.................................. *Mengea* Grote.
  b. Two detached branches of radius and two of medius between radius and medius.. *Apractelytra* Pierce.
  c. One detached branch of radius and one of medius between radius and medius............................ *Xenos* Rossi. / *Pseudoxenos* Saunders. / *Paraxenos* Saunders. / *Stylops* Kirby.
  d. One detached branch of radius and one of medius between radius and medius; and detached branch of medius between medius and cubitus. *Eupathocera* Pierce.
  e. Medius curved upward and branched toward apex..... *Myrmecolax* Westwood.
2. Seven primary veins from base.
  a. Cubitus appearing as a detached vein; radius and medius basally united; with a detached branch of each between them............... *Hylechthrus* Saunders.
  b. Third anal lacking.
    A detached branch of radius and one of medius between radius and medius; a detached branch of medius between medius and cubitus.
Ophthalmochlus Pierce.
    Radius sometimes broken for a short distance; a detached branch of medius between radius and medius; a detached branch of medius immediately behind medius................................ *Acroschismus* Pierce. / *Schistosiphon* Pierce.
    Radius broken for a considerable distance; medius with one detached and two connected branches in front of it.................... *Trioxocera* Pierce.
  c. Cubitus lacking.
    Two detached branches of medius between radius and medius.
      Medius branched near apex behind.............. *Pentoxocera* Pierce.
      Medius with detached vein commencing just before the apex on its anal side..................................... *Halictophagus* Dale.
    Two detached branches of medius between radius and medius.
Pentacladocera Pierce.

3. Six primary veins from base.
   a. Cubitus and third anal lacking.
      Detached branch of radius between radius and medius; also detached branch of medius behind medius........................*Caenocholax* Pierce.
      Detached branch of radius, and one of medius between radius and medius; also branch of medius behind medius............*Anthericomma* Pierce.
   b. Only one anal vein arising from base; second anal appearing as a detached branch of first anal....................................*Crawfordia* Pierce.
4. Five primary veins from base (costa, subcosta, radius, medius, anal).
   a. One detached branch of medius between radius and medius; cubitus and first anal indicated at base....................................*Elenchus* Curtis.
   b. One detached branch of medius between radius and medius..*Mecynocera* Pierce.

(Owing to the necessity of forming part of this table from published drawings there is a possibility that the venation has not in every case been interpreted correctly. The venation should not be used for identification unless the other available characters are obscured.)

FEMALES.

Table of superfamilies, families, and genera based on females.

1. Spiracles more or less easily discernible, generally prominent; four or five genital tubes entering brood canal..................Superfamily XENOIDEA Pierce.
   Spiracles not usually discernible, never prominent..........................2.
2. Tubercles of head apical.................Superfamily HALICTOPHAGOIDEA Pierce.
   Tubercles of head more or less obsolete, ventral; only three genital tubes entering brood canal.............................Superfamily ELENCHOIDEA Pierce.

Superfamily XENOIDEA Pierce.

1. Head considerably narrower than metathorax at spiracles......................2.
   Head not considerably narrower than metathorax at spiracles...................5.
2. HYLECHTHRIDÆ: Head not more than one-half as wide as metathorax at spiracles; lateral lobes of mesothorax indicating presence of supposed mesothoracic spiracles (according to Saunders); lower lip (ventral) overhanging transverse slit; mandibles merely lobes...*Hylechthrus* Saunders.
   Head often much less than one half as wide as metathorax; no lateral lobes indicating presence of suppressed mesothoracic spiracles........................3.
3. Head about one-third width of metathorax at spiracles........................4.
   STYLOPIDÆ: Cephalothorax broadly truncate or rounded at apex; head about one-half width of metathorax at spiracles; five genital tubes entering brood canal...*Stylops* Kirby.
   XENIDÆ. Cephalothorax almost triangular, lateral margins sinuate; five genital tubes entering brood canal.............................*Halictoxenos* Pierce.
4. STYLOPIDÆ (?): Cephalothorax almost triangular, narrowly truncate at apex.
   Halictostylops Pierce.
5. Cephalothorax with lateral lines extending from mandibles to spiracles.
   Crawfordia Pierce.
   Cephalothorax with head extending laterally not more than two-thirds of the distance to the spiracles; four genital tubes entering brood canal.
   Xeninæ, *Homilopinæ*.

Superfamily HALICTOPHAGOIDEA Pierce.

1. Transverse slit narrow...2.
   Head subtruncate at apex, transverse slit very broad, cutting a deep three-sided emargination in the head ....*Agalliaphagus* Pierce.
2. Mandibles prominent, toothed; thorax shorter than head, ventral slit turned posteriorly at sides..*Dioxocera* Pierce.
   Mandibles mere lobes ....3.
3. Thorax shorter than head, rather suddenly narrowed to base; sides of head oblique. *Pentoxocera* Pierce.
   Thorax longer than head, gradually narrowed to base; side of head convex. *Megalechthrus* Perkins.

Superfamily ELENCHOIDEA Pierce.

1. Head trilobed, mouth seemingly on an elevation; transverse slit narrow. *Deinelenchus* Perkins.
   Head presenting two obsolete areas; transverse slit very broad, deeply cutting a rounded emargination into thorax; a thin curtain overhanging cavity at base. *Mecynocera* Pierce.

An interesting and valuable comparison of genera may be had by giving the range of variation in the following ratios. The first ratio is that of the breadth at the spiracles (5) to the distance between the mandibles (3); the second is that of the breadth of the head (4) to the distance between the mandibles (3); the third is that of the breadth at the spiracles (5) to the breadth of the head (4); the fourth is that of the breadth of the spiracles (5) to the distance from spiracles to apex (2).

Genus.	Cephalothorax. to mandibles. (5):(3)::—:1.	Head to mandibles. (4):(3)::—:1.	Cephalothorax to head. (5):(4)::—:1.	Breadth to length. (5):(2)::—:1.
Dioxocera	3.15	3.15	1.00	1.40
Crawfordia	3.14–4.63	2.96–4.47	1.03–1.06	1.41–1.76
Vespaexenos	4.12	3.50	1.17	1.04
Leionotoxenos	4.66–5.11	4.00–4.90	1.03–1.16	1.33–1.64
Acroschismus	4.42–5.90	3.36–4.68	1.22–1.46	1.31–2.43(?)
Sceliphronechthrus	5.54	4.18	1.32	1.84
Stylops	6.06–8.11	3.46–5.64	1.36–1.88	1.32–1.77
Homilops	6.26–8.30	5.12–6.00	1.14–1.41	1.74–1.95
Monobiaphila	6.93	4.40	1.60	1.76
Halictoxenos typical	6.66–9.71	3.16–5.00	1.90–2.10	1.29–1.55
s. g. *Halictophilus*	7.81–8.00	5.45–5.70	1.40–1.43	1.32–1.33

Table for separation of genera of the Triungulinids.

1. Nine abdominal segments simple, the tenth consisting of two large lateral lobes, each bearing a long stylet...............................*Stylops*, *Halictoxenos*.
   Eight abdominal segments simple, ninth elongate inclosing tenth ....2.
2. Ninth laterally armed with stylets, and tenth apically so..............*Mecynocera*.
   Tenth only, terminated by two large approximate lobes bearing stylets. *Acroschismus*, *Vespaexenos*, *Monobiaphila*, *Leionotoxenos*, *Ophthalmochlus*, *Homilops*, and *Pentoxocera*.

4. The tribe is a division of convenience at present, separating genera confined to a single family of hosts.

5. The genera are based on the characters of the mouth parts, genitalia, wing venation, and thoracic structure. They are found to be confined to single genera of hosts.

6. The species are based on proportionate lengths of mouth parts, width of head, wing venation, the shape of the œdeagus, position of genital pore and coloration in the male; and on the shape of the cephalothorax and mandibles in the female. They are as a rule confined to single species of hosts.

MALES.

Table of superfamilies and families based on males.

Winged, elytrophorous.
- Tarsi with five joints and two tarsal claws.....Superfamily MENGEOIDEA Pierce.
- Tarsi with four joints; antennæ with third joint laterally produced. Superfamily XENOIDEA Pierce.
- Tarsi with three joints..................Superfamily HALICTOPHAGOIDEA Pierce.
- Tarsi with two joints.........................Superfamily ELENCHOIDEA Pierce.

Superfamily MENGEOIDEA Pierce.

Antennæ seven-jointed, third and fourth joints laterally produced. I. MENGEIDÆ Pierce.

Superfamily XENOIDEA Pierce.

Antennæ seven-jointed, fourth joint short, others beyond elongate. II. MYRMECOLACIDÆ Pierce.

Antennæ six-jointed, the last three joints not much surpassing the flabellum of the third .... III. STYLOPIDÆ Kirby

Antennæ five-jointed, with fourth joint very short, and fifth elongate. IV. HYLECHTHRIDÆ Pierce

Antennæ four-jointed, with flabellum of third, and fourth joint elongate, subequal V. XENIDÆ Semenov.

Superfamily HALICTOPHAGOIDEA Pierce.

Antennæ seven-jointed, with the third, fourth, fifth, and sixth joints laterally produced, and the seventh elongate .... VI. HALICTOPHAGIDÆ Pierce.

Antennæ four-jointed, with the flabellum of the third, and fourth joint elongate, subequal .... VII. DIOXOCERIDÆ Pierce

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Table of genera.

1. Family MENGEIDÆ Pierce

Mandibles, maxillæ and maxillary palpi present, labial palpi absent; wings having eight primary veins from base, with one distal unattached vein between subcosta and radius and with the first and second anal apically united.... 1. *Mengea* Grote

Mandibles apparently absent, wings with seven primary veins from base, with one distal detached vein beyond the tip of the radius, another above the radius, media with two superior branches, third anal lacking......... 2. *Triozocera*, new genus.

2. Family Myrmecolacidæ Pierce.

Wings with all eight primary veins from base, the medius curved upward and branched at right angles.. 3. *Myrmecolax* Westwood.

Wings having only six primary veins, the cubitus and third anal being missing, with a short detached vein just below the apex of the radius, medius short and continued by a long detached vein beginning behind it and shortly before its apex. 4. *Cænocholax*, new genus.

3. Family Stylopidæ Kirby.

Wings with eight primary veins from base, with two distal detached veins between the radius and medius; antennæ short and robust............... 5. *Stylops* Kirby.

Wings with seven primary veins from base, cubitus missing, costal margin with distinct stigma, subcosta and radius apically united, a detached branch of radius immediately posterior to that vein, a detached branch of medius between radius and medius; third anal very short; antennæ more attenuate. 6. *Parastylops* Meijere.

Males unknown.. 7. *Halictostylops* new genus.

4. Family Hylechthridæ Pierce.

Wings with seven primary veins from base, with two distal detached veins between the radius and medius, which are basally united, and with the cubitus appearing as a detached vein.. 8. *Hylechthrus* Saunders.

5. Family Xenidæ Semenov.

Maxillæ simple, two-jointed.

Scutellum of metathorax pedunculate anteriorly, postlumbium short and transverse; œdeagus inflated at basal angle........................ *Xeninæ* Pierce.

Scutellum of metathorax not pedunculate anteriorly; postlumbium more than half as long as wide; œdeagus not conspicuously inflated at basal angle. *Halictoxeninæ* Pierce.

Maxillæ three-jointed, apparently.

Scutellum of metathorax pedunculate anteriorly; postlumbium short and transverse (if Westwood saw the mouth parts wrongly this group must become a part of the Xeninæ).. *Homilopinæ* Pierce.

Scutellum of metathorax not pedunculate anteriorly; postlumbium more than half as long as wide; œdeagus beginning as a narrow tube, then greatly inflated, bent at right angles and produced as a very slender process; (in previous publications the writer interpreted the mouth parts incorrectly to include a third pair).. *Crawfordinæ* Pierce.

Subfamily Xeninæ Pierce.

Wings having eight primary veins.

Wings with two distal detached veins between the radius and medius, and one detached vein between the medius and cubitus; postlumbium very short, transverse and not differing in consistency from the scutellum or postscutellum. 19. *Eupathocera* Pierce.

Wings with two distal detached veins between the radius and medius.

Antennæ foliaceous, bluntly rounded at tips of ramæ (œdeagus not bounded at base by two apical lobes, simple, sinuate, reflexed).

Palpi with basal joint short, robust, second elongate, subcylindrical, deflexed; œdeagus longitudinally ridged...... 13. *Pseudoxenos* Saunders.

Palpi with basal joint crassate, arcuate, second cylindrical, deflexed. 16. *Paraxenos* Saunders.

Antennæ tapering to tips of ramæ, short, hardly longer than head is wide, ramæ equal, deflexed, compressed somewhat ensiform; œdeagus arising between two reflexed lobes, broad at base, strongly reflexed toward apex, apically acute.. 9. *Xenos* Rossi.

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- Scutellum of metathorax not pedunculate anteriorly; postlumbium more than half as long as wide; œdeagus not conspicuously inflated at basal angle. *Halictoxeninæ* Pierce.

Maxillæ three-jointed, apparently.

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- Scutellum of metathorax not pedunculate anteriorly; postlumbium more than half as long as wide; œdeagus beginning as a narrow tube, then greatly inflated, bent at right angles and produced as a very slender process; (in previous publications the writer interpreted the mouth parts incorrectly to include a third pair)... *Crawfordinæ* Pierce.

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Wings having eight primary veins.

- Wings with two distal detached veins between the radius and medius, and one detached vein between the medius and cubitus; postlumbium very short, transverse and not differing in consistency from the scutellum or postscutellum. 19. *Eupathocera* Pierce.
- Wings with two distal detached veins between the radius and medius.
  - Antennæ foliaceous, bluntly rounded at tips of ramæ (œdeagus not bounded at base by two apical lobes, simple, sinuate, reflexed).
    - Palpi with basal joint short, robust, second elongate, subcylindrical, deflexed; œdeagus longitudinally ridged...... 13. *Pseudoxenos* Saunders.
    - Palpi with basal joint crassate, arcuate, second cylindrical, deflexed. 16. *Paraxenos* Saunders.
  - Antennæ tapering to tips of ramæ, short, hardly longer than head is wide, ramæ equal, deflexed, compressed somewhat ensiform; œdeagus arising between two reflexed lobes, broad at base, strongly reflexed toward apex, apically acute .... 9. *Xenos* Rossi.

Wings having seven primary veins, third anal missing.
- Wings with one distal detached vein between radius and medius, and one between medius and cubitus; œdeagus considerably dilated at base, arising between two reflexed lobes.. 10. *Acroschismus* Pierce
  - Œdeagus cleft at apex .... 11. *Schistosiphon* Pierce
- Wings with two distal detached veins between radius and medius, and one between medius and cubitus...................... 18. *Ophthalmochlus* Pierce.

Males unknown ....
- 12. *Vespaxenos*, new genus.
- 14. *Leionotoxenos*, new genus.
- 17. *Sceliphronechthrus*, new genus.
- 15. *Monobiaphila*, new genus.

Subfamily Homilopinæ Pierce.

Genitalia consisting merely of a two-jointed plate-like exserted appendage (ninth and tenth segments), œdeagus not visible (according to Templeton).
20. *Homilops* Pierce.

Subfamily Crawfordinæ Pierce.

Œdeagus not reflexed, nor bounded at base by lobes, very narrow at base, vesiculate and bent at middle, tenuate and very acute at apex; wings having six primary veins from base, second anal appearing as a branch of the first anal. 23. *Crawfordia* Pierce.

Subfamily Halictoxeninæ Pierce

Maxillæ with first joint longer than the second; œdeagus strongly arcuate beneath at middle.. 21. *Halictoxenos* Pierce
Maxillæ with first joint shorter than the second; œdeagus not strongly arcuate beneath at middle; wings with two detached branches of radius, and two of medius between the radius and medius................ 22. *Apractelytra* Pierce.

6. Family HALICTOPHAGIDÆ Pierce.

Prothorax band-like, not interrupted.
- Prothorax simple, not arched forward; wings having seven primary veins from base, with two distal detached veins between the radius and medius, cubitus lacking
  - Medius simple.. 25. *Pentacladocera* Pierce
  - Medius broken, or with detached vein commencing just before the apex on its anal side .... 24. *Halictophagus* Dale
- Prothorax and mesothorax arched forward, fitting into excavation of head, wings having seven primary veins from base, the radius meeting the costal margin, a detached branch of medius immediately below that vein, medius with a branch in front and one behind, both as a rule detached but arising close to the medius
  - Œdeagus large at base, acute and greatly reflexed at apex, antennæ with the third joint very short and flat, maxillæ with first joint very slender and over half as long as the second......... .... 26. *Pentozocera* Pierce
  - Œdeagus more slender, but with reflexed apex proportionately shorter and less acute than in preceding genus, antennæ with the third joint cylindrical and as long as the preceding, maxillæ with first joint very short and stout, and only about one third as long as the second, radius and medius basally united for a short distance . .. . 29. *Neokoler*, new genus

Prothorax represented by a pronotal and prosternal disc placed in the excavation of the head and mesonotum, wings having six primary veins from base, with one distal detached vein between the radius and medius and with the medius branched above and below, the branches slightly separated from the main vein, cubitus and third anal veins lacking.............. . . . . . 30. *Anthericomma* Pierce

Males unknown.............................. . . . .
- 27. *Agalliaphagus* Pierce
- 28. *Megalechthrus* Perkins

7. Family DIOXOCERIDÆ Pierce.

Thorax normal.. 31. *Dioxocera* Pierce.

8. Family ELENCHIDÆ Pierce.

Mouth parts consisting of mandibles and two-jointed maxillæ.

Species large; first antennal joint elongate, second very short and transverse; frontal process not prominent; oral cavity broad, semicircular.
36. *Deinelenchus* Perkins.

Species small; first two antennal joints subequal; frontal process prominent; oral cavity triangular; wings having five primary veins from base, with one distal detached vein between the radius and medius, and two brief basal veins representing the cubitus and first anal........................ 32. *Elenchus* Curtis.

Mouth parts consisting of mandibles and two-jointed maxillæ, bearing on the first joint an elongate, knobbed, linear, chitinous filament; species small; oral cavity triangular; wings as in the preceding, but without traces at base of cubitus and first anal.. 34. *Mecynocera* Pierce.

Males unknown..................................
- 37. *Colacina* Westwood.
- 33. *Elenchoides*, new genus.
- 35. *Pentagrammaphila*, new genus.

Artificial key to genera based on wing venation.

1. Eight primary veins from base (costa, subcosta, radius, medius, cubitus, three anal). (The costa is always a very short, inconspicuous vein at the base and is merged with the subcosta).
   - *a.* One distal detached vein between the subcosta and radius; first and second anal veins apically united.................................. *Mengea* Grote.
   - *b.* Two detached branches of radius and two of medius between radius and medius.. *Apractelytra* Pierce.
   - *c.* One detached branch of radius and one of medius between radius and medius.................................
     - *Xenos* Rossi.
     - *Pseudoxenos* Saunders.
     - *Paraxenos* Saunders.
     - *Stylops* Kirby.
   - *d.* One detached branch of radius and one of medius between radius and medius; and detached branch of medius between medius and cubitus. *Eupathocera* Pierce.
   - *e.* Medius curved upward and branched toward apex..... *Myrmecolax* Westwood.
2. Seven primary veins from base.
   - *a.* Cubitus appearing as a detached vein; radius and medius basally united; with a detached branch of each between them............... *Hylechthrus* Saunders.
   - *b.* Third anal lacking.
     - A detached branch of radius and one of medius between radius and medius; a detached branch of medius between medius and cubitus.
       Ophthalmochlus Pierce.
     - Radius sometimes broken for a short distance; a detached branch of medius between radius and medius; a detached branch of medius immediately behind medius.................................
       - *Acroschismus* Pierce.
       - *Schistosiphon* Pierce.
     - Radius broken for a considerable distance; medius with one detached and two connected branches in front of it..................... *Trioxocera* Pierce.
   - *c.* Cubitus lacking.
     - Two detached branches of medius between radius and medius.
       - Medius branched near apex behind.............. *Pentoxocera* Pierce.
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     - Two detached branches of medius between radius and medius.
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3. Six primary veins from base.
   a. Cubitus and third anal lacking.
      Detached branch of radius between radius and medius; also detached branch of medius behind medius.........................*Caenocholax* Pierce.
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4. Five primary veins from base (costa, subcosta, radius, medius, anal).
   a. One detached branch of medius between radius and medius; cubitus and first anal indicated at base...................................*Elenchus* Curtis.
   b. One detached branch of medius between radius and medius..*Mecynocera* Pierce.

(Owing to the necessity of forming part of this table from published drawings there is a possibility that the venation has not in every case been interpreted correctly. The venation should not be used for identification unless the other available characters are obscured.)

FEMALES.

Table of superfamilies, families, and genera based on females.

1. Spiracles more or less easily discernible, generally prominent; four or five genital tubes entering brood canal....................Superfamily XENOIDEA Pierce.
   Spiracles not usually discernible, never prominent...........................2
2. Tubercles of head apical.................Superfamily HALICTOPHAGOIDEA Pierce.
   Tubercles of head more or less obsolete, ventral; only three genital tubes entering brood canal...............................Superfamily ELENCHOIDEA Pierce.

Superfamily XENOIDEA Pierce.

1. Head considerably narrower than metathorax at spiracles.......................2.
   Head not considerably narrower than metathorax at spiracles....................5
2. HYLECHTHRIDÆ. Head not more than one-half as wide as metathorax at spiracles, lateral lobes of mesothorax indicating presence of suppressed mesothoracic spiracles (according to Saunders), lower lip ventral (overhanging transverse slit, mandibles merely lobes...*Hylechthrus* Saunders.
   Head often much less than one half as wide as metathorax; no lateral lobes indicating presence of suppressed mesothoracic spiracles..........................3.
3. Head about one third width of metathorax at spiracles..........................4.
   STYLOPIDÆ. Cephalothorax broadly truncate or rounded at apex, head about one-half width of metathorax at spiracles, five genital tubes entering brood canal...*Stylops* Kirby.
   XENIDÆ. Cephalothorax almost triangular, lateral margins sinuate, five genital tubes entering brood canal...........................*Halictoxenos* Pierce.
4. STYLOPIDÆ (? Cephalothorax almost triangular, narrowly truncate at apex.
   Halictostylops Pierce.
5. Cephalothorax with lateral lines extending from mandibles to spiracles.
   Crawfordia Pierce.
   Cephalothorax with head extending laterally not more than two-thirds of the distance to the spiracles, four genital tubes entering brood canal
   Xenos, *Homilops*.

Superfamily HALICTOPHAGOIDEA Pierce.

1. Transverse slit narrow .... 2.
   Head subtruncate at apex, transverse slit very broad, cutting a deep three-sided emargination in the head .... *Agalliaphagus* Pierce.
2. Mandibles prominent, toothed; thorax shorter than head, ventral slit turned posteriorly at sides .... *Dioxocera* Pierce.
   Mandibles mere lobes .... 3.
3. Thorax shorter than head, rather suddenly narrowed to base; sides of head oblique. *Pentoxocera* Pierce.
   Thorax longer than head, gradually narrowed to base; side of head convex. *Megalechthrus* Perkins.

Superfamily ELENCHOIDEA Pierce.

1. Head trilobed, mouth seemingly on an elevation; transverse slit narrow. *Deinelenchus* Perkins.
   Head presenting two obsolete areas; transverse slit very broad, deeply cutting a rounded emargination into thorax; a thin curtain overhanging cavity at base. *Mecynocera* Pierce.

An interesting and valuable comparison of genera may be had by giving the range of variation in the following ratios. The first ratio is that of the breadth at the spiracles (5) to the distance between the mandibles (3); the second is that of the breadth of the head (4) to the distance between the mandibles (3); the third is that of the breadth at the spiracles (5) to the breadth of the head (4); the fourth is that of the breadth of the spiracles (5) to the distance from spiracles to apex (2).

Genus.	Cephalothorax. to mandibles. (5):(3)::—:1.	Head to mandibles. (4):(3)::—:1.	Cephalothorax to head. (5):(4)::—:1.	Breadth to length. (5):(2)::—:1.
Dioxocera	3.15	3.15	1.00	1.40
Crawfordia	3.14–4.63	2.96–4.47	1.03–1.06	1.41–1.76
Vespaexenos	4.12	3.50	1.17	1.04
Leionotoxenos	4.66–5.11	4.00–4.90	1.03–1.16	1.33–1.64
Acroschismus	4.42–5.90	3.36–4.68	1.22–1.46	1.31–2.43(?)
Sceliphronechthrus	5.54	4.18	1.32	1.84
Stylops	6.06–8.11	3.46–5.64	1.36–1.88	1.32–1.77
Homilops	6.26–8.30	5.12–6.00	1.14–1.41	1.74–1.95
Monobiaphila	6.93	4.40	1.60	1.76
Halictoxenos typical	6.66–9.71	3.16–5.00	1.90–2.10	1.29–1.55
s. g. *Halictophilus*	7.81–8.00	5.45–5.70	1.40–1.43	1.32–1.33

Table for separation of genera of the Triungulinids.

1. Nine abdominal segments simple, the tenth consisting of two large lateral lobes, each bearing a long stylet .... *Stylops*, *Halictoxenos*.
   Eight abdominal segments simple, ninth elongate inclosing tenth .... 2.
2. Ninth laterally armed with stylets, and tenth apically so .... *Mecynocera*.
   Tenth only, terminated by two large approximate lobes bearing stylets. *Acroschismus*, *Vespaexenos*, *Monobiaphila*, *Leionotoxenos*, *Ophthalmochlus*, *Homilops*, and *Pentoxocera*.

The following arrangement will illustrate the progression of specialization in five of the principal characters in the order:

Name.	Males.			Females.	Triungulinids.
	Number of tarsal joints.	Number of antennal joints.	Number of primary veins in wings.	Number of genital tubes.	Number of simple segments in abdomen.
	Mengeoidea.	*Mengeidæ.*			
Mengea	5	7	8	(?)	(?)
Trioxocera	5	7	7	(?)	(?)
	Xenoidea.	*Myrmecolacidæ.*			
Myrmecolax	4	7	8	(?)	(?)
Caenocholax	4	7	6	(?)	(?)
		Stylopidæ.			
Stylops	4	6	8	5	9
		Hylechthridæ.			
Hylechthrus	4	5	7	(?)	(?)
		Xenidæ		*Halictoxeninæ.*	
Halictoxenos	4	4	(?)	5	9
				Xeninæ.	
Xenos	4	4	8	4	8
Apractelytra *Pseudoxenos*	4	4	8	(?)	(?)
Monobiaphila *Leionotoxenos*	4	4	(?)	(?)	8
Paraxenos *Eupathocera*	4	4	8	(?)	(?)
Ophthalmochlus	4	4	7	(?)	8
Schistosiphon	4	4	7	(?)	(?)
Acroschismus	4	4	7	4	8
Homilops	4	4	(?)	(?)	8
			Crawfordinæ.		
Crawfordia	4	4	5	(?)	(?)
	Halictophagoidea.	*Dioxoceridæ.*			
Dioxocera	3	4	(?)	(?)	(?)
		Halictophagidæ.			
Halictophagus	3	7	6	(?)	(?)
Pentoxocera	3	7	6	(?)	8
Anthericommr	3	7	5	(?)	(?)
	Elenchoidea.	*Elenchidæ.*			
Mecynocera	2	5	4	(?)	8
Elenchus	2	5	(?)	(?)	(?)
Elenchoides	(?)	(?)	(?)	3	(?)

The two points which stand out in this comparison are the affinities of *Halictoxenos* to the Stylopidæ as well as Xenidæ, and the intermediate position of *Dioxocera* between the Xenidæ and Halictophagidæ. The grouping of genera in the Xenidæ is very weak at present, owing to the deficiencies in our knowledge, hence the best possible way of grouping the genera at present is by host relationships. Many surprises are still in store in this order, and the classification will undoubtedly need many revisions. The group Homilopinæ rests upon a description which may prove wrong; in such event *Homilops* will group with the Ophthalmochlini. If the genitalia of *Schistosiphon peckii* should prove to have been incorrectly figured and described, and to be of the same character as those of *Acroschismus*, then *Schistosiphon* must become a synonym. If *Halictostylops spencii* is bred and proven to be xenid, as the writer expects will happen, the genus *Halictostylops* may become a synonym of *Halictoxenos* which is first described in the tables of genera. The classification of the Halictophagoidea and Elenchoidea is hardly more than suggested. These superfamilies will prove very fertile in their diversity of forms.

CORRELATION OF HOST AND PARASITE CLASSIFICATIONS.

	Mengeoidea.
	Mengeidæ.
Unknown fossil host.	Mengea; Germany.
Hymenoptera.	Xenoidea.
Formicoidea.	Myrmecolacidæ.
Formicidæ.	Myrmecolax; Ceylon.
Apoidea.	
Prosopidæ.	Hylechthridæ.
Prosopis.	Hylechthrus; Europe.
Andrenidæ.	Stylopidæ.
Andrena.	Stylops; America, Europe.
Halictus.	(?) Halictostylops; Europe.
	Xenidæ.
	Halictoxeninæ.
Halictus.	Halictoxenos; America.
Panurgidæ.	Crawfordinæ.
Panurginus.	Crawfordia; America.
Vespoidea.	Xeninæ.
Vespidæ.	Xenini.
Polistes.	Xenos; Europe, America (?).
Polistes.	Acroschismus; America.
Polistes.	Schistosiphon; America.
Vespa.	Vespæxenos; Asia.
Eumenidæ.	Pseudoxenini.
Odynerus.	Pseudoxenos; Europe.
Leionotus.	Leionotoxenos; America.
Monobia.	Monobiaphila; America.
Bembecidæ.	Paraxenini.
Bembecinus.	Paraxenos; Europe.
Sphecoidea.	
Sphecidæ.	Ophthalmochlini.
Sceliphron.	Sceliphronechthrus; America.
Priononyx.	Ophthalmochlus; America.
Sphex (Ammophila).	Eupathocera; America.
	Homilopinæ.
Proterosphex.	Homilops; America, Asia (?).

Homoptera.	Halictophagoidea.
Cicadoidea.	
Tetigoniidæ.	
Penthimiini.	Dioxoceridæ.
Xerophloea.	Dioxocera; America.
	Halictophagidæ.
Tetigoninii.	
Tetigonia.	Pentoxocera; Australia.
Eurymelini.	
Agallia.	Agalliaphagus; America.
(?) Agallia.	Pentacladocera; Australia.
Genus unknown.	Halictophagus; Europe.
Genus unknown.	Anthericomma; America.
Fulgoroidea.	
Issidæ.	Neocholax; Java.
Eurybrachyinæ.	
Platybrachys.	Megalechthrus; Australia.
	Elenchoidea.
	Elenchidæ.
(?) Platybrachys.	Deinelenchus; Australia.
Asiracidæ.	
Perkinsiella.	Elenchoides; Oceana.
Liburnia.	Elenchus; Europe.
Liburnia.	Mecynocera; America.
Pentagramma.	Pentagrammaphila; America.
Poekillopteridæ.	
Tropiduchinæ.	
Tropiduchini.	
Epora.	Colacina; Malaysia.

CHECK LIST OF THE STREPSIPTERA OF THE WORLD.

I. Superfamily MENGEOIDEA Pierce, 1908.

1. Family Mengeidæ Pierce, 1908.

1. Genus *Mengea* Grote, 1886 (*Triæna* Menge, 1866).
    1. *tertiaria* Menge, 1866 (type); fossil.
2. Genus *Trioxocera* Pierce.
    1. *mexicana* Pierce (type); Mexico.

II. Superfamily XENOIDEA Pierce, 1908.

2. Family Myrmecolacidæ Pierce, 1908.

3. Genus *Myrmecolax* Westwood, 1858.
    1. *nietneri* Westwood, 1858 (type); Ceylon.
4. Genus *Cænocholax* Pierce.
    1. *fenyesi* Pierce (type); Mexico.

3. Family Stylopidæ Kirby, 1813.

5. Genus *Stylops* Kirby, 1802.
    1. *melittæ* Kirby, 1802 (type); Europe.
        (*haworthi* Stephens, 1829.)
        (*kirbii* Leach, 1814.)
    2. *dalii* Curtis, 1828; England.
        (*dahlii* Friese, 1906.)
    3. *childreni* Gray, 1832; Nova Scotia.
    4. *spencii* Pickering, 1835; Europe.
    5. *aterrima* Newport, 1847; England.
        (*trimmerana* Smith, 1857.)
    6. *thwaitei* Saunders, 1872; Europe.
    7. *advarians* Pierce; British Columbia.
    8. *bipunctatæ* Pierce; United States.
    9. *bruneri* Pierce; United States.
    10. *californica* Pierce; California.
    11. *claytoniæ* Pierce; United States.
    12. *cornii* Pierce; Wisconsin.
    13. *crawfordi* Pierce; Texas.
    14. *cressoni* Pierce; Maine.
    15. *dominiquei* Pierce; France.
    16. *grænicheri* Pierce; Wisconsin.
    17. *hartfordensis* Pierce; Georgia.
    18. *hippotes* Pierce; Ohio.
    19. *imitatrix* Pierce; Texas.
    20. *multiplicatæ* Pierce; Wisconsin.
    21. *nasoni* Pierce; Pennsylvania.
    22. *nassonowi* Pierce; Europe.
    23. *nubeculæ* Pierce; Colorado.
    24. *packardi* Pierce; Massachusetts.
    25. *polemonii* Pierce; Colorado.
    26. *salicifloris* Pierce; Washington.
    27. *solidulæ* Pierce; Washington.
    28. *sparsipilosæ* Pierce; Maine.
    29. *subcandidæ* Pierce; Southern California.
    30. *swenki* Pierce; United States.
    31. *ventricosæ* Pierce; Europe.
    32. *vicinæ* Pierce; United States.
    33. *vierecki* Pierce; Texas.
    34. *oklahomæ* Pierce; Oklahoma.

6. Genus *Parastylops* Meijere, 1908.
    1. *flagellatus* Meijere, 1908 (type); Java.

7. Genus *Halictostylops* Pierce.
    1. *spencii* Nassonow, 1893 (type); Europe.

4. Family Hylechthridæ Pierce, 1908.

8. Genus *Hylechthrus* Saunders, 1850.
    1. *rubi* Saunders, 1850 (type); Epirus.
        var. *pustulatus* Saunders, 1872.
    2. *quercus* Saunders, 1850; Epirus.
    3. *sieboldii* Saunders, 1852; Epirus.

5. Family Xenidæ Semenov, 1902.

1. Subfamily Xeninæ Pierce, 1908.

1. Tribe Xenini Pierce.

9. Genus *Xenos* Rossi, 1790.
   1. *vesparum* Rossi, 1790 (type); Europe.
   2. *jurinei* Saunders, 1872; Europe.
10. Genus *Acroschismus* Pierce, 1908.
    1. *hubbardi* Pierce (type), 1908; Florida.
    2. *bruesi* Pierce; Michigan.
    3. *nigrescens* Brues, 1903; Texas.
    4. *pallidus* Brues, 1903; United States.
       var. *texensis* Pierce; Texas.
    5. *pecosensis* Pierce; Texas.
    6. *wheeleri* Pierce; Connecticut, District of Columbia.
       (*peckii* Brues, 1903.)
    7. *bowditchi* Pierce; United States.
    8. *hunteri* Pierce; Texas.
    9. *texani* Pierce; Texas.
    10. *rubiginosi* Pierce; Louisiana.
    11. *maximus* Pierce; Texas.
11. Genus *Schistosiphon* Pierce, 1908.
    1. *peckii* Kirby, 1813 (type); Massachusetts.
12. Genus *Vespæxenos* Pierce.
    1. *crabronis* Pierce (type); Japan.
    2. *moutoni* Buysson, 1903; China.
    3. *buyssoni* Pierce; Annam.

2. Tribe Pseudoxenini Pierce.

13. Genus *Pseudoxenos* Saunders, 1872.
    1. *schaumii* Saunders, 1872 (type); Corcyra.
    2. *klugii* Saunders, 1852; Epirus.
    3. *corcyricus* Saunders, 1872; Corcyra.
    4. *heydenii* Saunders, 1852; Epirus, Corcyra.
14. Genus *Leionotoxenos* Pierce.
    1. *jonesi* Pierce; Louisiana.
    2. *louisianæ* Pierce; Louisiana.
    3. *hookeri* Pierce; Texas.
15. Genus *Monobiaphila* Pierce.
    1. *bishoppi* Pierce (type); Texas.

3. Tribe Paraxenini Pierce.

16. Genus *Paraxenos* Saunders, 1872.
    1. *erberi* Saunders, 1872 (type); Corcyra.

4. Tribe Ophthalmochlini Pierce.

17. Genus *Sceliphronechthrus* Pierce.
    1. *fasciati* Pierce (type); Santo Domingo.
18. Genus *Ophthalmochlus* Pierce, 1908.
    1. *duryi* Pierce, 1908 (type); Ohio.
19. Genus *Eupathocera* Pierce, 1908.
    1. *lugubris* Pierce, 1908 (type); Ohio.
    2. *pruinosæ* Pierce; Colorado.
    3. *sphecidarum* Dufour, 1837; Europe.
    (?) 4. *sieboldii* Saunders, 1872; Germany.

2. Subfamily HOMILOPINÆ Pierce, 1908.

20. Genus *Homilops* Pierce, 1908.
1. *westwoodii* Templeton, 1838 (type); Brazil.
2. *bishoppi* Pierce; Texas.
3. *ashmeadi* Pierce; Santo Domingo.
4. *abbotti* Pierce; Siam.

3. Subfamily HALICTOXENINÆ Pierce, 1908.

21. Genus *Halictoxenos* Pierce, 1908.
Subgenus *Halictoxenos* Pierce.
1. *jonesi* Pierce, 1908 (type); Louisiana.
2. *crawfordi* Pierce; Nebraska.
3. *grænicheri* Pierce; Wisconsin.
4. *versati* Pierce; Wisconsin.
5. *zephyri* Pierce; Wisconsin.
6. *sparsi* Pierce; Oklahoma.
Subgenus *Halictophilus* Pierce.
7. *manilæ* Pierce; Philippines.
8. *robbii* Pierce; Philippines.
22. Genus *Apractelytra* Pierce, 1908.
1. *schwarzi* Pierce, 1908 (type); District of Columbia.

4. Subfamily CRAWFORDINÆ Pierce, 1908.

23. Genus *Crawfordia* Pierce, 1908.
1. *pulvinipes* Pierce, 1904 (type); Nebraska.
2. *cockerelli* Pierce; New Mexico.

III. Superfamily HALICTOPHAGOIDEA Pierce, 1908.

6. Family HALICTOPHAGIDÆ Pierce, 1908.

24. Genus *Halictophagus* Dale, 1832.
1. *curtisii* Dale, 1832 (type); England.
25. Genus *Pentacladocera* Pierce, 1908.
1. *schwarzii* Perkins, 1905 (type); New South Wales.
26. Genus *Pentoxocera* Pierce, 1908 (*Bruesia* Perkins, 1905).
1. *australensis* Perkins, 1905 (type); Queensland.
(?) 2. *phæodes* Perkins, 1905; Queensland.
(?) 3. *stenodes* Perkins, 1905; Queensland.
(?) 4. *schwarzi* Pierce; Guatemala.
27. Genus *Agalliaphagus* Pierce, 1908.
1. *americanus* Perkins, 1905 (type); Ohio.
28. Genus *Megalechthrus* Perkins, 1905.
1. *tryoni* Perkins, 1905 (type); Queensland.
29. Genus *Neocholax* Pierce.
1. *jacobsoni* Meijere, 1908 (type); Java.
30. Genus *Anthericomma* Pierce, 1908.
1. *barberi* Pierce, 1908 (type); New Mexico.

7. Family DIOXOCERIDÆ Pierce, 1908.

31. Genus *Dioxocera* Pierce, 1908.
1. *insularum* Pierce (type); West Indies.

IV. Superfamily ELENCHOIDEA Pierce, 1908.

8. Family Elenchidæ Pierce, 1908.

32. Genus *Elenchus* Curtis, 1831.
  1. *walkeri* Curtis, 1829 (type); Great Britain.
  2. *tenuicornis* Kirby, 1815; England.
  3. *templetonii* Westwood, 1835; Mauritius.
33. Genus *Elenchoides* Pierce.
  1. *perkinsi* Pierce (type); Fiji.
34. Genus *Mecynocera* Pierce, 1908.
  1. *kœbelei* Pierce, 1908 (type); Ohio.
35. Genus *Pentagrammaphila* Pierce.
  1. *uhleri* Pierce (type); Dacota.
36. Genus *Deinelenchus* Perkins, 1905.
  1. *australensis* Perkins, 1905 (type); Queensland.
37. Genus *Colacina* Westwood, 1877.
  1. *insidiator* Westwood, 1877 (type); Borneo.

DESCRIPTIONS OF STREPSIPTERA.

STREPSIPTERA KIRBY REDESCRIBED.

Kirby, 1813; Klug, 1814; Germar, 1817; MacLeay, 1821; Hoeven, 1828; Stephens, 1829; Pickering, 1835; Westwood, 1835; Templeton, 1838; Westwood, 1840; Siebold, 1843; Newport, 1845, 1847; Hoeven, 1850; Saunders, 1850; Newport, 1851; Siebold, 1853; Saunders, 1853; Joly, 1858; Westwood, 1861; Schaum, 1864; Mäklin, 1867; Blanchard, 1868; Kraatz, 1870; Siebold, 1870; Müller, 1872; Riley, 1873; Westwood, 1877; Carus, 1879–1899; Brandt, 1879, 1882; Friese, 1883; Harris, 1884; Kolbe, 1884–86; Müller, 1887; Claus, 1888; Mayer, 1888–1894; Nassonow, 1892, 1893; Meinert, 1896; Janet, 1897; Nassonow, 1897; Sharp, 1899, 1900–1905; Buysson, 1903; Holmgren, 1903; Handlirsch, 1903, 1904; Boerner, 1904; Clark, 1904; Henneguy, 1904; Klapalek, 1904; Shipley, 1904; Pierce, 1908.

Name derived from *στρέφειν* (*στρέψαι*) to twist, +*πτερόν*, a wing=twisted wings.

SYNONYMY.

Xenos, 1749 (a genus next to Ichneumon), Rossi, 1790, 1793.

Phthiromyæ, 1807 (Tribe III, Diptera), Latreille, 1807.

Stylopidæ, 1813 (a family in Coleoptera, Heteromera); Stephens, 1829; Westwood, 1839; Schaum, 1862; Crotch, 1863; Dallas, 1867, 1868; Packard, 1870, 1872; Sharp, 1871; Saunders, 1871; Rye, 1871–1879; Ebell, 1872; Saunders, 1877; Austin, 1882; LeConte and Horn, 1883; W. F. Kirby, 1883–84; Henshaw, 1885; J. B. Smith, 1885; Scudder, 1885, 1886; Sharp, 1887–1894; Scudder, 1890; J. B. Smith, 1890; Schwarz, 1891; Dale, 1892; Comstock, 1895; J. B. Smith, 1899; Dury, 1902; Green, 1902; Brues, 1903; Pierce, 1904; Brues, 1905; Perkins, 1905; Friese, 1906; Dury, 1906. (Kirby, 1813, used "Stylopidae" as the base family of Strepsiptera.)

Rhipidoptera, 1816 (a family in Diptera), Lamarck, 1816, 1835; Menge, 1866.

Rhipiptera, 1817 (an order), Latreille, 1817; Guérin-Meneville, 1829–1838; Latreille, 1836; Erichson, 1841; Latrielle, 1845; Duval, 1857; Laboulbene, 1876; Acloque, 1897.

Rhiphiptera, 1817 (a mistake for Rhipiptera), Leach, 1817, 1819.

Strepsiptera, 1827 (a family, Neuroptera Trichoptera), Gegenbaur, 1827.

Stylopidæ, 1840 (a family, Neuroptera, between Forficulidæ and Phryganeidæ), Shuckard, 1840.

Stylopites, 1847 (a tribe, Coleoptera), Newman, 1845, 1847, 1850; Smith, 1850; Schaum, 1852.

Stylopides, 1859 (a family, Coleoptera), Lacordaire, 1859.

Strepsiptera, 1883 (a family, Coleoptera, Heteromera), SHARP, 1881; KARSCH, 1883; SHARP, 1895–1898; SEIDLITZ, 1903–1905.

Strepsiptera, 1885 (a family, Coleoptera, Malacodermata), BRAUER, 1885.

Stylopinæ, 1900 (a subfamily, Coleoptera, Melandryidæ), LAMEERE, 1900.

Xenidæ, 1902 (a family, Coleoptera, Tenebrionoidea, near Rhipidophoridæ), SEMENOV, 1902; JACOBSON, 1904.

CHARACTERIZATION.

An order of hypermetamorphic endoparasitic insects with highly specialized reduction of certain functional organs, great specialization of other functional organs, and with dissimilar sexes.

Male.—Elytrophorous, winged, ephemeral, aerial. Head and thoracic segments united by elastic commissures. Head transverse, with eyes stalked and composed of regularly placed separated hexagonal ommatidia. Mouthparts specialized, rudimentary, vestigial, or lacking. Labrum and labium absent; pharynx presenting a great exposed surface which is folded crater-like and contracts into a small tube distant from the appendages; mandibles and maxillæ arising beneath the genæ near their base; maxillæ more or less reduced. Antennæ sensitive, with one or more joints laterally produced.

Thorax with principal parts capable of independent movement. Prothorax much reduced; mesothorax reduced; metathorax greatly elongated, occupying at least one-half the length of the body and apically covering the base of the abdomen. Front coxal cavities open behind; tarsi with each joint pulvilliform below (except in Mengeidæ and Myrmecolacidæ); tarsal claws present in only the Mengeidæ. The legs are unfit for use except in adhering to the body of the female's host during copulation, which is the only function of the males. Halteres, or balancers, attached very low on the mesopleuræ and not serving as a protection to the wings, deformed and greatly reduced. The mesostigmata are frequently protected by a lobe-like process beneath the base of each elytron. Wings folded longitudinally; veining simple, radial. Genitalia with œdeagus exposed, arising at tip of ninth segment; ninth segment ventrally much surpassing tenth, at the tip of which is the anus.

Female.—Larviform, apodous, permanently endoparasitic, inclosed by the persistent skin of the pupa. Pupa larviform, apodous.

Head and thorax adnate, forming an acariform chitinized disk, separated by a constriction from the sac-like abdomen. This disk, the cephalothorax, protrudes from between the abdominal segments of the host, with the oral or ventral surface upwards. Mouth parts vestigial. Eyes lacking. Thorax separated ventrally from head by opening of brood canal, an intermembranal conduit between pupal and adult skins leading from the genital apertures on the second to fifth segments anteriad to this ventral slit.

Reproduction prolific, larviparous. Development endoparasitic and highly hypermetamorphic. Alimentation probably osmotic. Hosts various, hexapodal. First larvæ, or triungulinids, campodeiform hexapods. Parasitic stages apodous. Male pupal case, with cephalothorax protruded from the abdomen of the host, is merely the last larval skin with cap-like lid, or cephalotheca. The pupa is similar to those of the Coleoptera and Hymenoptera and lies free in its case.

Superfamily MENGEOIDEA Pierce, 1908.

Based on the family Mengeidæ.

Characterized by having the tarsi five-jointed, and with two tarsal claws.

1. Family MENGEIDÆ Pierce, 1908.

Based on the genus *Mengea* Grote (1886), which is fossil in amber.

Antennæ seven-jointed, third and fourth joints laterally produced.

The family contains two genera:

1. *Mengea* Grote (1886). Fossil in amber.
2. *Trioxocera* Pierce, host genus unknown. Mexico.

1. Genus MENGEA Grote (1886).

Triæna MENGE 1866 (preoccupied.)

Type-species.—*Mengea tertiaria* Menge (1866).

Wings having eight primary veins from base, with one distal unattached vein between the subcosta and radius, and with the first and second anal veins apically united.

1. MENGEA TERTIARIA Menge (1866).

Triæna tertiaria MENGE, 1866.
Mengea tertiaria GROTE, 1886.—PIERCE, 1908.

This species is fossil in amber, belonging to the Tertiary age, and occurring in Germany (pl. 1, fig. 1).

The following is a translation in part of Menge's original description of this species:

Male.—Length 3 mm., breadth between tips of expanded wings 7 mm. Color of body golden brown, wings whitish. Head convex, twice as wide as long. Vertex at apex broadly emarginate, prominent laminate. Mandibles short, three edged, apically acute. Maxillæ short, obtuse, bearing on the side a knife-like, single-jointed, pubescent palpus, which is about three times as long as the maxilla proper. Labial palpi absent. Surface very finely granulate, with scattered darker punctures. Eyes hemispherical, prominent, but not petiolate, with about forty separated ommatidia, each with a hemispherical cornea, and arranged in regular lines. Antennæ seven-jointed, first joint short, cylindrical; second top-shaped, as long as first; third long, on inner side produced in a flabellum almost twice as long as the joint itself; fourth joint also laterally produced, but with flabellum shorter; fifth and sixth joints top-shaped, of equal length with first and second; seventh joint cylindrical, obtuse at apex, almost as long as sixth and seventh together. The entire antennæ are very finely pubescent. Head separated from thorax by narrow commissure. Prothorax becoming broader behind; mesothorax somewhat broader and longer, with a sharply outlined scutellum; metathorax a little longer, narrowed behind into a long shield-like postscutellum, which reaches to the middle of the abdomen. Elytra reduced to short lobes. Hind wings subtriangular, almost as long as wide, with eight (costa and subcosta united) straight radial veins, and no cross-veins, but with several short longitudinal detached veins. Legs eight-jointed, the trochanters long and strong, somewhat curved, reversed top-shaped; femora twice as long, somewhat arcuate, cylindrical; tibiæ scarcely half as long as femora, reversed top-shaped; tarsi with first joint thickest, fifth longest, first reversed top-shaped, the following subcylindrical, the last joint bearing two lancet-shaped, three-angled, straight claws, without pulvillus; legs very finely pubescent. Abdomen ten segmented.[a]

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[a] *Male.*—Länge des Leibes 3 mm. Breite bei ausgespannten Flügeln 7 mm. Jetzige Farbe des Leibes gelblichbraun, die der Flügel weisslich. Kopf rundlich, doppelt so breit wie lang. Oberlippe, wie es scheint, ein breites am Vorderende abgerundetes Blättchen. Oberkiefer zwei kurze, dreieckige, spitze etwas vorstehende Zangen. Unterkiefer (maxillæ) kurz, dreieckig, stumpf. An der Seite derselben zwei messerförmige eingliedige fein behaarte Taster (palpus, or second joint of maxilla), etwa dreimal so lang als die Unterkiefer. Die Unterlippe so viel zu ersehen ist, dreilappig, ohne Taster, wenn nicht die beiden Seitenteile als solche anzusehen sind; der mittlere Teil durch eine schwache Furche in zwei Teile geteilt. Hinter derselben ein dreieckiges Kinn, bedeutend lang und breit. * * * Die Oberfläche ist sehr fein gekörnelt und mit einzelnen dunklern Punkten überstreut. * * * Augen halbkugelförmig, zu beiden Seiten stark vorgequollen, jedoch nicht gestielt, aus etwa vierzig, von einander getrennten Äuglein bestehend, jedes Äuglein mit halbkegelförmiger Hornhaut, die in der Mitte kreisförmig eingedrückt erscheint, bedeckt. * * * Fühler siebengliedrig, das erste Glied kurz, cylindrisch; das zweite kreiselförmig, eben so lang; das dritte länglich dreieckig, nach der Innenseite in einen cylindrischen, am Ende kegelförmigen, Seitenast verlängert, der fast doppelt so lang ist, wie das Glied selbst; das vierte Glied eben so gestaltet, der Seitenast jedoch etwas kürzer; das fünfte and sechste Glied kreiselförmig, mit dem ersten und zweiten fast von gleicher länge; das siebente Glied cylindrisch, stumpf zugespitzt, fast so lang wie das sechste und siebente zusammen. Das dritte und vierte Glied bildet mit den drei letzten vereint eine dreieckige Gabel. Alle Glieder sind mit feinen Härchen besetzt.

