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OF

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(January 5, 1893, to June 1, 1893.)
[Issued March 8, 1894.]

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C. W. Stiles, W. H. Ashmead,
T. N. Gill, F. H. Chittenden.

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PROCEEDINGS.

JANUARY 5, 1893.

President C. V. Riley in the chair and 13 members present.

The following new members were elected:

Active members—W J McGee, Dr. J. B. Jones, Frederick C. Pratt. Corresponding members—W. G. Johnson, Palo Alto, Calif.; J. W. Toumey, Tucson, Arizona; C. H. Rowe, Malden, Mass., and Wm. H. Patton, Hartford, Conn.

The Publication Committee reported the publication of No. 3, Volume II, of the Proceedings, copies of which were issued December 31, 1892. The new Publication Committee was appointed by the chair as follows: Messrs. Marlatt, Schwarz, Howard, Stiles, and Ashmead.

The discussion of the annual address of the President had been postponed, from lack of time, to the present meeting and was opened by Dr. Stiles, who made the following remarks:

PARASITISM.

By C. W. STILES.

[Author's abstract.]

Although Dr. Riley, in his interesting address, considered the subject of "parasitism" entirely from the standpoint of an entomologist, it may be well for us, in discussing the subject, to draw other groups of organisms besides insects into comparison. I would therefore take the liberty of presenting a few remarks upon parasitism from the standpoint of an helminthologist.

Starting with Leuckart's definition of a parasite as "an organism which lives in or upon another organism from which it draws its nourishment," I would admit two fundamental ideas in parasitism: *first*, the association of two or more individuals, and, *secondly*, the sponging of nourishment. As might be expected, however, if we accept this view (or in fact any other view upon the subject) we find numerous gradations between the parasites and the free-living animals, so that we are unable to draw any sharp line between them.

Association or symbiosis. Organisms may associate together for different purposes and in different degrees of intimacy; and the association may be between different individuals of the same (or very closely allied) species, or between individuals of different species very widely separated from each other systematically.

If two individuals, a male and a female of one species, associate for the purpose of reproduction, we speak of "*pairing*." If more than two individuals are concerned in this association (as, for instance, in the case of bees, etc.) we speak of "*colonizing*."

But as soon as the two contracting parties belong to natural groups more or less widely separated (systematically) from each other, we have before us some stage of parasitism. Although this holds good as a general rule, the fact that the two individuals belong to the same species does not necessarily exclude the association from the field of parasitism, for we find some remarkable examples of "pairing" which have at the same time a certain tinge of parasitism about them. For instance, we find in the bladder of rats a species of *Trichosoma* (*T. crassicauda*), in which (as Leuckart has shown) the males live in the uterus of the female. Although the female may have a number of males in her uterus, this symbiosis is unquestionably a case of pairing (polyandrism); at the same time the symbiosis is a case of parasitism—more strictly speaking, a case of mutualism.

At first thought we might suppose that the association between individuals of the same species is a more common occurrence than the symbiosis of organisms of widely different species; in other words, that *pairing* is a more common occurrence than *parasitism*, but we can convince ourselves that this idea is erroneous if we recall that there is probably not one of us present who has not, at some time during his life, harbored parasitic worms, lice, and fleas; furthermore, that every one of us at the present moment has a large number of species--twenty or more—of bacteria in his mouth and upon his skin, and that of each species we may harbor hundreds of thousands of individuals. If we need further examples to convince us, we have only to examine the first stomach of any ruminant, and we shall find there countless hosts of bacteria and infusoria, belonging to numerous different species. I would hence make the general statement that parasitism in its different grades is a much more general occurrence (among the higher animals, at least) than pairing; or, in other words, that organisms are associated with individuals of other species more than with other individuals of their own species.

Parasitism. In parasitism, I would recognize several different grades: *first*, *mutualism*, in which the symbiosis results in mutual benefit to the two contracting parties; *secondly*, *commensalism*, in which the symbiosis results in a benefit to one party, but does not entail any disadvantage to the other party (the host); *thirdly, true parasitism*, in which there is a benefit to one of the parties concerned (*i. e.*, the parasite), to the disadvantage of the other party (the host). Naturally, I do not contend that these three grades of parasitism can be separated by sharp lines, any more than we can draw a sharp line between animals and plants.

Mutualism. We not infrequently find sponges grown fast to the back of a crab. In this symbiosis we can see the first step towards parasitism, but this symbiosis, as Looss and others have already pointed out, is mutually advantageous to both the crab and the sponge, for the former is thereby more or less concealed from view and will thus escape his enemies, while the sponge is carried around from place to place and thus furnished with more nourishment. *Hydra viridis* presents another case of mutualism: here the hydra can utilize the oxygen produced by the zoochlorellæ, while the latter can utilize the carbon dioxide produced by the hydra.

Commensalism. The organisms referred to by Germans under the term "*Raum-Parisiten*" furnish examples under this head. For instance, in the intestinal tract of many aquatic insect larvæ, we find numerous rotatoria. These organisms obtain room-rent free; they do not, however, injure their hosts (so far as we can observe) but they feed upon other microörganisms found in the same place. The numerous infusoria in the first stomach of ruminants would also come under this second grade of parasitism.

True parasitism. As examples of true parasitism, we can cite the tape-worms, the lumbricoid worms, trichinæ, etc., etc. That this symbiosis is of advantage to the parasites will be doubted by no one, for we know that they cannot live and reproduce outside of the body of their hosts. The disadvantage to the host may be of three different kinds: first, the parasites live upon food which should go to the nourishment of the host (cf. the adult tape-worms, ascarides, *Echinorhynchus*, etc.); secondly, they may exert pressure upon the various organs and thus cause a mechanical injury, as in the case of echinococcus-hydatids of the liver, brain, etc., or *Eustrongylus gigas* in the kidneys; thirdly, the parasites may form certain chemical products which act in various ways upon the tissues, as in the case of the genus *Ascaris* and the pathogenic bacteria.

Rather than define a *true parasite*, as some persons are inclined to do, as an organism which must necessarily live a parasitic life, I think it better to follow the majority in accepting the term "*obligatory parasites*" for such organisms, and to include those organisms which may or may not live a parasitic life under the term "*facultative parasites.*"

We can make another division of parasites into "*temporary* *parasites*" and "*stationary parasites*," including in the former those organisms which visit their hosts only from time to time in order to procure food, as *Culex*, *Cimex*, *Dermanyssus*, etc. The "*stationary parasites*" would include those organisms which are with their hosts continuously for the whole or a portion of their life. In this class we can recognize two subdivisions: the "*periodical parasites*"—that is, those organisms which spend only a period of their life as parasites, and the *permanent parasites*—*i. e.*, those organisms which complete their entire life-cycle as parasites.

As examples of the former, we may cite the genera *Mermis* and *Gordius*, which spend their larval stages in the body cavity of insects, etc., or *Nectonema*, which, as H. B. Ward has recently shown, is parasitic in fish for a portion of its life. *Hypoderma*, *Cuterebra*, and *Gastrophilus* would furnish examples familiar to entomologists. As examples of *permanent parasites*, we might cite the Cestodes.

Among the Nematodes, we find a most striking example of parasitism which must be looked upon as intermediate between the *periodical* and the *permanent parasites*. I refer to the genus *Rhabdonema*. *R. nigrovenosum*, to take a specific example, is an hermaphroditic (? or parthenogenetic) worm which, in alternate generations (1, 3, 5, 7, etc.), is an obligatory parasite in the lungs of amphibians (*Rana*, *Bufo*). In the 2d, 4th, 6th, etc., generations the sexes are separate and the organisms are free-living animals.

Another division of parasites would be (A) the *phyto-parasites* and (B) the *zoo-parasites*, and each of these may be subdivided, according to whether they are parasitic upon plants or animals.

Still another division of parasites is implied in Leuckart's definition, *i. e.*, *ectoparasites* and *endoparasites*.

In helminthology we frequently use the terms *pseudo-parasites* and *spurious parasites*. Most authors do not make a distinction between these two, but include the *spurious parasites* under the head of *pseudo-parasites*. It seems to me, however, that there is a difference between the two which it will be well to observe.

Under *pseudo-parasites* I would include all those organisms which as a rule do not live a parasitic life, but which happen by chance to get into the body of an animal and live there for a short period; all pseudo-parasites would be facultative parasites, although all facultative parasites are not pseudo-parasites. Mosquito larvæ, muscid larvæ, or species of the genera *Gordius* and *Mermis* are occasionally swallowed by chance; upon coming into the intestinal tract, they are capable of living a parasitic life for a short time, but after a few days they are either killed and digested or they are expelled from the body. Under the term *spurious parasites*, on the other hand, I would include: (1)

those animals which have been swallowed by chance or purposely (for the sake of committing suicide, etc.) but *which are not capable of taking food while in the body;* these animals are generally expelled very soon, or they are killed and partially digested. As an example of this sort, I would mention a case recorded by Bremser. A woman vomited a *Bombinator igneus* and two years afterwards she confessed she had attempted to commit suicide by swallowing this animal wrapped up in a membrane she obtained from a butcher. Weiss records a similar case. (2) In the *spurious parasites* I would also include all those objects introduced into the body by patients—generally suffering from hysteria—for the sake of perplexing their physicians. One very noted case of this kind is that of a French woman who went to her physician time after time to have some "worms" extracted from her vagina. A zoölogist who examined these "worms" was able to show that they were nothing more or less than the entrails of fish which the hysterical patient had herself introduced into her vagina. Quite a number of similar cases have been recorded, and I can here add a case which I believe has never been published. It is recorded in the hospital records of the 65th U. S. C. T. that F. B—— was "admitted to hospital Dec. 23, 1865; complaint, piles; Feb. 24, 1866, returned to duty; Remark—This man feigned sick with the piles for two months, when his deception was detected, he having procured the heart of a turkey and introduced it into his rectum to resemble piles." (3) Another class of *spurious parasites* would be those objects, such as the pulp-cells of lemons and oranges, which have been mistaken for flukes (I had a case of this kind sent to me but a short time ago), various portions of plants which have been described as parasites (*Diacanthus polycephalus* Stiebel, 1817, proved to be fragments of a bunch of grapes), various animal structures described as parasites (*Physis intestinalis* Scopoli is a portion of the trachea of a bird; *Sagittula hominis* is the hyolaryngeal apparatus of a bird). (4) A fourth kind of *spurious parasite* would be those "parasites" which exist only in the imagination of various persons. As examples, we may cite *Furia infernalis* L., an imaginary worm which is supposed to live in the air; it is said to descend upon the body, bore through it, and cause death in a short time. *Vermis umbilicalis* is another imaginary worm, said to live in the umbilicus of children; to diagnose the presence of this fabulous creature it is only necessary to bind a small fish upon the navel, and in a short time the fish will be entirely skeletonized in case the "worm" is present.

I can hardly leave the subject of spurious parasitism without referring to the case of Pastor Döderlein (1697), which is cited by all writers as being the most wonderful case of its kind on record. His 12-year-old boy is said to have passed a small *Por-*

cellio. After treatment he passed at different times the following objects: 162 specimens of *Porcellio*, 2 worms, 4 scolopendras, 2 "springing butterflies," 2 ant-like worms, a white *Porcellio*, 32 brown caterpillars, 4 frogs (whenever the boy went near a pond, the frogs in his body croaked!), several toads (the largest one had poisonous breath which immediately killed the smaller ones), a snake (which started to come out through the boy's mouth, but immediately returned), shoe-nails, half the link of a chain, white and red egg-shells, 2 knife-blades, portion of a salve-box, and 2 spikes ! (Quoted from Looss.)

Another division of parasites, based upon the number of hosts required in their life-history, would be: *Monoxenous parasites*, those parasites which require but one host, and *heteroxenous parasites*, those which require two different hosts at different stages of the life-history.

From the foregoing remarks we see that the study of parasites is in reality a study of a fauna; exactly as one zoologist studies the fauna of the seas, another the fauna of lakes, another the fauna of mountains or plains, the parasitologist studies the fauna or flora of the body.

To sum up these informal remarks in a table, we can divide the parasites as follows:

A. Based upon symbiosis and food:
   1. Mutualists.
   2. Commensalists.
   3. True parasites.
   4. Pseudo-parasites.
   5. Spurious parasites.

B Based upon position:
   1. Ectoparasites.
   2. Endoparasites.

C. Based upon the animal and plants:
   1. Phyto-parasites:
      a) In or upon animals.
      b) " " " plants.
   2. Zoo-parasites:
      c) In or upon animals.
      d) " " " plants.

D. Based upon time:
   1. Temporary parasites.
   2. Stationary parasites:
      a) Periodical parasites.
      b) Permanent parasites.

E. Based upon adaptation or necessity:
   1. Facultative parasites.
   2. Obligatory parasites.

F. Based upon the number of hosts:
  1. Monoxenous parasites.
  2. Heteroxenous parasites.

In conclusion I will state that the foregoing remarks are, in large part, based upon the writings of Leuckart, Looss, R. Blanchard, Railliet, Neumann, and others; the division of parasites proposed is a combination, with slight modifications, of the divisions followed by these authors.

Mr. Fernow objected to the definition of the word parasitism as given by Dr. Stiles, and believed that the definition should make it necessary for the parasite to not only obtain its food, but also its domicile from its host, which would exclude such animals as the mosquito; and, further, that the parasite should, in some stage of its existence, be entirely dependent on or unable to exist apart from its host. He would further limit it also by making it necessary that the food should be taken from the living host in a form ready for immediate assimilation, and which would exclude vegetable-feeding animals, whose food would necessarily have to go through a more or less elaborate process of digestion. Thus, in general, plants only can be parasitic on plants, and animals on animals.

Mr. Hubbard believed, with Mr. Fernow, that the definition in question was open to criticism, and was of the opinion that the principle of absolute dependence at some stage, mentioned by Mr. Fernow, should be present. He gave various examples of mess-mates, etc., illustrating this idea.

Mr. Doran mentioned other cases of parasitism in animals other than insects and not referred to by Mr. Stiles. Some of these cases, as pointed out by Mr. Stiles, were association for copulation only. In reference to the limitation mentioned by Mr. Fernow, viz., that the parasitic relation could only be sustained by members of the same kingdom, as animals on animals, etc., Mr. Stiles took issue on the ground that no sharp lines should be drawn separating plants from animals, and gave certain cases where such association of plants and animals is certainly parasitic, such as ringworm.

Mr. Fernow replied that for all practical purposes, and in the general estimation, there is a distinct separation of plants from animals, and maintained the validity of his former restriction.

Mr. Waite pointed out the advantage enjoyed by the student of vegetable parasitic relations from the fact that in this field parasites are always fixed and no difficulty is experienced in determining the host, the only subject for question being whether the host is living or dead.

Professor Gill, after referring to the breadth of the subject and the impossibility, on this account, of discussing it with any degree of minuteness, gave, as his opinion, that plants and animals may manifest a parasitic relation with regard to each other, and discussed at some length the differences separating animals from plants. Speaking of the presidential address, in which the true parasites in insects were limited to certain families of the Hymenoptera, in the strict sense, he suggested that these latter (Chalcidids, etc.) sustain rather an intermediate relation between the typical parasite, as the intestinal worm, and such insects as the various wasps which stored their nests with spiders. The typical parasite, he said, shows a great deviation from the normal structure as the result of its parasitic relationship, and he pointed out the nature of such modification, especially in the Mollusks and Crustaceans, giving a number of interesting illustrations. He said that parasites occur in all polytypic classes in animal life, except, perhaps, the Vertebrata, and in these, in the case of fishes, certain forms are pseudo-parasitic, but are not examples of very excessive modifications in consequence. A striking example, however, of modification in fishes was illustrated by the sucking disk of certain forms. Mr. Schwarz was of the opinion that Leuckart's system of classification is too widely drawn to apply to insects, and should be considered rather as applying to the general subject of parasitism wherever manifested.

Prof. Riley, in summing up and closing the discussion, stated that he had been very much pleased with the various facts and ideas which the discussion of his address had brought out, but had not been led, by anything that had been said, to change in any way the conclusions reached by him; as, for instance, the term parasitism, as applied to insects, on account of the peculiarity and diversity of the facts, requires special definition. With reference to Prof. Fernow's remarks, he stated that it was impossible to make a strict and circumscribed definition, because in the broad sense all living things are parasitic. He believed that nothing would be gained by broadening the definition, and was glad to find that so many of the members agreed with the treatment of the subject in the address.

—Under general notes and exhibition of specimens, Mr. Schwarz stated, in connection with his remarks, at the November meeting, on the food-habits of the genus Silpha, that our common *S. lapponica* would have to be considered as an injurious species, since according to the observations of Mr. H. F. Wickham this insect is so injurious to dry salmon in northern British Columbia that it is known among the Indians and white settlers as the "salmon bug." *S. lapponica* is universally distributed throughout North America but is strictly boreal in the Old World. Its distribution is, therefore, just the opposite in this respect from that of *S. opaca*.

—Mr. Hubbard called attention to the mode of hibernation in *Chrysomela flavomarginata*, which differs greatly from that hitherto observed in North American species of Chrysomela and Doryphora, in which hibernation takes place in the imago state. Of *C. flavomarginata* examples of the larvæ, both young and mature, as well as imagos, were found, on May 15, in their winter quarters, among the roots of a species of Aster growing in the mountains near Glenwood Springs, Colo., at an altitude of six thousand feet.

—Mr. Ashmead presented the following:

NOTES ON THE GENUS CENTRODORA.

By William H. Ashmead.

The genus *Centrodora* was erected by Dr. Arnold Förster in Verh. pr. Rheinl. 1878, p. 66, to contain an interesting Chalcid presenting some characteristics entirely different from any known genus in the subfamily *Aphelininæ*.

In the female, the ovipositor is very long, at least two-thirds the length of the sessile, broadly oval abdomen; the head is transverse, wider than the thorax, while the antennæ are biannulate with white. In the male the antennæ are 6-jointed, with the scape broadened and the front tibiæ distinctly thickened.

Up to the present time only a single species is described, the type *Centrodora amœna* Förster, taken June 3, in a room, on a window.

It is therefore with considerable pleasure that I announce the discovery of a new species belonging to this genus in our fauna;

also to be able to contribute something towards the habits of the genus.

This new species is exhibited to-night and was reared by myself at Jacksonville, Florida, in October, 1887, from the eggs of *Clisiocampa americana* Harris.

I submit the following description:

Centrodora clisiocampæ, sp. n.

♀.—Length, 0.6 mm. Polished black; ovipositor about two-thirds the length of abdomen, with the tip white; antennæ biannulate with white; basal two-thirds of front wings fuliginous, the apical third hyaline.

Head transverse, wider than thorax, antero-posteriorly thin, the vertex somewhat acute; cheeks, clypeus and trophi yellowish-white; the tips of mandibles black; flagellum subclavate, biannulate with white.

Thorax subrobust, very little longer than wide, the pronotum visible from above as a transverse line, the mesonotum wider than long, with distinct parapsidal furrows, the scutellum semicircular, the metanotum exceedingly short, scarcely visible from above; anterior wings fuliginous, with the apical third hyaline, fringed, the marginal vein long, as long as the submarginal, the postmarginal not developed, the stigmal very oblique, clavate, about one-fourth the length of the marginal; hind wings likewise with a long marginal vein and with the apex and hind margin with long cilia; legs brown, trochanters, bases of tibiæ and tarsi yellowish-white.

Abdomen broadly sessile, oval, about as long as the thorax, depressed above, convex beneath and terminating in a long ovipositor.

Hab.—Jacksonville, Florida.

Types in Coll. Ashmead.

February 2, 1893.

Vice-President Ashmead in the chair. Twelve members and two visitors present.

The following persons were elected to corresponding membership: Rev. J. L. Zabriskie, Flatbush, L. I., and O. F. Cook, Huntington, L. I.

A paper by Mr. H. G. Hubbard, accompanied by the exhibition of specimens, was presented by Mr. Schwarz as follows:

NOTE ON BRATHINUS.

By Henry G. Hubbard.

Two species of the genus *Brathinus* have been hitherto known from the eastern United States. Both species range from central

New York to Nova Scotia, and westward into the Lake Superior region. That one or both of these should extend their range across the continent to the Pacific coast would be entirely in accord with the well-known tendency of boreal insects. The discovery of a representative of the genus in California would lead one to suspect a form or climatic variation of one of the Eastern species. A careful comparison of the abundant material now at hand seems, however, to establish the fact that the Californian Brathinus which is herein described is specifically distinct.

TABLE OF SPECIES.

Maxillary palpi long:
- Last joint of palpus longer than the second joint; body glabrous: antennæ slender, unicolored..............nitidus, Lec.
- Last joint of palpus as long as the second joint; body pubescent; antennæ stout, suddenly enlarged and pale at tip..varicornis, Lec.

Maxillary palpi short:
- Last joint of palpus shorter than the second joint; body pubescent; antennæ stout, unicolored........californicus, n. sp.

In the foregoing table I have called the maxillary palpus long if when directed forwards the second joint passes the mandibles, and short if the second joint does not project beyond the mandibles.

Brathinus nitidus, Lec. This is our largest and most slender species. The body is glabrous, light or dark brown, paler beneath. Antennæ very long, filiform, joints from the fourth opaque, finely pubescent; the last three joints not larger and scarcely paler than the preceding joints. The palpi are very long and slender; the first joint very minute, the second joint greatly prolonged beyond the mandibles, the third joint half as long as the second joint, the fourth joint longer than the second joint. Length, 5mm.

Brathinus varicornis, Lec. The smallest species. Elytra with sparse fine setæ placed in four lines. Legs pubescent. Antennæ stout, shining toward the base; from joint four gradually more opaque and more densely pubescent, the last three joints suddenly enlarged and pale in color. The maxillary palpi are elongate, the second joint passing the mandibles, the last joint as long as the second joint. Length, 3.6 mm.

Brathinus californicus, n. sp. Dark brown, shining; elytra with sparse setæ; antennæ moderately long, robust, reddish brown; underside dark brown; legs pale testaceous, pubescent; maxillary palpi short, last joint stout, fusiform. Length, 4 mm.

The elytra bear four rows each of short setæ, there are no striæ, but the suture is somewhat elevated throughout its entire length. The thorax in many specimens shows a more or less deeply impressed median line. The underside of the body is always as dark as the upper surface, the legs are paler than the antennæ. The antennæ are unicolorous, the first three joints shining, the remaining joints opaque, equally setose, growing uniformly stouter towards the tip.

Lake Tahoe, Cala., numerous specimens; Sisson, Cala., two specimens.

This species is distinguished from *B. nitidus* and *B. varicornis* by its short maxillary palpi, the last joint of which tapers regularly toward base and tip, and is but little longer than the preceding joint. In size it is intermediate between the two Eastern species, and is darker in color than either of them. The underside is never lighter than the upper surface, as in dark specimens of *B. nitidus.* The rows of setæ upon the elytra and the pubescence upon the legs are nearly as in *B. varicornis*, but upon the antennæ the pubescence is finer and denser, the joints from the fourth outwardly are equally opaque, and the last three joints are not suddenly enlarged as in the latter species.

The sexual characters are not strongly expressed in this genus. The penultimate (sixth) segment in the males is prolonged over the anal plate, and presents slight differences in the three species. The distal edge of this prolongation is frequently sinuate or emarginate, forming three more or less distinct lobes.

In *B. nitidus* this segment is produced in an acute raised point with shallow sinuations on the sides. *B varicornis* has also the tip of the sixth segment prolonged in an acute point, but the side lobes are wanting. In *B. californicus* the prolongation is obtuse and frequently terminates in three small, nearly equal, elevated points separated by emarginations.

A numerous colony of *B. californicus* was found at Lake Tahoe, in July, 1891, living in wet moss, darkly overshadowed by bushes, at the margin of a mountain stream.

Mr. G. C. Davis, of Agricultural College, Michigan, gave a description of the insect collections of that institution. These collections are especially rich in the orders Lepidoptera and Coleoptera, and are rapidly growing in other orders. The two orders named have been largely increased by the purchase of large collections of North American insects, notably the Tepper collection of Lepidoptera and the Austin collection of Coleoptera. A general description of the extent and character of the collections was given. Mr. Schwarz said he was glad that a good collection had been started by the Michigan Agricultural College, and urged the importance of the founding of such collections by other similar institutions, few of which have any determined insect collections of importance. He said that a portion of the Coleoptera collected by himself and Mr. Hubbard in Michigan during the years 1875 to 1877 were represented in this collection, and that the Neuroptera collected at the same time had been sent to Hagen and were now in the Cambridge Museum. Mr. Davis, referring to the local nature of the collections, in that they included a very good representation of the Michigan fauna, spoke more particularly of the richness in insect life of the State of Michigan, which he ascribed to the diversified topography of that State. Mr. Schwarz said, however, that the real reason for this prodigality of insect life is the fact that Michigan possesses two faunal regions, viz., the boreal zone and the northern limits of the transitional zone.

—Mr. Howard presented the following paper, illustrating the text by the aid of blackboard drawings:

A PECULIAR STRUCTURAL FEATURE OF THE ELASMINÆ.

By L. O. Howard.

The subfamily Elasminæ, ordinarily placed at the head of the tetramerous series of the Chalcididæ, has in Europe, according to Kirchner's catalogue, five species, all belonging to the genus Elasmus. It seems probable from comparison of descriptions that these five will be reduced to three and perhaps two. From the United States I have described five species and have since found two more which still remain undescribed. These also belong to the typical genus Elasmus. The subfamily, in fact, contained but this single genus until, in 1888, Prof. Riley figured, without description, a species of a new genus to which he gave the name Euryischia, and which is parasitic in Australia upon Lestophonus. The subfamily, therefore, is not extensive. The species of Elasmus, however, are difficult of separation. Antennal, sculptural, venational, and other characters hitherto used, are of little avail in this group. A close study of considerable material belonging to this subfamily received from Cambridge, England, and which was collected on the island of St. Vincent by Mr. Herbert Smith, has shown a new character which is in itself very remarkable, and which enables the ready separation of groups of species and of species themselves. The material was found to comprise nine new species.

The character referred to consists of a peculiar arrangement of specialized spines on the hind tibiæ. They are short, sharp, broad spines occurring in regular rows, their bases connected, forming straight lines or more or less intricate figures. They are present in lesser degree upon the middle tibiæ, and here invariably form only straight lines. They also occur on the first joint of the hind tarsi, and here also form straight lines. Upon the hind tibiæ, however, they are strikingly evident through an almost universal differentiation of color, the tibia itself being light and the spines very dark. They occur upon the upper or outer side of the tibiæ and in the species which I have examined take the following forms:

1. Two very long ellipses side by side and touching. 2. Three longitudinal subparallel wavy lines. 3. A single long ellipse occupying the central two-thirds of the length of the tibia, and the beginnings of two other ellipses, above and below, each interrupted by the extremity of the joint. The upper and lower loops are joined at tip to the central ellipse, and two outer convex lines surround each of these joints. 4. The disk of the tibia bears two such ellipses placed end to end, and two half ellipses, at top and bottom, being surrounded at junctions by such a row as occurs in 3. 5. The disk occupied by three instead of two ellipses, and the ends by two loops. 6. The disk is covered by a double row of elongate ovals closely applied and arranged so that the side bulge of one fills the cavity caused by the meeting of the ends of two others. 7. A series of superimposed antique figures 5, the dash at the top of one forming the base of the next one above.

Sufficient variations of these arrangements occur and within apparently specific limits. This is not a secondary sexual character, since it occurs equally in both males and females. No similar character has been noticed in any other subfamily of the Chalcididæ, and it is particularly fortunate that it should occur among the Elasminæ, on account of the difficulty in otherwise separating the forms.

Mr. Stiles asked if there was any explanation of the occurrence of these spines on evolutional grounds. Mr. Howard replied that he had looked into the matter very carefully, and had discovered nothing which would lead him to offer any such explanation of their occurrence. Mr. Ashmead stated that Mr. Howard's discovery is of exceeding interest, on account of the fact that in this group the species are very frequently most difficult to separate by other available characters. He referred also to the importance of similar or homologous structures in other families, which are of considerable importance in separating the species, as, for instance, the genus Macrocentrus, in which he finds a peculiar plate on the femora, having one or more peculiar spines at the base, which varies in different species. He believed, also, that the arrangement of the spines on the tibiæ in other Hymenoptera, as Ichneumonidæ, etc., will be found of importance in the separation of species. Mr. Schwarz said that these peculiar spiny structures reminded him very forcibly of similar features in the hind tibiæ and tarsi of Mordellistena, which are referred to in the writings of LeConte and Smith as ridges, and by European authors as incisions. These furnish the only characters which can be used in the satisfactory identification of species. They occur in both sexes, and are usually found covered with pollen, the beetles being of a flower-frequenting habit, and these spines are, therefore, doubtless of importance as a means of cross-fertilization of plants. Mr. Howard stated as a curious coincidence that the Elasminæ bear a close general resemblance to Mordellistena.

—Mr. Schwarz presented the following paper, illustrating it with specimens and figures:

A "PARASITIC" SCOLYTID.

By E. A. Schwarz.

Parasitism, as defined by Prof. Riley in a presidential address recently read before our Society, cannot possibly occur in truly phytophagous insects; but if we take the term in its widest meaning, as lately discussed by Dr. Stiles and others (see p. 1), we find in the life-histories of phytophagous insects various phenomena which more or less closely approach parasitism.

Confining myself to the three great phytophagous families of Coleoptera, I do not recall any instances of this sort among the Cerambycidæ and Chrysomelidæ, but quite a number are known among the Rhynchophora. Thus the larvæ of *Copturus longulus* inhabit the galls of *Podapion gallicola*, but they are mere messmates, and their presence is not detrimental to the welfare of the author of the gall. Some of our species of Otidocephalus which have frequently been bred from various Cynipid galls appear to have a similar mode of life. The larva of *Conotrachelus posticatus* is known to live within certain Phylloxera galls on Hickory leaves, and in this case the Phylloxeras always perish, probably from starvation, since it can hardly be assumed that the Conotrachelus larva is insectivorous.

Apion sordidum develops in large numbers in the galls of a Cecidomyiid on Bigelovia and causes the death of the gall-maker. Some of our Anthonomus, viz., *A. æneolus* (formerly incorrectly referred by me to *A. flavicornis*) and *A. sycophanta* furnish other examples of a parasitic mode of life.

Among the Scolytids no such larval parasitism occurs. but it has long since been observed that in some species the female beetle uses the galleries made by another female, either of the same or another species, to enter the wood for a shorter or longer distance and then to excavate a separate gallery. Eichhoff mentions several European species in which this habit of taking advantage of the work of other individuals of the same or different species is known to occur, and among our own species I have also observed it. Some years ago I exhibited before our Society (see Proc. I, p. 48) the work of *Tomicus cælatus*, where two females had used the entrance hole previously made by a third female. At another time I cut from the solid wood of a Walnut the network of a gallery in which two different species of Xyleborus (*X. fuscatus* and *pubescens*) had developed so that it was impossible to decide which species was the original author of the burrows and which the intruder.

In some species of Scolytids this habit is only exceptional, while in others it occurs more frequently, and there is a possibility that in one or the other species it becomes the rule; in other words, that such species are more or less dependent upon the work done by other species and unable to pierce the bark of a tree by their own effort.

I do not know whether or not such "parasitic" Scolytids exist, but there is in our fauna a minute species of Crypturgus, the galleries of which, as often as I found them, always started from the main gallery of a Tomicus, usually *T. cacographus*. More extended observations are, however, necessary to decide whether or not this is the normal habit of this species. I found it first in 1876, near Tampa, Fla., under bark of *Pinus palustris*, and in subsequent years near Washington, D. C., under bark of *P. inops*. It does not appear to be a very common species, but in the fall of 1892 quite a number of the galleries were found, though the beetles had in most instances already deserted them. The main gallery starts either rectangularly or obliquely from that of the Tomicus, at such place where no eggs of the host were laid or where the eggs had been destroyed by some predaceous insect. The gallery is either tolerably straight or more or less irregularly curved and of varying length, the longest measuring about 25 millimeters. At irregular intervals secondary galleries branch off which are extremely short, not more than 2 millimeters in length, so that the larvæ appear to be more or less stationary. All colonies observed by me were very small, and I never counted more than eight larval galleries in one colony.

The species itself appears to be undescribed and is evidently the southern representative of *Crypturgus pusillus* Gyll. (*atomus* Lec.) which belongs to the circumpolar fauna. It may be briefly characterized as follows:

Crypturgus alutaceus, n. sp. Elongate, nearly cylindrical, moderately shining, sparsely and inconspicuously pubescent, pubescence longer on head, sides of thorax and on the elytral declivity; color brown, or yellowish-brown, antennæ and legs pale. Head distinctly alutaceous, extremely finely and obsoletely punctulate. Thorax slightly longer than wide, slightly rounded on the sides, greatest width at the middle, surface distinctly alutaceous and with sparse, fine, more or less obsolete punctures; a smoother median line is feebly indicated. Elytra as wide and nearly twice as long as the thorax, more shining than the latter, punctate-striate, the striæ distinctly impressed with the punctures closely placed and moderately strong, interstices narrower than the striæ, convex and without distinct punctures, declivity simple. Length, 0.9 mm.

Described from eight specimens from Tampa, Fla., and Bladensburg, Md.

Of nearly the same size and form as *C. pusillus*, but the latter is at once distinguished by the more shining head and thorax, the very conspicuous large punctures on the thorax, and the wide elytral interstices.

Mr. Schwarz also exhibited a few Coleoptera which have been described as from North America, but have hitherto remained unknown or unidentified by American coleopterists. The species were as follows: *Trimium clavicorne* Mækl., found at Portland, Or., and Astoria, Or.; *Othius californicus* Mannh., found at Astoria, Or., and Victoria, Vancouver Island; and *Stenus immarginatus* Mækl., found at Banff Hot Springs, Alberta, Canada.

—Mr. Stiles reported a case of spurious parasitism in the human subject. He had received specimens of two larvæ, identified by Mr. Howard as *Ephestia zeæ*, which were said to have been passed by a maiden lady with urine. He said that this was undoubtedly another case of hysteria, a number of similar cases being on record.

—Mr. Schwarz invited the members of the Society to inspect three large collections of Coleoptera of considerable local interest. The first was a collection made by Mr. H. G. Hubbard at Lake Tahoe, Cala., in July, 1891; the second, a large collection also made by Mr. Hubbard in the Yellowstone National Park, at Fort Assiniboine, Mont., and at Bear Paw Mountains in northern Montana, in July and August, 1891; and the third, a large collection made in May and June, 1892, by Mr. Hubbard and himself, in parts of Oregon, Washington, and British Columbia.

THURSDAY, MARCH 9, 1893.

In the absence of the President and the Vice-Presidents, Mr. E. W. Doran was elected to the chair. There were ten members present.

The first paper of the evening was the following, by Mr. Frank Benton, and was accompanied with an exhibit of the objects described:

THE CURIOUS DEFENSES CONSTRUCTED BY MELIPONA AND TRIGONA.

By FRANK BENTON.

Some twenty years ago Mr. Ed. Drory, then editor of *Le Rucher*, of Bordeaux, France, himself a skilful apiarist and a student of entomology, imported from Brazil a large number of nests and hives of the Meliponas and Trigonas native to that country and bred some of the species for several years, even succeeding, by extra precautions, in carrying some of them through the winters of his portion of France. Seven species of the genus Melipona and four of Trigona were studied by him and some of his observations were published in *Le Rucher* for 1873 and 1874, while his particular study of *Melipona scutellaris* was published by himself in pamphlet form at Bordeaux.* Mr. Maurice Girard having visited the apiary of Mr. Drory in the autumn of 1873, and also made some additional observations on the bees of two hives of different species of Melipona presented by Mr. Drory to the Jardin d'Acclimatation, read before the Entomological Society of France, at three of its meetings held in 1874, some notes on these bees. Referring to *Melipona postica* Latr. (*M. dorsalis* of F. Smith), he said, June 10th, of the hive in the Jardin: "They have constructed outside, around each hole, a very pretty spreading cornet of reddish-brown wax, having the appearance of some kind of crêpe or stiff lace." †

* Quelques Observations sur la Mélipone scutellaire, *Melipona scutellaris* Latr., par Ed. Drory, Bordeaux, 1872.

† Bulletin de la Société Entomologique de France, 1874, p. CVI (Séance du 10 Juin).

Again, July 22d, he remarks: "The small species, *M. dorsalis* Smith, now has at the entrance of its hive a long, somewhat distorted, cylindrical tube of brown wax, 5 or 6 cm. long and 1 cm. in diameter, ending outside with a reddish spreading cornet. * * * * The workers of the other species, *Melipona scutellaris* Latr., have built of brown wax, granular and soft, a sort of a wall which completely closes the large entrance hole which was made in the bottom of the wooden box that serves as their hive. This work must be intended to protect them from the light and to prevent the entrance of insect enemies." * At the meeting of the 9th of December, 1874, Mr. Girard said: "It is seen in the nest of *Melipona scutellaris* that a tube of wax starts from the entrance-hole and leads to the brood-nest, so that the insect traverses it in the same manner as the Termites of Landes and Charantes their galleries of sawdust. It is the exterior collar of this tube which I have observed around the flight-hole of the small species in the Jardin d'Acclimatation, *M. postica* Latr., or *dorsalis* Smith. It is probable that this tube, which is found in the nests of all species of Melipona and Trigona, serves to shut out all light from the interior and prevents the introduction of insect enemies." †

It is particularly to the opinion expressed in this last sentence, as well as on one other occasion by Mr. Girard, namely, *that these defenses were constructed for the purpose of preventing the entrance of light*, that I wish to direct your attention, and also to the statement made in all four quotations, *that the material of these entrance-tubes is wax*. So far as I am aware, no one has ever called in question the correctness of these observations made, as they were, by one of the former presidents of the Entomological Society of France, who has himself written a work on apiculture which professes, as its preface states, "to be a guide both scientific and practical," and "for apiculturists a clear and exact *résumé* of the natural history and of the technical operations connected with the harvesting of the products; for *savants*, a complete monograph from the entomological standpoint." ‡

It is true he does not directly state that the tubes or defenses constructed by Trigona are of the same material as those made by Melipona, but he distinctly states on three different occasions that the entrance barriers of the latter are of wax, and when referring to Trigona he fails to note any exception. This, it seems to me, implies that he considers the nature of the material employed in these constructions by each genus the same, as also the purpose they serve. Mr. Drory clearly regarded them as built for protec-

* *Id.*, p. CXL (Séance du 22 Juillet).

† M. Girard in Annales de la Société ent. de France, 1874, p. 568 (Séance du 9 Déc., 1874).

‡ Les Abeilles, Organes et Fonctions, éducation et produits, miel et cire, par Maurice Girard, Paris, 1878. (See pp. 7–8.)

tion against insect enemies, and made no mention of their exclusion of light from the interior of the nests. Certain observations I have made lead me to form conclusions differing somewhat from those recorded by Mr. Girard, and I will, therefore, mention briefly some of them, as well as show you entrance-tubes and combs constructed by bees of these genera that you may judge for yourselves as to the materials used in each.

Melipona.—In 1883 I was kindly shown by Mr. Drory himself his collection of 30 or 40 nests and hives of Melipona and Trigona—mostly the former. The entrance-tubes and barriers, where constructed, were, as far as I could determine, of the same material as the entrance-tube leading from the flight-hole to the brood-nest of the hive now before you, contained in the original case in which it was imported from Brazil, and which was kindly presented to me by Mr. Drory in acknowledgment of specimens of East Indian bees I had given to him. This nest or hive is one of *Melipona scutellaris* Fabr. It can be readily seen that considerable difference exists between the material of the entrance-tube and that of the honey-cells and labyrinthine envelope of the brood-nest. I have examined the material of entrance-tubes and cells with considerable care, and find that of the tubes to be quite hard and brittle at ordinary temperatures, under which wax is somewhat yielding and pliable; in burning it gives no odor of wax, but rather that of some resinous gum. The tube where it passes through the labyrinthine envelope to reach the brood-nest, and also where, outside this envelope, honey-cells are attached to it, undoubtedly has incorporated in its mass more or less wax of the peculiar brown color and soft, almost greasy, consistency characteristic of the wax of Melipona. But all parts of the tube which are separated from the nest proper seem to be composed wholly of resinous substances corresponding to the propolis or so-called "bee-glue" of our Apis. The nest itself, made up of the store-cells, labyrinthine envelope, and within this the brood-combs, is built wholly of the "brown wax, granular and soft," of which Mr. Girard speaks. The two substances seem to me to be similar only in color. Being quite familiar with all of the substances produced by bees, I feel sure I am not mistaken in identifying the material of the entrance-tube proper as corresponding to the propolis gathered by our *Apis mellifica*, and I am much surprised that they should have been confounded.