Der Kopf ist von der Brust durch einen schmälern Hals getrennt. Der Prothorax nach hinten sich verbreiternd, der Mesothorax etwas breiter und länger, oben mit einem stark ausgeschnittenen Schildchen bedeckt, der Metathorax wenig länger, sich nach hinten verschmälernd, oben in einen länglichen schildartigen Fortsatz auslaufend, der beinah bis zur Mitte des Hinterleibs reicht.

Vorderflügel auf zwei kurze linienförmige Stummel reducirt, die an der untern Seite rinnenförmig sind und am Ende durch Umschlagung des Randes eine löffelartige

2. TRIOXOCERA, new genus.

Type of genus.—*Trioxocera mexicana*, new species.

Name derived from τρία (three) + ὄζος (branch) + κέρας (horn) = three-branched antennæ.

Wings having seven primary veins from base, with one distal unattached vein beyond the tip of the radius, one long unattached vein beginning above and very near the medius, medius with two branches on the costal side; cubitus and second anal very heavy, first anal light, third anal lacking.

1. TRIOXOCERA MEXICANA, new species.

Described from two specimens collected by Dr. A. Fenyes at Cordoba, Vera Cruz, Mexico (fig. 3, nos. 1, 2; pl. 1, figs. 2, 3, 4).

Male.—Length 1.7 mm.; wing expanse 3.7 mm.; brown; lighter, yellowish below; wings clouded, veins dark and distinct. Head transverse; eyes prominent, normal; antennæ seven-jointed, first two joints transverse cup-shaped receiving the following joint, third even shorter cupped, inferiorly extended in a long flattened sensitive flabellum which points outward and lies closely under the following joint, extending almost as far and reaching beyond the base of the seventh joint; fourth joint similarly produced, the flabellum reaching almost to the middle of the seventh; fifth joint elongate becoming flattened like the flabelli, considerably longer than the two following; sixth joint about one-third the length of the fifth; seventh one-half longer than the sixth. The mouth parts can not be studied in the specimens at hand.

Wings with seven primary veins from base; the first two (costa + subcosta) strong, united, bracing the margin to its middle; parallel with this and very close to it is the third (radius) which is much lighter and not as long as the first, about opposite the tip of the subcosta a short wavy vein appears which is evidently an interrupted

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Vertiefung bilden. Doch sind die beiden Randadern (Costa u. Subcosta) angedeutet. Hinterflügel dreieckig, fast so lang wie breit; * * * der ganze Flügel stralenförmig mit sieben ziemlich geraden Längsadern durchzogen, ohne alle Queradern, aber mit vielen unregelmässigen Querfalten und einigen Längsfalten versehen. * * *

Füsse achtgliedrig, die Hüften (coxa) ziemlich lang und stark, etwas gekrümmt umgekehrt kegelförmig; die Schenkel (femur) doppelt so lang, etwas gebogen, cylindrisch, die Schienen (tibia) kaum halb so lang, umgekehrt kegelförmig. Von den Tarsengliedern ist das erste Glied das dickste, das fünfte das längste, das erste umgekehrt kegelförmig, die folgenden sich allmälich der Cylinderform annährend; am Ende des letzten Gliedes zwei lanzettförmig dreieckige, gerad ausgestreckte Krallen, ohne Haftpolster. Die ganzen Füsse unbewehrt und nur mit feinen kurzen Härchen bekleidet. Der Hinterleib neungliedrig, in der Mitte wenig breiter als am Grunde, am Ende sich allmälig zuspitzend, von oben etwas flach gedrückt, die Ringe an den Seiten mit etwas flach gedrückt, die Ringe an den Seiten mit etwas vorstehenden Ecken. Die Oberfläche ist fein gekörnelt. Die fein behaarte stumpfe Spitze scheint das vorstehende Copulationsorgan zu sein. (Menge, 1866.)

continuation of the radius; the fourth primary (medius) arises contiguous to the second but rapidly diverges; between the bases of these two veins is a short darkened area, about the middle this vein sends off above a short slightly diverging branch indicated by an infuscation, beyond this and between the main vein and its branch is another infuscated branch which extends parallel and very close to the main vein to the outer margin of the wing; above all of these branches is an unattached infuscated vein beginning above the origin of the second branch and but a little distance from the main vein and extending to the outer margin of the wing; the fifth primary (cubitus) diverges from the medius at the same angle as the radius does from the medius; the sixth primary (first anal) is halfway between the cubitus and second anal and very strong; the seventh primary (second anal) diverges from the cubitus at the same angle as exists between the medius and cubitus, and extends to the margin. Anterior and median coxæ transverse; trochanters arising at the sides, as long as the femora, or tibiæ; posterior coxæ prominent, cylindrical, cupped; trochanters flared at apex, not as long as femora; tarsi five-jointed, first joint two-thirds as long as tibia, second almost half as long as first, third slightly shorter, fourth bilobed, fifth slender almost as long as the third, and armed with two long slender claws. Œdeagus long and slender, gently sinuate, acute at tip but not abruptly angulate near tip.

Type.—Cat. No. 10080, U.S.N.M.

Superfamily XENOIDEA Pierce, 1908.

Hymenopterobiæ (part) SAUNDERS, 1872.
Stylopinæ PERKINS, 1905.

Type-family.—Xenidæ Semenov.

Tarsi four-jointed.

The superfamily includes four families, all parasites of Hymenoptera.

2. Myrmecolacidæ Pierce, parasitic on Formicoidea.
3. Stylopidæ Kirby, parasitic on Apoidea.
4. Hylechthridæ Pierce, parasitic on Apoidea.
5. Xenidæ Semenov, parasitic on Apoidea, Vespoidea, Sphecoidea.

2. Family MYRMECOLACIDÆ Pierce, 1908.

Hymenopterobiæ (part) SAUNDERS, 1872.
Myrmecolacides SAUNDERS, 1872.

Type-genus.—*Myrmecolax* Westwood (1858).

Antennæ seven-jointed, third joint laterally produced, fourth short, others elongate; tarsi four-jointed.

The family includes *Myrmecolax* Westwood, parasitic on an unknown ant from Asia, and *Caenocholax* Pierce with unknown host from Mexico.

3. Genus MYRMECOLAX Westwood (1858).

Myrmecolax SAUNDERS, 1872.

Type of genus.—*Myrmecolax nietneri* Westwood (1858).

Name derived from μύρμηξ (an ant) + κόλαξ (parasite), meaning an ant parasite.

The genus is parasitic upon ants and at present is restricted to Southern Asia. It is separated from *Cænocholax* by the characters of the wing venation and by the extraordinary tenth abdominal segment of the latter.

Wings having eight primary veins from base, the medius curved upward and branched at right angles.

1. MYRMECOLAX NIETNERI Westwood (1858).

Myrmecolax nietneri SAUNDERS, 1872.—PIERCE, 1908.

The host is an undetermined formicid, collected at Ramboddo, Ceylon, by Herr Nietner on April 29 (pl. 1, figs. 5, 6).

Westwood's description is as follows:

Male.—The eyes are large, the interstices being conically elevated; the front of the head is produced into two rounded lobes. The antennæ partake of the character of those of *Elenchus*, the first and second joints being very short, the third also very short but having its under apical angle produced into a long slender branch, of which the extremity had been injured; the three terminal joints are much longer and more slender than those of the genus *Stylops;* these joints are also more curved, and with the extremities dilated. In certain positions the third joint appears to be followed by a distinct but very short joint.

The mandibles are long, very slender and curved, acute at the tips, whilst the maxillary palpi are long and compressed, with the first joint very short and the second long, occupying nearly the whole of the organ. The thorax does not appear to offer any material difference from that of the already described genera; the prothorax is narrow and ring-shaped, as is also the mesothorax, having the pseudelytra affixed at the posterior angles; the latter are clavate at the tips. The wings are traversed by four strong black veins, radiating from the base of the wing, exclusive of the costal portion; the second (medius or fourth primary) of these veins is curved at its extremity. The legs are very short, and the basal joint of the tarsus in one foot was observed to have its lower angle produced. (Westwood, 1858.)

4. CÆNOCHOLAX, new genus.

Name derived from καινός (strange, unusual, new) + χόλαξ (parasite); meaning an interesting new parasite.

Tarsi four-jointed, the first large and not closely united to the following; antennæ with first two joints short cylindrical, third laterally produced into a long flabellum, fourth transverse cylindrical, fifth, sixth, and seventh elongate flattened; wings with only six primary veins, with a short detached vein just below the apex of the radius, with the medius short and continued by a long detached vein commencing behind it and shortly before its apex, cubitus and third anal lacking.

The genus is based on *Cænocholax fenyesi* from Mexico.

1. CÆNOCHOLAX FENYESI, new species.

Described from four males collected by Dr. A. Fenyes, at Cordoba, Mexico, May 21, 1908 (fig. 3, nos. 3, 4; pl. 1, figs. 7, 8, 9, 10, 11).

Male.—Length 1–1.5 mm., wing expanse 3.25–3.5 mm. Dark brown, wings slightly infuscated, veins strong. Head transverse, considerably wider than thorax, eyes very large, faceted. Occiput prominent bearing the antennæ on each side. Antennæ seven-jointed; the first two joints transverse, cylindrical, cupped; third joint transverse, cupped, but produced outwardly beneath in a long flabellum, which is almost as long as the metathorax; fourth joint transverse, cylindrical; fifth elongate five-sixths as long as the width of the head; sixth seven-tenths as long as the fifth and slightly surpassed by the flabellum of the third; seventh four-fifths as long as the fifth. Face almost as wide at the thorax; mandibles arising at posterior corners of face at edge of eyes, chitinous, elongate, slender, and acute, almost as long as the sixth joint of the antennæ; maxillæ arising just behind the mandibles on the posterior margin of the occiput, the maxilla proper being a large globular fleshy organ, very sensitive, and bearing on the outer side about the middle a long slender palpus, almost twice as long as the mandibles and nearly as slender; oral orifice at a considerable distance from the bases of the appendages; occiput merely a narrow basal band. Thorax as in other genera, except that the scuti are united for some little distance in the middle behind the præscutum; balancers long. Wings with six primary veins; the first two consisting of the very short basal costa and the subcosta reaching the middle of the anterior margin; the third (radius) lies very close to the subcosta, runs parallel to it and considerably beyond and becomes thickened toward its apex; below the apex of the radius and close to it is a short, thickened unattached branch; the fourth primary (medius) is united to the radius at its base, but diverges rapidly, and only extends one-third of the distance to the margin; immediately below the medius and beginning about its middle is an unattached vein which runs parallel to the medius to its apex and thence straight onward to the outer margin; the fifth primary (first anal) diverges from the medius at almost twice the angle between radius and medius; the sixth primary (second anal) is shorter and united with the preceding for a little distance at its base. Front and middle coxæ transverse; trochanters arising at the sides and longer than the femora; tibiæ about as long as the femora; tarsi short, hardly more than half as long as the tibiæ, with the first joint cylindrical and as long as the three following, these three joints with pubescent pad beneath as in other genera. Posterior coxæ prominent, cylindrical; trochanters short. Tenth dorsal segment of abdomen a large, broad, almost circular plate, wider than the preceding segments and completely covering the ninth ventral. Ninth ventral elongate, overhung by the much larger tenth dorsal, with the œdeagus arising from its tip. Œdeagus chitinous, concave on the inner margin for two-thirds of the distance to the apex, then abruptly turned outward, making a very sharp process below; on the outer edge acutely curved outward opposite the inferior process and meeting the inner margin to form a very acute apex.

Named in honor of its collector, Dr. A. Fenyes, of Pasadena, Cal.

Type.—Cat. No. 10081, U.S.N.M.

3. Family STYLOPIDÆ Kirby, 1813, redefined.

Strepsiptera or *Stylopidæ* HOEVEN, 1850 (part).
Hymenopterobiæ (part) SAUNDERS, 1872.
Stylopides SAUNDERS, 1872.

Type-genus.—*Stylops* Kirby (1802).

Antennæ six-jointed, third laterally produced; tarsi four-jointed.

This family includes three genera, parasites of Andrenidæ.

5. *Stylops* Kirby (1802), parasitic on *Andrena;* Europe, America.
6. *Parastylops* Meijere (1909); Java.
7. *Halictostylops,* new genus, parasitic on *Halictus;* Europe.

The location of the third genus is uncertain, as no male has ever been seen; but since the female of *Halictostylops spencii* Nassonow resembles a *Stylops* female it is placed here. The genus may subsequently be found to fall near *Halictoxenos* in Xenidæ.

5. Genus STYLOPS Kirby (1802).

Stylops KIRBY, 1813.—CURTIS, 1828.—HOEVEN, 1850.—SAUNDERS, 1872.—PIERCE, 1908.

Type of genus.—*Stylops melittæ* Kirby (1802).

Name derived from στῦλος (pillar) + ὤψ (eye), = stalked eye.

Parasitic on the genus *Andrena.*

Curtis described this genus as follows:

Male.—Antennæ inserted between the eyes near the crown of the head, membranous, perforated or punctured, composed of six joints, the basal one somewhat cup-shaped; second very short, transverse; third produced on the internal side into a dilated hollow lobe extending beyond the fifth joint; fourth large subclavate; fifth smaller subovate; sixth as long, ovate and compressed. Labrum wanting. Pharynx visible. Mandibles arising between the eyes, very remote, at their base conniving, long, slender, lanceolate and horny. Maxillæ large and robust, membranous, indistinctly pubescent, biarticulate. Prothorax and mesothorax very short rings, not so broad as head. Tarsi four-jointed, each with pulvillus, basal joint largest, terminal smallest and notched at tip (Curtis, 1828).

Female.—Cephalothorax rather abruptly narrowed behind stigmatal angle, subtriangular to ovate, more or less obtuse or truncate in front. Stigmata often prominent. Mouth ventral with mandibles on each side, rather broad and obtuse. Abdomen with five median genital canals on second to sixth segments (Nassonow, 1893 *a*).

Triungulinid. Body oblong, slightly narrowing posteriad. Tenth segment medianly cleft, forming two tubercles, each bearing a long stylet (Nassonow, 1893 *a*).

The genus contains the following species:

1. *melittæ* Kirby (1802), parasitic on *Andrena nigro-ænea* Kirby; England, Germany, Hungary.
2. *dalii* Curtis (1828), parasitic on *A. labialis* Kirby; England.
3. *childreni* Gray (Griffith, 1832), parasitic on *A. victima* Smith; Nova Scotia.
4. *spencii* Pickering (1835), parasitic on *A. tibialis* Kirby; England, Germany.
5. *aterrima* Newport (1847), parasitic on *A. trimmerana* Kirby; England.
6. *thwaitei* Saunders (1872), parasitic on *A. afzeliella* Kirby; England, France, Germany, Switzerland, Hungary.
7. *advarians* Pierce, parasitic on *A. advarians* Viereck; British Columbia.
8. *bipunctatæ* Pierce, parasitic on *A. bipunctata* Cresson; Nebraska Wisconsin, Indiana, Alabama.
9. *bruneri* Pierce, parasitic on *A. illinoiensis* Robertson; Nebraska, Illinois.
10. *californica* Pierce, parasitic on *A. subtilis* Smith; Southern California.
11. *claytoniæ* Pierce, parasitic on *A. claytoniæ* Robertson; Georgia, Illinois.
12. *cornii* Pierce, parasitic on *A. commoda* Smith; Wisconsin.
13. *crawfordi* Pierce, parasitic on *A. crawfordi* Viereck; Texas.
14. *cressoni* Pierce, parasitic on *A. cressoni* Robertson; Maine.
15. *dominiquei* Pierce, parasitic on *A. flessæ* Panzer; France.
16. *grænicheri* Pierce, parasitic on *A. nivalis* Smith; Wisconsin.
17. *hartfordensis* Pierce, parasitic on *A. hartfordensis* Cockerell; Georgia.
18. *hippotes* Pierce, parasitic on *A. hippotes* Robertson; Ohio.
19. *imitatrix* Pierce, parasitic on *A. imitatrix* Cresson; Texas.
20. *multiplicatæ* Pierce, parasitic on *A. multiplicata* Cockerell; Wisconsin.
21. *nasoni* Pierce, parasitic on *A. nasoni* Robertson; Pennsylvania.
22. *nassonowi* Pierce, parasitic on *A. carbonaria* Linnæus; Germany, Egypt.
23. *nubeculæ* Pierce, parasitic on *A. nubecula* Smith; Colorado.
24. *packardi* Pierce, parasitic on *A. placida* Smith; Massachusetts.
25. *polemonii* Pierce, parasitic on *A. polemonii* Robertson; Colorado.
26. *salicifloris* Pierce, parasitic on *A. salicifloris* Cockerell; Washington.
27. *solidulæ* Pierce, parasitic on *A. solidula* Viereck; Washington.

28. *sparsipilosæ* Pierce, parasitic on *A. sparsipilosa* Viereck; Maine.
29. *subcandidæ* Pierce, parasitic on *A. subcandida;* Southern California.
30. *swenki* Pierce, parasitic on *A. solidaginis* Robertson; Nebraska, Pennsylvania.
31. *ventricosæ* Pierce, parasitic on *A. ventricosa* Dours; Hungary.
32. *vicinæ* Pierce, parasitic on *A. vicina* Smith; New Hampshire, Connecticut, Canada, Massachusetts.
33. *vierecki* Pierce, parasitic on *A. texana profunda* Viereck; Texas.
34. *oklahomæ* Pierce, parasitic on *A. flavoclypeata miserabilis* Cresson; Oklahoma.

The following names have been used in *Stylops* and are now synonyms:

dahlii Friese (1906) =*dalii* Curtis (1828), Pierce.
haworthi Stephens (1829) =*melittæ* Kirby (1802), Saunders, 1872.
kirbii Leach (1814) =*melittæ* Kirby (1802), Saunders, 1872.
trimmerana Smith (1857) =*aterrima* Newport (1847), Saunders, 1872.

As the writer has seen none of the species hitherto described in the genus, a table may be given here based on the illustrations of such species. The only available character in the illustrations is the antenna. Hereafter species should also be separated by the shape of the œdeagus and length of maxillary joints, as well as relative lengths of antennal joints. The thorax and wing venation may also present good characters.

Partial key of males.

1. Fourth joint of antennæ subequal to or greater than the following two together... 2.
   Fourth joint not as great as the sum of the two following.................... 5.
2. Fourth joint about twice as great as the two following together, third not reaching sixth laterally ....*melittæ* Kirby.
   Fourth joint hardly greater than sum of two following .... 3.
3. Third joint laterally reaching beyond base of sixth, fifth and sixth subequal (Smith's 1857 and Griffith's 1832 figures disagree)..........*childreni* Gray.
   Third joint laterally not reaching sixth.................................. 4.
4. Fifth joint slightly longer than the sixth....................*spencii* Templeton.
   Sixth joint acuminate, longer than fifth....................*dominiquei* Pierce.
5. Fourth and fifth joints subequal, shorter than sixth............*aterrima* Newport.
   Fourth joint longer than fifth or sixth, sixth longer than fifth....*dalii* Curtis.
   Fourth joint about twice as long as fifth, sixth longer than fifth....*crawfordi* Pierce.

Key to females.

In the genus *Stylops* the mandibles of the females show fewer points of difference than in the xenid genera, so the best key for differentiation of the species described herein will be one based on the comparative measurements of the various dimensions of the cephalothorax. In order to accurately study the females of the

Strepsiptera, the cephalothorax should be mounted on a slide in balsam. Good mounts can be obtained from dried specimens by running up through water, alcohol, xylol, and cedar oil to balsam.

The measurements are with a Bausch and Lomb stand, tube length 160, eyepiece 1, objective ½, with eyepiece micrometer; 1 space = .01062 mm. As the comparative dimensions are the sought-for characters, other microscopes will be just as available. The actual size of each species may be found with its description.

The following measurements were taken: The length is the distance from the base of the flattened cephalothorax to the apex of the same; the distance from spiracle to apex is measured from the apical edge of the spiracle; the breadth between the mandibles is the shortest distance between the same; the breadth of the head is measured from the posterior lateral angles of the head, which in most species is indicated by a slight convex or concave angle, and by the lateral extension of the ventral slit which represents the base of the head; the breadth of the cephalothorax at the spiracles is measured between the outermost points of the spiracles; the greatest breadth of the cephalothorax is generally equal to the preceding, although it sometimes occurs behind the spiracles.

Species.	1. Length.	2. Spiracle to apex.	3. Breadth between mandibles.	4. Breadth head.	5. Breadth at spiracles.	6. Greatest breadth.
solidulæ	130.0	90.0	18.0	66.0	119.0	119.0
cornii	119.0	85.0	15.0	69.0	115.0	115.0
	113.0	78.0	14.0	57.0	105.0	105.0
vicinæ	106.0	76.0	16.0	61.0	107.0	107.0
grænicheri	104.0	76.0	14.5	63.0	119.0	119.0
crawfordi	98.0	69.0	15.0	59.0	107.0	107.0
salicifloris	96.0	69.0	14.0	61.0	98.0	98.0
advarians	89.5	64.5	15.0	52.0	91.0	91.0
californica	84.0	60.0	12.0	58.0	91.0	91.0
imitatrix	84.0	54.0	11.0	49.0	84.0	84.0
cressoni	83.0	56.0	12.0	46.5	86.0	86.0
multiplicatæ	82.0	56.0	12.0	49.0	85.5	85.5
nubeculæ	79.5	56.5	12.0	48.0	89.0	89.0
claytoniæ	79.5	51.5	10.0	45.0	77.0	77.0
hippotes	79.0	50.0	12.5	50.0	78.5	78.5
swenki	78.0	55.0	14.5	57.0	91.0	91.0
vierecki	78.0	54.0	12.0	50.0	81.0	81.0
bipunctatæ	73.5	51.5	11.0	43.0	71.0	73.0
subcandidæ	71.0	46.0	10.0	45.0	73.0	75.0
nasoni	69.0	48.0	9.0	39.0	70.0	70.0
sparsipilosæ	68.5	47.5	10.0	44.0	73.0	73.0
bruneri	68.0	37.0	9.5	46.0	63.0	63.0
hartfordensis	65.0	46.0	10.5	41.0	64.5	66.5
polemonii	55.0	37.0	7.0	29.5	49.0	51.0

Following is a comparison of dimensions by ratio. The first column represents the ratio of the breadth of the cephalothorax between the spiracles to the distance between the mandibles; the second represents the ratio of the breadth of the head to the distance between the mandibles; the third the ratio of the breadth between the spiracles to the breadth of the head; the fourth the ratio of the breadth between the spiracles to the distance from spiracle to apex. The species are arranged in the same order as in the preceding table.

Species.	Cephalothorax to mandibles. (5):(3)::—:1.[a]	Head to mandibles. (4):(3)::—:1.	Cephalothorax to head. (5):(4)::—:1.	Breadth to length. (5):(2)::—:1.
solidulæ	6.61	3.66	1.80	1.32
cornii	7.50–7.66	4.07–4.60	1.66–1.84	1.34–1.35
vicinæ	6.68	3.81	1.75	1.40
grænicheri	7.12	4.34	1.88	1.56
crawfordi	7.13	3.93	1.81	1.55
saliciﬂoris	7.00	4.35	1.60	1.42
advarians	6.06	3.46	1.75	1.41
californica	7.58	4.83	1.56	1.51
imitatrix	7.63	4.45	1.71	1.55
cressoni	7.16	3.87	1.84	1.53
multiplicatæ	7.12	4.08	1.74	1.52
nubeculæ	7.41	4.00	1.85	1.57
claytoniæ	7.70	4.50	1.71	1.49
hippotes	6.28	4.00	1.77	1.77
swenki	6.27	3.93	1.59	1.65
vierecki	6.75	4.16	1.62	1.50
bipunctatæ	6.45	3.90	1.65	1.37
subcandidæ	7.30	4.50	1.62	1.58
nasoni	7.77	4.33	1.78	1.45
sparsipilosæ	7.30	4.40	1.65	1.53
bruneri	6.63	4.84	1.36	1.79
hartfordensis	6.14	3.90	1.57	1.40
polemonii	7.00	3.91	1.66	1.32
oklahomæ	9.57	5.52	1.73	1.43

[a] These ratios refer to the numbers at the head of the preceding table.

This study of comparative dimensions is sufficient to show any one that the species may be easily distinguished. To facilitate identification the writer has illustrated a female of each species and given the mandibular character prominence. No relationship can be found between the parasites and the artificial subgenera designated for *Andrena* by Robertson.

1. STYLOPS MELITTÆ Kirby (1802).

Stylops kirbii LEACH, 1814.
Stylops haworthi STEPHENS, 1829.
Stylops melittæ SAUNDERS, 1872.

Host.—*Andrena nigro-aenea* Kirby; England, Germany, Hungary (fig. 2, no. 14; pl. 2, fig. 4).

The following description is drawn from Kirby's original description:

Male.—Black, with feet fuscous. Length, 1½ lines. Head anteriorly obsoletely tri-lobed. Antennæ six-jointed; first joint longer than second, clavate or obconic, apically obliquely truncate; second very short, cylindrical; third short, inferiorly produced in a long lanceolate, subauriform, compressed flabellum; fourth longer, sublinear, outwardly a little broader; fifth short; sixth very short, apically rounded, tenuate. Mandibles a little inflated toward apex. Maxillæ obconic, compressed; with the palpus semiovate, acute, concave beneath. Eyes large, prominent. Vertex rather flat. Elytra small, sublinear. Wings large, longer than the body, folded, white, with costal margin dark. Postscutellum elongate, covering abdomen. Feet compressed, piceous.[a]

From the figures of this species (Kirby, 1806; Smith, 1857) the following may be added: Third joint of antennæ laterally not quite reaching sixth; fourth equal to twice fifth plus sixth.

2. STYLOPS DALII Curtis (1828).

Stylops melittæ dahlii FRIESE, 1906.
Stylops dalii Pierce, 1908.

Host.—*Andrena labialis* Kirby, England.

Male.—Length 3.5 mm., wing expanse 7.8 mm.

The following is Curtis's description:

Intense velvety black. Palpi with the second joint much smaller than the first. Antennæ with the second joint very minute, and the fifth shorter than the sixth. Scutellum at the base and abdomen at the sides ochraceous. Superior wings or elytra fuscous, inferior wings emarginate at the posterior edge and narrowed toward the anal angle; milky white, iridescent, the costa fuscous as well as several of the nervures at the base. Legs fuscous. (Curtis, 1828.)

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[a] *Male.*—St(ylops) aterrima; alis corpore majoribus; pedibus fuscis.

Long. corp. lin. 1½.

Corpus aterrimum, obscurum. Caput antice obsolete trilobum. (Saunders, 1872, 27, from Kirby, 1802.)

Antennæ bipartitæ [sexarticulatæ], ramis compressis, superiori articulato; stipite biarticulato; articulo primo sequente longiori, clavato vel obconico; apice oblique truncato; secundo brevissimo, cylindrico, ramos duos emittente (sic); inferiori [articulo 3tio] paulo breviori, lanceolato et fere auriformi, compresso, exarticulato, supra concavo; superiori compresso, triarticulato; articulo primo [4to] longiori, sublineari, extrorsum paulo latiori; secundo [5to] brevi, tertio [6to] brevissimo, apice rotundato, linearibus, tenuioribus.

Mandibulæ apice paulo crassiores.

Palpi (maxillæ) articulo primo, obconico, compresso; secundo semiovato, acuto; subtus concavo. (Saunders, 1872, 26, from Kirby, 1813.)

Oculi magni prominuli, conspicue reticulati, pedunculo brevi, crasso, insidentes. Vertex planiusculus.

Truncus: Elytra parva, sublinearia, thoracis lateribus affixa. Alæ magnæ, corpore longiores, plicatæ, lacteæ, costâ lineolâque submarginali, nigricantibus. [Pro-] scutellum [postscutellum, Aud.] (this latter is the correct) porrectum, elongatum, calceiforme, abdomen obtegens; processu corneo utrinque munitum. Pedes compressi picei. Abdomen, sub scutelli tegmine delitescens, carnosum, ano truncato, subemarginato. (Saunders, 1872, p. 27, from Kirby, 1802.)

Further amplification of this description may consist in the following, drawn from the illustrations of the species (Curtis, 1828; Smith, 1857): Third joint of antennæ laterally reaching about to middle of sixth; fourth and sixth subequal, and a little longer than fifth.

3. STYLOPS CHILDRENI Gray (Griffith, 1832).

Stylops childreni SMITH, 1857.—SAUNDERS, 1872.—PIERCE, 1908.

Host.—*Andrena victima* (?) Smith; Nova Scotia.

Type in British Museum.

According to Saunders it may be described as follows:

Male.—Sooty black, with antennæ and maxillæ piceous, abdomen luteopiceous; feet rufescent; wings pale fuscous, iridescent, with anterior margin darker.[a]

From Smith's (1857) drawing of the type the following characters may be assumed: Third joint of antennæ laterally almost reaching tip of sixth; first joint short, not much longer than sixth; fourth subequal to fifth plus sixth.

The typical species has not been found in this country since its first record. It must be thoroughly understood that the writer has found no species parasitic on two distinct species of Andrena. Packard's references to *Stylops childreni* were based on parasites of *Andrena placida* in Massachusetts, to which species the writer gives the name *Stylops packardi*, and upon parasites of *Andrena vicina* in Massachusetts which the writer herein describes as *Stylops vicinæ*.

4. STYLOPS SPENCII Pickering (1835).

Stylops spencii WESTWOOD, 1840.—SAUNDERS, 1872.—PIERCE, 1908.
Stylops melittæ NASSONOW, 1893*a*.
Stylops melittæ spencei FRIESE, 1906.

Host.—*Andrena tibialis* Kirby; England, Germany.

The original description by Pickering is as follows:

> *Male.*—Specifically distinguished by its comparatively large size; dark wings, marked with strong black nervures; basal joint of antennæ produced obliquely internally to a considerable distance beyond the insertion of the second joint; by the shape of the wings, which are produced at the external anterior angle to a point (not literally true) and are very broad and rounded behind; and by the pitchy red anus. (Pickering, 1835.)

From the figures of the species published by Pickering the following may be added: Third joint of antennæ not attaining tip of fifth, fourth joint greater than fifth plus sixth. Mandibles short, slender, and very acute, slightly longer than first joint of maxillæ. Maxillæ two jointed on a tuberculate base, with second joint once and one-half longer than first.

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[a] *Male.*—Fuliginosa, antennis palpisque piceis; abdomine luteopiceo; pedibus rufescentibus; alis pallide fuscis, iridescentibus, margine antico obscuriore.. (Saunders, 1872.)

Female.—Cephalothorax light brownish with slightly concave dark band at base; as long as broad, apically sinuately truncate; truncation a little over one-fourth the width at the spiracles. Lateral margin convex. Spiracles dorsal, not reaching lateral margin.

This description is imperfect, as it is drawn from the figure (Nassonow, 1893 *a*, pl. 1, figs. 2, 3, 5).

5. STYLOPS ATERRIMA Newport (1847).

Stylops trimmerana (=*melittæ?*) SMITH, 1857.
Stylops aterrima SAUNDERS, 1872.—PIERCE, 1908.
Stylops melittæ aterrima FRIESE, 1906.

Host.—*Andrena trimmerana* Kirby; England, April, May.

According to Saunders the description is as follows:

Male.—Similar to *Stylops melittæ*, but with occipital margin of head deeply excised; antennæ, head, thorax, legs, and abdomen black.[a]

Smith (1857) reproduces Newport's figure of *aterrima* and gives his own figure of *trimmerana* which is from a fresh specimen. Both figures agree on the following points: The first joint of the antennæ is long; the second very short; the third produced laterally and parallel to the remainder attaining a point beyond the beginning of the sixth; the fourth, fifth, and sixth joints subequal, the sixth longer than the fifth.

6. STYLOPS THWAITEI Saunders, 1872.

Stylops dalii THWAITES, 1841.
Stylops thwaitei SAUNDERS, 1872.—PIERCE, 1908.
Stylops thwaitesci SAUNDERS, manuscript correction.

Host.—*Andrena afzeliella* Kirby; England, France, Germany, Switzerland, Hungary. (See Host List for references.)

This might be considered a *nomen nudum* if it were not for the fact that the host determines the parasite. Hence it may be expected that a valid description of the species will shortly be forthcoming from Europe.

It is very unfortunate that the name was published incorrectly.

7. STYLOPS ADVARIANS, new species.

Host.—*Andrena advarians* Viereck (det. H. L. Viereck); Vancouver, British Columbia, April 5, 1902. Described from one specimen received from H. L. Viereck (pl. 3, fig. 1).

Female.—Length of cephalothorax 0.95 mm., breadth at spiracles 0.96 mm., breadth at base of head 0.55 mm., distance between mandibles at base 0.16 mm. Cephalothorax light yellowish brown with

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[a] *Male.*—*S. melittæ* simillima, sed capitis margine occipitali profunde exciso; antennis, capite, thorace, (alis?) pedibus, abdomineque aterrimis. (Saunders, 1872.)

dark brown transverse band at base; as long as broad, trapezoidal broadly truncate at apex; truncation about one-third breadth at spiracles. Mandibles broadly rounded with acute outwardly curved tooth at inner apex. Mouth broadly rounded, subquadrate. Spiracles prominent.

Type.—Cat. No. 10082, U.S.N.M.

8. STYLOPS BIPUNCTATÆ, new species.

Host.—*Andrena bipunctata* Cresson; Indiana, collected by C. F. Baker. Described from one specimen from the Carl F. Baker collection of the U. S. National Museum.

Female.—Length of cephalothorax 0.78 mm., breadth at spiracles 0.75 mm., breadth at base of head 0.45 mm., distance between mandibles at base 0.16 mm. Cephalothorax light yellowish brown with narrow dark transverse band at base; slightly longer than broad, deltoid, broadly truncate at apex; truncation about one-third breadth at spiracles. Head slightly constricted laterally at base of mandibles. Mandibles oblique, broadly rounded with acute outwardly curved tooth at apex, and a second tooth about middle of outer side below. Mouth almost round. Spiracles dorsal, not reaching lateral edge.

Paratypes with the following records were also studied: Polk County, Wisconsin, C. F. Baker; Alabama, C. F. Baker; Sioux County, Nebraska, May, L. Bruner; Milwaukee, Wisconsin, April 17, 1902, S. Graenicher. The outer tooth of the mandibles is not as distinct in these as in the type.

Type.—Cat. No. 10083, U.S.N.M.

9. STYLOPS BRUNERI, new species.

Host.—*Andrena illinoiensis* Robertson; Sioux County, Nebraska, May, L. Bruner, collector. Described from one specimen from the collection of the University of Nebraska (pl. 3, fig. 2).

Female.—Length of cephalothorax 0.72 mm., breadth at spiracles 0.66 mm., breadth at base of head 0.48 mm., distance between mandibles at base 0.1 mm. Cephalothorax light yellowish brown with narrow dark transverse band at base; slightly longer than broad, elongate trapezoidal, broadly truncate at apex, truncation a little over one-third breadth at spiracles. Mandibles with sides rounded to outwardly curved acute apical tooth, and with obtuse subbasal tooth on ventral side near outer edge. Spiracles laterally prominent.

Paratypes with the following record were also studied: Lincoln, Nebraska, April (two individuals).

Type.—Cat. No. 10084, U.S.N.M.

Dedicated to the honor of Prof. Lawrence Bruner, of the University of Nebraska, the collector of the type specimen, and to whom the author owes his preparation in entomology.

10. STYLOPS CALIFORNICA, new species.

Host.—*Andrena subtilis* Smith; Southern California. Described from two females and their triungulinids from one bee in the collection of the University of Nebraska.

Female.—Length of cephalothorax 0.89 mm., breadth at spiracles 0.96 mm., breadth at base of head 0.61 mm., distance between mandibles at base 0.14 mm. Cephalothorax light brownish, with narrow darker transverse band at base; slightly broader than long, broadly rounded truncated at apex; truncation about two-ninths the breadth at spiracles. Mandibles very broadly rounded, armed at apex with outwardly curved acute tooth. Mouth large, round. Spiracles laterally prominent.

Type.—Cat. No. 10085, U.S.N.M.

Triungulinid: Length of body 0.15–0.18 mm., length including stylets 0.21–0.23 mm., breadth of head 0.04 mm., greatest breadth 0.06 mm., breadth of ninth abdominal segment 0.02 mm. Color, yellow to brown. The head is transverse, subreniform, with the reddish brown eye patches occupying a considerable space at each side. The antennæ are very minute, only visible under the highest powers. The mouth parts are very indistinct. The legs consist of coxa, femur, tibia, and tarsus. The femur is short and armed with a long spine; the tibia is twice the length of the femur; the acute, transparent, one-jointed tarsus is about equal to the tibia. The abdominal segments are freely bordered with transparent spines of two sizes, alternating regularly. The tenth abdominal segment is cloven into two tubercles each bearing a single stylet, which is almost equal to half the length of the body.

11. STYLOPS CLAYTONIÆ, new species.

Host.—*Andrena* (*Trachandrena*) *claytoniæ* Robertson (det. H. L. Viereck); Thomasville, Georgia, March 21, 1904; M. Hebard, collector (pl. 3, fig. 3).

Female.—Length of cephalothorax 0.84 mm., breadth at spiracles 0.81 mm., breadth at base of head 0.47 mm., distance between mandibles at base 0.13 mm. Cephalothorax light yellowish brown with dark brown transverse band at base; as long as broad, wedge shaped, narrowly rounded truncate at apex, apical margin shallowly emarginate, truncation less than one-third breadth at spiracles. Lateral margin slightly constricted at base of mandibles and at base of head. Mandibles oblique, broad, with outwardly curved tooth at apex and blunt tooth about middle of outer edge. Mouth elliptical. Spiracles only slightly prominent.

Type.—Cat. No. 10086, U.S.N.M.

12. STYLOPS CORNII, new species.

Host.—*Andrena commoda* Smith (*corni* Robertson, det. S. Graenicher); Milwaukee, Wisconsin, June 17, 1906; S. Graenicher. Described from one female and its triungulinids, presented by Dr. Sigmund Graenicher, of Milwaukee (pl. 3, fig. 4).

Female.—Length of cephalothorax 1.20 mm., breadth at spiracles 1.11 mm., breadth at base of head 0.60 mm., distance between mandibles at base 0.15 mm. Cephalothorax light brownish with dark brown transverse band at base; a little longer than broad, wedge shaped, roundingly truncated at apex; truncation less than one-third breadth at spiracles. Head slightly constricted laterally at base of mandibles; edge from this point to spiracles convex. Mandibles broadly rounded, armed at apex with outward pointing tooth, and at basal third of outer margin with small tumidity. Mouth elliptical. Spiracles laterally prominent.

A paratype collected at the same place June 2, 1902, has the following dimensions: Length of cephalothorax 1.26 mm., breadth at spiracles 1.22 mm., breadth at base of head 0.73 mm., distance between mandibles at base 0.20 mm. The difference between these two is probably very near to the extreme variation in size.

Triungulinid: Length of body 0.21–0.22 mm., length including stylets 0.31–0.35 mm., breadth of head 0.037–0.042 mm., greatest breadth 0.066 mm., breadth of ninth abdominal segment 0.03 mm. The characters are essentially the same as those described for *Stylops californica.*

Type.—Female and triungulinids, Cat. No. 10087, U.S.N.M.

13. STYLOPS CRAWFORDI, new species.

Host.—*Andrena Crawfordi* Viereck (det. H. L. Viereck). Described from two males collected at Dallas, Texas, April 27 and 28, 1906, and from many females collected by Mr. J. C. Crawford and the author (fig. 3, nos. 5, 6; pl. 2, figs. 5, 6, 8, 9, 10, 11, 12; pl. 3, fig. 5).

Male.—Color black; antennæ and legs brown; last two abdominal segments flavous; wings hyaline, with veins light brown. Length of body 4.5 mm., length of head and thorax 3.5 mm., breadth of head 1.05 mm., length of antennæ 1.36 mm., length of oedeagus 0.40 mm. Antennæ with first two joints short, subequal, cupped at apex; third joint laterally reaching to about the middle of the sixth; joints 3 to 6 in the proportion of 65, 36, 18, 21.5. Mandibles subcylindrical, tapering on dorsal edge, but apically flattened laterally and toward tips somewhat enlarged, then obliquely truncate. Palpi not quite as long as fourth and fifth antennal joints, with basal joint longer than the apical. Œdeagus at base triangularly truncate externally, at basal one-third with a long shallow emargination on external edge, at apical one-third abruptly bent outwards in a rounded right angle, tapering to a point, the inner edge convex from apex to tip of sharp process at apical third. The inner process is only about one-fourth the length of the outer or apical process. This type of œdeagus is unique and represented only by *Stylops*.

Male.—Cephalotheca: Length 1.02 mm., breadth 1.66 mm. Transverse, broadly elliptical, convex, the eyes occupying over one-half the width. Face divided medianly by the broad arcuate margin of the vertex. The vertigial margin extends only two-thirds of the distance from the center to each eye. Above the ends of this margin and extending almost to the eyes are the large subcircular antennal analogues, which are indicated by several faint concentric rings and by a granular structure in the center, composed of about fifteen minute granules. These analogues are less than one-fourth their diameter from the eyes. Below the vertigial margin is a transverse arched area bounded below by a pronounced line subparallel with the vertigial margin and equal to it. This strip, which may be a labral or clypeal analogue, has a punctured surface in distinction from the upper part of the pharyngeal area which is distinguished by a mass of close sinuate lines. The entire pharyngeal area is keystone shaped, roughly divided by sculpture into two areas of which the upper has just been described. It is laterally emarginate for the mandibular analogues, between which it contains the opening of the pharynx. The lower part of the pharyngeal area is of the same shape as the whole area, and begins at the opening of the pharynx. The mandibular analogues are sharply defined and prominent, being slightly closer to the pharyngeal opening than to the eyes. From these a narrow oblique strip extends to the lower margin and borders the eyes. Between this strip and the pharyngeal area lies a subcircular area in the center of which is the maxillary analogue. The latter analogues are distant from the mandibular by their own diameters and from each other by about three times their diameter. The labial analogue is a narrow marginal strip.

Female.—Length of cephalothorax 1.04 mm., breadth at spiracles 1.13 mm., breadth at base of head 0.62 mm., distance between mandibles 0.15 mm. Cephalothorax light yellowish brown, margin darker, especially at the front of the head, and the sides of the metathorax behind the spiracles; a very dark band on the abdomen sharply defines the limits of the cephalothorax. Cephalothorax slightly broader than long, trapezoidal, squarely truncate at apex; truncation less than one-fourth the breadth at the spiracles. Lateral margin slightly constricted at base of mandibles, at base of head, a little over half way from base of head to spiracles, and just before the spiracles; margin from spiracles to base of cephalothorax almost rectangularly bent. Mandibles obtuse with a prominent tooth at the apical third on the inner margin. Posterior margin of oral orifice angularly emarginate. Spiracles lateral, but hardly prominent.

A large series of this species were collected, and much of the material in the biological portion of this article was obtained from the study of this species and its relations to its hosts.

Type.—Cat. No. 10088, U.S.N.M.

Dedicated to the writer's friend, Mr. J. C. Crawford, who discovered the host as well as the parasite.

14. STYLOPS CRESSONI, new species.

Host.—*Andrena* (*Opandrena*) *cressoni* Robertson (det. H. L. Viereck); Waldoboro, Maine, on *Viburnum*, June 16. Described from one female and its offspring from the collection of H. L. Viereck (pl. 3, fig. 6).

Female.—Length of cephalothorax 0.88 mm., breadth at spiracles 0.91 mm., breadth at base of head 0.49 mm., distance between mandibles at base 0.13 mm. Cephalothorax light yellowish brown with dark brown band at base equally divided by basal line of cephalothorax; slightly broader than long, broadly trapezoidal, truncate at apex; truncation one-third the breadth between the spiracles. Lateral margin constricted at base of mandibles, rather wavy thence to spiracles. Mandibles obtuse, armed with outwardly curved tooth at inner apex, emarginate on outer apical angle. Mouth elliptical. Spiracles dorsal, just barely surpassing margin.

Triungulinid: Length of body 0.13–0.15 mm., length including stylets 0.20–0.24 mm., breadth at base of head 0.03 mm., greatest breadth 0.05 mm., breadth of ninth abdominal segment 0.03 mm.

The characters are in general the same as described for *Stylops californica.*

Type.—Cat. No. 10089, U.S.N.M.

Named in honor of the eminent Hymenopterist, Mr. Ezra T. Cresson, to whose honor the host has already been dedicated.

15. STYLOPS DOMINIQUEI, new species.

Stylops, species, DOMINIQUE, 1891.

In order to facilitate reference, the species figured by J. Dominique has been named in his honor. The figures and the host species with its type locality are sufficient to identify the parasite. The immense number of host records with no indication of the characters of the parasites makes it convenient when such characters are mentioned to have some specific name by which the parasite may be known. It is the writer's practice in most cases to designate the parasite by the name of the host, or by the name of the discoverer.

Host.—*Andrena flessæ* Panzer; Nantes, France, April. The figures were based upon the parasites from a quadristylopized *andrena.*

Male.—The male can be sufficiently differentiated from any others described by means of the antennæ alone, and has thus been separated in a table at the beginning of this genus.

16. STYLOPS GRÆNICHERI, new species.

Host.—*Andrena nivalis* Smith; Milwaukee, Wisconsin, June 11, 1901; S. Graenicher, collector. Described from one specimen presented to the writer by Doctor Graenicher (pl. 3, fig. 7).

Female.—Length of cephalothorax 1.10 mm., breadth at spiracles 1.26 mm., breadth at base of head 0.66 mm., distance between mandibles at base 0.19 mm. Cephalothorax light brown with dark transverse band at base; broader than long, convexly truncate at apex, sides convex, slightly constricted at base of mandibles; apical truncation about two-ninths of the breadth at spiracles. Mandibles obtuse, armed at apex with outward curving tooth, and tuberculate at basal third of outer edge. Mouth elliptical. Spiracles lateral, very prominent.

Type.—Cat. No. 10090, U.S.N.M.

This species is dedicated to the honor of Dr. Sigmund Graenicher, the collector, who has done such excellent work on the biologies and flower relations of the bees in his neighborhood.

17. STYLOPS HARTFORDENSIS, new species.

Host.—*Andrena hartfordensis* Cockerell (det. H. L. Viereck); Thomasville, Georgia, March 27, 1902. Described from one specimen (pl. 3, fig. 8).

Female.—Length of cephalothorax 0.69 mm., breadth of spiracles 0.67 mm., breadth at base of head 0.43 mm., distance between mandibles at base 0.12 mm. Cephalothorax light yellowish, with broad dark-brown band at base; slightly longer than broad, elongate trapezoidal, squarely truncate at apex; truncation a little more than one-third the breadth at the spiracles. Lateral margin almost straight from apical truncation to spiracles except for a constriction at the base of the mandibles. Mandibles blunt with very prominent outward curving tooth at apex, and with a large tumidity at the middle of the outer edge. Mouth elliptical, posterior margin almost straight. Spiracles dorsal, barely perceptible on lateral margin.

Type.—Cat. No. 10091, U.S.N.M.

18. STYLOPS HIPPOTES, new species.

Host.—*Andrena* (*Trachandrena*) *hippotes* Robertson (det. H. L. Viereck); Columbus, Ohio, April 21, 1902; J. C. Bridwell, collector. Described from one female (pl. 3, fig. 9).

Female.—Length of cephalothorax 0.83 mm., breadth at spiracles 0.83 mm., breadth at base of head 0.53 mm., distance between mandibles at base 0.15 mm. Cephalothorax light yellow with brown band at base, half on the thorax and half on the first abdominal; as long as broad, subtrapezoidal, squarely truncate at apex; truncation less than one-third the breadth at the spiracles. Lateral margin sinuate. Mandibles rounded, obtuse, with a small acute, curved tooth at apex. Posterior margin of mouth straight. Spiracles dorsal, just reaching lateral margin.

Type.—Cat. No. 10092, U.S.N.M.

19. STYLOPS IMITATRIX, new species.

Host.—*Andrena* (*Trachandrena*) *imitatrix* Cresson (det. H. L. Viereck); Round Mountain, Texas. Described from one female (pl. 3, fig. 10).

Female.—Length of cephalothorax 0.89 mm., breadth at spiracles 0.89 mm., breadth at base of head 0.52 mm., distance between mandibles at base 0.14 mm. Cephalothorax light yellowish brown with a darker-brown band at base; as long as broad, truncate deltoid; truncation less than one-fourth the breadth at the spiracles. Lateral margin slightly constricted at base of mandibles and at base of head. Mandibles subquadrate with large tooth at inner apical angle and with blunt prominent tooth on outer edge at middle. Posterior margin of mouth straight. Spiracles dorsal, just reaching lateral margin.

Type.—Cat. No. 10093, U.S.N.M.

20. STYLOPS MULTIPLICATÆ, new species.

Host.—*Andrena multiplicata* Cockerell; Milwaukee, Wisconsin, June 9, 1904, May 2, 1904; S. Graenicher, collector. Described from two females presented to the writer by Doctor Graenicher (pl. 3, fig. 11).