Trigona.—During the early part of 1881 I passed several weeks on the Island of Ceylon and while there examined about a dozen nests of Trigona located where built. These were all found in the more open portions of the country. None were noticed in the denser forest regions, although hollow trees suitable for nesting-places were not lacking there. The nests, with one exception, were in the hollows of small stubs or branches of low trees. The single exception was that of a swarm which had located in one of the iron posts supporting the porch of a house at Kaltura, on the southwestern coast. The only entrance to this nest was through a small hole scarcely 5 mm. in diameter in the side of the iron post—a hole probably caused by an air-bubble when the pillar was cast. The occupants of the pillar evidently considered themselves secure within their iron walls, with so small an opening for ingress, for they had constructed no outer defences. The same thing was noticed in all instances where the trees in which the nests were located were tolerably sound and the entrance-holes were small. But in several where the entrances were 10 mm. to 25 mm. in diameter the bees had built a ridge or rim 10 to 15 mm. high around the flight-hole. The sticky material used seemed to be a resinous gum, as in the case of the entrance-tubes of Melipona, and, like them also, the material appeared similar to the propolis collected by our honey-bees. Upon a casual examination I thought gnawings of bark had been incorporated into the mass. Under a lens it appears to be composed of particles of resin; it tastes like resin and burns like resin or pitch; it is much harder than wax and is quite brittle at temperatures at which wax is soft and more or less ductile; in fact, it shows *none* of the characteristics of real wax, but does show most of those of propolis as we know it here. I am therefore decidedly of the opinion that these entrance-tubes contain *no* wax, but are almost, if not wholly, constructed of propolis. The edges of these curious defences were as thin as ordinary cardboard, while at the bases where attached to the trees they were two or three millimeters thick. In one instance, in the jungle near Kaltura, I found a nest located in a small stub in which, a little farther down, a colony of ants had also established itself. The Trigonæ had extended their tubular defence out some 20 mm. and then downward, or perhaps in the heat the tube had naturally assumed that position, as it had reached a length of about 20 cm., the diameter varying from 10 to 25 mm., the tube being somewhat flattened. Through this tube the bees reached their nest, entering at the lower end, the only opening, and I noticed that the ants, usually so ravenous and destructive in this as well as other tropical regions, avoided this somewhat sticky tube. I carefully removed this tube, portions of which I now place before you, and the nest of Trigonæ from its lodgement in the tree and placed it in a small box, and being about to proceed eastward took it with me. The insects bore the confinement of the five days' sea-voyage to Singapore very well. They were permitted to fly there a couple of days and then confined for three days more on the journey to the Island of Java. Upon being released, with a number of colonies of *Apis mellifica* I had brought with me, at the Dutch East Indian Agricultural

College, near Buitenzorg, these diminutive bees immediately went vigorously to work "cleaning house," and were soon bringing in pollen and honey. When the flight-hole was much larger than was necessary in order to permit a single Trigona to pass in or out, the ants, large and small, were even more troublesome than in Ceylon. Individuals from the hives of *Apis mellifica* (Cyprian and Palestine varieties) which I had brought with me also made efforts to get into the nest or hive of Trigonæ. The latter immediately began the construction of an entrance-tube, but did not add to it after I contracted the entrance, and until some one disturbed the cover during my absence the small size of the entrance with perhaps some aid from the surrounding wall of sticky propolis enabled the tiny occupants to hold their fort. I found the cover awry one day and ants in full possession. The Trigonas had been destroyed and their honey and immature bees taken. No honey-bees were seen about the box, but perhaps they had helped at the banquet and had taken leave as soon as the first course (the honey) had been disposed of.

As the tubular entrances were only constructed, as far as I observed, when the flight-holes themselves were rather large, and when these were small the bees seemed to be secure without such passage-ways, I naturally concluded that the tubes served as defences only. Their whole arrangement, combined with the labyrinthine envelope of the brood-nest, is well calculated to afford considerable security to the stores of these stingless bees, for any other insect wishing to reach the honey of the Meliponas or Trigonas must needs pass, first of all, the length of the outer tube or barrier-wall where such has been constructed, then through the narrow entrance past the sentinels, down the inner tube into the brood-nest, and thence through the labyrinthine passages of the envelope to the outside of the brood-nest where the cells for holding honey and pollen are found attached to the inner walls of the cavity which has been selected as a home by the colony. Once there and gorged with honey the robber would have to run the same gauntlet to get out, if indeed he could remember his way through the labyrinthine passages, which the Meliponas and Trigonas traverse with ease and rapidity. It is easily understood that this arrangement also prevents the ready escape of the odor of honey which might attract pilferers.

The bees which I saw in nests having no outside entrance-tubes did not seem to be incommoded by the small amount of light which entered through the flight-hole. Nor are our bees of the sister genus Apis. Even Bombus, of which I have often had a dozen or more nests at a time in small wooden hives, is not apparently disturbed by the light which enters through a half-inch hole. Some varieties of our *Apis mellifica* construct corresponding entrance-defences to protect themselves in regions where the death's-head moth and wasps are abundant.

These facts lead me to conclude that Mr. Girard is quite in error in his opinion that these entrance-tubes are constructed of wax, and also equally so in the view that they are for the express purpose of shutting out the light. Propolis is doubtless the material of the tubes, and they are probably built for defence only.

Some discussion followed on the nature of the substance used in the construction of the entrance-tubes and honey-cells, and the author was also questioned as to the natural enemies of these bees. In reply he stated that one of their enemies seems to be the common honey-bee, *Apis mellifica*, which robs the nests and eventually drives out and destroys the stingless Melipona. Mr. Schwarz referred to a paper by Dr. Von Ihering, in which the statement was made that the native bees had been almost driven out and destroyed in the province of Rio Grande do Sul, Brazil, by *Apis mellifica*, which had rapidly spread over the entire district. The bee-moth was also stated by Mr. Benton to infest the nests of Melipona, but he was unable to give any facts as to the native or original enemies of Melipona except in a general way—that they were subject to the attacks of various birds and Vespas. That there must be, however, various insect parasites which are peculiar to these bees was urged by Mr. Schwarz and others. The death's-head moth having been mentioned as an enemy of bees, Mr. Schwarz inquired in what way the damage from this moth occurred. Mr. Benton stated that it consisted in its entering the hives and robbing them of their honey, which injury was probably not very extensive, as the moth rarely escaped from the hive, but was killed and dismembered by the bees and sealed up in the hive in a covering of propolis. Mr. Howard queried whether the wax which was known to be abundant and a common article of commerce in the times of the Motezumas, among the ancient Mexicans, was a product of the native Melipona. In answer to a question as to the geographical distribution of these bees (Melipona) Mr. Benton stated that, so far as he knew, they are limited to the New World and occur in the greatest abundance in Southeast Brazil and other parts of South and Central America, and in the West Indies. The Trigona occurs in Brazil and other tropical countries of South

America, also in Mexico, and in the eastern hemisphere, in Ceylon, the Malay peninsula, Sumatra, Java, and also in parts of Australia.

—Mr. Schwarz presented the following, illustrating his remarks by sketches and exhibition of specimens:

NOTE ON THE OVIPOSITOR OF SOME SPECIES OF DONACIA.

By E. A. Schwarz.

While arranging a collection of North American Donacias I noticed that in many females of the subgenus Plateumaris (Group D of Mr. Leng's Synopsis of the Donaciæ of Boreal America, in Trans. Am. Ent. Soc., xviii, pp. 159 ff.) the ovipositor is protruded and represents a very conspicuous object. In the typical Donacia the ovipositor is never visible, and upon dissection it was found that in these species the outer, horny sheaths of the ovipositor are but little developed and not capable of protrusion.

In the species of Plateumaris the outer sheaths of the ovipositor form two plates, a smaller and narrower dorsal plate and a wider and much longer ventral plate. The upper plate is always extremely thin and transparent, usually as long as wide, with the apical side either subtruncate, or rounded, or feebly triangularly produced.

The ventral plate is usually much longer than wide, with the sides parallel at the basal part, thence convergent either obliquely or arcuatedly and terminating in an acute point. The rim of this plate is slightly thickened, hard and horny, highly polished and of a rich umber brown; the edge itself is extremely sharp like that of a knife and finely (in one species coarsely) serrate. The middle of the plate from the base to some distance beyond the parallel portion is very thin, quite transparent and concave at the dorsal surface. The dorsal plate closly fits into this concavity and thus protects the inner parts of the ovipositor, which can be plainly seen through the transparent outer plates.

The whole apparatus just characterized evidently forms an instrument admirably adapted to sawing into the tissues of plants, and I have not the slightest doubt that in all species of this subgenus the eggs are laid within the stems or roots of plants. The ovipositor is exserted at an angle with the tip of the abdomen so that the beetle can operate it exactly like a saw moving up- and downward. When the ventral plate has sufficiently deeply penetrated into the plant, the apex of the dorsal plate is lifted up, which can be readily done on account of the higher rim of the ventral plate. The ovipositor proper, guided by the inner (lateral) pair of plates, then is pushed through this opening and the egg (or the eggs) is thus inserted into the slit.

It is well known that the imagos of Plateumaris differ in habit from those of Donacia: the former occur on palustral plants and the latter on truly aquatic plants. The supposed oviposition in Plateumaris greatly differs from that of the true Donacia, so far as the life-histories of these are known, and would seem to indicate a corresponding difference in the habits of the larva.

I am not aware that any similar structure of the ovipositor has been observed in other Coleoptera,* and while in several families (especially Cerambycidæ) the eggs are inserted into the tissues of plants, the ovipositor is at most a piercing instrument, but never a saw.

From an examination of a number of females of Plateumaris it can be readily seen that the form of the ovipositor, and more especially that of the ventral plate, offers excellent characters for the distinction of the species. The material at present at my disposal is, however, by no means complete enough to enable me to give a synoptic table of the species based upon this character, and I confine myself to indicate briefly the various types of this structure in the North American species:

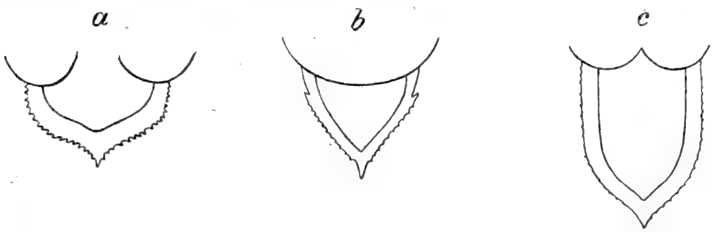

Fig. 1. Outer ventral plate of the ovipositor in Donacia (subgenus Plateumaris): *a*, *Donacia*, n. sp.?; *b*, *D. rufa*; *c*, *D. emarginata*.

1*st* Type. Ventral plate with a prominent, acute tooth on each side of the junction of the parallel basal part with the apical part; the latter triangular with the sides straight and finely serrulate; terminal point long and slender, spine-like.

This type occurs only in *D. rufa*.

2*d* Type. Ventral plate without such tooth; apical part more or less triangular, with the sides either straight or arcuate, edge finely serrulate; terminal point acute but not spine-like.

Most of our species belong here; specific differences are indicated by the greater or smaller width of the plate, the longer or

* The pupæ of the Chrysomelid genus Sagra have been found within the stems of plants, but I had no opportunity of examining female specimens of this genus.

shorter apical portion of the same, the greater or smaller extent of the thickened rim, etc.

3d Type. Ventral plate without such tooth; apical portion not triangularly produced but broadly rounded; edge coarsely serrate; terminal point represented by a broad tooth.

Here belongs a single species which is possibly undescribed.

—Mr. Schwarz exhibited samples of white and black insect pins made by Schlüter of Baden, Germany, and now offered for sale by Queen & Co. He said that from a short experience these pins appeared to him to be superior in many respects to the Kläger pins as now obtained in the market.

April 6, 1893.

In the absence of the President, Vice-President Ashmead presided. Ten members and one visitor were present.

Dr. Marx presented the following paper:

DEGENERATION BY DISUSE OF CERTAIN ORGANS IN SPIDERS.

By Geo. Marx.

A strange example of retrogradation in organs by disuse I have noticed among some spiders of the Fam. Drassidæ collected in the subarctic region of our continent. The genus Gnaphosa is known to make no web, their faculty of spinning being confined to making loose threads in crevices under bark and stones, to cocoon covering, and occasionally they issue a drag-line while running.

In the northern region their active life is so short that they seem to have no need to use their spinning organs at all, and these organs—the external spinnerets as well as the internal spinning glands—are apt to retrograde gradually and become rudimentary or they are lost altogether. This is the case in our *Gnaphosa conspersa* Thorell, of which I possess specimens in my collection from Alaska, Lake Superior, and Lake Klammath, Oregon. Here the two superior and the two median spinnerets are entirely wanting, while the two inferior spinnerets are fully developed. The anatomical change is confined to the absence of eleven large glands (either tubuliform or ampulaceæ and nine median glands), while in the inferior spinnerets there are retained three large and about twenty smaller pyriform glands. The product of the pyriform glands is the guy-rope or drag-line, while the tubuliform glands furnish the spinning material for the cocoons. Thus we see the males are able to render their walking secure by the usual guy-rope, and the females can cover their cocoons safely. In consequence, the absence of these organs does not interfere with the life of the animals.

The paper was discussed by Messrs. Gill, Ashmead, and Schwarz.

Dr. Marx stated in answer to a question by Mr. Schwarz that the Attidæ have the six normal spinnerets, for, although they spin no webs, they have occasion to elaborate a good deal of silk for their winter quarters. Dr. Marx further stated that he had learned from a correspondent near Baltimore that the common *Phydippus morsitans* had died in large numbers from cold during the past winter, thus showing that the idea he had presented at a previous meeting relative to the hibernation of Arctic spiders was probably correct.

Mr. Schwarz stated that he had observed a great mortality among the Scolytids affecting pine trees near Bladensburg, Md., the principal species being *Tomicus cacographus* and *T. cœlatus*. Last fall these insects and their larvæ were extremely abundant in the trees, but at the present time hardly a living individual was to be found. Specimens of a coleopterous enemy of the species, viz., *Hypophlœus parallellus*, are alive at the present time, and it may be that the work of this insect accounts in some degree for the disappearance of the injurious forms, but he is inclined to think that the unusual cold of the past winter was the principal cause of the great mortality. Dr. Smith stated that as these species occur also much further north, the mortality could hardly have been caused by the cold; to which Mr. Schwarz replied that in his opinion a more or less extensive mortality from unusual cold must occur occasionally to keep the numbers of the beetles within bounds. Mr. Ashmead spoke incidentally of the hibernation of a large spider of the genus Attus under the bark of trees in Florida.

—Mr. Ashmead presented the following:

A SYNOPSIS OF THE SPALANGIINÆ OF NORTH AMERICA.

By William H. Ashmead.

Head large oblong or ovate, often tricornuted in front, the occipital line usually complete. Ocelli 3, always present, triangularly arranged. Mandibles bidentate at tips. Maxillary and labial palpi 2-jointed. Antennæ clavate or subclavate, variable in the number of joints from 8 to 12. Prothorax usually large, well developed, narrowed before or subquadrate. Mesonotum usually with short, triangular, convex scapulæ. Scutellum flat and sometimes with an impressed cross-line before apex. Wings often absent, when present with a marginal fringe, the marginal vein most frequently long, linear, rarely short and thickened, the postmarginal and stigmal veins usually very short; hind wings narrowed toward base, not lobed, with a distinct marginal vein. Abdomen distinctly petiolated, the tip compressed into a horn-like point with the ovipositor exserted or subexserted. Legs rather slender, the tarsi 5-jointed, the claws simple.

The *Spalangiinæ* represent a small group in the family *Chalcididæ*, section *Macrocentri*, that is closely allied to the *Pireninæ* and *Tridyminæ*, and in which the occipital line is usually complete, the mandibles bidentate, while the antennæ are never more than 12-jointed.

The group is further distinguished by the very short, well-defined parapsides, a distinctly petiolated abdomen, by the venation, and by the apex of the abdomen being compressed into a small projecting horn-like process.

Of the five genera here brought together, the parasitism of four is known: *Isocratus* Först. is parasitic on different Aphids; *Cerocephala* Westw. attacks the larvæ of wood-boring beetles, belonging to the family *Scolytidæ*; *Chætospila* Westw. was reared from a beetle in seed of *Zea mays;* while *Spalangia* Latr. is parasitic on Dipterous larvæ.

The different genera may be distinguished by the aid of the following table:

Table of Genera.

Prothorax subquadrate, not or scarcely narrowed anteriorly.

Head transverse, normal, the antennæ 12-jointed, inserted far above the clypeus; marginal vein very short, . . . *Isocratus* Förster.

Prothorax long, narrowed anteriorly.

Head tridentate with deep antennal furrows, a sharp high-pointed carina between base of antennæ; marginal vein long.

Head with a long spear-like process; mandibles very large– three-fourths the length of the head; antennæ 10-jointed in both sexes,* . . . . *Paralæsthia* Cameron.

Head without a long spear-like process; mandibles not large.

Antennæ in ♀, 9-, in ♂ 10 or 11-jointed, *Cerocephala* Westw.

Antennæ in ♀ 8-jointed; ♂ unknown, . *Chætospila* Westw.

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*In Cresson's synopsis the mandibles are said to be three *times* as long as the head, instead of three *fourths* as long—plainly a copyist's or printer's error, but a serious one.

Head smooth, not tridentate, without distinct antennal furrows; antennæ inserted close to the mouth, in ♀ 10-, in ♂ 12-jointed, *Spalangia* Latr.

ISOCRATUS Förster, Hym. Stud., ii, p. 53 (1856).
Syn. Asaphes Walk., Ent. Mag., ii, p. 151 (1834).
(Type A. vulgaris Walk.)

Head transverse, wider than the thorax, with the frons impressed; viewed from in front it is subtriangular. Eyes moderate, broadly oval, bare. Ocelli on the vertex, triangularly arranged. Mandibles curved, bidentate, the teeth rather long, acute. Maxillary and labial palpi 2-jointed.

Antennæ clavate, 12-jointed in both sexes, inserted slightly below the middle of the face, all the funiclar joints transverse. Thorax subovoid, the pronotum large, nearly quadrate; the mesonotum with two distinct furrows, the parapsides subconvex, the metanotum small, rugulose.

Wings hyaline, the margins delicately fringed, the marginal vein shorter than the stigmal vein, the former slightly thickened towards apex. Legs slender, the tibial spurs 1, 1, 1, the last pair weak; tarsi 5-jointed.

Abdomen ovate, depressed above, distinctly petiolated, terminating in a small compressed process, the second segment about 1½ times as long as the third, the following segments short, subequal.

Only a single species, having several synonyms, is known, as follows:

I. vulgaris Walker.

Asaphes vulgaris Walk., Ent Mag., ii, p. 152.
Ann. and Mag. Nat. Hist., x, p. 114.
List. Brit. Mus. Chalc. 1846, p. 23.
Eurytoma aenea Nees, Hym. Ich. Aff. Monog, ii, p. 42.
Colax aphidii Curt., Jour. Roy. Agric. Soc., iii.
Pteromalus petiolatus (?) Zett., Ins. Lapp., xiv, p. 332.
Chrysolampus suspensus Nees, Monog., ii, p. 127.
altiventris Nees, l. c.
Isocratus vulgaris Thoms., Skand. Hym., iv, 208.
Riley, U. S. Agric. Rep. 1889, p. 35, pl. vi, f. 2.

♂ ♀.—Length, 1.6 to 2.3 mm. Aeneous black and most frequently with a decided metallic tinge on the thorax, pleura and coxæ; antennæ usually black, but the flagellum varies from brownish-yellow to brown and black; legs, except coxæ, brownish-yellow with sometimes the femora and tibiæ obfuscated; coxæ aeneous black or submetallic; wings hyaline, the venation pale brownish-yellow, the marginal vein shorter than the stigmal vein, a little thickened at apex.

The whole surface, except the middle mesothoracic lobe anteriorly and the metathorax, is smooth, shining; middle mesothoracic lobe anteriorly feebly punctate, metathorax finely rugose, its pleura with long greyish hairs. Antennæ 12-jointed, clavate, the funiclar joints transverse. Abdomen ovate, petiolate, depressed above, its tip compressed into a little point, the petiole about $2\frac{1}{2}$ times as long as thick, rugulose, the ruguosities longitudinally directed, or striated; rest of abdomen smooth polished, the second segment the longest—$1\frac{1}{2}$ times as long as the third, the segments after the third short, subequal; ♂ abdomen smaller, more depressed and with the tip truncate.

Hab.—Europe, North and South America, and Australia.

This species is a common parasite on different species of Aphids; the only exception is a specimen reared by myself from *Dactylopius adonidum* Linn.

PARALÆSTHIA Cameron, Biol. Cent. Am., Hymn., p. 110.

(Type P. mandibularis Cam.)

"Head elongate, broad, produced in front into a spear-head process, the apex of which is blunt, and its base produced into a blunt tooth-like process. Eyes small, oval, situated on the sides. Vertex with a wide and deep furrow extending from behind the ocelli to the antennæ and carinated in the middle, the keel running down to the centre. Mandibles very large, three-fourths of the length of the head, curved, bidentate. Antennæ 10-jointed, clavate, situated a little below the middle of the head; scape shorter than the first two joints of the flagellum, the first joint shorter than the second, fourth and fifth shorter and thicker; the rest become thicker towards apex. Prothorax large, a little broader than long, distinctly separated from the mesothorax, the sides scarcely straight, transverse behind, rounded and narrowed in front. Mesonotum rather flat above, the scutellum not clearly defined. Metanotum comparatively large, closely amalgamate with the mesonotum. Petiole long, curved, broader at the base than at the apex, round. Abdomen ovoid, flat, contracted before and behind; second segment longer than the next, fourth much longer than any of the others; apical a little shorter than the third. Ulna shorter than the marginal branch (which is prolonged a little beyond the cubitus); at its junction with ulna is a thickened spot of hairs; the marginal branch is provided with projecting hairs; the margins of the wings with long cilia. Coxæ large, thickened, widely separated; femora stout; tarsi longer than the tibiæ.

The female has a stout laterally compressed ovipositor, which is about half the length of the abdomen. The head over the mouth is broadly incised, the edges of the incision being tooth-like; the front below the antennæ is produced into a broad keel, which overhangs the mouth-region, terminating in a blunt thick tooth." (Cameron.)

This genus is unknown to me in nature; the type *P. mandibularis* Cam. is described from Panama. Mr. Cameron in speaking of it says: "The affinities of this genus are clearly with *Theocolax* Westw., with which it agrees in the structure of the thorax and abdomen and of its wings; but the enormous development of the mandibles, the very deep and long suture on the head, and the greater development of the basal abdominal segments sufficiently differentiate the two."

CEROCEPHALA Westwood, Mag. d. Zool. i., p. (1831).
(Type C. cornigera Westw.)

Syn. Theocolax Westw., Lond. Edin. Phil. Mag., 3d ser., i, p. 127 (1832).
Epimacrus Walk., Ent. Mag., i, p. 369 (1833).
Læsthia Hal., Ent. Mag., i, p. 335 (1833).
Sciatheras Ratzb., Ich. d. Forstins., ii, p. 209 (1848).
Tricoryphus Först., Hymn. Stud., ii, p. 209 (1856).

Head oblong oval, tridentate before from deep antennal furrows and a sharp carina between. Ocelli 3, in a triangle. Eyes oval.

Antennæ clavate, inserted away from the clypeus, in the ♂ 10- or 11-jointed, the last two joints sometimes connate and apparently reducing the number of joints; in the ♀ 9-jointed, the club in the ♀ sometimes jointed and giving a corresponding increase in the number of joints.

Maxillary and labial palpi short, 2-jointed.

Thorax long, the prothorax large, triangular, or quadrate, the mesonotum with short, triangular scapulæ, the scutellum without a transverse impressed line before the tip, the metathorax more or less rounded off posteriorly.

Front wings fringed, the marginal vein rather long, the stigmal and poststigmal veins short. Females often wingless.

Abdomen suboval or conic-ovate, longly petiolated, the ovipositor exserted.

Legs rather stout, hairy.

Förster, as early as 1856,* united *Theocolax* with *Cerocephala* and says: Walker hat in dem Ent. Mag., vol. ii, p. 149, Zwei Arten angeführt, *cornigera Westw.* und *formiciformis* Westw. Beide halte ich für dieselbe Art, die in Bezug auf Färbung und selbst auf die Kopfbildung, sowie nicht minder in der Grösse bedeutend variirt. Oft sind nicht zwei Exemplare völlig gleich gebildet. Der Name *cornigera*, als der ältere, würde beibehalten werden müssen und die Synonymie wäre folgende:

Cerocephala cornigera Westw., Guerin Mag. d. Zool., prem. Livr., pl. 4 (1831) ♂.
Theocolax formiciformis Westw., Lond. and Edin. Phil. Mag., 3d ser. i, no. ii, p. 127 (1832) ♀.

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* Hymen. Stud. ii, p. 41.

Læsthia vespertina Hal., Ent. Mag., i, p. 335 (1833) ♂ ♀.
Epimacrus rufus Walk., Ent. Mag., i, p. 369 (1833) ♀.
Sciatheras trichotus Ratzb., Ichn. der. Forstins., ii, Bd. p. 209, (1848) ♀ alata.

Notwithstanding this, Thomson, in his Skandinaviens Hymenoptera, vol. iv, p. 207 (1875), gives a table of the Spalangiina, based entirely on the color, the absence or presence of wings, and the smoothness of the mesonotum, in which he again separates *Theocolax* from *Cerocephala* and also recognizes the genus *Tricoryphus* Förster, as belonging to the group which was originally placed by Förster in his family *Cleonymoidæ*. In my studies in the group, I am convinced that color, punctuation, and the absence of wings are of no generic value, and I have united all of these genera under the older name *Cerocephala*.

The three species in our fauna may be separated as follows:

TABLE OF SPECIES.

Wingless or with rudimentary wings, ... 2

Winged.

Pale brown disk of mesonotum and scutellum metallic brown.

Abdomen bronzy black; head and prothorax with iridescent reflections; wings hyaline with a broad brown band beyond the middle. ♀ Length, 1 mm., ... *C. pityophthori*, sp. n.

Reddish-yellow or honey-yellow. ♂ with a brownish metallic blotch across mesonotum and scutellum.

Abdomen in ♀ with the apical half metallic brown, in ♂ with a brownish transverse band.

Wings hyaline in ♂ with a slight brownish blotch below the stigmal vein; in ♀ with a larger discal blotch and a slight brownish streak below the juncture of the submarginal with the marginal. Length, 1.5 to mm.,
C. scolytivora, sp. n.

2.—Metallic brownish red; mesothorax broad, longitudinally aciculated. Length, 2 mm., ... *C. canadensis*, Prov.

C. pityophthori, sp. n.

♀.—Length, 1 mm. Pale brown, polished, impunctured; the disk of mesothorax and the scutellum metallic brown; the abdomen bronzy black; the head and prothorax with iridescent reflections; the tip of the antennæ black; ovipositor not quite half the length of the abdomen; the legs pale brownish-yellow, the posterior femora sometimes metallic.

Antennæ 9-jointed, clavate, moniliform, the pedicel longer than the first funicle joint; club large, usually inarticulate, but sometimes with one or two indistinct sutures. Wings hyaline with a broad brown band beyond the middle; the marginal vein is longer than the submarginal, the stigmal and postmarginal veins very short.

Hab.—Haw Creek, Florida.

Types in National Museum.

Described from four specimens, reared by Mr. E. A. Schwarz, in April, 1887, from *Pityophthorus consimilis* Lec.

C. scolytivora, sp. n.

♂ ♀.—Length, 1.5 to 2 mm. Reddish-yellow or honey-yellow, highly polished, impunctured; in the ♂ with a brownish submetallic blotch across the mesonotum and the scutellum, and a brownish transverse band on the abdomen; the coxæ, trochanters, tarsi, and petiole, white; antennæ 10- or 11-jointed gradually incrassated toward tips, submoniliform; wings hyaline, except a slight brownish blotch below the stigmal vein; in the ♀ the apical half or more than the apical half of the abdomen is metallic-brown, sometimes with purplish reflections, the ovipositor projects with stout valves, its basal half yellow, its apical half black; the antennæ are stout, moniliform, 9-jointed, the club usually not jointed; wings hyaline with a brown blotch on its disk below the stigmal vein and a much narrower brown streak below the juncture of the submarginal with the marginal; the marginal vein is longer than the submarginal, the stigmal and postmarginal short, the former oblique and thickened at tip. The eyes, in both sexes, are brown, bare, ocelli in a triangle. The head anteriorly is tricornuted, the keel between the antennæ sharp, triangularly pointed.

Hab.—South Florida.

Types in National Museum.

Described from 16 specimens, reared April 14, 1884, by Mr. E. A. Schwarz, from *Loganius ficus* Schwarz, MS., found on *Ficus aurea*.

C. canadensis Prov.

Theocolax canadensis Prov., Faun. Hym. Can. ii, p. 809.

♀.—Length, 2 mm. Metallic brownish-red with coppery reflections. Antennæ kneed after the scape, which is long and lodged in a groove of the face, brown, the scape testaceous, the last joints thickened, clavate. Prothorax in the form of an elongate collar; mesothorax broad, longitudinally aciculated before. Rudiments of wings short. Legs testaceous; the extremity of the femora and the anterior tibiæ brownish. Abdomen thickened at the extremity; the ovipositor one-quarter the length of the abdomen, testaceous, the extremity black.

Hab.—Cap Rouge, Canada.

Type in Coll. Provancher.

Unknown to me. The Abbé says: "Nous ne somme pas certain que cet insect soit réellement un *Théocolax*, ce sont bien les antennes de ce genre tel que décrit par Westwood, mais le prothorax n'est pas triangular."

CHÆTOSPILA Westwood, Thes. Ent. Oxon., p. 137.
(Type C. elegans Westw.)

"Caput quadratum antice trilobatum; mandibulæ subtrigonæ apice obliquo 4-dentato (pl. xxv, fig. 10a); maxillæ lobo apicali membranaceo rotundato setoso, palpis maxillaribus 4-articulatis articulis primo et tertio brevibus (fig. 10b); mentum oblongo-ovale; labium oblongum in medio paullo constrictum apice rotundato, palpis labialibus biarticulatis articulis aequalibus (fig. 10c); antennæ 8-articulatæ (absque articulis annuliformebus) articulis 2-7 longitudine fere aequalibus at sensim crassioribus, ultimo majori longo-ovali (fig. 10d); collare semiovale capite angustius; mesonoti scutum breve, scutellum magnum; pedunculus abdominalis brevis; abdomen magnum ovale; alæ amplæ, setis longis marginatæ, vena subcostali trientem costæ vix attingente, apice ejus in fasciculum setarum erectarum terminato, ramo stigmaticali minuto; pedes graciles."

Unknown to me. Prof. Westwood further says: "The remarkable fascicles of short erect bristles at the junction of the subcostal vein with the costa is quite peculiar, and, so far as I have observed, does not occur in any other insect. The insect is closely allied to Cerocephala, from which it differs in the short peduncle to the abdomen and the 8-jointed antennæ, these organs in Cerocephala being distinctly 10-jointed, the eighth and ninth being equal in size to the two preceding joints."

The type *C. elegans* is figured l. c. supra, on pl. xxv, fig. 10, and was reared from *Zea mays*. It is undoubtedly parasitic on some Coleopteron living in the corn.

The peculiar fascicles of short erect bristles to which Prof. Westwood calls especial attention is likewise at times present in *Cerocephala*. It is a peculiar feature of *Sciatheras trichotus* Ratz., and is very distinctly shown in his figure of this insect, Ichn. der Forstins, Bd. ii, Taf. iii, fig. 1. Moreover, on page 209 he has called especial attention to it in the following words: "Weit eigenthümlicher und ganz einzig ist die Verzierung der Flügel-Junktur. Hier steht ein Flausch von feinen Börstchen (Fig. a, schwach vergrössert und Fig. 6, jener Flausch in einer etwas veränderten Richtung stark vergrössert)."

The genus appears to me scarcely distinct from *Cerocephala*.

SPALANGIA Latreille, Gen. Crust. et Ins., iv, p. 29.
(Type S. niger Latr.)

Head oblong or ovate, anteriorly truncate. Eyes ovate, hairy. Ocelli 3, in a triangle.

Mandibles oblong, bidentate at tips.

Maxillary and labial palpi 2-jointed.

Antennæ elbowed, inserted at the mouth, 10- or 12-jointed, in ♀ clavate or subclavate, in ♂ filiform, the third joint elongated.

Thorax long, the prothorax long, narrowed anteriorly, mesonotum prominent anteriorly, the scapulæ prominent, the scutellum flat with a transverse impressed or punctate line before the tip, metathorax subquadrate, the posterior angles obtusely dentate, the dorsum with a medial sulcus.

Wings narrowed basally, the margins fringed; the marginal vein is very long, and the postmarginal and stigmal veins are very short.

Abdomen ovate, convex, the apex obtuse, ovipositor sub-exserted, short, stout, and slightly compressed.

Legs rather long and slender, the coxæ large, compressed, the femora most frequently attenuated, tibial spurs 1, 1, 1, the tarsi shorter than the tibiæ, the intermediate joints very minute, metatarsus anteriorly dilated, the posterior tarsi elongate.

This genus is distinguished at once by the long head, the antennæ inserted at the mouth, and by the cross-furrow before the tip of the scutellum.

Five species have been recognized in our fauna, only three of which are known to me, which may be separated as follows:

Table of Species.

Females.

Blue-black species, ... 2

Bluish-green, the tergum with a cupreous band at base, densely punctured.

Wings hyaline, slightly dusky, ... *S. polita* Say.

Black, more or less bronzed, the thorax rugoso-punctate.

Wings dusky with brownish nervures, ... *S. ænea* Prov.

2. Mesonotum and scutellum æneous.

Head and prothorax with large, close, umbilicate punctures; wings hyaline, the marginal vein a little more than half the length of the submarginal, ... *S. rugosicollis*, sp. n.

Head with coarse, distant punctures, the prothorax smooth; wings hyaline, the marginal vein long, . . *S. drosophilæ*, Ashm.

Head and prothorax smooth, impunctured; wings hyaline, the marginal vein two-thirds the length of the submarginal, *S. hæmatobiæ*, sp. n.

S. polita Say. Leconte Ed. Say's Works, vol. i, p. 382.

"Bluish-green; tergum with a cupreous band at base. Inhabits Virginia.

"Body bluish-green, varied with violaceous, densely punctured; front grooved to receive the basal joint of the antennæ; flagellum fuscous; wings hyaline, slightly dusky; scutel somewhat prominent; abdomen a little depressed; first segment brilliant cupreous; incisures glabrous; terminal segment longer than the others together, forming at tip a narrowed, carinated black process for the reception of the tip of the oviduct; feet dull honey-yellow. Length ♀ seven-twentieths of an inch." (Say.)

Hab.—Virginia.

Mr. Say further says:

"I found this species on the sea beach of Sempuxent Island."

S. ænea, Prov. Add. à la Faun. Hym., p. 200.

♂.—Length, 2 mm. Black, more or less bronzed, with the mouth and antennæ reddish. Antennæ very long, filiform, pubescent, the joints distinct. Thorax rugoso-punctate, the prothorax very short. Wings generally obscured with brownish nervures. Legs brown, more or less reddish. Abdomen with a short and stout petiole, the rest oval, depressed; the third segment the largest, polished, shining, rounded at the extremity. (Provancher.)

Hab.—Ottawa (Harrington).

Unknown to me and probably not a Spalangia.

S. rugosicollis sp. n.

♀.—Length, 2.5 mm. Blue-black, the mesonotum and scutellum, æneous; the head and prothorax with large, close, umbilicate punctures; the mesonotum with a large, polished, impunctate space anteriorly, but rugoso-punctate posteriorly; the parapsides and scutellum with some sparse round punctures; mesopleura smooth with a fovea at the middle.

Legs blue-black, the tarsi, except the last joint and the claws, reddish-yellow; the second joint of posterior trochanters is dilated above. Scutellum with a transverse row of punctures before the tip. Metathorax carinated, the space on each side of the central carina, rugoso-punctate.

Abdomen oval, the petiole very long, longitudinally striated, the second and fourth segments the longest, the latter longer than the second, the third about half the length of the second. Wings hyaline, the venation brown; the marginal vein is a little more than half the length of the submarginal, the postmarginal and the stigmal veins very short, about equal, thrice as long as thick.

Hab.—Missouri.

Type in National Museum.

Described from a single specimen. The species seems to come nearest to the European *S. hirta* Hal., but it is decidedly smaller and not so distinctly metallic.

S. drosophilæ, Ashm. Trans. Am. Ent. Soc., xiv, p. 199.

♀.—Length, 2 mm. Blue-black, shining. The oblong, flattened head has a longitudinal medial groove, with coarse, *distant* punctures and a sparse pubescence. Antennæ 10-jointed. Prothorax elongate, narrowed before; the scutellum is divided by a transverse row of punctures before the tip; the metathorax has two lateral longitudinal grooves and its disk with a double row of coarse punctures confluent behind. The abdominal petiole is moderately long, longitudinally striated; the third abdominal segment very slightly shorter than the fourth, the second the longest. Legs clavate, black, pubescent, the tarsi reddish. Wings hyaline, the marginal vein long.

Hab.—Jacksonville, Fla.; Savannah, Ga.

Type in Coll. Ashmead.

The type was reared by me from a dipterous larva, *Drosophila* sp., feeding in decaying oranges; there is also another specimen in the National Museum, reared by Dr. Riley, August 29, 1881. from a dipterous puparium found by Mr. Howard on rice at Savannah, Ga.

S. hæmatobiæ, sp. n.

♀.—Length, 2 mm. Blue-black, highly polished, impunctured, except a small oval space on the mesonotum just in front of the scutellum; the parapsides or shoulders are metallic. The oblong head is smooth, impunctured, with a central longitudinal grooved line.

Mandibles and palpi black. Antennæ 10-jointed (scape, pedicel, 7 funicle joints and club), subclavate, black; the scape is almost as long as the head, slender and cylindrical; the pedicel long, twice the length of the first funicle joint; the second funicle joint is a little shorter than the first, the joints beyond to the club quadrate; club inarticulate and about as long as the three preceding joints together.

The prothorax is about twice the length of the mesonotum, polished, except the narrow neck-like process at the juncture of the head, which is finely, opaquely rugose. Scutellum large, smooth, with a transverse subapical impressed line; the post-scutellum is followed by a row of round punctures. Metathorax as long as the scutellum, tricarinated, smooth and shining. Legs blue-black, the posterior femora æneous; tarsi above fuscous, beneath with a short, dense, pale pubescence. Wings hyaline, strongly iridescent, the venation black; the submarginal vein reaches the costa at about one-third of the length of the wing, its tip a little incrassated; marginal vein long, more than two-thirds the length of the submarginal; the postmarginal and stigmal very short, equal, about thrice as long as thick.

Hab.—Warrenton, Virginia.

Type in National Museum.

Described from a single specimen, reared by Dr. Riley September 13, 1889, from the Horn-fly larva, *Hæmatobia serrata*.

The paper was briefly discussed by Messrs. Howard and Smith, the latter inquiring whether the Spalangia which has been reared in this country from cow's dung infested by the larvæ of the Horn Fly is an imported species. Mr. Ashmead replied that it is new to science, and in all probability a native form.

Dr. J. B. Smith spoke informally concerning the Rabbit Flea, giving the results of some studies recently made, stating, however, that his remarks were of a purely preliminary character, and that he was not prepared to present any formal conclusions. He illustrated his remarks by a series of photographs of slide mounts of the insect, and called attention to the presence of two long, curved, chitinous rods in the abdomen of the male, which, while apparently of use in extruding the genitalia, are so inserted that it appears they cannot have this function. He further stated that a study of the mouth-parts of this flea shows that the oral sclerites resemble much more closely those of the Hemiptera than those of the Diptera. The piercing organs, instead of being articulated to the mentum, pass into the head and are inserted into the sucking stomach. Dr. Smith considers that this fact must have great weight in the discussion of the systematic position of the fleas, and is convinced that instead of forming a family of the Diptera these insects constitute a separate order. He is therefore in favor of reviving the order Siphonaptera. In further support of this view, he stated that while the metamorphoses of the fleas resemble those of the Diptera in being complete, the flea larva, as he has been informed by Mr. Pergande, differs in important particulars from the normal dipterous type. The communication was discussed by Messrs. Stiles, Marx, Gill, and Howard.

Dr. Stiles stated that it is a fact that all fleas leave the body of an animal shortly after death. Dr. Marx stated that the piercing organs of the fleas are similar in their origin to those of the ticks, and that in his opinion the fact that these organs enter the head gives them an additional purchase and fits them better for piercing the tough skin of an animal. Dr. Gill endorsed Dr. Smith's conclusions as to the ordinal rank of the fleas. He spoke of Klatsch's classification, and considered that in general too much classificatory value has been given to the metamorphoses of insects. He does not believe in dividing insects into two great groups upon metamorphosis alone. He considers the morphology of the adult a much safer guide to a rational classification than the method of transformation. As he had shown in a previous paper before the Society, complete metamorphosis is an acquired rather than a primitive character, and this fact supports the view that it is of relatively slight importance in classification. Mr. Howard expressed himself as of the opinion that the curved chitinous rods in the abdomen of the flea must be functional, and that if Professor Smith would examine fresh specimens in which the muscular tissue had not been destroyed by maceration in potash, he would find muscular bands accompanying and partly enveloping the rods. Such muscles being found, the extrusive function of the rods might be considered proven, however rigid the attachment of the anal end to the body walls might seem. He asked Professor Smith if he had homologized the piercing organs which arise from the sucking stomach, and the latter replied that he had not. He stated, however, that in the Hemiptera he had been unable to find a satisfactory trace of the labium, whereupon Mr. Howard remarked that, supposing these piercing organs to be, after all, homologous with those of the mosquito, for instance, which arise from the mentum, the flea might with some justice be said to have practically swallowed its own labium.

—Dr. Smith stated further that in his opinion the mouth-parts of the insects of the old order Neuroptera deserve investigation. He spoke of the Panorpatæ or Mecaptera, and stated that he had recently examined the mouth-parts of Panorpa and Bittacus, showing that the extraordinary elongation is unique; he had noticed an approach to a chela in one of the maxillary sclerites.

—Mr. Schwarz exhibited a specimen of a Pterostichus from Montana, showing a curious malformation in the middle tibia on the right side. The tibia was double and bore three tarsi. A similar fact has been recorded concerning species from other countries, but the malformation usually does not extend to the tibial spurs, of which there are two, while in the specimen exhibited by Mr. Schwarz there were four tibial spurs and the tibia bore two tarsi. As a general rule, among the Coleoptera, whenever there is extensive malformation of the tarsus the tibial spurs are often affected.