Female.—Length of cephalothorax 0.87 mm., breadth at spiracles 0.90 mm., breadth at base of head 0.62 mm., shortest distance between mandibles 0.12 mm. Cephalothorax light yellowish brown with black band at base, half on the thorax and half on the first abdominal; almost as long as broad, subtrapezoidal, truncate at apex; truncation less than one-fourth the breadth at the spiracles. Lateral margin slightly convex. Mandibles subquadrate, with an acute curved tooth at inner apex and slight indication of a convex protuberance on outer edge midway between inner tooth and base. Spiracles laterally prominent.

Type.—Cat. No. 10094, U.S.N.M.

21. STYLOPS NASONI, new species.

Host.—*Andrena nasoni* Robertson (metatype det. H. L. Viereck); Ashbourne, Pennsylvania, April 19, 1897. Described from one female (pl. 4, fig. 1).

Female.—Length of cephalothorax 0.73 mm., breadth at spiracles 0.74 mm., breadth at base of head 0.41 mm., distance between mandibles 0.09 mm. Cephalothorax light yellowish brown with narrow dark-brown band at base, half on the thorax and half on the first abdominal; as long as broad, truncate wedge-shaped, edges very nearly straight, angles sharp; truncation less than one-third the breadth at the spiracles. Mandibles rounded with an outward curved tooth at apex. Spiracles laterally prominent.

Type.—Cat. No. 10095, U.S.N.M.

22. STYLOPS NASSONOWI, new species.

Stylops mellittae NASSONOW, 1893 *a*.

Host.—*Andrena carbonaria* Fabricius; recorded parasitized from Germany and Egypt.

Female.—Cephalothorax light brownish with concave dark band at base; slightly longer than broad, narrowly and squarely truncate at apex; truncation a little less than one-fourth the breadth at the spiracles. Lateral margin convex. Spiracles laterally prominent.

This description is imperfect, as it is drawn from the figure (Nassonow, 1893 *a*, pl. 1, figs. 1, 7).

23. STYLOPS NUBECULÆ, new species.

Host.—*Andrena nubecula* Smith (det. H. L. Viereck); Colorado; C. F. Baker, collector. Described from one female from the Baker collection of the U. S. National Museum (pl. 4, fig. 2).

Female.—Length of cephalothorax 0.84 mm., breadth of spiracles 0.94 mm., breadth at base of head 0.51 mm., distance between mandibles 0.12 mm. Cephalothorax light yellowish brown with convex dark-brown band at base, half on the thorax and half on the first abdominal, the convexity filled with a lighter brown, and the band laterally interrupted before reaching the spiracles; broader than long; wedge shaped, narrowly and convexly truncate at apex; truncation slightly less than one-third the breadth at the spiracles. Lateral margin almost straight, slightly sinuate. Mandibles broad, subquadrate with an outward curved tooth at inner edge, outer edge rounded. Posterior margin of mouth rounded. Spiracles lateral, but not very prominent.

Type.—Cat. No. 10096, U.S.N.M.

24. STYLOPS PACKARDI, new species.

Stylops childreni PACKARD, 1864, 1872.

Host.—*Andrena placida* Smith; Salem, Massachusetts, April 29, on Mezercon; collected by A. S. Packard.

Professor Packard originally described this species as follows:

Male.—The whole body, the antennæ, and the appendages of the mouth were velvety black; abdomen slightly brownish; legs and anal forceps pale resinous brown; the tarsal joints, and tips of tibiæ pale testaceous (Packard, 1864).

This name also is given in order to straighten out the synonymy and with the assurance that material will soon be forthcoming from which more accurate descriptions can be made.

25. STYLOPS POLEMONII, new species.

Host.—*Andrena polemonii* Robertson (?); Colorado; C. F. Baker, collector. Described from one female and its triungulinids from the Baker collection of the U. S. National Museum (pl. 4, fig. 4).

Female.—Length of cephalothorax 0.58 mm., breadth at spiracles 0.52 mm., breadth of base of head 0.31 mm., distance between mandibles at base 0.07 mm. Cephalothorax light brown, with dark-brown band at base, a little more than half on the first abdominal; longer than broad, wedge shaped, narrowly but squarely truncate at apex; truncation about one-fourth the breadth at the spiracles. Lateral margin slightly convex to spiracles; posterior portion transversely quadrate. Spiracles lateral, but not prominent. Mandibles rounded with acute curved tooth at apex.

Triungulinid: Length of body 0.13 mm., length including stylets 0.18 mm., breadth of head 0.02 mm., greatest breadth 0.03 mm., breadth of ninth abdominal segment 0.018 mm.

The characters are essentially the same as those described for *Stylops californica.*

Type.—Cat. No. 10097, U.S.N.M.

26. STYLOPS SALICIFLORIS, new species.

Host.—*Andrena* (*Trachandrena*) *salicifloris* Cockerell (det. H. L. Viereck); Washington, and Seattle, Washington, on gooseberry. Described from two females (pl. 4, fig 5).

Female.—Length of cephalothorax 1.01 mm., breadth at spiracles 1.04 mm., breadth at base of head 0.64 mm., distance between mandibles 0.14 mm. Cephalothorax light yellowish brown, with slightly convex dark-brown band at base, half on thorax and half on first abdominal; about as long as broad, broad-wedge shape, narrowly truncate; truncation slightly convex, more than one-fourth the breadth at the spiracles. Lateral margin wavy, convex. Mandibles rounded obtuse, with sharp curved tooth at apex. Spiracles lateral, slightly prominent.

Type.—Cat. No. 10098, U.S.N.M.

27. STYLOPS SOLIDULÆ, new species.

Host.—*Andrena solidula* Viereck; collected at Pullman, Washington, by C. V. Piper, and *A. solidula* Viereck (*junonia* Viereck), bearing same date, all determined by H. L. Viereck. Described from one male and three females (pl. 2, figs. 7, 13; pl. 4, fig.6).

Male.—A male pupa was extracted, which furnishes the following characters. Antennæ with third joint not quite attaining tip of sixth; fourth, fifth, and sixth joints subequal, with sixth slightly longer than fifth. The mandibles were not visible; the first joint of the maxillæ seems to be short, the second is elongate flattened, somewhat tapering to the apex and considerably longer than the sixth segment of the antennæ. The œdeagus is of peculiar shape, being bent at about a right angle upward with the lower outside angle acutely produced downward and the outer side almost straight from this angle to the apex; the lower side is broadly and shallowly sinuate; the upper side is broadly rather deeply emarginate in the middle one-third. The adult in its puparium measured 3.25 mm.

Male.—Cephalotheca: Transverse, broadly elliptical, convex, the eyes occupying only a little over one-half of the width. Face divided medianly by the broad arched margin of the vertex, above the center of which is a short transverse reversed ridge. The vertigial margin extends only two-thirds of the distance from the center to each eye. Immediately above the ends of this margin and extending almost to the eyes are the large suboval antennal analogues, which are indicated by several faint concentric rings and a difference of surface. Below the vertigial margin is a transverse arched area bounded below by an indistinct line parallel and equal to the vertigial margin. This strip, which may be a labral or clypeal analogue, has a punctured surface in distinction from the upper part of the pharyngeal area which is distinguished by a mass of closely sinuate lines. The entire pharyngeal area is somewhat keystone-shaped, roughly divided by sculpture into three areas of which the upper has just been described. The median area contains the opening of the pharynx and is laterally deeply emarginate for the reception of the mandibular analogues. These analogues are prominent and sharply defined, and considerably closer to the pharynx than to the eyes; they arise below the ends of the labral analogues and are separated from the antennal analogues by a distance equivalent to the width of that strip. The maxillary are contiguous to the mandibular analogues and slightly closer together on the inner side; they are faintly defined by a large subelliptical area, including a much smaller ellipse. The labial analogue is a narrow marginal strip.

Female.—Length of cephalothorax 1.38 mm., breadth at spiracles 1.26 mm., breadth at base of head 0.70 mm., distance between mandibles 0.19 mm. Cephalothorax brown with darker band at base;

considerably longer than broad, more or less convex on all sides, apically convexly truncate; truncation one-fourth the breadth at the spiracles. Mandibles rounded, obtuse, with acute curved tooth at apex and slightly rounded elevation at middle of outer edge. Spiracles reaching a little beyond lateral margin.

Type.—Cat. No. 10099, U.S.N.M.

28. STYLOPS SPARSIPILOSÆ, new species.

Host.—Andrena sparsipilosa Viereck (paratype); Waldoboro, Maine, July 12, 1898. Described from female from the collection of H. L. Viereck (pl. 4, fig. 7).

Female.—Length of cephalothorax 0.72 mm., breadth of spiracles 0.77 mm., breadth at base of head 0.46 mm., distance between mandibles at base 0.10 mm. Cephalothorax light yellowish brown with a darker brown band at base; not as long as broad, squarely truncate at apex; truncation less than one-third the breadth at the spiracles. Lateral margin convex. Mandibles broadly, convexly quadrate. Spiracles lateral but not prominent.

Type.—Cat. No. 10100, U.S.N.M.

29. STYLOPS SUBCANDIDÆ, new species.

Host.—Andrena subcandida (det. H. L. Viereck); Southern California. Described from three females and many triungulinids (pl. 4, fig. 8).

Female.—Length of cephalothorax 0.75 mm., breadth at spiracles 0.77 mm., breadth at base of head 0.47 mm., distance between mandibles at base 0.10 mm. Cephalothorax light brownish, with narrow slightly darker band at base, half on thorax and half on abdomen; about as long as broad, truncate at apex; truncation almost one-third the breadth at the spiracles. Lateral margin sinuately convex. Mandibles obtusely rounded, with small acute curved tooth near apex. Spiracles dorsal, just reaching lateral margin.

Triungulinid: Length of body 0.19 mm., length including stylets 0.23 mm., breadth of head 0.04 mm., greatest breadth 0.06 mm., breadth of ninth abdominal segment 0.03 mm.

The characters are essentially the same as those described for *Stylops californica.*

Type.—Cat. No. 10101, U.S.N.M.

30. STYLOPS SWENKI, new species.

Xenos (?), species, PIERCE, 1904, p. 17.

Host.—Andrena solidaginis Robertson; Lincoln, Nebraska, September, August 18, 19, 30, 1903. Also collected at Collingdale (Delaware County), Pennsylvania, August 31. Described from three females and multitudes of triungulinids collected at Lincoln by Mr. Swenk and the writer.

Female.—Length of cephalothorax 0.82 mm., breadth of spiracles 0.96 mm., breadth at base of head 0.60 mm., distance between mandibles 0.15 mm. Cephalothorax light yellowish brown, with dark brown band at base; broader than long, subtrapezoidal, squarely truncate at apex; truncation over one-fourth the breadth at the spiracles. Lateral margin very slightly convex. Mandibles rounded with an outward curved tooth at apex. Spiracles slightly prominent at sides.

Triungulinid: Length of body 0.18 mm., length including stylets 0.22 mm., breadth of head 0.03 mm., greatest breadth 0.063 mm., breadth of ninth abdominal segment 0.02 mm.

Proportionate breadths of segments at broadest point:

Head.	Pro.	Meso.	Meta.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
12	14	15	19	21	22	22	21	20	18	16	14	12	8

Proportionate lengths of segments on median line, dorsal:

Head.	Pro.	Meso.	Meta.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
8	8	5	5	3.5	4.5	3	3.5	3	4	2.5	3	4	2

This triungulinid was previously described by the writer with the following characters:

Head shorter than broad; eyes not prominent, consisting of several little blotches of pigment; antennæ very small, not as long as eyes are wide; mandibles short, acuminate, about as long as eyes, immediately in front of eyes, not meeting at middle; other mouth parts too small to recognize distinctly. Legs short, slender, weak, hardly equaling in length the width of the prothorax; tibiæ terminated by long, almost invisible acuminate pad, which is strongly convex on the edge and almost equals in length the tibiæ. Body enlarging gradually to second abdominal and then narrowing to the last segment, which is squarely truncate and terminated at each side by a short tubercle, bearing a long, stout, acuminate stylet, which equals about six segments of the abdomen. Dorsum armed with many short stout spines at the apical edge of each segment; venter armed with but few spines on each abdominal segment.
Twenty-one hundred and fifty-two of these were actually counted as offspring of one female (Pierce, 1904, 17).

Type.—Cat. No. 10102, U.S.N.M.

Named in honor of the writer's former associate, Myron H. Swenk, who collected some of the specimens, and who has proven himself a diligent worker on the Apoidea (pl. 4, fig. 9).

31. STYLOPS VENTRICOSÆ, new species.

Stylops melittæ NASSONOW, 1893 *a*.

Host.—*Andrena ventricosa* Dours; Europe (recorded definitely from Fiume, Hungary, by Friese, 1893).

Female.—Cephalothorax light yellowish brown with a dark band extending convexly forward to the middle of the disk, but laterally beginning at the spiracles; as long as broad, apically broadly rounded obtuse, laterally very slightly convex. Spiracles dorsal, not reaching lateral margin.

This description is incomplete, as it is drawn from the figure (Nassonow, 1893 *a*, pl. 1, figs. 4, 6).

Triungulinid: This stage is accurately figured by Nassonow (1893 *a*, pl. 1, figs. 8, 9).

32. STYLOPS VICINÆ, new species.

Stylops childreni PACKARD, 1864.

Host.—*Andrena vicina* Smith (det. H. L. Viereck); New Hampshire, C. F. Baker, collector; Canada, C. F. Baker, collector. Described from five females from the Baker collection of the United States National Museum. Packard's specimen was collected at Salem, Massachusetts, June 18, on raspberry, by himself. The parasite was just giving forth its young (pl. 4, fig. 10).

Female.—Length of cephalothorax 1.12 mm., breadth at spiracles 1.13 mm., breadth at base of head 0.64 mm., distance between mandibles at base 0.17 mm. Cephalothorax light brownish with a darker brown transverse band at base; as long as broad, squarely truncate at apex; truncation one-fourth the breadth at the spiracles. Lateral margin irregularly convex, with a prominent tuberculation at the base of the mandibles. Mandibles subquadrate with a large curved tooth at the inner apex, spiracles laterally prominent.

Type.—Cat. No. 10103, U.S.N.M.

33. STYLOPS VIERECKI, new species.

Host.—*Andrena* (*Trachandrena*) *texana profunda* Viereck (det. H. L. Viereck); Fedor, Texas, March 18, 1905; Rev. G. Birkmann, collector. Described from three females (pl. 4, fig. 11).

Female.—Length of cephalothorax 0.82 mm., breadth at spiracles 0.86 mm., breadth at base of head 0.53 mm., distance between mandibles at base 0.12 mm. Cephalothorax light yellowish brown with a dark brown band at base; almost as long as broad, squarely truncate at apex; truncation slightly more than one-third the breadth at spiracles. Head slightly constricted at base of mandibles; edge from this point to spiracles almost straight. Mandibles blunt, subquadrate with out-curved tooth at inner apex and small blunt tooth on outer edge. Spiracles hardly prominent laterally.

Type.—Cat. No. 10104, U.S.N.M.

Named in honor of Mr. H. L. Viereck, who furnished the material containing many of these types.

34. STYLOPS OKLAHOMÆ, new species.

Host.—*Andrena flavoclypeata miserabilis* Cresson; Ardmore, Oklahoma, March 12, 1907, on wild plum; F. C. Bishopp, collector (pl. 4, fig. 3).

Female.—Length of cephalothorax 0.78 mm., breadth at spiracles 0.72 mm., breadth at base of head 0.41 mm., distance between mandibles at base 0.07 mm. Cephalothorax light yellowish brown with dark-brown band at base; longer than broad, wedge shaped, squarely truncate at apex; truncation less than one-third of the breadth at the spiracles. Head slightly constricted at the base of the mandibles, margin slightly wavy. Mandibles rounded quadrate, with out-curved tooth at apex and less prominent tooth at the middle of the outer edge. Spiracles lateral but not prominent.

Type.—Cat. No. 10105, U.S.N.M.

6. Genus PARASTYLOPS Meijere (1908).

Type of genus.—*Parastylops flagellatus* Meijere. The genus is typically Javan, but the hosts are unknown.

Antennæ long, six-jointed, the three first joints short, the third with a very long cylindrical process; the three last flattened, together as long as the process of the third joint. Mandibles long and slender, outwardly arcuate. Maxillæ long, the second joint straight, almost cylindrical, not greatly narrowed at apex. Tarsi four-jointed. Wings very broad, rounded, with seven principal veins, the subcostal and radial united at their apices; two free veins between radius and medius; stigma distinct.[a]

1. PARASTYLOPS FLAGELLATUS Meijere (1908).

Semarang, Java, November 28, 1905; Edw. Jacobson (pl. 2, figs. 1, 2, 3).

The following description is taken from Meijere.

Male.—Head soft blackish brown. Antennæ grayish brown, with the first three joints very short; the three following considerably longer; the fourth somewhat longer than the sixth; the fifth only half as long as the last. Mandibles and maxillæ dark brown. Thorax dark brown; on the sutures brighter, golden brown. Abdomen dark brown. Front femora dark brown; hind femora golden brown with apex darker; front tibiæ golden brown, darker beneath; hind tibiæ brown; knees blackish; tarsi with basal portion of each joint very dark brown, the remainder white. Elytra golden brown, somewhat club shaped. Wings on costal margin gray; veins blackish brown, reaching almost to the margin; costal margin in basal half thick, dark.

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[a] Augen sitzend, mit zahlreichen Facetten. Fühler lang, 6-gliedrig, die 3 ersten Glieder kurz, das 3te mit sehr langen cylindrischen Anhang; die 3 letzten Glieder bandartig abgeflacht, zusammen so lang wie der Anhang des 3ten Gliedes. Mandibel lang und schmal, nach oben gebogen. Taster von derselben Länge, 2-gliedrig, das 2te Glied gerade, fast cylindrisch, nach der Spitze hin sehr wenig verjüngt. Bildung des Metathorax wie in Fig. 8. Tarsen 4-gliedrig. Flügel sehr breit, gerundet, mit 7 Hauptadern, die 2te und 3te an der Spitze verbunden; zwischen der 3ten und 4ten 2 wurzelwärts freie Adern; am Vorderrand ein deutliches Stigma (Meijere, 1908).

Length of body, 1.75 mm.; breadth of head, 0.5 mm.; length of antennæ, 1 mm.; length of elytra, 0.4 mm.; expanse of wings, 3 mm. Œdeagus near apex bent back into an acute process.[a]

7. HALICTOSTYLOPS, new genus.

The genus is parasitic on the Andrenid genus *Halictus* and in the present sense occurs in Europe.

This genus name may be spoken of as a transitional name. That is, it is proposed to contain the species *Halictophagus spencii* Nassonow (1893 *a*) until the proper resting place of that species may be ascertained. The genus will undoubtedly hold its rank because of the great dissimilarity between this species and *Halictoxenos crawfordi*. The location of the genus however is dubious. The female has the aspect of a *Stylops* and yet *Halictoxenos* is a xenid. It would be strange indeed if the parasites of the halictine series should fall part in Stylopidæ and part in Xenidæ.

Female.—Cephalothorax triangular from stigmatal angles, narrowly truncate at apex; mandibles marginal. Stigmata not lateral. Abdomen with five median genital tubes on the second to sixth segments (Nassonow, 1893 *b*).

Triungulinid: Similar in form to that of *Stylops*. Tenth abdominal segment short, triangular, with two ventral tubercles as long as segment and each bearing a long stylet (Nassonow, 1893 *b*).

1. HALICTOSTYLOPS SPENCII Nassonow (1893).

Halictophagus spencii NASSONOW, 1893 *a*.
Halictophagus curtisii NASSONOW 1893 *b*.

The species is parasitic on *Halictus minutus* Kirby, and occurs in England and on the continent of Europe.

This name was given in error, but was accompanied by an illustration, which is technically a description. The genus *Halictophagus* is composed of homopterous parasites, by a strange error in assumption of evidence.

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[a] *Male.*—Kopf matt schwarzbraun, Fühler graubraun, die 3 ersten Glieder sehr kurz, die 3 folgenden bedeutend länger, das 4te Glied etwas länger als das 6te, das 5te nur halb so lang als letzteres. Mandibel und Taster dunkelbraun, Thorax dunkelbraun, an den Nähten und am Rande heller, ins Gelbbraune ziehend. Hinterleib dunkelbraun, desgleichen Bauch und Hypopygium. Vordere Hüften dunkelbraun; Hinterhüften braungelb mit dunkelbrauner Spitze; vorder Schenkel braungelb, unten dunkler, Hinterschenkel braun, Schienen schwarzbraun, die Tarsen oben am Wurzelteil der Glieder schwarzbraun, im Übrigen weiss. Elytren schwarzbraun, etwas keulenformig. Flügel namentlich am Vorderrande etwas graulich, das Geäder schwarzbraun, die Adern fast bis zum rande verlaufend; der Vorderrand an der Wurzelhälfte dick, dunkel; für das Geäder vergleiche man Fig. 10. Körperlänge 1.75 mm., Kopfbreite 0.5 mm., Fühlerlänge 1 mm.; Länge der Elytren 0.4 mm.; Flügelspannung 3 mm. Die Genitalien sind schwer sichtbar, aber der Hauptsache nach wie bei *Halictophagus*, an der Spitze findet sich ein zurückgeschlagener, fast gerader dornförmiger Fortsatz (Meijere, 1908).

From Nassonow's figure of the female the following description may be deduced: Cephalothorax abruptly angled at the metastigmata, thence rapidly narrowed to the apex, with a very short truncation. Head not equal in width to one-third the distance between the metastigmatal angles. Mandibles, obtuse, rounded, and approximate to the edge of the head. Stigmata not visible on the lateral edge. A dark segment of a circle lies ventrally against the posterior edge of the cephalothorax (Nassonow, 1893 *a*, pl. 1, figs. 11, 12).

Triungulinid: The body is elongate, only slightly tapering apically. Head semicircular. Eye patches showing three small lenses ventrally. Thorax only slightly broader than head. Legs four-jointed, (coxa, femur, tibia, tarsus); tarsi long, acute. Abdominal segments, each with a light fringe of hairs. Tenth segment subacute with two ventral tubercles, from each of which arises a long stylet equal to about seven segments of the abdomen.

4. Family HYLECHTHRIDÆ Pierce, 1908.

Hymenopterobiæ (part) SAUNDERS, 1872.
Stylopides (part) SAUNDERS, 1872.

Antennæ five-jointed, with fourth joint very short, and fifth elongate.

The family includes the one genus *Hylechthrus* Saunders, parasitic on *Prosopis* in Europe.

8. Genus HYLECHTHRUS Saunders (1850).

Hylechthrus SAUNDERS, 1872.—PIERCE 1908.

Type of genus.—*Hylechthrus rubi* Saunders, 1850.

Named from *Hylæus* + ἐχθρός (enemy), meaning a parasite of the genus *Hylæus* or *Prosopis*.

The following description is taken from that published by Saunders.

Antennæ 5-jointed; basal joint short; second small, truncate; third laterally produced in a very long flat process; fourth very small, annulate; fifth elongate, similar to the process of the third and resting against that. Maxillæ small, broader than palpi, with apex obliquely truncate; palpi slender, setose.[a]

The remainder of the description given by Saunders is merely of specific value and will be added to the description of *H. rubi*, as it is evidently based on that species, which, as the type of the genus, is the basis of comparison for the other species of the genus and the only one adequately figured.

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[a] Antennæ 5-articulatæ; articulo basali brevi; secundo parvo, truncato; tertio longissimo, spatulato, totâ ferè latitudine subæquali, quartumque basin versùs latere externo ferenti, hoc parvo, annuloso; extimo (5-to) tertio simillimo, et illum recumbenti. Palpi parvi, articulo basali crassior, apice obliquo; apicali graciliori, setoso (Saunders, 1850).

1. HYLECHTHRUS RUBI Saunders (1850).

var. *Hylechthrus rubi pustulatus* SAUNDERS, 1872.
Hylechthrus rubi SAUNDERS, 1852, 1872.—PIERCE, 1908.

Host.—Prosopis rubicola Saunders; Epirus, June (fig. 3, nos. 7, 8; pl. 5, figs. 1, 2).

The original description by Saunders is essentially as follows:

Male.—Black, legs luteous, wings milky, veins piceous. Length $\frac{1}{2}$–$\frac{5}{8}$ lines; wing expanse almost $1\frac{1}{2}$ lines. Head large, transverse. Eyes very large. Thorax anteriorly constricted; disk gibbous, subequal to breadth of head; praescutum very large, elongate-triangular, with anterior margin sinuate, sides straight, with posterior angle subacute, porrect. Elytra small, apically strongly dilated clavate, subconcave. Wings thickened on costal margin to middle, subcosta abbreviated, joined to costa; radius parallel with subcosta, becoming evanescent beyond middle of wings; medius arising from radius at base, straight, deflexed from radius; between radius and medius lie a detached branch of each, the first very strong at base; cubitus not basally attached, slender, attaining external margin; first two anal veins subapproximate, near internal margin, strong at base, third anal almost obliterated. Abdomen strongly constricted. Legs of moderate length, posterior tibiæ dilated, compressed.

Female.—Larviform; cephalothorax flattened, above subconvex, below subconcave, pale, with darker marginal line; with a vitta on each side, two small transverse spots near base, and posterior angles brown.[a]

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[a] *Male.*—Niger, gibbosus; pedibus luteis; alis lacteis; venis saturatè piceis.

Long. corp. $\frac{1}{2}$–$\frac{5}{6}$ lin. Expans. alar. ferè $1\frac{1}{2}$ lin.

(The remainder is from the original generic description.)

Caput magnum, transversum. Oculi ingentes. Thorax anticè constrictus, disco gibboso capiti latitudine subæquali; scutello maximo; elongato-triangulari; margine antico sinuato, lateribus rectis, angulo postico subacuto porrecto. Pseudelytra parva, apice valdè dilatato crassiori, subconcavo. Alae, costae dimidio basali inspissato, seu potiùs venâ subcostali, abbreviatâ cum costâ quasi conjunctâ, primâ discoidali, prope basin furcatâ, rama antico ejius cum costâ parallelo, ultra medium alae evanescente ramo postico, recto, deflexo; prope apicem alae incrassatio exstat, cujus basis, venaque duplex tenuissima de margine externo sinuatè producta, intra furcam, retrò extendunt: venis reliquis rectis, deflexis; quarum una gracilis, margini externo attingens; duae subapproximatae, margini interno propiores, basi robustiores; altera (?) analis ferè obliterata. Abdomen valdè constrictum. Pedes longitudine mediocres, posteriorum tibiis dilatatis, compressis, genubus constrictis, tarsorum articulis quatuor, apicali integro.

Female.—Vermiformis; cephalothoracem complanatum, suprà subconvexum, infrà subconcavum, e dorso apis educantis tantum modo protrudens; vaginae aditû, olim clauso, post coitum, sat amplè patenti. Nuper declarata, cephalothorace pallido, lineolâ marginali tenuissimâ nigricanti; vittâ utrinque, maculis binis parvis transversis prope basin, angulisque posticis, brunneis; parturientes autem disco convexiori, ferè omnimò flavescenti, vittâ mediâ longitudinali dilutiori (Saunders, 1850).

The host of this species, *Prosopis rubicola* Saunders, occurs in Epirus. It makes its own nests as a rule, in briars, although sometimes they have been found to build in the unoccupied excavations of *Osmia*, and even in the mud cells of *Odynerus*, and in the same excavations as *Cemonus unicolor*. When parasitized by male *Hylechthrus* this species has the abdomen much lighter, so much so that Saunders described this variation as *Prosopis* (*Hylaeus*) *versicolor*.

2. HYLECHTHRUS QUERCUS Saunders (1850).

Hylechthrus quercus SAUNDERS, 1852, 1872.—PIERCE, 1808.

Host.—Prosopis gibba Saunders; Epirus, May, June.

Saunders described this specie.essentially as follows:

Male differs from *Hylechthrus rubi* by its greater size, by the wings being more obscured, and the veins much darker. Length $\frac{2}{3}$–1 line; expanse of wings about $1\frac{3}{4}$ line.[a]

Prosopis gibba, the host of this species, dwells in vacant cynipid oak galls, and also in briars in diagonal series. (This last note is based on a marginal note by Saunders in the separate possessed by the author.)

3. HYLECHTHRUS SIEBOLDII Saunders (1852).

Hylechthrus sieboldii SAUNDERS, 1872.—PIERCE, 1908.

Host.—Prosopis variegata Fabricius, Epirus, June.

The cephalothorax of the female of this species is distinguished by a broad yellow longitudinal band dilated toward the apex, and by a dark transverse line at the base, interrupted by the passage to the abdominal region.

5. Family XENIDÆ Semenov, 1902; redefined Pierce, 1908.

Strepsiptera or *Stylopidæ* (part) HOEVEN, 1850.
Xenides (part) SAUNDERS, 1872.
Pseudoxenides (part) SAUNDERS, 1872.
Stylopinæ (part) PERKINS, 1905.
Xenini PERKINS, 1906 in correspondence (a tribe of Stylopinæ).

Type genus.—Xenos Rossi (1794).

Parasites of Hymenoptera.

Antennæ four-jointed, the third laterally produced; tarsi four-jointed.

The family is composed of four subfamilies:

Xeninæ Pierce, parasitic on Vespoidea and perhaps Sphecoidea.

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[a] *Male.*—Differt (from *Hylechthrus rubi*) magnitudine duplò majori, alis parùm obscurioribus, venisque magis nigricantibus.

Long. corps, $\frac{2}{3}$–1 lin. Expans. alar. ferè $1\frac{3}{4}$ lin.

Individua mutilata tantum vidi (Saunders, 1850).

Homilopinæ Pierce, parasitic on Sphecoidea.
Halictoxeninæ Pierce, parasitic on Apoidea.
Crawfordinæ Pierce, parasitic on Apoidea.

1. Subfamily XENINÆ Pierce, 1908.

Type genus.—*Xenos* Rossi (1794).
Parasitic on Vespoidea and possibly Sphecoidea.
Maxillæ two-jointed.
The subfamily is composed of four tribes:
Xenini Pierce, parasitic on Vespidæ; Europe, America, Asia.
Pseudoxenini Pierce, parasitic on Eumenidae; Europe, America.
Paraxenini Pierce, parasitic on Bembecidæ; Europe.
Ophthalmochlini Pierce, parasitic on Sphecidæ; America.

1. XENINI, new tribe.

Xenides SAUNDERS, 1872.
Xenini PERKINS, 1906, in correspondence.

Type-genus.—*Xenos* Rossi (1790).
Parasites of Vespidæ.
The tribe includes four genera:
9. *Xenos* Rossi (1790), parasitic on *Polistes;* Europe.
10. *Acroschismus* Pierce (1908), parasitic on *Polistes;* America.
11. *Schistosiphon* Pierce (1908), parasitic on *Polistes;* America.
12. *Vespaexenos* Pierce, parasitic on *Vespa;* Asia.

9. Genus XENOS Rossi (1790), redefined.

Ichneumon ROSSI, 1793.
Xenos KIRBY, 1813.—HOEVEN, 1850.—SAUNDERS, 1872.—PIERCE, 1908.
Xenus RYE, 1875.—CENTURY DICTIONARY, 1897.—STILES, 1905.

Type of genus.—*Xenos vesparum* Rossi (1790).
Name derived from ξένος (strange) or ξεῖνος (a guest).

Male.—Antennæ four-jointed, the third produced laterally, third and fourth tapering; tarsi four-jointed; wings having eight primary veins from base, with two distal unattached veins between the radius and medius.

Female.—Cephalothorax rounded, broadly at sides, narrowly in front. Abdomen with four median genital tubes, on the second to fifth segments. Head short at middle, longer at sides; mouth about middle of ventral side, with mandibles on each side, about half way to lateral margins. This brief description is derived from Nassonow's excellent plate of *Xenos vesparum* (Nassonow, 1892 *c*, pl. 1, figs. 1, 4, 9, 14).

Triungulinid: Robust, broadest at mesothorax. Base of head broader than contiguous portion of prothorax. Tarsus of first two pairs of legs rounded pad like, of third pair long, acute. Ninth lateral segments greatly surpassing ninth ventral and bearing a spine on the outer apical angle. Tenth ventral elongate subtriangular, equal in length to about four segments, apically cleft, with a long stylet on each apical point.

The genus contains but two typical species:

1. *vesparum* Rossi (1790), parasitic on *Polistes gallicus;* Italy.
2. *jurinei* Saunders (1872), parasitic on *Polistes gallicus;* Switzerland.

The two species may be identical, but by description are separated as follows:

1. Maxillæ with joints unequal, the first short, rounded, second elongate. *vesparum* Rossi.
   Maxillæ with joints subequal, the last subulate.................*jurinei* Saunders.

1. XENOS VESPARUM Rossi (1790).

Ichneumon vesparum Rossi, 1793.
Xenos vesparum Siebold, 1843.—Pierce, 1908.
Xenos rossii Kirby, 1813.—Saunders, 1872.—Nassonow, 1892 *c, e.*

Host.—Polistes gallicus Linnæus; Europe (Italy) (fig. 2, nos. 15, 16, 17; pl. 5, fig. 4; pl. 7, figs. 4, 8, 13).

The original description by Saunders was essentially as follows:

Male.—Black, fuliginous. Head small. Eyes strongly prominent, spherical, composite. Maxillæ short, rounded, with palpus elongate, compressed. Antennæ short, hardly longer than head, third joint branched, the branch equalling the elongate fourth, both of which are deflexed, compressed, somewhat ensiform. Prothorax and mesothorax cylindrical, neck like; metathorax broader, convex, posteriorly greatly elongate. Abdomen almost cylindrical. Femora and tibiæ posteriorly depressed and short. Tarsi fuscous, beneath white. Wings white, as long as the abdomen.[a]

Kirby (1813) has made a humorous statement. He asks pardon for "altering the trivial names" given by Rossi and Peck to these species as they would lead to confusion, and because "a species should not be named from a habitat which is common to several or to a genus." Now it happens that Kirby described *Stylops melittæ,* which name is as general as *vesparum* or *vespæ.* The writer replaces *vesparum,* as according to his interpretation it is a legitimate name. He permits *vespæ* to become a synonym of *Schistosiphon peckii* Kirby, because it was merely a manuscript name (Stiles, 1905, p. 45).

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[a] *Male.*—Totus ater, fuliginosus. Caput parvum. Oculi valde prominuli, sphærici, manifeste compositi. Palpi duo filiformes longiusculi, articulis duobus inæqualibus, primo brevi, rotundo, altero elongato, compresso. Antennæ breves, vix capite longiores, duplici ramo instructæ, ramis æqualibus, deflexis, compressis, quasi ensiformibus. Thorax lobo antico in collum veluti protractus, et singulariter utrinque ad basin appendiculatus, membranula, seu pedunculo instar halterum porrecto, cochleariformi (elytris); in medio latior, convexus, inæqualis, posticeque admodum elongatus. Abdomen fere cylindricum, neque petiolatum neque aculeatum. Femora tibiæque postice depressæ et breviores. Tarsi (articulis) quatuor, fusci, subtus albidi, Alæ albæ, longitudine abdominis (Saunders, 1872).

Female.—The principal character of the species is the mandible. This appendage is very broad at base, with two lobes, to the outer of which one set of muscles is attached. At the middle of the concave base another set of muscles is attached. The forward or outer angle is toothed, acute, the inner angle is lower and rounded.

The following description by Nassonow is taken from a translation in manuscript in the library of the Bureau of Entomology:

Triungulinid: Size never more than 0.25 mm. in length. Body ventrally flattened, dorsally convex, narrowed at ends and widened at middle. Color, bright cinnamon; with side of head at eyes and sides of last abdominal segment black. Head somewhat triangular, with rounded angles. Five simple eyes at lateral angles. Antennæ and sutures absent. Head above hard, chitinous; below soft, transparent and provided anteriad with two small bristle-bearing protuberances. Mouth parts very incompletely developed. Mouth opening above bounded by the border of the upper wall of the skull and below by a strip which passes over without definite limits into the lower wall of the skull. Thus differentiated upper and lower lips are absent. The only pair of mouth appendages corresponds most probably to the mandibles. These appendages are seen outside only through the thin and transparent wall of the lower part of the head and have the appearance of sticks bent toward the longitudinal axis of the body. The thorax consists of three distinctly delineated segments and is slightly narrowed toward the front. These segments are longer than the abdominal. The dorsal segments bear figures of the shape of three or four transverse rows of quadrangles of irregular outline. These dorsal sclerites bear each a pair of bristles near the posterior margin. The pronotum is also armed with a pair near the anterior margin. The ventral sclerites are but slightly convex at the middle, and on the sides at the posterior margin of the convexity of each segment is attached a pair of legs. Between the bases of the legs are regular rows of bristles. The basal member of each leg is strongly widened and is so joined with the thorax as to be slightly movable. Its opening for the reception of the femur is very large and is directed obliquely forward. On its anterior margin it bears a more or less obtuse tooth near which are situated three round bristles with a ring-shaped shaft at the base. Femur basally enlarged, joined by very free, movable articulation with preceding joint. Tibia straight, narrow, bispinose. Tarsus merely a pulvillus. Abdomen consisting of ten distinct segments, the first eight of nearly equal length and gradually narrower posteriorly. Dorsal sclerites armed near sides of apical margin with spine. The ninth dorsal longer than preceding; posterior margin with semilunar excavation; near sides of posterior margin armed with spine. Ninth ventral apically bearing two conical bristle-tipped appendages. Last segment very narrow apically; posteriorly bearing very long styloid processes; dorsally near sides of apical margin with bristles (Nassonow, 1892 *e*).

2. XENOS JURINEI Saunders (1872).

Xenos vesparum JURINE 1818, 1832, not ROSSI.
Xenos rossii jurinei SAUNDERS, 1872.

Host.—*Polistes gallicus* Linnæus; Geneva, Switzerland (pl. 5, fig. 3).

The following description is abbreviated from the original description by Jurine.

Male.—Head flattened in front. Mandibles long, yellowish, slightly arcuate, crossing in front of mouth. Maxillæ pubescent, subequal with the palpi, which latter are subulate. Eyes large, oval, very prominent, many faceted. Antennæ with third joint laterally produced, the flabellum flat, surface granular. Front terminated by a short sharp process. Thorax very elongate, blackish; prothorax and mesothorax a narrow collar; mesothorax longer; the segments separated by a white membranous connective membrane. Wings very large. Abdomen tawny, short, oval. Legs tawny.[a]

10. Genus ACROSCHISMUS Pierce (1908).

Acroschismus PIERCE.—(DURY, 1906, *b*, *c*).

Type of genus.—Acroschismus hubbardi Pierce.

Name derived from ἄκρον, apex +σχισμός, cleavage = apical cleavage, referring to the apical cleavage of the ninth abdominal segment.

This genus seems to be the predominant xenid genus in North America. Species of *Polistes* are the hosts.

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[a] La tête du Xenos est aplatie par-devant. La bouche a deux lèvres, une supérieure, large et ciliée, une inferieure, beaucoup plus petite; près de la supérieure sont implantées deux longues mandibules cornées, jaunâtres, légèrement arquèes sans dentelures, et qui, dans l'etat de repos, se croisent par leur extrémité devant la bouche. Au-dessous des mandibles se trouvent deux longs barbillons formés l'un et l'autre de deux anneaux un peu velus, d'égale longeur, le dernier subulé. Aux parties latérales de la tête sont placés deux grands yeux ovales, très-saillants, et taillés à facettes nombreuses, les petites yeux lisses manquent. Au milieu du front sont implantées les antennes dont la configuration est remarquable; chacune d'elles est composée d'un autre fourchu, ou divisé en deux parties alongées, un peu recourbées et comprimées à-peu-près comme une lame d'épée, à surface granduleuse. Le front se termine par une languette pointu et courte. Le corselet se trouve plus alongé que celui des mouches a quatre ailes. On peut le diviser en trois parties. La première, qui est la plus petite, constitue une espèce de large cou au bout duquel est implantée la tête. De chaque coté de ce cou sort un long appendice, en forme de balancier, d'une structure vraiment, particulière. Il est composée d'un anneau court (prothorax), sur lequel se meut un autre (mesothorax) long anneau, qu'on peu regarder comme la tige de balancier, laquelle est divisée, selon se longeur, en deux parties bien distinctes savoir, l'anterieure qui est ronde, solide, cornée et noirâtre, tandis que la postérieure est faite d'une légère membrane blanche (connective membrane). Au bout de cette tige se trouve la tête du balancier ou le maillet, dont le milieu est creusé en gouttière et le devant un peu échancré. La seconde partie du corselet (metathorax) est divisée en quatre lobes par autant de sillons; il y en a un anterieur (præscutum), un posterior (scutellum) et deux latéraux (lumbi of scutum). De dessous ces derniers sortent deus ailes conformées d'une manière très-remarquable. Elles sont fort grandes et beaucoup plus amples que celles d'aucun diptère; elles n'ont ni nervures, ni cellules apparentes. La partie postérieure du corselet est formée de trois prolongemens particuliers, un superieur (postscutellum; the postlumbium is omitted in his descriptions), qui s'etend, en guise d'ecusson pointu, jusqu'à la base du ventre, et deux latéreaux (femoralia) qui, apres s'être portés en arrière, se contournent sur aux-mêmes en s'inclinant du côté de l'abdomen, et offrent encore une conformation toute particulière. Le ventre du *Xenos* à, comme les pattes, une couleur bistrée; il est court, ovale, pétiolé, et composé de sept anneaux marqués en dessus de deux tâches plus foncées. Ce ventre, comme celui des diptères, s'affaise et se déforme par l'exsiccation. Les pattes sont divisée en quatre parties, savoir, le trochanter, le cuisse, le jambe et le tarse formé de cinq articles, dont le dernier est dépourvu de crochets (Jurine, 1818).

Male.—Typically xenid in the possession of four-jointed antennæ, four-jointed tarsi, and two-jointed maxillæ. Species of this genus differ from *Schistosiphon* (*Xenos*) *peckii* Kirby in the cleavage of the ninth segment of the abdomen to form two claws, between which the reflexed œdeagus arises, and in having the tip of the œdeagus simple, not cleft, with the genital pore before the apex. A characteristic of the genus is the presence of the mesostigmatal lobe on the mesothorax.

Female.—Cephalothorax not as a rule abruptly narrowed behind the stigmatal angle, elongate trapezoidal, obtuse or truncate at apex. Stigmata seldom laterally prominent. Mouth ventral with mandibles on each side, rather broad and obtuse. Abdomen with four median genital canals on second to fifth segments.

Triungulinid: Body oblong, slightly narrowing posteriad. First eight segments normal, ninth greatly elongate, deeply emarginate for tenth, which is elongate and terminated by two stylet bearing lobes, contiguous at base.

The genus contains the following species:

1. *hubbardi* Pierce, parasitic on *Polistes crinitus* (*americanus*); Florida.
2. *bruesi* Pierce, parasitic on *P. metricus;* Michigan.
3. *nigrescens* Brues (1903), parasitic on *P. rubiginosus;* Texas, Louisiana.
4. *pallidus* Brues (1903), parasitic on *P. annularis;* Texas, District of Columbia, Florida.
5. *pecosensis* Pierce, parasitic on *P. texanus, rubiginosus;* Texas.
6. *wheeleri* Pierce, parasitic on *P. metricus;* Connecticut, District of Columbia.
7. *bowditchi* Pierce, parasitic on *P. pallipes;* Massachusetts, Ohio.
8. *hunteri* Pierce, parasitic on *P.* new species, near *minor;* Texas.
9. *texani* Pierce, parasitic on *P. texanus;* Texas.
10. *rubiginosi* Pierce, parasitic on *P. rubiginosus;* Louisiana.
11. *maximus* Pierce, parasitic on *P. rubiginosus;* Texas.

Key of males.

1. Wing venation pale except at costal margin .... 2.
   Wing venation dark and distinct throughout .... 7.
2. Palpus indistinctly separated from maxilla .... *nigrescens.*
   Palpus distinctly separated .... 3.
3. Second antennal joint set very deeply in first .... *hubbardi.*
   Second antennal joint not set very deeply into first .... 4.
4. Apex of œdeagus turned upward almost at a right angle .... 5.
   Apex of œdeagus turned upward at an acute angle .... 6.
5. Palpus considerably shorter than maxilla .... *hunteri.*
   Palpus about equal to maxilla .... *bruesi.*
6. Radius of wings not interrupted at node .... *pallidus.*
   Radius of wings interrupted at node .... *pallidus texensis.*

7. Palpus arising from truncate tip of maxilla .... 8.
Palpus arising some distance before tip of maxilla .... *pecosensis*.
8. Subcosta and radius black, other veins brown; œdeagus at widest point abruptly rounded above.. *wheeleri*.
All veins colored black; œdeagus at widest point rounded from rectangle. *bowditchi*.

Key of females.

A table based on the mandibles would be very hard to use, so the following table, based on comparative measurements of the various dimensions of the cephalothorax, is presented. The specimens studied were mounted in balsam.

The measurements are with a Zeiss stand, tube length 160, eyepiece 2, objective A, with eyepiece micrometer (1 space = 0.0076 mm.). As the comparative dimensions are the sought-for characters, other microscopes will be just as available. The actual size of each specimen may be found with its description.

The following measurements were taken: (1) Length from base of cephalothorax to apex; (2) length from line between apices of spiracles to apex; (3) shortest distance between mandibles; (4) breadth of head at base; (5) breadth of cephalothorax at spiracles; (6) greatest breadth of cephalothorax. On account of the larger size of these insects a lower power of microscope was used than in Stylops.

Species.	1. Length.	2. Spiracle to apex.	3. Breadth between mandibles.	4. Breadth of head.	5. Breadth at spiracles.	6. Greatest breadth.
maximus	225	145	43	195	240	260
pecosensis	233	148	47	180	225	230
	207	127	38	178	220	220
	207	127	44	180	225	225
rubiginosi	220	160	40	155	210	222
hubbardi	212	138	31	145	183	189
texani	210	140	36	140	205	205
pallidus	194	124	31	124	172	178
bruesi	195	118	43	170	213	216
	186	111	37	148	185	187
hunteri	170	110	29	127	160	164
wheeleri	170	110	35	137	168	174
nigrescens	170	100	38	128	168	172
bowditchi	136	76	38	148	185	189

Following is a comparison of dimensions by ratio. The first column represents the ratio of the breadth of the cephalothorax between the spiracles to the distance between the mandibles; the second represents the ratio of the breadth of the head to the distance between the mandibles; the third the ratio of the breadth between the spiracles to the breadth of the head; and the fourth the ratio of the breadth between the spiracles to the distance from spiracles to apex. The third and fourth are of greatest importance.

Species.	Cephalothorax to mandibles. (5) : (3) : :—: 1.	Head to mandibles. (4) : (3) : :—: 1.	Cephalothorax to head. (5) : (4) : :—: 1.	Breadth to length. (5) : (2) : :—: 1.
maximus	5.58	4.53	1.23	1.65
pecosensis	4.78-5.78	3.83-4.68	1.23-1.25	1.52-1.77
rubiginosi	5.25	3.87	1.35	1.31
hubbardi	5.90	4.67	1.26	1.32
texani	5.69	3.88	1.46	1.32
pallidus	5.54	4.00	1.38	1.38
bruesi	4.95-5.00	3.95-4.00	1.25	1.66-1.80
hunteri	5.52	4.37	1.25	1.45
wheeleri	4.80	4.60	1.22	1.52
nigrescens	4.42	3.36	1.31	1.68
bowditchi	4.87	3.84	1.25	2.43

1. ACROSCHISMUS HUBBARDI Pierce (1908).

Xenos, species HUBBARD, 1892.
Xenos hubbardi PIERCE, in determinations.

Host.—*Polistes* (*americanus* Fabricius) *crinitus* Felt; Crescent City, Florida, April 6. Described from fourteen males in the collection of the U. S. National Museum, collected by H. G. Hubbard (Hubbard, 21). It is upon these specimens that Hubbard based his valuable observations on the life history of *Xenos* (pl. 6, figs. 1–12; pl. 9, fig. 3).

Male.—Wing expanse 5.5 mm., length 2–3 mm. The specimens measured, respectively, 2, 2, 2, 2.25, 2.5, 2.5, 2.5, 2.5, 2.75, 3, 3, 3, 3 mm.

The following description was published by the present author in 1908:

Color, brown. Antennæ apparently brown, but on closer inspection transparent yellow with blackish brown pubescence; first joint yellow. Face fulvous, pubescent; mandibles transparent yellowish, glabrous. Vertex dark, head brown, eyes black. Prothorax and mesothorax dark with elytra yellowish, pubescent, darker at club. Metathorax lighter, brownish, with exception of postscutellum, which is dark brown. Wings milky white, hyaline, irridescent, with dark brown costal margin; veining delicate yellowish brown, pubescent gray; last three veins very light. Legs yellowish. Abdomen yellow with black borders (Pierce, 1908).

Antennæ a little shorter than width of head, very sensitive pubescent; the first with a veil-like curtain extending beyond and enveloping the entire second joint, but so transparent that the second joint is easily made out when viewed with a microscope. Maxillæ yellow, two-jointed, with the first joint longest and somewhat obliquely truncate (the second joint is the palpus). Mandibles acute, somewhat curved, ensiform, about twice as long as maxillæ. Eyes stalked. Prothorax and mesothorax about equal in length, each about one-half as long as wide. Mesothorax with apical angles produced obliquely backward. Elytra a little longer than the width of the mesothorax, ladle-form with the hollow of the spoon ventral, much wrinkled. Under a compound miscroscope a small hook is discernible beneath the base of each elytron and apparently attached thereto. In diameter it is about one-quarter the width of the elytron. Below this is the very delicate hairy mesostigmatal lobe belonging to the mesosternum and broadly attached to the second quarter of the lateral edge. The lobe presents a broadly convex surface to the hook, but ventrally shows a folding parallel with its edge, which creates a channel leading back to the base, where it is narrowed by an anterior lobe and a posterior acute ridge, which form the guardians to the almost circular orifice of the mesostigma. The lobe is about once and a half as long as the basal width of the elytron. Metathorax with praescutum keystone shape; scuti about twice as long as wide, almost meeting behind the praescutum, at which point they are laterally broadest; scutellum triangular; postlumbium transverse, short; femoralia linear, long; postscutellum broadest near its base, rounded at the apex, over twice as long as broad at broadest point. Wings with seven primary veins, arising at the base. The radius is interrupted at the node, beyond which interruption it immediately forms an open loup and continues in the original direction. A short vein occurs between this and the medius and another between the medius and cubitus. Prosternum narrow, band-like, hardly one-fourth as long as the mesosternum. Coxæ transverse, not contiguous, apparently open behind; trochanters elongate subcylindrical, over twice as long as coxæ; femora elongate, slender, nearly twice as long as trochanters and slightly curved; tibiæ elongate, slender, equaling femora; tarsi four-jointed, first three joints subequal, obliquely truncate and cup-shaped at apex for reception of the following, ventrally and laterally produced into velvety underlapping pulvilli; last tarsal joint as long as the three preceding (to its own base), forming a very delicate enlarged conical cup with the apex obliquely truncate from near the middle of dorsum. The pulvilliform parts of the tarsi are thickly matted with sharp hairs. Mesosternum broader than long; coxæ apical, open behind, contiguous on inner edges, transverse; trochanters longitudinal, contiguous on inner edges, sinuately curved on outer edges, femora equaling trochanters plus coxæ, inflated at basal third, narrowed beyond apical third; tibiæ subequal to femora; tarsi as on anterior legs. Metasternum elongate; legs apical; coxæ contiguous, cylindrical, length and breadth subequal, cupped for the reception of the trochanters; trochanters flaring toward apex, longer than broad, obliquely cupped for the reception of the femora, femora at base equaling base of trochanters in diameter, inflated and obtusely bent at basal third, longer than the two preceding joints; tibiæ not attaining the bend of the femora when folded, narrowest just beyond base, gradually flared toward apex; tarsi equaling tibiæ, and similar to preceding pairs. Genitalia with the ninth ventral segment apparently uncovered, and apically cleft, forming two lobes, from between which the siphonated oedeagus arises. "Œdeagus reflexed and apically protected by the overhanging tenth segment. The genital pore through which the slender penis finds exit is situated at the basal one-third of the upturned tip of the oedeagus on the inner angle" (Pierce, 1908).

Female.—Length of cephalothorax 1.61 mm., breadth at spiracles 1.39 mm., breadth at base of head 1.10 mm., distance between mandibles at base 0.23 mm. Cephalothorax light brownish, lighter at apex; longer than broad, elongate subquadrate, slightly oblique at sides; broadly, convexly truncate at apex, truncation more than one-half the breadth at the spiracles; lateral margin sinuate with three depressions, the last in front of the spiracles; spiracles not laterally prominent; mandibles distant from lateral margins of head, subquadrate with inner angle receding and armed with an outward curved tooth.

Triungulinid: Length of body 0.22 mm., length including stylets 0.30 mm., breadth of head 0.06 mm., greatest breadth 0.07 mm., breadth of ninth abdominal segment 0.04 mm. First eight segments normal, ninth elongate, deeply emarginate for the tenth, which is elongate and terminated by two stylet-bearing lobes, contiguous at base.

Type.—Cat. No. 9825 U.S.N.M. Cotype in collection of Charles Dury at Cincinnati, Ohio.

2. ACROSCHISMUS BRUESI, new species.

Xenos bruesi Pierce in determinations.

Host.—*Polistes metricus* Say. (det. W. H. Ashmead); Detroit, Michigan; two specimens of male, several females (pl. 5, figs. 7, 10, 11; pl. 9, fig. 2).

Named in honor of Mr. C. T. Brues, of Milwaukee, Wisconsin.

Male.—Length 3.5–4 mm., antennæ 1.25 mm. Reddish brown: antennæ brownish, cheeks black, front lighter, mouth parts fulvous, eyes black. Scuti reddish brown, scutellum blackish, postlumbium very light, postcutellum brown, lightening toward apex. Abdomen and legs fulvous; oedeagus glabrous, yellow; and claws yellow, pubescent. Wings milky, with clear-white pubescence. Antennæ long, equaling width of head, first joint obliquely truncated, second very small, fourth joint surpassing third. Maxillæ with first joint short, palpus narrowed at base and once and a half as long as preceding joint. Mandibles about twice the length of second maxillary joint (palpus), and not capable of reaching eyes. Thoracic structure similar to that of *A. hubbardi.* The writer was, however, unable to detect the mesostigmatal lobes described for that species, but thinks they are present. Genitalia similar with the exception that the oedeagus is more abruptly curved, is obliquely depressed to the second turn, and thence is much narrowed and very acute to the apex.

Female.—Length of cephalothorax 1.41–1.48 mm., breadth at spiracles 1.40–1.61 mm., breadth at base of head 1.12–1.29 mm., distance between mandibles at base 0.28–0.32 mm. Cephalothorax light brown with very little color variation; as broad or broader than long, laterally convex to spiracles, thence straight to point opposite base of mandibles, apically very convex; spiracles not laterally prominent; mandibles distant from lateral margins of head, quadrate; inner angle armed with a large outward curving tooth.

Type.—Cat. No. 9826, U.S.N.M.; Hubbard and Schwarz collection.

3. ACROSCHISMUS NIGRESCENS Brues (1903).

Xenos nigrescens BRUES, 1903, 1905.
Acroschismus nigrescens PIERCE, 1908.

Host.—*Polistes rubiginosus* Lepeletier; Austin, Texas (males, female). *P. rubiginosus* and *P. annularis* (?) (males, females); Paris, Texas (Brues, 1905).

The original description by Brues is as follows:

Male.—Length 4.5 mm. Black above, abdomen often gray at base, head above piceous, antennæ dark cinereous. Mandibles black at base, lighter at tips. Palpi cinereous, indistinctly two-jointed, the second joint one-half as long as, and connate with, the first ventrally, where no suture is visible; above it appears indistinctly constricted off from the first. Prothorax black or piceous above, somewhat lighter on the sides; elytra cinereous. Dorsum of thorax fuscopiceous, lighter on the sides and at tip of post-scutellum. Abdomen usually black, sometimes gray at base and with two indistinct longitudinal dark bands. Wings delicate, pale hyaline, much as in (*X.*) *pallidus* except that the subcostal nervure (=third, or radial) is interrupted near the middle (node) as in *X. peckii* (=*Acroschismus wheeleri* Pierce); all the posterior veins nearly obsolete. Body below in great part piceous, abdomen black or gray below. Legs cinereous, darker above on femora, tibiæ, and tarsi.

Female.—Length 9–10 mm. Exposed surface of head (=cephalothorax) black on posterior two-thirds, orange on anterior one-third, the line dividing the two colors straight transverse. Anterior half of thorax (=basal segments of abdomen) yellow, its lateral wrinkles ferruginous. Dorsal (sic, =ventral morphologically, although uppermost) stripe of abdomen (=area of brood canal) brownish, nearly half as wide as the body, at base narrowed and faded out posteriorly. Genital pores on median line near posterior margin, distinct.

Described from one female and four male specimens, collected and bred at Austin, Texas, during October, 1901 (Brues, 1903).

Triungulinid: Length 0.28 mm. Oval, head obtusely rounded, anteriorly. Head and thorax together slightly longer than the abdomen. Head a little less than half as long as the thorax, almost semicircular when seen from above, being truncate behind. Eyes large, strongly pigmented. Oral opening large, almost contiguous with the eyes below; mouth parts consisting apparently of a short proboscis-like organ with chitinous sides. No antennæ or other tactile organs to be seen. Thorax one and one-half times as long as wide, consisting of three nearly equal transverse segments. Each segment below bears a pair of very small and delicate legs. The coxæ are all greatly swollen and globose, those of each side contiguous with one another and the pairs only moderately separated along the median line. Each coxa is hollowed out below and the trochanter sunk within it. Femora slender, enlarged somewhat at base, bearing a spine apically. Tibiæ slender, of equal width, the hind ones with a preapical spine. Tarsi greatly reduced, those of the four anterior legs scarcely distinguishable from the tips of the tibiæ furnished with a pulvilliform appendage, the posterior pair elongated, with a styliform appendage. Abdomen consisting of nine short, transverse segments and an elongated tenth segment which encloses the extrusible tip of the abdomen (eleventh segment?). The dorsal sclerites reach far down on the sides, as do also those of the thorax, making the underside of the body somewhat concave. Tip bearing two approximated bristles, each as long as the abdomen, in addition to a much shorter one at each lateral angle of the last segment (Brues, 1905).

Brues's figure of the triungulinid is evidently in error, as it is given fourteen abdominal segments.

Female.—The following description is drawn from the type specimens:

Length of cephalothorax 1.49 mm., breadth at spiracles 1.27 mm., breadth at base of head 0.97 mm., distance between mandibles at base 0.28 mm. Cephalothorax light brownish, darker on basal two-thirds except on center of disc; deeply emarginate at base, oblique, convex to point opposite base of mandibles, apex very convex; spiracles not laterally prominent; mandibles distant from lateral margins of head, oblique, oblong, with outward curved tooth on inner angle and outer angle prominent rounded.

4. ACROSCHISMUS PALLIDUS Brues (1903).

Xenos pallidus Brues, 1903, 1905.
Acroschismus pallidus Pierce, 1908.

Host.—*Polistes annularis* Linnæus; Austin, Texas (Brues, 1903); Paris, Texas (Brues, 1905).

Brues originally described this species as follows:

Male.—Length 2.25 mm. Head and thorax above fuscous, below, very pale luteous, antennæ with the first two joints luteous, the rami of the fourth joint (third and fourth joints) yellowish gray, their spots pale. Eyes black, their hemispherical facets of the usual size. Mandibles pale luteous, white at tip. Palpi white, distinctly two-jointed, the first joint nearly twice as long as the second and obliquely truncate at apex; second joint oval. Prothorax and mesothorax fuscous; elytra pale, grayish at tip. Dorsal sclerites of the metathorax shaped as in *X. peckii* (=*Acroschismus wheeleri* Pierce); fuscous, darker on the post-scutellum. Legs pale luteous, tarsi slightly grayish above near tips. Wings pale hyaline, the nervures very delicate and not pigmented along their edges. The costal margin darkened for nearly its entire length. Abdomen finely transversely wrinkled on the dorsal surface; grayish yellow, blackened above, especially posteriorly. Ventral plates honey yellow, hypopygium (ninth segment) yellow except the dorsal piece (tenth segment), which is grayish.

Described from 24 male specimens, all bred from individuals of *Polistes annularis* Linnæus, at Austin, Texas, during May (Brues, 1903).

Female.—The following description is drawn from the typical material:

Length of cephalothorax 1.47 mm., breadth at spiracles 1.30 mm., breadth at base of head 0.94 mm., distance between mandibles at base 0.28 mm. Cephalothorax dark brown except in front of line between posterior lateral corners of head, which portion is much lighter; considerably longer than broad, very slightly constricted at base, convex from base to spiracles, thence oblique and almost straight to base of head, thence unevenly sinuate; apex truncate, sinuate; spiracles not laterally prominent; mandibles distant from lateral margins of head, oblique, oblong, with outward curved tooth on inner margin.

ACROSCHISMUS PALLIDUS TEXENSIS, new variety.

Material collected at Rosser, Texas, in August, 1905, by F. C. Bishopp and C. R. Jones from *Polistes annularis* has been called *Acroschismus pallidus* by the writer, but a careful comparison of the descriptions of *A. pallidus* and *A. nigrescens* indicates a varietal tendency; hence the convenience name *texensis* (fig. 3, nos. 9, 10; pl. 7, figs. 1, 5, 9; pl. 8, figs. 2, 3; pl. 9, figs. 5, 6).

Male.—Size: *texensis*, specimens measure respectively 2.6, 2.8, 2.8, 3, 3, 3, 3, 3, 3, 3.1, 3.2, 3.2, 3.3, 3.4, 3.5 mm.; i. e., 2.6–3.5 mm.; *pallidus*, 2.25–2.75 mm. (Brues); *nigrescens*, 4.5 mm. (Brues). Antennæ: *texensis*, first joints pale, third and fourth darker; *pallidus*, first joints pale, third and fourth darker (Brues); *nigrescens*, dark cinereous (Brues). Mandibles: *texensis*, entirely pale yellow; *pallidus*, pale luteous to white (Brues); *nigrescens*, black to lighter (Brues). Maxillæ: *texensis*, distinctly jointed, pale; *pallidus*, distinctly jointed, pale (Brues); *nigrescens*, indistinctly jointed, cinereous (Brues). Wing nervures pale, weak; *texensis*, radius ("subcosta" Brues) interrupted at node; *pallidus*, radius not interrupted (Brues); *nigrescens*, radius interrupted at node (Brues).

The following accurate measurements were taken by microscope and may best be considered from the comparative standpoint. A Bausch and Lomb instrument, with two-thirds objective and 2-inch eyepiece, tube length 160, is the standard. The figures given below are in spaces which measure 0.0157 mm. The same scale is used later for other species.

Antennæ: Length = 55; fourth segment = 48; greatest breadth = 6.5.

Head: Distance between outer basal corners of antennæ = 17; between inner front edges of eyes = 27; between inner hind edges of eyes = 42; breadth of head = 54.

Mouth parts: Mandible = 22; maxilla = 10; distance to base of palpus or second joint = 6; palpus = 6.

Prothorax: Length = 10; breadth = 28.

Mesothorax: Length = 10; least breadth = 24; greatest breadth = 39.

Balancer, or elytron: Length = 34.

Metathorax: Length = 110.5; præscutum plus scutellum = 54; postlumbium = 13; postscutellum = 43.5; greatest breadth = 47.

Abdomen: Length tenth segment = 18; length œdeagus = 20.

Anterior leg: Trochanter = 29; femur = 35; tibia = 36; tarsus = 29.

Median leg: Trochanter = 25; femur = 35; tibia = 34; tarsus = 29.

Posterior leg: Trochanter = 14; femur = 38; tibia = 30; tarsus = 29.

In addition to these measurements actual measurements by a cruder method were taken, as follows:

Length of body = 3.3 mm.

Length of head and thorax = 2.1 mm.

Breadth of head = 0.8 mm.

Length of wing on costal margin = 1.9 mm; on anal margin = 2.2 mm.

Type.—Cat. No. 10114, U.S.N.M.

5. ACROSCHISMUS PECOSENSIS, new species.

Xenos nigrescens, determinations in collection of Amer. Ent. Soc. Philadelphia.

Host.—*Polistes texanus* Cresson: Pecos, Texas, February 27, September 30; Austin, Texas; Victoria, Texas. *Polistes rubiginosus* Lepeletier: Waco, Texas, August 29; F. C. Bishopp, collector (pl. 7, figs. 3, 7, 12; pl. 8, figs. 1, 4; pl. 9, fig. 7).

Male.—Length, 3.8 mm. Color, brown; antennæ, light brown; mandibles brown at base, yellow at tip; eyes black; wings with costal margin brown; legs lighter, yellowish; œdeagus clear yellow. Antennæ as long as breadth of head, very sensitive, pubescent, first joint concave for reception of second. Maxillæ yellowish, pubescent, narrowed to one-half original diameter beyond middle, apically rounded; palpus arising at the apical one-third and somewhat surpassing the apical lobe of the maxilla. Mandibles ensiform, over twice the length of the maxillæ. Mesostigmatal lobe present. Œdeagus reflexed, angled at thickest point above, apex turned at an obtuse angle above. It differs from that of *A. pallidus* in that the latter is rounded at the thickest point, and has the apex turned at an acute angle above.

The following accurate measurements were taken on the same scale as in *A. pallidus texensis*, one space = 0.0157 mm.

Antennæ: Length = 67; fourth segment = 60; greatest breadth = 7.

Head: Distance between outer basal corners of antennæ = 25; between inner front edges of eyes = 32; between inner hind edges of eyes = 46; breadth of head = 65.

Mouth parts: Mandibles = 26; maxilla = 12; distance to base of palpus or second joint = 8; palpus = 4.

Prothorax: Length = 12; breadth = 30.

Mesothorax: Length = 10; least breadth = 25; greatest breadth = 38(?).

Balancer, or elytron: Length = 39.

Metathorax: Length = 122; præscutum plus scutellum = 56; postlumbium = 8; postscutellum = 56; greatest breadth = 53.

Abdomen: Length tenth segment = 15; length œdeagus = 18.

Anterior leg: Trochanter = 30; femur = 30 (?); tibia = 45; tarsus = 35.

Median leg: Trochanter = 32; femur = 33; tibia = 36; tarsus = 31.

Posterior leg: Trochanter = 15; femur = 39; tibia = 29; tarsus = 31.

In addition the following measurements were taken by cruder methods:

Length of body = 3.8 mm.

Length of head and thorax = 2.4 mm.

Breadth of head = 1 mm.

Length of wing on costal margin = 2.6 mm; on anal margin = 2.8 mm.

Female.—Length of cephalothorax 1.57–1.77 mm., breadth at spiracles 1.67–1.71 mm., breadth at base of head 1.35–1.36 mm., distance between mandibles at base 0.28–0.35 mm. Cephalothorax light brown with a broad dark-brown band at base; broader than long; margin convex from base to apex, slightly depressed or concave in front of mandibles; spiracles not laterally prominent; mandibles distant from lateral margins of head, deeply bilobed at apex, the inner lobe acute, the outer obtuse.

The larger measurements are from a specimen from *Polistes rubiginosus* taken at Waco, Texas, and which may belong to a distinct species. The species is variable, as shown by specimens in the same lot, and may even include *A. maximus*, since the ratios for this species are included in each case within the range of *A. pecosensis*.

Cotypes.—Cat. No. 10120, U.S.N.M.; and in Academy of Natural Sciences, Philadelphia.

6. ACROSCHISMUS WHEELERI Pierce (1908).

Xenos peckii Brues, 1903.

Host.—*Polistes metricus* Say, Colebrook, Connecticut, August; Washington, D. C., September 6, 7 (U. S. D. A. 3513°) (pl. 5, figs. 8, 9, 12, 13; pl. 9, fig. 10).

The following description is from Brues:

Male.—Length, 3–4.5 mm. Dark fuscous, abdomen usually lighter and pale at apex. Mandibles black at base, pale at tips, antennæ yellowish gray, the rami of third joint about one and one-third as long as the width of the head. Head fuscous. Palpi indistinctly two-jointed, the second joint only one-half as long as the first and not separated from it ventrally, so that the palpus appears to be obliquely cleft, the first joint being obliquely truncate at apex. Dorsum of thorax varying from fuscous to piceous, darkest medially, elytra gray. Abdomen usually yellowish gray above, often darker; ventral surface honey yellow; sexual organs pale yellow. Wings stout, subhyaline, the veins very strong and dark, the wing being fuscous along the margins of the veins, so that they appear rather wide capital. Subcostal (radial) nervure interrupted slightly before the middle; costal margin infuscated on basal two-thirds. Legs grayish luteous, darkened on upper side of femora and tibiæ and especially so on the tarsi.

Female.—Length 6.25–9 mm. Head (cephalothorax) above orange, irregularly blackened on posterior half. The black portion emarginate in front at the middle and not extending so far forward on the sides, so that the black extends forward as a projection on each side of the middle. Anterior half of thorax (abdomen) fuscous or piceous, with black wrinkles on the sides. Dorsal abdominal stripe usually quite dark in front and fading out posteriorly, sometimes obsolete. Genital pores distinctly visible externally.

About a dozen males, numerous male pupæ and over 80 females collected by Dr. W. M. Wheeler at Colebrook, Connecticut, during the month of August (Brues, 1903).

7. ACROSCHISMUS BOWDITCHI, new species.

Xenos peckii Bowditch, 1903.
Acroschismus bowditchi Pierce (Dury, 1906).

Host.—*Polistes pallipes* Lepeletier, Marion, Massachusetts, September 2–12, 1902, (Fred C. Bowditch, collector); Cincinnati, Ohio, June 15–September 22, (Charles Dury, Miss Annette F. Braun, collectors) (pl. 7, figs. 2, 6, 11; pl. 9, fig. 1).

Male.—Length 3.25 mm. Antennæ light brown; mandibles brown; eyes black; wings with costal margin brown; legs lighter; œdeagus clear yellowish. Antennæ longer than breadth of head, very sensitive, pubescent. Maxillæ light brown, pubescent. Mandibles ensiform, curved near base, longer than maxillæ. Mesostigmatal lobe present. Œdeagus reflexed, broadly rounded at thickest point above, apex turned almost at a right angle.

Female.—Length of cephalothorax 1.03 mm., breadth at spiracles 1.40 mm., breadth at base of head 1.12 mm., distance between mandibles at base 0.29 mm. Cephalothorax light brown with a dark-brown band at base; slightly broader than long; margin very convex from base to spiracles, almost straight thence to point opposite base of mandibles, apically broadly convex-angulate; spiracles not laterally prominent; mandibles distant from lateral margins of head, oblong-quadrate, with large outward curved tooth on inner angles.

Type.—Cat. No. 10117, U.S.N.M.

Named in honor of Mr. Fred C. Bowditch, who collected the types, in return for his courtesies in assisting the writer with material.

8. ACROSCHISMUS HUNTERI, new species.

Host.—*Polistes*, new species, near *minor* Beauvais; Victoria, Texas, September 25, 1906, J. C. Crawford, collector; June 27, 1906, C. R. Jones, collector (pl. 7, fig. 10; pl. 9, fig. 4).

Male.—Length 4 mm. The color may not be satisfactorily described, as the specimen was extracted from its puparium. Antennæ slightly longer than the breadth of the head, very sensitive, basally arising under a projecting flap, the first, second, and third joints concave for reception of following joint, but first not concealing second, basal joints lighter than rami, and not sensitive. Maxillæ bent at base thence cylindrical, pubescent, obliquely truncate at apex; palpus arising from center of truncation, elliptical, pubescent, almost one-half the length of the maxilla, and about one-half as thick in diameter. Mandibles ensiform, strongly curved throughout, with tip slightly recurved, surpassing the maxillæ and palpus by the lengths of the palpus. Mesostigmatal lobe present. Œdeagus reflexed, broadly rounded at thickest point above, apex turned almost at a right angle.

The following measurements were taken by microscope and may be considered in the same light as those preceding. A Bausch and Lomb instrument, with two-thirds objective, 2-inch eye-piece, tube length 160, is the standard used. The figures given below are in spaces which measure 0.0157 mm.

Antennæ: Length = 60; fourth segment = 53; greatest breadth = 7.

Head: Distance between outer bases of antennæ = 22; between inner front edges of eyes = 33; between inner hind edges of eyes = 45; breadth of head = 57.

Mouth parts: Mandibles = 22.5; maxilla = 11; distance to base of palpus or second joint = 10; palpus = 4.

Prothorax: Length = 9; breadth = 22.

Mesothorax: Length = 10; least breadth = 22; greatest breadth = 30.

Balancer or elytron: Length = 48.5.

Metathorax: Length = 105.5; præscutum plus scutellum = 50; postlumbium = 11.5; postscutellum = 44; greatest breadth = 43.

Abdomen: Length tenth segment = 18; length œdeagus = 20.

Anterior leg: Trochanter = 20; femur = 29; tibia = 33; tarsus = 30.

Median leg: Trochanter = 26; femur = 34; tibia = 30; tarsus = 28.

Posterior leg: Trochanter = 16; femur = 30 (remainder could not be measured).

Female.—Length of cephalothorax 1.29 mm., breadth at spiracles 1.21 mm., breadth at base of head 0.96 mm., distance between mandibles at base 0.22 mm. Cephalothorax light brown with a dark band covering the basal two-thirds; slightly longer than broad; not greatly constricted at base, margin slightly convex to apical truncation, apex slightly sinuate convex; spiracles dorsal, not reaching lateral edges; mandibles large quadrate with a large outward curved tooth near inner angle on apical side.

Type.—Cat. No. 10115, U.S.N.M.

Named in honor of W. D. Hunter, the writer's immediate superior, who has greatly encouraged and aided the present work.

9. ACROSCHISMUS TEXANI, new species.

Host.—*Polistes texanus* Cresson, July 25, 1906, Victoria, Texas (pl. 9, fig. 9).

Female.—Length of cephalothorax 1.59 mm., breadth at spiracles 1.56 mm., breadth at base of head 1.06 mm., distance between mandibles at base 0.27 mm. Cephalothorax brown, lighter toward apex; slightly longer than broad; constricted at base, margin convex to apex with slight sinuations in front of mandibles and at side of head; spiracles dorsal, not reaching lateral edges; mandibles large quadrate with large tooth on inner apical angle.

Type.—Cat. No. 10121, U.S.N.M.

10. ACROSCHISMUS RUBIGINOSI, new species.

Host.—*Polistes rubiginosus* Lepeletier; Logansport, Louisiana, June 6, 1906; W. D. Pierce, collector (pl. 9, fig. 11).

Female.—Length of cephalothorax 1.67 mm., breadth at spiracles 1.59 mm., breadth at base of head 1.17 mm., distance between mandibles 0.30 mm. Cephalothorax dark brown to line between posterior angles of head, thence much lighter; slightly longer than broad; constricted at base, margin oblique with emarginations in front of spiracles, and at base of head, between which it is slightly convex; apically sinuate truncate; spiracles dorsal; mandibles subquadrate, apically strongly emarginate between outward curving tooth on inner angle and rounded lobe of outer angle.

Type.—Cat. No. 10119, U.S.N.M.

11. ACROSCHISMUS MAXIMUS, new species.

Host.—*Polistes rubiginosus* Lepeletier, Texas (pl. 9, fig. 8).

Female.—Length of cephalothorax 1.71 mm., breadth at spiracles 1.10 mm., breadth at base of head 1.48 mm., distance between mandibles 0.32 mm. Cephalothorax dark brown, lighter at apex and in large median emargination of the dark pigment; considerably longer than broad; constricted at base, margin somewhat concave from widest point to base of head, thence very convex to apex, rounding emarginate in front of mandibles, spiracles dorsal; mandibles considerably wider at base than at apex, apically emarginate between large tooth on inner angle and the large blunt outer angle.

Type.—Cat. No. 10118, U.S.N.M.

11. Genus SCHISTOSIPHON Pierce (1908.)

Type of genus.—*Schistosiphon peckii* Kirby (1813).

Name derived from σχιστός = cleft + σιφών = siphon = cleft siphon, referring to the apical cleavage of the œdeagus. This genus lies between the typical European *Xenos* and the typical American

Acroschismus, differing from the former in wing venation and from the latter in genitalia. The antennæ taper as in *Xenos*. The œdeagus is not bounded at its base by reflexed lobes, is basally bisulcate and apically cleft. The wings have seven primary veins from the base, with one unattached distal vein between the radius and medius and one between the medius and cubitus.

The genus is parasitic upon *Polistes* and is confined to North America.

1. Palpi with first joint longer than second.............................. *peckii* Kirby.

1. SCHISTOSIPHON PECKII Kirby (1813).

Xenos vespæ Peck in correspondence.
Xenos peckii Kirby, 1813.
Schistosiphon peckii Pierce, 1908.

Host.—*Polistes fuscatus* Fabricius; near Cambridge, Massachusetts (pl. 5, figs. 5, 6).

The original description by Kirby is essentially as follows:

Male.—Dark fuscous, antennæ with rami subterete, dilutely albo-punctate, anus pallid, legs yellowish, tarsi fuscous. Length 1½ line (0.15 inch); breadth of head at eyes, 0.04 inch, length of antennæ 0.045 inch. Body dark fuscous, minutely pubescent, velvety. Head between antennæ longitudinally elevated and almost carinate. Maxillæ longer than their palpi, fuscous, minutely white pubescent, subdiaphanous. Thorax with postscutellum longitudinally and transversely canaliculate; postlumbium pale. Wings whitish cinereous; margin thickened, veins black. Legs cinereous or dusky; tarsi darker. Abdomen more obscure than the rest of the body; anus pale rufescent.[a]

12. VESPÆXENOS, new genus.

Name derived from *Vespa* (the host genus) + *Xenos* (the original genus of wasp parasites), meaning a xenid parasite of *Vespa*.

Type of genus.—*Vespaexenos crabronis*, new species.

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[a] *Male.*—X. nigro-fuscus, antennis; ramis semiteretibus dilutioribus albo punctatis, ano pallido, pedibus luridis; tarsis fuscis. Long. corp. 1½ lin. (Professor Peck's measurements of fresh specimens: Length of body 0.15 inch, breadth of head at eyes 0.04 inch, length of antennæ 0.045 inch.) Corpus nigro-fuscum, ex pube brevissima et nisi sub lente forti omnino inconspicua opacum et quasi velutinum. Caput inter antennas longitudinaliter elevatum et ferè carinatum. Palpi articulo primo secundo longiori. Antennae capite longiores; ramis magis dilutè fuscis, subdiaphanis, punctis minutissimis albis, et, uti suspicor, hexagonis, nisi sub lente forti vix conspicuis irroratis. Truncus. Thorax posticè in medio obtusangulus. Scutellum longitudinaliter et late canaliculatum. Postlumbium pallidum. Alae cinereo-albidae; margine crassiori, nervisque nigris. Pedes cinerei vel potiùs luridi; tarsis nigricantibus. Abdomen reliquo corpore magis obscurum; ano pallide rufescentii (Kirby, 1813).

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The genus is restricted to parasites of *Vespa* and is at present confined to Asia.

Male.—At present unsatisfactorily described.

Female.—Typically xenine, but larger than any other known genus. Most nearly approaching the shape of *Acroschismus*.

Triungulinid in general similar to that of *Acroschismus*.

1. VESPÆXENOS CRABRONIS, new species.

Host.—*Vespa crabro* Linnæus; Japan.

Female.—Length of cephalothorax 3.15 mm., greatest breadth 2.95 mm., breadth at spiracles 2.73 mm., breadth at base of head 2.35 mm., distance between mandibles 0.63 mm. Cephalothorax rounded, constricted at base, widest point just behind spiracles, spiracles dorso-lateral, not visible from ventral side, large convex; margin deeply constricted in front of spiracles, then abruptly enlarging, from thence broadly convex to apex; mandibles very large, quadrate, deeply emarginate at apex, apical angles large, obtuse.

Type.—Cat. No. 12667, U.S.N.M.

2. VESPÆXENOS MOUTONI Buysson (1903).

Xenos moutoni Buysson, 1903, 1904.

Host (typical).—*Vespa mandarina* Smith; also recorded on *Vespa magnifica* Smith, *Vespa nigrans* Buysson; China (Yun-nam, Tsé-kou, Ngan-hoei, Yng-chan).

Female.—Length 17 mm.; length of abdomen 6 mm. Cephalothorax yellowish, bordered with brown, extremity with a little subtriangular plaque, emarginate at apex; base of cephalothorax having on each side a little whitish spiracle surrounded with brown; abdomen 9 segmented, the first narrowed into the form of a collar, the last very large; a large yellowish band more chitinous, running the entire length of the dorsum, represents the ventral brood canal.

3. VESPÆXENOS BUYSSONI, new species.

Xenos moutoni R. du Buysson, 1906.

The following description is taken from the account furnished by Buysson in 1906.

Host.—*Vespa ducalis* Smith; Hué, Annam; collected by E. Fleutiaux, 1905, in Museum of Paris.

Male.—Similar to *Xenos vesparum* Rossi, from which it is distinguished by its larger size, its smooth, brilliant body, without velvety pubescence; by the much longer præscutum, which is about twice as long as the width of its base, and finally by the more elongate scutellum, with its less arcuate sides. Length 5 mm. ("Ecusson" has been translated as præscutum, and "segment mediaire" as scutellum, but this may be entirely wrong.)[a]

2. PSEUDOXENINI, new tribe.

Pseudoxenides SAUNDERS, 1872.

Type genus.—Pseudoxenos Saunders (1872).

Parasitic on Eumenidæ.

The tribe includes three genera:

13. *Pseudoxenos* Saunders (1872), parasitic on *Odynerus* (sens lat.); Europe.

14. *Leionotoxenos* Pierce, parasitic on *Leionotus;* America.

15. *Monobiaphila* Pierce, parasitic on *Monobia;* America.

The author has used a grouping into tribes of those genera parasitic on hosts of the same family, believing that as soon as sufficient material is at hand this grouping will be justified. For this reason the tribe is limited to the eumenid parasites.

13. Genus PSEUDOXENOS Saunders (1872).

Name derived from ψεῦδος (so called) + *Xenos*, meaning so-called *Xenos*.

Type of genus.—Pseudoxenos schaumii Saunders (1872).

The genus is, in the broad sense, parasitic on the old genus *Odynerus*, but in the typical sense on the genus *Ancistrocerus*, formerly a part of *Odynerus*. At present it is known only from Europe.

The genus can only be satisfactorily characterized at present by the presence of eight longitudinal veins in the wings, with two disconnected veins between the radius and medius. The further generic character, the general form of the genital apparatus, is as yet undescribed. Saunders's use of the antennæ is without doubt unavailable, due to alteration of shape on drying.

1. PSEUDOXENOS SCHAUMII Saunders (1872).

Host.—Ancistrocerus (*Odynerus*) *parietum* Linnæus; Corcyra, October (pl. 10, fig. 2).

This species was described by Saunders as follows:

Black, with antennæ, maxillæ, elytra, and legs brown; abdomen flavescent, with a transverse brown vitta on each dorsal tergite

[a] Obtenu d'une pupe portée sous le 4[e] tergite abdominal d'une ouvriere de *Vespa ducalis* Sm., provenant de Hué, dans l'Annam (E. Fleutiaux, 1905, Museum de Paris); le céphalothorax de la pupe faisant légèrement saillie sur le coté droit de la guêpe.

Male.—Semblable au *Xenos vesparum* Rossi mâle, dont il se distingue par sa grande taille, son corps lisse et brilliant, sans tomentum velouté; par l'écusson beaucoup plus long, sa longueur étant égale environ à deux fois la largeur de sa base; enfin par le disque du segment médiaire plus allongé les cotés moins arqués. Long. 5 mil. (Buysson, 1906).

except the first; anal process piceous; wings hyaline, veins piceous; costal area opaque. Length $1\frac{3}{5}$ line.[a]

Saunders drew his description of the genus from this species, and as the characters are mainly specific they must be incorporated in the specific description.

Maxillæ with basal joint short, robust; palpi elongate, subcylindrical, pubescent, deflexed. Mandibles elongate, ensiform. Antennæ with basal joint short, apically dilated, with internal angle porrect; second transverse, very small; third produced internally in a compressed, uniform flabellum with apex subobtuse; fourth lamelliform, very similar, almost equal in length, inserted at base of the preceding, and recumbent upon it. Wings with costal margin thickened to middle; radius abbreviated, the area between subcosta and radius clouded; medius strongly sinuate, almost attaining external margin of wing; cubitus fine; the three anal veins simple, thickened at base, beyond middle attenuate. Legs elongate, slender; four anterior trochanters about equaling femora, posterior pair shorter; tibiæ slender, elongate, with apex hardly dilated; tarsi dark, with apical angles of each joint prominent, base slender; joints diminishing in length, apical joint rounded.[b]

2. PSEUDOXENOS KLUGII Saunders (1852).

Xenos klugii SAUNDERS, 1852.
Pseudoxenos klugii SAUNDERS, 1872.

Host.—Hoplomerus (*Odynerus*) *lævipes* Shuckard; Epirus, May.

This species was very briefly described as follows:

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[a] Niger; antennis, palpis, elytris, pedibusque brunneis; abdomine flavescente, segmento singulo, basali excluso (septem), disco dorsali ventralique vittâ transversali abbreviatâ brunneâ; processu anali piceo; alis hyalinis, neuris piceis; areâ costali opacâ. Long. corp. $1\frac{3}{5}$ lin. (Saunders, 1872, 44).

[b] Palpi articulo basali brevi, robusto, secundo elongato, subcylindrico, hirto, deflexo. Mandibulæ elongatæ, ensiformes. Antennæ 4-articulatæ; articulo basali brevi, apice dilatato, angulo interno porrecto; secundo transversali, minimo; tertio in ramum internum subrectum, compressum, uniformem, apice subobtusum, producto; quarto lamelliformi, simillimo, longitudine fere coæquali, ad basin præcedentis inserto, in illum recumbente, spatio libero vix basi relicto. Alæ costæ dimidio basali inspissato; neura postcostali abreviata, areâ costali latâ nebulosâ, ultra neuras productâ, neurâ externo-mediâ valde sinuatâ, ultra medium alæ tenuissimâ, ad marginem exteriorem vix attingente; area intermedia superior neurâ primâ insulatâ duplicatâ abbreviatâ; secundâ insulatâ elongatâ, valde sinuatâ, simplice, de margine exteriori usque ad neuram externo-mediam basin versus fere attingente; area intermedia inferior neurâ primâ (subexterno-mediâ) gracillimâ, aliisque tribus simplicibus, basi inspissatis, ultra medium tenuissimis; quarum ultima analis. Pedes omnes elongati, graciles; trochanteres anteriores 4 femoribus fere coæquales; postici 2 breviores; tibiæ tenues, elongatæ apice vix dilatatæ; tarsi nitidi, articulis apice angulis prominulis, basi tenuissimis; articulo primo paulo longiore, reliquis longitudine diminuentibus, apicali rotundato integro. Puparium, operculo oculorum situ fenestralis paucis minutissimis instructo. (Saunders, 1872, p. 44.)

Male.—A little larger than *Pseudoxenos heydenii;* antennæ more slender; legs pale.[a]

3. PSEUDOXENOS CORCYRICUS Saunders (1872).

Paraxenos corcyricus SAUNDERS, 1872.

Host.—*Hoplomerus* (*Odynerus*) *spinipes* Linnæus; Corcyra, May.

The description of this species was also brief.

Male.—Differs from *Paraxenos erberi* by its shorter antennæ, broader antennal rami, legs very long, slender, luteous. Length $\frac{5}{6}$ line.[b]

4. PSEUDOXENOS HEYDENII Saunders (1852).

Xenos heydenii SAUNDERS, 1852.
Pseudoxenos heydenii SAUNDERS, 1872.

Host.—*Odynerus deflendus* Saunders; Epirus, Corcyra, July–October.

This species may be described as follows:

Male.—Very black; antennal rami densely clothed with minute white tubercles; wings hyaline, with veins piceous; legs luteous. Length 1 line.[c]

14. LEIONOTOXENOS, new genus.

Type of genus.—*Leionotoxenos jonesi* Pierce.

Name derived from *Leionotus* (the host genus) + *Xenos* (the typical parasite genus).

This genus is formed to include those forms which are parasitic upon the genus *Leionotus* and is at present confined to North America. The form of the female shows it to be typically xenid as does also the triungulinid.

The genus is composed of three species:

jonesi Pierce, parasitic on *Leionotus colon* Cresson; Louisiana.
louisianæ Pierce, parasitic on *Leionotus vagans* Saussure; Louisiana.
hookeri Pierce, parasitic on *Leionotus verus* Cresson; Texas.

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[a] Præcedente (*Ps. heydenii*) paulo major; antennis subtilioribus pedibus pallidis. Habitat Epirum, cum *Odynero lævipede*, Shuck. (*O. rubicola* Dufour et Perris), in rubis exsiccatis, cellulas limosas construente, ex quibus imagines, cum alumnorum pupariis expositis, Maio mense exeunte evadunt (Saunders, 1872, 45).

[b] A præcedente (*Paraxenos erberi*) differt antennis brevioribus, ramis latioribus, pedibus cunctis longissimis, tenuibus, luteis. Long. corp. $\frac{5}{6}$ lin. Habitat Insulam Corcyram cum *Odynero spinipede* L., cujus exemplar, marium puparia quatuor sub-abdominis segmentis 2°, 3°, 4°, et 5°, superne alternatim dextra sinistraque exhibens, in sabuletis die Maii lectum; e quibus die 22 ejusdem mensis imagines tres obtinui (Saunders, 1872, 46).

[c] Aterrimus; antennarum rami tuberculis minutis albis dense bullati; alis hyalinis neuris piceis, pedibus luteis. Long. corp. 1 lin. Habitat Epirum et Insulam Corcyram, *Odyneri deflendi* alumnus; a Julio ineunte usque ad Octobris idus, mares in pupariis cum altoribus lecti; fœminæ parturientes quoque diebus Julii decimo tertio, Augusti nono, et Octobris undecimo, cum eâdem Odyneri specie prehensæ (Saunders, 1872, 45).

The generic ratio has been obtained from measurements of the females of the three species, the ratios being between the following dimensions: (2) = distance from line between spiracles to apex, (3) = distance between mandibles, (4) = breadth at base of head, (5) = breadth at spiracles.

Species.	(5):(3)::—:1.	(4):(3)::—:1.	(5):(4)::—:1.	(5):(2)::—:1.
jonesi	5.11	4.44	1.15	1.64
louisianæ	4.66	4.00	1.16	1.61
hookeri	5.09	4.90	1.03	1.33
The generic ratios	4.66–5.11	4.00–4.90	1.03–1.16	1.33–1.64

1. LEIONOTOXENOS JONESI, new species.

Host.—*Leionotus colon* Cresson (det. W. H. Ashmead); Mound, Louisiana, May 12, 1905, C. R. Jones, collector; Kerrville, Texas, June 2, 1906, F. C. Pratt, collector (pl. 11, fig. 3).

Female.—Length of cephalothorax 1.04 mm., breadth 1.01 mm., breadth of head 0.91 mm., distance between mandibles 0.19 mm. Cephalothorax light brown, with lateral margins narrowly darker, spiracles light on dark background; broadly oval, constricted at base, widest just behind spiracles, obliquely convex to apex; spiracles dorsal; mandibles armed with long tooth at inner apical angle.

Type.—Cat. No. 10123, U.S.N.M.

Named in honor of the writer's former associate, Mr. C. R. Jones, who has materially assisted in this work.

2. LEIONOTOXENOS LOUISIANÆ, new species.

Host.—*Leionotus vagans* Saussure (det. W. H. Ashmead); Mound, Louisiana, May 12, 1905, C. R. Jones, collector; Lincoln, Nebraska, July (pl. 11, fig. 4).

Female.—Length of cephalothorax 0.87 mm., breadth 0.91 mm., breadth of head 0.76 mm., distance between mandibles 0.19 mm. Cephalothorax brown, lighter on disk basally, and in front of mouth, darker on lateral margin, spiracles light on dark background; very broadly oval, narrowed from spiracles to base, convex from spiracles to apex; spiracles laterally prominent; mandibles very short and broad, armed with short tooth at inner angle.

Triungulinid: Length 0.16 mm., length including stylets 0.22 mm., breadth of head 0.04 mm., greatest breadth 0.08 mm., breadth ninth abdominal segment 0.04 mm. Head elongate, abdominal segments 1–8 short, but normal; ninth segment elongate, as long as three preceding, deeply emarginate for tenth; tenth segment hardly surpassing the lateral prolongations of the ninth, apically provided with two contiguous stylet bearing lobes.

Type.—Cat. No. 10124, U.S.N.M.

3. LEIONOTOXENOS HOOKERI, new species.

Host.—*Leionotus verus* Cresson (det. W. H. Ashmead); Dallas, Texas, July 21, 1906, on *Helenium tenuifolium;* W. A. Hooker, collector (pl. 11, fig. 2; fig. 1, p. 31).

Female.—Length of cephalothorax 1.21 mm., breadth 1.37 mm., breadth of head 1.17 mm., distance between mandibles 0.19 mm. Cephalothorax brown, lighter basally on disk, much darker on lateral margins; broader than long, constricted at base, angularly convex from spiracles to apex, the angles being at base of head, at sides of mandibles, and in front of mandibles; spiracles dorsal; mandibles broad, apically emarginate with tooth on inner angle.

Triungulinid: Length 0.21 mm., length including stylets 0.28 mm., breadth of head 0.07 mm., greatest breadth 0.09 mm., breadth with abdominal segment 0.05 mm.

Type.—Cat. No. 10125, U.S.N.M.

Named in honor of the writer's associate, W. A. Hooker, who collected the types.

15. MONOBIAPHILA, new genus.

Name derived from *Monobia* + φίλα (loving), meaning fond of *Monobia.*

Type of genus.—*Monobiaphila bishoppi*, new species.

The genus is parasitic on the odynerid genus *Monobia*, which is broadly scattered over the United States. The form of the female shows it to be xenid and closely related to *Leionotoxenos.*

Only one species is known, *bishoppi* Pierce, parasitic on *Monobia quadridens* Linnæus; Texas.

The generic ratio is obtained, therefore, from this one species: (2) = distance from line between spiracles to apex, (3) = distance between mandibles, (4) = breadth at base of head, (5) = breadth at spiracles.

Species.	(5):(3)::—:1.	(4):(3)::—:1.	(5):(4)::—:1.	(5):(2)::—:1.
bishoppi	6.93	4.40	1.60	1.76

1. MONOBIAPHILA BISHOPPI, new species.

Host.—*Monobia quadridens* Linnæus; collected at Wolfe City, Texas, May 31, 1906, and at Orange, Texas, August 23, 1906, by F. C. Bishopp (pl. 11, fig. 1).

Female.—Length of cephalothorax 1.78 mm., breadth at spiracles 1.86 mm., breadth of head 1.48 mm., distance between mandibles 0.34 mm. Cephalothorax brownish, light on disk to line between posterior angles of head, dark on margins and front of prothorax, light in front of mouth and mandibles; broader than long, constricted at base, broadest at spiracles, convex from base to spiracles, slightly oblique but very nearly straight from spiracles to base of head, a small abrupt emargination at base of head, thence very oblique, straight to mandibles, apex convex; spiracles dorsal, showing light on dark background; mandibles broad, apically emarginate between the long curved tooth on the inner angle and the obtuse outer angle.

Triungulinid: Length 0.25 mm., length including stylets 0.34 mm., breadth of head 0.07 mm., greatest breadth 0.10 mm., breadth ninth segment 0.06 mm. Similar to that of *Leionotoxenos*.

Type.—Cat. No. 10122, U.S.N.M.

Named in honor of Mr. Fred C. Bishopp, one of the writer's associates, who has been of great assistance in obtaining material for study.

3. PARAXENINI, new tribe.

Pseudoxenides (part) SAUNDERS, 1872.

Parasitic on Bembecidæ.

The tribe includes one genus: *Paraxenos* Saunders (1872), parasitic on *Bembecinus;* Europe.

16. Genus PARAXENOS Saunders (1872).

Name derived from παρά (near) + *Xenos*, meaning related to *Xenos*.

Type of genus.—*Paraxenos erberi* Saunders (1872).

This genus is typically parasitic on the genus *Bembecinus*, and at present is known only from Europe.

The following description is taken from Saunders:

Maxillæ with basal joint stout, arcuate; palpus cylindrical, pubescent, deflexed. Mandibles broader at base, internally strongly emarginate. Antennæ with first joint short apically dilated, with internal angle prominent; second small, subcuneiform; third internally produced into a flabellum, dilated to basal quarter, thence compressed, apically more slender, obtuse; fourth elongate, basally dilated, apically subobtuse, more or less exceeding the branch of the preceding in length. Wings with radius remote from subcosta, subabbreviated; costal area clouded; medius sinuate; a detached branch of radius and one of medius between these veins; cubitus delicate; the three anal veins subapproximate, thickened slightly at base. Legs with anterior trochanters, femora, and tibiæ subequal; tarsal joints almost alike, the basal more robust, the apical more slender; middle pair almost the same; posterior coxæ reniform, with trochanters subovate, robust; tibiæ more slender.[a]

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[a] Palpi articulo basali crasso, arcuato; secundo cylindrico, hirto, deflexo. Mandibulæ basi latiores, interne fortiter emarginatæ. Antennæ 4-articulatæ: articulo primo brevi, apice dilatato, angulo interno prominulo, tertii cubitum versus porrecto: secundo minimo, subcuneiformi, lateribus angulatis: tertis in ramum internum producto, basi externè dilatatum ad quartum recipiendum, deinde subito rectangu-

1. PARAXENOS ERBERI Saunders (1872).

Host.—Bembecinus peregrinus Smith; Corcyra, May (pl. 10, fig. 1).

According to Saunders this species may be described as follows:

Male.—Elongate, black, legs fuscous, antennal rami subequal in length. Length $\frac{5}{6}$ line.[a]

4. OPHTHALMOCHLINI, new tribe.

Type genus.—Ophthalmochlus Pierce (1908).

Parasitic on Sphecidæ.

The tribe includes three genera:

17. *Sceliphronechthrus* Pierce, parasitic on *Sceliphron;* America.

18. *Ophthalmochlus* Pierce (1908), parasitic on *Priononyx;* America.

19. *Eupathocera* Pierce (1908), parasitic on *Sphex;* America, Europe.

When better studied this tribe may be found to belong to the Homilopinæ, it being only for that reason that it is separated at all.

17. SCELIPHRONECHTHRUS, new genus.

Name derived from *Sceliphron* (the host genus) + ἐχθρός (enemy) = parasite of *Sceliphron.*

Type of genus.—Sceliphronechthrus fasciati Pierce.

The genus is parasitic on the genus *Sceliphron* (*Pelopæus*) and at present is only from the West Indies.

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lariter reflexo, reliquo compresso, distorto, basi tumido, apice subtiliore, obtuso: quarto e basi præcedentis retrorsum emergente, in illum inflexo spatio libero intermedio basi relicto, similiter compresso, basi dilatato, apice subobtuso, longitudine præcedentem plus minusve excedente. Alæ costæ dimidio basali cum neurâ mediastinâ (=subcosta) proximo sed distincto; postcostali (=radius) remotâ subabbreviatâ; areâ costali latâ nebulosâ, ultra neuras productâ; neurâ externo-mediâ (=medius 2) sinuatâ, dimidio apicali duplicatâ, tenuissimâ: area intermedia superior (above medius 2) neuris insulatis binis duplicatis (=radius 2 and medius 1), de margine externo retro productis; quarum discoidales paulum longiores, a neurâ externo-mediâ (=medius 2) longe abstantes: area intermedia inferior neuris rectis tenuibus; primâ (subexternomediâ) (=cubitus) gracili; aliis e basi radiantibus, subapproximatis, tribus (=anal veins), basi paulum inspissatis, deinde quasi duplicatis, quarum ultima analis. Pedes antice trochanteribus femoris tibiisque longitudine fere æqualibus; tarsorum articulis 4, fere similibus, basali robustiore, apicali tenuiore; intermedii fere consimiles; postici coxis reniformibus, trochanteribus subovatis, robustis; tibiis tenuioribus.

Puparium, operculo oculorum situ fenestrulis paucis minutissimis instructo (Saunders, 1872, pp. 45, 46).

[a] Elongatus, ater, pedibus fuscis, antennarum ramis longitudine fere coæqualibus. Long. corp. $\frac{5}{6}$ lin. In Mus. nostro (British Museum). (Saunders, 1872.)

1. SCELIPHRONECHTHRUS FASCIATI, new species.

Host.—*Sceliphron* (*Pelopæus*) *fasciatus* Lepeletier (det. W. H. Ashmead); Santo Domingo; from collection of the U. S. National Museum (pl. 11, fig. 5).