—Mr. Schwarz also spoke of the occurrence of *Sphærius gibbioides* as an herbarium pest in San Francisco. He had mentioned this matter before the Society on a previous occasion, and recurred to the subject for the reason that he had recently learned that the species has spread from the Museum of the Academy of Sciences into the commercial establishments of the city, feeding upon drugs and other stored products.

—He also exhibited specimens of *Agalissus chamærópis* Horn, from Biscayne Bay, Florida; of *Metopomata repens* Casey, found at Portland, Ore., and of *Lapethus discretus* Casey, found at Astoria, Ore.

—Dr. Stiles mentioned in some detail a comedy of errors in a recent pseudo-scientific paper by a New Jersey author.

May 4, 1893.

Owing to a break in the street-car cable, only six members of the Society succeeded in reaching the place of meeting. Vice-President Ashmead presided.

The following paper by Prof. C. H. Tyler Townsend was read by Mr. Schwarz:

NOTE ON THE CORUCO, A HEMIPTEROUS INSECT WHICH INFESTS POULTRY IN SOUTHERN NEW MEXICO.

By C. H. Tyler Townsend.

There exists in southern New Mexico a Cimicid, known by the Mexican name of *Coruco*, which is an unmitigated pest of poultry in this region. When the insect once gains access to a hen-house, it soon swarms in great numbers, infesting the inmates and roosts, and covering the eggs with its excrementa, which show as black specks. It is a very difficult pest to exterminate, and has frequently been known to spread from roosts to dwelling-houses, where it proves more formidable than the bedbug. This insect also exists in western Texas.

In a paper published in *La Naturaleza* (2d series, vol. ii, 1892, pl. viii, 8 figs.), Dr. Alfredo Dugès has described and carefully figured a similar species, under the name of *Acanthia inodora*, which infests poultry in the region about Guanajuato, Mexico.

Our species seems to be the same as *A. inodora* A. Dugès. The following is a brief description of the nymph, made from specimens taken from roosts in a hen-house in Las Cruses on May 22, 1891. It is designed to show the peculiarities of the nymph as compared with the description and figures of the adult given by Dugès, which correspond quite well with our specimens.

Nymph.—Length, $1\frac{3}{5}$ to $2\frac{1}{2}$ mm.; greatest width, 1 to $1\frac{4}{5}$ mm. Pale whitish in color during life; changed by immersion in alcohol to a brownish color, legs pale yellowish with a brownish tinge, and eyes brown.

General form rather oval in outline from above, flattened; antennæ 4-jointed, first joint short, second longest, third and fourth shorter and about equal. Differs from Dugès' figures of the adult as follows: head and thoracic segments gradually broadening posteriorly, each broader than the one anterior to it. No signs of wings. Clypeus elongate, broadened and truncate anteriorly, rapidly narrowed posteriorly where it is set into a median notch of the posterior sclerite of the head, entire, not bearing two lateral sclerites. Beak reaching nearly to base of posterior legs. Lateral edges of prothorax without any pubescence. Rings of abdomen straight or nearly so transversely, the sutures being nearly straight or but slightly and gently curved, none angulate anteriorly on the median line. Prothorax about as long as head, other two thoracic segments very distinctly shorter; first two abdominal segments much shortened, the others about as long as last two thoracic segments and nearly equal in length. Abdominal segments 3 and 4 the widest part of whole body. Abdomen showing no rounded stigma-like spot on dorsum near posterior extremity in any of the specimens. Feet terminated by a pair of sharp claws, cushions not so much or but little developed.

Described from four specimens, evidently about two-thirds grown. It is possible that this may not be the same as Dugès' species, but it seems probable that it is. The adult insect is larger, and of a light rufous brown color. It does not grow quite as large as does the bedbug.

Dr. Dugès mentions applications of vinegar as a remedy, doubtless to be applied to the poultry to alleviate the bites as well as to deter the corucos from biting. Here burning of sulphur in the hen-houses and spraying of kerosene have been tried, with doubtful results. About the only way to keep poultry uninfested is to keep them entirely out of doors, and not to house them at all. The corucos infest and stick to the houses and roosts, awaiting the return of the hens at night. They began to appear in Las Cruces the present year (1893) before the middle of April.

I am informed that the corucos often swarm in immense numbers in houses, coming up through the floors and cracks. In such cases it is almost impossible to get rid of them, the easiest and most economical way being to desert the house. They have been known, according to one informant, to swarm in military posts in former times in southern New Mexico to such an extent that the soldiers were ordered out and formed in two lines, one line with brooms to sweep the corucos en masse up against an adobe wall, where the other line stood ready with trowels and mud and plastered them into the wall alive—a novel but effective means of riddance!

Discussing this paper, Mr. Ashmead stated that Dr. Dugès had sent him a specimen of the insect some 8 or 10 years ago, and that he had informed him that it was a new species. Mr. Ashmead stated that it was smaller than a true bedbug, paler in color, nearly round, and broader in form. He also spoke of the habits of the described species of Cimex. Mr. Schwarz expressed the opinion that *C. inodora* is migrating northward since Dugès described it from Mexico, and had it been abundant in New Mexico previously we should have heard of it. He considered the northward spread of Conorhinus as similar. Mr. C. W. Johnson spoke of the habits of the species of Conorhinus which occurs commonly in the pine woods of Florida.

Mr. Schwarz read the following descriptions of Coleoptera:

DESCRIPTIONS OF TWO RHYNCHOPHOROUS COLEOPTERA FROM SEMITROPICAL FLORIDA.

By E. A. Schwarz.

Quite a number of the insects, and more especially Coleoptera, forming the colony of the Antillean fauna in Florida have of late years been described or noticed. Others still remain undescribed, and of these the following two are herewith described because they represent well-marked genera hitherto not known to occur in North America, and because both were found in large number of specimens.

Anchonus floridanus, n. sp.—Oblong-oval, convex, opaque, black; antennæ, tarsi, and often also the last ventral segment reddish; the whole body more or less coated with a dirt-colored incrustation.

Beak nearly as long as head and thorax combined, moderately curved, very little widening at base, basal constriction obsolete, sculpture varying according to sex, upper side with a few inconspicuous bristles; scrobe lateral, well-defined, straight, not widening behind and reaching the lower part of the eye; antennal scape not quite reaching the anterior margin of the eye, funicle very little longer than the scape, eight-jointed, shining, with a few grayish hairs; first joint short, about twice as long as wide; second joint elongate, as long as the three following joints combined and slightly clavate at tip; joints 3 to 6 subequal, each as long as wide; joint 7 slightly wider and distinctly transverse; joint 8 still wider, well separated from the club; club oval, pointed at tip, entirely sensitive and pubescent, solid, with no visible sutures. Head usually deeply retracted within the thorax, somewhat shining, alutaceous, with a few obsolete punctures; eyes flat transverse, coarsely granulated.

Thorax wider than long, anterior margin feebly tri-sinuate, base truncate, sides slightly arcuate or almost straight from the base to apical third; apical constriction deep and suddenly formed at the sides but obsolete dorsally; surface coarsely and densely cribrate, some of the narrow interstices frequently absent, so that the punctures are confluent, usually in a transverse direction; a few, scattered, short clavate bristles arise from the interstices.

Elytra at base as wide as that of the thorax, more than twice longer than the thorax, slightly widening from base to apical third, rather narrowly conjointly rounded at apex, declivity steep but not vertical, basal margin straight, distinctly elevated, not crenulated; humeri nearly rectangular, not prominent; sculpture very variable, consisting of nine or ten rows of moderately coarse and widely distant punctures, of which six rows are visible from above and three or four rows on the inflexed portion of the elytra, the punctures of these outer rows being larger and more numerous; the tenth row, if present, is short and basal; interstices 3, 5, and 7 more or less strongly elevated or subcarinate, the carinæ furnished with an irregularly interrupted series of round or elongate tubercles; the outer carina is continued around the declivity to the suture and forms a well-marked subapical ridge; suture cariniform at the declivity and sometimes slightly so on the disk; interstices 2, 4, and 6 usually slightly elevated, each being a series (abbreviated before and behind) of tubercles which greatly vary in number, prominence, and shape; a short series of tubercles is also visible at the base of the eighth interstice; all tubercles and punctures bear short, clavate, yellowish bristles.

Prosternum deeply emarginate in front, anterior coxæ closely approximate but not contiguous, metasternum coarsely cribrate, metepisterna not visible; first abdominal suture arcuated, moderately impressed, the other sutures deep and straight; segments 1 and 2 coarsely cribrate, the latter at middle as long as the following three united; segments 3 and 4 impunctate, together shorter than the anal segment, which is strongly punctate; legs rather slender, sparsely beset with short stiff bristles; femora hardly clavate, not dentate, coarsely cribrate; tibiæ longitudinally carinate, seriately punctate, with the bristles also seriate, anterior tibiæ straight, terminal hook longer than the width of the tibia; tarsi short, third joint moderately bilobed, claw joint as long as the other joints combined; claws slender, fine, strongly divergent.—Length, 4.1 to 5.3 mm.

Male.—Beak shorter, less curved, coarsely, subseriately punctate throughout; antennæ inserted at apical fourth, first two ventral segments broadly concave, last ventral slightly sinuate at middle of apex.

Female.– Beak longer, more curved, coarsely punctate only at base, punctures much sparser and finer apically; antennæ inserted at apical third, abdomen not concave, last ventral segment rounded at tip.

A strictly maritime Curculionid which occurred in great abundance at Cocoanut Grove, Fla., on the inner shore of Biscayne Bay, under deep layers of seaweed. It belongs unquestionably to Anchonus as defined by Schönherr and Lacordaire, and seems also to be included in the same genus as restricted by J. Faust (Deutsche Ent. Zts., 1892, pp. 17 ff.). I failed to identify the Floridian species with any of the numerous Anchonus described from the Antillean region, but it seems closely related to *A. aspericollis* Suffrian from Cuba.

Loganius ficus, n. sp.—Cylindrical, shining, nearly glabrous above, piceous; antennæ pale, legs reddish-brown or paler. Head widely but not deeply concave, the concavity limited each side by a straight, more or less obtuse, supraorbital ridge, feebly shining, finely, not densely, punctulate, each puncture bearing a yellowish appressed hair; clypeus broadly emarginate with the anterior edge shining, impunctate; eyes greatly transverse, more than three times wider than long, flat, not emarginate, rather coarsely granulate. Antennal scape much longer than the funicle, curved, strongly but gradually clavate; funicle seven-jointed: first joint distinctly transverse, narrowly attached to the second joint and with the apical angles rounded; joints 2–7 closely united, very small, greatly transverse, very little increasing in width, each bearing, in either sex, on each side a very long pale seta; club large, strongly compressed, much longer than the funicle, oblong, broadly rounded at tip, on both sides pubescent and with three greatly curved sutures, first suture more narrowly rounded than the two outer ones.

Thorax slightly longer than wide, gradually widening from the apex to basal fifth, thence slightly narrowing to base; anterior margin broadly arcuated; base truncate, finely margined; hind angles obtuse, nearly rounded, lateral marginal line acute and entire; a very slight apical constriction; surface not pubescent (except, in some specimens, a few hairs along the lateral marginal line), shining, moderately sparsely punctate, punctures larger and denser anteriorly and on the sides, smaller and sparser on basal portion of the disk. Scutellum small, rounded, not depressed.

Elytra at base as wide as that of the thorax, slightly longer than the thorax, basal margin not elevated; glabrous at base and on the disk, with a few short seriate bristles on the sides and on the declivity; anteriorly with regular rows of moderately coarse punctures; at the sides the striæ are feebly impressed; interstices wider than the striæ, with regular rows of punctures, which are either slightly or not at all smaller than those of the striæ; declivity simple, moderately convex, the striæ deeply impressed, the interstices convex, each with a row of tubercles.

Underside sparsely pubescent; anterior coxæ widely separated, the posternum between them triangular, with the tip rounded off; flanks of prothorax concave and smooth at middle; metasternum finely densely, abdomen more coarsely punctate; sutures of ventral segments deep and straight.

Legs short and stout; femora and tibiæ compressed, the former widening apically, the latter not denticulate at outer margin; front tibiæ of equal width throughout, outer apical angle prolonged into a moderately long uncus, which is bent inwardly and acute at tip,* middle and hind tibiæ distinctly widening from base to apex, hind tibiæ slightly narrower than the middle tibiæ; tarsi slender, as long as the tibiæ, third joint very little wider than the second joint and hardly bilobed, fourth joint very small, claw joint as long as the rest of the tarsus.—Length, 2.1–2.3 mm.

Locality: Key West, Fla.

Described from many specimens which I found, in April, 1887, under the bark of *Ficus aurea*, the colonies being so crowded that nothing can be said of the nature of the galleries. The sexual differences are rather feeble: in the male the supraorbital ridge is stronger and more acute, the antennal club larger, and the hairs of the funicular joints are longer.

The species represents a group of Hylurgini (Le Conte) new to our fauna, viz., the Camptoceri (groupe Camptocérides, Lacordaire; subtribus Camptoceridæ, Chapuis), which is well characterized by the form of the antennæ and anterior tibiæ. The genus Loganius was very briefly diagnosed by Chapuis in his Synopsis des Scolytides, but a full description has never been published, so that it is not possible to decide whether or not the above-described species is congoneric with the type of the genus *L. flavicornis* from Cumana, Venezuela.

The insect resembles some of our smaller species of Scolytus not only in superficial characters, but also in the structure of the front tibiæ, and should be placed at the head of the Hylurgini, immediately following the tribe Scolytini. In the nature and arrangement of the funicular hairs there is an unmistakable resemblance between *Loganius ficus* and *Thysanoes fimbricornis*.

Mr. Ashmead spoke briefly of the remarkable subtropical fauna of Florida, and Mr. Schwarz defined accurately the Antillean faunal belt.

—The following notes on Hymenoptera by Mr. William H. Patton were read by the Secretary:

NOTES UPON WASPS. I.

By Wm. Hampton Patton,
Hartford, Conn.

Steniolia edwardsii Cress. (Syn. *S. duplicata* Prov.)

The markings vary in position and extent without any varietal differences worthy of a separate name.

*In freshly hatched individuals the inner and outer edges of the front tibiæ are fringed with a row of fine setæ, which are usually lost in the older specimens, while the setæ on the middle and hind tibiæ are stronger and more persistent.

ISODONTIA AZTECA Sauss. (Syn. *S.* (*I.*) *macrocephala* Fox, "Ent. News").

This species occurs in California and Florida, as well as in Mexico and Pennsylvania.

CHLORION CÆRULEUM, var. ÆRARIUM.

Chlorion ærarium Pttn. (1879).

A male specimen from Indian River, Florida (Dr. Wittfeld) shows this to be a color variety of *cæruleum*. This specimen has minute dots of blue scattered irregularly over the body. The spiracles on first segment are not elevated. The median pieces of the claspers are lighter colored than in the typical form. But in all structural characters the two agree; the eighth ventral segment forming an isosceles triangle, the other segments with their margins straight.

A variety occurs showing the blue to change into green.

GASTROSPHÆRIA is but a section of HARPACTOPUS; its type [*G. anthracina* Costa = *Sphex subfuscatus* Dahlb.; now *Harpactopus subfuscatus* (Dahlb.)] differs from the type of *Harpactopus* [*Sphex ægyptia* Lepel. = *H. crudelis* Sm. = ? *Sphex pensylvanica* Linn.; now *H. ægyptia* (Lepel.)] in nothing except the smooth thorax and the form of clypeus. The mistaken reference of *pensylvanica* led to the suggestion of its relationship with *Sphex* of the *S. ichneumonea* section.

The characters of the genus appear to be: Sharp tubercle on postscutellum; second cubital cell higher than its width on the cubital; abdomen globose, short, first segment perpendicular on the petiole.

Pepsis hesperiæ, n. sp.

Violet-blue, thorax violaceous black; antennæ orange, three basal joints in female blackish, the third and base of fourth verging to brown, two basal and base of third (at least above) in male black. Wings yellowish-ferruginous; the base and margin blackish, more broadly in the male.

Groove on second ventral segment deep in female, moderate or indistinct in male.

Male.—Fourth ventral segment with two dense tufts of bristles each side of apical middle, their apices curled inward; Fifth, hairy on apical middle, the margin scarcely sinuate; Sixth, deeply sinuate in the middle; each side of sinus near apex a stout, blunt, posteriorly and inwardly directed spine; Seventh, filling sinus; Eighth, elongate, flat, without tooth, apex truncate, sides parallel. Claspers: sagittæ curved, S-shaped, apex inwardly beaked, almost hooked, shorter than the two slender simple median pieces; outer pieces little longer, simple, a little flattened, the base narrower, the apex subangular.

Size of *P. cærulea*.

Habitat.—Poway, San Diego Co., Calif. (Dr. F. E. Blaisdell).

Resembles *P. marginata* in the color of wings and in its slender body; but distinguished by its pale antennæ and the male ventral characters. In *P. marginata* male the fourth ventral segment has a simple line of bristles.

Pepsis sommeri Dahlb.

Violet-blue, antennæ black; abdomen verging to green in the male. Wings red with dusky margin, the apex subhyaline; base of wings, more broadly in the male, black. First abdominal segment, especially in the female, short and broad; groove on second ventral segment deep in the female, moderate in the male.

Male.—Fourth ventral segment simple, without bristles; fifth, not hairy, margin scarcely sinuate; sixth, like preceding species; seventh, filling sinus, polished, a minute sinus in middle; eighth, with a transverse median ridge beyond centre, the sides of the ridge connecting with oblique carinæ extending forward to the sides of the segement at the base; apex thinner, polished, bent downwards at a right angle and its tip forming two rounded lobes separated by an equal sinus.

Claspers: sagittæ flat, much curved, apices pointed below and contiguous, a minute tooth near base within, sagittæ equal in length with the two flattened, parallel median pieces, the median pieces curved dorsad and pointing downward at apex; outer pieces little longer, flat; hairy apex little thickened and subobtusely pointed.

Size of *P. cærulea.* *Habitat.*—Poway, Calif. (F. E. Blaisdell).

Differs from *P. cærulea* in fuscous wing margin and in eighth segment. Body is less slender than in *P. marginata.*

In discussing this communication Mr. Ashmead said that he had identified *Pepsis marginatus*, one of the species referred to by Mr. Patton, in a collection made by Mr. Cordley in New Mexico. He had previously received it also from the same locality.

—Mr. Ashmead read the following paper:

SYNOPSIS OF THE NORTH AMERICAN SPECIES OF TOXONEURA SAY.

By Wm. H. Ashmead.

The Braconid genus *Toxoneura* was described fifty-eight years ago by Thomas Say, in the first volume of the Boston Journal of Natural History, 1835, page 258.

Although quite a characteristic genus, it yet remained for years unknown to our entomologists.

In 1865 Mr. E. T. Cresson, in his paper entitled "On the Hymenoptera of Colorado Territory," redescribed it under the name of *Tenthredoides* with one species *T. seminiger*.

A few years afterwards, however, he recognizes his mistake, and in 1873, in the Canadian Entomologist, vol. v, p. 54, acknowledges the synonym and gives an excellent synoptic table of the species known to him at that time in the North American fauna.

In this paper he enumerates 12 species, 8 being described for the first time, and, of these, four were from Mexico. He also gave valid reasons for believing Say was wrong in placing his *Bracon populator* in this genus.

Cresson here recognizes the original spelling of the genus *Toxoneuron*, but in his "synopsis," 1886, changes it to *Toxoneura*, but without giving his reason for doing so. As this change seems to have been universally followed, I have not thought it worth while to restore the original name.

Toxoneura has now been made the type of a subfamily, *Toxoneurinæ*, and a position assigned it between the *Ichneutinæ* and the *Helconinæ*. It appears to me, however, that this is an unnatural position, as it has no affinities whatever with these groups. All its affinities are entirely with the *Agathidinæ* and the *Microgasterinæ;* the structure of the abdomen closely resembles many forms in the latter, while all its other characters, except venation (although here, too, there is still a resemblance to some exotic forms), are those of the former.

If the genus is not referred to the subfamily *Agathidinæ*, in my opinion the *Toxoneurinæ* should, at least, be placed next to them.

Comparatively little is known of our species. Messrs. Riley and Howard have recorded in Insect Life, vol. iii, page 60, the rearing of *Toxoneura minuta* Cr., at Kirkwood, Mo., from a Tineid *Gelechia prunifoliella* Chambers, found on Peach, while I have in my own collection a specimen of *Toxoneura tibiator* Say reared from a Lepidopterous Leaf-roller on Black Locust.

Although this is all we know of the habits of our species, it is quite evident the genus is parasitic only on Lepidopterous larvæ.

Below I give a synoptic table of the species found in our fauna north of Mexico, and describe three new forms: one from Florida, *T. floridana*, in my collection, and two, *T. pluto* and *T. californica*, from California, in the U. S. National Museum:

TABLE OF SPECIES.

Body not entirely black.. 2
Body entirely black.
  Wings black or fuliginous.
    Vestiture black.
      Legs entirely black..................................T. pluto, sp. n.
    Vestiture pale or grayish.

Legs black; anterior knees and tarsi honey-yellow or pale; tibial spurs white..................... ....T. minuta Cr.
Legs black; anterior legs, except coxæ and trochanters, yellowish-red; tibial spurs on middle and hind legs black.......................... ....T. floridana, sp. n.
Legs, except the coxæ, trochanters, and base of femora, reddish-yellow; hind tarsi fuscous; large species.. .... T. californica, sp. n.
Legs, except the coxæ and trochanters and the hind tarsi, which are black, reddish-yellow; smaller species.................. . ...T. explorator Say.
Wings hyaline, the apex fuliginous.
Legs black; anterior pair, except base, honey-yellow...................... ....T. apicalis Cr.
Legs black; anterior tibiæ and tarsi, base of middle tibiæ, their tarsi, and an annulus at base of hind tibiæ, white or pale yellowish...... ....T. tibiator Say.
2. Black; head, pro- and meso-thorax and anterior legs flavo-ferruginous ....T. thoracica Cr.
Head and thorax black; abdomen fulvo-ferruginous; anterior margin of clypeus and legs, except coxæ and trochanters, ferruginous...... ....T. abdominalis Cr.
Reddish or orange-yellow.
Head, antennæ, metathorax, and pleura black; stigma black.......... ....T. seminigra Cr.
Head mostly sanguineous; pleura beneath and metathorax black; stigma yellow.................................. T. viator Say.

(1) **Toxoneura pluto**, sp. n.

♀.—Length, 7.5 mm. Black, highly polished, covered with a sparse pubescence; mandibles and palpi black; antennæ 42-jointed; a little longer than the body; scutellum with a punctate frenum; metathorax areolated and coarsely rugose; mesopleura with a large crevate furrow; wing black, a white spot at origin of first transverse cubital vein, and another at apex of the second abscissa of radius and including the base of the third abscissa and the apex of the second transverse cubital. Abdomen depressed, the basal segment the largest, bisulcate; ovipositor scarcely exserted.

Hab.—Los Angeles, California.

Type in National Museum.

(2) **Toxoneura minuta** Cress.

Toxoneuron minutum Cr. Can. Ent. v, p. 67.

Toxoneura minuta Cr. Syn. Hym., p. 230.

♀.—Length, 2.5 mm. Black, shining, faintly punctate, sparsely sericeous; wings subfuliginous, iridescent, the stigma and nervures dark brown or blackish, with the second submarginal cell a little shorter than the first; legs black, tibial spurs white; anterior knees, their tibiæ, four anterior tarsi, except tips and middle knees, pale yellowish; abdomen oval, the ovipositor prominent.

Hab.—Illinois, Missouri.

Type in Coll. American Entomological Society.

This species has been reared by Miss Mary Murtfeldt, at Kirkwood, Mo., from *Gelechia prunifoliella*.

(3) **Toxoneura floridana**, sp. n.

♂.—Length, 7 mm. Black, polished; tips of mandibles and anterior legs, except coxæ and trochanters, alone yellowish-red; trophi and middle and hind legs, except a piceous tinge on the knees of middle legs, entirely black; tibial spurs on middle and hind legs black.

Head impunctate; eyes pubescent; clypeus with a median furrow; thorax trilobed, the middle lobe triangular; metathorax coarsely rugose, with a large central area; wings blackish fuliginous, the stigma and nervures black, the second abscissa of radius scarcely more than twice as long as the first. Abdomen oblong-ovate, depressed, the first segment about as large as the second and third united, the second shorter than the third, with the sutures between deeply impressed, the following segments shorter but about equal in length.

Hab.—Jacksonville, Fla.

Type in Coll. Ashmead.

(4) **Toxoneura californica**, sp. n.

♀.—Length, 6 mm. Polished black, sparsely punctate; metathorax and mesosternum rugose, the former not areolated; mandibles and palpi black; abdomen subcompressed, the ventral valves large, prominent, plow-share shaped. Antennæ 27-jointed, shorter than the body. Wings subfuliginous, the first abscissa of radius less than one-third the length of the second, the second transverse cubital and the second abcissa of radius at their junction hyaline. Legs, except coxæ, trochanters and base of the femora, reddish-yellow; hind tarsi fuscous.

Hab.—Los Angeles, California.

Types in National Museum.

Allied to T. explorator Say, but much larger; the ovipositor shorter, scarcely projecting beyond the apex of abdomen, the face and clypeus more strongly punctate, while the wings are paler at base.

(5) **Toxoneura explorator** Say.

Bracon explorator Say. Bost. Journ. Nat. Hist., i, p. 259.

Toxoneuron explorator Lec. Ed. Say, ii, p. 710; Cress. Can. Ent., v., p. 67.

Toxoneura explorator Cr. Syn. Hym., p. 230.

♀.—Length, 3.75 mm. Black, polished; mandibles, at the middle, rufo-piceous; palpi piceous; face shining, sparsely microscopically punctate; antennæ 29-jointed; thorax with smooth impressed parapsidal furrows; metathorax rugose. Wings subfuliginous, the stigma large, the second abscissa of radius a little more than twice as long as the first. Legs, except the coxæ, trochanters, and posterior tarsi, which are black, reddish-yellow; the middle femora is sometimes black at base. Abdomen compressed, black, shining; the ovipositor very prominent, nearly half the length of abdomen.

Hab.—Indiana, Missouri, and Colorado.

A single ♀ is in the National Museum, bred August 12, 1881, from an unknown *Tortrix*.

(6) **Toxoneura apicalis** Cr.

Toxoneuron apicale Cr. Can. Ent., v, p. 68.

Toxoneura apicalis Cr. Syn. Hym., p. 230.

♂.—Length, 5mm. Black, shining, clothed with a very short dull pubescence; sutures of mesothorax not crenulated; metathorax with strongly developed elevated lines; wings hyaline, the apex fuliginous, leaving base of marginal and of second cubital cells hyaline; nervures and stigma black; legs black; anterior femora, except base and their tibiæ entirely, bright orange-yellow; intermediate knees slightly tinged with testaceous. (Cresson.)

Hab.—Illinois.

Unknown to me.

(7) **Toxoneura tibiator** Say.

Bracon tibiator Say. Long's Second Exped., ii, p. 322.

Toxoneuron tibiator Lec. Ed. Say., ii, p. 710; Bost. Jour., i, p. 259; Cr. Can. Ent., v, p. 68.

♀.—Length, 5mm. Black; wings hyaline, fuscous at apex; the nervures stout, dark brown; legs black; the anterior tibiæ and tarsi, base of middle tibiæ, their tarsi and an annulus at base of hind tibiæ, white or pale yellowish. Abdomen oval, depressed.

Hab.—Atlantic coast from Florida to Canada, and west to Kansas.

Not rare in the Eastern States. In my collection is a single specimen reared some years ago by Mr. C. L. Marlatt, at Manhattan, Kansas, from a Lepidopterous Leaf-roller on Black Locust.

(8) **Toxoneura thoracica** Cr.

Toxoneuron thoracicum Cr. Can. Ent., v, p. 68.

♂ ♀.—Length, 5 mm. Black, shining; head, prothorax, mesothorax, spot beneath tegulæ, and anterior legs, except coxæ, trochanters, and base of femora, pale ferruginous; spot on cheeks beneath, mouth, more or less of clypeus, and a spot between ocelli and eyes in ♂ black; wings uniformly blackish-fuliginous, nervures and stigma black; metathorax with strongly developed elevated lines, forming an ovate central area.

Hab.—Codova, Mexico, and Arizona.

Type in Coll. American Entomological Society.

The specimen from Arizona is in my collection, obtained through a collector.

(9) **Toxoneura abdominalis** Cr.

Toxoneuron abdominale Cr. Can. Ent., v, p. 68.

Toxoneuron abdominalis Cr. Syn. Hym., p. 230.

♀.—Length, 7 mm. Polished black, but sparsely minutely punctate; face and clypeus more closely punctate; clypeus anterior, posterior orbits, legs, except coxæ, trochanters, and hind tarsi, which are black, and the abdomen entirely pale sanguineous or yellowish-red; sheaths of ovipositor black; wings fuliginous, the stigma and nervures black; second submarginal cell longer than the first; metathorax rugose, areolated.

Hab.—Illinois, Missouri.

(10) **Toxoneura seminigra** Cr.

Tenthredoides seminiger Cr. Proc. Ent. Soc. Phil., iv, p. 291.

Toxoneuron seminigrum Cr. Can. Ent., v, p. 69.

Toxoneura seminigra Cr. Syn. Hym., p. 230.

♂ ♀.—Length, 7 to 7.5 mm. Yellowish-red, shining; head, antennæ breast, metathorax, coxæ, and trochanters black; wings blackish-fuscous; metathorax coarsely rugose.

♀.—Head black, smooth, and polished, slightly pubescent; narrow inner and broad outer orbits, and basal margin of the clypeus, rufous; antennæ entirely black; thorax yellowish-red, smooth, and polished; mesothorax with two approximate black dots, sometimes confluent on the extreme margin, sometimes concealed by the head; pectus and the pleura, except the broad anterior margin, black; space on each side of the scutellum obliquely striated, its lower margin flat, polished and black, as well as the space on each side of the postscutellum; metathorax black, opaque, coarsely rugose, the disk having a longitudinal ovate excavation surrounded by a well-defined carina; tegulæ yellowish-red, bordered behind with black. Wings uniformly blackish-fuscous; nervures black; lower margin of the first submarginal cell, two dots at tip of prædiscoidal cell, and a furcate line at tip of second submarginal cell where it joins the marginal, hyaline. Legs yellowish-red, the coxæ and trochanters black, the four posterior tarsi and tips of the femora within more or less dusky. Abdomen about as long as the thorax, broadly ovate depressed, polished, yellowish-red, basal segment, orange-yellow, with a more or less distinct black mark on the prominent dorsal middle; valves of the ovipositor robust, black.

♂.—Resembles the female, but the antennæ are as long as the body and the abdomen more depressed, less broad, and obtusely rounded at tip.

Hab.—Colorado. (Cresson.)

Types in Coll. American Entomological Society.

All the specimens of this species I have seen were taken in Colorado.

(11) **Toxoneura viator** Say.

Toxoneuron viator Say. Bost. Journ. Nat. Hist., i, p. 258; Cr. Can. Ent., v, p. 67; Lec. Ed. Say, ii, p. 710.

Toxoneura viator Cr. Syn. Hym., p. 230.

♀.—Length, 6.2 mm.. Sanguineous; antennæ, vertex, face below antennæ extending almost to clypeus and including base of cheeks, mesopleura, pectus, and metathorax, black. Thorax polished, feebly microscopically punctate, the furrows crenulate; antennæ 29-jointed; metathorax rugose, areolated. Wings fuliginous, with the costa and stigma yellowish, the other nervures robust, black, the second abscissa of radius fully three times as long as the first. Legs sanguineous, with the coxæ and trochanters black, the posterior tarsi dusky. Abdomen depressed, broadly oval, smooth; the ovipositor prominent, with black sheaths.

Hab.—Western States.

Not rare.

—Under the head of "Short Notes and Exhibition of Specimens," Mr. Heidemann exhibited a new Capsid from the vicinity of Washington. He had tentatively placed it among his Acanthocorinæ, but upon closer examination he found it to be a true Capsid, and considered it to be a new genus near *Fulvius* of Stal.

—Mr. Schwarz exhibited specimens of the Floridian *Gononotus lutosus*, and remarked that the species is apparently identical with the previously described *Anchonus angulicollis* Suffr., upon which Mr. J. Faust has lately erected the genus Nemosinus. The name of the insect should, therefore, be *Gononotus angulicollis* Suffr. It was placed by Dr. Le Conte in the Calandridæ, while according to Faust it forms, with Cotaster and some other genera, a group of Curculionidæ allied to Plinthus and Pissodes.

—Mr. Johnson spoke of having collected a specimen of *Anthocharis genutia* in the vicinity of Washington on the 30th April. He had been much pleased at this capture, as the species is extremely rare near Philadelphia, where he resides. Mr. Schwarz remarked that this butterfly is peculiar in that it occurs only upon the range of hills immediately outside of Washington, never being found in the country beyond or in the city within this range.

June 1, 1893.

Fifteen members present. The President, Prof. Riley, in the chair. Mr. Donald MacCuaig, chief clerk Department of Agriculture, was elected an active member, and President H. H. Goodell, of the Massachusetts Agricultural College, was elected a corresponding member.

Dr. Geo. Marx read the following paper:

CONTINUATION OF THE LIFE-HISTORY OF THE WHIP-TAIL SCORPION.

By Geo. Marx.

At the December, 1891, meeting of this Society I read a short report on some observations on the life-habits of *Thelyphonus giganteus* which I had made during twenty-one months in which I had a specimen of this species under daily study in a glass jar (containing moist sand) on my office desk.

I stated that it was born at or about October 1, 1890; when about one year old it shed its skin for the first time. In January, 1891, it shut up the entrances to its subterraneous abode for hibernation, which period lasted about three months. The specimen did not fall into a dormant state during this time, but stood quietly in its cavern, sensitive to the slightest disturbance, like a horse in a stable. I promised then that I would at a future meeting report further observations on this interesting Arachnid, and to-night I beg leave to narrate the final chapter in its life-history.

After December, when I made the first report, it continued to do well and occupied its time catching roaches, in which occupation it acquired a remarkable talent, and also by rebuilding its subterraneous galleries, which I purposely destroyed every two weeks for the purpose of giving the little prisoner some exercise. In the pursuance of this work the animal went about with the greatest indolence. It was funny to see it stand before the little excavation, stare in it, feel around it with its long palpal or antennæ-like forelegs and hesitate until it shoved a pellet of moistened sand between its palpi, then retreated backward out of the excavation and carried the sand to the farthest corner. Thus it lived on, in peaceful mind and healthful body, until October 2, 1892, or precisely two years after its birth, when it shed its skin for the second time. It had now grown to 30 mm., a gain of 12 mm. in this year, and its color had changed to that of an adult—that is, uniformly very dark brown, the sclerites covering the body altogether.

Foreseeing the severity of last winter, it went into winter quarters a month earlier than in 1891, but opened the entrance again on the 2d of January and several times in February and finally abandoned its burrow altogether on March 4. It stayed on the surface from this date, notwithstanding the severe cold which prevailed. I set its jar near the radiator during the night.

About this time it commenced to behave strangely, for it stood in one place and stuck its head into the cool sand, apparently suffering from headaches. It finally died March 14, 1893.

In the discussion Mr. Schwarz stated that he was much interested in the account of preparation of winter quarters, since some time ago he was at Tampa, Florida, during a very cold spell, and failed to observe anything resembling hibernation on the part of Thelyphonus. He found them under logs as usual, and they were as active as during the summer. Dr. Marx stated that the specimen which he observed was also active when disturbed, and in that respect could not be said to be hibernating. In answer to a question by Mr. Howard, he stated that the young possess none of the acid secretion which is so characteristic of the adult. Prof. Riley asked whether a reasonable explanation of the function of the whiptail had been offered. There was no answer to this question, and Dr. Marx remarked that the tail is thicker in proportion to its length in the young than in the adult.

—Mr. Ashmead read the following paper:

NOTES ON THE FAMILY PACHYLOMMATOIDÆ.

By Wm. H. Ashmead.

The subject of my remarks to-night relates to a small but exceedingly rare and interesting group of the Hymenoptera, comprising up to the present time but two genera and two species, that have occasioned considerable conflict of opinion among systematists, both as regards their relationship and their position in our present system of classification.

The two peculiar insects that have occasioned such a combat of opinion among Hymenopterists present the following characteristics:

Ophioniform; head transverse, wider than the thorax, with large eyes and large prominent ocelli; clypeus subacutely produced with a median carina; mandibles short, narrow, curved, and bifid at tips; maxillary 4-jointed, filiform pilose; labial palpi 3-jointed, filiform. Antennæ 13-jointed, filiform, shorter than the body. Thorax short, ovoid, convexly elevated anteriorly, the collar not being visible from above; no parapsidal furrows; metathorax short, oblique, delicately areolated. Legs long, slender, the posterior pair the longest, their coxæ long and cylindrical, their tarsi thickened, especially the basal joint, which is always as long or longer than all the following joints united; tibial spurs 1, 2, 2. Abdomen much as in the Ophionid genus *Limneria*, attached to metathorax above insertion of hind coxæ, subcompressed, with the first and second joints very long, forming a long petiole; third and fourth segments shorter, subequal; all following segments very short. Wings with two submarginal cells, one recurrent nervure and the stigma long, narrow, lanceolate; otherwise as in many Braconids.

It was in 1825 that Mr. L. A. De Brébisson discovered these insects, captured in Germany, and upon which, in the Encyclopédie Methodique, vol. x, p. 23, he founded the genus *Paxylomma*, now changed to *Pachylomma*, naming the two species *Paxylomma buccata* and *P. Cremieri* respectively, and placing the genus among the *Ichneumonidæ*.

The next two authors to treat of the genus were Latreille and Haliday, and they removed it to the family *Evaniidæ*.

In 1834 Nees von Esenbeck, in his well-known Monograph, vol. i, p. 28, redescribed *Pachylomma buccata* under the name *Hybrizon latibricola*, placing it in the family *Braconidæ*, between the genera *Aphidius* and *Perilitus*.

A year later, 1835, Wesmael, in his work on the Belgian Braconidæ (Nouv. Meth., &c., Brux., p. 90), also treats of it as a Braconid genus.

Westwood, five years later, or 1840, in his "Introduction," vol. ii, p. 53, treats of it under the family *Evaniidæ*, and in fig. 74, no. 17, gives an enlarged figure of *P. buccata*.

While treating of it under the *Evaniidæ* he remarks, however, as follows: "The genus *Paxylomma* Brébisson, placed by Latreille and Haliday in this family, as well as *Stephanus*, appear rather to belong to the *Ichneumones adsciti*, or at least to constitute the links between them and the present family," and in his Generic Synopsis, at the end of the volume, has placed it with the *Braconidæ*, among the Polymorphi, with *Euphorus*, *Macrocentrus*, &c.

Three years later, Brullé in Histoire Naturelle des Insectes Hymenopteres, tome iv (1843), p. 482, treats of the genus under the *Braconidæ*, but says, "On ne connait qu'une seule espèce de ce group, qui semblenait se rapporter beaucoup mieux aux Ichneumonides de la division des *Ophion*, qu'a aucun groupe de Braconides," but finishes by remarking: "Nous laissons neanmoins ce groupe dans la familie des Braconides à cause de l'absence de la seconde nervure recurrente."

In 1848 Ratzeburg in his "Die Ichneumoniden der Forstinsecten Band. ii, p. 53," treats of both species, placing the genus with the *Braconidæ* and giving us, for the first time, some information respecting their habits. Fourteen years later Dr. Arnold Förster, who was probably the greatest systematic worker among the parasitic Hymenoptera, in his "Synopsis der Familien und Gattungen der Braconen," published in 1862, made *Pachylomma* the type of his subfamily 13, or the Pachylommatoidæ, and subdivides the old genus into two, as follows:

Basal joint of hind tarsi twice as long as the four following joints united; the first branch of radius shorter than the second. ....Eurypterna Först.
(Type *Pachyl. cremieri* Bréb.)

Basal joint of hind tarsi scarcely one-third longer than the four following joints united; the first branch of radius much shorter than the second...... ....Pachylomma Bréb.
(Type *P. buccata* Bréb.)

Notwithstaning the concensus of opinion in favor of the group belonging to the *Braconidæ* by such authorities as Nees, Westwood, Wesmael, and Förster, the latest writer on this family, the Rev. T. A. Marshall, in his "Monograph of the British Braconidæ," 1885, evidently holds different views and makes no reference to the group, except in the following curt sentence: "Excluding Förster's *Pachylommatoidæ*, as belonging to the *Evaniidæ*, we will treat the *Braconidæ* under six divisions, each including a number of subfamilies." He then follows with his tables, and has accepted, as subfamilies, all of Förster's families, except the *Pachylommatoidæ*.

During my visit to Berlin, in the winter of 1889-'90, I saw for the first time, in the Royal Berlin Museum, a specimen of *Pachylomma buccata*, and at once recognized its relationship to a Braconid in the U. S. National Museum, which I had only a short time previously described as *Wesmaelia rileyi*, in the subfamily *Euphorinæ*.

At the time of my drawing up the description I did not feel entirely satisfied that it was properly placed, and remarked as follows: "This remarkable insect agrees with the definition of this genus, but seems out of place in the group, and appears more closely allied with the group *Aphidiinæ*, where it may ultimately be placed."

That it was anything else than a Bracon, however, never once entered my mind, and now, after four years' study in the family, I am convinced the *Pachylommatoidæ* are Braconids, and should be considered as a subfamily allied to the *Euphorinæ* and the *Aphidiinæ* and of equal rank.