Female.—Length of cephalothorax 1.38 mm., breadth at widest point 1.36 mm., breadth of head 1.02 mm., distance between mandibles 0.25 mm. Cephalothorax brownish, lighter on disk except in front of spiracles, also lighter in front of mouth and mandibles, margins dark; enlarging obliquely from base to spiracles, widest just behind spiracles, thence narrowing obliquely in wavy lines to mandibles, apically rounded; spiracles laterally prominent; mandibles broad, armed with outward curving tooth on inner apical angle.

Type.—Cat. No. 10128, U.S.N.M.

18. Genus OPHTHALMOCHLUS Pierce (1908).

Name derived from ὀφθαλμός (eye) + ὄχλος (group), signifying the typical strepsipteran cluster eye.

Wings having seven primary veins, the third anal missing, with two distal detached veins between the radius and medius, and one between the medius and cubitus; maxillæ two-jointed; palpi four-jointed; antennæ four-jointed.

Type of genus.—*Ophthalmochlus duryi* Pierce. The genus is parasitic on the genus *Priononyx* and at present is confined to North America.

1. OPHTHALMOCHLUS DURYI Pierce (1908).

Acroschismus duryi Pierce, MS. (Dury, 1906.)

Host.—*Priononyx atrata* Lepeletier; Cincinnati, Ohio, June 17 (female), August 16–September 21 (males, female). (Pl. 10, figs. 7, 8, 13).

Male.—Length 2.5 mm.; head, prothorax, and mesothorax black; antennæ, legs, and metathorax velvety reddish brown; postlumbium lighter, membranous; wings snowy white, venation very light. Head transverse; vertex medianly produced in a high ridge, on each side of which arise the antennæ; mandibles chitinous, dark in basal half, yellowish in apical half, very acute and curved near tip; palpi two-jointed, black. Scutellum just reaching præscutum in a narrow angle, which separates the scuti; postlumbium as in *Acroschismus*. Œdeagus inflated at base of the general profile found in *Acroschismus*, but very much narrowed at first angle, thence very straight, and near apex abruptly and acutely bent upward, apex very acute.

Triungulinid: Length 0.19 mm., length, including stylets, 0.27 mm., breadth of head 0.06 mm., greatest breadth 0.09 mm., breadth of ninth abdominal segment 0.05 mm. Characters very similar to those of *Leionotoxenos*.

Type.—In Mr. Dury's collection.

Dedicated to Charles Dury, of Cincinnati, Ohio, in return for the many favors he has rendered the writer and in acknowledgment of the new species in the group which he has discovered.

19. Genus EUPATHOCERA Pierce (1908).

Name derived from εὐπαθής (sensitive) + κέρας (horn), meaning sensitive antenna, referring to the characteristic sensitive surface of the strepsipteran antennæ.

Wings with eight primary veins; with two distal detached veins between the radius and medius, and one detached vein between the medius and cubitus; postlumbium very short, transverse, and not differing in consistency from the scutellum or post-scutellum.

Type of genus.—*Eupathocera lugubris* Pierce. The genus is typically parasitic on *Sphex* (the old genus *Ammophila*), and is typically North American, although European species have been added because of congeneric hosts.

1. EUPATHOCERA LUGUBRIS Pierce (1908).

Acroschismus lugubris PIERCE, MS. (DURY, 1906.)

Host.—*Sphex* (*Ammophila*) *fragilis* Smith; Cincinnati, Ohio, September 3, October 2; Charles Dury, collector (pl. 10, figs. 11, 12, 14).

Male.—Length 2.25 mm. Head and thorax jet black; antennæ, legs, and abdomen brown; wings snowy white, venation almost invisible. Head transverse, vertex medianly produced in a high ridge, on each side of which arise the antennæ; antennæ typically xenid; mandibles chitinous, flattened, scimitar-like; palpi two-jointed, black. Scutellum anteriorly acute angled, reaching præscutum; postlumbium very short, transverse, and not differently colored or of different consistency from the surrounding parts. Œdeagus almost as in *Ophthalmochlus*.

In *Acroschismus* the scutellum sends forward a narrow stem to meet the præscutum and has the postlumbium more than one-fourth as long as wide and of a different color and consistency from the surrounding parts.

Type.—In Mr. Dury's collection.

2. EUPATHOCERA PRUINOSÆ, new species.

Host.—*Sphex* (*Ammophila*) *pruinosa* Cresson; Canyon City, Colorado, August; Denver, Colorado; J. S. Hunter, collector; from collection of the University of Nebraska (pl. 11, fig. 7).

Female.—Length of cephalothorax over 1.05 mm., breadth at spiracles 1.17 mm., breadth of head 0.95 mm., distance between mandibles 0.16 mm. Cephalothorax dark brown except toward base on disk;

widest behind spiracles, more or less evenly convex throughout; spiracles dorsal; mandibles subquadrate, with a large tooth on inner apical angle.

Triungulinid: Length 0.16 mm., length, including stylets, 0.24 mm., breadth of head 0.05 mm., greatest breadth 0.09 mm., breadth of ninth abdominal segment 0.05 mm. This triungulinid belongs to the same type as that of *Leionotoxenos.*

Type.—Cat. No. 10129, U.S.N.M.

3. EUPATHOCERA SPHECIDARUM Dufour (1837).

Xenos sphecidarum DUFOUR, 1837.—SIEBOLD, 1839.
Paraxenos sieboldii SAUNDERS, 1872 (part).
Eupathocera sphecidarum PIERCE, 1908.

Host.—*Sphex* (*Ammophila*) *sabulosa* Linnæus; Southern France, August; Germany, June.

4. EUPATHOCERA (?) SIEBOLDII Saunders (1872).

Xenos sphecidarum SIEBOLD, 1839 (part).
Paraxenos sieboldii SAUNDERS, 1872.
Eupathocera (?) *sieboldii* PIERCE, 1908.

Host.—*Miscus campestris* Latreille, Germany, June.

Male.—Fuliginous; legs piceous; wings milky, with the anterior margin brown; antennal rami laterally compressed, the inner branch always a little longer. Length 1½ lines; wing expanse 2 lines.

Siebold's original description, given here as a footnote, does not make it clear whether he described the species from the parasites of *Miscus campestris* or *Sphex* (*Ammophila*) *sabulosa.*[a]

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[a] Fuliginosus; pedibus piceis; alis lacteis, margine antico brunneo; antennarum ramis lateraliter compressis, interno semper paulo longiore. Long. corp. 1½ lin. Expans, alar. 2 lin. (Saunders 1872. p. 47).

[The original description by Siebold follows.]

Die Farbe des 1¼ Lin. langen Körpers von *Xenos sphecidarum* ist sammet-schwarz, die Beine schimmern etwas ins Pechbraune, die beiden Flügel sind milch-weiss, der Vorderrand derselben ist braunlich angelaufen; es scheint als wenn auf jedem Flügel drei zarte Nerven von der Wurzel bis zu dem Aussenrande desselben hinlaufen, doch sind es vielleicht nur drei Falten. Bei ausgebreiteten Flügeln hat das Insekt, quergemessen, eine Breite von ohngefähr zwei Linien. Die ganze Gestalt desselben stimmt im allgemeinen mit der des *Xenos rossii* überein.

Der Kopf des Thierchens ist um vieles breiter als lang, sein Vorderrand ist zweimal sanft ausgeschnitten, wodurch in der Mitte eine kleine Spitze hervorragt. Auf dem Rücken des Kopfes zeigen sich eine vordere und hintere Querfurche. Die beiden kugelförmigen Augen ragen zu beiden Seiten des Kopfes auffallend hervor, sie besitzen sehr grosse Facetten, welche in der Mitte weiss gefärbt sind. An der Stirn stehen, etwas entfernt von einander, die eigenthümlichen schwarzen Fühlhörner, deren Basis aus drei kleinen Gliedern besteht, von denen das dritte das kürzeste ist. Von diesem entspringt ein sehr langes und seitlich zusammengedrücktes Glied, aus dessen etwas verdickter Wurzel nach aussen ein zweites langes und ebenfalls seitlich zusammen-

2. Subfamily HOMILOPINÆ Pierce, 1908.

Type genus.—Homilops Pierce, 1906.

Parasitic on Sphecidæ. Maxillæ three-jointed.

The subfamily includes—

20. *Homilops* Pierce, parasitic on *Proterosphex;* America, Asia.

The tribe Ophthalmochlini may probably belong with this genus.

20. Genus HOMILOPS Pierce (1908).

Type of genus.—Homilops westwoodii Templeton (1838).

Name derived from ὅμιλος (group) + ὤψ (eye), meaning cluster eye, referring to the grouping of the separated ommatidia into a compound eye.

The genus is parasitic on the sphecid genus *Proterosphex,* formerly known as *Sphex,* and at present contains species from America and Asia. It contains—

1. *westwoodii* Templeton, parasitic on *Proterosphex ichneumoneus;* South America.
2. *bishoppi* Pierce, parasitic on *Proterosphex ichneumoneus;* North America.
3. *ashmeadi* Pierce, parasitic on *Proterosphex pernanus;* Insular America.
4. *abbotti* Pierce, parasitic on *Proterosphex,* species; Siam.

This genus is characterized by the possession of one pair of palpi, which are three-jointed. The genitalia consist merely of a two-jointed plate-like exserted appendage, with the œdeagus not exserted, according to Templeton. The first joint of each tarsus is the longest, while the joints themselves are described by Templeton as appendic-

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gedrücktes Glied hervorgeht. Jenes innere Glied ist immer etwas länger als dieses äussere; im Ruhezustande hängen diese beiden langen Glieder nebeneinander auf jeder Seite über das Gesicht des Insektes fast senkrecht gerad, stehen aber an ihrem freien Ende etwas voneinander ab. In der gegend des Mauls stehen ein Paar zweigliedrige Palpen in ziemlich weiter Entfernung voneinander, sie sind nach unten und innen gebogen, und haben eine schwarze Farbe; das zweite Glied ist kürzer als das erste und länglich oval. Dicht neben diessen Fühlern erkennt man mit Mühe nach innen zwei in die Höhe gebogene und einander zugekehrte braunfarbige Kiefern, sie sind schmal und platt, werden vor ihrem freien Ende etwas breiter und laufen dann in eine kurze Spitze aus (Siebold, 1839).

[The following is a portion of the description of the triungulinid:]

Triungulinid: Die acht folgenden (1st 8 abdominal) Körpersegmente sind sehr kurz und sowohl an den Seiten als auch an dem Hinterrande (jedoch nur auf der Bauchfläche) mit kurzen Borsten eingefasst. Das vorletzte Körpersegment hat eine oblonge Gestalt und sein Hinterrand ist auf der Bauchfläche tief ausgeschnitten; zu beiden Seiten des Ausschnitts steht eine längere Borste und in dem Ausschnitte selbst steckt das letzte sehr dunkel gefärbte Körpersegment fast verborgen. Aus dem hinteren Rande dieses kleinen Segmentes entspringen zwei längere Borsten, zwischen welchen noch zwei sehr lange (Siebold, 1839).

ulate and arising before the apex of the preceding. Antennæ with last two joints dilated in the middle and tapering somewhat to the tip.

1. HOMILOPS WESTWOODII Templeton (1838).

Xenos westwoodii TEMPLETON, 1838.
Paraxenos westwoodii SAUNDERS, 1872.
Homilops westwoodi PIERCE, 1908.

Host.—Proterosphex (*Sphex*) *ichneumoneus aurifluus* Perty, Rio Janeiro, Brazil (pl. 10, figs. 9, 10).

Male.—Head small, carrying anteriorly two cupped tubercles, which bear the stout antennæ. The first antennal joint is short, subcylindric, slightly contracted near the base, dilating toward the apex, and internally extended; second joint minute, a little longer than broad, constricted in middle, cupped beneath for third joint; first two joints covered with short rigid hairs and not sensitive; third joint short, cupped for fourth, internally produced, in an elongate, flat process, rounded at tip, and dilated at the middle; fourth joint also produced, exceeding production of third by one-fourth, and dilated at the middle. Margin of pharyngeal opening slightly corrugated; mandibles elongate, narrow, slightly arched; palpi triarticulate; first joint minute; second large, tumid, and a little curved backwards; apical small, cylindric, and densely covered with minute hairs.

2. HOMILOPS BISHOPPI, new species.

Host.—Proterosphex (*Sphex*) *ichneumoneus* Linnæus; Waco, Texas, August 29, 1906; F. C. Bishopp, collector (pl. 11, fig. 6).

Female.—Length of cephalothorax 1.71–2.09 mm., breadth at spiracles 1.86–2.39 mm., breadth of head 1.52–1.82 mm., distance between mandibles 0.27 mm. Cephalothorax brown, lighter on posterior half of disk; broader than long, margins convex oblique, wavy at sides of head; spiracles dorsal; mandibles broad subquadrate with large tooth on inner apical angle.

Type.—Cat. No. 10127, U.S.N.M.

Named in honor of F. C. Bishopp, its collector.

3. HOMILOPS ASHMEADI, new species.

Host.—Proterosphex (*Sphex*) *pernanus* (?) Kohl; Santo Domingo; from the collection of the U. S. National Museum (pl. 11, fig. 8).

Female.—Length of cephalothorax 1.85 mm., breadth at spiracles 2.01 mm., breadth of head 1.63 mm., distance between mandibles 0.32 mm. Cephalothorax brown, lighter on posterior half; regularly convex from base to apex, apex squarely but narrowly truncate; spiracles dorsal; mandibles oblique, apically emarginate, angles acute.

Triungulinid: Length 0.19 mm., length, including stylets, 0.30 mm., breadth of head 0.07 mm., greatest breadth 0.08 mm., breadth of ninth segment 0.05 mm. This triungulinid also belongs to the type represented by *Leionotoxenos*.

Type.—Cat. No. 10126, U.S.N.M.

Named in honor of the late Dr. William H. Ashmead.

4. HOMILOPS ABBOTTI, new species.

Host.—Proterosphex, species, Trong, Lower Siam; from collection of U. S. National Museum.

Female.—Length cephalothorax 2.46 mm., breadth at spiracles 2.62 mm., breadth of head 1.78 mm., distance between mandibles 0.38 mm. Cephalothorax brownish, head lighter; broader than long, constricted at base, broadest just behind spiracles, convex oblique from spiracles to apex, broadly rounding emarginate in front of mandibles; spiracles laterally prominent or at least reaching lateral margin; mandibles oblique, apically emarginate with rounded outer angle surpassing the acute curved tooth of the inner angle.

Named in honor of Dr. W. L. Abbott, its collector.

Type.—Cat. No. 12668, U.S.N.M.

3. Subfamily HALICTOXENINÆ Pierce, 1908.

Type genus.—Halictoxenos Pierce.

Parasitic on Halictinæ.

The subfamily includes two genera, as follows:

21. *Halictoxenos* Pierce, 1908, parasitic on *Halictus*; America, Asia.
22. *Apractelytra* Pierce, 1908, host unknown; America.

21. Genus HALICTOXENOS, Pierce (1908).

Name based on *Halictus* + *Xenos*, meaning a xenid parasitic on *Halictus*.

Type of genus.—Halictoxenos jonesi, new species.

The genus is parasitic on *Halictus* and contains the following species:

1. *jonesi* Pierce, parasitic on *Halictus*, species; Louisiana.
2. *crawfordi* Pierce, parasitic on *H. bruneri* Crawford; Nebraska.
3. *grænicheri* Pierce, parasitic on *H. albipennis* Robertson; Wisconsin.
4. *versati* Pierce, parasitic on *H. versatus* Robertson; Wisconsin.
5. *zephyri* Pierce, parasitic on *H. zephyrus* Smith; Wisconsin.
6. *sparsi* Pierce, parasitic on *H. sparsus* Robertson; Oklahoma.
7. *manilæ* Pierce, parasitic on *H. manilæ* Ashmead; Philippines.
8. *robbii* Pierce, parasitic on *H. robbii* Ashmead; Philippines.

Numerical key to the females.

In the genus *Halictoxenos* the female cephalothorax is very greatly narrowed in front, so that a new series of comparative ratios is obtained which is very different from that of any other genus. The measurements are with a Zeiss stand, 160 tube, 2 eyepiece, and A objective; 1 space = 0.0076 mm.

Species.	1. Length.	2. Spiracles to apex.	3. Breadth between mandibles.	4. Breadth of head.	5. Breadth at spiracles.	6. Greatest breadth.
manilæ	80	65	11	60	86	86
robbii	80	60	10	57	80	80
crawfordi	76	62	12	38	80	80
grænicheri	76	57	10	40	76	76
zephyri	72	55	9	32	74	74
versati	70	50	7	35	68	68
sparsi	60	40	7	30	62	62

From these figures the following ratios, which are derived as in the discussion of *Stylops*, are obtained:

Species.	Cephalothorax to mandibles. (5):(3)::—:1.	Head to mandibles. (4):(3)::—:1.	Cephalothorax to head. (5):(4)::—:1.	Breadth to length. (5):(2)::—:1.
manilæ	7.81	5.45	1.43	1.32
robbii	8.00	5.70	1.40	1.33
crawfordi	6.66	3.16	2.10	1.29
grænicheri	7.60	4.00	1.90	1.33
zephyri	8.22	3.55	2.31	1.34
versati	9.71	5.00	1.94	1.36
sparsi	8.75	4.28	2.06	1.55

The great difference in shape between the two Philippine species and the American specimens led to the division of this genus into two subgenera.

Subgenus *Halictoxenos* is parasitic on *Chloralictus*, a subgenus of green *Halictus*, and is typically American. The breadth of the cephalothorax is 1.9 to 2.3 times the breadth of the base of the head, and the breadth of the head is 3.1 to 5 times the distance between the mandibles.

Subgenus *Halictophilus* is parasitic on *Evylæus*, a subgenus of black *Halictus*, and is typically Philippine. The breadth of the cephalothorax is 1.4 times the breadth of the base of the head, and the breadth of the head is 5.4 to 5.7 times the distance between the mandibles.

There is very little doubt that when males are found these subgenera will become genera, and that *Halictostylops* of Europe, which is founded on a parasite of a black *Halictus*, will fall near *Halictophilus* of the Philippines and out of the Stylopidæ, where it is now provisionally placed.

HALICTOXENOS, new subgenus.

1. HALICTOXENOS JONESI Pierce (1908).

Host.—*Halictus* (*Chloralictus*), species; Texas; near Logansport, Louisiana, June 7, 1905, W. D. Pierce, collector; Mound, Louisiana, May 12, 1905, C. R. Jones, collector (pl. 13, figs. 1, 2, 3).

Male.—These specimens were given a name, although in both cases they were males extracted from the puparium. The xenid antennæ were sufficient to place the genus properly. The maxillary palpus is large and flattened and at least as long as the maxilla. The balancers are as long or longer than the rami of the antennæ. The œdeagus is evenly curved near base but not enlarged, resembling that of *Apractelytra;* the tip could not be made out. The wings are dark and the venation is strong.

Cephalotheca: The antennal analogues are nearly circular and lie next to the eye and less than one-half their breadth from the arched vertex which lies between them. The mandibular analogues are prominent, acute and considerably nearer the pharynx than the eyes. The maxillary analogues are represented by an ovate ring with a very slight median lobe. They are very near the eyes, nearer by their width than the mandibles.

Named in honor of C. R. Jones, the writer's former associate.

Type.—Cat. No. 12669, U.S.N.M.

2. HALICTOXENOS CRAWFORDI, new species.

Host—*Halictus bruneri* Crawford, cotype, June 10, 1901, West Point, Nebraska, on honeysuckle; J. C. Crawford, collector (No. 202) (pl. 12, fig. 1).

Female.—Length of cephalothorax 0.57 mm., breadth at spiracles 0.61 mm., breadth at base of head 0.28 mm., distance between mandibles 0.09 mm. Cephalothorax very light yellowish brown, darker on basal margin, the dark band extending back over the brood canal; pyriform about as long as broad, suddenly constricted at base, widest behind spiracles, thence rapidly convexly narrowing to base of head, thence oblique, almost straight to mandibles, apically convex truncate; spiracles not laterally prominent; mandibles reaching lateral margin, broader at base than apex, emarginate truncate at apex, outwardly widening toward base.

Triungulinid: Length 0.12 mm. Resembles in general the triungulinid of *Stylops.*

Type.—Cat. No. 10106, U.S.N.M.

This species is named in honor of J. C. Crawford, of the U. S. National Museum, who is an authority on the genus *Halictus* in America, and who collected the type of the species.

3. HALICTOXENOS GRÆINCHERI, new species.

This species is named in honor of Dr. Sigmund Grænicher, of Milwaukee, Wisconsin, who collected two male *Halictus* (*Chloralictus*) *albipennis* Robertson on August 4, 1906, each bearing a female of this species (pl. 12, fig. 2).

Female.—Length of cephalothorax 0.57 mm., breadth at spiracles 0.57 mm., breadth of head 0.30 mm., distance between mandibles 0.07 mm. Cephalothorax light yellowish brown, the dark-brown area of the brood canal extending over the base of the thorax; truncate pyramidal, constricted at base, widest behind spiracles, thence narrowing obliquely to mandibles with a slight emargination at the base of the head; spiracles lateral but not prominent; mandibles near lateral margin, transverse, emarginate at apex.

Type.—Cat. No. 10107, U.S.N.M.

4. HALICTOXENOS VERSATI, new species.

Host.—*Halictus* (*Chloralictus*) *versatus* Robertson; one female bee, Milwaukee, Wisconsin, September 1, 1906 (containing one female); one female, September 10, 1906 (containing one female); and one female, September 22, 1906 (containing three females); S. Grænicher, collector (pl. 12, fig. 4).

Female.—Length of cephalothorax 0.53 mm., breadth at spiracles 0.51 mm., breadth of head 0.26 mm., distance between mandibles 0.05 mm. Cephalothorax yellowish brown, with brown band at base; triangular with rounded truncate apex, strongly constricted at base, widest behind spiracles, thence oblique, slightly convex to mandibles with shallow concave emargination at base of head, apex convex; spiracles lateral, but not prominent; mandibles bluntly triangular, with broad base.

Type.—Temporarily in possession of author.

5. HALICTOXENOS ZEPHYRI, new species.

Host.—*Halictus* (*Chloralictus*) *zephyrus* Smith; Milwaukee, Wisconsin, September 12, 1903; S. Graenicher, collector.

Female.—Length of cephalothorax 0.54 mm., breadth at spiracles 0.56 mm., breadth of head 0.24 mm., distance between mandibles 0.068 mm. Cephalothorax yellowish brown, with a dark band at base; truncate pyramidal, constricted at base, widest at spiracles, thence oblique and almost straight to mandibles, apex rounded at sides, squarely truncate in front; spiracles not laterally prominent; mandibles broad at base, armed with blunt tooth at inner angle.

Type.—Cat. No. 10110, U.S.N.M.

6. HALICTOXENOS SPARSI, new species.

Host.—*Halictus* (*Chloralictus*) *sparsus* Robertson; Ardmore, Oklahoma, April 12, 1907; F. C. Bishopp, collector (pl. 12, fig. 3).

Female.—Length of cephalothorax 0.45 mm., breadth at spiracles 0.47 mm., breadth of head 0.228 mm., distance between mandibles 0.05 mm. Cephalothorax light yellowish brown, with longitudinal dark-brown band as wide as brood canal and extending from spiracles posteriad, being equally on thorax and abdomen; truncate pyramidal, constricted at base, widest behind spiracles, rapidly narrowing to mandibles, shallowly concave at base of head, squarely truncate at apex; spiracles lateral but not prominent; mandibles small with apical tooth.

Type.—Cat. No. 10108, U.S.N.M.

HALICTOPHILUS, new subgenus.

7. HALICTOXENOS MANILÆ, new species.

Host.—*Halictus* (*Evylæus*) *manilæ* Ashmead; Manila, Philippine Islands; Robert Brown, collector; from U. S. National Museum collection (pl. 12, fig. 5).

Female.—Length of cephalothorax 0.608 mm., breadth at spiracles 0.65 mm., breadth of head 0.45 mm., distance between mandibles 0.08 mm. Cephalothorax yellowish brown, with narrow dark-brown strip at base which extends back over abdomen to form a semicircle; stylopiform, abruptly constricted behind spiracles, convex throughout, very shallowly emarginate at base of head; head rounded evenly throughout from base to base, not narrowed and truncate as in the preceding species; spiracles not laterally prominent; mandibles broad, apically armed with two blunt teeth.

Type.—Cat. No. 10112, U.S.N.M.

8. HALICTOXENOS ROBBII, new species.

Host.—*Halictus* (*Evylæus*) *robbii* Ashmead; Manila, Philippine Islands; Robb, collector; from U. S. National Museum (pl. 12, fig. 6).

Female.—Length of cephalothorax 0.608 mm., breadth at spiracles 0.608 mm., breadth of head 0.43 mm., distance between mandibles 0.07 mm. Cephalothorax yellowish brown, darker on middle of disk; stylopiform, abruptly constricted behind spiracles, widest at spiracles, convex throughout, shallowly emarginate at base of head, evenly rounded in front; spiracles not laterally prominent; mandibles subquadrate, with small tooth on inner apical angle.

Type.—Cat. No. 10111, U.S.N.M.

22. Genus APRACTELYTRA Pierce (1908).

Type of genus.—*Apractelytra schwarzi* Pierce.

Name derived from ἄπρακτος (abortive) + ἔλυτρον (elytron) = aborted elytra.

This genus is characterized by the absence of the cleavage at each side of the base of the œdeagus. The subequal length of the palpal joints is also characteristic. It belongs to the typical Xenidæ, in that it has four-jointed antennæ, four-jointed tarsi, and two-jointed palpi.

1. APRACTELYTRA SCHWARZI Pierce (1908).

Xenos schwarzi Pierce in determinations.

Host.—Unknown.

Locality.—Washington, D. C. (pl. 10, figs. 3, 4, 5, 6).

Male.—Length 1.66 mm. Wing expanse 4 mm. Black, with whitish pubescence. Wings milky, very pubescent. Last ventral segment brownish; œdeagus yellow. Under parts lighter. Head transverse, eyes stalked, but not prominently, vertex roundingly produced above each antenna. Antennæ compact, with branches closely flattened, equaling the distance from the inside of one eye to the outside of the other, or subequaling the length of the elytra. Maxillæ and palpi subequal; the maxilla from a side view, obliquely truncate beneath, and thicker than the palpus; palpus slightly tapering, rounded at apex. Mandibles short, acute, slightly curved, not much longer than first joint of palpi. Pronotum narrow, bandlike; mesonotum subequal and similar. Metanotum very long; præscutum keystone shape; scuti elongate subtriangular with apices at posterior angles of præscutum distant; scutellum subequal to præscutum in size and shape but inverted, with broadest side apical; postlumbium transverse semielliptical; femoralia short; postscutellum linear elongate, over twice as long as broad, with apices squarely rounded. Genitalia consisting of tenth segment overlapping the troughlike cavity of the ninth segment, which is bounded by the flaplike edges of the last ventral segment and apically terminated by a short œdeagus. In the type specimen the œdeagus is not reflexed and shielded by the tenth segment, but is directed backward. The sinuation is slight until about the posterior one-fifth, where the tube is abruptly turned downward. The apex is abruptly acute.

Type.—Two males, Cat. No. 9827, U.S.N.M.

Named in honor of Mr. E. A. Schwarz, from whose collection it is described.

4. Subfamily CRAWFORDINÆ Pierce, 1908.

Type genus.—*Crawfordia* Pierce (1908).

Maxillæ three-jointed, apparently; postlumbium as large as in *Stylops*, *Halictoxenos*, and *Apractelytra*, thus linking the bee-parasite genera; œdeagus very different from that of the three genera mentioned.

The subfamily includes one genus: *Crawfordia* Pierce, parasitic on *Panurginus;* America.

23. Genus CRAWFORDIA Pierce (1908).

Type of genus.—*Crawfordia pulvinipes Pierce,* 1904.

Dedicated to the honor of J. C. Crawford, who captured the type species and thus first interested the writer in this group of insects.

This genus is confined to North America. The hosts belong to the genus *Panurginus* in the Panurgidæ.

It is characterized by the peculiar shaped œdeagus which, arising at the apex of the abdomen, quickly dilates from a slender tube into a bent inflated vesicle, which again suddenly narrows into a very acute curved process.

The genus has the xenid characters of four-jointed antennæ, and four-jointed tarsi, but has apparently three-jointed maxillæ.

Key to females.

In the genus *Crawfordia* the female cephalothorax is very different from that of *Stylops*, so that the comparative ratios will be considerably different. The measurements are with 160 tube, 2-inch eyepiece, A objective, Zeiss stand, 1 space = 0.0076 mm.

Species.	1. Length.	2. Spiracle to apex.	3. Breadth between mandibles.	4. Breadth head.	5. Breadth at spiracles.	6. Greatest breadth.
cockerelli..............................	92	60	27	80	85	87
pulvinipes..............................	81	50	19	85	88	88

From these figures the following ratios, which are derived as in the discussion of *Stylops*, are obtained:

Species.	Cephalothorax to mandibles. (5):(3)::—:1.	Head to mandibles. (4):(3):—:1.	Cephalothorax to head. (5):(4):—:1.	Breadth to length. (5):(2):—:1.
cockerelli..............................	3.14	2.96	1.06	1.41
pulvinipes.....	4.63	4.47	1.03	1.76

1. CRAWFORDIA PULVINIPES Pierce (1904).

Xenos pulvinipes Pierce, 1904.
Xenoides pulvinipes Pierce, 1905, in correspondence.
Crawfordia pulvinipes Pierce, 1908.

Host.—*Panurginus*, new species; West Point, Nebraska, August 10; collected by J. C. Crawford, in whose honor the genus is named. Types in writer's collection (pl. 12, fig. 7; pl. 13, figs. 4, 5*a*, 5*b*, 6, 7).

Male.—Antennæ four-jointed; first and second joints externally obliquely truncate, emarginate, for the reception of the following joint, very short; third joint with stem as short as preceding joints but elongated anteriorly into a very long, ribbon-like lamella which twists around the fourth joint; fourth joint surpassing third by length of stem of first three; third and fourth joints very slightly inflated, thickly covered with very fine hairs and very closely provided with large sensory pores. Eyes globular; lenses few, large, and separated by slightly raised, densely pubescent partitions. The mandibles are transparent yellow lancet-shaped appendages, curved slightly at the base, toothed near the tip, obliquely truncate and acute at tip. Almost obscuring the mandibles is a highly developed three-jointed appendage, with the first two joints subequal, semi-cylindrical, elbowed at each joint, and with the third an immense paddle-shaped sensitive lamella, fully as broad as the eyes, being broadest before the middle and thence narrowing to a rounded tip about one-third as wide, and measuring in length about the distance from the inner edge of one eye to the outer edge of the other. The prothorax is a mere band. The mesothorax is about double the length of the prothorax. The metathorax is typical. The lumbi of the scutum do not meet in the center and are somewhat elevated, with the interior margin rounded; the præscutum and the scutellum are distinctly separated, but together resemble a spindle; the post-lumbium is shield-shaped, rounded behind, lower than the scutellum, rather concave, medianly longitudinally ridged, closely, finely punctate, yellowish; postscutellum long, narrow, surpassing the femoralia which cover the sides of the body and several abdominal segments. The thorax, with the exception of the postlumbium, is finely pubescent. Elytra short, narrow, apically thickened and rumpled into many ridges, thickly pubescent. Wings large, surpassing abdomen, consisting merely of the primary veins, costa, subcosta, radius, and media from the costal stalk and the first and second anal from the anal stalk; radius arises from subcosta; the second anal is not basally attached. Coxæ of first two pair of legs single-jointed, long; third pair with rather short coxæ, and a long trochanter. Femora and tibiæ longitudinally obliquely furrowed. Tarsi four-jointed, each joint inserted far before the apex of the preceding and with the apex sucker-like or pulvilliform. The abdomen is short and is mainly characterized by the peculiar œdeagus, which is immediately dilated at base, then turned and narrowed into a very acute curved process.

Female.—Length of cephalothorax 0.61 mm., breadth at spiracles 0.65 mm., breadth of head 0.57 mm., distance between mandibles 0.14 mm. Cephalothorax yellowish with dark brown band on base and base of abdomen, forming a collar; broad, subquadrate, constricted at base, broadest at spiracles, spiracles large convex, laterally prominent, placed obliquely; thence straight, slightly oblique, obtusely angled about anterior eighth and thence more oblique to mandibles, squarely and broadly truncate at apex; angles of head immediately in front of spiracles, from which a long oblique line extends to the anterior edge of the prothorax, just behind the mouth; mandibles triangular, with a sharp tooth at apex.

2. CRAWFORDIA COCKERELLI, new species.

Host.—*Panurginus ornatipes* Cresson (*boylei* Cockerell); Las Vegas, New Mexico, August 3; W. Porter, collector (pl. 12, fig. 8).

Female.—Length of cephalothorax 0.70 mm., breadth at spiracles 0.64 mm., breadth of head 0.608 mm., distance between mandibles 0.20 mm. Cephalothorax yellowish, with a dark brown basal band extending over upon abdomen and forming a collar; longer than broad, roundingly constructed at base, widest behind spiracles, spiracles lateral but not prominent, margin slightly convex, oblique to mandibles, squarely truncate at apex; mandibles large, blunt, placed on lateral strip of head; spiracles not large, convex.

Dedicated to Prof. T. D. A. Cockerell, of the University of Colorado, who has done so much toward the advancement of our knowledge of the Apoidea.

Type.—Cat. No. 10113, U.S.N.M.

Superfamily HALICTOPHAGOIDEA Pierce, 1908.

This superfamily includes two families; the Halictophagidæ and the Dioxoceridæ.

6. Family HALICTOPHAGIDÆ Pierce, 1908.

Strepsiptera or *Stylopidæ* (part) HOEVEN, 1850.
Hymenopterobiæ (part) SAUNDERS 1872.
Stylopides (part) SAUNDERS, 1872.
Halictophaginæ PERKINS, 1905.

Type genus.—*Halictophagus* Dale (Curtis, 1832).

Parasites of Tetigonidæ.

Antennæ seven-jointed, third to sixth produced laterally, seventh elongate; tarsi three-jointed.

This family includes five genera:

24. *Halictophagus* Dale (1832); hosts unknown; Europe.
25. *Pentacladocera* Pierce (1908), parasitic on *Agallia*?; Australia.
26. *Pentoxocera* Pierce (1908), parasitic on *Tetigonia, Hecalus, Paradorydium;* Australia.
27. *Agalliaphagus* Pierce (1908), parasitic on *Agallia;* America.
28. *Megalechthrus* Perkins (1905), parasitic on *Platybrachys;* Australia.
29. *Neocholax* Pierce, parasite on fulgorid; Java.
30. *Anthericomma* Pierce (1908); hosts unknown; America.

24. Genus HALICTOPHAGUS Dale (Curtis, 1832).

Halictophagus DALE MS.—HOEVEN, 1850.—SAUNDERS, 1872.

Type of genus.—*Halictophagus curtisii* Dale (Curtis, 1832).

Name derived from *Halictus* (the supposed host) + φαγεῖν (to eat), meaning erroneously that the genus is parasitic on *Halictus*.

The hosts are undoubtedly homopterous, but have not been discovered.

The genus is the type of the family Halictophagidæ. It has seven-jointed antennæ, the third to sixth joints being laterally produced, and the seventh subequaling the sixth. Tarsi triarticulate. Prothorax and mesothorax normal, ring like. Wings with seven primary veins and with a short vein beyond the radius, another detached but apparently arising from the medius, and a short vein arising just below the medius.

1. HALICTOPHAGUS CURTISII Dale (Curtis, 1832).

Halictophagus curtisii SAUNDERS, 1872.

The host of this species is unknown, although it has been ascribed to *Halictus aeratus* Kirby, which was found stylopized in the vicinity where the male was collected. The species occurs in the adult male form in August at Lulworth Cove, England, on a rock called Durdle Door, and was originally taken by Mr. Dale by brushing some long coarse grass and thistles close to the sea.

Length 1.4 mm., expanse of wings 3.8 mm.

The following description of this species was published by Curtis in 1832:

Black and slightly glossy, clothed with a brown velvety pubescence; antennæ and legs dull brownish ochre; wings slightly tinged with fuscous ochre and obscurely iridescent; nervures brown; tips of the joints of the tarsi and apex of abdomen ochreous. (Curtis, 1832.) Head broader than the thorax. Eyes very remote, prominent and coarsely granulated. Prothorax and mesothorax short, the latter with a pseudelytron attached on each side; they are very slender at the base and terminated by an ovate club. Metathorax somewhat scutate, the anterior portion forming three nearly equal lobes, the scutellum being short and rounded. Postscutellum very long tongue-shaped and thick, with a long deep groove at the base. Wings large, minutely punctured, rounded at the apex, with the costa thickened, a subcostal and five other strong longitudinal nervures and a callous stripe at the apex, the second nervure apparently a detached branch of the third, which has a short ray near the base of the second. Abdomen rather short, a great portion concealed by the postscutellum, composed of about eight joints, terminated by an obtuse process. (Anterior trochanters long.) Thighs rather short. Tibiæ short and compressed. Tarsi triarticulate, basal joint stout in the anterior pair, the second long and slender, third small obovate; nearly of equal length in the posterior pair, the apex of each joint produced beneath and submembranous or fleshy. Claws none.

The female is unknown.

25. Genus PENTACLADOCERA Pierce (1908).

?*Halictophagus* Perkins, 1905.

Name derived from πέντε (five) + κλάδος (branch) + κέρας (horn), meaning five-branched antennæ.

Type of genus.—*Pentacladocera schwarzii* Perkins (1905).

The genus is parasitic upon *Agallia* or a nearly related bythoscopid genus and is at present confined to Australia.

This genus differs from *Pentoxocera* in that the five apical joints of the antennæ are not all of thin laminate form throughout, but the basal ones of these are of more normal form, and the branches are less thinly laminate. Palpi more slender than in *Pentoxocera.* The general form of the metathorax, tarsi, and genital segment as in *Pentoxocera.*

Differs from *Halictophagus* Curtis (according to Westwood) in that the metathorax is very different, as also is the terminal abdominal segment. Intermediate between *Halictophagus* and *Pentoxocera* in antennæ.

1. PENTACLADOCERA SCHWARZII Perkins (1905).

Halictophagus? schwarzii Perkins, 1905.
Pentacladocera schwarzii Pierce, 1908.

Host.—*Agallia* (?), species; Mittatong, New South Wales (pl. 13, figs. 13, 14).

Male.—Expanse 3 mm. Black, clothed with extremely delicate sericeous pubescence, which is cinereous in some parts; the extreme tip of the abdomen testaceous; metathorax more or less obscurely pale in some parts, at least along the sutures. Antennæ blackish, third and fourth joint short, subtriangular, with one of the apical angles produced into a long branch, fifth and sixth joints shorter than the preceding, more ring-like, but produced into similar branches; seventh joint lamellate throughout. Wings subhyaline, slightly smoky and iridescent, the nervures very distinct blackish.

26. Genus PENTOXOCERA Pierce (1908.)

Halictophagus, subgenus *Bruesia* Perkins, 1905 (preoccupied).

Name derived from πέντε (five) + ὄζος (branch) + κέρας (horn), meaning five-branched antennæ.

Type of genus.—*Pentoxocera australensis* Perkins, 1905.

The genus is typically parasitic on the genus *Tetigonia,* although at present parasites of *Hecalus* and *Paradorydium* are included. It is limited in our knowledge to the Orient. It contains at present four species:

1. *australensis* Perkins, 1905, parasitic on *Tetigonia parthaon* Kirkaldy; Queensland.

?2. *phæodes* Perkins, 1905, parasitic on *Hecalus immaculatus* Kirkaldy; Queensland.

?3. *stenodes* Perkins, 1905, parasitic on *Paradorydium menalus* Kirkaldy; Queensland.

?4. *schwarzi* Pierce, 1909, parasitic on *Diedrocephala sanguinolenta* Coquibar, Guatemala.

The following description is taken from Perkins:

Male.—Head very deeply concave behind, seen from above consisting only of a narrow rim supporting the eyes, and produced considerably in front of these to form the tip of the blunt and wide frontal projection, at the sides of which the antennæ are inserted. That which appears to be the tip of the head on superficial inspection is in reality the dorsum of the pro- and meso-thorax, which in their natural position are deeply immersed within the posterior concavity of the head, which they more or less fill up. Antennæ with the two basal joints simple, the following excessively short, being produced laterally into an elongate and thin lamina, the first and fifth (or last) of these laminæ being larger than the others and capable of inclosing them in a fan-like fashion. Mandibles very short compared with those of other Stylopids, their tips not reaching one another, simply pointed. Labial palpi very large, the second joint foliaceous half as wide as long, pilose, subacuminate at the apex. Scutellar portion of the metanotum moderately large, penetrating somewhat between the lateral lobes of its anterior portion, triangular, and very different from the small semilunar scutellum of *Elenchus;* the postscutellum very elongate, twice as long as wide, or appearing still longer in dry specimens, covering several of the basal abdominal segments. Elytra clavate or ladle-shaped in well-preserved specimens. Wings smoky hyaline, neuration black, very distinct. Tibiæ dilated apically, and grooved or hollowed above for the partial reception of the three-jointed tarsi, when these are drawn up. (Perkins, 1905.)

1. PENTOXOCERA AUSTRALENSIS Perkins (1905).

Halictophagus (*Bruesia*) *australensis* PERKINS, 1905, 1906.
Pentoxocera australensis PIERCE, 1908.

Host.—*Tetigonia parthaon* Kirkaldy, Cairns; Queensland (pl. 13, figs. 8, 9, 10, 11, 12).

Length about ⅓ mm. Expanse about 4 mm.

Perkins has described this species as follows:

Male.—Black or blackish fuscous, the thorax paler, piceous or brownish, the lamellate joints of the antennæ also paler, yellowish or sordid testaceous. Wings smoky hyaline, with slight but evident iridescence, the neuration strong, black. Apical abdominal segment with its genital process concave above and much produced, towards the base with an upright tongue-shaped, pilose organ; in lateral view the sides are slightly convergent to the apex, which is armed with a recurved hook, the tip of which is itself bent upward; in front of the origin of this uncus the process has a small deep emargination. The apical ventral segment is triangular and produced at the apex. The abdomen is clothed with delicate cinereous pubescence.

Female.—Length about ⅓ mm. Head yellow or brownish yellow, distinctly rounded at the sides, with a distinct anterior median area (or plate) marked out, and slightly produced; tuberculate on either side of this area in front. The opening of the brood chamber is behind the middle of the exposed part of the head, the surface between this opening and the apex subconvex. (Perkins, 1905.)

?2. PENTOXOCERA PHÆODES Perkins (1905.)

Halictophagus (*Bruesia*) *phaeodes* PERKINS, 1905, 1906.
Pentoxocera phaeodes PIERCE, 1908.

Host.—*Hecalus immaculatus* Kirkaldy, Cairns; Queensland.

This species has been described by Perkins as follows:

Female.—Length about ¼ mm. Head broader than long, brown, more yellowish in front and darker behind the opening of the brood chamber, strongly rounded at the sides, the anterior median area defined and slightly produced, tuberculate on either side of this area in front; the surface slightly convex between the opening of the brood chamber and the apex. (Perkins, 1905.)

?3. PENTOXOCERA STENODES Perkins (1905).

Halictophagus (*Bruesia*) *stenodes* PERKINS, 1905, 1906.
Pentoxocera stenodes PIERCE, 1908.

Host.—*Paradorydium menalus* Kirkaldy, Cairns; Queensland.

According to Perkins this species may be described as follows:

Female.—Length about ¼ mm. Head narrow, subelongate, sides not strongly rounded, more parallel-sided, piceous, shining opening of the brood-chamber near the middle of the head, the surface slightly convex. Otherwise agreeing generally with the preceding, *P. phæodes* (Perkins, 1905).

?4. PENTOXOCERA SCHWARZI, new species.

Host.—*Diedrocephala sanguinolenta* Coquibar; Cacao, Finca Trece Aguas, Alta Vera Paz, Guatemala, March, 1906; E. A. Schwarz and H. S. Barber (pl. 14, fig. 11).

Male.—Cephalotheca: Transverse diameter 0.65 mm., longitudinal diameter 0.49 mm.; yellowish brown, broad elliptic; pharyngeal orifice central, opening behind an inferior concave ridge, and bounded superiad by a more concave vertigial ridge; antennal analogues lateral, distant, prominent; vertex straight from eye to eye except in front of pharynx as described above; mandibular analogues immediately below vertex, prominent, chitinized brown, very close to lateral edges of pharyngeal orifice; maxillary analogues elliptic, oblique, reaching mandibles above, with a small prominent circular area at lower end.

Type.—Cat. No. 12316, U.S.N.M.

Named in honor of Mr. E. A. Schwarz, and placed provisionally in this genus.

27. Genus AGALLIAPHAGUS Pierce (1908).

Halictophagus (?) PERKINS, 1905.

Type of genus.—*Agalliaphagus americanus* Perkins, 1905.

The genus is parasitic on the bythoscopid genus *Agallia* and is at present limited to North America.

Name derived from *Agallia* (the host genus) + φαγεῖν (to eat), meaning parasitic on *Agallia*.

The location of the genus is uncertain although it undoubtedly belongs in the Halictophagidæ with the other jassid parasites.

1. AGALLIAPHAGUS AMERICANUS Perkins (1905).

Halictophagus (?) *americanus* PERKINS, 1905.
Agalliaphagus americanus PIERCE, 1908.

Host.—*Agallia 4-notata;* Columbus, Ohio.

This species was described by Perkins as follows:

Female.—Length about $\frac{1}{6}$ mm. Dark brown or piceous, suboblong, the anterior median area distinct in apical view, but generally hardly visible in surface view, owing to its portion on the apex of the head, which is bent at an angle to the outer surface, tuberculate on either side of this area; the whole disk of the head deeply impressed so as to form a great cavity leading into the opening of the brood-chamber (Perkins, 1905).

28. Genus MEGALECHTHRUS Perkins (1905).

Name derived from μεγάλη (large) + ἐχθρός (enemy) = large parasite.

Type of genus.—*Megalechthrus tryoni* Perkins (1905).

The genus is parasitic on the genus *Platybrachys* or an allied genus. Male antennæ 7-jointed, five being foliaceous.

Female.—Head ovate, moderately elongate, the opening of the brood-chamber near the middle or rather in front of it, the small anterior median area distinct, a little produced in front, and tuberculate on either side of this area in front. This large form appears to be allied to *Pentoxocera* and *Pentacladocera,* but is, as Perkins thinks, distinct generically from these, by its long, ovate form and great size.

1. MEGALECHTHRUS TRYONI Perkins (1905).

Host.—*Platybrachys* (?), species, Cairns; Queensland.

Female.—Head ovate, moderately elongate, yellow or brownish yellow, shining when clean, but often dull from the excrement of its host, more strongly convex behind the orifice of the brood-chamber than in front of it.

Male.—Puparium brown or pitchy, unicolorous or nearly so. Length about $\frac{3}{4}$ mm.

29. NEOCHOLAX, new genus.

Name derived from νέος (new) + χόλαξ (parasite), meaning a new and interesting parasite.

Antennæ 7-jointed, the third, fourth, fifth, and sixth branched beneath, the basal part of the third elongate as in *Pentacladocera.* Mandibles short and acute. Palpi with first joint short, cylindrical, one-third as long as second, obliquely truncate at apex; second joint borne on apical truncation of the preceding, elongate, tapering, sensitive. Prothorax anteriorly convex, fitting into excavation of head. Wings as in *Pentoxocera*.

Type of genus.—*Halictophagus jacobsoni* Meijere 1908. The genus is typically parasitic on Fulgoridæ and at present is confined to Java.

1. NEOCHOLAX JACOBSONI Meijere (1908).

Halictophagus jacobsoni MEIJERE, 1908.

Parasitic on a fulgorid, Semarang, Java, June and July, 1905, Edw. Jacobson (pl. 14, figs. 1, 2, 3, 4).

Male.—Head dark brown; antennæ brown, somewhat transparent, the rami of decreasing lengths, the last joint scarcely longer than the branch of the preceding, as in *Pentacladocera schwarzi*. Mandibles brown. Thorax and abdomen grayish brown, the thorax brighter. Prothorax strongly arched forward. Head emarginate at base. Tibiæ brown; tarsi brighter, golden. Elytra dark brown. Length 1.3 mm., wing length 1 mm.; antennal length 0.4 mm.; length of branch of third antennal joint 0.26 mm., the last antennal joint 0.16 mm.; breadth of head 0.52 mm.; length of palpus 0.14 mm.

Female.—Cephalothorax golden brown, behind the opening of the brood canal dark brown, scarcely broader than long (0.28 mm.); sides rounded, head convex, behind the protuberant parts a small darker median stripe.

Triungulinid.—Similar to that of *Pentoxocera*, sides almost parallel, the whole appearance somewhat oval. Length 0.13–0.16 mm.; breadth 0.06 mm.; length of bristle of last segment 0.09 mm., or more than half as long as the body. On the venter of the next to last segment are three pairs of bristles, of which the middle pair are shortest, the next longer, and the outer pair still longer; each ventral segment bearing on apical margin three short hairs arranged in longitudinal rows. Eye-spot with five pigment lenses arranged in a cross.

Male puparium.—The diameters of the cephalotheca are 0.5 mm. × 0.4 mm.[a]

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[a] *Male.*—Kopf schwarzbraun, Fühler braun, etwas durchsichtig, die Anhänge in abnehmender Länge, das letzte Glied kaum etwas länger als der Anhang des vorletzten, also wie bei *H.* (*Pentacladocera*) *schwarzii* Perk. gebildet. Taster braun. Thorax und Hinterleib graubraun, der Thorax an den Nähten heller. Prothorax in der Mitte mässig vorgebuchtet, Kopf hinten im oberen Teile ausgehöhlt. Beine braun, Tarsen heller, gelblich. Elytren schwarzbraun. Flügelgestalt und Geäder wie in fig. 3, 3te Hauptader also einfach. Körperlänge 1.3 mm.; Flügellänge 1 mm.; Länge der Fühler 0.4 mm. Länge des Anhangs des 3ten Fühlergliedes 0.26 mm., des letzten Fühlergliedes 0.16 mm. Breite des Kopfes 0.52 mm. Länge des letzten Tastergliedes 0.14 mm.

Female.—Kopf gelbbraun, hinter dem Querspalt dunkelbraun, kaum etwas breiter als lang (ca. 0.28 mm.), die Seiten abgerundet, der vor der Quernaht liegende Teil convex. Hinter dem heraustretenden Teil kein dunkler Medianstreifen.

Triungulinid.—Die winzigen Larven stimmen sehr mit den bei Perkins abgebildeten von *Bruesia* (*Pentoxocera*) überein, sie sind bald parallelseitig, bald von mehr

30. Genus ANTHERICOMMA Pierce (1908).

Name derived from ἀνθέριξ (stalk) + ὄμμα (eye) = stalked eye.

Type of genus.—*Anthericomma barberi* Pierce.

This genus is confined to America. Hosts unknown.

The genus is characterized by having the pronotum and prosternum confined to median disks, surrounded on three sides by the mesothorax, which is laterally contiguous to the head. The antennæ are seven-jointed, with the last five joints flabellate of graduated length, making the apical slightly the shortest. The tarsi are three-jointed.

1. ANTHERICOMMA BARBERI Pierce (1908).

Halictophagus barberi PIERCE, 1905, in determinations.

Host.—Unknown; Santa Fe, New Mexico.

Male, collected by H. S. Barber, in whose honor it is named, May 6, 1904 (fig. 3, Nos. 13, 14; pl. 14, figs. 5, 6, 7, 8).

Male.—"Length 1.25 mm.; including wings folded, 2 mm. Species stout, compact, with very large wings. General color black, wings milky white" (Pierce, 1908). Head transverse, closely and coarsely punctate, eyes stalked, facets close, round, and bordered by few hairs. Antennæ transparent grayish with darker pubescence, the last five joints outwardly flattened, foliaceous, and covered with a very sensitive surface. Maxillæ two-jointed, pubescent. Mandibles short, pubescent. Gula transverse, striate. "Pronotum obovate, disk-like, not connected with prosternum, projecting about equally into emarginations of the head and mesothorax, medianly depressed longitudinally and transversely. Mesonotum transverse, anteriorly broadly emarginate for the admission of the pronotum; transversely depressed near apical margin. Metanotum very long" (Pierce, 1908). Præscutum long, wider at base than apex; scutum elongate linear, with oblique ridge to apical corners of præscutum; scutellum with base and sides rounded and apex transversely truncate; postlumbium linear transverse, very short; postscutellum as long as all the anterior portions of the thorax; femoralia reaching posteriorly one-third the

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ovaler Gestalt, ihre Länge beträgt 0.13–0.16 mm., die Breite 0.06 mm., die Borsten des letzten (10ten Ringes) sind 0.09 mm., also etwas länger als die halbe Körperlänge; ferner fallen noch an der Ventralseite des vorletzten Ringes 3 paar Börstchen auf, von welchen das mittlere Paar äusserst klein, das darauf folgende etwas grösser ist, während das äussere Paar, welches nahe dem Seitenrande liegt, bei weitem am meisten vorragt; die Borsten desselben sind 0.02 mm. lang. Im übrigen finden sich an der Unterseite des Abdomens am Hinterrande der Segmente noch einige in 3 Reihen (einer medianen und 2 seitlichen) angeordnete, äusserst winzige, dornartige Fortsätze. Jede Seite des Kopfes zeigt einen fast runden schwarzen Pigmentfleck, welcher 5 Linsen trägt, von welchen die 3 vorderen etwas grösser sind als die 2 hinteren. Die Linsen sind in einem Kreis angeordnet. Unmittelbar hinter dem Fleck fängt der Prothorax an.

Male puparium.—Der vorspringende Teil des männlichen Pupariums ist 0.45 mm. lang, der Deckel desselben misst 0.5 × 0.4 mm. (Meijere, 1908).

length of the postscutellum. The wings are very long, milky white, and pubescent. The legs are very small and do not appear fit for use. The prosternum is a mere rounded, oblong disk not connected with propleuræ, which are lacking; consisting only of the two coxæ; trochanters elongate, longitudinal, contiguous throughout, and flattened anteriorly; femora and tibiæ subequal, black, tarsus very small and inconspicuous. Mesosternum as mesonotum, adjacent to head, except in space occupied by the anterior coxæ; coxæ not contiguous, placed just outside of the anterior coxæ; femora a little longer than the tibiæ; tarsi three-jointed normal. Posterior legs longer than the median and proportioned about the same except that the trochanters are shorter. The last two pairs of legs silky pubescent, pulvilli yellow. The genitalia could not be seen in this specimen.

Type.—Cat. No. 9829, U.S.N.M.

7. Family DIOXOCERIDÆ Pierce, 1908.

Type-genus.—*Dioxocera* Pierce, parasitic on *Xerophlœa*, a gyponine genus, which is distributed over North America and the West Indies.

The family is characterized by the three-jointed tarsi, and four-jointed antennæ, with the third and fourth antennal joints laterally produced as in the Xenidæ.

31. Genus DIOXOCERA Pierce (1908).

Type-species.—*Dioxocera insularum* Pierce, which is parasitic on *Xerophlœa viridis* Fabricius. The genus is confined to North America.

Name derived from δύο (δι–) (two) + ὄζος (branch) + κέρας (horn) = two-branched antennæ.

Male.—Defined by family characterization.

Male puparium.—Cephalotheca transverse obovate. Pharyngeal area divided from occipital area by straight transverse side lines and an arched median vertex. The three analogues on each side not separated from one another by distances greater than the diameter of the antennal analogue, and placed in a straight line.

Female.—Cephalothorax subquadrate, with sides rounded, mandibles apical and prominent, pharyngeal orifice subapical; transverse slit behind the middle, straight in median half, but deeply retreating at sides. Dorsally the chitinous portion ceases at a broadly curving line directly above the ventral slit. At this point the body is enlarged to fit the interior of the host.

The ratio of breadth at spiracles, that is, at the corner of the ventral slit, to the distance between the mandibles is as 3.15 : 1. The ratio of breadth at spiracles to distance from spiracles to apex is as 1.4 : 1.

1. DIOXOCERA INSULARUM Pierce (1908).

Type.—Male and two females, collected at Fort St. George, Grenada, West Indies.

Cotypes.—One female collected at Grand Ance, Grenada; one female, one male pupa collected on St. Vincent, West Indies.

Host.—*Xerophlœa viridis* Fabricius (fig. 3, Nos. 11*a*, 11*b*, 12; pl. 14, figs. 9, 10).

Male.—Dark brown. Thorax normal. On account of the imperfect condition of the specimen, which was extracted from a puparium, the remaining parts can not at present be defined.

Male puparium.—Cephalotheca transverse obovate; yellowish brown, sparsely minutely punctate. Eyes occupying one-quarter of median line on each side, sparsely punctate to correspond with ommatidia. Median transverse line limiting anterior edge of pharyngeal area passes straight from eyes to the arched vertex. Antennal analogues distant from eyes by less than their diameter, and from median transverse line by less than one-third their diameter; irregularly rounded with four concentric rings, the inner of which is covered with little tubercles. Mandibular analogues distant from eyes by about their breadth and from the median transverse line by the same distance as the antennal analogues; not or hardly longer than broad, bilobed at apex, the inner lobe an acute tooth. Pharyngeal orifice equidistant from vertex and mandibular analogues by its own breadth. Maxillary analogues not as distinct as antennal, indicated by a small circle with a larger indistinct concentric circle. Oral analogues all on a lighter-colored bilobed area, between the lobes of which a darker area extends from the ventral base to the pharyngeal orifice.

Female.—Cephalothorax light reddish brown; length 0.238 mm.; breadth at base of head 0.273 mm. Apex broadly subtruncate arched in front of mouth, with mandibles prominent at sides of truncation. Mandibles broad, interiorly armed with an acute outward pointing tooth, and exteriorly obtusely angled, thus resembling the mandibles on the male puparial cephalotheca.

Type.—Cat. No. 12315, U.S.N.M.

Superfamily ELENCHOIDEA Pierce, 1908.

This superfamily includes only one family, the Elenchidæ.

8. Family ELENCHIDÆ Pierce, 1908.

Strepsiptera or *Stylopidæ* (part) HOEVEN, 1850.
Hymenopterobiæ (part) SAUNDERS, 1872.
Stylopides (part) SAUNDERS, 1872.
Homopterobiæ SAUNDERS, 1872.
Elenchinæ PERKINS, 1905.

Type-genus.—Elenchus Curtis (1831).

Parasitic on Fulgoroidea.

Antennæ five-jointed, the third laterally produced, the fourth and fifth elongate; tarsi two-jointed.

The family includes six genera:

32. *Elenchus* Curtis (1831), parasitic on *Liburnia;* Europe.
33. *Elenchoides* Pierce, parasitic on *Perkinsiella;* Fiji Islands.
34. *Mecynocera* Pierce (1908), parasitic on *Liburnia;* America.
35. *Pentagrammaphila* Pierce, parasitic on *Pentagramma;* America.
36. *Deinelenchus* Perkins (1905), parasitic on *Platybrachys;* Australia.
37. *Colacina* Westwood (1877), parasitic on *Epora;* Asia.

32. Genus ELENCHUS Curtis (1831).

Elenchus Hoeven, 1850.—Saunders, 1872.

Name derived from ἔλεγχος (anything pending), referring possibly to the resemblance of the elytra to pendants.

Type of genus.—Elenchus walkeri Curtis (1829).

The genus is parasitic on insects of the fulgorid genus *Liburnia*, and in the present broad sense occurs in Europe, Asia, and America.

This genus is typical of the family *Elenchidæ*, having the antennæ 5-jointed, the first two short, cup-shaped, the third laterally produced as a long flat appendage, the fourth elongate flattened, the fifth flattened double the size of the fourth and exceeding the apex of the third. The tarsi are two-jointed. The wing venation consists of a very short costa with a strong subcosta and radius on the costal margin, a detached outer vein between these and the medius, a long medial vein with several small basal veins or folds on either side of it, and one long anal vein.

1. ELENCHUS WALKERI Curtis (1829).

Stylops walkeri Curtis, 1829.
Elenchus walkeri Curtis, 1831.—Westwood, 1835 *b*, 1840.—Saunders, 1872.

Host.—Unknown.

Localities.—Southgate and Dorset, England; Belfast, Ireland; June, July.

Male.—Length, 1.2 mm.; expanse of wings, 3.4 mm.

The following description is revised from that originally furnished by Curtis in 1831.

Dull ochreous-fuscous; eyes black and shining; wings iridescent, pale fuscous, costa and nervures darker fuscous; legs and antennæ pubescent (Curtis, 1831). Head short, producing an obtuse lobe in front and a smaller one on each side. Eyes remote, lateral, globose, composed of about twenty hexagons. Prothorax short. Mesothorax longer, with pseudelytron attached on each side, exceeding in length the breadth of the mesothorax, clavate, slender toward the base. Metathorax large and oblong, divided diagonally into four portions, the scutellum being the smallest.

Postscutellum elongate ovate. Wings large, rounded at the apex, punctured and pubescent, with the costa thickened, a few imperfect nervures below it, and a long one running parallel to the interior margin. Abdomen slender, composed of nine or ten joints, as long as the trunk but incurved. Legs long, hinder pair remote. Coxæ (trochanters), anterior and intermediate very long, hinder short. Thighs and tibiæ nearly of equal length, the four anterior long slender and curved, the posterior short, and broad toward the apex. Tarsi composed of two joints, slenderest in the first pair; basal joint forming a lobe beneath, and hollow above to receive the second, which is subclavate (removed from description of genus, Curtis, 1831).

Mr. A. H. Haliday swept two males from herbage near Belfast, Ireland, which may prove to be different from the typical species. His manuscript notes are interesting and of importance, so are copied in part from Curtis (1831).

They are as follows:

It seems very delicate; the only specimen I could succeed in bringing home alive I put under a watch glass, but having to leave it for an hour I found it dead, though in a cool spot. It moved with a vacillating but tolerably rapid gait with the upper wings extended and the lower rapidly vibrating, the abdomen, with which it smooths its wings, twisting freely in all directions. The antennæ are kept apart with the branches divaricated, and the longer one generally bent in an angle at the articulation; the palpi? (maxillæ) mostly in motion. All the membranous parts are capable of much dilation and contraction, and are fully expanded when in lively motion, but contract after death. The wings were cinereous with blacker nervures. Abdomen longer than the rest of the trunk, fleshy, of eight segments besides the anal one bearing the appendage. The first three are softer, more extensile and versatile than the rest, which have a single row of transverse spots down the back, one on each segment, of stronger consistence and darker color; also a series of more minute ones down the belly. The color of the membranous parts is cinereous yellow, the horny plates of a darker blackish cinereous shade; the ovipositor (œdeagus), tibiæ, and base of antennæ nearly black, eyes deep black.

Female.—Unknown.

2. ELENCHUS TENUICORNIS Kirby (1815).

Stylops tenuicornis KIRBY, 1815.
Elenchus tenuicornis S. S. SAUNDERS, 1872.—E. SAUNDERS, 1892 *a*, *b*.

Host.—*Liburnia*, species; England, August 20.

Male.—Black; eyes subsessile; antennæ very elongate, piceous, rami linear, wings dark. Length about ½ line.[a]

3. ELENCHUS TEMPLETONII Westwood (1835).

Elenchus TEMPLETON, 1838.
Elenchus templetonii SAUNDERS, 1872.

Host.—Unknown, Mauritius, August (pl. 15, fig. 1).

Male.—Fuscous; thorax strongly gibbous; eyes large, black; abdominal segments constricted; fifth joint of antennæ subclavate and narrowed slightly at middle; elytra clavate, blackish toward

[a] *Male.*—Aterrimus, oculis subsessilibus, antennis tenuioribus piceis, ramis linearibus, alis nigricantibus. Long. corp. ½ lin. circiter. In Mus. Brit. (Saunders 1872, p. 32).

apex; wings very broad, pale fuscous, veins obscure; tarsi as in *Elenchus walkeri;* legs and antennæ very finely pubescent. Length $\frac{2}{5}$ line; wing expanse 1 line.[a]

33. ELENCHOIDES, new genus.

Type of genus.—Elenchoides perkinsi Pierce.

Parasitic upon the fulgorid genus *Perkinsiella* and confined to the islands of the Pacific Ocean.

The male cephalotheca is almost round and is characterized by having the mandibular analogues much more nearly approximate than the antennal or pupal analogues, the distance between the mandibles being one-quarter of that between the pupal or antennal analogues.

The female has only three genital canals entering the brood canal, which begins with the fifth segment. The opening of the latter is semicircular, with a narrow curtain extending forward. The spiracles are at the sides of the base of the head and opening of the brood canal. The head is broadly cordiform, more angulate at apex than in *Mecynocera kœbelei.* The single pair of lobes or analogues are approximate, but not contiguous, as in *Mecynocera.*

The male larva has prominent mouth parts, the labrum being distinct, ellipsoidal; mandibles blunt, not approximate; maxillæ apparently three jointed, with two minute appendages on the third joint, and subquadrate.

The description is drawn from the figures by Muir (1906).

1. ELENCHOIDES PERKINSI, new species.

Elenchus tenuicornis MUIR, 1906, not KIRBY, 1815, not PERKINS, 1906.

Host.—Perkinsiella vitiensis Kirby; Fiji (pl. 15, fig. 6).

It is very evident from the figures that this species is not identical with the American *Mecynocera kœbelei,* which Perkins referred to as *Elenchus tenuicornis* Kirby. In fact, it is probable that they have still another species parasitic on *Aloha ipomoeæ* in Hawaii, which has also been given the same determination.

In the absence of specimens, the species must remain defined by the host, habitat, and by the drawings published by Muir.

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[a] Fuscus, thorace valde gibboso, oculis magnis nigris, segmentis abdominalibus constrictis, antennarum articulo 5to subclavato et in medio subangustato, articulum referente; elytris clavatis nigricantibus versus apicem; alis latissimis pallidis fuscescentibus, nervis obscurioribus; tarsis ut in *El. walkeri,* Curt. formatis; pedibus antennisque pube tenuissimâ indutis. Long. corp. $\frac{2}{5}$ lin.; expans. alarum fere lin. 1 (Westwood, 1835 *b*).

34. Genus MECYNOCERA Pierce (1908).

Type of genus.— *Mecynocera kœbelei* Pierce.

Name derived from μηκύνω (=elongate) + κέρας (=horn), referring to the elongate antennæ, which are characteristic of the Elenchidæ. This genus is confined to North America. The hosts belong to the genus *Liburnia*, Homoptera, Fulgoridæ.

It differs from *Elenchus* principally by having the ninth dorsal segment of the abdomen obliquely truncate from the dorsal median base to the ventral apex, and terminated by the reflexed œdeogus, which is shallowly siphonated or sinuate. The maxillæ are feebly two-jointed, the first joint bearing about its middle a filiform process with a knobbed apex, reaching the tip of the second joint of the maxillæ.

1. MECYNOCERA KŒBELEI Pierce (1908).

Elenchus tenuicornis Perkins, 1905, not Kirby, 1815.

Host.—*Liburnia campestris, Liburnia lutulenta;* Columbus, Ohio, female, August 17; males, August 11; collected by Mr. A. Koebele while endeavoring to find parasites of fulgorids for introduction into Hawaii, and named in his honor (fig. 3, nos. 15, 16; pl. 15, figs. 2, 3, 4, 5).

Male.—Length, 1 mm.; wing expanse, 2 mm. Slender, frail, yellowish. This insect is a typical elenchid, although typifying a new genus closely related to *Elenchus*. The antennæ are five-jointed, tæniæform; the first two joints more or less cylindrical; third, laterally produced into a long ribbon-like appendage with strongly sensitized surfaces; the fourth leaving the third at a distance from its base less than the length of the third; fifth joint flattened as the two preceding, separated from the fourth in the same plane by a transverse constriction and extending beyond the tip of the third by one-half its length. The surface of the antennæ is typical. The tubercles, however, are not as closely guarded as in *Acroschismus*. Antennæ very nearly as long as thorax. Eyes with comparatively few hairs and with the lenses close. Maxillæ feebly bilobed with a chitinous filament from the middle of the first segment. Mandibles short, stout, acute. Prothorax a mere band, and mesothorax double. Elytra, clavate, with a long peduncle; club paddle-shaped, with sensitive surface. Wings delicate hyaline. The veining consists of five primary veins, the first and second costal and subcostal, the third radial, and the fourth medial; fifth anal with a short unattached vein between the radius and medius. Tarsal joints two, the second arising considerably before the apex of the first. Trochanters of the first two pairs of legs very long, as long or longer than the femora. Femora of posterior leg nearly three times as long as trochanters and about twice as long as coxæ; coxæ depressed for reception of trochanters at apex; trochanters curved, socket-shaped; femora cylindrical, enlarging apically, obliquely truncate, and grooved for the reception of the tibiæ, which are much smaller in diameter at all points than the femora; tibiæ enlarged gradually toward apex, but not equaling length of coxæ and trochanters. Tarsi not as long as tibiæ. The ninth segment occupies about a third the length of the abdomen. From the anal extremity the œdeagus is reflexed forward, slightly sinuate, with apex turned upward, and is protected laterally by two high flexible flaps, which are contiguous at their upper anterior corners and graduate obliquely to the base of the genital tube. The tenth segment is somewhat obscure in the concavity of the ninth. The œdeagus is glabrous, hyaline yellow, abruptly tapering and acute at the apex; the lateral flaps are very pubescent. The wing venation differs from that of the typical *Elenchus*, as does also the metathoracic scutellum.

Female.—The female is very different from the xenid type. No sign of mandibles can be found. The head composes the greater part of the disk with the oral aperture marginal. The thorax seems to be sunken into the abdomen, with an immense opening to the brood canal.

According to Perkins it is described as follows:

> Head brownish or pitchy, opening of the brood chamber far behind the middle and very large, no anterior median area and tubercles defined, but with a faint round spot just in front of the brood-chamber orifice on each side of the middle line. Length, ½ mm. (Perkins, 1905.)

Type.—Cat. No. 9028, U.S.N.M.

35. PENTAGRAMMAPHILA, new genus.

Type of genus.—*Pentagrammaphila uhleri* Pierce.

This genus is typically American and parasitic on the genus *Pentagramma.*

1. PENTAGRAMMAPHILA UHLERI, new species.

Female.—Length of cephalothorax 0.35 mm., breadth at spiracles 0.38 mm., breadth at base of head 0.34, distance between mandibles 0.098 mm. Cephalothorax; reddish-brown subquadrate, spiracles at basal angles, sides oblique, apex truncate with rounded lobe in front of mouth; spiracles not prominent; head occupying one-half the length of the cephalothorax; mandibles elongate oblique, obtuse.

Type.—Cat. No. 12317, U.S.N.M.

Named in honor of Dr. P. R. Uhler, in whose collection were found *Pentagramma vittatifrons* Uhler, collected by Rothauer in "Dacota," in which this species was taken. The locality "Dacota" includes North and South Dakota, Wyoming, Montana, and probably part of Idaho, so it is not very definite.

36. Genus DEINELENCHUS Perkins (1905).

Name derived from δεινός (powerful) + *Elenchus*, meaning very large Elenchid.

Type-species.—Deinelenchus australensis Perkins.

Parasitic on *Platybrachys*, limited to Australia.

The original description was as follows:

Male.—Like *Elenchus* in most respects, e. g., in the structure of the tarsi and antennæ, but very much larger, and with the second antennal joint, seen from above, very short and transverse, the basal one elongate. Frontal process much blunter and less prominent than in *Elenchus*. As in that genus, the face is deeply excavated, but it is much more open, not triangular, but with the sharp edge of the front and sides forming a great semicircle, or rather more. The palpi are two-jointed sparsely pilose, the second joint narrower than the first and in the form of a curved blade. The postscutellum of the metathorax is longer than in *Elenchus*.

Female.—Head nearly circular, very wide, the anterior margin simply and widely rounded, with no defined anterior median area, and without evident tubercles in front. Between the openings of the brood-chamber and the anterior margin there are two distinct areas marked out by impressed lines, which run backward to the brood-chamber orifice as deep grooves on either side of a smooth slightly raised tubercle. Opening of the brood-chamber bisecting the head in surface view. Allied to *Elenchus* by the absence of a definite anterior median area and the presence of those on the disk, between the anterior margin of the head and the orifice of the brood-chamber (Perkins, 1905).

1. DEINELENCHUS AUSTRALENSIS Perkins (1905).

Host.—Platybrachys, species, Cairns; Queensland.

Perkins described this species as follows:

Male.—Piceous, perhaps blacker in mature specimens; the sides and the scutellum of the metathorax pale, its anterior lobe and postscutellum dark. Legs with the femora pale, the tibiæ dark, fuscous. Elytra for the most part blackish, the wings quite smoky, with a slight iridescence, neuration black. Expanse probably about 4.5–5 mm.

Female.—Head brownish in front of and yellow behind the brood-chamber orifice. The discal areas between the latter and the apical margin somewhat fan-shaped, and themselves divided by very fine grooves. Sometimes in apical view of the head two round faint spots can be seen, but there is no definite median area nor tubercles. Length and breadth each about $\frac{3}{4}$ mm.

Male puparium dark brown with a pale ring at the base of its protruded portion (Perkins, 1905).

37. Genus COLACINA Westwood (1877).

Type of genus.—Colacina insidiator Westwood (1877).

Name derived from κόλας (parasite).

The genus is parasitic on Fulgoridæ of the genus *Epora*, and at present is restricted to the Malayan regions.

On *Colacina* Saunders (1872) based his group Homopterobiæ. The location of the genus is uncertain, although it is probably allied to the other fulgorid parasites, which are all elenchids.

The generic description will have to be drawn from the specific description which follows. The ventral surface of the male is appressed to the dorsum of the host.

1. COLACINA INSIDIATOR Westwood (1877).

Host.—*Epora subtilis* Walker (1857), a fulgorid insect, from Sarawak, Borneo (pl. 15, fig. 7).

Male puparium.—Cephalotheca subquadrate; eye covers at sides, large and somewhat lunate; antennal analogues in form of two rounded spaces, adjacent to eyes and distant from each other by over their diameter, partially covered with minute granules; antennal analogues connected by transverse impression; two small transverse pieces below antennal analogues represent the mandibular analogues, while the two small swollen spaces which follow these indicate the maxillary analogues.

GEOGRAPHICAL DISTRIBUTION OF THE STREPSIPTERA.

This subject has been somewhat difficult to handle owing to the fact that only a little over a hundred species are known, but yet some satisfaction has been obtained by studying the records of insects parasitized, from the geographical standpoint. It is found that there are fifty genera of insects in four orders, and fourteen families, which are known to be attacked by the Strepsiptera, from only 25 of which genera have specimens of parasites been described. In the 50 genera of hosts, 238 species are known to be parasitized, and it is first on the basis of these host insects that the following discussion is founded.

As a basis for the study of zoogeography there are two excellent works, one by Wallace (1876) and the other by Heilprin (1886), each of which contains a map of the zoogeographic regions of the world. The regions defined by Wallace are accepted by the writer as best adapted to show the distribution of the Strepsiptera. It is, however, well to first draw a few conclusions from Heilprin's standpoint.

According to the latter author the Strepsiptera as now known would be classed as primarily Holarctic; that is, native to North America and Eurasia, north of the Himalayas. They are entirely absent or unknown from Heilprin's first division of this realm, which extends through Canada, northern Europe, and Siberia. This would therefore define them as belonging only to the temperate and tropical regions.

According to Wallace there are six primary realms which he conveniently divides into four regions each. His Nearctic realm comprises all of North America, except a greater part of Mexico. The Palæarctic realm includes Eurasia, except Arabia south of the

Tropic of Cancer, India, Siam, and southern China, and also includes Africa north of the Tropic of Cancer. The Ethiopian realm includes Africa and Arabia south of the Tropic of Cancer. The Oriental realm includes India, Siam, Burma, southern China, Sumatra, Java, Borneo, and the Philippines. The Australian realm includes the remainder of Malaysia, Melanesia, Polynesia, Australia, and New Zealand. A map is presented herewith to show the delimitation of the subdivisions.

Taking the host records as the only available criterion, it is found that the parasitized species are distributed as follows: Nearctic 90, Palæarctic 91 (Holarctic of Heilprin, excluding Mediterranean fauna, 162), Neotropical 19, Ethiopian 3, Oriental 14, and Australian 23. It is probable that the low number for the tropical realms is due to the fact that less collecting has been done, for it seems likely that the tropical fauna should be most prolific in such forms.

The following tables present the distribution of the known 238 species of host insects and show that the order is indeed world-wide, yet not because of cosmopolitan host insects. The only regions from which no hosts have been recorded are the boreal, the west central African, Madagascar, and New Zealand. Only 13 of the 50 genera are found parasitized in two or more realms. These genera are distributed as follows:

Polistes in 5 realms and 9 regions; *Sceliphron* in 4 realms and 6 regions; *Sphex* in 4 realms and 6 regions; *Proterosphex* in 3 realms and 5 regions; *Liburnia* in 3 realms and 4 regions; *Vespa* in 3 realms and 3 regions; *Andrena* in 2 realms and 5 regions; *Eumenes* in 2 realms and 2 regions; *Odynerus* in 2 realms and 2 regions; *Ancistrocerus* in 2 realms and 2 regions; *Parasphex* in 2 realms and 2 regions; *Priononyx* in 2 realms and 2 regions; *Halictus* in 3 realms and 3 regions.

Only five of these genera are both Nearctic and Palæarctic with regards to stylopization, namely, *Liburnia*, *Polistes*, *Sphex*, *Andrena*, and *Halictus*.

Table of the Distribution of Stylopized Genera.

Genus.	Nearctic.				Neotropical.				Palæerctic.				Ethiopian.				Oriental.				Australian.			
	1.	2.	3.	4.	1.	2.	3.	4.	1.	2.	3.	4.	1.	2.	3.	4.	1.	2.	3.	4.	1.	2.	3.	4.
Gryllotalpa													1											
Tetigonia																						2		
Diedrocephala							1																	
Xerophlœa								1																
Deltocephalus																						1		
Eutettix																						1		
Hecalus																						1		
Paradorydium																						1		
Phlepsius																						1		
Agallia			1																			1		
Perkinsiella																							1	
Megamelanus			1																					
Liburnia			3						2													1	1	
Pentagramma		1																						
Hadeodelphax																						1		
Aloha																							1	
Platybrachys																						2		
Epora																				1				
Chrysocoris																				1				
Paragia																						2		
Eumenes										1								1						
Rygchium						1																		
Monobia			1																					
Odynerus						1				1														
Ancistrocerus			1			1																		
Leionotus		1	5																					
Hoplomerus						2																		
Psiloglossa						1																		
Vespa									1			1							3					
Polistes	1	4	14			1	1		1	2					1		2							
Polybia						1																		
Belonogaster										2														
Icaria																	1							
Sceliphron			1		1			1				1									3	1		
Proterosphex			3			1	1	1											1					
Isodontia						1																		
Chlorion					1																			
Parasphex										1								1						
Prionyx			1		1																			
Sphex		1	5						1	2			1					1						
Miscus									1															
Stizomoyhus																						1		
Bembecinus										1														
Bembex																						1		
Prosopis									1	4														
Halictus			6						12									2						
Andrena	6	6	26						49	5														
Panurginus		1	1																					
Halictoides									1															
Meliturga									1															

APPENDICES.

PARASITISM.

Certain characteristics or laws of parasitism may be framed as a general summary of the results found in the article.

I. The fact that a certain peculiarity is possessed by two insects in varying degrees does not indicate close relationship.

(1) The abortion, or loss of wings, occurs in Coleoptera, Diptera, Strepsiptera, Dermaptera, Homoptera, Orthoptera, and Hymenoptera.

(2) The wingless female occurs in Coleoptera, Lepidoptera, Strepsiptera, Hymenoptera, and Homoptera.

(3) The "raspberry" eye occurs in Diptera (Pupipara), Strepsiptera, and Thysanoptera.

(4) Hypermetamorphosis occurs in Coleoptera, Neuroptera, Hymenoptera, and Strepsiptera.

(5) Larviparous reproduction occurs in Homoptera, Strepsiptera, and Diptera.

(6) Flabellate antennæ occur in Coleoptera, Strepsiptera, and Hymenoptera.

II. Two lines of descent may arise from greatly variant sources and through the assumption of similar habits of life develop organs closely approximating each other. Or two different combinations of causes may exert influences inducing an approximation of resultant organs.

(1) The Meloidæ, Rhipiphoridæ, and Strepsiptera have the first larval stages similar.

(2) The antennæ of the Rhipiphoridæ are flabellate, as they are also in male Strepsiptera.

(3) The mouth parts of the Rhipiphoridæ and Strepsiptera are atrophied. The peculiar rhipiphorid *Rhyzostylops inquirendus* Silvestri may be referred to in this connection.

III. Parasitism is an acquired habit; an adaptation—hence a specialization. In the specialized adaptation to a parasitic life certain organs become unnecessary and are changed to accomplish new functions or become aborted or lost. Certain other organs at the same time have an increase of function or assume duties entirely new, and consequently through selection and modification induced by changed functions become very different from the type organs.

(1) In the Strepsiptera the first change noted is the loss of legs and eyes by the larva, and the ultimate recovery of these organs by the male, but the final loss of them by the female.

(2) The reduction of the male front wings to clubs is accompanied by the assumption of the function of sound making.

(3) The female's permanence in one position has brought about the complete reduction of all appendages except the mandibles

which are used in pushing out the cephalothorax, and perhaps aid in the act of copulation. The necessity of being inconspicuous on the host's body, or rather the necessity of preventing a drying up of the host's interior, has reduced the cephalothorax to a flattened disk which hardly raises the abdominal plates of the host.

IV. A parasite may by constant reduction of parts become exceedingly simple in structure; in other words, generalized. This is, however, generalization by reversion, and is by no means indicative of primitiveness.

V. Hypermetamorphosis is the extreme of known specialization in development of insects.

(1) The appearance of the hexapod larva resembling the most primitive of adult insects, followed by successive stages representing various types of larvæ, then succeeded by an internally formed pupa, which remains inclosed in its larval skin, and finally the resultant highly specialized male, seems to carry the insect through all of the evolutionary stages experienced in the production of specialized insects. In fact, hypermetamorphosis rehearses the stages of evolution.

VI. Larviparous reproduction is a modification of biology due to specialization of activities.

(1) The female strepsipteran never leaves its host, and therefore oviposition is impossible.

VII. The differing habits of the hosts have given rise to the isolation of species of parasites, and their dependence upon a single species of host for nourishment is the result of specialization to meet the requirements of life in that host.

VIII. A single host may in different localities have different species of parasites in the same genus or group.

HABITS OF LARVÆ OF INSECTS.

The following generalized table is planned to show the progression of dependence in insect larvæ, leading to parasitism. It is, in fact, designed mainly to show that the nature of the parasitism by the Strepsiptera is different from that of any other group of insect. Leading examples only are given. (Acarina are included for comparative purposes.)

a. Eggs deposited:
- *aa*. The egg placed promiscuously .... 1.
- *ab*. The egg placed regularly away from larval food .... 3.
- *ac*. The egg placed in or on the larval food .... 4.
  - (Tachinidæ) .... 4*b*.

b. Eggs not deposited:
- *ba*. Larvæ issuing in presence of food—
  - (Sarcophagidæ) .... 4*b*, 4*c*.
  - (Aphididæ) .... 4*a*.
  - (Tachinidæ) .... 4*b*.

bb. Larvæ issuing away from food—
(Strepsiptera) .... } 3*b*.
(Tachinidæ) .... }
bc. Larvæ nourished by parent and issuing ready for pupation; adults parasitic on warm-blooded animals: Pupipara.
bd. Offspring issuing as adults; adults parasitic on insects: *Pediculoides.*

1. Larvæ omnivorous, predaceous, and scavengers (precocious), as, for example, Blattoidea, Mantoidea, etc. (*aa*).
   Larvæ feeding on decaying matter, scavengers (*aa*) .... 2.
2. Adults not parasitic: Dermestidæ, other Coleoptera, Diptera (1*b*).
   Adults parasitic on warm-blooded animals: Suctoria (1*b*).
3. Larvæ generally vegetation feeders; eggs laid in ground (precocious), as, for example, Acridoidea (*ab*).
   Larvæ after first stage parasitic and reliant upon carriers or search to find hosts:
   Meloidæ, Rhipiphoridæ (*ab*) .... 4.
   Strepsiptera (*bb*) .... 4.
   Ixodoidea (*ab*) .... 4.
   Tachinidæ (*ab*, *bb*) .... 4.
4. Larvæ phytophagous (*ac*, *ba*) .... 5.
   Larvæ zoophagous (*ac*, *ba*, 3*b*) .... 7.
   Larvæ scavengers: Sarcophagidæ (*ba*).
5. Larvæ capable of finding food after immediately surrounding supply is exhausted (precocious): Homoptera, including some Aphididæ (*ba*), Chrysomelidæ, Lepidoptera, Tenthredinidæ, *Phytonomus* (4*a*).
   Larvæ dependent upon immediate surroundings for food supply: Rhynchophora, Bruchidæ, etc. (4*a*).
   Larvæ dependent upon other insects (4*a*, *ba*) .... 6.
6. Larvæ dependent upon insects of their own species for nourishment (altricious): Isoptera, Formicoidea, Vespoidea, Apoidea (5*c*).
   Larvæ dependent upon insects of other species for attention: Aphididæ (*ba*), Coccidæ, Aleurodidæ (5*c*) (frequently attended or distributed by ants).
7. Larvæ dependent upon insects of their own species for stored food: Sphecoidea, Bembecidæ (4*b*).
   Larvæ receiving their food at the expense of warm-blooded animals (4*b*) .... 8.
   Larvæ receiving their food at the expense of other insects (4*b*, 3*b*) .... 9.
8. Larvæ externally parasitic upon warm-blooded animals: Ixodoidea, Mallophaga, Parasitica (7*b*).
   Larvæ internally parasitic in warm-blooded animals: Oestridæ (7*b*).
9. Larvæ feeding upon food stored for other insects (commensals) (7*c*): termitophila, myrmecophila.
   Larvæ feeding upon other insects (7*c*) .... 10.
10. Larvæ feeding externally upon host (ectozoic) (9*b*) .... 11.
    Larvæ feeding internally upon host (endozoic) (9*b*) .... 12.
11. Larvæ compelled to seek or be carried to host: Rhipiphoridæ, Meloidæ (10*a*, 3*b*).
    Larvæ hatching in reach of host: Ichneumonidea, Chalcidoidea (10*a*).
12. Pupation outside of dead host: Sarcophagidæ (*ba*), Ichneumonoidea, Chalcidoidea (10*b*).
    Pupation within the skin of dead host: Tachinidæ, Ichneumonidæ (10*b*).
    Pupation within host, female never leaving host, which matures and does not die until the progeny of the parasite are distributed: Strepsiptera (10*b*, *bb*).

Although this table makes no attempt to comprehend all the various types of metamorphosis in insects, it is believed that it shows satisfactorily that the Strepsiptera represent the nearest approach to true permanent parasitism that is to be found in insects.

HOST LIST.

ORTHOPTERA.

Superfamily GRYLLOIDEA.

Family GRYLLOTALPIDÆ.

Gryllotalpa Latreille.
species, Vituland, East Africa (Voeltzkow, 1880, pp. 441–5).

HOMOPTERA.

The classification follows Kirkaldy.[a]

Superfamily CICADOIDEA.

Family TETIGONIIDÆ = JASSOIDEA Authors.

Tribe TETIGONIINI.

Tetigonia Geoffroy (*Tettigonia* Authors).
albida, Australia, *Pentoxocera*, species (Perkins, 1905).
parthaon Kirkaldy, Cairns, Queensland, (male, female); *Pentoxocera* (*Bruesia*) *australensis* Perkins (Perkins, 1905, 1906).
Oncometopia Stal.
lateralis Fabricius, Nogales, Arizona (A. Koebele), (male) (Perkins, 1907).
Diedrocephala Spinola.
sanguinolenta Coquibar, Cacao, Finca Trece Aguas, near Senaju, Alta Vera Paz, Guatemala, March (Schwarz and Barber); (puparium) *Pentoxocera schwarzi* Pierce.

Tribe PENTHIMIINI.

Xerophloea Germar.
viridis Fabricius, St. Vincent, West Indies; Grand Ance (South End); Fort St. George, Grenada, West Indies (H. H. Smith), (puparia, females); *Dioxocera insularum* Pierce.

Tribe PHRYNOMORPHINI.

Deltocephalus Burmeister.
?species, Australia (Perkins, 1906).
Eutettix Van Duzee.
species, Australia (Perkins, 1906).
Hecalus Stal.
immaculatus Kirkaldy, Cairns, Queensland; (female) *Pentoxocera* (*Bruesia*) *phæodes* Perkins (Perkins, 1905, 1906).

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[a] Hawaiian Sugar Planter's Experiment Station, 1907.

Tribe CEPHALELINI.

Paradorydium Kirkaldy.
menalus Kirkaldy, Cairns, Queensland; *Pentoxocera* (*Bruesia*) *stenodes* Perkins (Perkins, 1905, 1906).

Tribe ATHYSANINI.

Phlepsius Fieber.
species, Australia (Perkins, 1905).

Tribe EURYMELINI=BYTHOSCOPIDÆ Authors.

Agallia Curtis.
quadrinotata, Columbus, Ohio; *Agalliaphagus* (*Halictophagus?*) *americanus* Perkins (Perkins, 1905).
?species, Mittatong, New South Wales; *Pentacladocera* (*Halictophagus?*) *schwarzii* Perkins (Perkins, 1905).
Ceratagallia Kirkaldy.
bigeloviæ Baker, Nogales, Arizona (A. Koebele), (Perkins, 1907).
species, Australia (Perkins, 1905).

Superfamily FULGOROIDEA.

Family ASIRACIDÆ.

Perkinsiella Kirkaldy.
vitiensis Kirkaldy, Fiji; *Elenchoides perkinsi* Pierce (*Elenchus tenuicornis* Muir), (Muir, 1906, p. 6).
species, Fiji, *Elenchus* ?, species (Perkins, 1905, p. 93).
Megamelanus Ball.
species, Bay Ridge, Maryland, September 1 (Otto Heidemann).
Stobæra Stal.
species, Nogales, Arizona (A. Koebele), (Perkins, 1907).
Liburnia Stal.
brevipennis Boheman, Horsens, Denmark, September 25 (female); Ruderhegen, Denmark, March 9 (puparium); *Elenchus*, species (Meinert, 1896 *b*).
campestris Van Duzee, Columbus, Ohio, August 11 (males), August 17 (female); *Mecynocera koebelei* Pierce (collection U. S. National Museum).
lutulenta Van Duzee.
1. Columbus, Ohio, August 11 (male); *Mecynocera koebelei* Pierce (*tenuicornis* Perkins), (Perkins, 1905; collection U. S. National Museum).
2. Alameda, California (Perkins, 1905).

species, Surbiton, England, August 20 (male); *Elenchus tenuicornis* Kirby, (E. Saunders, 1892 *a*).
species, Queensland; (*Elenchus tenuicornis* Perkins), (Perkins, 1905).
species, Bay Ridge, Maryland, September 1 (Otto Heidemann).

Pentagramma Van Duzee.

vittatifrons Uhler, "Dacota" (Rothauer), (females); *Pentagrammaphila uhleri* Pierce (collection P. R. Uhler, U. S. National Museum).

Hadeodelphax Kirkaldy.

species, Australia (?) (*Elenchus tenuicornis* Perkins), (Perkins, 1906).

Aloha, Kirkaldy.

ipomoeæ Kirkaldy, Mount Tantalus (1,300 feet), Hawaii (W. M. Giffard); (*Elenchus tenuicornis* Muir)?, (Muir, 1906, p. 6).

Family ISSIDÆ.

Subfamily EURYBRACHYINÆ.

Platybrachys Stal.

species, Cairns, Queensland; *Deinelenchus australensis* Perkins (Perkins, 1905).

? species, Cairns, Queensland; *Megalechthrus tryoni* Perkins (Perkins).

Family POEKILLOPTERIDÆ.

Subfamily TROPIDUCHINÆ.

Tribe TROPIDUCHINI.

Epora Walker

subtilis Walker, Sarawak (puparium); *Colacina insidiator* Westwood (Westwood, 1877).

Location doubtful.

species, Semarang, Java, June, July (E. Jacobson), (male, female); *Neocholax jacobsoni* Meijere (Meijere, 1908).

species, Honolulu, Hawaii; *Elenchus* species (Perkins, 1906, in letter).

HETEROPTERA.

Family PENTATOMIDÆ.

Subfamily SCUTELLARINÆ.

Chrysocoris Hahn. (*Callidea* Burmeister).

grandis baro Fabricius, East Asia (female), (Sharp, 1899, p. 303; Perkins, 1905).

HYMENOPTERA.

Superfamily FORMICOIDEA.

Family FORMICIDÆ.

—————, species, Ramboddo, Ceylon, April 29; *Myrmecolax nietneri* Westwood (Westwood, 1861).

Superfamily VESPOIDEA.

Family MASARIDÆ.

Paragia Shuckard.

decipiens Shuckard, Australia (exuvium), (Smith, 1867).

tricolor Smith, Australia (female), (S. S. Saunders, 1872).

Family EUMENIDÆ.

Eumenes Latreille.

fenestralis Saussure, (female), (L. von Heyden, 1867).

maxillosa DeGeer (*tinctor* Christ) (female), (L. von Heyden, 1867).

petiolata Fabricius, India (female, exuvium), (Smith, 1859).

pomiformis Fabricius, Nicaea (puparium), (S. S. Saunders, 1872).

tinctor Christ = *maxillosa* DeGeer.

Rygchium Spinola (*Rhynchium* Billberg).

flavomarginatum Smith, Brazil (exuvium), (Smith, 1859).

Monobia Saussure.

quadridens Linnæus, Wolfe City, Texas, May 31 (female); Orange, Louisiana, August 23 (females), (F. C. Bishopp); *Monobiaphila bishoppi* Pierce (collection U. S. Cotton Boll Weevil Investigation).

Odynerus Latreille.

chloroticus, Spinola, (female), (L. von Heyden, 1867).

deflendus Saunders, Epirus; Corcyra (male); *Pseudoxenos heydenii* Saunders (S. S. Saunders, 1853).

species, Brazil (exuvium), (Smith, 1859).

Ancistrocerus Wesmael (*Odynerus* Latreille, part).

campestris Saussure, Missouri (C. V. Riley), (exuvium), collection U. S. National Museum).

parietum Linnæus, Corcyra (male); *Pseudoxenos schaumi* Saunders (S. S. Saunders, 1872).

Leionotus Saussure (*Odynerus* Latreille, part).

annulatus Say, Dallas, Texas, July 31, on *Helenium tenuifolium* (W. A. Hooker), (female), (collection U. S. Cotton Boll Weevil Investigation).

colon Cresson, Mound, Louisiana, May 12 (C. R. Jones), (female); *Leionotoxenos jonesi* Pierce (collection U. S. Cotton Boll Weevil Investigation).

foraminatus Saussure, Cincinnati, Ohio, August 10 (female), (Dury, 1902; collection C. Dury).

pertinax Saussure, National Park, Wyoming, July 31 (male), (collection U. S. National Museum).

vagans Saussure, Mound, Louisiana, May 12 (C. R. Jones), (female); *Leionotoxenos louisianae* Pierce (collection U. S. Cotton Boll Weevil Investigation).

verus Cresson, Dallas, Texas, July 21, on *Helenium tenuifolium* (W. A. Hooker), (female); *Leionotoxenos hookeri* Pierce (collection U. S. Cotton Boll Weevil Investigation). Triungulinids of this parasite were found on an *Agapostemon texanus* taken at the same flower species.

Hoplomerus Westwood (*Odynerus* Latreille, part).

lævipes Shuckard, Epirus (male); *Pseudoxenos klugii* Saunders (S. S. Saunders, 1872).

spinipes Linnæus, Corcyra (males); *Pseudoxenos? (Paraxenos) corcyricus* Saunders (S. S. Saunders, 1872).

Psiloglossa Saunders.

odyneroides Saunders, Epirus (exuvium), (S. S. Saunders, 1872).

Family VESPIDÆ.

Vespa Linnæus.

concolor Kirby (exuvium), (Kirby, 1813).

crabro Linnæus, Japan (female); *Vespæxenos crabronis* Pierce (C. F. Baker collection, U. S. National Museum).

ducalis Smith, Huë, Annam (male); *Vespæxenos buyssoni* Pierce (Buysson, 1906).

lama Buysson, Sikkim, India; altitude 12,500 feet (female) (Buysson, 1905).

magnifica Smith, Yun-nam and Tsé-kou, China (females); *Vespæxenos (Xenos) moutoni* Buysson, 1903).

mandarina Smith, Ngan-hoei and Yng-chan, China (females); *Vespæxenos (Xenos) moutoni* Buysson (Buysson, 1903).

nigra Buysson, Yun-nam and Tsé-kou, China (females); *Vespæxenos (Xenos) moutoni* Buysson (Buysson, 1903).

vulgaris Linnæus, Stuttgart, Germany (female), (Roser, 1836).

Polistes Latreille.

americanus Fabricius = *crinitus* Felt.

annularis Linnæus.

1. Austin, Texas, May (males); *Acroschismus (Xenos) pallidus* Brues, 1903).
2. Paris, Texas, July–October (males, females); *Acroschismus (Xenos) pallidus* Brues; *A. (X) nigrescens* Brues (Brues, 1905).
3. Paxton (Shelby County), Texas, August 9 (W. D. Pierce), (female).
4. Rosser, Texas, September, October (F. C. Bishopp, C. R. Jones), (males, females); *Acroschismus pallidus* Brues (collection U. S. Cotton Boll Weevil Investigation).

5. Agricultural College, Mississippi (female), (from collection Mississippi Agricultural College).
6. Bennington, Indian Territory, August 28 (J. C. Crawford), (collection U. S. Cotton Boll Weevil Investigation).
7. Victoria, Texas, July 16 (W. E. Hinds), (females), (collection U. S. National Museum).
8. Texas (Belfrage), (puparia), (collection U. S. National Museum).
9. Plummer's Island, Maryland, November, 1907 (female, puparia); W. P. Hay, W. L. McAtee, collectors; *Acroschismus pallidus* Brues.

aurifer Saussure.

1. Washington State (exuvium); California (puparium), (collection Philadelphia Academy of Sciences).
2. Folsom, California, July 10, 12 (exuvia), (collection U. S. National Museum).

bellicosus? Cresson, Natchitoches, Louisiana, September 15 (female); (collection U. S. Cotton Boll Weevil Investigation).

canadensis Linnæus.

1. Texas (exuvium), (collection Philadelphia Academy of Sciences).
2. Mound, Louisiana, August 20 (F. C. Bishopp), (exuvium), (collection U. S. Cotton Boll Weevil Investigation).

carnifex Fabricius, Mexico (puparium, exuvium), (collection Philadelphia Academy of Sciences).

crinitus Felton (*americanus* Fabricius).

1. North America (exuvium), (Smith, 1859).
2. Crescent City, Florida (H. G. Hubbard), (males, females); *Acroschismus hubbardi* Pierce (Hubbard, 1892; collection U. S. National Museum).

diadema Latreille = *gallicus* Linnæus.

flavus Cresson, Colorado (puparium), (collection U. S. National Museum).

fuscatus Fabricius, Newbury, Massachusetts (male); *Schistosiphon* (*Xenos*) *peckii* Kirby (Kirby, 1813).

gallicus Linnæus.

1. France; Italy (male); *Xenos vesparum* Rossi (Rossi, 1790, 1793).
2. Geneva, Switzerland (male); *Xenos jurinei* Saunders (Jurine, 1818).
3. Cairo, Egypt (males, females); *Xenos vesparum* Rossi (Nassonow, 1893 *a*).
4. Europe (Rouget, 1873), Rosenhauer, 1842.
5. (*diadema* Latreille), (Rouget, 1873).

6. (*diadema* Latreille), Innsbruck, Austria, October 28 (Karl Hofeneder).

hebræus Fabricius, Northwest India (female), (Horne, 1871).

instabilis Saussure.

1. Brazil (female, exuvium), (Smith, 1859). This Polistes is either *crinitus* Fabricius or *fuscatus* Fabricius.
2. New Orleans, Louisiana, July (exuvium), (collection U. S. National Museum).

lineatus Fabricius, Cuba (Palmer and Riley), (puparium, exuvium), (collection U. S. National Museum).

marginalis Fabricius.

1. Boma, Ethiopia (Schulz, 1905).
2. *stigma* Fabricius, Northwest India (female), (Horne, 1871).

metricus Say.