The mere fact that the abdomen is attached to the metanotum some distance above the insertion of the hind coxæ is in itself not sufficient, in my opinion, to separate the group from other Braconids, especially as a few other Braconids show this character to a still greater degree. For example, the genus Cenocœlius Haliday (which equals *Aulacodes* Cress. = *Laccophrys* Förster = *Capitonius* Brullé = *Promachus* Marshall) has the abdomen attached far up on the metathorax as in the genuine Evaniids.

I propose, therefore, to accept Förster's family *Pachylommatoidæ* as a subfamily in the family *Braconidæ*, and as our species, so far discovered, do not fit exactly into the two European genera, I have here erected a new genus for their reception under the name *Eupachylomma*.

The three genera may be separated as follows:

First joint of hind tarsi twice as long as the four following joints united..2

First joint of hind tarsi scarcely one-third longer than the four following joints united, or of an equal length.

Second submarginal cell longly petiolated, the radius divided into three divisions.............................Pachylomma Bréb.

Second submarginal cell sessile, at the most subsessile, the radius divided into two divisions......Eupachylomma Ashm., g. n.

2. Second submarginal cell sessile, the radius divided into two divisions..Eurypterna Först.

PACHYLOMMA De Brébisson.

1825. *Paxylomma* De Bréb. Enc. Meth., x, p. 23.
1834. *Hybrizon* Nees. Monog., i, p. 27.
1862. *Pachylomma* Först. Syn. d. Fam. und Gatt. d. Braconiden, p. 247.

(Type *P. buccata* De Bréb.)

(1) PACHYLOMMA BUCCATA De Brébisson.

Paxylomma buccata De Bréb. Enc. Méth., x, p. 23. Cal. Ent. Mag., i, p. 343; id., iii, p. 22; Westw. Intro., ii, p. 136, fig. 74, 17.
Hybrizon latebricola Nees. Mong., i, p. 28.
Pachylomma buccata Ratzb. Die Ichn. d. Forstins., Bd. ii, p. 53; Först. Verh. d. n. Ver., xix, p. 247.

Hab.—Europe.

EUPACHYLOMMA Ashm., gen. nov.

(Type *Wesmaelia rileyi* Ashm.)

Differs from *Pachylomma* De Bréb. principally in the venation of anterior wings, the radius having but two branches, the cubitus being interstitial with the apex of the first branch of radius and strongly curved outwardly from the base, while the second abdominal segment is much longer than the first (the petiole) and the spurs of hind tibiæ are also longer.

Two species are known to me, separated as follows:

Head and thorax black, abdomen piceous, nearly black; clypeus, trophi, two basal joints of antennæ, and four anterior legs whitish; hind legs yellowish..................E. rileyi Ashm.

Head black; thorax, sutures of abdomen, and base of fourth segment luteous; rest of abdomen, three stripes on mesonotum, small spot on scutellum, and the metathorax brown..E. flavocincta, sp. n.

(1) **Eupachylomma rileyi** Ashm.

Wesmaelia rileyi Ashm. Proc. U. S. Nat. Mus., 1888, p. 641.

♀.—Length, 2 to 2.2 mm. Black, smooth, shining; face and mesosternum piceous; clypeus, trophi, first two joints of antennæ, tegulæ, and four anterior legs whitish; abdomen shaped as in *Limneria*, piceous, nearly black, with sutures 1, 2, and 3 pale.

Head transverse, much wider than thorax, three times as wide as thick antero-posteriorly; eyes large, occupying the whole side of the head; ocelli in a triangle, large, prominent, whitish or pale, the lateral nearer to each other than to the eye; clypeus subtriangularly produced. Thorax short ovoid, convexly elevated anteriorly, the collar, or pronotum, not visible from above; mesonotum smooth, without furrows; metathorax short, obliquely declining and delicately areolated. Wings hyaline, iridescent, with the stigma and nervures light brown; stigma narrow, acuminate; marginal cell narrow, acutely lanceolate, terminating much before the apex of wing; first abscissa of radius straight, forming with the second abscissa a right angle; cubital nervure interstitial with the first branch of radius, submedian cell a little shorter than the median. Legs long and slender, the hind pair being much longer than the others, their coxæ long and cylindrical, and their tarsi thickened the basal joint being as long as the four following joints united; middle legs with their femora longer than the tibiæ, the latter only a little longer than the tarsi.

Hab.—Lafayette, Ind.

Types in National Museum.

Originally described from specimens in Coll. National Museum, labelled No. 124, July 28, "Coll. C. V. Riley," but no record of its habitat or rearing could be found. Since this paper was read, however, among some Hymenoptera sent me by Prof. F. M. Webster for determination, was a single specimen bearing the same number and date, and on writing to Prof. Webster about it he informs me that all the specimens were bred by him at ~~Lafayette~~, Indiana, from an Aphid. Ox[

This rearing is interesting and virtually substantiates and confirms my views in regard to the position the group should occupy in the family *Braconidæ*.

(2) **Eupachylomma flavocincta**, sp. n.

♂.—Length, 4.1 mm. Head black, polished; face below rufopiceous; clypeus, mandibles, palpi, first two joints of antennæ, tegulæ, four anterior legs, and hind coxæ yellowish-white; flagellum dark brown; thorax luteous, three stripes on mesonotum, a small spot on scutellum and metathorax brown, the latter obsoletely areolated, rest of thorax smooth polished. Wings hyaline, the stigma and venation brown; cubitus interstitial with first branch of the radius or nearly so. Abdomen twice as long as head and thorax united, brown, the sutures broadly and a large spot at base of fourth segment luteous or pale yellowish; venter luteous with some brown markings; second segment much longer than the first, both finely, longitudinally aciculated; fourth segment shorter than the third, the third very little longer than half the length of second; following segments very short.

Hab.—Arlington, Virginia.

Collected by myself in 1889 on Arlington Heights, along the banks of the Potomac.

EURYPTERNA Förster.

1862. Syn. d. Fam. und Gatt. d. Braconen, p. 247.
(Type *Pachylomma cremieri* De Breb.)

(1) EURYPTERNA CREMIERI Förster.
Paxylomma cremieri De Breb. Enc. Méth., x, p. 23.
Pachylomma cremieri Ratzb. Die Ichn. d. Forstins., ii, p. 53.
Eurypterna cremieri Först. L. c. supra, p. 247.
Hab.—Europe (Germany).

This species has been taken among ants (*Formica*) and is supposed to be parasitic upon them.

ROPRONIA Provancher.

1886. Add. et Corr. à la Fn. Hym. du Can., p. 154.
(Type *R. pediculata* Prov.)

(1) ROPRONIA PEDICULATA Prov. L. c., pp. 154, 406.
Hab.—Ottawa, Canada (Harrington).

This genus is unknown to me, but, judging from the description and the figure of the wing, I believe it will be found to belong in this group. Abbe Provancher originally described it as a Bracon in the subfamily *Aphidiinæ*, but subsequently removed it to the *Helorinæ* in the family *Proctotrypidæ*.

The paper was briefly discussed by Messrs. Riley and Howard.

—Mr. Benton presented the following communication:

THE DEATH'S-HEAD MOTH IN RELATION TO HONEY-BEES.

By FRANK BENTON.

Westwood states in vol. ii, p. 367, of his work on insects that the Sphingid moth *Acherontia atropos* is the largest European lepidopterous insect. It is not, however, confined to Europe alone, but is found even more abundantly in North Africa and Western Asia, my own experience with it having been mainly acquired in Tunis, Syria, and Cyprus.

The general characteristics of the moth are sufficiently striking to make it readily recognizable. The length of body is 65 mm., or about $2\frac{1}{2}$ in.; wing-expanse, 115 mm., or $4\frac{1}{2}$ in. The general color is a dark velvety brown. The markings of the back of the thorax, dark brown and orange colored, present such a resemblance to a skull as to have led to the popular name, Death's-Head Moth. The abdomen is dark brown, each segment bearing a quadrangular blotch of yellow on either side of the dorsal line. The anterior wings are dark brown, marked with irregular black stripes and a lighter blotch of buff color toward the outer edge; the posterior wings orange yellow with two transverse bars of black—the outer one broader and less well-defined than the inner one.

The larvæ of this moth are most frequently found feeding on various species of Solanum, as the potato, bitter-sweet, etc., but they will also feed upon jasmine (*Jasminum officinale*), thorn-apple (*Datura stramonium*), etc. It is only the imago, which appears the latter part of summer, that does any damage to honey-bees—this damage being not to the bodies of the bees themselves except incidentally when the moth attempts to escape their attacks when it is caught pilfering their honey or attempting to do so.

But before taking up this part of my subject some reference to the note uttered by the moth will be of interest, especially as by this means the moth is said to terrify the bees. It is a shrill stridulation often loud enough to be heard at least ten or twelve rods away.

"It is somewhat strange," says Henry Edwards in *Insect Life*, vol. ii, p. 13, that in this age of entomological research the means by which the sound is produced by this species is yet unknown, comparative anatomists being considerably at variance in their opinions on the subject." Réaumur and Roesel have attributed it to friction produced by the labial palpi. Passerini (Osservazioni, Pisa, 1828) located the sound in the head of the insect, where there is a cavity connected with its spiral tongue. De Johet and Vallot (L'Institut, 1834, p. 4) think the sound is due to the sudden impelling of air by means of the wings, against the scales at the base of the latter. Lorey and Goreau think it is due to the expelling of air through orifices in the sides of the abdomen, which openings are covered with fine hairs. Westwood points out that this cannot be so, as other Lepidoptera having these holes are *mute*. Kirby and some others state that the larva produces a squeaking sound when captured. These are but a few of the many references which have been made by entomological authorities to the strange sound produced by this Acherontia—a sound whose production is still something of a mystery. This noise, so exceptional with Lepidoptera, together with the great size of the insect and the grotesque representation of a skull on its back, have led to much superstition and terror concerning it among the peasants of some countries of Europe, most of them regarding it as a harbinger of evil.

But it is more particularly as an enemy to the honey-bee that I wished to refer to this insect; hence, with these few general references to its striking peculiarities, I will proceed with that portion of the subject.

I think it was the blind naturalist F. Huber who, in 1804, first called attention to the depredations of this moth in connection with the honey-bee. The moth is very fond of honey and approaches the entrances of the hives just at nightfall and attempts to gain entrance. It is at this hour that the workers are most on the alert for enemies. The field-bees have all returned home, and in front of the populous hives numbers of them may be seen clustered about the entrances. The Death's-Head Moth poising a moment before the entrance of such a hive soon sees that it would be a hopeless task to gain admittance there. The workers exhibit signs of great excitement, numbers of them running toward the edge of the alighting-board and some even darting toward the moth. Should the moth alight it will be instantly seized by the nearest bees, the contented, continuous hum of the hive ceases at once, and a sharp, quickly and frequently uttered note of alarm calls forth additional defenders of the hive as fast as they can pour through the exit. The moth redoubles its efforts, uttering constantly its peculiar cry of terror. Should the moth escape, as it is very likely to do on account of its great strength and the violent fluttering of its powerful wings as well as the confusion which its note seems to occasion among its enemies, the offender is certain to leave the apiary at once. If a less populous hive having a large entrance should be attacked, and the moth succeed in gliding in without encountering guards, it will regale itself with the contents of a number of honey-cells, though the report which Huber gave, to the effect that it would suck up a tablespoonful of honey at one time, seems rather overdrawn. The moth runs great risks for the sake of this sip of nectar, as the chances are greatly against its ever getting out alive. Even though the colony be weak, still some workers are likely, in the summer season, to be on all combs which contain honey, and once the alarm has been given the intruder is soon compassed about and is quite sure to become so confused as to be unable to regain the hive entrance. Having finally despatched the moth with their stings, the bees commence to denude the wings and body of all scales and pubescence, frequently biting off legs and antennæ, nor do they leave it until they have completely skeletonized the wings and removed all internal organs, leaving merely the chitinous frame of the insect intact, as shown in the specimen herewith exhibited, which I took from a hive in Syria. This they usually glue fast to the bottom of the hive.

The bees of Oriental and North African countries when located in hives having large flight-holes, especially if the latter are somewhat circular in outline, build from the upper inner edges of the orifice a descending apron, composed of propolis and beeswax, which nearly closes the entrance; sometimes these are multiplied and overlap somewhat loosely, making passages rather labyrinthine in character; or, again, when the entrance is wide but only half to three-fourths of an inch high numerous pillars or portions of a solid wall reach from the top of the entrance to the bottom-board, rendering it more difficult or impossible for enemies, especially large-bodied ones, to force their way in.

Though I have found the remnants of as many as four Death's-Head Moths in one old hive, still I do not consider it a serious pest even where it is most plentiful. I cannot see why it would not thrive and multiply should it be accidentally introduced here, since climatic conditions are not unfavorable for it and its food-plants are abundant.

The remedy which the apiarist should adopt against this moth in localities where it is abundant is very simple and naturally suggests itself to one who considers its mode of attack. It is merely to make the entrance to the hive as low as possible without interfering with the ingress and egress of the bees—that is, 7 to 8 mm. or about $\frac{5}{16}$ of an inch. This will at the same time keep out many of the marauding Vespidæ, mice, snails, etc., and lessen the chances for the wax-moth to get in. The Death's-Head Moth will then do no more harm than to create a disturbance now and then at the hive entrance, and kill a few workers by the fluttering of its wings when it ventures near enough to be assailed by the bees.

The paper was discussed by Messrs. Stiles, Schwarz, Riley, Gill, Chittenden, Marx, and Howard. Dr. Stiles criticised the popular name of "Death's-Head Moth" since, in his opinion, the thoracic makings have no resemblance to a skull. Prof. Riley stated that in some specimens the resemblance to a skull is quite marked, but that the form of the markings varies considerably in different individuals. Mr. Schwarz expressed some surprise at the activity of the bees during the evening, when this moth flies, but was informed by Messrs. Benton and Riley that during warm weather the bees are very active at night. Prof.

Riley, in reference to the noise made by the moth, stated that although he had not given it much personal attention he imagined that the patagia have something to do with it. Dr. Gill expressed himself as of the opinion that it will be very easy to solve the question as to how the sound is produced by comparing the insect with closely allied forms which are silent. Prof. Riley stated that this had already been done by many older authors and contended that it is by no means an easy problem to solve, since the noise only occurs during extreme activity on the part of the insect. He stated that the sound produced by Culex is equally difficult to locate even by comparison with noiseless allied species. Mr. Howard was under the impression that he had noticed a slight squeak with certain North American Sphingidæ, and in this Messrs. Riley and Chittenden were inclined to agree with him, although neither was positive. Prof. Riley further spoke of his pleasure in rearing this moth when a boy in France. He had not found it during his early boyhood in England, where it was very rare at that time. Mr. Benton stated that the species is growing more abundant in England, and Dr. Marx referred to the fact that it was formerly a serious pest to the potato crop along the Rhine in Germany.

—Prof. Riley read the following:

FURTHER NOTES ON LACHNOSTERNA.

By C. V. Riley, Ph. D.

There has been a general impression, from the previous studies of Lachnosterna, that there is a certain chronological sequence in the occurrence of the different species. The great partiality of these insects for the tender foliage of young oaks, especially recently transplanted trees, is well known and has been fully attested in our previous discussions. I have had some difficulty in preventing the utter defoliation of three young oaks (*Quercus palustris*) which were transplanted from the nursery a year ago last fall, and on the evening of the very first day of May, which happened to be warm and quiet, the beetles appeared for the first time. A number which I took on that occasion showed that the specimens represented four well-known species, namely, *L. hirticula*, *L. arcuata*, *L. micans*, and *L. fraterna*. They were abundant in the order of their naming, *hirticula* being the earliest and the most active in flight, *arcuata* next most abundant, while but a single specimen of *fraterna* was taken.

These insects continued throughout the month, whenever the weather was warm and calm enough to permit of their flight, and at the close of the month another lot preserved showed the same preponderance of *hirticula* and *arcuata* and about the same relative proportion of *micans*, but instead of *fraterna* a single specimen of *hirsuta* was taken. Thus during the month of May these species occurred simultaneously and continuously.

By carefully picking off and shaking down two or three times between 8 and 11 o'clock, I had no great difficulty in substantially preserving the foliage of the trees named. During the present month there will undoubtedly be a sequence of the species, but in far less abundance and with no essential injury to the foliage. I have a suspicion that the habit which our oaks, in the District at least, manifest, of putting out a secondary vigorous growth in the month of June or later, has been acquired as a consequence of the very general eating-off of the terminal young growth in the beginning of the season by Lachnosterna. How very difficult these insects are to deal with when the question is one of a large number of trees has been indicated the present spring by the experience of Mr. D. H. Rhodes, who has charge of the tree-planting in the grounds at Arlington. He had a very large number of young maples set out from the nursery and very many of them have been ruined by these beetles, and the measures he could adopt failed to prevent their onslaught.

I had a curious experience with the first lot I preserved. They were thrown into an old cyanide bottle, the cork of which was not very tight, and the cyanide in which was more or less inoperative. The bottle was lined with blotting-paper and the beetles—just exactly two dozen specimens—chewed the paper up into a triturated mass, some of them retaining life up to the third week. This was a rather singular experience, considering that in empty bottles the beetles would perish in as many days, and I have little doubt that the blotting-paper saturated with cyanide and thus kept moist helped to preserve life in these insects in this instance, a result which one would hardly have anticipated from its well-known deadly effects upon insects generally.

NOTES ON COCCIDÆ.

By C. V. Riley, Ph. D.

MODE OF HIBERNATION—EFFECTS OF SEVERE COLD—VIVIPARITY—REMEDIES.

General experience indicates that most of our Coccidæ hibernate in the egg state, yet there is no uniform rule in this respect and I have been somewhat interested the past year in noting the hibernating habits of a few species that have come under my own notice. *Chionaspis euonymi*, which has been extremely injurious to the *Euonymus japonicus* in this city, and which attacked certain fine plants in my own garden, is a difficult species to deal with by virtue of the fact that it is so irregular in breeding. Last year I became aware of its occurrence on my own plants too late to deal with it effectually. Experiments made during the autumn and winter of 1892–'3 with the ordinary kerosene emulsion 4 or 5 times diluted only destroyed but a small portion of the mature females, but a much larger proportion of the immature scales. A curious thing about this particular species is that there is continuous hatching throughout the summer at no regular intervals, and that even as late as frost larvæ will be still hatching. Moreover, the females hibernate in various stages of development. No eggs will be found under the females during winter, and one might almost be led to suppose that it is viviparous. From about the middle of May, however, the eggs begin to be produced, a few only from each female, and these continue to hatch over quite a period.

An experience which I had last summer is interesting as indicating the migratory power of the young larvæ. I had planted in the spring a vigorous specimen of *Euonymus scandens* against the stone wall of my front porch. This is about ten feet from the nearest standard Euonymus which was infested, and there is a flower bed nearly three feet wide, besides three strips of grass sod, and a gravel walk four feet wide between the two. I know that the young *Euonymus scandens* was perfectly free from insects, and yet by midsummer I noticed that the insects swarmed upon it—so much so that it was practically killed down this past winter. The young larvæ must have persistently crawled this distance, a large number of them reaching the climbing Euonymus—whether instinctively wending their way in that direction or whether others were scattered in all directions and lost I did not ascertain. It is very doubtful if they could have been carried over in such numbers by other insects, especially as ants are seldom seen on the Euonymus, and that the wind played no part in the distribution may be justly inferred from the fact that the climbing plant was in a northwesterly direction from the other, a direction in which the winds are rare in summer, as they are far more often from the west or southwest or else from the north.

The Maple Scale, *Aspidiotus tenebricosus*, was exceedingly abundant two years ago and, as many of the members are aware, the Park Commissioners severely pruned and cut down many of the trees along some of our principal streets and whitewashed the trunks, with a view of checking or destroying it. This treatment, as I know from examinations made both by others as well as myself, did not kill the insects, as they continued to breed last year on all the new growth. Observations on this species also indicate that it is viviparous and hibernates in the mature female form. The most interesting fact connected with it, however, is that the very severe and exceptional cold of last winter seems to have killed it out, as, so far, Messrs. Pergande, Schwarz, and Chittenden, who have examined the subject for me, report that they have found no living specimens.

In this connection I may also give a little experience with *Chionaspis furfurus*, the well-known Scurfy Scale of Pyrus trees. This proved in my own garden extremely fatal to a hedge of *Pyrus japonica*, when allowed to multiply, and experiments with kerosene emulsion only $\frac{1}{5}$ diluted showed that comparatively few of the perfect scales in autumn or winter, while the leaves are off the plant, are destroyed by it. It becomes necessary, therefore, to attack it in the young or newly hatched larva state. Fortunately the larvæ hatch quite uniformly about the middle of May, and the kerosene emulsion diluted in 5 times its bulk of water proved, when carefully applied, thoroughly effectual, without any injury to the plants. Where, however, it was repeated two or three times upon the same plant it caused a dropping of the foliage and a blackening of the more tender growth, yet the plants are not materially injured and will undoubtedly put forth fresh shoots and foliage. But a single treatment has been effectual in killing every individual scale.

In connection with the hibernation of the species mentioned I have been led to go over my own earlier records on the hibernating habits of the family, as also over the records of the Division of Entomology. I have compiled the facts contained in Prof. Comstock's article in his own report as U. S. Entomologist for 1880. From these data it will appear that no general rule can be formulated, and that we not only have species in the same subfamily hibernating either as larvæ or in stages intermediate between the larva and adult, but in the adult female form and in the egg, and that some species will be found in all these different stages of development during the winter. The fact remains, however, that in the armored scales the great majority, in more northern latitudes, hibernate in the egg state.

Summary of Records.

Diaspinæ.—*Aspidiotus obscurus* Comst.—On *Quercus phellos*. The notes indicate that in the District of Columbia this species hibernates in both the larva and adult states. No eggs have been observed.

Aspidiotus tenebricosus Comst.—Maples; D. C. Viviparous; hibernates as adult female.

Aspidiotus perniciosus Comst.—On Apple and a number of other deciduous fruit trees; California. Specimens examined in December, 1879, showed that the mature females were hibernating, and that with some of them were found a few eggs and recently hatched larvæ. There were also younger females in different stages of development. Others examined October, 1880, showed that all the females were living and that the younger larvæ were present, but no eggs were found. The species thus seem to hibernate in the mature female condition and to be both oviparous and viviparous.

Aspidiotus aurantii Mask. — Cal. Both oviparous and viviparous; Hibernates as adult female.

Aspidiotus rapax Comst.—On Euonymus, Orange, etc.; Florida and California. Observations made from March to the end of June indicate that this species hibernates in the adult female, in the egg state, or as recently hatched larvæ.

Aspidiotus sabalis Comst.—On Palmetto; Florida. The records indicate that this species hibernates both in the adult female and larva states. Mature males were also observed March 23, 1883, but no eggs are recorded.

Aspidiotus ancylus Putn.—On various species of trees; District of Columbia. Hibernates as half-grown female and as male larva, the male appearing in March and April; eggs unknown.

Aspidiotus, n. sp.—On Camellia; California. Hibernates in the adult state, but numerous eggs are found the latter part of the winter.

Aspidiotus, n. sp.—On Japanese tea-plant; California. Hibernates in the adult female state, the eggs being produced the latter part of the winter.

Diaspis boisduvalli Sign.—On Livingstonia; D. C. Adult females with eggs and younger females in different stages, male pupæ and adult males, were all observed as late as November 12.

Diaspis lanatus Morg. and Cckl.—On Peach; Florida. Mature females hibernate without eggs; eggs are, however, found during the latter part of June, probably of the second generation.

Diaspis rosæ Sandb.—On Rose, etc.; D. C., Florida, California. Specimens received from Florida February 20, 1880, embraced adult and partly grown females, adults with numerous eggs, some of which were hatching. Males were at the same time swarming. By April 20 adult females and eggs were still present, though the males were absent. Specimens of the same species received from California February 7, 1881, showed that the females were about half-grown and the males fully developed. The same species from Washington, examined March 6 of this year (1893), showed adult and half-grown females, the majority, however, being in the egg state.

Diaspis carueli Targ.—On Juniperus, etc.; D. C. Hibernates in the adult female state, no eggs having so far been found.

Chionaspis pinifolii Fitch.—On Pine. Oviparous; hibernates in the egg state.

Chionaspis biclavis Comst.—On Camellia; D. C. Oviparous; appears to be a continuous breeder.

Chionaspis quercus Comst.—On Oak; California. Oviparous; hibernates as partly grown female, or as adult female, though the male larvæ and pupæ have been observed as late as August.

Chionaspis fraxini Sign.—On Ash; England. Oviparous; hibernates in the egg state.

Chionaspis, n. sp.—On Black Cherry; New York. Oviparous; hibernates in the egg state.

Chionaspis, n. sp.—On Cornus; D. C. Probably hibernates in the adult female form. Specimens examined June 9, 1881, contained numerous eggs.

Chionaspis, n. sp.—On Dwarf Apricot; Japan. Oviparous; hibernates in the egg state.

Mytilaspis, n. sp.—On *Myrtus barometrica*; D. C. Oviparous; hibernates in both egg and larva state.

Mytilaspis, sp.—On *Ulmus purpurea*; D. C. Oviparous; hibernates in the egg state.

Mytilaspis, n. sp.—On Yucca; D. C. Oviparous; hibernates in the egg state.

Mytilaspis, n. sp.—On *Camellia japonica*; Georgia. Oviparous; probably hibernates in the egg state, as eggs were found as late as August 25.

Mytilaspis, n. sp.—On *Celastrus scandens;* Virginia. Oviparous; probably hibernates in the egg state, these being found late in summer.

Lecano-diaspini.—*Asterodiaspis quercicola* Bouché.—D. C.; hibernates in the adult female state; eggs not observed.

Asterodiaspis pustulans Cockl.—On Hibiscus, etc.; Florida. Oviparous; hibernates in the egg state.

Lecaniini.—*Ceroplastes floridensis* Comst.—On Orange, etc.; Florida. Oviparous; hibernates as adult; eggs hatching from middle of February until end of April.

Ceroplastes cirripediformis Comst.—On Orange, etc.; Florida. Oviparous; winter habit not observed.

Lecanium hesperidum Linn.—On various plants; D. C. Viviparous; breeds continuously.

Lecanium platyceri Pack.—On *Platycerum alcicorne;* D. C. Viviparous; hibernates as adult female, though a few recently produced larvæ were noticed in December. Probably breeds continuously.

Lecanium tulipiferæ Cook.—On Magnolia, etc.; Florida; D. C. Viviparous. At Washington the species hibernates in the larva state; in Florida all stages have been observed during the winter.

Lecanium hemisphæricum Targ.—On various plants; D. C. Oviparous; hibernation not noticed.

Lecanium oleæ Bern.—On various plants; D. C. Breeds continuously.

Lecanium, sp.—On *Acacia decurrens;* D. C. Viviparous; larvæ of all stages were observed as late as December 8, 1880.

Lecanium, sp.—On Red Bay, *Persea carolinensis;* Florida. Viviparous; hibernates as adult.

Lecanium, sp.—On Elm. Oviparous; hibernates as partly grown larva.

Lecanium, sp.—On Fraxinus; D. C. Oviparous; hibernates as larva.

Lecanium, sp.—On Grape; California. Oviparous; hibernates as adult female.

Lecanium, sp.—On Celtis; D. C. Oviparous; hibernates as larva.

Lecanium, sp.—On Mesquite; Arizona. Appears to be viviparous; numerous larvæ were issuing from scales received June 20, 1882.

Lecanium, sp.—On Osage Orange; Utah. Oviparous; winter habit not observed.

Lecanium, sp.—On Oak; D. C. Probably hibernates as partly grown larva.

Lecanium, sp.—On *Quercus laurifolia;* Alabama. Oviparous; dead females filled with eggs received April 18, 1881.

Lecanium, sp.—On Pear; California. Oviparous; hibernates in the egg state.

Lecanium, sp.—On Peach; D. C. Oviparous; hibernates in the imago state.

Lecanium, sp.—On *Sagaretia michauxii;* So. America. Oviparous; hibernates probably in the imago state; scales filled with eggs examined May 1, 1885.

Pulvinariini.—*Pulvinaria innumerabilis* Rathv.—This and all other species of the subfamily studied are oviparous and hibernate in the partly grown female state. In Florida the females commence ovipositing in March, while further north oviposition does not take place until May.

Kermesini.—*Kermes galliformis* Riley.—On Oak; widely distributed. Oviparous; mode of hibernation not positively ascertained, though probably as adult females.

Kermes, sp.—On *Quercus obtusiloba;* Texas. Oviparous; hibernates probably in adult female, eggs hatching being received May 17, 1882.

. *Kermes*, sp.—On *Quercus niger;* Missouri. Oviparous; hibernates in the larva state.

Kermes, sp.—On *Quercus tinctoria;* New York. Oviparous; hibernates probably as larva.

Kermes, sp.—On Live Oak; California. Oviparous; hibernates in larva state.

Kermes, sp.—On *Quercus obtusiloba;* Texas. Oviparous; hibernates probably as adult female, as larvæ were just hatching May 18, 1882.

Dactylopiini.—*Dactylopius destructor* Comst.—On Orange, etc.; Florida Oviparous; breeds continuously.

Dactylopius, sp.—On Roots of Clover. Oviparous; hibernates in adult and egg states. Taken June 10, 1880; eggs hatched from January 31 to February 3.

Dactylopius longifilis Comst.—On hot-house plants; D. C. Viviparous; breeds continuously.

Dactylopius, sp.—On Maple. Oviparous; hibernates in the egg state. Dead females and eggs found March 16, 1881; larvæ hatched March 28.

Dactylopius, sp.—On Sycamore; D. C. Oviparous; hibernates in partly grown larva state. Dead females and eggs were found September 18, 1873; eggs hatched September 23.

Dactylopius, sp.—On grass; D. C. Oviparous; hibernates apparently in all stages. Adult females, eggs, and immature specimens in all stages were found October 22, 1881.

Acanthococcini.—*Cerococcus quercus* Comst.—On Oak; Arizona. Oviparous; hibernates in the egg state. Scales received January, 1874, contained numerous eggs, which commenced hatching March 18, 1874.

Gossyparia ulmi Groff.—On Elm; D. C. This species appears to be oviparous and hibernates in the larva state.

Eriococcus azaleæ Comst.—On Azalea; D. C. Oviparous; hibernates in all stages.

Rhizococcus quercus Comst—On Live Oak; Florida. Oviparous; hibernates in all stages. Among specimens received March 29, 1882, were mature females, partly grown females, young larvæ, eggs, and fully developed males, which seems to indicate that there are two or more generations each year.

Rhizococcus araucariæ Comst.—On Araucaria; California. Oviparous; the eggs were probably deposited in August or September. It hibernates probably as partly grown larva.

In discussing these several communications Mr. Doran stated that at one time he had kept a Scarabæid beetle for five days in a bottle containing fresh cyanide, and that at the expiration of this time it was apparently as healthy as ever. Mr. Schwarz stated that in his opinion the species of Lachnosterna are much longer lived than supposed by Prof. Riley. Instead of dying in three or four days, he thinks that they normally live for several weeks. Dr. Marx stated that on May 10 he received a male and female *Centrurus vittatus* from Baltimore and placed them separately in dry bottles. The male died in five days, but the female is still alive, having given birth to numerous young. In this case the longevity is plainly influenced by maternity. Mr. Howard thought that the influence of Prof. Riley's cyanide was far from being proven, and suggested that if the check bottles had contained an equal amount of moistened blotting-paper the comparative results might have been different. In regard to the instance of the travelling of the young of the Chionaspis, he thought that this was rather to be explained by the accidental portage of many individuals by flying insects and by English sparrows, everywhere so abundant. Mr. Ashmead stated that from observations in Florida he was convinced that ants have a great influence in the carriage of bark-lice to a distance. Prof. Riley stated that no

English sparrows nest on his grounds and that he had not seen one upon his Euonymus bush. He had carefully considered all possible means of transit and had concluded that the young must have crawled the entire distance to have appeared so suddenly and in such numbers upon a previously uninfested plant. He further stated that there are no ants whatever upon the bush and that he had never seen ants attending *Chionaspis euonymi*, on account of the lack of honey dew. Mr. Ashmead stated that ants undoubtedly do attend and transport young Diaspinæ, and that although the honey dew is comparatively slight it is still present with these forms.

—Mr. Schwarz exhibited a remarkable species of Rhodobænus which he had found alive at Fortress Monroe, Va., in May of the present year. It differs strikingly from any species yet found in North or South America, to which countries the genus is restricted. It is a question whether the insect was brought to that locality by some of the vessels participating in the naval review which occurred a short time previously, or whether it may be called a North American insect. The coast region from the capes nearly to Florida, he stated, is practically still *terra incognita* to entomologists, so that the form may possibly belong to our fauna.

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(October 5, 1893, to February 1, 1894.)

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FRANK BENTON, Corresponding Secretary,

Department of Agriculture,

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PROCEEDINGS.

OCTOBER 5, 1893.

President C. V. Riley was in the chair and 12 members and 2 visitors present.

The following new members were elected:

Active—R. S. Lull, of Maryland Agricultural College. Corresponding—W. D. Doan, Coatesville, Pa.; J. L. Healey, Rogers Park, Ill.; H. C. Fall, Pomona, Cal.; H. F. Wickham, Iowa City, Iowa; L. W. Mengel, Lancaster, Pa.

Mr. Schwarz read the following paper:

ADDITIONS TO THE LISTS OF NORTH AMERICAN TERMITOPHILOUS AND MYRMECOPHILOUS COLEOPTERA.

By E. A. SCHWARZ.

1—TERMITOPHILOUS SPECIES.

Platycholeus leptinoides Crotch.—A number of specimens were obtained by Mr. H. G. Hubbard, in July, 1891, at Lake Tahoe, Cala., in a colony of *Termopsis angusticollis* within the stump of a large pine tree; other specimens, found by Mr. A. Koebele in California with the same host, are in the U. S. National Museum. The general appearance of this remarkable Silphid indicates a parasitic or inquilinous mode of life, and I have no doubt that it is a true termitophilous species.

Microcyptus testaceus Lec.—A specimen was found by Mr. H. Ulke near Washington, D. C., under bark of a dead pine tree. No white ants were seen near by, but the tree bore evidence of having been inhabited by them. Another specimen was found by myself many years ago under similar circumstances at New Smyrna, Fla., in the month of June. This would seem to prove that, as it is the case with myrmecophilous inquilines, at least some termitophilous species do not accompany immediately the termites when these are changing the location of their nests.

What, in my list of termitophilous Coleoptera (Proc. Ent. Soc. Wash., 1, p. 161), I have called "true nests" of *Termes flavipes* is a rather misleading term, and requires some explanation. I intended to designate thereby colonies in which, at the proper season, eggs or very young larvæ are found, or from which the swarms of winged individuals issue. That such colonies, which are quite abundant, are only temporary habitations is proven by the fact that they do not contain any egg-laying females. The eggs are, therefore, carried into them by the workers from other colonies of a more permanent nature, and which should be considered more properly as the "true nests." Such colonies are extremely rare, or, perhaps, only difficult to find, but hitherto only supplementary queens, *i. e.*, egg-laying individuals with long wing-pads (sexually advanced female pupæ), or egg-laying individuals with short wing-pads (sexually advanced female larvæ), have been found in them. A true queen, *i. e.*, an egg-laying female imago with wing-stumps, has never been found, and is probably never developed in *Termes flavipes*, a fact which would be well in accord with the wandering habit of this species.

2—Myrmecophilous Species.

Species belonging, in my opinion, to the class of accidental visitors in ants' nests and which have been found or recorded since the publication of my paper on Myrmecophilous Coleoptera (Proc. Ent. Soc. Wash., 1, 1890, pp. 237–247) are not enumerated in the following list. The occurrence of *Tachys incurvus* in large number of specimens in the hills of *Formica schaufussi* and *exsectoides* as observed at several localities is of interest, but may be explained by the fact that the earth of which these hills are constructed retains always a considerable amount of moisture which, during periods of severe drought, is naturally greatly attractive to these beetles.

Fustiger fuchsi Brend.—Found by Mr. H. F. Wickham with *Cremastogaster lineolata*, at Williams, Ariz. (Psyche, 6, 1892, p. 321).

Fustiger californicus Brend.—Specimens of the ant with which this species was found by Mr. A. Koebele near Los Angeles, Cala., prove to be *Cremastogaster lineolata*.*

Adranes n. sp.—Many specimens were found by Mr. H. G. Hubbard in a colony of *Lasius rubripes* at Lake Tahoe, Cala., July 12, 1891. The species agrees in size and color with *A. lecontei*, but the males are at once distinguished by the absence of the triangular metasternal ridges and by the much shorter spine at the base of the middle femora. I have seen other speci-

* For the determination of the ants mentioned in this list I am indebted to Mr. Theo. Pergande.

mens in the cabinet of Mr. H. Ulke, collected by Mr. Titus Ulke in the Black Hills of South Dakota, with a *Lasius claviger*.

Tyrus corticinus Cas.—Numerous specimens were found by Mr. Hubbard and myself with *Formica sanguinea** in a decayed pine log above Alta, in the Wahsatch Mountains of Utah, at an elevation of about 10,000 feet.

Ctenistes pulvereus Lec.—Found with *Formica schaufussii* at Tucson, Ariz., by Mr. Wickham (Psyche, 6, 1892, p. 321).

Arianops amblyoponica Brend.—This blind species, the largest Pselaphid in our fauna, was originally described from specimens found by Rev. Jerome Schmitt, near Beatty Station, Pa., in colonies of *Amblyopone serrata*. In June, 1893, Mr. Hubbard and myself found a considerable number of specimens in the mountains of North Carolina, at Retreat and Round Knob. They occurred in deep layers of vegetable mould, in company with other blind species of Coleoptera (Anillus, Pinodytes). A few specimens of *Amblyopone serrata* were found under the same conditions, but the beetles were more numerous than the ants.

Batrisus ferox Lec.—A single female specimen with extremely small eyes was found by Mr. Theo. Pergande with *Amblyopone serrata* near Washington, D. C. *B. juvencus* of my former list has to be referred to *B. ferox*.

? *Myrmecochara* n. sp.—The species mentioned in my list from Lake Tahoe, Cala., has been found by Mr. Wickham at Cañon City, Colo., with *Solenopsis debilis* (Psyche, 6, p. 321). It is incorrectly referred by him to the genus Gyrophæna.

Lispinus.—Some of the more convex species are so constantly found with ants in old stumps or under bark that they are possibly to be included in this list. Thus *L. prolixus* was found abundantly by Mr. Titus Ulke with *Formica obscuripes* in the Black Hills, S. Dak.; *L. lævicauda* is equally common with *Camponotus pennsylvanicus* at Grand Ledge, Mich., and a third species which is distributed in cabinets under the MS. name *L. caraboides* Fauv. was found in large numbers with *Formica sanguinea* var. at Alta, Ut.

Emphylus americanus Lec.—A number of specimens occurred with *Formica sanguinea* var. in a rotten log near Alta, Utah.

Hister subopacus Lec.—A single specimen was found under a stone in a colony of *Formica fusca*, race *subænescens*, at Tenino, Wash., early in July.

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*I am informed by Mr. Pergande that this is not the typical *F. sanguinea*, which has not yet been found in North America, but one of the sub-species or races which will shortly be described by Mr. C. Emery.

Hetærius morsus Lec.—Found by Mr. T. D. A. Cockerell at West Cliff, Colo., April 23, in a " nest of a brown ant, apparently, without doubt *Formica fusca* L." (Ent. Mo. Mag., 26, 1890, p. 158).

Hetærius hornii Wickh.—This species, which is unknown to me, was described by Mr. Wickham (*Pysche*, 6, p. 322) from a specimen found with *Formica schaufussi*, at Cheyenne, Wyo., in May, 1889.

Hetærius tristriatus Lec.—This is a common species from the Rocky Mountains to the Pacific States, and seems to live with all species of Formica occurring in that region. The following hosts were ascertained by Mr. Hubbard and myself: *Formica subænesceus* (Glenwood Springs, Colo., May 15), *F. obscuripes* (Tenino, Wash., May 30), *F. schaufussi* (Ft. Assiniboine and Helena, Mont., in April and May).

Hetærius n. sp.—A very small species allied to *H. brunnipennis* was found by Mr. Hubbard and myself just as widely distributed and having the same hosts as *H. tristriatus.* Upon uncovering colonies of *Formica subænesceus* at Glenwood Springs we repeatedly observed that an ant seized with its mandibles the beetle and carried it into the safe retreat of the subterranean galleries.

Cremastochilus crinitus Lec.—This is extremely abundant throughout northern Utah, in the plains as well as in the mountains to an altitude of about 7,000 feet, and it is a common sight to see specimens being dragged about by ants. *Formica obscuripes* and *F. fusca* have been ascertained as hosts. Normally, the upperside of the beetle is furnished with long hairs, but in most specimens found the hairs have been eaten off by the ants, usually completely so. The excretion which is so eagerly sought for by the ants issues from a pair of glands at the inner side of the anterior thoracic angles and another pair of glands situated beneath and within the posterior angles. That exuded from the latter source is very copious, and, if a specimen of the beetle is for some time not attended to by ants, it accumulates as a honey-colored, sticky mass at the base of each elytron.

Saxinis saucia Lec.—Several larval cases were found under stones in colonies of *Formica subænescens* at Glenwood Springs, Colo., May 15, 1891. The larvæ were full grown at that time, and two imagos were bred from them about three weeks later. The dirty brown cases are slightly bulging behind and have no longitudinal ridges.

Coscinoptera vittigera.—Larval cases were quite abundant among colonies of *Formica subænescens* at Glenwood Springs, Colo., May 15, 1891. Two specimens of the beetle were bred therefrom and belong to the variety with abbreviated elytral vitta. The cases are darker in color than those of the preceding species, nearly cylindrical in shape and furnished dorsally with a few straight, irregularly interrupted or abbreviate, ridges.

Coscinoptera dominicana.—A single larval case entirely different from that figured by Dr. Riley* was found under a stone in a weak colony of *Camponotus melleus* at Mt. Vernon, Va., April 13, 1893. It is of a bright clay color corresponding with that of the surrounding soil, quite cylindrical in shape and externally smooth and without any trace of longitudinal ridges. Upon opening the case a few weeks later the perfect beetle was found dead within it. The great difference in form and sculpture of the larval cases made by the same species is certainly very remarkable and induces me to abstain from a comparison of the larval cases of the two preceding species with those found and described from Colorado by Mr. T. D. A. Cockerell.† In the larval case found at Mt. Vernon the larva had evidently prepared to enter the chrysalid state; for the margin of the anterior opening had been enlarged into a broad rim which was firmly glued to the under surface of the stone, and a short distance above this rim the larva had tightly closed its case by a circular lid.

In answer to a question by Prof. Riley, Mr. Schwarz stated that the Chrysomelid cases received by Prof. Riley from Montana probably belonged to *C. dominicana* and were all more or less provided with longitudinal ridges. He stated, further, that these cases are very fragile and require very careful handling to prevent breakage, and that some of the specimens collected by him were entirely destroyed on account of this extreme fragility. He stated, also, that one of Prof. Riley's specimens, received from Morrison, from Arizona, was a distinct form. He was convinced that the larvæ of all the species of this genus are myrmecophilous in habit.

Prof. Riley was greatly interested in the wide difference between the cases of *Coscinoptera dominicana* figured by him and those exhibited by Mr. Schwarz—differences apparently due to the varying nature of the soil of which they were constructed, one form being in a clay soil and the other in a soil containing

* Sixth Rep. Ins. Mo., p. 127.

† Entom. Mo. Mag., 27, 1891, p. 190; see also Riley & Howard, *Insect Life*, 4, 1891, p. 148, and Dr. John Hamilton, *l. c.*, 1892, p. 268.

considerable humus; and he drew attention to the futility of attempting to base specific differences on structures of this kind, which are so apt to be divergent, depending on the surrounding conditions, the same species adapting itself to changed environment and constructing widely different structures.

Dr. Marx said that if ant-feeding insects were included in mrymecophilous species, the large Arachnid, Solpugo, should be classed among them. He described its method of feeding on ants at some length, based on the observations of Mr. Gustav Eisen in Lower California, and those of Mr. Caspar Butcher in Texas. Mr. Schwarz stated that these Arachnids are abundant in the West but are always nocturnal in habit, and observations such as those described by Dr. Marx could be made only with great difficulty.

—Mr. Marlatt presented the following paper:

NEURATION OF THE WINGS OF TENTHREDINIDÆ.

By C. L. Marlatt.

In the first study of any group of insects in which the neuration plays an important part in classification, one is apt to be discouraged by the varied and conflicting terminology of the veins and cells, in the description of which scarcely any two authors agree. To increase the difficulty, it frequently happens that an author's system has to be picked up from random descriptions without the aid of any full and adequate explanation in connection with figures. These last, also, are absolutely necessary to the correct understanding of the names, because of the frequent use of the same terms for distinct things by different writers.

Two of the later European writers on the Tenthredinidæ, Cameron and André, have, however, given very careful and full explanations, leaving little to be desired in this respect, and have practically coincided in a very satisfactory terminology which harmonizes, also, as well as could be with older systems. Konow has given a rather imperfect explanation of the system which he has followed, and which is based on that of the older German authors. The importance of Konow's recent work in the Tenthredinidae gives value to certain features of this terminology, which will be explained later on.

The American writers have generally followed Norton and Cresson, whose terminology, though good, lacks completeness, and is at a disadvantage on account of its divergence from the accepted system of Europeans. Still, if we had only to deal with

American insects, it might be well to continue to follow these writers, but the time is passed when new species can be described without reference to foreign literature, not only because many species will be found to be common to the old and new worlds, but others, especially those affecting cultivated plants once restricted to one or the other hemisphere, are being or will be by the agency of commerce more and more widely distributed. Comparisons with foreign descriptions will therefore, in the future, have to be the rule, and it will be easier now than later to harmonize our characterizations with those of European writers. This will not necessitate the introduction of a new and strange terminology, for the accepted European systems are not, after all, so widely divergent from Norton's, and will be found, with a few important exceptions, to differ on account of additions rather than changes.

Of the later important European writers on the Tenthredinidæ, Cameron, André, and Konow, I have most closely followed the first, introducing, in fact, few and unimportant changes and some few additions of parts not designated by him.

I have given preference to Cameron's system of nomenclature, because I believe it to include the terminology most often used and because his extensive monograph in English will be more frequently referred to by American students than André's, in which, however, the system followed differs only in minor and, in general, unimportant particulars. For a full synonymy of the terminology employed by all the older European writers, the excellent lists furnished by Cameron and André may be referred to. The system here adopted is illustrated, with explanations accompanying, in Fig. 2.

The names of veins and cells in anterior and posterior wings correspond, except that in the posterior wings the 1st cubital (8) is usually called the upper discal, the lower discal being numbered (10) in the figure, and the cells numbered (11) and (12) are the 1st and 2d posteriors.

The only important divergence from Cameron is the addition of the terms axillary for nerve (*f*) of the posterior wings which also sometimes occurs as a rudiment in the anterior wing; and the designation of cell (2) as sub-costal rather than humeral.

André's system differs only in the following particulars. Of the veins: *j* is called posterior; *k*, transverse brachial; *p*, margino-discoidal, and *s* and *t*, medio and transverso discoidals. Of the cells, (1) is the brachial and (2) costal.

In the system of Cresson and Norton, so far as the veins have been designated, there are but two changes, viz., (*h*) is the marginal and (*l*) transverse marginal; with the cells (2) is the median, (3) sub-median, (6) marginal, (8–11) sub-marginal, and (15 and 16) apical.

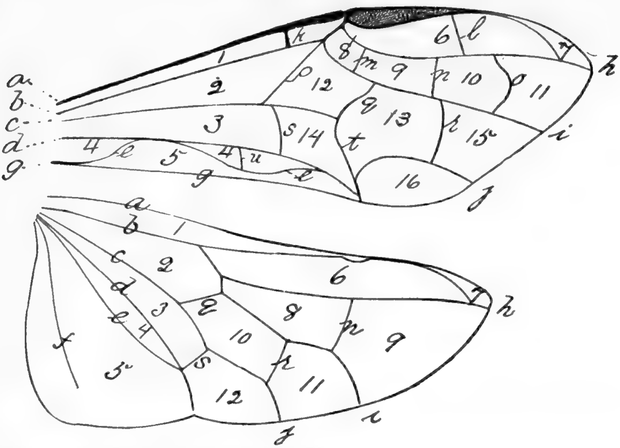

Fig. 2.—Neuration of Tenthredinid wings. See text for description (original).

The Veins.

Longitudinal Veins.

a, costal.
b, sub-costal.
c, median.
d, anal.
e, accessory.
f, axillary.
g, inferior.
h, radial.
i, cubital.
j, sub-discal.

Cross Veins.

k, transverse costal.
l, transverse radial.
m, 1st transverse cubital.
n, 2d " "
o, 3d " "
p, basal.
q, 1st recurrent.
r, 2d "
s, 1st transverse median.
t, 2d " "
u, transverse lanceolate.

The Cells.

1, costal.
2, sub-costal.
3, median.
4, lanceolate.
5, anal.
6, radial.
7, appendiculate.
8 to 11, 1st to 4th cubitals.
12 to 14, 1st to 3d discals.
15 and 16, 1st and 2d posteriors.

Konow, in an incomplete characterization in his earliest paper,* indicates the following differences: In the case of the veins *c*, is either median or discoidal; *d*, brachial; *e*, humeral; *p*, discoidal

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* Deutsche Ent. Zeit., XXVIII, 1884, Heft II, p. 306.

cross-nerve; *s* and *t*, areal and anal cross-nerves, and *u*, humeral cross-nerve. With the cells, the few that are referred to in the anterior wings agree with my system; in the posterior wing the lanceolate cell (4) is strangely enough called the anal cell.

The most important of the cells on classificatory grounds is the lanceolate cell of the anterior wings, which is peculiar also to the Tenthredinidæ. It assumes in different genera three distinct types, each presenting variations of value. 1. It is *petiolate*, as in Nematus, Fig. 3, (1), when the accessory vein joins the anal vein and terminates remotely from the base of the latter. 2. It is *contracted* when the accessory vein coalesces with the anal for a distance at the centre, called *contracted* when widely so as in Hylotoma, Fig. 3 (2), or *subcontracted* when narrowly so as in Pachyprotasis, Fig. 3 (3). 3. It is open when the accessory vein extends independently to the base of the wing without meeting the basal—simple or without cross-vein—as in Selandria, Fig. 3 (6); with oblique cross vein as in Dolerus, Fig. 3 (4); and with straight cross vein as in Tenthredo. Fig. 3 (5).

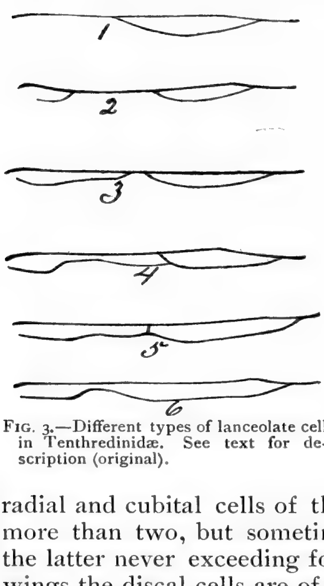
FIG. 3.—Different types of lanceolate cell in Tenthredinidæ. See text for description (original).

Next in importance are the radial and cubital cells of the anterior wings—the former never more than two, but sometimes with an appendiculate cell, and the latter never exceeding four nor less than three. In the hind wings the discal cells are of the most importance—their number, when present, and relative size giving good characters. The lanceolate cell (Konow's anal cell) also occurs in two distinct forms, viz: either with the accessory vein received a greater or less distance in front of the transverse median (*s*) or interstitial with this cross vein.

With the veins the more important features are in the cross veins, their number and position relative to each other and the cells which they join. Of the longitudinal veins it may be noted that the costal extends entirely to the apex of the wing and includes the peculiar enlargement called the stigma, the size and shape of which latter affords good generic and specific characters. On the hind wing, near the middle of this vein, occur a number of minute hooks which clasp the thickened hind border of the anterior wings and serve to connect the two in flight. The clear spots or "bullæ" of Walsh, which sometimes occur particularly on the veins of the anterior wings, have not proven of very great value in the separation of species.

Considerable variation will be found in the venation within generic limits, and even in some cases in the same species, but a little experience will soon enable one to properly refer such specimens. That the absence or presence of any particular vein is abnormal will usually be indicated by the position of the other veins and the character of the venation as a whole.

The paper was discussed by Messrs. Ashmead, Riley, and Howard, Messrs. Riley and Ashmead suggesting one or two changes in nomenclature, and Mr. Howard calling attention to the comprehensive system of numeral designation of veins proposed by Redtenbacher and based upon evolutional studies. He urged the adoption of this system by specialists.

—Prof. A. D. Hopkins, of West Virginia, presented short notes upon, and finely executed drawings of, certain "timber worms" which produce the so-called pin-holes in the solid wood of various trees, and are thus very injurious. The species discussed and exhibited were the following: 1, larvæ of *Hylecœtus lugubris* from chestnut; 2, larvæ of *Serropalpus striatus* from black spruce; 3, larvæ of *Eupsalis minuta* from oak, and which is much more injurious than has hitherto been supposed; 4, an unknown Coleopterous larva with a curiously formed anal segment, greatly injurious to oak and chestnut timber, which is identical with an unbred larva figured and described by Prof. Riley in his 6th report on the insects of Missouri (Fig. 32), where it is suggested that it may be the larva of the genus Strongylium. Prof. Hopkins also exhibited very fine specimens of the work of an Agrilus (probably *bilineatus*) which appears to be the primary cause of the wide-spread dying of the chestnut trees. In one of these samples the galleries had been completely filled up by a new growth of hard wood.

In the discussion of this paper, Mr. Schwarz stated that he was greatly interested in the undetermined larva which had been figured by Prof. Riley in his sixth report, and suspected to belong to the genus Strongylium, but stated that some doubt as to this reference arises from the fact that all the species of Strongylium are much too large for any of the larvæ so far found. Mr. Schwarz also called attention to the frequent confusion by collectors of Serropalpus and Lymexylon, describing the distribution of the two genera, the first being confined to the northern and the second to the more distinctively southern States in range. Specimens of the two genera were also exhibited.

Dr. Riley was greatly interested in the burrow of the Agrilus exhibited by Mr. Hopkins, which had become filled up with a growth of liber so as to make the burrow a raised ridge, and, from its serpentine course, gave it somewhat the appearance of a lignified snake. In connection with this he referred to the very curious so-called lignified snake from Brazil, which was exhibited in Europe some years ago, and which was so natural in appearance as to deceive several European writers, but which was really but another example of the burrow of an insect afterwards filled up by a woody growth like the one exhibited. Mr. Hopkins stated, in connection with the work of this insect, that the tree in which the specimen was obtained was in a dying condition, but was evidently being killed by the attacks of the Agrilus, which affects living and growing trees rather than those already injured or in a dying condition, as is sometimes thought.

NOVEMBER 2, 1893.

President Riley in the chair, and twelve members present. Mr. Heidemann presented designs for a seal for the Society. One of the designs was adopted, and Mr. Heidemann was urged to engrave it upon wood. Upon motion, a vote of thanks was extended to Mr. Heidemann for his voluntary services in this matter.

—Prof. Riley read the following:

NOTES UPON BELOSTOMA AND BENACUS.

BY C. V. RILEY.

It is well known that for many years the commoner species of our so-called "electric light bug" was generally referred to

Belostoma grande, and, further, that of late years it has come to be known that this was not the true *grande*, and that the commonest species we have belongs to Stal's genus Benacus and is Say's *griseus*. This is undoubtedly the common species in this section and throughout the larger portion of the United States, and has received a number of different names, as *haldemanus* Leidy, *harpax* Stal, *ruficeps* Dufour, *distinctum* Dufour, *angustatum* Guer. The Belostoma is a relatively rare form, judging from the material in the National Museum, and has also received various names, as *impressum* Haldeman, *litigiosum* Dufour, and *obscurum* Dufour, all of these being synonyms given in Uhler's list. Stal established the genus Benacus in 1861 in "Oversigt Vetenskaps-akademiens Forhandlingar," XVIII, Stockholm, upon *Belostoma haldemanum* Leidy, which was described in 1847 (Journal Acad. Phil., New Series I, page 59). Stal's diagnosis is as follows:

Belostoma Latr. "Femoribus anticis subtus sulcatis. Articulo basali tarsorum anticorum secundo multo breviore."

Benacus Stal. "Femoribus anticis pro receptione tibiarum haud sulcatis; tarsis anticis articulis aequilongis."

Both characters are obvious upon careful examination, but I may add that the front femora of Belostoma are bisulcate their whole length, and that the front tibiæ are deeply unisulcate. The two sharp edges of the tibiæ fit into the two furrows of the femur when folded together. Benacus has, on the contrary, both femora and tibiæ rounded. The two genera, as exemplified by these two common species, are otherwise very similar and easily mistaken for each other. Benacus on the average is somewhat larger in size and with the body more distinctly widened at the basal third. The paler coloring of the side margins of the thorax and the median vitta are, as a rule, more distinctly relieved and more or less ferruginous. Ventrally there are usually two sublateral black stripes. The legs are usually unicolorous and the hind tibiæ and tarsi are more expanded than in Belostoma. I notice also that in Belostoma, in all the species represented in the National Museum collection, the middle and hind tibiæ are usually spotted or banded. All the mere colorational characters, however, vary considerably, and realizing the great variation and especially the great sexual differences that occur in many of the aquatic Heteroptera, which is particularly exemplified in *Rheumatobates rileyi*, it occurred to me that the supposed generic differences might possibly be sexual. This suspicion appeared to me all the more plausible from the fact that, in looking over the literature at hand, I could not find that the sexual differences had been pointed out. I was, therefore, quite interested in ascertaining what the sexual differences in these large Belostomatidæ were, and have recently had specimens of Benacus softened and dissected with a view of ascertaining. These examinations show conclusively that both sexes occur in Benacus proper, and that the differences between the two genera are, therefore, not sexual. The only external indication of the sexes is that the tip of the abdomen in the male is whole, while in the female it is slightly notched, and with a small thorn on either end of the notch. There is no difference in the length of the long appendages nor in their shape, but the genital hooks and the cerci of the male are well pronounced and are replaced in the female by mere plates. Specimens illustrating these structures are herewith exhibited. Seven species of Belostoma are recognized by Uhler from the United States and the West Indies, while in the genus Benacus we have but the one species. Say describes his *Belostoma grisea* as "beneath with three blackish vittæ." This points to Benacus, and Uhler has so included it in his check list. Otherwise Say's description would not indicate which of the two insects he had reference to. Stal took Say's species to be the northern species of Belostoma (*sensu stricto*) and therefore kept Leidy's name *haldemanus* for Benacus. I once sent specimens of *Benacus griseus* to Prof. Montandon, who corrected the name to *Benacus haldemanus*, evidently accepting Stal's determination. Packard in his "Guide to the Study of Insects," page 537, mentions the two species as follows: "*Belostoma haldemanum* Leidy is not uncommon in our waters. It is 3½ inches in length and has black patches on the under side of the body, while in *B. grisea* Say the under side is unspotted." The first reference is undoubtedly to *Benacus griseus*, and the second to *Belostoma americanum*. I refer to Packard because his statement indicates how very generally the two insects were confounded by entomologists, so that even in our leading *Guide*

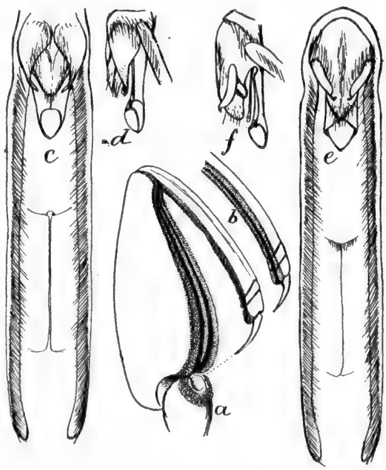

FIG. 4.—BELOSTOMA AMERICANUM: *a*, front leg; *b*, front tibia and tarsus; *c*, tip of abdomen of female, dorsal view, with wings and dorsal membrane removed; *d*, genetalia of same, lateral view; *e*, *f*, same parts of male.

the structural differences were overlooked. It is evident that the insect figured by me in the *American Entomologist* (Vol. I, Fig. 106) and in the Ninth Report on the Insects of Missouri (Fig. 33) as *Belostoma grandis* was really *Benacus griseus*, and the eggs figured (Fig. 32) in connection with the former species, as probably belonging to it, evidently belongto the latter, judging from dissections recently made.

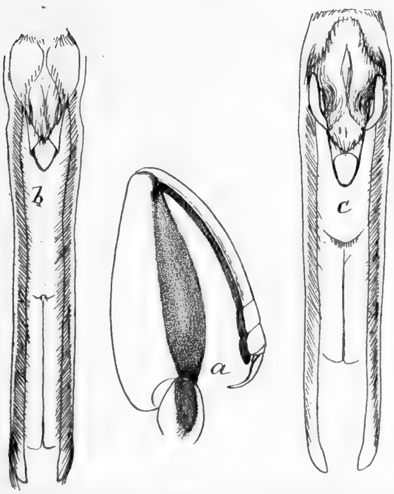

FIG. 5.—BENACUS GRISEUS: *a*, front leg; *b*, tip of abdomen of female, dorsal view, the wings and dorsal membrane removed; *c*, do. of male.

In figures 4 and 5 the differences in the femora and tibiæ between the two genera are illustrated, as also the genitalia of both sexes. The femoral grooves of Belostoma seem to vary somewhat in intensity with different individuals, and moreover the two grooves in the same individual vary somewhat in width. An important feature in this species not previously mentioned is the smooth cavity or pit on the inner border of the coxa where it articulates with the femur, as shown in figure 4, *a*. It is against this surface that the tarsal claw impinges when the tibia is closed upon the femur. With Benacus there is no sign of this articulating facet, the inferior surface of the coxa remaining convex and roughened as shown in figure 5. The outer and upper end of the clypeus in Benacus is velvety and dark-colored. In the majority of specimens of Belostoma this spot is lighter in color, and only occasionally velvety in appearance. The genitalia of the two forms, when a large series is examined, are very close in structure, as shown in the figures. After examination, however, of a large number of specimens, the distinctions indicated in the drawings 4, *c* and 5, *e* seem to be reasonably constant in the male sex, while the differences shown between 4, *c* and 5, *b* are largely caused by the protrusion of the central organ. The figures represent a dorsal view, after the wings and the dorsal plates of the abdomen have been removed, while the lines between the appendages indicate the tip of the abdomen, and of the lateral expansions, beneath.

In the discussion Mr. Gill said that the Chicago contention arose in a discussion on the transmissibility of acquired characters. He had mentioned the fact that he had, on a summer's evening, picked up one of a large number of these water-bugs on the Washington streets, and had found it to be Belostoma. A few nights later he picked up another and found it to be Benacus. He then examined some fifty or more and found them all Benacus. He wished to know whether the two species occur simultaneously or whether they follow each other in point of time of flight. He further said, in regard to Prof. Riley's reference to Belostoma as *americanum* and to the family as Belostomatidæ, that, in his opinion, such names should be considered as feminine nouns and not neuters; that in the Latinization of the Greek noun it should take on the customary gender of its Latin termination. Prof. Riley said that on the whole he agreed with Prof. Gill on this point, but that he had simply followed the custom of the purists. Mr. Schwarz, however, dissented, and thought that the Greek gender should be preserved. Mr. Schwarz also called attention to the peculiar noise which these insects make in flight, which resembles that of an electric battery. He also said that in their marvellous power of flight they are unique in the whole order Hemiptera. The hind wings are very weak, and the fore wings are therefore strongly functional in flight and possibly cause the noise by rubbing against some other part.

Mr. Ashmead stated that he had taken *Benacus griseus* and *Belostoma annulipes* together in numbers in Florida. He thinks that *Belostoma americanum*, as a rule, however, flies earlier in the season than Benacus. Mr. Heidemann stated that he had found both species on the same night in Washington, but that Benacus was the more abundant of the two. Mr. Howard said that he had seen both species taken on the same night, and that one or both fly abundantly in New Orleans in the month of December. Mr. Schwarz stated that Dr. Hessel of the Fish Commission had told him that since the introduction of the electric light in the streets of Washington these bugs have become much more numerous in the fish ponds near the monument, showing that the lights of the city have probably attracted them from a wide area and concentrated them in the nearest water ponds. Mr. Schwarz further asked whether any one had ever seen one of these bugs rise again after falling to the pavement, and whether any one had noticed them in the morning in the same numbers in which they occurred at night. In other words, what becomes of those individuals which fall to the pavement? Dr. Gill said he had noticed the insects most abundant at the lights nearest the fish ponds and gradually diminishing about lights further away. Mr. Schwarz said that in his experience electric lights are much less attractive to insects now than when they were first introduced. He believes that the insects are gradually becoming accustomed to the lights. Prof. Riley said that this statement, if true, is of extreme interest, as it involves the question of the heredity of the knowledge that it is injurious to the species to fly to the light. In reference to the flight, it was extraordinary only because of the size of the species, since all the Heteroptera use their hemelytra in flight.

—Prof. Riley also read the following paper:

THE EGGS OF CERESA BUBALUS Fab. AND THOSE OF C. TAURINA Fitch.

By C. V. Riley.

In the fifth report on the insects of Missouri, page 121, I have described and figured the eggs and egg-punctures of what was then considered to be the Buffalo Tree-hopper, *Ceresa bubalus* Fab. The egg-punctures there described consisted of a row of more or less straight, slightly raised slits in the bark, in each of which is an oval, dark-colored egg. I described and figured various stages of the insect which was reared from these eggs, and which was determined from the only bred and somewhat undeveloped individual as belonging to this species. Of late years the eggs of this species have been described and referred to by several Western writers, especially by our fellow-member, Mr. Marlatt, who published a full and illustrated account of them as observed by him in Kansas, and calls attention to the error in my own account above referred to (Trans. Kans. Ac. Sc., Vol. x, pp. 84–5, 1885–6). The eggs and egg-punctures as there figured are quite different from those which I illustrated and described, and agree with others which I have been familiar with for many years but never reared. An explanation of this discrepancy is, therefore, very desirable.

Careful comparison of my bred material with the material in the Museum, in connection with Fitch's own types, and some examinations of the last ventral segment that have been made for me by Mr. Ashmead, explain the apparent discrepancies, and

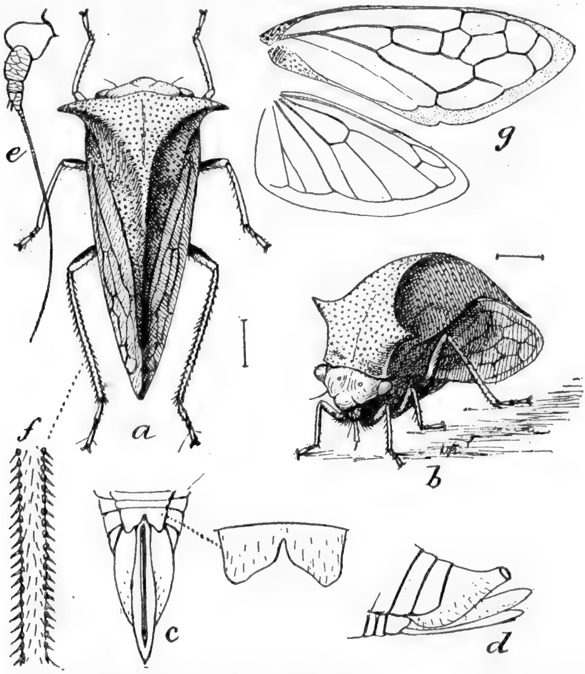

FIG. 6.—*Ceresa taurina* Fitch: *a*, adult female, dorsal view; *b*, one-half lateral view of same; *c*, ventral view of tip of female abdomen with last ventral arc still more enlarged at side; *d*, lateral view of same; *e*, antenna; *f*, portion of hind tibia—all enlarged—from *Insect Life*.

the insect which I reared is in reality Fitch's *taurina* and not the typical *bubalus*. The latter is a larger insect, with broader body and especially with broader prothoracic parts and more

FIG. 7.—*Ceresa taurina* Fitch: *a*, single egg-puncture enlarged; *b*, row of punctures in twig, natural size (after Riley).

prominent prothoracic horns. The last ventral segment has a distinct, simple, median, rather acute notch, and is very little longer than the two preceding segments united, the emargination rather acutely triangular and extending about half way or a little more than half way, to the base of the segment; the posterior margin obliquely truncate to the rounded hind angle, not sinuate; the valves shorter than the middle tibiæ.

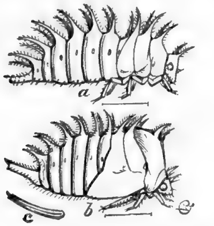

FIG. 8.—*Ceresa taurina* Fitch: *a*, larva; *b*, nymph, (after Riley).

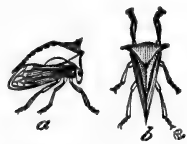

FIG. 9.—*Ceresa taurina* Fitch: dorsal and lateral views of adult, natural size (after Riley).

In *taurina* the prothoracic horns are less prominent, the last ventral segment is a little longer than the three preceding segments united, the emargination extending to the basal one-fifth and very

FIG. 10.—*Ceresa bubalus* Fab.: *a*, female; *b*, enlargement of anterior foot of same; *c*, do. of antenna; *d*, do. of wing; *e*, last ventral segment of female; *f*, ventral view of tip of abdomen of female, showing terminal segments and ovipositor; *g*, do. lateral view; *h*, penultimate ventral segment of male; *i*, ventral view of tip of abdomen of male—all enlarged—from *Insect Life*.

narrow at its origin. The hind margin from here is rather deeply and broadly sinuate, with the hind angles well rounded. The differences between some of the smaller specimens of *bubalus* and the larger specimens of *taurina* are not very noticeable at first. The slits of this *Ceresa taurina* Fitch were mistaken by him for the crescent cuts of the Plum Curculio, while he very strangely describes the eggs of what we know now belong to *Œcanthus niveus*, or the Snowy Tree-cricket, as of the *Ceresa bubalus*. I am familiar with various other kinds of small egg-punctures in the twigs of various plants, undoubtedly of species belonging to the Membracidæ or Fulgoridæ, but have reared and identified the parent only in the case of *Pœciloptera* [*Orminis*] *pruinosa* Say and *Enchenopa binotata* Say, the punctures of this last being hidden with a white, waxy, ribbed covering, which, as already pointed out (Am. Nat., xv, p. 574, July, 1881), was referred by Fitch, in his collections, to Dorthesia.

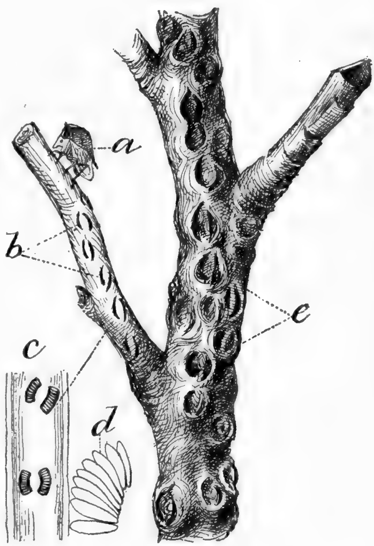

FIG. 11.—*Ceresa bubalus* Fab.: Twig of apple showing: *a*, female at work; *b*, recent egg-punctures; *c*, bark reversed with eggs in position, slightly enlarged; *d*, single row of eggs still more enlarged; *e*, wounds of two or three years' standing on older limbs (after Marlatt).

On referring to my scrap-books and notes, it seems that the first record of the oviposition of *C. bubalus* was in a short reply to a correspondent published by Prof. Cyrus Thomas in the *Prairie Farmer* of February 5, 1876, in which a brief description is given of the nature of the egg-punctures of an insect which was identified as belonging to the same family as *C. bubalus*, if not to the same genus, but supposed to be distinct on account of their difference from the punctures of *bubalus* as wrongly determined by me. At the time I had several notes of earlier date on similar punctures, and having submitted the drawings of them to Prof. Thomas, he recognized his punctures as identical with those now known to be of *bubalus*. My first specimens of these were received Nov. 12, 1875, from Uriah McCall, Manchester, O., who found them on Apple, Pear, and Quince. My notes describe the punctures as follows: "Ordinarily there is a pair of simple slits, the adjacent parts slightly swollen, each slit leading to a row of, on an average, 10 eggs just under the bark, the anterior or outer ends converging toward the middle. The individual eggs are 1.3 mm. long by one-fourth as wide, pale amber colored, with the anterior end somewhat more opaque. The wood around the eggs, as usual, is discolored. Sometimes there is but a single slit, sometimes but a single egg, in cases where the parent had evidently been disturbed. Sometimes a double pair are found close together." I received similar punctures also from Dr. Lintner, from Pennsylvania, March 29, 1877, and have also described in my notes punctures similar to the above, which, however, are confined to a single crescent, differ in the number and size of the eggs, and undoubtedly are deposited by some closely allied but distinct species. I introduce for comparison Mr. Marlatt's figure of the eggs and punctures which accompanied his first careful description of these, and his original identification of the author of the slits. I also reproduce figures of *C. taurina* and *C. bubalus* to bring out the imaginal differences between the two species which are so easily overlooked.* *C. taurina* is now to be associated with the egg-punctures which have previously been assigned to *bubalus* by most writers on this insect, following my reference to it in the Missouri report. I also here reproduce my original figures of the egg-punctures, preliminary stages, and adults, which illustrated my original article.

—Professor Riley, under the head of "Notes from 'Sunbury,'" showed a young sycamore tree transplanted on his grounds in a perfectly healthy condition last spring. In the course of the summer this tree was girdled by *Chrysobothris femorata*, the eggs of which must have been laid in the summer. The pupæ were all formed and the beetles will issue next spring. He also showed a yearling shoot of ash which had sprung up from an old stump that had been cut down the present season. It was oviposited upon by *Trochilium syringæ* the present summer and the adults began to issue the first of October. Both of these species, then, are sometimes shorter-lived in the larva state than is usually supposed.

Mr. Schwarz stated that he had noticed the adults of Trochilium

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* Subsequently to the reading of this paper these two figures, the first of which was in preparation while I was yet in charge of the Division of Entomology, have appeared in *Insect Life*, Volume VII, No. 1, pp. 8–14, and are here reproduced by the courtesy of the Honorable Assistant Secretary of Agriculture.

issuing from ash trees on the streets of Washington in September. He thought that there are two broods in this species. Mr. Ashmead stated that he had reared two annual broods of a Sesiid from oak galls in Florida. Mr. Ashmead further discussed the note on Ceresa, and gave in full the synonymy of *C. uniformis* of Fairmaire. He called attention to the excellent character for the separation of species in the last ventral segment of the female, which varies in the intensity and form of a central indentation of the hind margin.

Dr. Gill, apropos of the difference in the sexual organs and their use in separating species, asked as to the difference in the genitalia of Belostoma and Benacus. Dr. Riley stated that, curiously enough, the differences in this respect between these two forms are slight.

Mr. Ashmead and Mr. Schwarz further discussed this point, agreeing that in many groups whole families occur in which the sexual characters are uniform, while in others they are very variable and afford criteria for the separation of species.

Dr. Stiles stated that in the worms the genital characters are the main ones in use. He said that in the Strongylidæ, for instance, all classification was, until recently, based on the bursa of the male. He now finds that the spicule affords a good character, and in fact all through the Nematodes where workers are lost on all other characters this spicule can be relied upon.

Mr. Schwarz asked about the females, and Dr. Stiles replied that it is dangerous to determine the females specifically. The labia of the vulva afford some characters, but the determination of species takes place mainly through association with the male.

Dr. Gill stated that in the Helicidæ we have an illustration of the value of sexual characters. *Helix hortensis* and *H. nemoralis* vary greatly in color, but in the color of the shell lip they are constant, that of *hortensis* being invariably white, and that of *nemoralis* brown, and this character is coincident with certain genital modification. In fact, in the genitalia of this group we have the best criteria for classification. Dr. Stiles asked as to the reason for these sexual variations. Dr. Gill said that they might be the coefficients of evolution, *i. e.*, that these variations might perpetuate varieties owing to structural difficulty in copulation between the unlike forms. Dr. Riley followed up this idea but thought that these differences are not to be used so implicitly in classification. He was of opinion that they might be considered to be varietal in most cases, and the beginnings of species rather than absolutely distinguishing species.

Dr. Gill thought that the question as to what constitutes a species is far from being answered. As a postulate, however, he believes that we may found a species upon any character that is absolutely constant. Where, however, we have absolute connecting links the forms cannot be considered as more than subspecies.

—Under the head "Short notes and exhibition of specimens" Mr. Schwarz, in connection with a note in the last number of *Entomological News* referring to Dr. R. Thaxter's work on the Laboulbeniaceæ, exhibited specimens of a Pterostichus from North Carolina which shows on the right elytron a veritable forest of these parasitic plants.

—Mr. Ashmead showed a species collected in Florida of the African genus Amplicotes, a Fulgorid. He also referred to another case where in the Hymenoptera an African genus possesses a representative in Florida.

Mr. Schwarz stated that in the Coleoptera such cases are known and referred to Argopistes, a Halticid resembling a Coccinellid, which occurs in Africa and which has a representative in subtropical Florida.

—Mr. Heidemann exhibited certain new Capsids, comprising one new genus and two new species, and stated that he had been making a special collection of the Capsids affecting Locust, Linden, and Walnut the present season.

DECEMBER 7, 1893.

President Riley in the chair, and eighteen members and one visitor present.

The following new members were elected: Active—G. B. Sudworth. Corresponding—Robert H. Walcott, Grand Rapids, Mich.

The election of officers for 1894 resulted as follows: President, Wm. H. Ashmead; Vice-Presidents, Theodore Gill and C. L. Marlatt; Recording Secretary, L. O. Howard; Corresponding Secretary, F. H. Chittenden; Treasurer, E. A. Schwarz; additional members of the Executive Committee, George Marx, B. E. Fernow, and C. V. Riley.

The delivery of the annual address of the outgoing President, Prof. C. V. Riley, was postponed for one month.

—The first paper of the evening was by Mr. C. L. Marlatt, entitled "Revision of the genus *Pontania*, Costa, with Descriptions of New Species." The relationship of this genus, which is a subdivision of the old genus Nematus, was explained, and its characters pointed out. A list of seventeen species which will belong to it in the North American fauna was given, and the prominent characters which may be used in the classification of these species and in their differentiation were explained. The genus includes *small* species of the old genus Nematus of gall-making habits, so far as known, and include the well-known species *salicis-pomum* and *pisum* making the common leaf-galls of the willow. Seven of the species are new. In answer to a question by Prof. Riley, Mr. Marlatt pointed out the salient characters separating the genus Pontania from Euura, the species of the latter genus, in gall-making habit, being closely allied to the former.

—Mr. Chittenden presented, by title, the following paper:

ON THE HABITS OF SOME LONGICORNS.

By F. H. Chittenden.

The notes which follow are based on the writer's personal experience, and the dates of rearings given are, for the most part, as in nature. In very many instances the material from which the species herein mentioned were reared was gathered but a few days before the transformation of the insects and kept in an unheated room.

In referring to published records the observer's name is mentioned for authority, as most of these records are to be found in Dr. A. S. Packard's report on forest insects (Fifth Report U. S. Ent. Comm.) and that of Mr. A. D. Hopkins (Bull. 33, W. Va. Agl. Expt. St.). Other records are given in articles by Dr. C. V. Riley and Dr. J. L. LeConte in the third volume of the *American Entomologist*.

Parandra brunnea Fab.—This is one of the most omnivorous of longicorns. Living, as it evidently does, chiefly in decomposing wood, it infests both deciduous and coniferous trees. In my notes its occurrence is recorded under the bark of oak and apple; in cherry wood (*Prunus cerasus*), just beneath the tightly-clinging bark, and on willow (*Salix alba*), deeply buried in the rotten wood. Mr. W. H. Ashmead has recently shown me specimens taken under the bark of maple. I have also seen specimens found under bark of elm and basswood, and Mr. M. L. Linell informs me that he found it in abundance in the hollow trunks of *Ailanthus glandulosus* growing in the streets of Brooklyn, N. Y. At Spring Lake Beach, L. I., it occurred under bark of pitch pine (*Pinus rigida*). Dr. LeConte also states that the species of this genus live under pine bark (Class. Col. N. A., pt. II, p. 280). Others have recorded as food-plants: beech (Horn), ash (Riley), and *Tilia americana* (Townsend). At Washington, D. C., I have taken it at lights during the second week of June. At Ithaca, N. Y., it appeared in July.

Callidium æreum Newm. was reared from the wood of chestnut (*Castanea dentata*) on two occasions: at Ithaca, N. Y., May 14, and at Clifton, N. J., May 30, occurring also in June.

Elaphidion villosum Fab., under which name I include also *parallelum* Newm., has most often been noticed as infesting oak and hickory; Haldeman has recorded chestnut and Abies (!); apple, plum, and grape have been added by Dr. Riley, and peach and walnut by Professors Cook and Hopkins respectively. To this I may add that I have reared the species from pruned twigs of quince, locust, red-bud (*Cercis canadensis*), and from trimmed ends of twigs of Osage orange (*Maclura aurantiaca*). In past years I have seen pear trees very extensively pruned by this insect; also the climbing bitter-sweet (*Celastrus scandens*). More recently I have ascertained that this or allied species attack almost every woody plant that grows. In the vicinity of Washington the genus Elaphidion is not so abundant as in most northern localities that I have visited, but pruned twigs of various trees and shrubs are of frequent occurrence, among which I have noted spice-bush (*Lindera benzoin*), *Sassafras officinale*, sumach (*Rhus glabra* and *typhina*).

It has been noticed that this, as well as related species, does not always prune the twig in which it lives, but I do not remember to have seen mention of the fact that the insect sometimes remains in the proximal end of the limb attached to the tree, while the severed end is as often found empty, thus reversing the usual order of affairs.

The species is evidently parasitized by *Bracon eurygaster* Brullé.

Phyton pallidum Say is one of the species mentioned by Dr. LeConte as having bred from hickory. It lives also in *Cercis canadensis*, passing its earlier stages under the bark and appearing as a beetle in the latitude of Washington during the latter part of June and continuing till toward the close of July.

Curius dentatus Newm. also breeds in *Cercis canadensis*, appearing abroad in this neighborhood early in July.

Molorchus bimaculatus Say was reared from dead twigs and branches of ash (*Fraxinus americana*), dogwood (*Cornus florida*), *Cercis canadensis*, and from the larva found in a wild maple sprout. The adult insects abound on flowers of different species of Prunus, Cornus, Viburnum, *et. al.*, in New York State, occurring in May and June; about Washington, also, in April. This is included in the list of hickory species by Dr. LeConte, and, according to Glover, infests also walnut.

Rhopalophora longipes Say is not uncommon in Maryland and Virginia near Washington. May 21 a few sections of branches of red-bud were gathered from which the beetle was reared May 24, others issuing early in June. It also occurs in July, frequenting the flowers of *Ceanothus americanus* and *Hydrangea arborescens*.

Xylotrechus colonus Fab., a general feeder, partial to oak, maple, and hickory, was reared on two occasions from chestnut, June 8–14. It is parasitized by the rare Ichneumonid, *Xylonomus rileyi* Ashm., a single example of which was reared June 15, Rosslyn, Va.