1. Colebrook, Connecticut, August (W. M. Wheeler), (males, females); *Acroschismus wheeleri* Pierce (*Xenos peckii* Brues), (Brues, 1903).
2. Washington, District of Columbia, September 6 (males); *Acroschismus wheeleri* Pierce (collection U. S. National Museum).
3. Ithaca, New York, August, September (authority, F. C. Chittenden).
4. Detroit, Michigan (males, females); *Acroschismus bruesi* Pierce (collection U. S. National Museum).
5. Readville, Massachusetts (males, females), (Austin, 1882).
6. Chicopee, Massachusetts (F. Knab), (exuvia).

navajoe Cresson, Metacomba Key, Florida, March, 1898 (Collins and Pollard), (exuvium), (collection U. S. National Museum).

pallipes Lepeletier.

1. Marion, Massachusetts, September 2–12; *Acroschismus bowditchi* Pierce (Bowditch, 1902; collection F. C. Bowditch).
2. Cincinnati, Ohio, June 15 (puparia); July 3 (puparia); August 24, 25 (exuvia, puparia, female; September 13 (exuvia); September 16 (males, females); September 22 (male); *Acroschismus bowditchi* Pierce (Dury, 1902, 1906; collections C. Dury, Annette F. Braun, Cincinnati, Ohio).

perplexus Cresson, Texas (exuvium), (collection Philadelphia Academy of Sciences).

rubiginosus Lepeletier.

1. Austin, Texas (male); *Acroschismus* (*Xenos*) *nigrescens* Brues (Brues, 1903, 1905).

2. Round Mountain, Texas (exuvia, female), (collection Philadelphia Academy of Sciences).
3. Logansport, Louisiana, June 6 (W. D. Pierce), (puparium, females); *Acroschismus rubiginosi* Pierce (collection U. S. Cotton Boll Weevil Investigation).
4. New Boston, Texas, September 26 (F. C. Bishopp), (exuvia, puparia), (collection U. S. Cotton Boll Weevil Investigation).
5. Henrietta, Texas, October 5 (J. C. Crawford), (exuvium).
6. Mineola, Texas, July 19 (Bishopp and Jones), (exuvia), (collection U. S. Cotton Boll Weevil Investigation).
7. Waco, Texas, August 29 (F. C. Bishopp), (female, exuvia); *Acroschismus pecosensis* Pierce (collection U. S. Cotton Boll Weevil Investigation).
8. Onaga, Kansas (Crevecoeur), (exuvium).
9. Texas, *Acroschismus maximus* Pierce.

stigma Fabricius = *marginalis stigma* Fabricius.

texanus Cresson.

1. Austin, Texas (exuvia), (Brues, 1903).
2. Victoria, Texas, July 7 (C. M. Walker), (puparia); (collection U. S. Cotton Boll Weevil Investigation).
3. Pecos, Texas, February 27 (puparia, males); September 25 (females); September 30 (males), (A. E. Brown); *Acroschismus pecosensis* Pierce (Skinner, 1903, *a, b;* collection Philadelphia Academy of Sciences).
4. Victoria, Texas, July 25 (C. R. Jones), (female, exuvium); *Acroschismus texani* Pierce (collection U. S. Cotton Boll Weevil Investigation).
5. New Mexico (C. F. Baker; collection U. S. National Museum).

variatus Cresson.

1. Connecticut, *Xenos peckii* Brues (Brues, 1903).
2. Washington, District of Columbia (puparia), (authority F. C. Chittenden).

species, Caffraria (male), (S. S. Saunders, 1872).

species, Hat Creek (Sioux County), Nebraska, August (female, exuvia); *Xenos bruneri* Pierce (from collection University of Nebraska).

species, Virginia (male), (collection Philadelphia Academy of Sciences).

species, Victoria, Texas, June 27 (females), (C. R. Jones); September 25 (females, puparia), (J. C. Crawford); *Acroschismus hunteri* Pierce (collection U. S. Cotton Boll Weevil Investigation).

Polybia Lepeletier.
sericea Olivier, Brazil (female), (Smith, 1859).
Belonogaster Saussure.
grisea Fabricius.
1. Africa (female), (S. S. Saunders, 1872).
2. (*rufipennis* De Geer), Africa (female, exuvium), (S. S. Saunders, 1872).
juncea Fabricius, Tripoli (female), (Smith, 1859).
rufipennis De Geer = *grisea* Fabricius.
Icaria Saussure.
ferruginea Fabricius, Northwest India (female), (Horne, 1871).

Superfamily SPHECOIDEA.

Family SPHECIDÆ.

Sceliphron Klug (*Pelopæus* Latreille).
chiliensis Spinola = *Chlorion spinolæ* Smith.
deformis Smith, Shanghai, China (female), (Smith, 1859).
fasciatum Lepeletier.
1. Chili (exuvium) (S. S. Saunders, 1872).
2. Santo Domingo (female); *Sceliphronechthrus fasciati* Pierce (collection U. S. National Museum).
flavo-fasciatum Smith, Celebes (exuvium), (S. S. Saunders, 1872).
intrudens Smith, Celebes (female), (Smith, 1859).
laboriosus Smith, Aru Island (female), (Smith, 1859).
tibialis Fabricius (*Sphex tibialis* Fabricius), North America (exuvia), (S. S. Saunders, 1872).
species, Australia (Perkins, 1905, 91).
Proterosphex Fernald (*Sphex* Authors). Synonymy according to Fernald (Proceedings U. S. National Museum, No. 1487).
auriflvus Perty = *ichneumoneus* Linnæus.
aurocapilla Templeton = *ichneumoneus auriflvus* Perty.
caliginosus Erichson, Boqueti, Chiriqui, Panama (2,500 feet altitude), (Rosenberg), (exuvia), (C. F. Baker, collection U. S. National Museum).
flavipes Smith = *flavitarsis* Fernald.
flavitarsis Fernald (*flavipes* Smith), Georgia (exuvium), (Smith, 1859).
ichneumoneus Linnæus.
1. North America (males); new species larger by one-half than *Xenos peckii* (L. von Heyden, 1867).
2. Cincinnati, Ohio, June 18 (female, puparia), (Dury, 1902; collection C. Dury, Cincinnati).

3. *aurifluus* Perty (*aurocapilla* Templeton), Brazil (male); *Homilops* (*Paraxenos*) *westwoodi* Templeton (Templeton 1838).
4. Waco Texas, August 29 (F. C. Bishopp), (females, exuvia); *Homilops bishoppi* Pierce (collection U. S. Cotton Boll Weevil Investigation).

pennsylvanicus Linnæus, det. Ashmead, Cincinnati, Ohio, August 12 (Annette F. Braun), (female, exuvium).

pernanus (?) Kohl, Santo Domingo (females, exuvium); *Homilops ashmeadi* Pierce (collection U. S. National Museum).

petiolata Smith = *Isodontia costipennis* Spinola.

tibialis Fabricius = *Sceliphron tibialis* Fabricius.

new species (female, exuvium), (S. S. Saunders, 1872).

species, Trong, Lower Siam (Dr. W. L. Abbot), (exuvia, female); *Homilops abbotti* Pierce (collection U. S. National Museum).

Isodontia Patton.

costipennis Spinola (*petiolata* Smith), Brazil (female), (Smith, 1859).

Chlorion Latreille.

spinolæ Smith (*Pelopæus chiliensis* Spinola), Chili (exuvium), (Smith, 1859).

Parasphex Smith.

albisecta Lepeletier, Epirus (female), (S. S. Saunders, 1872).

fervens Fabricius = *viduatus* Christ.

viduatus Christ (*fervens* Fabricius), India (female), (S. S. Saunders, 1872).

Priononyx Dahlbom.

atrata Lepeletier, Cincinnati, Ohio, June 17 (female); August 16, (male); August 19 (male); September 21 (puparium, female); *Ophthalmochlus duryi* Pierce (Dury, 1902; collections C. Dury, Annette F. Braun, Cincinnati, Ohio).

chiliensis Lepeletier, Chili (E. C. Reed), (male, exuvia); (C. F. Baker, collection U. S. National Museum.)

Sphex Linnæus (*Ammophila*, Authors).

atripes Smith, India (female), (S. S. Saunders, 1872).

capensis Lepeletier = *tydei* Guillon.

extremitatus Cresson, Cincinnati, Ohio, August 6 (female); August 30 (females, male); *Eupathocera lugubris* (?) Pierce (Dury, 1902; collection C. Dury).

ferrugineipes Lepeletier, Gambia (exuvium), (Smith, 1859).

fragilis Smith, Cincinnati, Ohio, September 3 (male); October 2 (exuvium); *Eupathocera lugubris* Pierce (collection C. Dury).

holosericea Fabricius, Sicily (females, exuvium), (Smith, 1859).

intercepta Lepeletier, Cincinnati, Ohio, August 25 (exuvium), (collection C. Dury).

procera Dahlbom (*gryphus* Smith, det. Dury), Cincinnati, Ohio, September (authority C. Dury).
pruinosa Cresson, Canyon City, Colorado, August; Denver, Colorado (J. S. Hunter), (female), *Eupathocera pruinosæ* Pierce.
sabulosa Linnæus, France, Germany (female); *Eupathocera?* (*Paraxenos*) *sphecidarum* Dufour (Dufour, 1837; Siebold, 1839).
tydei Guillon (*capensis* Lepeletier), Tunis (exuvium), (Smith, 1859).
varipes Cresson, Beulah, New Mexico, August 11 (exuvium), (Viereck, 1903; collection Philadelphia Academy of Sciences).
species, Milwaukee, Wisconsin (male), (S. Grænicher in letter).

Miscus Jurine.
campestris Latreille, Germany, *Eupathocera* (?) (*Paraxenos*) *sieboldii* Saunders (Siebold, 1839).

Family STIZIDÆ.

Stizomorphus Costa.
species (Perez, 1886).
species, Australia (Perkins, 1905, 91).

Family BEMBECIDÆ.

Bembecinus Costa.
peregrinus Smith, Corcyra; *Paraxenos erberi* Saunders (S. S. Saunders, 1872).

Bembex Fabricius.
species, Australia (Perkins, 1905, p. 91; 1906 in letter).

Superfamily APOIDEA.

Family PROSOPIDÆ.

Prosopis Fabricius.
bipunctata Fabricius, England (female), (S. S. Saunders, 1872).
gibba Saunders, Epirus (male, female); *Hylechthrus quercus* Saunders (S. S. Saunders, 1850).
rubicola Saunders.

1. Epirus (male, female); *Hylechthrus rubi* Saunders; *Hylechthrus rubi pustulatus* Saunders (S. S. Saunders, 1850).
2. (stylop) *versicolor* Saunders, Epirus (males); *Hylechthrus rubi* Saunders (S. S. Saunders, 1850).

signata Panzer = *bipunctata* Fabricius.
variegata Saunders, Epirus (female, exuvium); *Hylechthrus sieboldii* Saunders (S. S. Saunders, 1853).

Family ANDRENIDÆ, Authors.

Subfamily HALICTINÆ.

Hălictus Latreille.

æratus Kirby, England (female), (Curtis, 1832). Curtis ascribed *Halictophagus curtisii* Dale to this host because he found it flying in the same locality as a parasitized bee.

albipennis Robertson (*Chloralictus*), Milwaukee, Wisconsin, August 4 (S. Grænicher), (females); *Halictoxenos grænicheri* Pierce.

?*albipes* Kirby.

1. England (Perkins, 1892).
2. (*obovatus* Kirby), England (S. S. Saunders, 1872).

bruneri Crawford (*Chloralictus*), West Point, Nebraska, June 10 (female); *Halictoxenos crawfordi* Pierce (from collection J. C. Crawford).

calceatus Scopoli (*cylindricus* Fabricius), England (Perkins, 1892).

cylindricus Fabricius = *calceatus* Scopoli.

longulus Smith, England (female), (Smith, 1859).

manilæ Ashmead, Manila, Philippine Islands (Robt. Brown), (female); *Halictoxenos manilæ* Pierce (collection U. S. National Museum).

minutissimus Kirby, England (Perkins, 1892).

minutus (Schrank) Lepeletier, England (female); *Halictostylops* (*Halictophagus*) *spencii* Nassonow (Smith, 1859; Nassonow, 1893 *a*, *b*).

morio Fabricius, England (Perkins, 1892).

nitidiusculus Kirby, England (female), (Smith, 1859).

obovatus Kirby = *albipes* Kirby.

quadrinotatus Kirby, England (female), (S. S. Saunders, 1872).

robbii Ashmead, Manila, Philippine Islands (female); *Halictoxenos robbii* Pierce (collection U. S. National Museum).

rubicundus Christ, England (female), (S. S. Saunders, 1872).

sparsus Robertson (*Chloralictus*), Ardmore, Oklahoma, March 12 (F. C. Bishopp), (female); *Halictoxenos sparsi* Pierce.

tumulorum Linnæus, England (female), (Perkins, 1892).

versatus Robertson (*Chloralictus*), Milwaukee, Wisconsin, September 1, 10, 22 (S. Grænicher), (females); *Halictoxenos versati* Pierce.

xanthopus Kirby, England (Perkins, 1905, 92).

zephyrus Smith (*Chloralictus*), Milwaukee, Wisconsin, September 12 (S. Grænicher), (female); *Halictoxenos zephyri* Pierce.

species, Selma, Alabama, October (W. H. Patton), (exuvium), (collection Philadelphia Academy of Sciences.)

species (*Chloralictus*), Logansport, Louisiana, June 7 (W. D. Pierce), (male); Mound, Louisiana, May 12 (C. R. Jones), (puparium); *Halictoxenos jonesi* Pierce (collection U. S. Cotton Boll Weevil Investigation).

Subfamily ANDRENINÆ.

Andrena Fabricius. The synonymy of species is according to Dalla Torre (1895), which brings the synonymy later than the "Catalogus."

advarians Viereck (types), Vancouver, British Columbia, March 26, April 5 (females); *Stylops advarians* Pierce.

æneiventris Morawitz (Perez, 1886).

afzeliella Kirby.

1. (First generation) England, France (females), (Pickering, 1835; Smith, 1875; Perez, 1886; Alfken,1899).
2. *albofasciata* Thomson (second generation), (Perez).
3. (stylopized) *convexiuscula* Kirby, England (male, female); *Stylops thwaitei* Saunders (Thwaites, 1841; Smith, 1875; Alfken, 1899).
4. (stylopized) *convexiuscula* Kirby, Mecklenburg, Sachsen, and Elsass, Germany; Switzerland; Hungary (Friese, 1893).
5. *fuscata* Kirby, England (female), (Smith, 1859).

albicrus Kirby.

1. Strandmellen Nordsjaelland, Denmark (male); (*Stylops mellitæ* Meinert), (Meinert 1896 *b*).
2. Hungary (Friese, 1893).
3. (*barbilabris* Kirby), England (male, female); *Stylops dalii* Curtis (Curtis, 1832).

albofasciata Thomson = *afzeliella albofasciata* Thomson.

albopunctata Rossi (*funebris* Panzer), (Perez, 1886).

angustitarsata Viereck = *subtilis* Smith (stylopized) *angustitarsata* Viereck.

aprilina Smith = *nigroænea* (stylopized) *aprilina* Smith.

atriceps Kirby = *tibialis* Kirby.

austriaca Panzer.

1. Fiume, Hungary (Friese, 1893).
2. (*rosæ* Panzer), Epirus (female), (S. S. Saunders, 1872; Perez, 1886).

barbilabris Kirby = *albicrus* Kirby.

biareolina Perez = *Biareolina neglecta* Dufour.

bicolor Fabricius = *gwynana bicolor* Fabricius (vernal).

bimaculata Kirby.

1. (*conjuncta* Smith), (Smith; Perez, 1886.)
2. *decorata* Smith, Bozen, Germany (Friese, 1906).

3. *decorata* Smith (*magrettiana* Schmiedeknecht), Lugens, Switzerland (Friese, 1893).

bipunctata Cresson (*Opandrena*).

1. Sioux County, Nebraska, May (L. Bruner), (female); *Stylops bipunctatæ* Pierce (collection University of Nebraska).
2. Milwaukee, Wisconsin, April 8, 17, (females); *Stylops bipunctatæ* Pierce (collection S. Graenicher).
3. Park County, Wisconsin (C. F. Baker), (female); Indiana (C. F. Baker), (female); Alabama (C. F. Baker), (female); *Stylops bipunctatæ* Pierce.

braunsiana Friese, Hungary (Friese, 1893), Peste (Nassonow, 1893 *a*).

bucephala Stephens.

1. (Perez, 1886.)
2. Hungary (Friese, 1893).

carbonaria Fabricius.

1. Egypt (female), (S. S. Saunders, 1872).
2. Ribben, Kreis Sensburg, East Prussia, May 30 (Dr. P. Speiser in letter).
3. (*pilipes* Rossi), *Stylops nassonowi* Pierce (*melittæ* Nassonow), (Nassonow, 1893 *a*; Perez, 1886).
4. (*pilipes* Rossi), Schwerin and Zerbst, Germany (Friese, 1893).

chalybea Perez = *suerinensis* Friese.

chrysosceles Kirby (Smith; Perez, 1886; Schmiedeknecht, 1884; Chitty, 1902).

cineraria Linnæus (Sagemehl, 1882).

cingulata Fabricius (Perez, 1886).

clarkella Kirby (Smith; Perez, 1886).

claytoniæ Robertson (*Trachandrena*).

1. Thomasville, Georgia, March 21 (M. Hebard), (female), *Stylops claytoniæ* Pierce.
2. Carlinville, Illinois (Robertson, 1891).

collinsonana Kirby = *proxima* Kirby.

combinata Christ, Fiume, Hungary; Straussburg, Germany (Friese, 1893; Perez, 1886).

commoda Smith (*corni* Robertson), Milwaukee, Wisconsin, June 2, 17 (female); *Stylops cornii* Pierce (collection S. Graenicher).

congerens (Schmiedeknecht) Nassonow = *congruens* Schmiedeknecht.

congruens Schmiedeknecht (*congerens* Nassonow), Fiume, Hungary (Friese, 1893; Nassonow, 1893 *a*).

conjuncta Smith = *bimaculata* Kirby.

convexiuscula Kirby = *afzeliella* (stylopized) *convexiuscula* Kirby.

corni Robertson = *commoda* Smith.

crawfordi Viereck (*Pterandrena*), Dallas, Texas, April 26–May 24 (Crawford, Pierce, Bishopp), (puparia, exuvia, females) *Stylops crawfordi* Pierce (collection U. S. Cotton Boll Weevil Investigation).
cressoni Robertson (*Opandrena*), Waldoboro, Maine, June 16 (H. L. Viereck), (female); *Stylops cressoni* Pierce.
curvungula Thomson (*squamigera* Schenck), (Perez, 1886).
decipiens Schenck (Perez, 1886).
decorata Smith = *bimaculata* Kirby *decorata* Smith.
denticulata Kirby (*listerella* Kirby), Osnabruck, Germany (Friese, 1893; Perez, 1886).
desponsa Smith, Nova Scotia (male, female); *Stylops childreni* Gray (Smith, 1853).
dilecta Mocsary = *ephippium* Spinola.
distinguenda Schenck, Agram, Hungary (Friese, 1893; Perez, 1896).
dubitata Schenck, Thuringen; Hungary (Friese, 1893; Perez, 1886).
ephippium Spinola (*dilecta* Mocsary), Hungary (Friese, 1893).
erigeniæ Robertson (*Ptilandrena*), Carlinville, Illinois (Robertson, 1891).
extricata Smith (Perez, 1886).
ferox Smith (Chitty, 1902).
fimbriata Brullé = *variabilis* Smith.
flavipes Panzer (*fulvicrus* Kirby).

1. England (female), (Pickering, 1835; Perez, 1886).
2. Sarepta, Russia (Friese, 1893).

flavoclypesta miserabilis Cresson; Ardmore, Oklahoma, March 12, 1907 (F. C. Bishopp), (female); *Stylops oklahoma* Pierce (collection U. S. Cotton Boll Weevil Investigation).
flessæ Panzer, Fiume, Hungary; *Stylops dominiquei* Pierce (Friese, 1893; Perez, 1886; Dominique, 1891).
florea Fabricius (Perez, 1886).
fucata Smith, Mecklenburg, Germany (Friese, 1893); Varnamyunda ?, March 28–May 5 (Nassonow, 1893 *a*).
fulva Schrank.

1. England (female), (Perkins, 1892; Perez, 1886).
2. Fiume, Hungary; Berne, Switzerland (Friese, 1893).

fulvescens Smith = *humilis* Imhof.
fulvicrus Kirby = *flavipes* Panzer.
funebris Panzer = *albopunctata* Rossi.
fuscata Kirby = *afzeliella fuscata* Kirby.
fuscipes Kirby (*pubescens* Fabricius), England (female), (Pickering, 1835; Perez, 1886).
gallica Perez (Perez, 1886).

gascheti Perez (Perez, 1886).

gwynana Kirby.

1. (*æstival*) England (female), (Pickering, 1835; Smith, 1859).
2. (*æstival*), Mecklenburg and Strassburg, Germany (Friese, 1893).
3. *bicolor* Fabricius (vernal), England (female), (Smith, 1859; Perez 1886).

hartfordensis Cockerell, Thomasville, Georgia, March 27 (M. Hebard), (female); *Stylops hartfordensis* Pierce.

helvola Linnæus = *varians helvola* Linnæus.

hippotes Robertson (*Trachandrena*), Columbus, Ohio, April 21 (female); *Stylops hippotes* Pierce.

humilis Imhof (*fulvescens* Smith), Strassburg, Germany (Friese, 1893; Perez, 1886).

illinoiensis Robertson.

1. Lincoln, Nebraska, April (females); Sioux County, Nebraska, May (female); *Stylops bruneri* Pierce (collection University of Nebraska).
2. Carlinville, Illinois (Robertson, 1891).

imitatrix Cresson (*Trachandrena*).

1. Round Mountain, Texas (female); *Stylops imitatrix* Pierce.
2. Ardmore, Oklahoma, March 12 (F. C. Bishopp), (females); *Stylops imitatrix* Pierce (collection U. S. Cotton Boll Weevil Investigation).

insolita Dufour = *variabilis* Smith.

junonia Viereck = *solidula* (stylopized) *junonia* Viereck.

korleviciana Friese, Fiume, Hungary (Friese, 1893).

labialis Kirby, England (male, female); *Stylops dalii* Curtis (Curtis, 1832; Smith, 1875; Perez, 1886).

labiata Schenck = *schenckii* Morawitz.

lapponica Zetterstedt, England (female), (Theobald, 1892).

latifimbria Perez = *niveata* Friese.

leucolippa Perez (Perez, 1886).

lichtensteinii Schmiedeknecht (Perez, 1886).

listerella Kirby = *denticulata* Kirby.

livens Perez (Perez, 1886).

maggretiana Schmiedeknecht = *bimaculata decorata* Smith.

minutula Kirby = *parvula minutula* Kirby (vernal).

mitis (Perez) Schmiedeknecht, Agram, Hungary (Friese, 1893).

morio Brullé, Hungary (Friese, 1893).

mouffetella Kirby = *tibialis* (stylopized) *mouffetella* Kirby.

multiplicata Cockerell, Milwaukee, Wisconsin, May 30, June 9 (females); *Stylops multiplicatæ* Pierce (collection S. Graenicher).

nana Kirby, England (female), (Perkins, 1892).

nasoni Robertson (metatype), Ashbourne, Pennsylvania, April 19 (H. L. Viereck), (female); *Stylops nasoni* Pierce (from collection H. L. Viereck).

neglecta Dufour (*Biareolina*) = *Biareolina neglecta* Dufour.

nigroaenea Kirby.

1. England (male, female); *Stylops melittæ* Kirby (Kirby, 1802; Perez, 1886).
2. Mecklenburg and Strassburg, Germany; Thüringia; Hungary (Friese, 1893).
3. (stylopized) *aprilina* Smith, England (females, exuvium), (S. S. Saunders, 1872; Smith).

nigrosericea Dours, Hungary (Friese, 1893).

nitida Kirby.

1. England (female), (Smith, 1859; Perez, 1886).
2. Strassburg, Germany; Thüringia; Hungary (Friese, 1893).

nitidiuscula Schenck (Perez, 1886).

nivalis Smith, Milwaukee, Wisconsin, June 11 (female); *Stylops grœnicheri* Pierce (collection S. Graenicher).

niveata Friese (*latifimbria* Perez), (Perez, 1886).

nubecula Smith, Twin Mountain, New Hampshire (W. F. Fiske), (exuvium); Colorado (female); *Stylops nubeculæ* Pierce.

nycthemera Imhof, Strassburg, Germany (Friese, 1893, 1906).

ovina Klug (*pratensis* Nylander), Merseburg and Wessenfels, Germany (males, females); *Stylops aterrimus* Friese (Sagemehl, 1882; Friese, 1883, 1893; Nassonow, 1893 *a*).

panurgina Destefani (Perez, 1886).

parviceps Kriechbaumer, Fiume, Hungary (Friese, 1893).

parvula Kirby.

1. England (female), (Pickering, 1835; Smith, 1859; Sagemehl, 1882; Perez, 1886).
2. Gissen (Nassonow, 1893 *a*).
3. *minutula* Kirby, Germany, "everywhere" (Friese, 1893).
4. *minutula* Kirby, England (female), (Perkins, 1892).

piceicornis Dours = *variabilis* Smith.

picicornis Kirby = *trimmerana* (stylopized) *picicornis* Kirby.

picicrus Schenck (*albofasciata* Perez), (Schenck; Perez, 1886).

picipes Kirby = *trimmerana* (stylopized) *picipes* Kirby.

pilipes Rossi = *carbonaria* Linnæus.

placida Smith, Salem, Massachusetts, April 29 (male, female); *Stylops packardi* Pierce (*childreni* Packard), (Packard, 1864, 1872).

polemonii Robertson, Colorado (C. F. Baker) (female); *Stylops polemonii* Pierce.

præcox Scopoli.

1. England (female), (Perkins, 1892).
2. Schwerin, Germany; Hungary (Friese, 1893).

pratensis Nylander = *ovina* Klug.

proxima Kirby.

1. Fiume, Hungary (Friese, 1893).
2. (*collinsonana* Kirby), England (female), (Pickering, 1835)

pubescens Fabricius = *fuscipes* Kirby.

ranunculi Schmiedeknecht (Perez, 1886).

robertsoni Dalla Torre (*Opandrena*).

1. Columbus, Ohio (female).
2. Polk County, Wisconsin (C. F. Baker), (female).

rosae Panzer = *austriaca* Panzer.

rufitarsis Zetterstedt, England (female), (Shuckard, 1866).

rufohispida Dours, "Balearen" and Elche, Spain (Friese, 1893).

rufula Schmiedeknecht, Agram, Hungary (Friese, 1893).

salicifloris Cockerell (*Trachandrena*).

1. Washington State (female); *Stylops salicifloris* Pierce.
2. var., Seattle, Washington (female).

schencki Morawitz (*labiata* Schenck), Thuringia, Germany; Hungary (Friese, 1893; Perez, 1886).

scita Eversmann, Hungary (Friese, 1893; Perez, 1886).

separata Smith (*labialis separata* Perez), England (female), (Smith, 1847).

sericata Imhof (*vetula* Lepeletier?), Agram, Hungary (Friese, 1893; Perez, 1886).

simillima? Smith, Florida (female, exuvium), (Smith, 1859).

sitiliæ Viereck, Dallas, Texas, May 7 (exuvium), (J. C. Crawford), (collection U. S. Cotton Boll Weevil Investigation).

solidaginis Robertson (*Pterandrena*).

1. Lincoln, Nebraska, August 8, 18, 30; September (L. Bruner, M. H. Swenk, W. D. Pierce), (females); *Stylops swenki* Pierce (Pierce, 1904).
2. Collingdale (Delaware County), Pennsylvania, August 31.

solidula Viereck.

1. Pullman, Washington (C. V. Piper), (female); *Stylops solidulæ* Pierce.
2. (stylopized) *junonia* Viereck, Pullman, Washington (C. V. Piper), (female); *Stylops solidulæ* Pierce.

sparsipilosa Viereck (paratype), Waldoboro, Maine, July 12 (females); *Stylops sparsipilosæ* Pierce.

squamigera Schenck = *curvungula* Thomson.

subcandida Viereck, Southern California (females).
subtilis Smith.
1. Southern California (females); *Stylops californica* Pierce (from collection University of Nebraska).
2. (stylopized) *angustitarsata* Viereck, Washington (female).

suerinensis Friese (*chalybea* Perez), Budapest, Hungary (Friese, 1893; Perez, 1886).
taraxaci Giraud (Perez, 1886).
texana profunda Viereck MS. (*Trachandrena*), Fedor, Texas, March 18 (G. Birkman), (female); *Stylops viereck*i Pierce.
thoracica Fabricius, Epirus (female), (S. S. Saunders, 1872; Perez, 1886).
tibialis Kirby.
1. England (male, female); *Stylops spencii* Pickering (*melittæ* Nassonow), (Pickering, 1835; Nassonow, 1893 *a*).
2. Strassburg, Germany (Friese, 1893; Nassonow, 1893 *a*).
3. (stylopized) *mouffetella* Kirby, England (female), (Pickering, 1835).
4. (*atriceps* Kirby), England (female), (Smith, 1875; Enock, 1875; Perkins, 1892).

trimmerana Kirby.
1. England (male); *Stylops aterrima* Newport (Newport, 1847; Perez, 1886).
2. (stylopized) *picicornis* Kirby, England (female), (Pickering, 1835).
3. (stylopized) *picipes* Kirby, England (female, exuvium), (S. S. Saunders, 1872).

truncatilabris Morawitz, Budapest, Hungary (Friese, 1893).
variabilis Smith.
1. (*fimbriata* Brullé), Epirus (female), (S. S. Saunders, 1872; Perez, 1886).
2. (*piceicornis* Dours (stylopized) *insolita* Dufour), (Perez, 1886).

varians Rossi.
1. England (female), (Pickering, 1835; Smith, 1859; Perez, 1886).
2. Rostock and Strassburg, Germany; Hungary (Friese, 1893); Strassburg (Nassonow, 1893 *a*).
3. *helvola* Linnæus, Rostock and Strassburg, Germany (Friese, 1893).

ventricosa Dours.
1. (Female), *Stylops ventricosæ* Pierce (*melittæ* Nassonow), (Nassonow, 1893 *a*).
2. Fiume, Hungary (Friese, 1893).

vetula Lepeletier=*sericata* Imhof.

vicina Smith.

1. Salem, Massachusetts, June 18 (female); *Stylops vicinæ* Pierce (*Stylops childreni* Packard) (Packard, 1864).
2. Canada, New Hampshire (females) *Stylops vicinæ* Pierce.

victima (?) Smith, Nova Scotia (male); *Stylops childreni* Gray (Latreille, 1845; Smith, 1853).

wilkella Kirby=*xanthura* Kirby.

xanthura Kirby.

1. England (female), (Pickering, 1835; Smith, 1859; Perez, 1886).
2. Kamionken, Kreis Sensburg, East Prussia, June 14 (female), (Dr. P. Speiser in letter).
3. Bremen, Germany, April 25 (male, female), (Alfken, 1899).
4. (*wilkella* Kirby), England (female), (Perkins, 1892; Chitty, 1902).

species, Canada (female), (C. F. Baker).

species, Nevada (female).

species, Southern California (female).

species (*Trachandrena*), Nevada (females).

species, Colorado (female), (collection U. S. National Museum).

Family PANURGIDÆ.

Panurginus Nylander.

ornatipes Cresson (*boylei* Cockerell), Las Vegas, New Mexico, August 3 (W. Porter), (female); *Crawfordia cockerelli* Pierce (collection U. S. National Museum).

new species, West Point, Nebraska, August 10 (male, female); *Crawfordia pulvinipes* Pierce (Pierce, 1904).

Halictoides Nylander.

species, Innsbruck, Germany (female), (Friese, 1906).

Biareolina Dufour.

neglecta Dufour (*Andrena biareolina* Perez), (Perez, 1886).

Family ANTHOPHORIDÆ.

Meliturga Latrielle.

species, Hungary (female), (Friese, 1893, 1906).

GLOSSARY OF TERMS INCLUDED IN THIS WORK.

A.

Ædeagus.—See *Œdeagus.*

Anal lobes.—A pair of reflexed lobes at the apex of the ninth or last ventral segment of the male.

Analogue.—Used in this paper only with reference to parts of the puparium.

Antennal analogue.—See *Analogue.*

Antennal flabellations.—The lobes of the third and succeeding joints of the male antennæ.

Anus.—The pore at the tip of the tenth abdominal segment.

Appendiculate tarsi.—Tarsi in which there seems to be a pulvilliform appendage to each joint.

Autophagus.—Applied to self-feeding larvæ.

B.

Balancers.—Another term for the elytra, or pseudelytra.

Brood canal.—A passage formed between the encased female and its persistent pupal skin, on the ventral side, leading from the genital apertures to the slit between the head and prothorax, on the cephalothorax; it serves as the exit canal for the newly hatched triungulinids.

Buccal cavity.—The mouth opening.

C.

Campodeoid larva.—The triungulinid, or free living hexapod; so called because of its general habitus; this is the first larval stage of the hypermetamorphic insects of the meloid type.

Carabidoid larva.—The second larva of hypermetamorphic insects of the meloid type; so called because of the resemblance to carabid larvæ in that the legs are still available for use.

Cephalic ganglion.—The supraœsophageal ganglion, or brain.

Cephalotheca.—The head cap of the puparium.

Cephalothorax.—The exposed flattened disk of the adult female; it is composed of the adnate parts of the head and thorax.

Chilophagous.—Applied to larvæ which feed upon stored up or foraged provisions.

Coarctate larva.—Generally the fifth instar of hypermetamorphic insects of the meloid type; this stage is semiquiescent, and is in Meloidæ also known as the pseudopupa.

Colony.—A comprehensive term to indicate all forms of social intercourse found amongst insects; for definitions of specific kinds of colonies see *Community, Hill, Hive, Nest.*

Community.—A colony of insects living in close contiguity to each other, but in separate holes, and those of the same species entirely independent of each other; all, however, being dependent upon certain local conditions; the colony may contain numerous solitary dwellers, social colonies, and parasites (Pierce, 1904, p. 181).

E.

Ectoparasite.—A parasite which lives only on the exterior of its host.

Elytra.—See *Pseudelytra.*

Encased female.—The adult female, which is always encased within its pupal skin.

Endoparasite.—A parasite which lives at some time during its biology in the interior of its host.

Epicranium.—The dorsal part of the head bearing the eyes, ventrally fused with the genæ with which it limits the buccal cavity.

Epimeron.—Used by Audouin for *Scutum.*

Exuvium.—The pupal skin after the exit of the male.

F.

Female.—See *Encased female.*

Femoralia.—Pleural segments on each side of the male postscutellum.

Flabellate.—Referring to the antennæ with lateral prolongations of the joints.

Foreign host.—The host of another parasite and not of the species in question.

Free larva.—The *Triungulinid* or *Campodeoid larva.*

G.

Genæ.—The plates at the sides of the eyes beneath, under which the mandibles and maxillæ arise.

Genital apertures.—The unpaired median ventral openings from the female body cavity into the brood canal.

Genital pore.—In the male, the pore at or near the tip of the œdeagus through which the penis may be exserted.

H.

Heterophagous.—Applied to larvæ which have to be fed by others.

Hexapod.—A term incorrectly used to designate the triungulinid; as it is generally used for all insects, it should be discarded in this sense.

Hill.—A colony of fossorial insects in which division of labor is practiced, as, for instance, ants and termites.

Hive.—A social colony of Hymenoptera constructing the nest of wax.

Host.—That insect which directly or indirectly furthers the life of the parasite. See *Foreign host*, *Maternal host*, *Permanent host*, *Temporary host.*

Host plant.—A plant habituated by a certain species of insect.

Hypermetamorphosis.—A complete metamorphosis in which the larva or pupa assumes very different aspects in different instars.

Hypopygium.—A term used by authors in referring to the ninth abdominal segment of the males.

I.

Instar.—Any successive stage in the metamorphosis, limited by two successive molts.

Interlumbium.—Used by Saunders for *Scutellum.*

L.

Labium.—The labium is absent, although the embryo discloses the corresponding lobe.

Labrum.—The labrum is absent; even in the embryo it is not represented by a lobe.

Larvæ.—See *Campodeoid*, *Carabidoid*, *Coarctate*, *Free*, *Parasitic*, *Scarabæidoid*, *Second*, *Third*, *Triungulinid.*

Larviparous reproduction.—The production of living young from the body of the parent.

Lumbi.—The side pieces composing the scutum.

M.

Mandibles.—The ensiform chitinous appendages arising under the genæ.

Mandibular analogue.—See *Analogue.*

Maternal host.—The adult insect sheltering the mature female; used in distinguishing between the host at the time of birth of the triungulinid and the larva which it is about to attack and make its permanent host.

Maxillæ.—The second pair of organs of the mouth.

Maxillary analogue.—See *Analogue.*

Mesostigmatal lobe.—A lobate organ, arising from the mesopleuræ and protecting the mesostigmatal pore.

Metapleura.—A narrow side piece bordering the scutum and behind the wings.

Molt.—The perfect or imperfect casting of the skin, or the complete separation but persistence of an immature skin. See *Female, Persistent larval skins, Persistent pupa, Puparium.* The molt is the act which separates the instars and stages.

N.

Nest.—The habitat of paper making, social Hymenoptera.

Ninth abdominal segment.—That elongate terminal segment of the male abdomen apically bearing the genital armature and basally overhung by the tenth segment. See *Hypopygium, Œdeagus.*

O.

Occiput.—The narrow ventral band at the base of the head and limiting the buccal cavity.

Œdeagus.—The tubelike sheath of the penis, arising at the apex of the ninth or terminal segment of the abdomen. See *Paramera, Penis.*

Oligotropic.—Refers to insects which visit a single species or genus of flowers, or sometimes to those which are confined to a single family of flowers.

Ommatidium.—A single facet of the eye, each being separated by a ciliate wall.

Osmosis surface.—Any surface of the body through which vigorous osmotic ingestion takes place.

Osmotic ingestion.—Obtaining food or nourishment through portions of the body at the expense of the vital organs of the host.

P.

Pædogenesis.—The production of young by immature parents.

Palpus, maxillary.—The second joint of the second pair of organs of the mouth.

Paramera.—The sheaths of the penis, together forming the œdeagus. In Strepsiptera they are fused throughout.

Parapleura.—A narrow side piece to which the wing is attached; it lies below the metapleura.

Parasitic larvæ.—All instars of the larval period after the entrance into the permanent host.

Penis.—A very slender tube contained within the œdeagus and which may be exserted through a pore in the latter.

Permanent host.—The host which harbors the strepsipteran from triungulinid until maturity.

Persistent larval skins.—The unshed larval skins which conceal the male pupa and form the pupa case or puparium.

Persistent pupa.—The stage of female maturity in which the adult remains hidden by its pupal skin until death.

Pharynx.—This organ, as the writer interprets it, is composed not only of the lining of the narrow opening near the front of the buccal cavity, but of the entire lining of the cavity, bounded by epicranium, genæ, and occiput. The lining of the pharynx is soft and evidently sensitive and forms, as it were, a broad surface, elevated crater-like in the middle and there constricted into a narrow tube. The clypeus, if present, is fused, and the labrum and labium are absent.

Philotropic.—Refers to flower-loving insects.

Podal analogue.—See *Analogue.*

Podex.—The term used by Kirby for the tenth abdominal segment.

Polytropic.—Refers to indiscriminate flower-visitors.

Postlumbium.—A narrow transverse band behind the scutellum of the male (=*Scutellum* Audouin).

Postscutellum.—The terminal portion of the metanotum (=*Proscutellum* Saunders).

Præscutum—The anterior segment of the metanotum (=*Scutellum* Saunders).

Prepupa.=A true pupal stage formed immediately within the puparium.

Proscutellum.—Used by Saunders for *Postscutellum.*

Pseudelytra.—The appendages corresponding to the elytra of beetles.

Pseudopupa.—See *Coarctate larva.*

Pulvilliform tarsi.—Tarsi having each joint padded with a bladder-like pulvillus beneath.

Pupa.—The true stage of preparation for maturity; typical only in male Strepsiptera where it is found incased by uncast larval skins. See *Prepupa* and *Second pupa,* the two pupal instars.

Puparium.—The incasement formed by the last unshed larval skins, which contains the male pupal instars. The empty puparium is the *Exuvium.* The head cap is the *Cephalotheca.*

R.

Race.—Conspecific insects of a particular strain, lineage, or progeny—a colony among social insects.

Rhipidopterous.—A term referring to the Strepsiptera.

Rhipipter, rhipipteran, rhipipterous.—Terms referring to the Strepsiptera.

Rudimentary.—Referring to organs newly appearing in a group and as yet undeveloped, or to the imaginal buds, or to organs which have reverted to a more primitive form.

S.

Scapular.—A very small piece in front of the wing.

Scarabæidoid larva.—The third instar of hypermetamorphic insects of the meloid type; considered as the middle stage of the second larva; characterized by the resemblance to scarabæid larvæ.

Scutellum.—1. The second segment of the metanotum, immediately behind the præscutum (=*Scutum* Audouin, *Interlumbium* Saunders). 2. This term was used for *Præscutum* by Saunders, for *Postlumbium* by Audouin, and for *Postscutellum* by Kirby.

Scutum.—The pleural segment at each side of the præscutum (=*Epimeron* Audouin). See *Lumbi.* The term *Scutum* was used by Audouin for *Scutellum.*

Second larva.—The period of parasitism preceding the pseudopupa in hypermetamorphic larvæ of the meloid type; comprises the carabidoid, scarabæidoid, and ultimate stages or the second to fourth instars.

Second pupa.—The second true pupal stage, formed within the prepupa.

Spermophagous.—Refers to seed-eating insects.

Spiracles.—In the female these are the prominent eye-like projections at the back of the cephalothorax. See *Mesostigmatal lobe.*

Strepsipter, strepsipteran, strepsipteral, strepsipterous.—Referring to the Strepsiptera.

Style.—The term used by Kirby for the *Œdeagus;* he supposed that all the winged specimens he had seen were females.

Stylopization.—The parasitism of an insect by a strepsipteran.

Stylops, stylopized, stylopid.—Referring to the Strepsiptera.

Subœsophageal ganglion.—See *Thoracic ganglion.*

Supraœsophageal ganglion.—See *Cephalic ganglion.*

T.

Tæniæform.—Ribbon-like, referring to male antennal flabellations.

Tarsal appendages.—See *Appendiculate tarsi.*

Temporary host.—Any insect which may become the agency of transfer of the triungulinid; the function of the temporary host commences at the flower or other point of transfer and ceases when the triungulinid is passed on to another host (temporary or permanent), or to another flower.

Tenth abdominal segment.—That flap-like segment of the abdomen overhanging the tip of the œdeagus and the cavity of the ninth segment; it is usually much surpassed ventrally by the ninth segment. Apically it bears the anus.

Tessellated.—Applied by Templeton to the hexagonal checker-board appearance of the antennæ.

Tessera.—The hexagonal areas of the antennæ (of Templeton).

Third larva.—The sixth and last larval instar of hypermetamorphic insects of the meloid type; characterized by its activity from the coarctate larva.

Thoracic ganglion.—The nervous mass located in the thorax.

Transfer.—The act or acts involved in transplanting the triungulinid from its maternal host to its permanent host.

Transfer plants.—Plants which are the passive agencies in the transfer of the triungulinids from host to host.

Triungulin.—Hexapod larvæ of the hypermetamorphic beetles, having three clawed tarsi (Meloidæ).

Triungulinid (proposed by Doctor Chobaut instead of "*triunguloid,*" 1906).—Hexapod larvæ of hypermetamorphic insects with or without tarsal claws, having also sucker-like pulvilli tipping the tarsi (Rhipiphoridæ; Strepsiptera).

Triunguloid (proposed by the writer in 1904).—See *Triungulinid.*

Trophapothetic.—Refers to insects which store food for their young.

U.

Ultimate stage of second larva.—The fourth instar of hypermetamorphic insects of the meloid type.

V.

Ventral ganglion.—The nervous mass located in the abdomen.

Ventral slit.—A slit-like opening on the venter of the cephalothorax at the base of the head; the exit of the brood canal.

Vestigial.—Used in contrast to rudimentary; referring to organs which have lost all function, as the vestigial mouthparts of the female.

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EXPLANATION OF PLATES.

Plate 1.

Family Mengeidae (males).

Family Myrmecolacidæ (males).

Drawings by the author.

Plate 2.

Family Stylopidæ (males).

Drawings by the author.

Plate 3.

Family Stylopidæ (females).

Illustrations from photomicrographs made by H. S. Barber and E. S. Tucker, and the author and retouched by the latter.

PLATE 4.

Family STYLOPIDÆ (females).

PLATE 5.

Family HYLECHTHRIDÆ (males).

Family XENIDÆ (males).

PLATE 6.

Family XENIDÆ (males).

Plate 7.

Family Xenidæ (males).

Drawings by the author.

Plate 8.

Family Xenidæ (males).

Illustrations from photomicrographs taken by Herbert S. Barber and the author, and retouched by the latter.

Plate 9.

Family Xenidæ (females).

Illustrations from photomicrographs made by E. S. Tucker and H. S. Barber and the author, and retouched by the latter.

Plate 10.

Family Xenidæ (males).

PLATE 14.

Family HALICTOPHAGIDÆ (males).

Family DIOXOCERIDÆ (males).

Family HALICTOPHAGIDÆ (males).

PLATE 15.

Family ELENCHIDÆ (males).

INDEX OF SCIENTIFIC NAMES.

Specific names are written in italics; generic and higher group names in Roman type; synonymical references are inclosed in parentheses; plant references are preceded by an *; references to other insects than the Strepsiptera and their hosts are preceded by a †; the principal reference is given in black-faced type.

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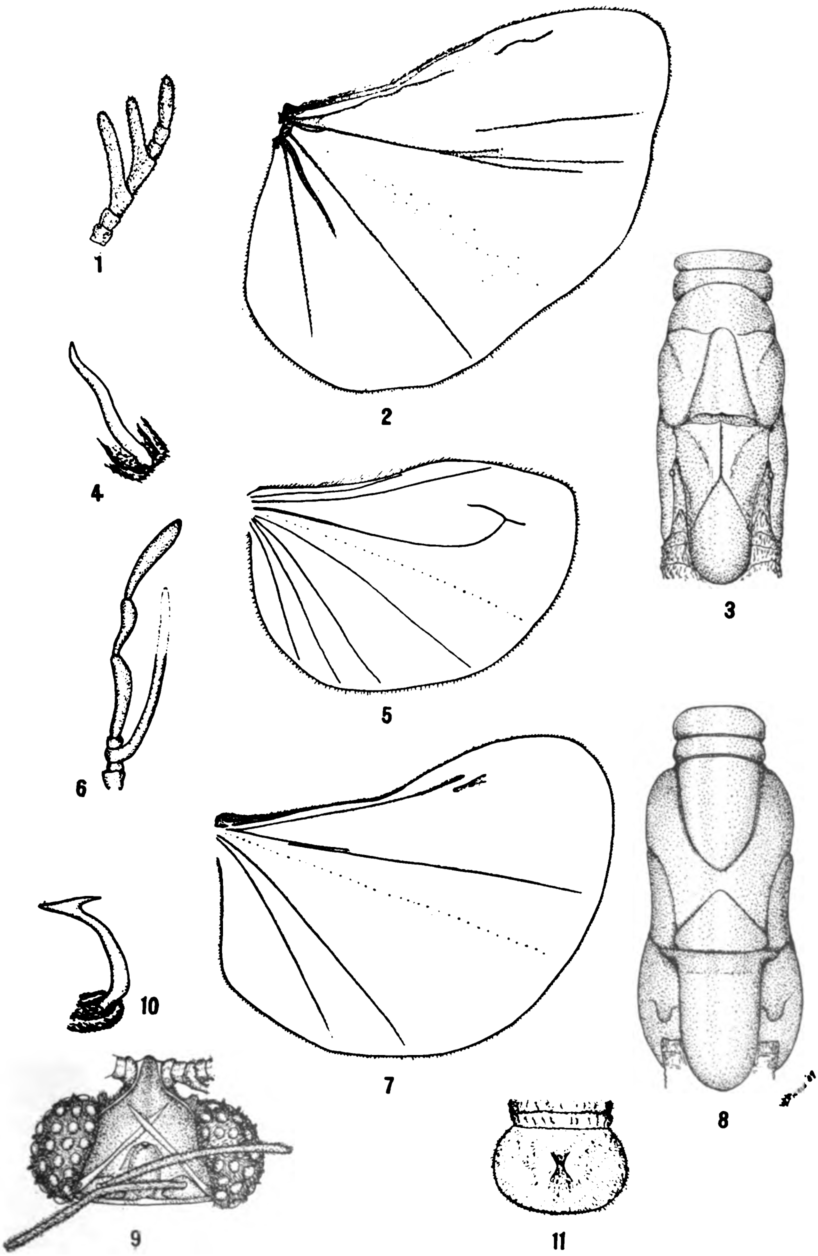

STREPSIPTERA: FAMILIES MENGEIDÆ AND MYRMECOLACIDÆ, MALES.