Neoclytus erythrocephalus Fab. is one of our most polyphagous species, having seemingly no favorite food-plant. I have reared numerous specimens, always in about equal abundance in trunk and branch, from *Cornus florida*, tulip (*Liriodendron tulipifera*), locust (*Robinia pseudacacia*), *Cercis canadensis*, hickory, and grape-vine, and have observed the adults on oak and apple, usually copulating and in such abundance that there could be no doubt as to the meaning of their presence. At Washington the beetle occurs from the last of April till toward the end of July.

Individuals reared from locust were from twigs kept two years indoors. In dogwood the larval galleries are very extensive, the younger larva evidently passing a considerable portion of its time under the bark, afterward penetrating the solid wood, which is still more extensively bored. The pupal cell is often placed in the centre of a large twig, the larva having previously excavated an exit-hole to the bark.

It is also said to infest elm (Hubbard), persimmon, maple, willow, and peach (Hopkins).

In the dogwood great numbers of Braconid cocoons were noticed in the larval galleries of this Cerambycid. Such of these as were gathered and carried to maturity produced *Bracon eurygaster* Br., previously recorded by me as a probable parasite of *Elaphidion villosum* Fab. The large Clerid beetle *Chariessa pilosa* Forst. was reared from pupæ taken under similar conditions, and probably preys on the *Neoclytus* larvæ.

Cyrtophorus verrucosus Ol.—I have reared this species from a chestnut limb, the imago issuing in confinement, March 18, Ithaca, N. Y., and have found the beetle in its pupal cell in a decaying and badly bored beech (*Fagus atropunicea*) at the same place, March 29. At South Woodstock, Conn., the imago was again taken from its pupal cell in recently dead, hard wood of European linden (*Tilia europæa*). Specimens also occurred at Ithaca in April on dying locust, and it probably infests this tree. It has also been obtained by Dr. J. Hamilton and others from the rough bark of oak, by Dr. F. Hadge from quince and by J. G. Jack from *Prunus pennsylvanica*.

This is one of the exceptional longicorns which sometimes mature in the fall and remain in the pupal chamber till spring. It is an early spring arrival, frequenting the flowers of the dogwoods from the date of their blooming, and continuing till late in June.

Euderces picipes Fab.—A specimen was bred from a dead chestnut twig at Ithaca, N. Y., July 20. Larvæ, without doubt of this species, were observed under bark of this twig March 22, over two years previous to this rearing, and this individual had therefore consumed at least three years in completing its transformations—a retardation in development undoubtedly due to the unnatural dryness caused by indoor breeding. The imago frequents the flowers of dogwood, elder, wild parsnip and carrot, and others, occurring in June and throughout July.

In spite of the abundance of the Lepturini, both in individuals and species, particularly in our northern states, very little is known of their larval food-habits further than a few records of some of the more common species. Several are known to pass their larval existence in old and decaying wood, and it is not probable that they are very discriminating in taste. Hence it would not be surprising to find some species in the group that breed indifferently in both deciduous and coniferous trees.

Leptura vagans Ol.—Larvæ, together with the dead imago in its pupal chamber, were cut from old and decomposing wood of bitter-nut hickory, *Hicoria minima* (*Carya amara*), at Ithaca, N. Y., in December. About this time Dr. A. E. Brunn discovered in dead birch wood a larva which agreed perfectly with the above. This larva, at the time of its coming into my possession, was much shrivelled and fast drying up. My own specimens having died, I placed this larva, by way of experiment, in the hollow cavity of a hickory twig pruned by Elaphidion. The Leptura thrived in this improvised home and transformed to imago June 11. The imago also occurs in July, frequenting the flowers of chestnut.

Cyrtinus pygmæus Hald. occurs rather commonly between New York city and Washington on locust, hickory, and box-elder (*Negundo negundo*). On the last-mentioned tree numerous small holes were noticed in the terminal twigs on which the imagos were resting or crawling, and which were without doubt made by them in exit. Dr. J. B. Smith found this species under similar circumstances on oak (*Ent. Am.*, VI, 137), and Mr. Schwarz has reared it from locust (Pr. Ent. Soc. Wash., II, 73); hence I feel no hesitation in placing hickory and box-elder on the list. About Washington the beetles have been noticed during June and July.

Acanthoderes quadrigibbus Say breeds in box-elder, all of the galleries seen, in a large trunk, being in the main longitudinal and situated immediately under or very near the bark. This species was bred by LeConte from hickory, and, according to Mr. Schwarz, attacks also oak, beech, and hackberry. It is parasitized by a large Braconid, evidently Bracon, the empty cocoons only having been found.

Leptostylus parvus Lec. occurs near Washington, on box-elder and tulip, having been beaten from dead branches, in about equal numbers, in the latter part of June and first of July.

Leptostylus biustus Lec.—June 17 my attention was attracted by a series of sharp, ticking sounds emanating from some jars of twigs in my apartments. The sound continuing, it was traced directly to its exact source on a twig, which, on removing the bark, disclosed, much to my surprise, a longicorn pupa with which I was unfamiliar. Subsequently other portions of the twig were decorticated, resulting in the discovery, June 20, of *Leptostylus biustus* in all its stages; the imago, however, had not fully matured and could not have issued until two or three days later.

This ticking sound resembled in every particular that made by *Liopus cinereus* Lec., which I had always, and correctly, attributed to the larva. That such a sound can be also produced by a pupa I do not remember to have ever seen recorded. To me this is a subject of sufficient interest to invite further inquiry. The larva of *Liopus cinereus* certainly produces this sound, as does the pupa of *Leptostylus biustus;* now the question is, how is it produced, and for what reason, and by what stages in different species?

Of other records, Dr. Riley mentions the rearing of this longicorn "from a dried-up pomegranate," and Mr. Hubbard, in his bulletin on "Insects affecting the Orange" (p. 174), has given an account of its breeding under the bark of orange.

Leptostylus macula Say breeds in almost all kinds of deciduous trees and shrubs. I have reared it from larvæ found under the bark of beech, chestnut, maple, butternut, and sumach, and have beaten specimens from the following trees in such abundance as to lead to the belief that they are all food-plants: box-elder, tulip, oak, and Carpinus. Mr. W. H. Harrington also records hickory, and Mr. Geo. E. Brackett, apple (Prac. Ent., 1, 19), as food-plants. At Ithaca the beetles occurred in greatest abundance from the latter part of June till the middle of July. Around Washington I have noticed imagos as early as May 5, and as late as July 26. The duration of the pupal state of two individuals observed was from fourteen to sixteen days.

Leptostylus collaris Lec.—I have noted the occurrence of what I take to be this species on chestnut on several occasions, the larvæ living under the bark, and the imago occurring, in the vicinity of New York city, throughout July and until August 8, the latter a rather late date for a Cerambycid.

Liopus variegatus Hald. was reared from hackberry (*Celtis occidentalis*), and from box-elder, being especially abundant on the latter tree. Five or six examples were beaten from a single dead branch of chestnut at Navesink, N. J., and a similar number from dead locust, and it probably breeds in both trees. A larva found under box-elder bark in April transformed to pupa May 1, and to imago May 17, which would give sixteen days as the duration of the pupal state. In the hackberry, which grew within a few yards of the box-elder, the beetle developed more than two weeks later than in the latter, the first specimen not appearing until May 30. Another did not pupate until June 4, and allowing sixteen days for the pupal period, the imago issued June 30. The cause of this difference was not due to food-plants nor to the age of the wood, but obviously to the fact that the box-elder was prostrate, moist, and exposed to the sun, while the hackberry was standing, dry, and constantly shaded. At Washington all stages are to be found during the last two weeks of May, the imago appearing as early as May 11, and continuing throughout the month of June.

Two enemies of this Cerambycid have been observed: an Ichneumonid parasite, *Ephialtes irritator* Fab., which lives externally on the larva; and *Tenebroides corticalis* Melsh., the larva of which was detected in the act of devouring the Cerambycid pupa in its cell.

Liopus punctatus Lec. was reared from *Cornus florida*, the imago being first noticed May 14 in its pupal chamber, and continuing in this neighborhood to July 3. According to Mr. Hopkins, this species also infests plum.

Lepturges symmetricus Hald. was reared from the larva found under the bark of a trunk of dead hackberry (*Celtis occidentalis*). One larva transformed June 2 and became an imago June 12, thus passing ten days as pupa. Latest capture of imago, July 11.

A Braconid parasite, *Cenocœlius rubriceps* Prov., was reared from this species June 17.

Lepturges signatus Lec. breeds in the limbs of *Cercis canadensis*, beginning its transformations to pupa toward the close of April, the imago appearing about Washington in May and continuing throughout June. It also infests beech (Hopkins).

Lepturges querci Fitch, as its specific name would indicate, was originally taken by its describer on oak. I have reared it with the preceding species from red-bud, May 28, and beaten it from the twigs June 11. At Ithaca, where I reared it from hickory, specimens were found as late as July 21. I have reared with this species a Braconid which Mr. W. H. Ashmead identifies as *Calyptus magdalis* Cr.

Ecyrus dasycerus Say. was also reared from twigs of red-bud May 31. This specimen was kept until June 17, remaining, as far as could be seen, inactive during the entire time. The insect itself is heavy in conformation, and sluggish, as its appearance would indicate. It stridulates, after the manner of its kind, loudly and slowly. I have beaten this species from the twigs of tulip and locust at Rosslyn, Va., from May 23 to June 27. It is one of the species bred by LeConte from hickory.

Eupogonius vestitus Say.—A pupa was found in a twig of *Cornus florida* near Washington May 6, from which the beetle issued May 25. The pupal stage is evidently long in this instance, probably not far from three weeks. I have also beaten specimens from chestnut at Ithaca, June 30 to July 11, and Dr. Riley records as food-plant, hickory, and Mr. Hopkins, walnut.

Dysphaga tenuipes Hald.—A single specimen of this anomalous species was reared from *Cercis canadensis* May 23. The imago, with its long wings and undeveloped elytra, flies freely with a humming or buzzing sound like a bee. It has short legs and runs slowly. When held it stridulates feebly for its size.

Haldeman, who described this species in 1845 (Pr. Ac. Nat.

Sci. Phil., III, 126), says: "The larva inhabits detached branches of the genus Carya (hickory), the perfect insect appearing in May in S.E. Pennsylvania." Glover states that it also infests walnut. Although half a century has elapsed since the insect was described, it is still extremely rare. It has been recorded also from southern New Jersey; my specimen was obtained on the Virginia shore of the Potomac, and we may safely infer that the species also inhabits the intervening territory of Maryland, Delaware, and the District of Columbia.

—Mr. Howard presented the following paper, illustrating it by black-board drawings:

NOTE ON THE MOUTH-PARTS OF STENOPELMATUS.

By L. O. Howard.

Dr. Packard, in his "Review of the Systematic Position of the Orthoptera in Relation to other Orders of Insects," gives, with some detail, the relative characters of the typical insects throughout the order Orthoptera, but does not seem to have examined Stenopelmatus, a striking and somewhat aberrant form. A recent examination made of the mouth-parts of a single specimen indicates that the sclerites approach most nearly to those of Anabrus, as might have been expected. The submentum is represented by a transversely oval chitinous sclerite in the membranous wall of the gula. The mentum is a large rhomboidal sclerite whose transverse diameter exceeds its length. The ligula is slightly divided at tip and the paraglossæ are hairy and movable. The palpiger is indistinctly differentiated. The maxillæ in particular resemble those of Anabrus. The cardo is large and proceeds at right angles from the ligula. The stipes is inserted at right angles upon the tip of the cardo. The palpifer is small and indistinctly separated by a suture. The subgalea is narrow and weak. The lacinia is very large and strong and furnished with two teeth, the apical one being still further dentated into one large and one small tooth. The inner edge of the body of the lacinia is densely bristly. In the galea was exhibited a strange asymmetry which is my main object for referring to this insect. The right galea is stout, well rounded, and its tip is evidently functional as a masticating or piercing organ since its point is composed of dense dark-brown chitin. The left galea, on the contrary, becomes flattened and subfoliaceous at its tip, which appears almost membranous, is yellowish in color and evidently not at all fit for the same purpose as its mate. The labrum is very large and very movable, almost half as long as the mandibles, and reaches quite to the tip of the mandibles when closed, capping them, in fact.

An examination of the collection of the National Museum shows that this galear asymmetry is abnormal. The normal galea is apparently midway between the two which I have described. It lacks the piercing black tip of the right one, and is rounder and solider than the left one.

—Prof. Fernow called the attention of the Society to a new insecticide which has appeared within the last year and is being extensively advertised under the name Antinonnin. He gave a brief description of the composition of the substance and mentioned the range of its use as an insecticide agent, as claimed by its manufacturers. He stated that as diluted for application it would cost about one cent per gallon, and that it was held to be a specific for practically all forms of insect life, subterranean insects included, as well as vermin, field mice, etc.

Mr. Marlatt said that the Division of Entomology of the Department had been familiar with this substance for upwards of a year, and that samples of it had been placed on exhibition with the other patented insecticides at the recent exposition at Chicago. In answer to a question by Prof. Riley, Prof. Fernow stated that the only insects against which experiment had actually proved it to be effective were *Lophyrus pini* and *Liparis monacha*, and that for extensive forest use it was in the case of these and other species impracticable on account of the impossibility of obtaining sufficient water to dilute it with; but that for more limited operations, as for garden or orchard work, this objection would not apply.

Prof. Riley thought that some of our insecticides, of which practical use had demonstrated the usefulness and general availability, such as kerosene emulsion, would be found preferable to, and much less expensive than, the substance mentioned by Prof. Fernow, and he stated as a further argument for the use of kerosene emulsion the fact of its very stimulating effect on the root-growth of plants, in the case of subterranean applications. He said that similar stimulating action seemed also to follow the application of the Bordeaux mixture, which fact he had particularly noticed in the treatment of the grape and the potato. Mr.

Waite suggested that there was still, however, a chance for doubt as to the actual stimulating effect of the Bordeaux mixture for the reason that there might be fungi on the plants which had been overlooked, and which this treatment counteracted, resulting in a more vigorous growth of the plant. Mr. Swingle, referring to the use of the same (Bordeaux) mixture, stated that the matter had been studied by a German investigator who had come to the conclusion that the substance had a stimulating effect on the chlorophyll of the plant, not by actually penetrating the leaves, but simply by what was known as chemio-tactic action. The subject was being further studied, and the action of the Bordeaux mixture would undoubtedly soon be satisfactorily explained.

—The following paper by Mr. A. D. Hopkins was read by the Secretary:

NOTES ON THE DISCOVERY OF A NEW SCOLYTID, WITH BRIEF DESCRIPTION OF THE SPECIES.

By A. D. Hopkins.

On my way home from the October meeting of the Society I stopped in Raleigh county, West Va., on Oct. 6, for the purpose of making some observations in the white pine and chestnut forests of that region. On the following day I discovered the galleries of a Scolytid in the otherwise uninjured sap-wood of living white oak trees. The frequent occurrence of these injuries, and the finding of a Scolytid new to me in the galleries, led to an investigation of the trouble, which has resulted in the development of some very interesting facts regarding the species, its habits, and the injuries resulting from its attack.

My first impression was that the Scolytid was *Corthylus punctatissimus*, but upon my return to the station, and comparing it with examples of this species, I found that it possessed differences which I believed to be sufficient to distinguish it as another species. It cannot be *C. spinifer*, described by Schwarz, on account of the absence of the spine on the antenna of the male, and, as it appears to differ from the South American species mentioned by Eichhoff in his "Descriptio Tomicinorum, 1879," I have decided that it is a new species, which I have named and will here briefly describe as follows:

Corthylus columbianus n. sp.—Structure and general appearance of male and female, same as *punctatissimus*. Differs from this species, however, in the following characters: Head of female faintly and sparsely punctured in front. Elytra declivity of male and female provided each side with small tubercules; suture elevated. Middle and hind tibia with four teeth near tip. Length, 4 mm. Described from two perfect males and parts of four females. From white oak, chestnut oak, and beech. Types in Collection West Va. Experiment Station.

In *punctatissimus* the head of the female is found to be deeply and coarsely punctured in front. Declivity of elytra, plain. Middle and hind tibia with only three teeth near tip.

One of the interesting facts regarding this species I have described is its apparent preference for perfectly healthy sap-wood of living trees, in which to excavate its galleries and brood-chambers. The entrance to the galleries thus excavated in a young, growing tree is, the subsequent year, covered over by a growth of wood, and as the tree continues to grow, layer after layer of wood is formed over the first until the tree reaches maturity, when the injury will be deeply buried in the heart-wood. The common occurrence of injuries thus caused throughout the wood of old oak trees is evidence that this species, or one having the same habit, has been for centuries more or less common in our forests. In fact, some very early dates of insect injuries in America may be obtained by counting the annual growths which have formed over the entrance to galleries occurring near the heart of large trees.

I have not yet met with injuries dating back to the time of Columbus, but it appears possible that brood-chambers may yet be found in some of our ancient oaks that were excavated by a Corthylus in the fifteenth century.

—The following, from Mr. Hopkins, was also read by the Secretary:

NOTES ON FOOD HABITS OF CORTHYLUS PUNCTATISSIMUS.

By A. D. Hopkins.

During an excursion to the Dells of the Wisconsin with members of A. A. A. S. on August 19, 1893, I found *Corthylus punctatissimus*, adults and pupæ, frequent in their brood-chambers at base of small bushes of dogwood (*Cornus* sp.), hazel (*Corylus americana*), and sassafras, and on September 6, near Evansville, Indiana, I collected the same species in water-beech (*Carpinus caroliniana*), sugar tree (*Acer saccharinum*), and ironwood (*Ostrya virginica*).

In every case the broods were found in the base of the plant, just beneath the ground. The plants were, as a rule, either dead or dying from the injury. It would, therefore, appear that the species chooses a great variety of host-plants.

I have also found that this species does not necessarily kill the plants attacked, for I find their galleries near the heart of living sassafras bushes of considerable size, where the entrance is covered over by a number of annual growths of wood.

—Mr. Heideman laid before the Society a fine series of *Lygæus turcicus* lately collected by himself in the vicinity of Washington, D. C., and which conclusively proved that the extent of the bifid red spot on the vertex as well as the color of the claws, which may be either entirely black or red anteriorly, are quite unstable characters. In a recent paper (Ann. Soc. Ent. Belgique, 37, 1893, p. 399) Mr. A. L. Montandon had maintained that *L. turcicus* Fabr. and *L. kalmii* Stal were two good species, but distinguished the same solely by these color differences. The series exhibited rendered it quite evident that the two forms could not be separated specifically. Prof. Uhler and Mr. Distant had also arrived at the same conclusion.

Mr. Ashmead stated that his study of the coloration of these forms had led him to the same conclusion, which Prof. Riley further sustained from his own observations.

—Mr. Ashmead exhibited a large and handsome Chalcidid, which he stated was a species described more than 100 years ago by Fabricius as *Chalcis cyaneus*, but which had been lost to science until he had very recently recognized it among some Brazilian material. He stated that the species belongs to the genus *Chryseida* Spinola, and that Westwood had also described two species belonging to this genus, but had failed to recognize their true affinities, and had erroneously placed them in the subfamily Perilampinæ, instead of in the subfamily Eurytominæ, in which they properly belong. He stated that the species bears some resemblance to the genus Axima.

Mr. Howard quite agreed with Mr. Ashmead in the reference of this genus to the subfamily Eurytominæ, and stated that its intermediate position between the subfamilies Aximinæ and Eurytominæ furnishes a connecting link between these subfamilies, and indicates very conclusively that Axima should not be accorded subfamily rank, as has been done by Cameron, but is properly placed in the subfamily Eurytominæ.

JANUARY 11, 1894.

Ten members were present. On taking the chair, President Ashmead made a few remarks appreciative of the honor which the Society had conferred upon him in electing him its chief officer for the year.

The following letter from Mr. A. D. Hopkins was read:

With reference to the scolytid, *Corthylus columbianus* Hopk., mentioned in my communication to the December meeting of the Society, you may say at this meeting, which I understand is to be held on the 11th, that I have recently found evidence of injuries apparently caused by this species which, according to the number of annual rings formed over the entrance, was produced thirteen years before Columbus discovered America (1479). This evidence was found in a tulip log in which the galleries were quite common, dating from the time mentioned up to the year (1892?) the log was cut.

I have also found the galleries, evidently of this same scolytid, in maple and basswood.—A. D. HOPKINS, *Morgantown, W. Va., January 10, 1894.*

This letter was discussed by several members. Mr. Fernow was particularly struck by Mr. Hopkins' find, because the past summer he had been hunting high and low for a 400-year-old tree.

Messrs. D. W. Coquillett and E. A. De Schweinitz were elected active members, and Prof. Jerome McNeil, of Fayetteville, Ark., a corresponding member.

The resignation of Mr. F. H. Chittenden as Corresponding Secretary was read, and, on motion, accepted. Mr. Frank Benton was elected to fill the vacancy.

The retiring President, Prof. C. V. Riley, then delivered his annual address:

ANNUAL ADDRESS OF THE PRESIDENT.

LONGEVITY IN INSECTS,

With some unpublished Facts concerning Cicada septendecim.

By C. V. Riley, Ph. D.

Friends and Fellow-members:

The question as to the necessity of death, which has been more or less ingeniously discussed in past centuries by philosophers and physicians, has acquired in recent years an added interest from the scientific point of view by virtue of some of the curious theories and experiments of Dr. Brown-Sequard, and of Weismann's theory of the immortality of the germ-cell, and the resultant immortality of the zoöspores or unicellular organisms. To be a little more specific as to Weismann's theory, it involves the continuation from the very beginning of life upon our planet of the germ-cell, and in controverting Vines' argument, that it is absurd to say that the immortal substance can be converted into mortal, he takes particular pains to distinguish between what he considers to be the confusion between two distinct ideas, viz., immortality and eternity. The immortality which he refers to of unicellular beings, and the reproductive cells of multicellular beings, is not absolute, but potential. He uses the word "immortal" to indicate not a substance, but a certain form of motion —a force. It is the property of fission, then growth by assimilation, then fission again, in the physical nature of protoplasm, which he calls immortality. It is, in other words, a purely biologic conception which he distinguishes from the immortality or eternity of non-living or inorganic matter, which is without beginning and without end. The distinction borders upon the metaphysical, but it is well to bear it in mind in discussing Weismann's views.

In line with this theory of the immortality of the germ-cell, Weismann has devoted a very interesting chapter, in his general work on heredity, to the question of the duration of life in different species, and quite ingeniously endeavors to show that death is by no means necessary. His premises are substantially these: The duration of life varies, and is by no means fixed in different kinds of organisms, but there is a correlation between longevity, or the duration of life in the individual of any particular species, and the risks which it runs in its struggle for existence, and its fecundity. In other words, the slowest-breeding animals, *cæteris paribus*, will, on the whole, prove the longest-lived, while the most prolific will be most ephemeral in individual existence. Further, he argues, with the ingenuity that characterizes his writings, that death has resulted in the evolution of life, not as an abstract necessity, but as an adaptation—an incident beneficial to the species through the agency of natural selection. It has been found more useful to the species that the individual shall perish and perpetuate the type in its offspring than for the individual continuously to exist, death being in one respect the instrumentality which nature has employed to produce an infinite variety of forms and an increased complexity of structure which the past and present history of life upon our planet exemplify. In short, while death has almost universally been looked upon as inherent in organic nature, Weismann, to use his own words, believes that this explanation is invalid, and considers death not as a primary necessity, but as an adaptation secondarily acquired. The unlimited existence of individuals would be a luxury without corresponding advantage, and the power of multiplying indefinitely was lost when it ceased to be of use.

It is not my purpose in this connection to discuss the deeper question of the necessity or non-necessity of death in the abstract; for, however ingenious Weismann's presentation of this part of his subject may be, most persons will accept his own conclusion that the problem is, for the present, insoluble, and that it is the quest after perfected truth, not its possession, that falls to our lot. Upon the second phase of the problem, as to whether the duration of individual life has been regulated by the conditions surrounding, and the necessities of, the species, there are numerous facts in nature which seem to justify the theory; also many which seem to disprove it and to indicate that other factors have been concerned in regulating such individual life. In the data given in his notes Weismann draws very largely from entomology, and a brief consideration of the subject of the duration of life in insects, and of its bearing on the views indicated, may prove profitable and suggestive, and permit me to introduce some unpublished facts in the life-history of what is generally conceded to be our longest-lived North American species, viz., *Cicada septendecim* Linn.

Weismann brings together a series of the best established facts which he has been able to gather, making no claim, however, to have included even most of those which are scattered through the enormous mass of entomological literature. He purposely confines his consideration to the life of the imago or adult insect, *i. e.*, the reproductive state, though I think that by so doing he very materially lessens the value of his data as bearing on his theories, especially as in other classes of animals he includes the whole life of the individual. The life of the larva should not be excluded. Neither does he reckon the time spent in the torpid condition, believing that it should not be reckoned with the active life of the species, there being no more in this condition than a *vita minima*, with the reduction of assimilation to its lowest point.

Longevity in Insects generally.

Let us, therefore, glance at the salient facts connected with the longevity of insects, as presented in the temperate zone, considering the subject by orders:

Hymenoptera.—In the Aculeate section of this order there is seen to be very great irregularity. In almost all the solitary species the term of individual life is limited by the year. This is essentially true of those species which are known to produce but one generation annually, in which case, as in the various species of Anthophora, Melissodes, etc., the hibernating period is usually in the larva state. In species which produce more than one generation annually, the term of life is shortened, especially in the imago. Except, however, where the species hibernates in the larva or pupa state and this adolescent condition is thus prolonged in dormancy or partial dormancy, these solitary members of the Aculeate section undoubtedly live longest in the adult state.

Among the social species, the subject becomes much more complex, but in most of the social wasps the impregnated females survive the winter, start the colony unaided in the spring, and themselves perish during the latter part of the summer. With the bees, this is also very largely true of most of the genera, but in *Apis mellifica*, the only species which has been at all carefully studied, the queen is known to live at least three years, though the drones perish either naturally or by violence with the waning summer, and the workers in the height of the season do not average an individual life of more than three months. The maximum life of the worker, including the hibernating season, is about eight months. With the ants there is great variation in the different genera and species, though the great majority resemble somewhat the social bees in hibernating for the most part as adults. It is well known that the females are longer lived than the workers, though the exact experiments of Lubbock show that these last in some species may live for at least six years, while a queen of *Formica fusca* which he kept in an artificial formicary attained the age of thirteen years. This is certainly a term of life for an adult insect beyond what we might expect, and even, perhaps, beyond what occurs in nature, since the artificial character of Lubbock's nests may have had something to do with the prolongation of the individual life, and on the whole the life of the adult in the Aculeate Hymenoptera, even when we include the parasitic families, is the longest, and that of the larva the shortest.

In the Cynipidæ or Gall-flies we have again every variation, though the larval life is usually long compared with the life of the adult, which, on the average, is brief. This may be said to be the rule with species producing summer and autumn galls on the firmer textures, whereas the opposite is true of spring forms on the more succulent parts of plants, the same species, in alternate generations, often representimg both conditions. I have known of many remarkable instances of the prolongation of the life of the individual in hard woody galls under unnatural conditions of dryness, in a number of cases the larva being carried over two or three years and then ultimately transforming, while in other cases the adult retained life for two years, unable to issue from its bonds. In one case, that of an undescribed species of Callirhytis (*C. fruticola* Riley MS.), where the gall, occurring in the acorn, is as hard as a stone, the larva retained life for a period of six years; yet in all these cases, under normal circumstances with the softening and rotting of the woody tissue on the moist ground, the individual life would hardly have been extended beyond the year.

In the parasitic families it is difficult to say whether more species hibernate as adults or as larvæ or as pupæ; but in whatever state the winter is passed, the other states are all of relatively short duration, and we have here again, frequently in the same genus, species which produce one and others which produce more than one annual generation, though it is very generally true that the longevity of the parasite is dependent on the character of its host.

In the Terebrantine Hymenoptera we have again a great majority of the forms limited in life duration by the recurring year. In the Uroceridæ—for the most part wood-borers—one annual generation is produced, and the winter is passed in the larva state, the life duration of the adult not exceeding three months. In all cases of this kind the larva lives longer than the adult. In the Tenthredinidæ we find great variation, the individual life varying according as there are one or more generations annually. Yet in no case, so far as known, does any species normally exceed a year in individual life duration, while the great majority have an adult existence of but a few weeks, with a larval existence of a much longer period. Most of the species hibernate in the cocoon, either above or below ground, and in the ultimate larva state, transforming to the true pupa in early summer, only a few weeks prior to the issuing of the adult.

Coleoptera.—In this Order, viewed as a whole, the larval life is generally prolonged, while that of the adult is limited to a few weeks or, at farthest, a few months. This is essentially true of all those species which, in the larva state, bore within the trunks or branches of trees, as in the Cerambycidæ and allied families, and of those which feed upon the roots of plants underground, as in the Scarabæidæ and various genera of the Chrysomelidæ, and of the Rhynchophora. It is more or less true of those species which feed upon dung and decaying vegetation, and of the great bulk of the Carabidous section of the predaceous forms. Yet, even in these cases, the term of larval life, under normal conditions, rarely exceeds three years, and more often not quite one. With the great bulk of the leaf-feeding species, however, we have, on the contrary, hibernation for the most part in the adult state and the larval period correspondingly shortened; whereas in the parasitic forms, irrespective of the families to which they belong, we have a mode of life dependent upon that of the host, and the adult is generally very short-lived as compared with the larva. This last manifests, indeed, a varying power to live in some instances in a quite remarkable manner, even without food. The habits of the triungulin in the Meloïdæ, and the very ephemeral existence of the male of the Stylopidæ as compared with that of the female, are illustrations in point. But no rule can be formulated as to the Order, because there sometimes occur in the same genus species which are two- or many-brooded, and species which are single-brooded annually, as also species which hibernate either in the larva or in the imago state.

In this Order, again, great adaptability to circumstances is indicated by the few observations and experiments that have been made. Thus, as I have shown in the Tenebrionidæ and Dermestidæ (Am. Nat., May, 1883, Vol. xvii, pp. 547–48), the larvæ will, where food is withheld, linger for a term of years and develop the power of moulting more frequently than they would normally have done if they had had an abundant food supply. There are many recorded cases of such prolongation of life in the Ptinidæ and the Cerambycidæ, when confined in dry wood made up into furniture, and almost every entomologist has had experience of such cases. O. Nickerl has recorded in his Beiträge zur Kenntniss vom Lebensalter der Insekten (Stett. Ent. Zeit. 50, 1889, pp. 155–163) that a female specimen of *Carabus auratus* found July 28, 1884, was fed and kept in confinement, and lived until June 21, 1889, or nearly five years, having hibernated five times. He believed that the specimen was not impregnated, and that the normal larval life is two years. A female specimen of *Calosoma* *sycophanta* found in May, 1877, survived three winters, the winter rest lasting seven months. A specimen of *Cetonia floricola* (sex not stated) found hibernating October 5, 1846, was kept alive until May 22, 1849. It was fed throughout the whole year and did not become torpid during the three winters of its existence. A Buprestid beetle (*Capnodes tenebrionis*) was kept alive from May 13, 1888, to April 28, 1889, being active during the winter. Seven specimens of *Blaps mortisuga* were kept alive five years in a tin box, dying during the extreme cold of the sixth winter. On the contrary, all his attempts to keep the common Stag Beetle of Europe (*Lucanus cervus* L.) alive longer than a few weeks failed, as the specimens never lived beyond August. L. von Albrecht Weiss records some observations on the life of the impregnated *Hydrophilus piceus* L. which he kept alive in confinement from February to October of the same year (Stett. Ent. Zeit. 1889, p. 343). J. H. Rouzet in a "Note sur la longevité de la vie dans Blaps" (*Annales Soc. Ent. de France*, 1856, Bull. p. 4) records having kept a number of *Blaps fatidica* in a tightly corked closed vessel from the winter of 1849–50 to November, 1855, when the last one died without having fed on the bodies of his associates. Boisduval (*Annales Soc. Ent. de France* 1853, Bull. p. 64) mentions that a Buprestid beetle, undetermined, had lived as larva "at least twenty years within a piece of furniture," and Al. Laboulbène, in the same number, remarked on a Hesperophanes, the larva of which must have lived ten years in the wood of a chair. Henry Baker, in the Philosophical Transactions, 1740, Vol. 41, pp. 441–8, records some experiments showing that *Blaps mortisuga* lived three years without food. In all cases like these the conditions of life were abnormal, and the same species, under normal circumstances, would doubtless have performed all their life functions and perished in much less time. It is even questionable whether any beetles in the imago state live longer than one year under natural conditions which permit the normal exercise of their life activities.

LEPIDOPTERA.—In this Order there is less variation in the term of life, as I do not know of a single species where the individual can be said to exist, under normal conditions, beyond a single year. While a certain number of the species hibernate in the adult or in the larva state, the great bulk of them hibernate either in the egg or in the pupa state. In the butterflies proper the more common method with those which are monogoneutic is that the longest or winter period is passed in the pupa or chrysalis state; but some of the more cosmopolitan species live longest as adults, the last generation produced developing exceptional vitality, and either braving the inclemencies of the top of Mount Washington, as in the case of Œneis, or literally burrowing under any shelter that may offer on the ground, even where the thermometer sinks to 40° and 50° degrees below zero, as in the case of *Vanessa antiopa;* or deliberately congregating and migrating in vast bevies, as in the case of our Milkweed Butterfly, *Anosia plexippus.* Where the winter is passed in the early larval stages, it may be without special winter protection (Apatura, etc.) or in a special hibernaculum (Limenitis, etc.).

In the Heterocera the longest period of individual existence is usually in the pupa condition, in which most of the species pass the winter. Yet a number in different families are known to hibernate in the adult state, probably a larger number in the egg state, and a goodly proportion in the larva state. In some species in warmer latitudes, as, for instance, in the notorious *Leucania unipuncta*, the winter may be passed in any one of these states. Again, also, species in the same family may be one-, or two-, or many-brooded. In some of the Sphingidæ and Noctuidæ the adult, especially in the monogoneutic forms, is endowed with great vitality, and feeds and propagates during most of the growing season, while in others the life of the adult is short and ephemeral, this being more particularly true in the Bombycidæ. Departures from these normal conditions in the Order we might expect to find in those species which, in the larva state, bore into the trunks and roots of trees, or which feed on woollen goods, dry vegetation or stored products, or which are sub-aquatic. For here there is some reason to believe that under conditions of uniform temperature and dryness the species may be prolonged in the larva state, even though active, beyond a single year. *Prodoxus decipiens* in the stems of Yucca is a case in point, as the larva has been known to live for five years and yet transform.

Hemiptera.—In the Heteropterous division of this Order we have, as a rule, the longest period of individual life in the adult, which is ordinarily the hibernating form. The Heteroptera exhibit great tenacity of life, especially in the adult condition; yet there are few records of experiments to indicate whether they could be made to survive the single year which limits the existence of the vast majority of the species. While so many hibernate as adults, yet a certain number pass the winter in the egg state, and the two forms of hibernation are not infrequently met with in the same family, or even genus. Aquatic forms, and those which live under the bark of trees, or in other more or less protected situations, may be found in all stages at almost all seasons of the year, and, in default of experiment, it is difficult to judge of the individual life period. That these insects are capable of extended individual life prolongation there is good evidence, and this is particularly the case with those which are partially parasitic or infest other animals. Thus the common *Acanthia lectularia* will survive in almost any state for more than a year under conditions which retard development.

In the Homopterous division we find great variation in the life of individuals. In the Membracidæ and the other families which are, when once out of the egg, active throughout life, the winter is passed in the egg state—rarely in the adolescent states. The same is essentially true of the Aleurodidæ, though there are a number of exceptions. In the Psyllidæ the winter is more often passed in the adult state, the exceptions being few. In the Aphididæ, where alternation of generation and parthenogenesis complicate the question, the adults, nevertheless, are, as a rule, ephemeral. The great majority of the species hibernate in the egg state. The gall-making species are, in the active states, longest lived in the stem-mother, which hatches from the winter egg and founds the gall in spring, while the true-sexed individuals are born for no other purpose than the production of the impregnated egg, are short-lived and are often incapable of feeding. The great variation in this respect which may obtain, however, is well exemplified in the Phylloxerinæ, in which, of the many species which occur in America, especially upon our hickories, we have every variation from those which produce practically but one generation annually, and which thus live individually for nearly a year, to those species which are reproduced agamically throughout the growing season and produce the sexed individuals and the winter-egg only as winter approaches. The number of these agamic generations varies according to the species. In the Coccidæ, also, the majority of the species hibernate in the egg state, but, as I have shown in recent notes before the Society, there is the greatest irregularity, and the dormant period may be passed in all stages of growth and in a variable manner in the same species. (Proc. Ent. Soc., Washn., III, p. 65.)

On the whole, therefore, it may be stated that the Hemiptera generally close the active individual life within a single year, and that the chief exceptions are to be found in the Heteropterous division among the species which have become household tenants with man, or among those which have a hypogean larval life. They show every variation, also, from a term of a few days or even hours, to a term of 9 or 10 months, and from single- to many-broodedness.

Larval Life of Cicada septendecim.

The Cicadidæ offer the most notable exceptions, and, as intimated at the outset, I take this occasion to put on record a few facts in reference to the larval life of *Cicada septendecim* and the *tredecim* race thereof, the exceptional nature of its longevity justifying somewhat fuller consideration in this connection. It is the only species of its family the larval habits of which have been studied with sufficient care, and it is, therefore, impossible to say just how exceptional it is as compared with other members thereof. As the majority of these recur annually over the whole extent of their range, their length of life has been assumed to be bounded by the year. But the same is true of many other insects, notably certain Coleoptera, *e. g.*, Lachnosterna, which are known to require nearly three years for the full life-cycle, and more careful study in future will doubtless reveal the fact that other species of Cicada live several years as larvæ underground. Having written so fully of *Cicada septendecim* in past years,* it is unnecessary to repeat here the many interesting facts connected with it, my design being to bring out a few points which bear on the subject of this address, or which serve either to correct or to render more complete what has already been published, as, also, to give more extended circulation among entomologists to certain experiments which may be watched by others in the future.

Few insects are more characteristically North American than this, and few have been more fully written about or have more fully interested the public. There is, therefore, a certain appropriateness in dealing with it at the close of the quadricentennial celebration of the landing of Columbus upon our shores, for while we become accustomed to annually-recurring phenomena, and are interested in the periodical recurrences of any particular species of insect, our interest increases proportionately to the length of the period intervening between such periodical appearances. A little sentiment is justified in connection with the different recurring broods of this insect, because they enable us to go back in thought centuries in the past and picture the woods in any particular locality resounding with its peculiar song. Thus, Brood XII, which will appear this year, has its largest distribution in New York and New Jersey, but reaches down to the National Capital, and the ancestors of this very brood, six generations back, commemorated, in their noisy way, the founding of Washington in 1792; while the preceding generation, seventeen years before, made the woods vociferous during the battle of Bunker Hill. Coetaneously, in 1894, will also appear

* See more particularly 1st Rep. Ins. Mo., 1868, pp. 18–42; Rep. of the Entomologist, Ann. Rep. U. S. Dept. Agr. for 1885, pp. 207-343; and Bull. No. 8, Div'n Ent. U. S. Dept. Agr., 1885.

an extensive 13-year brood, the brood which, in 1868, first gave me the opportunity of establishing and defining the *tredecim* as contradistinguished from the *septendecim* race.

The fact that thirteen years and seventeen years, respectively, are required for the full development of this insect, according to the race, is thoroughly established on chronological data, one of the *septendecim* broods having been observed every seventeen years since 1715. Nevertheless, there is chronic skepticism as to the facts, especially on the part of Europeans not familiar with the American literature upon the subject. Anomalous and exceptional facts in natural history very generally provoke such skepticism. While, therefore, there has never been any doubt in the minds of intelligent entomologists, it has always struck me as desirable to give experimental proof of the fact that this insect remains underground during the seventeen-year and thirteen-year periods allotted to it, according to race, minus the two brief months of its imaginal or winged existence. This was all the more necessary because of the difficulty of rearing the larvæ in confinement, and of following any one particular individual throughout its development. Nevertheless, a number of individuals are easily traced by repeated diggings under certain trees where the larvæ are known to have entered the ground abundantly in any particular year. This experimental proof I have endeavored to obtain ever since the year 1868, when I followed in St. Louis county, Missouri, the extensive *tredecim* brood which appeared there that year. The observations which I made there, and others made by an agent specially instructed, Mr. J. G. Barlow, of Cadet, Mo., for the *tredecim* race, and similar observations made here at Washington for the *septendecim* race, with the assistance of Mr. Th. Pergande and Mr. C. L. Marlatt, have permitted me to follow the larval life from year to year with great care, so far as the first twelve years are concerned, and with less care and continuity for the subsequent years. The development during these later years, however, has been followed with sufficient accuracy by the study of individuals from different broods, the age of which was chronologically known.

The cases of retarded or accelerated development in this species are remarkably few, considering the immense numbers in which the insects appear during their stated years. A few stragglers are sometimes heard the year before or the year after the regular appearance, but so rarely as to make the regularity all the more striking. It is, indeed, difficult to explain these exceptionally long periods of larval life in this species, or the great regularity in development through some eight degrees of latitude, on any theory of advantage to the species not possessed by other species of the family. Yet the relatively greater numbers in which the species occurs indicate that it has some advantage over them, and this may possibly rest in the total absence of parasites which so long a subterranean life insures to the larva. The imago is softer and more feeble than is that of most species of the genus, and is more easily captured by a host of enemies, and this fact may also have significance, and would comport with Weismann's theory.

The probabilities are that the species is a very old one, and that the underground life-periods of the two races have become firmly fixed through heredity. In this connection, and as bearing on their possible susceptibility to changed climatic conditions, I would call particular attention to the experiments which I made and recorded in 1885, where the eggs from a *septendecim* race and a *tredecim* race were interchanged as to localities (Rep. Entomologist, U. S. Dept. Agr., for 1885, pp. 254–257), as it is to be hoped that those living in the neighborhood of the marked trees under which the eggs were placed will observe and record the results between the years 1898 and 1902.

THYSANOPTERA.—In this sub-order there are few recorded observations as to length of life. Most of the species that have come under my observation produce several generations annually, continuing to breed through the summer, and, under greenhouse conditions, even through the winter. Normally the winter is passed in the adult state, and there is no record of any individuals living beyond a single year, while the average limit of life is probably but two or three months.

DIPTERA.—In this order, with its remarkable variety of forms and great diversity of life-habit, we have a corresponding diversity in individual longevity. It would require too much space even to indicate the habits of the different families, and it will suffice to state that, with very few exceptions, the insects of this Order are also limited to a single year in individual life, and that the larger number, or those which produce more than one generation annually, have a still more limited life duration. There are, nevertheless, some remarkable exceptions among the parasitic forms. In the great majority of species the longest period is passed in the larva state, and it is in this state chiefly that hibernation is had. Yet between the extremes of long larval and brief imaginal life, as illustrated in the Œstridæ, and extended imaginal life with the larval career so abbreviated that it is passed before birth, as in the Hippoboscidæ, we have examples of every variation, though the law of compensation is as manifest here as in the other Orders, and where the imago persists beyond the average length the larval period will be generally shortened, and *vice versa*. No exact records of the duration of life among the

Bat-flies have come under my notice, but we are justified in inferring that, just as in the case of the fleas, they are, under conditions adverse to development, capable of surviving for a much longer period than are the non-parasitic families.

ORTHOPTERA.—What Weismann records under this order (in which he includes Termes, Ephemeridæ, Libellula, and Lepisma) of Gryllotalpa, Gryllus, Locusta, and Acridium, is essentially true of the Order as a whole, namely, that the species are annual, existing on the average about half the year in the active condition, maturing the latter part of the growing season, and perishing soon after the eggs are laid or upon the approach of winter. As I have expressed it in treating of *Caloptenus spretus*, they are born with the coming of the leaves in spring and perish with their fall in autumn. The Acrididæ, for the most part, hibernate in the egg state. Yet there are numerous exceptions, and we may have, in the very same region and under like conditions, eggs laid early in the growing season and hatching in midsummer, and the mature insect developing in autumn and passing the winter in a more or less active condition, as in *Acridium americanum;* or we may have them hibernating in different stages of development as larvæ or pupæ, as in the numerous species of Tettix and in the Stenobothri.

Among the crickets the species are for the most part single-brooded, and those which live in the ground hibernate in various stages of development, while tree crickets invariably pass the winter in the egg state, and, together with the Mantes and Walking-sticks, with the Locusts, Grasshoppers, and Katydids, hatch in spring and perish in autumn. The Cockroaches, on the contrary, which so frequently breed in and around human habitations, show less regularity in development, and are more or less active throughout the year, with a longer individual life-period than in any of the other sections. In the sub-order Dermaptera, or Earwigs, we have, again, creatures which are fond of breeding near human habitations, and the adult is known to live for the best part of the year, but normally not to extend beyond the year.

NEUROPTERA.—Considering this old Order by its more modern sub-divisions, it may be said that in the Odonata the larval life is the essential part of the life of the individual. Among the Dragon-flies none of the species hibernate in the adult state, and most of them have an adult existence of but a few weeks, or at most two or three months, living for the rest of the year, more or less actively, as larvæ in the water. The same is true of the Trichoptera, or Caddis-flies, also of the Neuroptera proper, as exhibited in the Ant-lions and Mantispas. In the Hemerobiidæ, on the contrary, we have species which produce more than one generation annually, and in which the larval life, being for the most part predaceous and dependent upon Aphides, is greatly shortened, while the life of the imago is prolonged, many of the species living through the winter in this state. Thus, we have, again, in the same family the two extremes. In the Platyptera we have in the Termites or White Ants an illustration of the influence of the social habit and organization on longevity very similar to that which we find among the social Hymenoptera; for here, also, while the workers are for the most part limited within the year in their life duration, it is well known that some of the soldiers live for a longer period, while the queens or fertile females live for several years. So in the Bird-lice, or Mallophaga, the parasitic habit has produced a distinct change, and we find species breeding continuously upon our domestic animals and upon birds, the limitation of individual life hard to define, but showing great elasticity according to conditions. To some extent this is true of the Psocidæ, or at least of those species which are most frequently met with around houses. It is well known that some of these live for a long time in wainscoting, and, while no exact records are at hand, there is every reason to conclude that development is irregular, and that individual life may be abnormally prolonged under conditions of low temperature and dryness.

In the Plecoptera, or Stone-flies, we have an annual life quite similar to that of the other aquatic Neuroptera. Among the Ephemeroptera, or May-flies, we have a most striking illustration of the shortened existence of the adult, which, in some species, lasts for but a few hours, and, in most, for but a few days. Finally, in the Thysanura, we have no strict dividing line between the adults and the earlier stages, and the species have no regular breeding periods. Many of them have a life not extending beyond a few months, while others, as in Lepisma, doubtless, occasionally survive more than one year.

Spiders, Ticks, Mites.—As to the spiders, Dr. Marx informs me that he knows of no experimental facts of any consequence bearing on their longevity. The same rules apply to them as to the bulk of the Hexapods. The great majority of them are limited in individual life to the single year and hibernate in the egg state. The deviations, as in Hexapods, will be found in those species which live in tunnels underground or have become joint tenants with man in his abodes. The trap-door spiders and some of the species which winter in our cellars often extend individual life beyond the year. Like all predaceous articulates, they have developed great sustaining power under adverse food eonditions.

The same general conclusions may be applied to the Ticks, though here we have experimental evidence of remarkable life persistency under abnornal conditions, as I have known a specimen of *Argas reflexus* to remain alive in a corked vial without food for some five years, moulting repeatedly during the period.

So with the Mites they have developed a most remarkable adaptability to environmental requirements, the parasitic and gall-making forms exhibiting long resting periods alternating with periods of rapid multiplication; while some of the soft-bodied, non-parasitic forms are able to assume a Hypopus protecting mail which permits a long period of quiescence until circumstances again favor activity and reproduction.

Retardation in Development.

The subject of retardation in individual development is intimately bound up with the question of longevity. The annals of entomological literatare are replete with instances of such retardation, and, in this connection, I will content myself with a reference to some of the more common instances, especially to those that have come under my own personal observation. In the egg state the instances of retardation of development, under normal conditions, are few, as the period passed in the egg and the time of hatching are very uniformly and regularly controlled by meteorological and physical conditions, especially that of temperature. Where eggs are laid in summer or autumn by monogoneutic species, there is sometimes shown a tendency to hatch the same year, and thus produce a second annual generation, and the converse of this is true, and such facts are more particularly noticeable in species like the semi-domestic *Sericaria mori*, in which the number of generations has been influenced by man and has not become fixed through long periods of natural propagation. Yet, when the natural conditions are in any way interfered with, the almost unlooked-for power of adaptation is well illustrated by the somewhat exceptional case of the eggs of *Caloptenus spretus* to which I have drawn attention in several publications, especially in 1881 (Amer. Nat., 1881, pp. 1007–1008), where it is shown that eggs of this insect which were laid in the autumn of 1876 and covered by a layer of clay and a plank sidewalk, thus precluding the issuance of the young, remained latent four years longer than they normally would have done, freely hatching during the spring of 1881, when the sidewalk was taken up and removed.

Retardation in the larva state is rarely witnessed among leaf-feeding forms, though even here there will be great variation in the relative time of development of the individuals of a given brood, and where the species is polygoneutic I have not infrequently noticed that certain individuals of the spring brood would beget one further generation during the year, while others would beget two. In some instances, also, especially where there is summer or autumn dormancy (Phyciodes, Apatura, etc.), a certain portion of a brood will be retarded and go over till the ensuing year, while the balance will develop and transform the same year. It is, however, among the larvæ which live beyond the growing season of the year, as in most of the species of wood- and stem-boring and root-feeding Lepidoptera and Coleoptera, as also those which feed on dead and dry animal or vegetal matter, as shown in considering the Coleoptera, that cases of acceleration and more particularly of retardation have been observed.

The Heteroptera and Homoptera, the Mallophaga, the Spiders and the Ticks, also show, as we have already seen, a remarkable tendency to retardation, especially in the adolescent stages.

In the pupa state there is less opportunity or occasion for deviation from the normal habit of the species, and yet the literature of Lepidopterology furnishes more particularly very many instances of belated pupal development, or of instances where an individual in a given brood has passed on to a second or third year in the cocoon, while other individuals have developed and given out the imago at the normal period. This has happened frequently in my own rearings of insects, and particularly in the Bombycidæ, and there are innumerable recorded cases by others.

In the imago state the cases of retardation are numerous, but almost always in connection with abnormal conditions. Thus, as we have seen, they chiefly refer to hard-shelled insects like beetles, which have been kept in confinement without food and measurably protected from the influence of the weather. The most marked cases of this kind are of wood-boring beetles, especially Longicorns and Ptinidæ, which are known to have existed alive in wood very many years after the wood had been made up into household furniture.

Influence of prolonged Cold on Retardation.

Just how long the dormant state in insects, especially in the pupa state, could be extended by continuous cold, it would be difficult to tell; but experiments have been made, especially by Mr. William H. Edwards, in this country, which indicate not only that this state may be very materially prolonged beyond the normal period, but that the results of such prolongation almost justify the belief that, in those species which withstand extremely low temperatures—which, to use a common expression, may be frozen solid—there would seem to be hardly any limit to the continuation of this condition. Another interesting fact, worth mentioning in this connection, is that when artificial cold is brought to bear upon summer broods of chrysalides, the effect is noticeable in the character of the resultant imago, seasonal dimorphism being in many ways directly attributable to the influence of temperature.

Summary.

From the above statement of the more salient facts on this subject—a superficial selection from the immense number that might be cited—certain conclusions are justified. In general, it may be said that the great majority of insects, like annual plants, have their individual lives limited by the year, and that the conditions that determine which of the four states—egg, larva, pupa, or imago—shall occupy the longest period, are extremely difficult to formulate. Temperature and food-supply undoubtedly influence and control the length of the life-cycle; for insects strikingly exemplify the principle that the individual life is shortened in proportion as its activities are accelerated, and lengthened according as these are inactive or dormant. But whether the shortened or lengthened period of the normal or annual life-cycle of the insect shall be in the egg, the larva, the pupa, or the imago state, depends on conditions which we certainly cannot formulate. All that we can say is that there is a correlation between the protracted life in any one state and the more ephemeral existence in the other states. Thus the great majority of annual insects in the temperate zone hibernate in the larva state, which covers, on the average, from one-half to three-fourths of the year. But, as we have seen, the number of cases where the dormant period is passed either in the egg, the pupa, or the imago state, is very great, and hibernation in all these states takes place not infrequently among species of the same family, of the same genus, or even among individuals of the same species.

These remarks remain essentially true for those species which produce more than one annual generation. These not only hibernate in different states, according to the species, but there is more or less irregularity in the same species, which may sometimes hibernate in the imago, the pupa, the larva, or even in the egg state. Even a portion of the same brood of larvæ, hatching from the eggs of a single parent, as we have just seen in Phycides, etc., may go into lethargy in midsummer and not transform to the pupa state and give out the imago until the ensuing summer, while the other portion will pass through their transformations and continue their life functions the same year.

In respect of those insects which require more than one year to undergo their full life-cycle, we have seen that it is very generally the rule that the long-lived period is the larval, and that the duration of the imago, pupa, and egg states is relatively brief. This general rule has no exceptions of consequence that I can recall. Nevertheless, within the same genus, and particularly within the same family, different species vary greatly in the period of individual life, and this, too, where the habits are essentially similar.

The one fact that stands forth more prominently than another in this consideration of the subject of longevity among insects is the great variability, not only in the individuals of the species, but particularly in the different species of a given family. We are also impressed with the power of prolonging life in the individual under abnormal conditions which many insects exhibit. The facts of entomology are thus quite significant in their application to Weismann's views as to the influence of natural selection on the duration of individual life, and few will question the general conclusion that the length of life has, in the main, been fixed in each case by the necessities of the species—in other words, it is, as Weismann has argued with the higher animals, very largely dependent on the necessities of life.

This adaptation is more particularly noticeable in the compensatory adjustments between the lengths of life in different states of the individual development, and in this particular Weismann, as I have already hinted, is weak in confining his attention to the life of the adult, because it is in contemplating the whole life-cycle that he might have found his strongest support for the theory that natural selection has, in the main, influenced longevity. For nothing is more certain than that, with insects, where, as is more often the case, the vicissitudes of the imaginal life are such as to make it precarious, we find it to be brief, with a correspondingly lengthened period of larval existence; whereas, in the rarer cases where the vicissitudes of the active larval life are such as to give great risk to the species, this state is the abbreviated, and either the pupal or imaginal the extended one, in time.

Thus I am of the opinion that the length of life in insects has been, in the main, regulated by natural selection, acting upon individual variation for the benefit of the species. I say in the main, because I believe that Weismann's chief fault is that he does not sufficiently recognize the limitations of natural selection; and I believe that the same limitations must be recognized in its application to longevity which have been recognized by myself and others in its general application to the formation of species.* Natural selection has undoubtedly operated in the past, and is still operating, to fix more or less absolutely the limit of individual insect life in any particular state, according to the necessities of life in a particular species in relation to its environment and to other organisms. But the recognition of this fact does not explain why, in two species of the same genus, under like conditions, the one should hold its own, by producing a single annual generation, equally as well as the other, which produces two or more; nor does it explain why different species in the same genus or the same family should differ in length of life under like conditions. For we may justly argue that what was essential in the one case would be essential in the other. It is preferable, it seems to me, to recognize the limitations of natural selection, and to view life, especially insect life, as possessing inherent powers of adaptability and variability. Adaptivity, exhibited by the individual and confirmed or fixed by descent, is powerfully influenced by natural selection. Variability coöperates with adaptivity, and gives full scope to natural selection in fixing useful qualities, but it also manifests itself in lines which are not necessarily essential and in which natural selection plays little or no part; nay, further, in lines that are purely fortuitous.

These I believe to be general truths in evolution, and they are just as applicable to the subject of longevity as to the subject of structure and habit; and it is only by recognizing these limitations of natural selection that we can get at the true meaning of longevity in animals or of the phenomena of life generally. In short, nature is kaleidescopic, and no single law that we may formulate, however important or however wide its application, will explain all her varied manifestations. No gown can be made "all-sufficient" to fit an unlimited subject.

The address was discussed by Messrs. Fernow, Schwarz, Ashmead, and Riley. Mr. Fernow said that a comparison between plants and animals in the matter of longevity can hardly be made, since in plants the functional parts are renewed, while in animals they remain the same. Theoretically, a plant may never die. Weismann's idea of immortality is misleading, as generally stated, since the reproductive cell alone is immortal—the individ-

* Address before the section of Biology, A. A. A. S., Vol. XXXVII, 1888, "On the Causes of Variation in Organic Forms;" "Some Interrelations of Plants and Insects," Proc. Biol. Soc., Wash., 1892, VII, pp. 81–104.

ual is not. In his opinion, we have not enough facts as yet to generalize to the best advantage.

Mr. Schwarz, in speaking of the longevity of insects, mentioned the fact that entomologists, in general, live in the temperate zones, where circumstances are unfavorable to a regular development. In tropical regions no marked irregularities in climate and moisture interrupt the steady and regular life development. Our ideas would undoubtedly be changed if lengthy observations were made in the tropics.

Prof. Riley asked whether any one knew of any cases of more extended longevity in insects than in the 17-year Cicada and the 13-year Ant mentioned by Lubbock—that is, aside from the retarded beetles mentioned in the address. No such instances were cited by members.

Mr. Ashmead mentioned the fact that last summer he found in a nest of Pelopæus which was two or three years old a number of puparia of a small Dipterous insect. The puparia were dry and hard. He put them first in water and then into a box, and in two or three weeks found that nearly all had hatched. All of the adults, however, had aborted wings. He thought that the same puparia might have remained in this condition for several years, until finally the wasp cells would fall to pieces, when the puparia might reach some moist spot favorable to the issuing of the adult.

Mr. Schwarz stated that it is probable that other species of Cicada will be found to have long lives in the larval state. He stated that careful collecting of the rarer species, labelling with annual date, and continued for a term of 20 years or more, will probably show that this is the case.

Prof. Riley stated that he thought this quite possible, but, in his opinion, it would not be remarkable if no other species were found to approach this long life. His main interest in the question arises from the study of Weismann's views. In plant life we may have an indefinite continuation of what is ordinarily called the individual, but, properly speaking, the plant is not an individual. Without complexity and death we should not have had progress, but an infinite multitude of unicellular organisms would have existed for all time, according to Weismann.

With this aspect of the question he was inclined to agree, although he expressed himself as dissenting from the idea of the immortality of the germ cell. In fact, Weismann himself has been obliged to recede from this position and has confined the immortal element to the idioplasm of the germ cell. That the duration of life is determined by natural selection, and, in fact, that death is, or was, brought about by natural selection, is, however, very reasonable. He reviewed Weismann's objections to the old theory of the relation between bulk and longevity, and spoke of the shortening of life by domesticity in animals as the evidence of the influence of natural selection. He also brought up the point of fecundity and its influence on longevity.

Mr. Fernow insisted upon the omission of all teleological features in discussing these questions. Survival, in his opinion, exists not on account of teleological aggressiveness on the part of a chooser, but on account of what may be called the accident of parental characters. There is no necessity for any species—existence is an accident.

FEBRUARY 1, 1894.

President Ashmead occupied the chair, and Messrs. Riley, Benton, Marx, Gill, Stiles, Marlatt, Schwarz, Coquillett, Hubbard, Wait, Heidemann, and Howard were present.

Dr. Stiles presented a petition to Congress, originated by the Society of American Naturalists, for the purpose of securing the removal of duty from scientific apparatus. On motion, the Corresponding Secretary was directed to sign one of the forms on behalf of the Society, and forward it to the Hon. H. Cabot Lodge, U. S. S.

—The Corresponding Secretary read a letter from Mr. T. D. A. Cockerell upon the Hymenoptera of Jamaica, in which Mr Cockerell listed all of the species of this order found by him to occur upon the Island of Jamaica, and generalized as to the character of the Hymenopterous fauna, calling attention to such of the genera and species as are common to Jamaica and North America or the other West Indian Islands.

In discussing the paper Mr. Hubbard said that the Evania mentioned by Mr. Cockerell might have been introduced into Jamaica with domestic cockroaches from shipboard, but that, curiously enough, he found this same species in a mountain cave in the interior of the Island of Jamaica, and in an unsettled district. It was there parasitic upon a peculiar cave cockroach. Comparing specimens with others which he obtained in Florida, he could find no differences, and he thinks, therefore, that the species may be indigenous to Jamaica, and that, perhaps, it has been carried from that Island to other portions of the world.

Mr. Schwarz criticised Mr. Cockerell's paper on the ground that the material collected by the author was far too scanty to warrant generalizations. He found the same fault with the paper by Mr. Cockerell, recently published in the Transactions of the American Entomological Society, on the Coleoptera of the mid-Alpine region of Custer county, Colorado, in which several hundreds of species recorded from the same region and elevation had been overlooked. The number of species common to Jamaica and the United States must be much larger. In the Coleoptera, for instance, which Sallé and Fleutiaux have described from the Island of Guadeloupe, more than 50 out of about 500 are common to the United States. So with the Coleoptera of Cuba, and even of Venezuela.

Prof. Riley agreed with Mr. Schwarz, and spoke at some little length concerning the undesirability of generalizing on insufficient grounds. Mr. Ashmead agreed with the preceding speakers as to the superficiality of the paper. Of the genera mentioned by Mr. Cockerell as found in Jamaica and not in the United States, all but 3 or 4 are well known in the United States. With the parasitic Hymenoptera it is altogether too early for even the best informed entomologist to attempt to generalize on questions of distribution. Mr. Howard spoke briefly of the character of the parasitic Hymenoptera collected by Mr. Herbert Smith upon the Islands of St. Vincent and Grenada, showing a fair proportion of characteristic genera and a very large proportion of probably characteristic species.

Dr. Gill said that Mr. Cockerell might have been influenced in his conclusions, or in his desire to reach conclusions, by

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the interesting distribution of the terrestrial Mollusks of Jamaica. There are many more land shells in Jamaica than in North America, and many peculiar genera are common to the West Indies and Central America. On the Island itself almost every mountain and valley has its limited fauna. This is the case with Hayti and others of the West Indies which are mountainous in their character, and, in fact, it is characteristic of all old established archipelagoes, like the Philippines for instance. Mr. Hubbard stated that the land shells of Jamaica have been studied with particular care. When he visited the Island 20 years ago the study of land shells was almost the only department of natural history, aside from botany, which was receiving attention. Therefore the shells have become much better known than other elements of the fauna. The fauna of Hayti, however, is much less known. Dr. Gill said that Mr. Hubbard was quite right, and that the impetus to the study of land shells in Jamaica was originally given by Mr. C. B. Adams, an American naturalist who visited the Island about 1854–'55, and whose enthusiasm was caught by a number of resident observers. Hayti, moreover, has been much better explored by naturalists than is generally supposed, while the Molluskan fauna of Cuba is even better known than that of Jamaica.

—Mr. Hubbard presented the following paper:

THE OVIPOSITION OF MELITARA PRODENIALIS WALKER.

By H. G. Hubbard.

The depredations of this Phyticid moth upon cacti of the genus Opuntia have had for several years an exceptional interest to me, as I have under observation in my garden at Crescent City, Fla., a considerable number of species of these interesting plants, and owing to the attacks of the larvæ of Melitara many of the more delicate species, including most of our native Floridian Opuntias, cannot be grown successfully in that locality. I have observed that our most widely distributed species, *Opuntia vulgaris*, is so much subject to their attacks that large clumps of the plant are rare in the interior of Florida, and are to be found only near the coast or upon small islets in the inland lakes. And thus a plant which would otherwise probably form one of the most striking objects in the flora of the State is held in check and reduced to insignificant clusters and scattered isolated pads which are seldom permitted to attain their normal size and never to produce a numerous colony. Only the wonderful vitality of the Opuntia saves it from complete extinction at Crescent City and elsewhere, yet thanks to its recuperative powers it remains there, as elsewhere, one of our commonest plants. The larva of Melitara mines and burrows in the succulent pulp of the pads, working in companies, large or small, according to the abundance of food, and excavating chambers without cutting through the silicious rind. Usually each pad is entirely eaten out before the caterpillars enter the next joint, but as their operations promote various destructive processes in the pulp, such as rot and fungi, the destruction of the part attacked is rapid and the caterpillars are often obliged to cut an

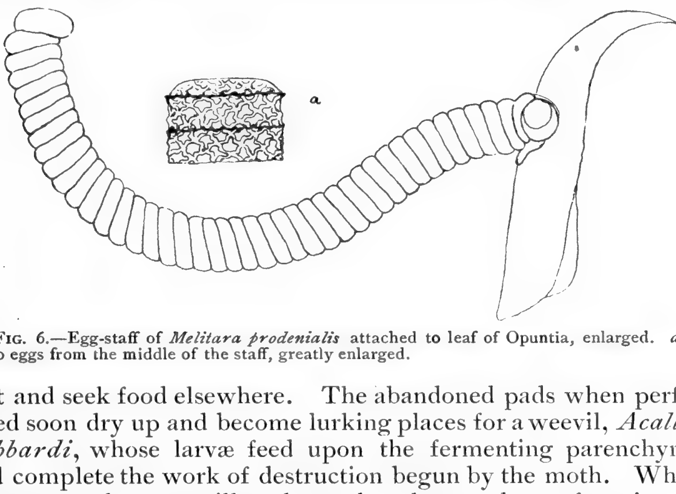

FIG. 6.—Egg-staff of *Melitara prodenialis* attached to leaf of Opuntia, enlarged. *a*, two eggs from the middle of the staff, greatly enlarged.

exit and seek food elsewhere. The abandoned pads when perforated soon dry up and become lurking places for a weevil, *Acalles hubbardi*, whose larvæ feed upon the fermenting parenchyma and complete the work of destruction begun by the moth. When full grown the caterpillars leave the plant and transform in the sand beneath the prostrate pads. The moths appear about the end of April or first of May at Crescent City and are nocturnal in habit.

The method of placing the eggs one on top of the other to form a stick has already been mentioned in a note by Dr. J. B. Smith (Entomological News, vol. 3, p. 208), but the details of the construction are so curious that I have thought them worthy of a more extended notice. It will be seen from the drawing here presented (fig. 6) that the mass of superimposed eggs form a long cylinder, not straight, but sinuously curved and bearing a wonderfully realistic resemblance to a slender geometrid caterpillar in the attitude it assumes when alarmed, with its body extended free from the plant, to which it clings only by its anal prolegs. The eggs, closely united and flattened, form cylindrical joints, and, as if designedly to make the resemblance more deceptive, the top egg is rounded and slipped a little to one side, forming a most perfect head with projecting jaws. When the forming embryos begin to darken in color, and are seen through the transparent shells, then the mimic worm becomes truly life-like, with mottled segments and a black head. The egg-stick is always attached to the true leaves or to the spines of Opuntia. They are straw-colored when fresh laid. Forty-five or fifty eggs may be counted in a single stick, but the moth frequently deposits short sticks consisting of a few eggs only. I have seen occasionally four or five eggs laid in a short stick, and in that case the caterpillar-like head is not apparent and the moth probably left the work unfinished because of some disturbance during the operation. As the various species of Opuntia vary much in the length of their spines and true leaves, these unfinished sticks often escape notice among the spines of the long-leaved species, and this resemblance to the spines and spiny leaves of the plant may have been the original *raison d'être* of the mimicry, which has, however, been elaborated by the moth in her finished work, on our short-spined Opuntias at least, and has at last produced a mimicry of a mimicry by copying a mimicking caterpillar.

The eggs are laid at night, and the operation of depositing them has not been observed. It must, however, be a wonderfully interesting performance. The egg-stick shown in the drawing is 80 mm. long. The separate eggs are cylindrical and measure 2 mm. in length by 7 mm. in width. The surface is beautifully reticulated with wavy raised lines anastomosing obliquely. The eggs are cemented together with a brownish glue which, under the pressure exerted upon the mass, is squeezed out at the sutures between each two eggs in the stick and hardens there, forming a ring or collar which always adheres to the egg beneath when two eggs in the stick are separated. It sometimes has the appearance of a circle of spinules, owing to the corrugations of the surface upon which it is moulded.

The young larvæ of *Melitara prodenialis*, on hatching from the eggs, feed for a time externally upon the bud-like leaves of Opuntia. When they become larger and stronger they cut through the silicious skin of the pads. The wounds made by them in the plant exude a gummy liquid, and a scab-like crust is formed. Under this the larvæ live in companies, large or small, according to the size of the plant, until they are about one-third grown. After this they burrow deeply into the substance of the succulent stems. The larvæ, as long as they live upon or near the exterior of the plant, are light brown in color, but after they burrow into the pulp and approach their full size, they attain a most beautiful dark-blue color. In pupating they form a long loose cocoon of yellow silk, which is concealed somewhere about the Opuntia clump, usually under a prostrate pad.

There are two broods during the year. Moths issue in June or July, and again in October. The eggs from this last generation hatch in the fall, and the young winter as larvæ, less than one-third grown, in the wounds which they have made in the succulent pulp. They continue to feed during warm weather, and are not killed by severe frost, surviving even when the juices with which they are surrounded are congealed to solid ice for more than twenty-four hours. The moth is nocturnal. During the day it hides among the detritus of the Opuntia clump. In this situation its neutral coloration is highly protective, and the difficulty of detecting it among the dry and twisted fragments of the plant is rendered still greater by the peculiar position it assumes when resting. With its wings closed and bent sharply downwards, while the abdomen is curved upwards between the slanting wings, if discovered at all, it is more likely to be taken for a dead than a living insect.

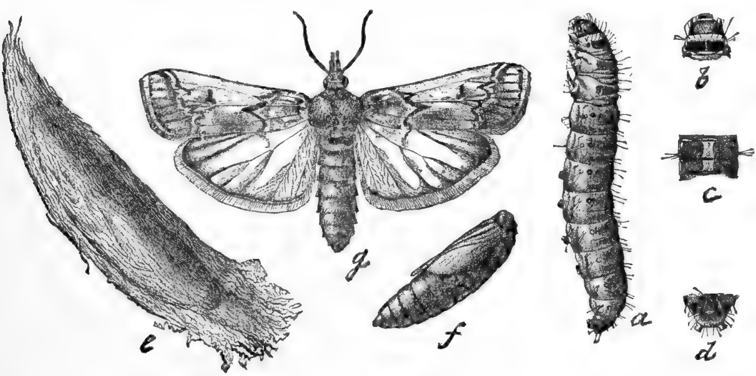

FIG. 7.—*Melitara prodenialis*; *a*, larva, in profile; *b*, head and prothorax, dorsal view; *c*, one of the segments, dorsal view; *d*, anal segment from above: *e*, cocoon; *f*, pupa; *g*, moth—all natural size.

The accompanying cut representing the moth with its larva, pupa, and cocoon was drawn by Miss L. Sullivan, under the supervision of Prof. C. V. Riley, from material collected by myself at Crescent City, Fla., in 1882.

Mr. Howard asked if the top egg, *i. e.*, the one laid last, is the first to hatch, as is the case with the eggs of *Grapta comma* and *G. interrogationis*. Mr. Hubbard replied that he had not observed the hatching of the eggs, but that he suspected that this method is followed, since in egg-sticks preserved in alcohol he observed that the embryo is further advanced in the top eggs.

Dr. Gill asked if there is any especial modification of the ovipositor. He thought there must be such a modification to enable the moth to lay such a peculiar egg mass. Mr. Hubbard said that no such modification had been found. Mr. Schwarz stated that the moth is much shorter than the egg mass, and that in his opinion the stick must have been bent and afterwards straightened by either the moth or its own erectile power. Prof. Riley thought that a membranous extensile ovipositor might exist by which the act of oviposition could readily be accomplished. Mr. Ashmead thought that the abdomen itself might be sufficiently telescopic to produce the result. Dr. Stiles thought that the necessary pressure to produce the compact stick might be brought to bear in the ovarian tubules. Prof. Riley, on the contrary, considered that the string was produced by purely external mechanical effect. Dr. Stiles, in reply, said that the eggs of insects as well as other animals are undoubtedly given their shape to a considerable extent while still in the ovary, in which Dr. Gill agreed with him. Mr. Howard said that the masses must represent the ripe products of several ovarian tubules, and that these could hardly be joined together until after they had passed down the oviduct proper beyond the entrance of the accessory glands, the secretion from which joined them together, and, in fact, produced a stick.

Mr. Schwarz asked if the cactus plants could not be saved easily by the examination of the plant and picking off the egg-sticks. Mr. Hubbard replied that he had saved a number of choice plants in this way, but that it was a very considerable task, and that during the month of May the plants had to be gone over every morning. Some varieties of Opuntia, he said, are so thick skinned that the young larvæ cannot penetrate them. Occasionally, however, larvæ are found in these varieties, having entered by means of artificial punctures or wounds.

Prof. Riley stated that he had reared the moths many years ago in St. Louis. It is the largest Phycitid which we have, and in his opinion there is little to be wondered at in the length of the egg-chain. The moth might readily balance itself upon the spines and drop the string of eggs until the lowest one touched and adhered to the epidermis of the pad.

Mr. Hubbard stated that the spines of those varieties of the plant which are most frequently attacked are from 8mm. to 12mm. in length.

—Mr. Schwarz presented a paper entitled:

SOME NOTES ON MELSHEIMER'S CATALOGUE OF THE COLEOPTERA OF PENNSYLVANIA.

By E. A. Schwarz.

The quaint little book published in 1806 by the Rev. Fred. Val. Melsheimer as the first part of an intended general catalogue of the insects of North America is now very rare, and not more than three or four copies are known to exist in the United States. It is briefly referred to at various times both in European and American literature, and a longer notice of it has been published by Dr. Hagen in his fascinating article on the Melsheimer family and the Melsheimer collection (Can. Ent. 16, 1884, p. 192). As a catalogue the book never had any scientific value, since most of the species enumerated are only manuscript names,* still it contains, in my opinion, some points of interest which deserve to be rescued from oblivion.

Melsheimer was not a mere collector of specimens, but paid considerable attention to the food habits and mode of occurrence. The many hundreds of species which he sent to his friend, Prof. A. W. Knoch, of Brunswick, Germany, were evidently accompanied by numerous notes, and only a few of these (and certainly not the most interesting ones) were published by Knoch in his "Neue Beyträge," etc. (1801), or referred to by Illiger. In Melsheimer's Catalogue we still find many names of Coleoptera, derived from those of the food-plants, and it is certainly to be

* Dr. Hagen says that of the 1,363 species only 205 are now surely known, but from the copy of the catalogue before me I find that more than twice that number can be identified. This copy, kindly presented to me by Mr. B. P. Mann, is that used by F. V. Melsheimer, and contains numerous manuscript corrections and additions, partly made by the author and partly made by his eldest son, the Rev. J. F. Melsheimer, the correspondent of Thomas Say. The latest of these additions dates from the year 1825. A few notes and an index, written previously to 1834, are from the hand of Dr. F. E. Melsheimer.

regretted that only a few of them could have been retained. The following are some examples: No. 143, *Bostrichus pini* (= *Tomicus pini* Say); No. 305, *Hispa arundinis* (= *Stenispa metallica* Fabr.); No. 307, *Hispa castaneæ pumilæ* (= *Odontota nervosa* Panz.); No. 421, *Chrysomela alni* (= *Lina scripta* Fabr.); No. 459, *Altica rhois* (= *Orthaltica copalina* Fabr.); No. 549, *Galeruca salicis* (= *Galerucella decora* Say); No. 572, *Curculio castaneæ pumilæ* (= *Balaninus rectus* Say); No. 616, *Curculio quercus* (= *Copturus quercus* Say); No. 695, *Anthribus agarici quercini* (= *Cratoparis lunatus* Fabr.); No. 709, *Clerus rosarum* (= *Clerus rosmarus* Say); No. 745, *Stenocorus sambuci* (= *Desmocerus palliatus* Forst.); No. 775, *Saperda juglandis albæ* (= *Oncideres cingulata* Say); No. 809, *Callidium juglandis* (= *Bathyle suturalis* Say); No. 1157, *Carabus herbivagus* (= *Harpalus herbivagus* Say). Many other names of a similar character cannot be interpreted with any reasonable degree of certainty.

Foot-notes to two coprophagous Lamellicorn beetles refer to the time of appearance: *Scarabæus volvens* (= *Canthon lævis* Dr.) is called: "*lætus mitioris cœli nuntius*," the harbinger of a milder sky; while *Scarabæus tesselatus* (= *Aphodius serval* Say) is said to be "*veris prænuntius sed fallax*."* Another foot-note to No. 159, *Anthrenus museorum* (= *A. varius* Fabr.), gives, so far as I know, the oldest description, published in America, of a Coleopterous larva. The description consists of only five words: "*Larva flavida, setacea, fasciis nigris*," but it must be conceded that the general appearance of the larva is well characterized thereby.

It is well known that Melsheimer had in his cabinet many European and other exotic species of Coleoptera which he received from Prof. Knoch. Many of these specimens were, no doubt, without names and locality labels, and a few of these were many years afterwards described as North American beetles by Dr. F. E. Melsheimer. But after a careful perusal of the Catalogue I fail to find evidence that F. V. Melsheimer erroneously credited to our fauna any foreign speeies. Some erroneous de-

* This is a good observation and refers to the swarming of this Aphodius during the first warm days in February or March, which are usually followed by severely cold weather. In the latitude of Washington, D. C., it is my experience that *A. inquinatus* has the habit of thus swarming during the first spring-like days of the year, while *A. serval* is abundant during the last warm days of autumn. I am informed, however, that in other localities farther north the latter species is flying about in the first warm days of spring.

terminations were caused by confusion with closely allied European species, *e.g.*, *Anobium pertinax* (=*Hadrobregmus carinatus* Say), *Altica urticæ* (=*Epitrix cucumeris* Harr.), *Altica oleracea* (=*Haltica chalybea* Ill.), etc., but I have not the slightest doubt that all other species identified (no doubt, by Knoch) with European species were collected by Melsheimer in Pennsylvania. A few of these deserve special mention: No. 533 is *Crioceris asparagi*, whose striking coloration precludes an erroneous determination. This record of the occurrence of the Asparagus beetle in North America at the beginning of this century has been entirely overlooked, but it seems probable that the disastrous invasion of this species which took place about 60 years later on Long Island, N. Y., and which has been treated of by Dr. Fitch in his 8th Report, was due to a second importation from Europe.

No. 50, *Onthophagus nuchicornis*, is, no doubt, the type of the species subsequently described by Dr. F. E. Melsheimer as *O. rhinocerus*, the occurrence of which was denied by Haldeman and LeConte, until, many years afterwards, it was found again at various places in the northeastern States (see Mr. S. Henshaw's note in Can. Ent., 19, 1887, p. 160), and also in Pennsylvania.

No. 178 is *Lictus* (*Lyctus*) *striatus*, to which, as a synonym, is added *L. canaliculatus*. Whether or not the *L. striatus* described by the younger Melsheimer is identical with the *L. striatus* of the Catalogue I cannot decide, but so much appears to be certain that our commonest species of Lyctus, so often referred to in our economic literature as the "powder-post beetle" and usually named in collections *L. striatus*, is an introduced species, and I fail to distinguish it from European specimens of *L. canaliculatus* in the collection of the U. S. National Museum.

Not the least interesting feature of the Catalogue are Melsheimer's references to economic entomology. As a matter of course the list of injurious Coleoptera was not as formidable at the beginning of this century as it is now. Some of the most destructive species had not yet been brought over from Europe at that time, and many of our native species were not so injurious then as they are now. They are simply enumerated in the Catalogue, and some of them (*e. g.*, *Chrysobothris femorata*) are not mentioned at all; or at least they cannot be recognized among the manuscript names. The scientific names of those species which Melsheimer considered as especially injurious are accompanied by the popular names, while foot-notes refer to the nature of the damage or even—in two instances—recommend remedial measures. It may be justly doubted, however, whether these recommendations did much good, since they were given in Latin and printed in a book which never had any circulation.

No. 77 is *Melolontha subspinosa* Fabr., Rose-Bug (=*Macrodactylus subspinosus*). Before Melsheimer became aware that this species had been described by Fabricius he had given it the significant name *Melolontha polyphaga*. A foot-note informs us: "*Habitat præcipue in rosarum floribus quos misere destruit.* No remedy is suggested here, and the feeling of utter helplessness against the ravages of this beetle is very well rendered by the word "*misere*."

No. 440 is *Altica segetum*, Earth-Flea (=*Chætocnema denticulata* Ill.). The foot-note: "*Destruit segetes tempore autumnali*" is of considerable interest, because, until quite recently, no species of Chætocnema have ever been referred to as injurious to cultivated plants. In fact, this particular species is never mentioned in our economic literature, but since it is extremely abundant and undoubtedly feeds on graminaceous plants I have no doubt of the correctness of Melsheimer's statement.

No. 545 is *Galeruca cucumeris*, Cucumber-Fly (=*Diabrotica vittata*). Foot-note: "*Pestis hortorum: pellitur oleo resinoso* (Tar) *et sulphure*." The larva and larval habits remained unquestionably unknown to Melsheimer, and the remedies suggested were intended to be used against the beetles. That dusting with flowers of sulphur had some effect may be conceded, but how the "*oleum resinosum*" had to be applied to the vines or to the beetles, I cannot explain.

No. 589 is the Plum Curculio, *Curculio* (*Conotrachelus*) *nenuphar*, to which Melsheimer had given the name *C. persicæ*. In a foot-note he informs us: "*Habitat in Malo persica, larva sub cortice*." It would seem strange that Melsheimer was unacquainted with the true larval habit of the Curculio, but so much is evident that his note is not the result of observation; it simply reflects the notion prevailing at that time among the farmers of York county, Pa. But this note has a history: Harris, in the first edition of his Treatise (p. 67), simply translates it: "The Rev. F. V. Melsheimer remarks in his Catalogue that this insect lives under the bark of the peach tree." In the second edition of his work Harris entirely drops the theory of the subcortical larval life of the Curculio, but it was taken up again by Fitch and Walsh. The former, who had never seen a copy of Melsheimer's book, considerably magnifies and overrates the importance of this note (3d Rep., 52, p. 351): "Fifty years ago, one of the best authorities in our country upon a topic of this kind, Rev. F. V. Melsheimer, of Pennsylvania, stated," etc. Walsh, who never saw Melsheimer's book nor the first edition of Harris, even outdoes Fitch by alluding (Am. Ent., I, p. 11) to Melsheimer's note as a "statement of this most accurate naturalist."

No. 670 is *Rhynchophorus* (*Calandra*) *granaria*, Weevil. Foot-note: "*Pellitur calce viva;*" *C. oryzæ* is also mentioned under No. 672, and with this the *Curculio exoticus* (No. 628) is probably identical, which is said to be "*allatus in oryza.*" The value of the remedy given may be justly questioned, but since this note is attached to *C. granarius* I infer that this was at that time the commoner species, whereas now *C. oryzæ* is the prevailing species.