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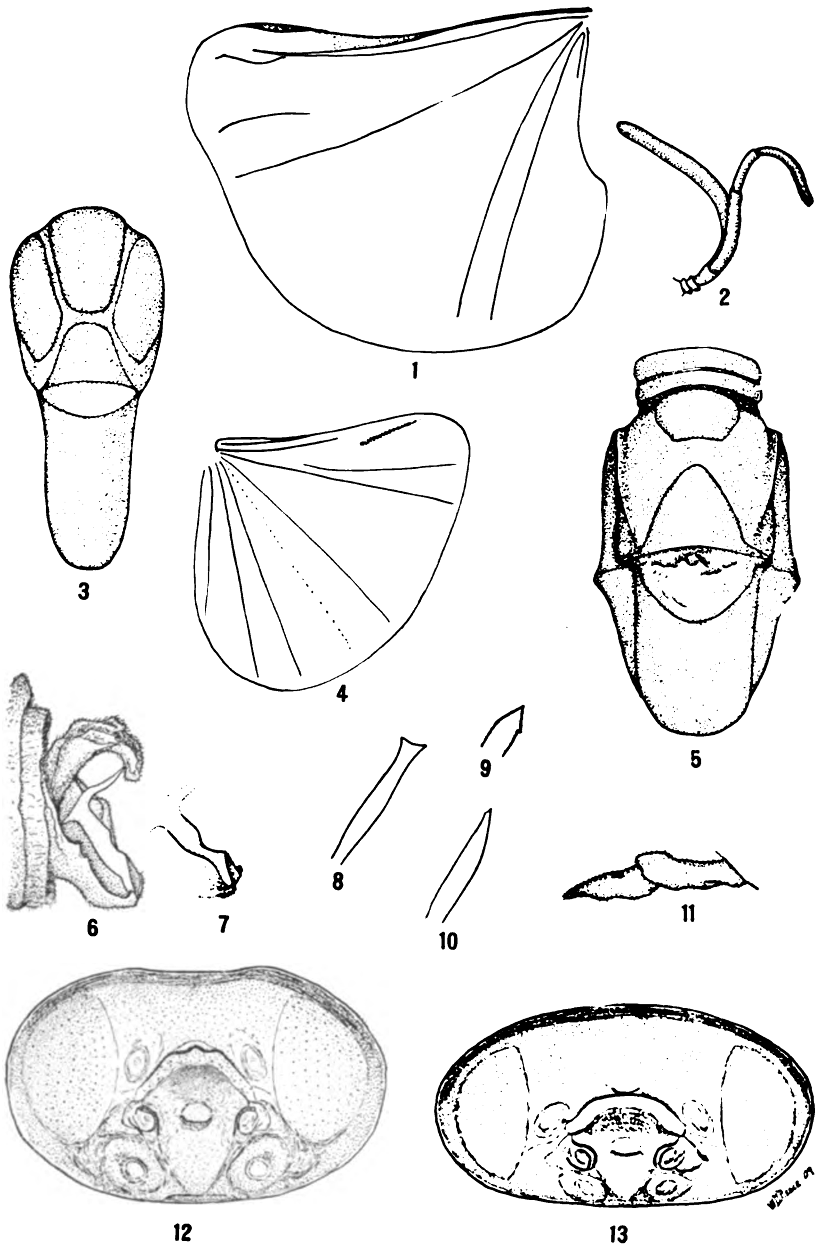

STREPSIPTERA: FAMILY STYLOPIDÆ, MALES.

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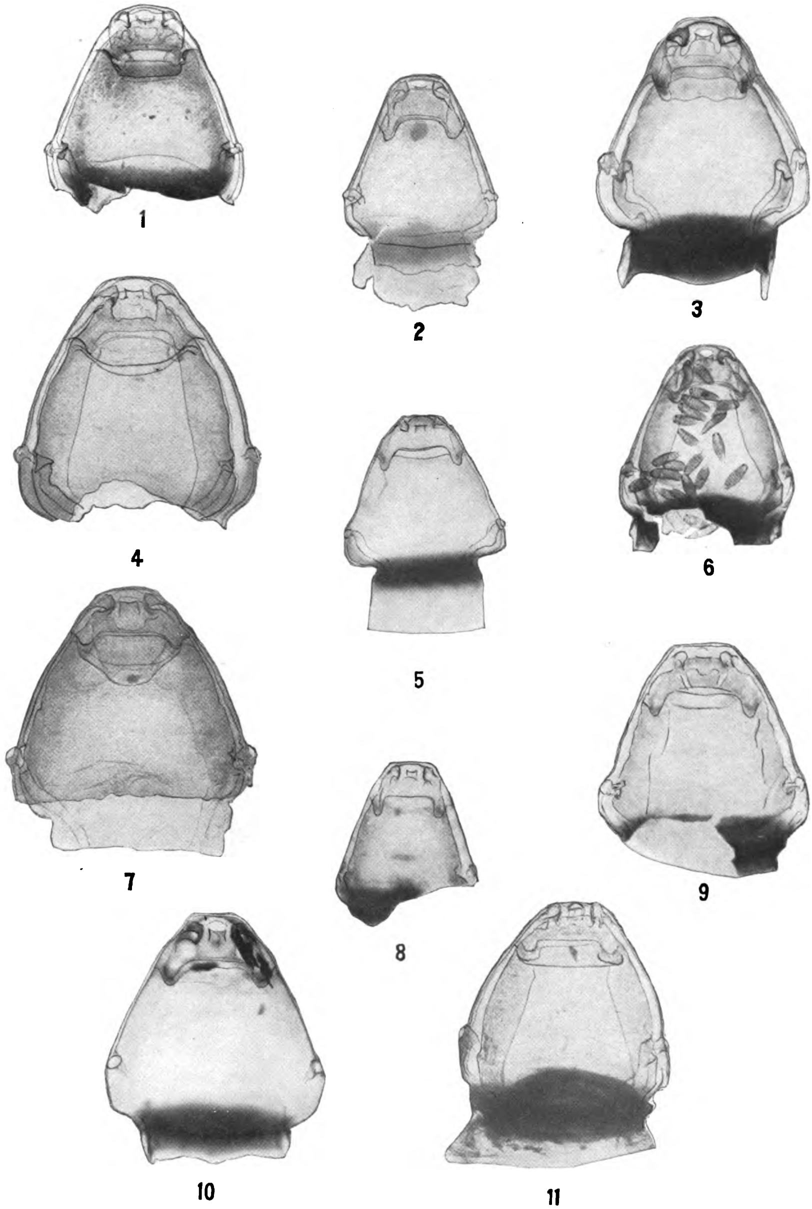

STREPSIPTERA: FAMILY STYLOPIDÆ, FEMALES.

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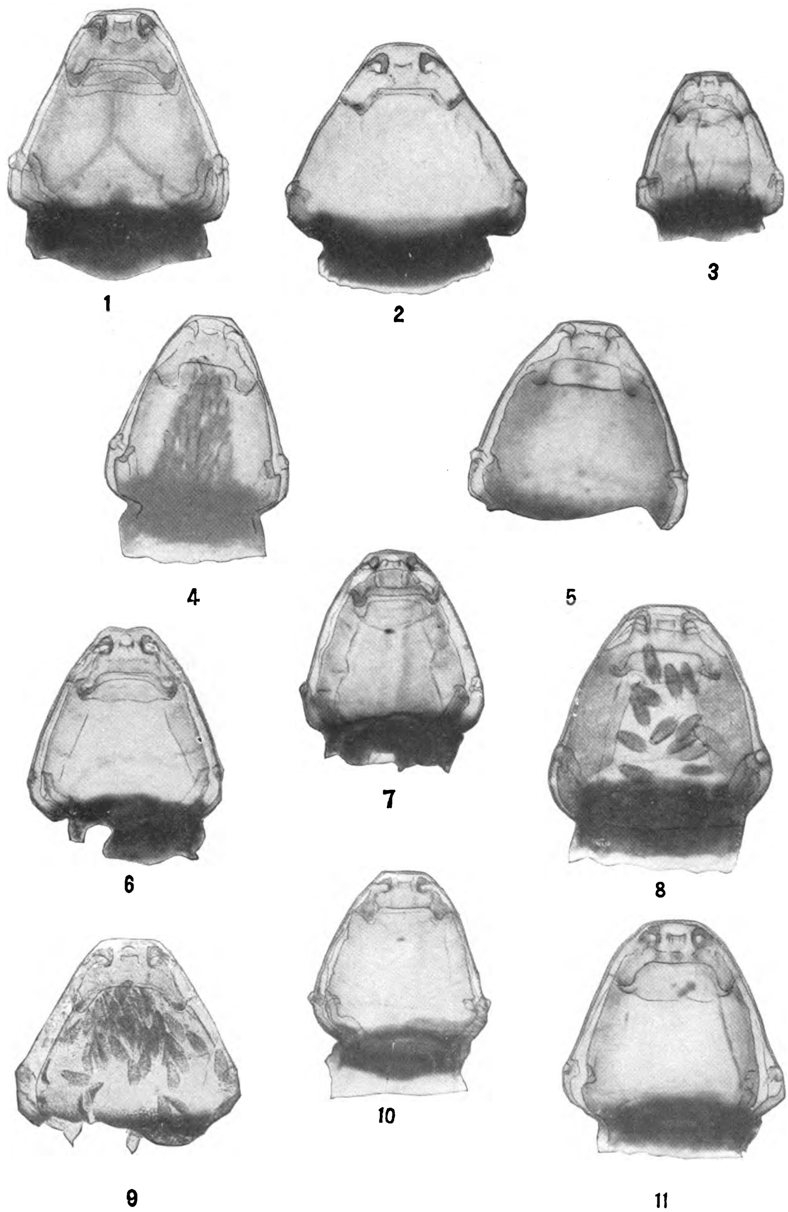

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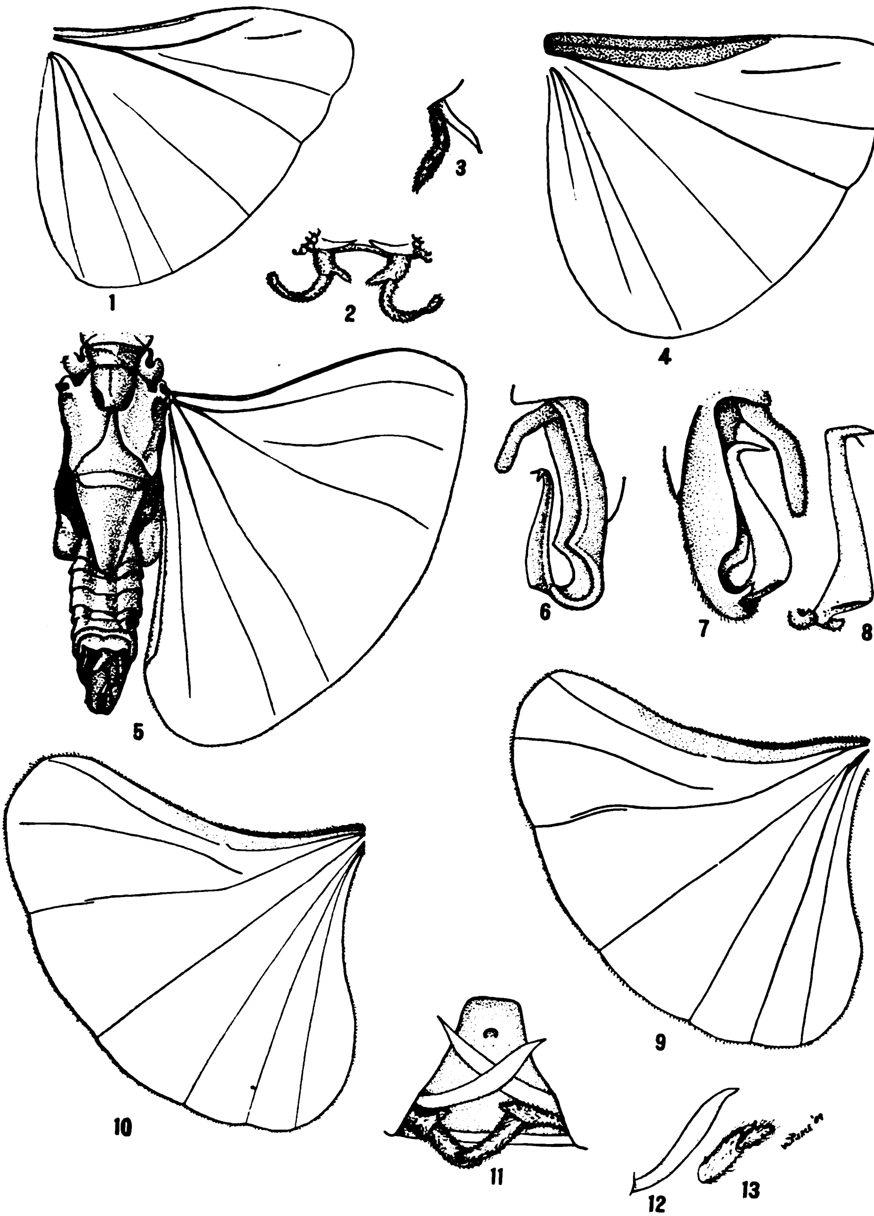

STREPSIPTERA: FAMILIES HYLECHTHRIDÆ AND XENIDÆ, MALES.

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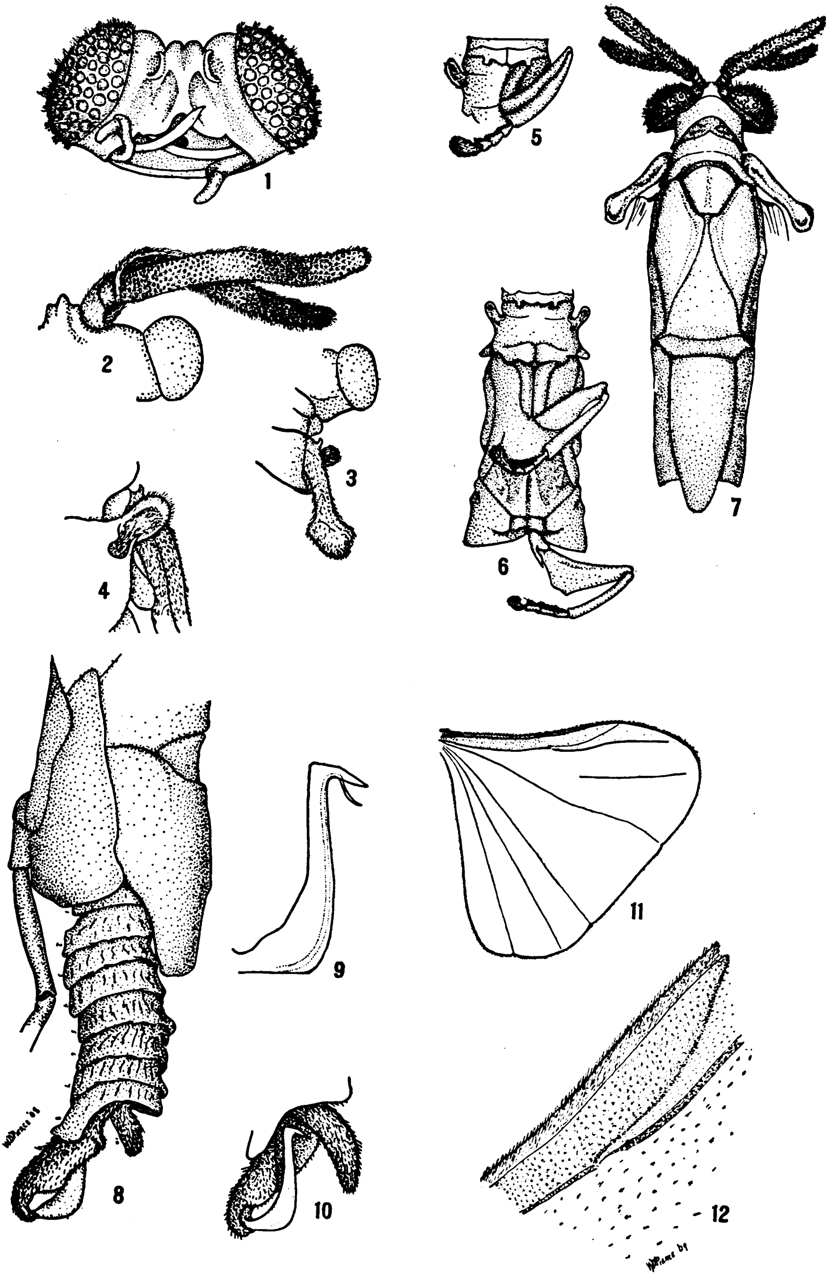

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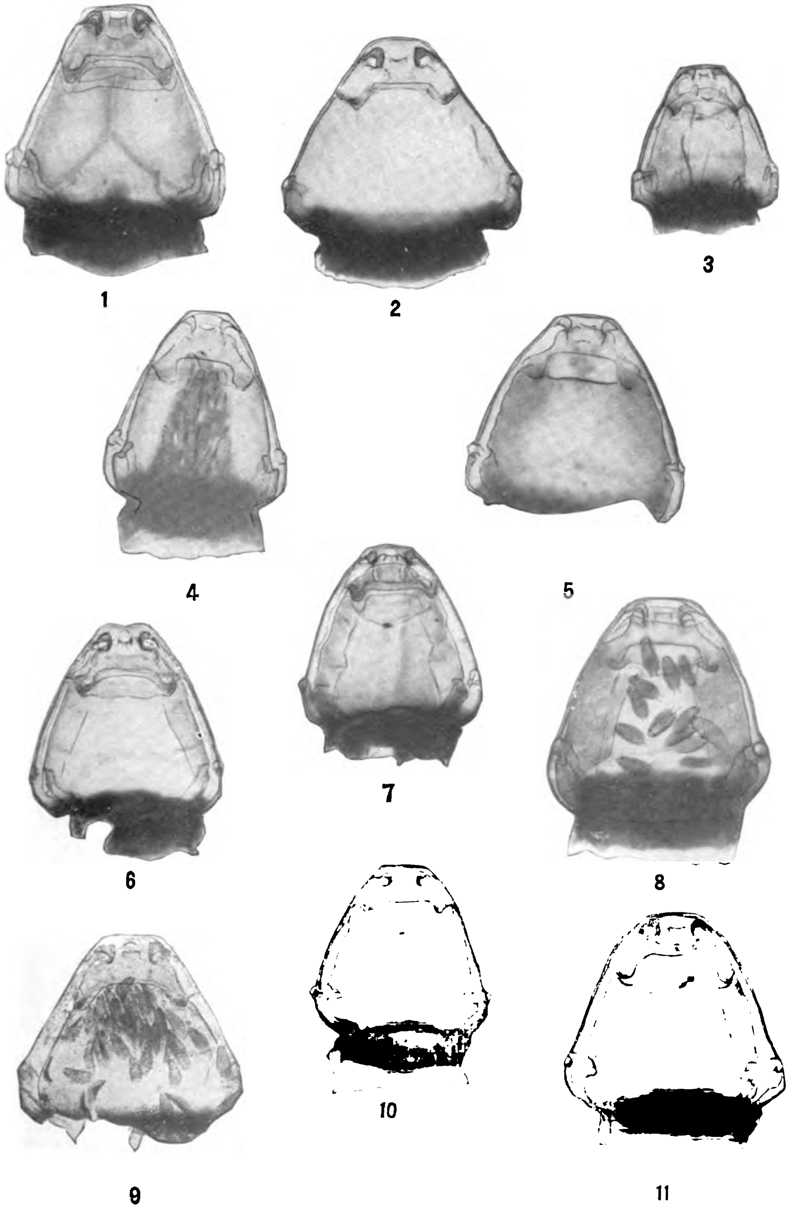

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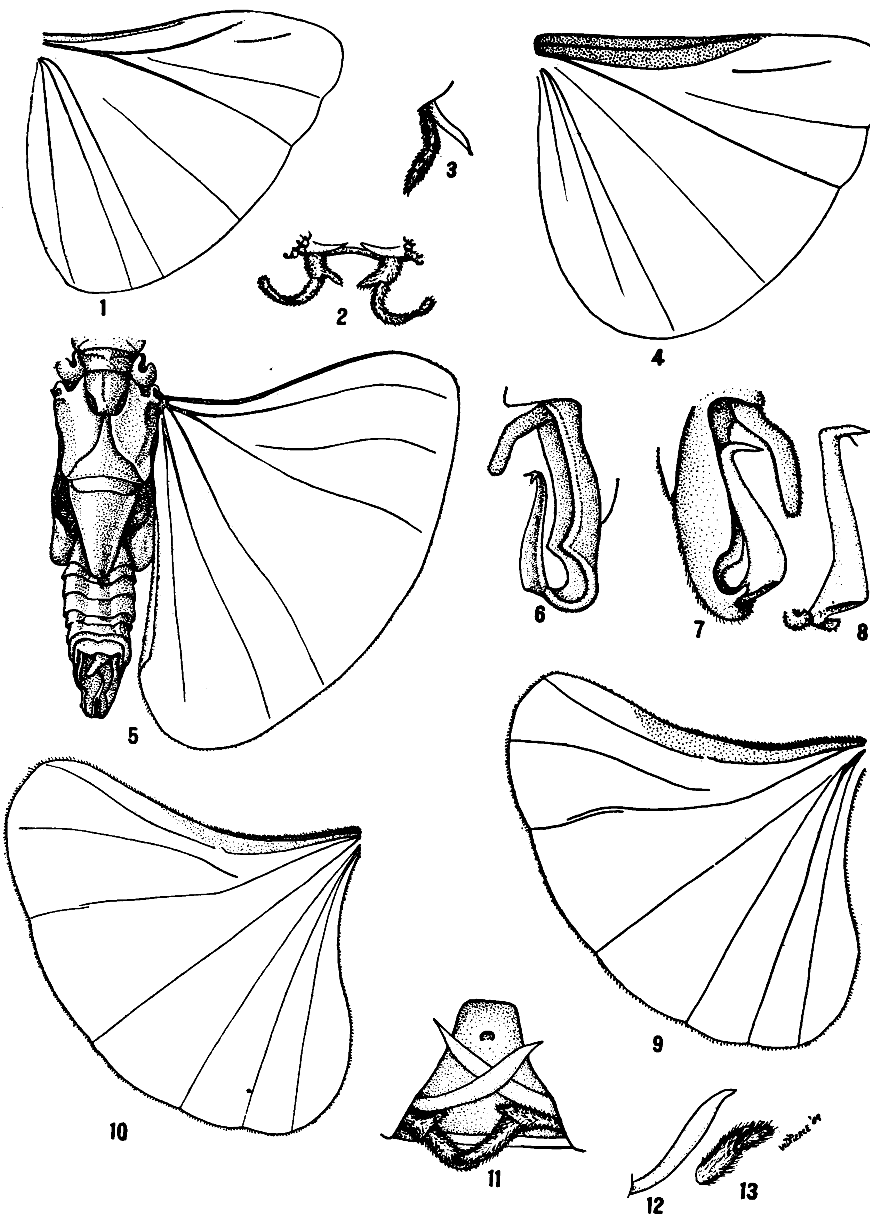

STREPSIPTERA: FAMILIES HYLECHTHRIDÆ AND XENIDÆ, MALES.

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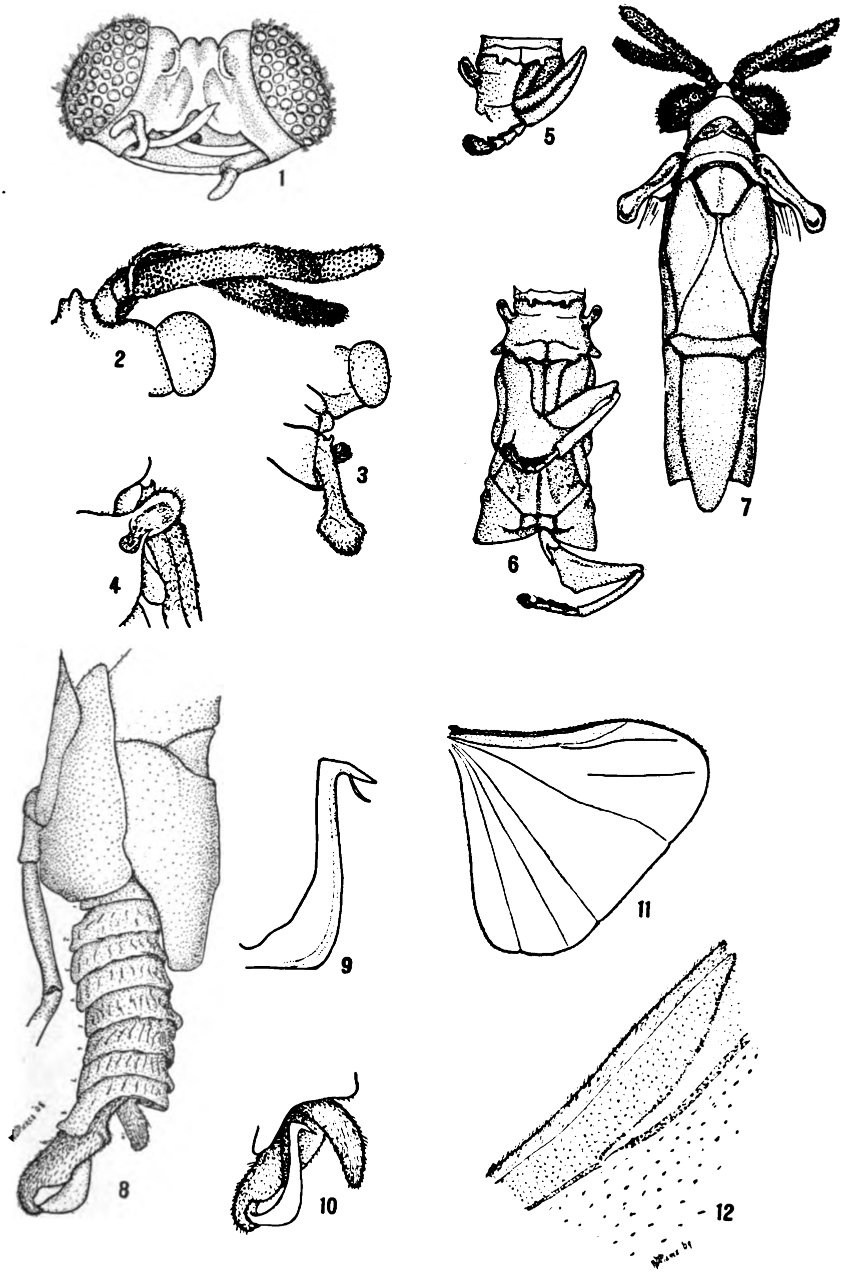

STREPSIPTERA: FAMILY XENIDÆ, MALES.

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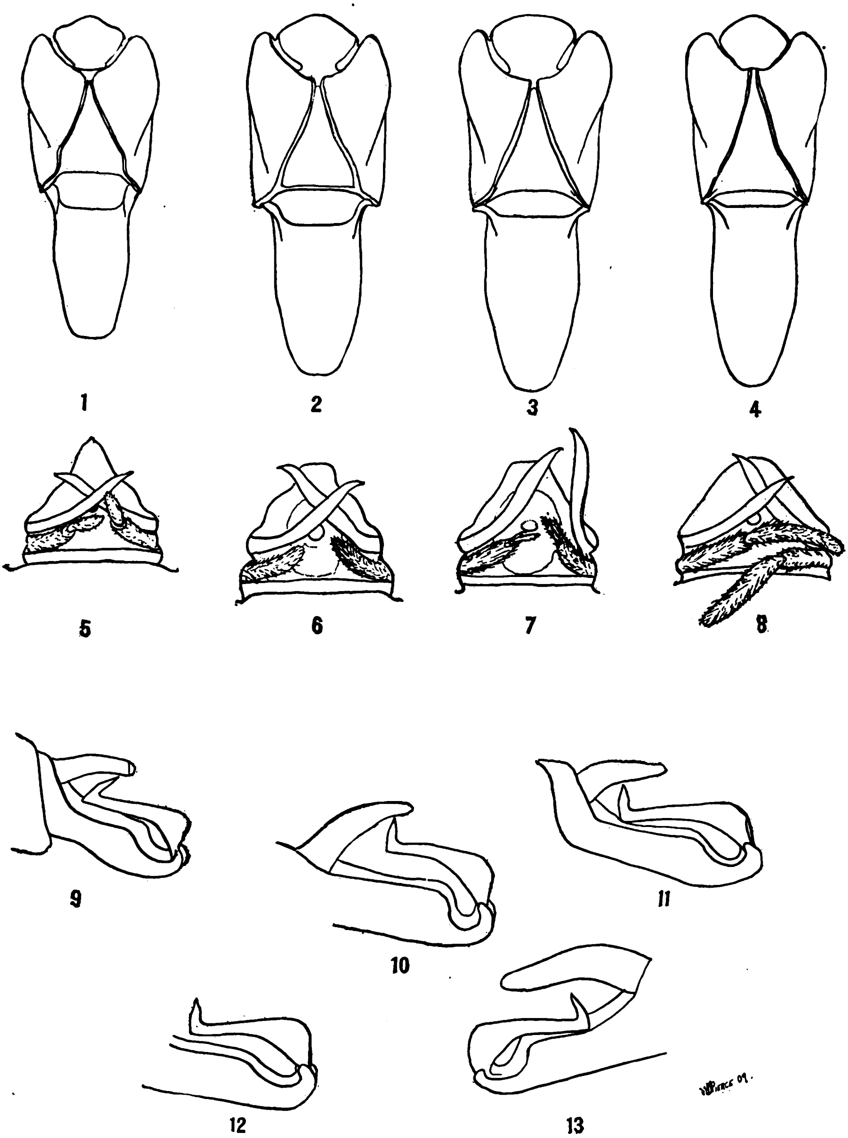

STREPSIPTERA: FAMILY XENIDÆ, MALES.

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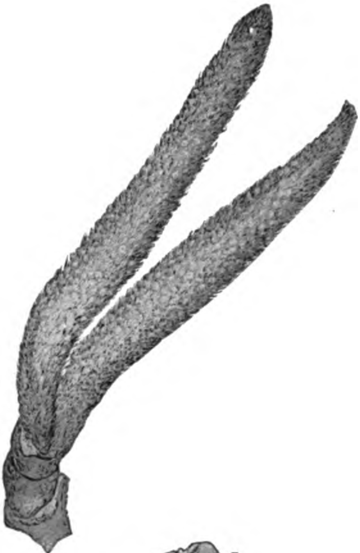
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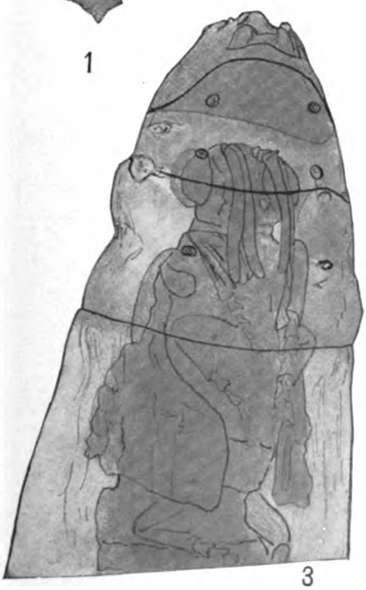
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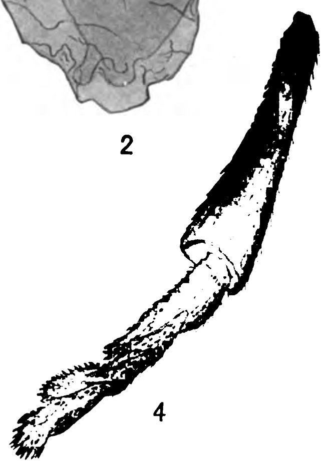
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STREPSIPTERA: FAMILY XENIDÆ, MALES.

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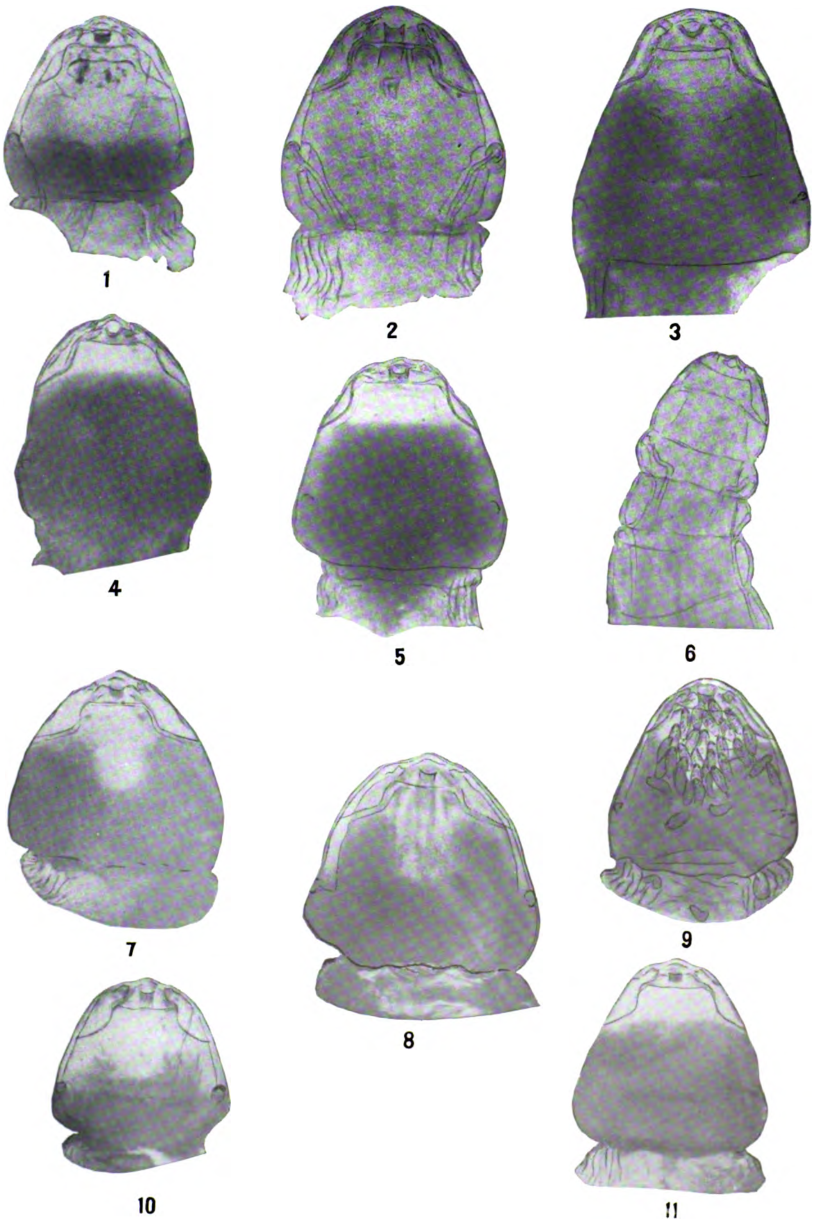

STREPSIPTERA: FAMILY XENIDÆ, FEMALES.

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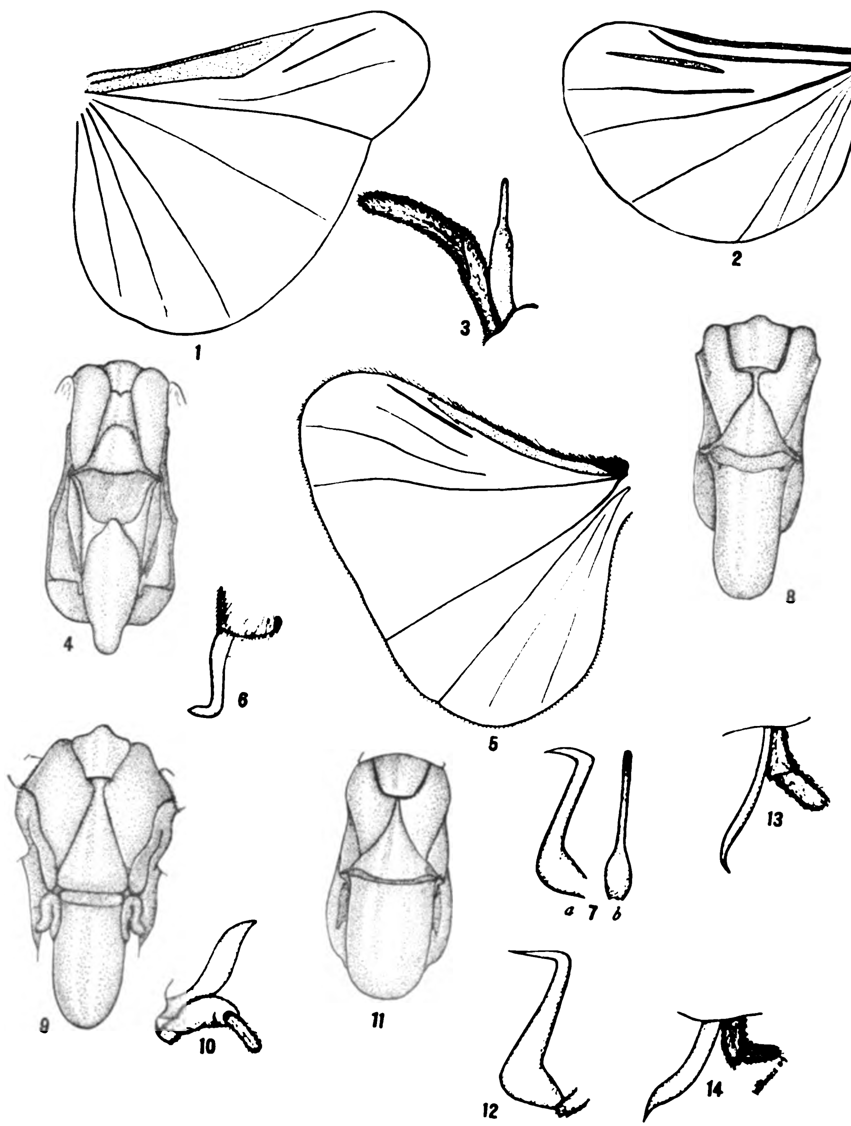

STREPSIPTERA: FAMILY XENIDÆ, MALES.

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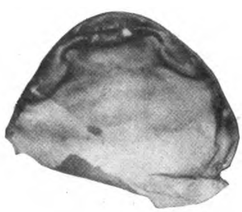
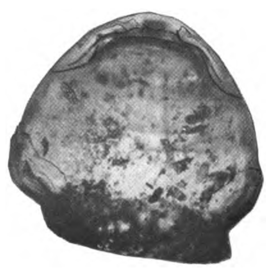


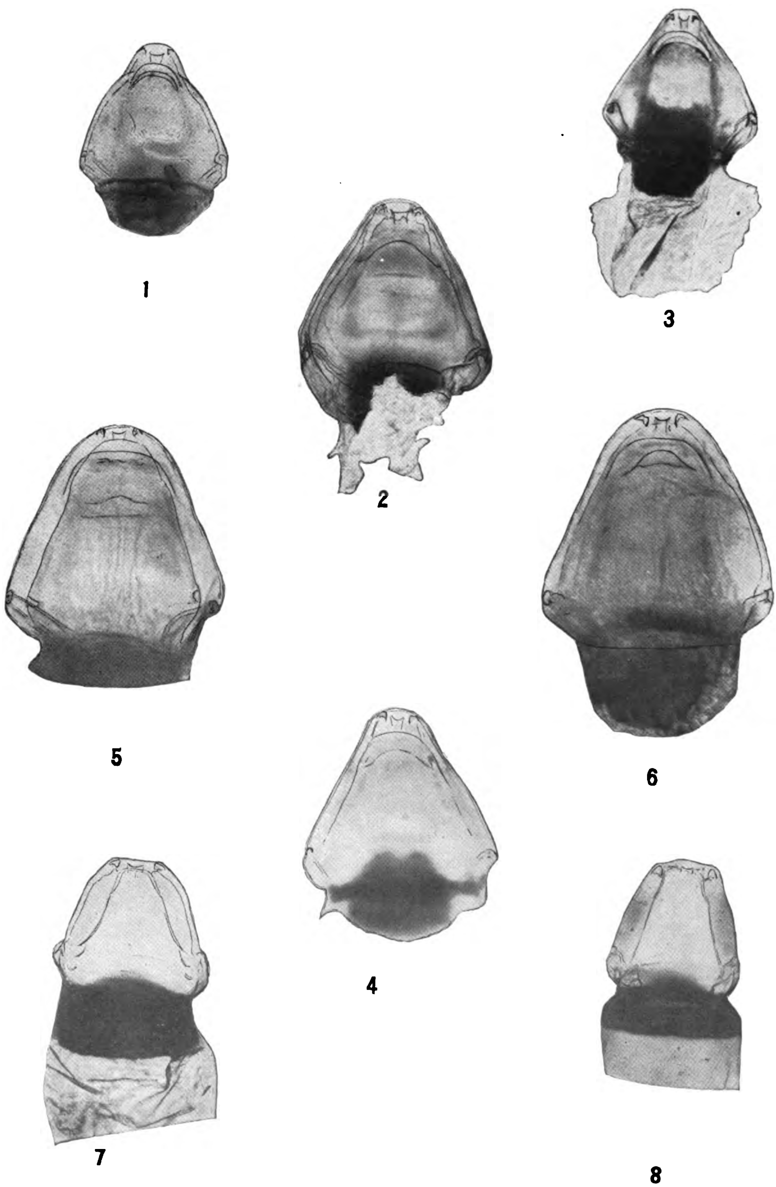
7



8

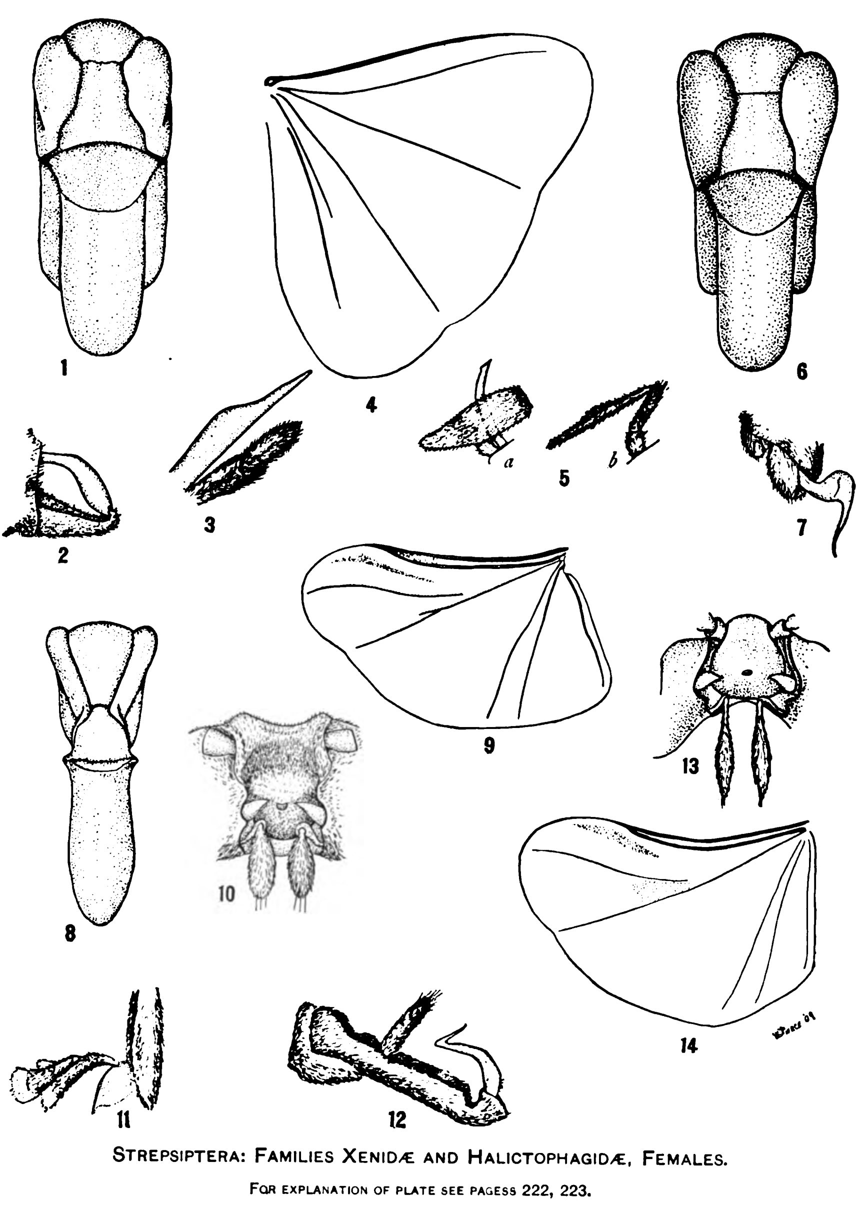
STREPSIPTERA: FAMILY XENIDÆ, FEMALES.

FOR EXPLANATION OF PLATE SEE PAGE 222.



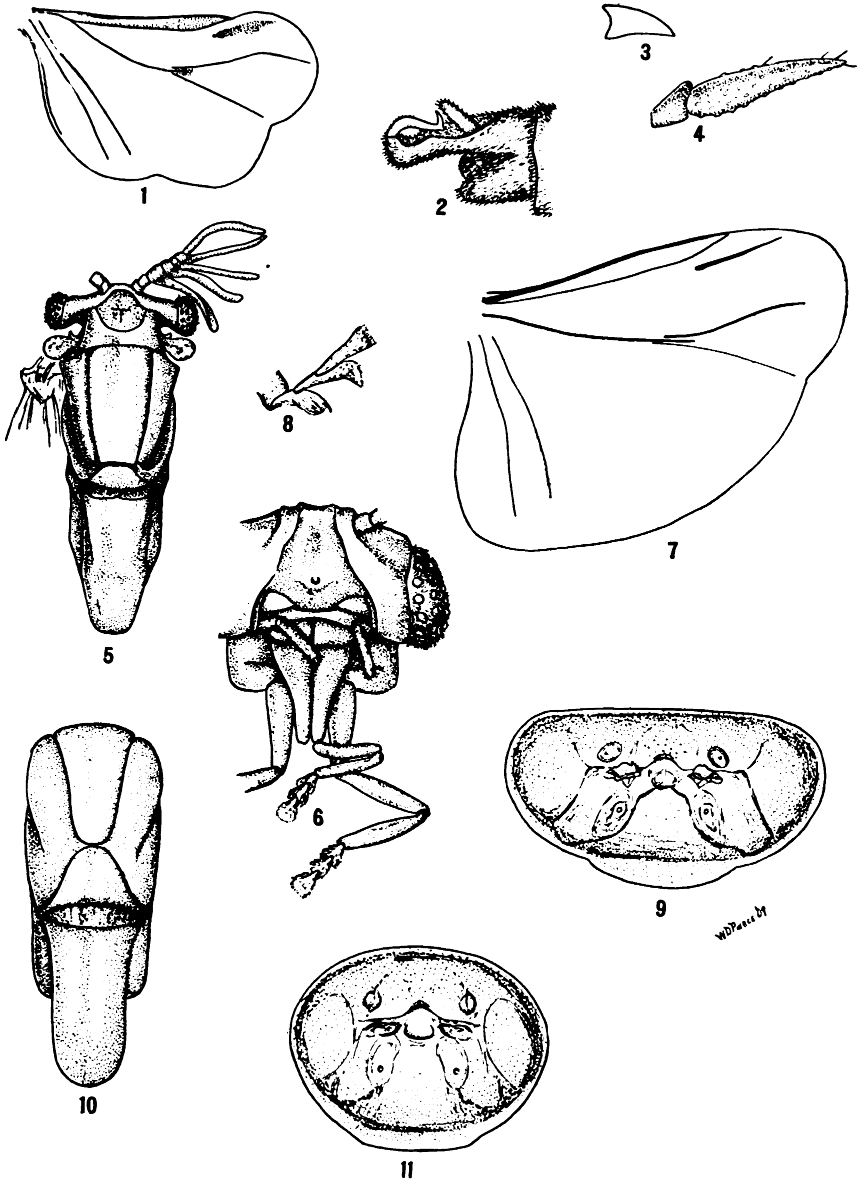
STREPSIPTERA: FAMILY XENIDÆ, FEMALES.

FOR EXPLANATION OF PLATE SEE PAGE 222.



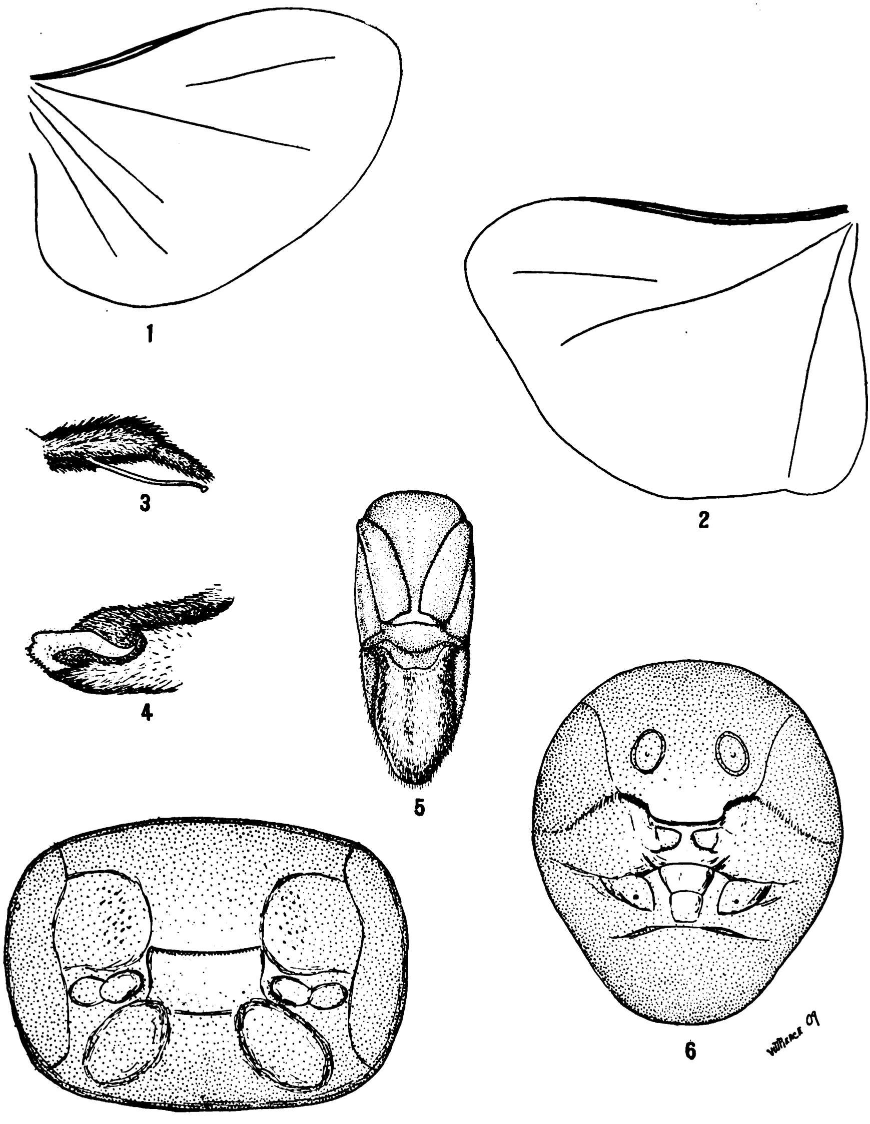
STREPSIPTERA: FAMILIES XENIDÆ AND HALICTOPHAGIDÆ, FEMALES.

FOR EXPLANATION OF PLATE SEE PAGESS 222, 223.



STREPSIPTERA: FAMILIES HALICTOPHAGIDÆ AND DIOXOCERIDÆ, FEMALES.

FOR EXPLANATION OF PLATE SEE PAGE 223.



STREPSIPTERA: FAMILY ELENCHIDÆ, MALES.

FOR EXPLANATION OF PLATES SEE PAGE 223.