Prof. Riley expressed himself as greatly interested in the paper. Concerning Melsheimer's note upon the Plum Curculio, he said that Melsheimer's statement was by no means totally incorrect, since Conotrachelus breeds in Black Knot. Mr. Schwarz, however, stated that neither Harris, Fitch, nor Walsh, in their statements, could possibly have meant anything else than that the insect breeds in the healthy twig, and Dr. Riley said that even that statement might be, to a certain extent, correct, and that he had seen the present year many oviposition marks not only in pear fruit but upon pear twigs. Mr. Waite stated that he had noticed the present season a very extensive oviposition in pear fruit.

—Dr. Marx, under the head of exhibition of specimens and short notes, showed an enlarged figure of a remarkable spider from Lower California. It belongs to the Oonopidæ, a well-known tropical family, and is the only spider known to him to possess a sclerite between the coxa and the sternum. This character is co-ordinated with undivided dorsal and ventral plates, and the species has, moreover, only two spinnerets. Mr. Schwarz suggested that this coxal character might have been overlooked in other described species of the same family, and the note was further discussed by Messrs. Gill, Riley, and Ashmead.

—The Corresponding Secretary exhibited two photographs sent in by Mr. A. D. Hopkins, and which indicated the holes and stains made by *Corthylus columbianus* in the 400-year-old tulip tree mentioned in his communication at the January meeting.

—Mr. Ashmead exhibited specimens of *Eudoxinna transversa* Walker, a peculiar Chalcidid from Brazil, which had been placed in the subfamily Chalcidinæ by Westwood, and which he himself considers to be a Eurytomine. He also showed a Diapriine from Brazil, which has a remarkable pronotal projection, and for which he proposes to erect a new genus, Notoxoides, on account of the superficial resemblance of the form to the coleopterous genus Notoxus.

—Mr. Hubbard exhibited specimens of the Colorado Potato-Beetle, collected at Fort Assiniboine, Montana, hundreds of miles from fields of cultivated potatoes. The only potatoes grown at that point occur in a small patch at the fort, and these are not touched by the insects, which breed exclusively upon a wild Solanum growing on the mounds of the prairie dogs. The dogs remove all other vegetation from the mounds, but this Solanum remains. These beetles have, therefore, not come in contact with the cultivated potato, and yet show no variation from the form now common in the East.

FEBRUARY 28, 1894.

President Ashmead occupied the chair, and there were also present Messrs. Uhler, Schwarz, Gill, Stiles, Marlatt, Benton, Marx, Sudworth, Heidemann, Fernow, Kuehling, Dodge, Test, and Howard. There were also present, as guests of the Society, Prof. E. B. Poulton, of Oxford University, England; Prof. Lester F. Ward, Hon. Chas. W. Dabney, Jr., Dr. Frank Baker, Prof. W. H. Dall, Prof. F. H. Knowlton, Mr. F. A. Lucas, Mr. B. T. Galloway, Dr. Tarleton H. Bean, Mr. Richard Rathbun, Mr. Francis E. Leupp, and Mr. Filibert Roth.

President Ashmead introduced Prof. E. B. Poulton, who addressed the Society. The object of his paper was to bring forward a series of illustrations of recent work upon the uses of colors to insects in the struggle for existence.

First, as regards Colors for Concealment, two examples were shown of a method of illustration for popular audiences. An insect is first represented upon some plain background, and then, in a second slide, in its appropriate environment, the slides being so painted and arranged that the insect appears upon the screen in the same place in both, the environment alone undergoing a change. In this way the meaning of the color and shape becomes particularly clear.

Then illustrations proving the derivation of the colors of certain caterpillars from the chlorophyll of their food-plant were brought forward. The green or brown ground color of the larva of *Tryphæna pronuba* was proved to depend upon the chlorophyll of the leaves or upon the yellow etiolin, closely related to chlorophyll. When, however, larvæ were fed upon the mid-ribs of the leaves, containing neither chlorophyll nor etiolin in an available form, the power of producing such ground color was wanting.

Other illustrations showed some of the methods by which the transparent spots and patches are formed on the wings of Lepidoptera in resemblance to holes in dead leaves, either by the loss of scales, as in Kallima, or by reduction of the scales to hairs, as in Attacus.

Recent experiments upon the modification of the colors of lepidopterous larvæ by their colored surroundings were then shown. These experiments have been conducted during the past summer (1893). The larvæ of *Odontoptera bidentata* fed upon the same food-plant and, surrounded by twigs of various natural colors, possessed the power of resembling these latter. When the twigs were covered with lichen, the larvæ possessed the power of developing green spots, resembling the lichen. This part of the experiment was new, such susceptibility having never been previously proved to exist. The same proved to be the case with *Gastropacha quercifolia*, in which the lichen produced gray patches upon the larvæ. In all these larval color changes the result is due to the effect of light, not food.

As regards Warning Colors, two examples from Portchinski's recent work were shown, the first proving that the attitude assumed by the distasteful moths of the genus Spilosoma are such as to display warning colors to enemies. The second example was the wonderful case of the pupa of *Limenitis populi*, which is so marked and colored as to appear to have been wounded.

As regards Mimicry, Col. Swinhoe's recent work upon a group of butterflies related to *Hypolimnas bolina* was shown by illustrations. These butterflies, when traced over the whole of their range as far as it is at present known, were found to mimic the local and unpalatable Euplœa, or in the case of Celebes and Africa, the local Danais. In Africa both males and females are invariably mimetic. On the other hand, in Asia and the Malay Archipelago, as a rule, the females only are mimetic. The closely-related *Hypolimnas misippus* always accompanies *Danais chrysippus*, and its female invariably mimics this butterfly.

Another series of illustrations proved that the loss of scales by transparent-winged Lepidoptera during their first flight is due to the rudimentary form of the stalk by which the scale is attached and of the socket into which it fits. In the case of one moth which was a more perfect mimic of a hymenopterous insect than another, the scales which fall off are more rudimentary, and support the view that the more perfect mimic has passed through a longer history of change than the less perfect one, thus allowing the useless scales to become more degenerate.

Illustrations of the larval form of a Membracid insect which mimics the leaf-carrying ants of tropical America were then brought forward, and it was seen that the leaf is represented by the flattened dorsal part of the body of the Homopteron.

Finally a series of illustrations was given, showing the loss of decorative coloring in the males of certain day-flying moths as the females become progressively degenerate—the degeneracy of one sex and loss of color in the other reaching their climax in the genus Psyche.

Upon the conclusion of the address, which was warmly applauded, Mr. Fernow congratulated the Society upon the opportunity which it had had of listening to what was probably the broadest and most interesting paper which had been presented before it since its organization. He moved a hearty vote of thanks to the lecturer. The motion was seconded by Mr. Howard, and carried unanimously. The hour for adjournment had nearly arrived upon the completion of the lecture, and there was no time for specific discussion, but brief remarks of a general character were made by Prof. Ward, Dr. Dall, Mr. Fernow, and Prof. Poulton.

APRIL 5, 1894.

President Ashmead in the chair, and Messrs. Benton, Chittenden, Gill, Linell, Coquillett, Schwarz, De Schweinitz, and Heidemann were also present.

The following paper was read by the Corresponding Secretary in the absence of the author:

FURTHER NOTE ON THE STRUCTURE OF THE OVIPOSITOR IN HYMENOPTERA.

By C. L. MARLATT.

Having recently, through the kindness of Mr. Howard, obtained a living specimen of *Pimpla conquisitor* Say, I undertook to settle a point in the structure of the ovipositor, as outlined in previous communications before the Society*, which I had not established to my own satisfaction, owing to the impossibility of determining the relation of the parts from dried museum specimens. In examining the living insect the motions of the parts could be witnessed under a hand-glass, and the structure and joints, which before could only be surmised, definitely differentiated. The point in doubt in the previous studies was the manner of union of the inner branches of the spicula (see *a*, *a*, and *b*, Figure 8). As previously described by me, each spiculum sends off an inner branch near the base, and these branches I had previously supposed united in forming a loop of uniform size throughout. In the case of Pimpla, at least, in the living specimen, it was seen that these branches, instead of being united in one piece, are connected by a sort of subsidiary cross-piece, or oscillating lever, *b*, in the ends of which they are joined in a sort of ball-and-socket joint, so that with the alternate motion up and down of the spicula during the action of the ovipositor, either in attempting to sting or in oviposition, the ends of what may be called the *spicule-cross-bar* move alternately up and down in a manner similar to the motion of a steamboat's walking-beam, except that the central support of the walking-beam is lacking. The hyaline integument, which forms the outer covering of the

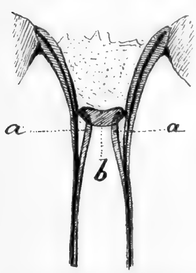

FIG. 8.—Bases of spicula of ovipositor of *Pimpla conquisitor* (original).

* 1. Notes on the Genus Metopius, etc., Proc. Ent. Soc. Wash., vol. ii, p. 101.
2. A study of the Ovipositor of Hymenoptera, l. c., p. 201.

oviduct, joins this cross-bar, and also fills the space between each branch and its corresponding spiculum. The alternate motion of the spicula would seem to require just such a subsidiary sclerite, and I have no doubt that something homologous with it will be found to occur in the case of most hymenopterous insects.

The see-saw motion of the spicula could be easily seen to result from the partial rotation of the spicule plates (shown in part at upper corners of figure), in alternation, on the supports of the ovipositor.

Mr. Heidemann exhibited specimens of the following species of interesting and rare Hemiptera, found near Washington, D. C.: *Abedus ovatus* Stal., *Zaitha anura* H. Schf., *Ambrysus pudicus* Stal., *Hygrotrechus robustus* Uhl., *Hygrotrechus productus*, *Brachymetra albinervis* Am. & Serv.

—Mr. Schwarz presented the following:

DESCRIPTION OF THE PINE-CONE-INHABITING SCOLYTID.

By E. A. Schwarz.

The discovery of a Scolytid infesting pine cones is due to Mr. W. H. Harrington, whose observations were first published in Dr. Packard's Report on Forest Insects, p. 810, and subsequently in Can. Ent., 23, 1891, p. 26. The insect is doubtfully referred by him to *Dryocœtes affaber* or *D. autographus*, and seems to have been collected near Ottawa, Can. What, no doubt, is the same species was observed some years afterwards by Dr. John Hamilton at Sparrow Lake, Ont., and a short note is published by him in Can. Ent., 25, 1893, p. 279. Dr. Hamilton, as well as Prof. A. D. Hopkins, to whom specimens were submitted, came to the conclusion that the species was both specifically and generically different from *D. affaber*. Having lately seen specimens bred from pine cones by Dr. Hamilton, I recognize in them a species which, in 1877, was sent by Mr. Hubbard and myself, with many other Lake Superior Scolytids, to Dr. LeConte, and named by him *Dryocœtes affaber*. It is evident that a confusion of numbers or specimens must have taken place, but, strangely enough, this confusion seems to have spread to various other collections. The reasons why this species has not been described by LeConte in the Michigan List or any subsequent publication I cannot explain.

I offer herewith a description of the species, being solely tempted thereto by the interest attached to its life-history; for, as far as I am aware, there is no other Scolytid known which normally develops within the cones of pine trees.

Pityophthorus coniperda *n. sp.*—Body cylindrical, less elongate, shining, sparsely beset with rather long, erect and serrate hairs; color black, mouth-parts, antennæ, and tarsi reddish testaceous, tibiæ often reddish.

Head more or less retracted into the thorax, very shining, furnished, in both sexes, with but a few hairs, sculpture varying according to sex, but always with a broad, smoother median space; eyes large, acutely, but not deeply emarginate in front; antennal scape straight, gradually thickened apically; funicle 5-jointed: first joint obconical, slightly longer than wide at tip, second joint as long as wide, arising from a very thin base, joints 3–5 transverse. extremely short and closely connate; club large, ovate, longer than the funicle, on both sides shining and sparsely pubescent, fringed with moderately long hairs, and divided by two nearly straight sutures into three nearly equal parts.

Thorax almost as wide as long at base, greatly narrowing apically (when viewed from above), front margin obliquely truncate each side, but not angulate at middle, base straight, margined, side margin acute from the base to apical third; surface much more densely hairy than the head, the hairs mostly suberect, anterior half rather densely but not very strongly tuberculate, concentric arrangement of the tubercles not much evident; median tubercle obsolete; posterior half strongly and densely muricately punctured, a smooth median line of larger or smaller width extends from the middle to near the base.

Elytra at base as wide as the thorax, conjointly rounded at tip, pubescence sparse, long and erect, sculpture consisting of regular rows of moderately coarse, not closely-set, punctures, the first row, and often one or two of the outer rows, slightly impressed posteriorly; first and second intervals very sparsely uniseriately punctured, sometimes nearly smooth, the other intervals with regular series of punctures so that the interstitial series can hardly be distinguished from the striæ; narrow basal margin of elytra irregularly punctured; declivity moderately steep. at middle slightly flattened, hardly retuse and not sulcate, smooth, very shining, traversed by a fine, elevated subsutural stria, which is either crenulate or slightly tuberculate, and limited externally by a tuberculated ridge which is the continuation of the second elytral interval and which is accompanied, internally, by a row of punctures.

Anterior tibiæ with a narrow base and more strongly dilated apically than in the typical Pityophthorus, without tarsal groove, outer edge fringed with rather long, moderately dense hairs and furnished, at apical third, with two strong teeth, the outer one being terminal; middle and hind tibiæ with the teeth less strong and fringed with hairs on inner and outer edges.

Male: Head smooth, except scattered punctures near the eyes, and with a flattened tubercle on the clypeal margin which is continued posteriorly for some distance as a feebly elevated ridge.

Female: Head with small scattered punctures which become stronger and denser at the sides; without clypeal tubercle and elevated ridge.

Length: 2.7–3.3 mm.

Described from several specimens collected by Mr. H. G. Hubbard and myself at the following localities: Marquette, Mich., July 3, 4, and 30; Eagle Harbor, Mich., June 9; Cambridge, Mass., November 11; Fortress Monroe, Va., June 17. I have also seen specimens from the States of New York and Pennsylvania.

This species differs from the generic description of Pityophthorus as given by Eichhoff (Ratio, etc., p. 173) in the structure of the antennæ and the anterior tibiæ, but since several other North American species described as Pityophthorus—even after removal of those which belong to Bedel's genus Pityogenes—present notable structural differences, it would be premature to erect a new genus for an isolated species. Superficially the species is at once recognizable from its large size, its less elongate form and the structure of the elytral declivity.

Since I have never found this Scolytid *in situ* I am unable to add anything to the knowledge of its life-history.

Mr. Schwarz pointed out an interesting feature in the history of the Otiorhynchid *Aramigus fulleri*. A single specimen, found at Cambridge, Mass., by the late Mr. Edw. Burgess, is in Mr. Henshaw's collection, but in 1875 and subsequent years it suddenly made its appearance at many widely distant localities in North America. On the Atlantic slope it occurred usually in greenhouses, rarely outdoors, from Massachusetts to Georgia, being evidently transported from place to place by nursery stock, but since a number of years it has entirely disappeared, except at some isolated localities in the South. In Canada it appeared likewise in greenhouses, and was still present in 1890. In California it occurred outdoors, and was still present in 1892. The species does not belong to the fauna of the Atlantic slope, nor to the Pacific fauna, but since it is evidently an American insect its original home is, in all probability, the central region where allied species and genera occur. We would thus have a case analogous to the invasion of *Doryphora decemlineata*. Some of the original specimens of *Aramigus fulleri* were received by Mr. A. S. Fuller from Montana, in 1875, unfortunately without further particulars regarding mode of occurrence, but neither in that State nor in Kansas and Colorado or further South the species has ever been found outdoors since that time.

—Mr. Schwarz exhibited a larval skin of the Dermestid beetle *Cryptorhopalum triste* which, with the enclosed living pupa of the beetle, had been found early last spring, among insect remains, within a hollowed twig of a tree near Alexandria, Va. He stated that the larvæ of *Cryptorhopalum* have, no doubt, the same habits as those of Anthrenus, except that they do not enter our houses, and that they had not been found before simply because they were mistaken for Anthrenus larvæ. The larvæ of these two genera are very closely allied, and, judging from the only larval skin available for comparison, he had found that the larva of *Cryptorhopalum* superficially differs only in that the hairs of the body, and more especially those forming the anal brush, are much shorter and less numerous than in Anthrenus.

—Mr. Schwarz exhibited pieces of the bark from a sapling of a Paper Mulberry (*Broussonetia papyrifera*), which showed at various places an abnormal growth, consisting of ridges, blisters, and tubercles which produced the resemblance to an incipient Black-knot. The excrescences occurred always above or around such places where a female of the Scolytid *Phlœotribus frontalis* was constructing her gallery beneath the bark, and resulted, evidently, from the irritation caused by the working of the beetle. The galleries of Phlœotribus were by no means completed, and had evidently been commenced only a few days ago, so that the excrescences of the bark had been formed within a remarkably short time. Mr. Schwarz said that no other tree was known to him that reacted in a similar way against the attacks of Scolytids. He also alluded to a paper recently read by Mr. Waite before the Biological Society, in which the author had pointed out that the paper mulberry was more frequently infested by knots, *hexenbesen*, and other kinds of abnormal growth than any other tree.

—He also remarked upon an improvement in the mounting of some small beetles, as invented by Mr. Hubbard, illustrating his remarks by the exhibition of various specimens; as usually mounted on cardboard triangles, a portion of the sternum is hidden from view, but in the present examples the tip of the triangle had been bent obliquely downward, and the beetle is attached to it only by its episternum, thus leaving the sternum free for examination and study.

—Mr. Schwarz also exhibited specimens of the Staphylinid *Oxyporus 5-punctatus*, and called attention to the remarkable secondary sexual characters presented by the male. In this sex the right mandible is greatly enlarged and deformed at apex, and the upper margin of the posterior thoracic angles is sharply turned upward and forms a kind of flap which overhangs a deep excavation at the angle itself. Nothing similar to these characters is seen in any other species of Oxyporus in our fauna. The abdomen has no pubescent spot, and the left mandible in both sexes is armed with a small tooth a little before the middle. In the female the right mandible is simple, and the peculiar excavation of the thoracic angles is merely indicated.

—Dr. Gill asked concerning the relative size in the different sexes among insects. Mr. Ashmead replied that, as a rule among the Hymenoptera, the female is larger than the male, but in the Australian genus *Thynnus* the male is much larger than the female. Mr. Schwarz stated that among Coleoptera, with comparatively few exceptions, mentioning the Lucanidæ and certain Rhynchophora, the female was the larger, and Mr. Linell remarked that in those species of Scarabeidæ the males of which are furnished with horn-like processes on the head or thorax this sex is larger than the female, whereas among those species the males of which do not possess such processes the female is the larger of the two. Dr. Gill stated that probably the greatest disparity between the sexes occurred in the fur seal, the males of which weighed from seven to eight hundred pounds, whereas the weight of the female did not exceed one hundred and fifty pounds.

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MAY 3, 1894.

President Ashmead in the chair, and resident members Benton, Chittenden, Coquillett, Fernow, Gill, Heidemann, Howard, Linell, Marlatt, Riley, Schwarz, Stiles, and Test also present. The following corresponding members were also present: Prof. P. R. Uhler, Dr. John Hamilton, Prof. A. D. Hopkins, and Mr. H. G. Hubbard.

The following were elected Corresponding members: Rev.

Jerome Schmidt, Beatty, Pa.; Mr. David M. Little, 40 Chestnut St., Salem, Mass.

Professor Riley presented some notes on Margarodes and exhibited two necklaces made of so-called "ground pearls," one from Montserrat, the other from Jamaica, the former being composed of larger specimens. The ground-pearls are Coccidæ of the genus *Margarodes* Guilding. He described the finding of these insects in the ground at Montserrat by himself and Mr. Hubbard in February, and detailed further observations by himself upon the same insect in Barbadoes and Jamaica. He read a review of the literature and explained at some length his views as to the formation of the shell. The communication was discussed by Messrs. Hubbard, Uhler, Howard, Stiles, and Riley. Mr. Hubbard stated that he had started to make a list of the plants on the roots of which Margarodes was found, but they proved to be so numerous that he concluded it would be more feasible to make a list of the plants on the roots of which the insects do not occur. They are found in all soils, from hard volcanic soil to the sand of the sea-beach. The activity of the adult insect was vouched for by Mr. C. A. Barber, superintendent of agriculture in the Leeward Islands, in conversation with Mr. Hubbard. Mr. Hubbard himself had found damaged adults. The broods he found to be well defined. He thinks that the shell of the insect may be compared with the shell of the turtle, and that it is composed of infiltrated cast skins. The larval skin splits, and is shoved up at the apical end, forming a cap, and the previous exuvia are pushed further out and to each side, making a succession of caps and four side tubercles. The filaments, he thinks, are of wax, and he has seen them pushed out more than the length of the insect. The shell is apparently chitinous. When placed in strong sulphuric acid it turns black in two days, but if the acid is diluted ever so slightly it does not produce the blackening effect.

Professor Riley considered the shell to be largely a secretion from definite pores, and that this secretion is, by the pressure of the earth, formed into plates something as in Vinsonia and Ceroplastes. Mr. Howard stated that the difficulty with this theory is that the secretion of Vinsonia and Ceroplastes is wax, whereas these plates in Margarodes are chitine. He stated that, in his opinion, the larval exuviæ form a small proportion of the shell, as he had not been able to find, upon close microscopic examination, in any one shell more than two of the scales which showed the larval rostrum.

In reply Professor Riley said that the last speaker must remem-member that all Coccid secretions are not wax; that even in Vinsonia the glass-like lateral secretion is of very different character from the dorsal waxy tuft. Mr. Uhler emphasized this point, and spoke of the varying character of Coccid secretions. Mr. Hubbard said further that in the empty shells small fragments of chitine, trapezoidal in form, and 30 to 40 in number, are found. This fact he considers very significant in connection with the formation of the shell. Dr. Stiles considered it essen-to cross-section the shells, but said that this would be very difficult to do. He advised a combination of the Whitman wax method with the Heider gum-mastic method, and offered to perform the sectioning if specimens were given him for that purpose.

—Mr. Hopkins read a paper entitled :

NOTES ON THE HABITS OF CERTAIN MYCETOPHILIDS, WITH DESCRIPTIONS OF EPIDAPUS SCABIEI, SP. NOV.

By A. D. Hopkins,
(Entomologist, West Virginia Experiment Station).

The rearing of Epidapus and of species of Sciara from scabby and diseased potato tubers, in 1891, led me to undertake some investigations for the purpose of determining the relation of this class of insects to the so-called potato-scab. Some of the facts so far obtained will, I trust, be of sufficient scientific interest to present to this Society as a contribution to the knowledge of the somewhat neglected family Mycetophilidæ.

The authorities Osten Sacken, Schiner, Winnertz, and others, refer to Mycetophilids, or fungus-gnats, as a class or family of insects the larvæ of which inhabit and feed upon fungi, decomposing vegetable matter, animal manures, and like substances. In a recent work, entitled "An Account of British Flies," by Theobald (Vol. 1, 1892, p. 105), the author says: "If, as mentioned in a former page, they do a certain amount of damage to mushrooms, the amount done is small compared with the benefits derived from their existence. The larvæ of these gnats act as scavengers; not only do they do away with rotting fungi, but they cause these often injurious productions to putrefy and become scarce by their destruction."

There are a few records of species of Sciara inhabiting living vegetable matter, but it appears that these observations have not been so substantiated as to leave no doubt in the minds of Osten Sacken and others regarding their correctness. Therefore, even if Sciara species have frequently been met with in injuries to vegetation during the investigation of such troubles, the observer, after referring to the best authorities on the habits of this class of insects, would more than likely fail to detect their true relation to the injury, and blame it to fungi, or to some other insect inhabiting the same wound. It would be natural to conclude that they were present merely for the purpose of feeding in the diseased and decaying matter. This, in connection with the fact that the theory, with reference to insects being the cause of the potato-scab, having been universally discarded, it would appear, has served to remove all suspicion from the so-called fungus-gnats as having anything to do with causing the blemish.

Had I the opportunity of examining the literature with reference to Mycetophilidæ and the diseases and blemishes of potato tubers when the investigations were begun, I have no doubt they would have been discontinued before any important results were obtained. I would have concluded, like others, that the insects were merely feeding on decaying substance. As it was, I had determined all of the principal facts with reference to the habits of the insects and their relation to the injury before I was enabled to examine any really important literature upon the subject. The observations, including my own, with reference to Sciara inhabiting potato tubers may be briefly stated as follows:

At least seven species of Sciara have been bred by European entomologists from what were supposed to be decaying potato tubers. Mr. Walsh, when State Entomologist of Illinois, found the larva of a Sciara inhabiting potato-scab, which he suspected of causing the trouble. I have observed the larvæ of a Sciara and an Epidapus feeding on the living, healthy tissue of potato tubers, and have obtained conclusive evidence that they are capable of causing, and actually do cause, conditions which in one stage would be recognized as potato-scab, and in a more advanced stage would be recognized as a form of potato-rot. When we consider, in connection with these facts, that the so-called potato-scab occurs in all countries where the potato plant grows; that fungus-gnats are also common in the same countries; that all of the conditions recognized as being favorable to the development and promotion of the scab are equally favorable for the presence and attack of the insects, it is convincing evidence, to me at least, that a large percentage of the trouble heretofore attributed to diseases, and other causes, may be brought about by the attack of one or more species of so-called fungus-gnats.

FIG. 9.—Work of *Epidapus scabiei.**

The species which I have found to be especially instrumental in causing injuries and conditions which would be recognized as the potato-scab blemish is a new and interesting Epidapus, for the generic determination of which I am under obligations to Dr. S. W. Williston. I take this occasion to present a full description and figures of the species in its different stages of transformation, under the specific name of Epidapus scabiei, and the common name Potato-scab Gnat.

In order to have better authority than my own limited knowledge of Diptera, I submitted the descriptions and drawings to Dr. Williston, who has kindly revised the more important descriptions, especially that referring to the wing.†

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* Observation 6526a.—Tuber taken from barrel in cellar Nov. 18, 1893. It had recently been attacked by larvæ, which had apparently entered through the stem. (Engraving from photograph, showing character of tuber Jan. 25, 1894, at which time it would have been recognized by the casual observer as ordinary potato-rot.)

† I wish also to acknowledge, in this connection, the kindness of Mr. L. O. Howard, Dr. J. A. Lintner, and Prof. S. A. Forbes, for extracts from works not in our library, and for other special favors.

EPIDAPUS SCABIEI Hopkins, sp. nov.

(The Potato-scab Gnat.)

Order DIPTERA; Family MYCETOPHILIDÆ; Subfamily SCIARINÆ.

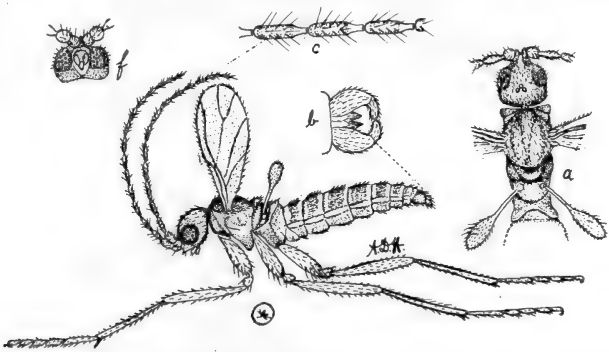

FIG. 10.—*Epidapus scabiei.* Male; enlarged 35 diameters. *a*, dorsal aspect of head and thorax; *b*, genitalia; *c*, middle joints of antennæ; *f*, ventral view of head, showing mouth-parts.

Male: Length, 1 to 1.5 mm. General color, dusky. Head round, dark, pubescent above and on sides, hairs pointing forward. Eyes, black (purple in balsam), situated near front part of the head, widely separated above, margins converging near mouth-parts, with about 75 round, prominent corneæ in each eye, and with a few short hairs projecting from between the corneæ. Ocelli, three, of equal size, arranged in a triangle on vertex, anterior one nearly in line with posterior margin of eyes. Palpi, thick, cone-shaped, curved upward, joints obscure, with truncated pubescent tip;

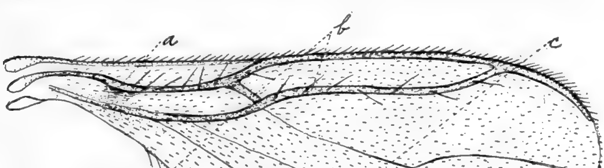

FIG. 11.—*Epidapus scapiei.* Long wings of male enlarged 57 diameters, showing venation. *a*, first longitudinal. *b*, third. *c*, fourth. *d*, fifth. *e*, sixth. *f*, anterior cross-vein on thickened portion of the fourth vein.

also a few long hairs. Proboscis, small, obscure. Antennæ three-fourths the length of the body, 16-jointed, all of the joints covered with short, stiff hairs pointing towards the tip; first and second joints, large; first joint, cup-shaped; second, round and somewhat larger than the first; third, oval, with petiole at both ends; fourth to eleventh inclusive, oblong, each joined to the one succeeding it by a short, smooth petiole; last joint without petiole. Thorax, dark; meso-thorax as wide as the head, with a few short hairs above and larger ones on the side; scutellum prominent, projecting over base of metanotum, and with hairs on tip. Legs long, pale, covered with short hairs; coxa and trochanter together nearly as long as femur; femur, tibia, and tarsus of about equal length; front tibia with one small spur on tip; middle and hind tibia with two small spurs, second one often obscure.

Wings: length .5 to 1.5 mm.; width, .2 to .5 mm. They vary greatly in breadth and length in different specimens, the larger portion (about 80 per cent.) have very short wings, scarcely extending beyond the second and third segments of the abdomen, while others have the wings projecting almost half their length beyond the tip of the abdomen; anterior and posterior margins with long hairs, the surface minutely hairy; hyaline with rainbow reflections; the usual veins of the anterior part much thickened; auxiliary obscure, if not obsolete; the first vein terminates in the costa at some distance before the middle of the wing, the third vein at a considerable distance before the tip; the thickened costa continuous beyond the tip of the third for a distance equal to about half its penultimate sec-

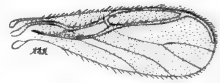

FIG. 12.—*Epidapus scabiei.* Short wing of male enlarged 57 diameters.

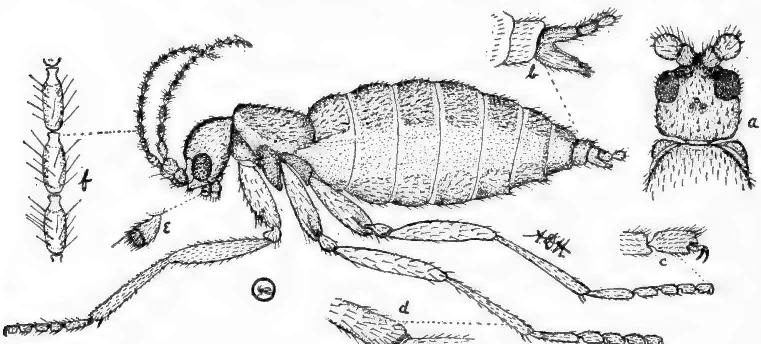

FIG. 13.—*Epidapus scabiei.* Female enlarged 35 diameters. *a,* dorsal aspect of head and anterior portion of thorax. *b,* genitalia. *c,* last joint of tarsus, showing petiole and claws. *d,* tip of tibia, showing spurs. *f,* middle joints of antenna.

tion; the third vein arises near the end of the first at an angle with the second section, which is continuous with the anterior cross-vein, or rather with the thickened portion of the fourth vein, for the anterior cross-vein is wholly obsolete, the prefurca of the fourth vein arising exactly from the beginning of the second section of the third vein; first and third veins with hairs; fourth, fifth, and sixth veins very delicate; furcation of the fourth vein very long; the fifth and sixth veins arise independently from the stout vein at the basal third of the wing.

Halteres long, pale at base; knob dark, bearing a few long hairs.

Abdomen slender, with seven segments, each one with a rectangular, pubescent dark space on the dorsal and ventral aspect; sutures, smooth and pale; a narrow, smooth space along the sides. Second to sixth segments show a pair of pale stigmata. Genitalia: claspers or forceps, pubescent, without claws.

Female: Length 1 to 2 mm. Color lighter than male. Wings and

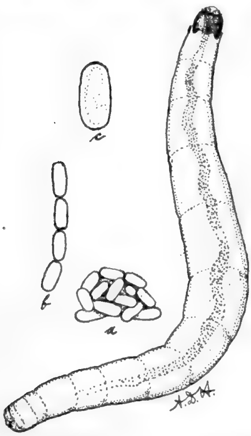

FIG. 14.—*Epidapus scabiei.* Eggs and larva. *a*, eggs in group, as usually deposited. *b*, eggs in string, as they occasionally occur, enlarged 17 diameters. *c*, same enlarged 35 diameters. Larva enlarged 35 diameters.

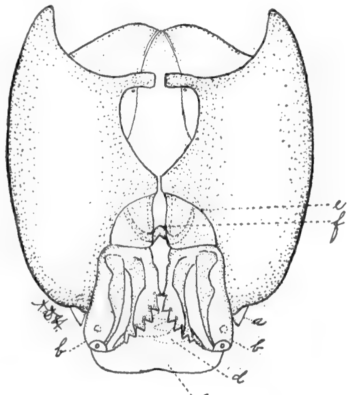

FIG. 15.—*Epidapus scabiei.* Head of larva greatly enlarged; ventral view. *a*, antennæ. *bb*, maxillæ. *c*, labrum. *d*, mandibles. *e*, cardinal piece. *f*, labium (?).

halteres obsolete. Head dark, round from above, slightly flattened from side; eyes, small, appear round from above, differ from those of male in being truncated next to the mouth-parts; widely separated above and beneath, with about 40 corneæ. Ocelli same as male. Palpi and proboscis somewhat larger than in the male. Antennæ short, 16-jointed; tips extend to anterior suture of first abdominal segment; joints shorter and thicker than in male, with shorter petioles.

Thorax short, width of head; meso-thorax with parallel sides, not conical as seen from above; the scutellum compressed, forming a margin across the base of the meso-thorax.

Legs shorter than those of male; otherwise the same.

Abdomen, with seven segments, much extended or incrassate before eggs are deposited, the sutures forming wide, pale bands between the dark pubescent rectangular spaces on the segments, and with a wide, pale, and smooth space along the sides. After the eggs are deposited the abdomen is much contracted, being slender, dark, and without pale bands. Tip, attenuated; not necessarily decurved. Genitalia, pubescent. Lamellæ free, anterior oblong, flattened; posterior round, flattened.

Egg: Length .25 mm.; white, oblong.

Larva: Length 4 mm.; width .5 mm.; body, white, with jet-black head.

Head (dorsal aspect) as wide as it is long. Occipital lines approach each other beyond the middle, and join in a lanceolate point at the posterior margin, with three minute shining spots like ocelli arranged along the outside of each line, and one on the inside about the middle.

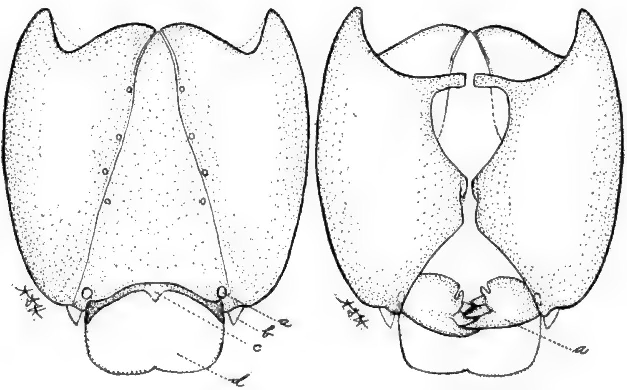

FIG. 16.—*Epidapus scabiei.* Left figure, head of larva, dorsal view, greatly enlarged. *a*, ocelli. *b*, antenna. *c*, horny frame of labrum. *d*, labrum. Right figure, ventral view. *a*, mandibles, showing position when closed.

Antennæ short, fleshy, cone-shaped, and transparent; situated at base of mandibles, and at anterior end of occipital lines. Ocelli just above base of antennæ. Labrum large, projecting beyond tip of maxillæ; fleshy, transparent, with black horny frame at base.

Ventral aspect shorter than dorsal. The horny plates (genæ) are joined by narrow strips at the posterior margin, and at the middle, leaving an open cordate space one-third the length of the head. There are also two small open or light spaces in the trophi; one rectangular between the cardinal pieces of the maxillæ; the other triangular, situated between the base of the maxillæ. A small V-shaped, horny piece, probably a rudimentary labium, separates these two small open spaces, and joins together the cardinal pieces of the maxillæ at their base. Maxillæ large, flattened, horny pieces, with rudimentary palpi in a pale spot at their tips; inner edge serrated, with four large and two small teeth; outer edges thickened, with two dark, longitudinal elevations and a pale spot posterior to the palpi. When closed, they conceal the mandibles and a greater part of the labrum.

Mandibles black, with four teeth, the first and second large and fitting together when they are closed; the third smaller, and situated above the other three; the fourth at right angles with the first, on the same level, and pointing back. The teeth of the mandibles come together just above the four larger teeth in each of the maxillæ, thus forming, as it were, a double set of mandibles. Body cylindrical, elongated, smooth, shining, and transparent, showing distinctly the internal canal. Slightly thicker in the middle than at each end. With twelve segments, sutures and stigmata obscure.

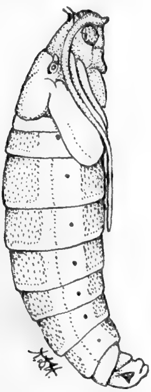

FIG. 17.—*Epidapus scabiei.* Pupa, lateral view, enlarged 35 diameters.

Pupa: Length 1 to 2 mm.; white, changing to dark before the imago emerges. Appears to have nine abdominal segments, the eighth and ninth encasing the genitalia. Abdominal segments pubescent above and below. The legs are applied to the breast. Antennæ joined in front, bent around the eyes, and lying between the legs and the wing-pads. As viewed from the side, the base of the antenna projects in an obtuse point. Two acute conical horns in front, each bearing a long bristle; also two similar horns without bristles just in front of the prothoracic stigma; the latter being small protuberances situated a little above the base of the wing-pad. Seven abdominal stigmata are distinctly seen on the side; as viewed from above, those on the second to sixth segments appear as brown, nipple-shaped projections. The last abdominal (or the genital segment) bears two triangular, flattened horns on each side above, and two fleshy, short protuberances, like prolegs, beneath.

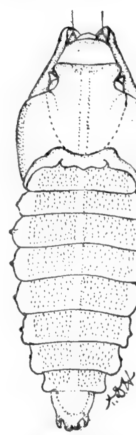

FIG. 18.—*Epidapus scabiei.* Pupa, dorsal view, enlarged 35 diameters.

The female pupa is distinguished from the male by its large size and by the eyes only, since, remarkable as it may seem, the wing-pads are quite as distinct on the female pupa as on that of the male. The pupæ before me are sufficiently advanced to show the female organs through the transparent pupa-skin. After the pupa is a day or two old, the eyes are distinctly seen; those of the female being much smaller, rounded above and truncated next to the mouth-parts, while the eyes of the male pupa are larger and more ovate, the margins converging next to the mouth-parts.

Described from a large series of live, alcoholic, and balsam specimens, bred from tubers reared from specimens collected in the greenhouse. Types in collection of West Virginia Agricultural Experiment Station.

Habits.

The adults are very rapid in their movements, abruptly stopping and starting at short intervals. The short-winged males seldom attempt to fly, but like the wingless females, when alarmed, conceal themselves in the soil, or in the substance infested by them. The long-winged males under the same conditions escape by flight. The females are sometimes seen to leap like fleas. They readily move about through loose earth, and have been observed to go into the soil for considerable depth. They deposit from twenty to thirty eggs, which hatch in five to six days. The larvæ move about freely through damp soil and in the substance on which they are feeding, and, at times, they are quite active. They may occur singly or in great numbers, massed together in the substance infested by them. They appear to spin a web wherever they go, and if the substance upon which they are feeding is exposed to the light they will quickly spin a web over the surface in order to conceal themselves beneath it. Under favorable conditions, they will cease feeding in seven or eight days after they are hatched, and, after wandering about for a short time, they proceed to make a cocoon, apparently of silk, in the soil, or in the outer portion of the substance inhabited by them, and in about three days they change to pupæ, the adults emerging in three or four days after. The female commences to deposit eggs in five to six days after she emerges, and usually dies soon after performing this duty. Thus it will be seen that, under favorable conditions, a brood or generation may develop every twenty to twenty-five days.

Fig. 19.—Work of *Epidapus scabiei.*

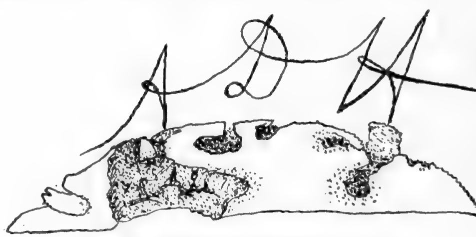

Fig. 20.—Work of *Epidapus scabiei.*

This species has been reared from potatoes obtained from different sections of our State (West Virginia) and from seed tubers received from Philadelphia. It has also occurred in the new greenhouse at the station in great numbers during the past winter, and was reared from ordinary potting soil, from stable manure, and was found common in all stages in the mushroom bed in the greenhouse.

That the larvæ will feed upon and develop from eggs to pupæ in the healthy substance of the potato tuber there can be no doubt, since I have repeatedly demonstrated the fact by transferring the eggs and young larvæ to slight wounds in the skin of the tubers; also by placing healthy young tubers with infested ones in the breeding jar. That the wounds inhabited by them are not necessarily extended by the action of fungi or bacteria is evident from the fact that a wound which is being rapidly extended by the larvæ will cease to enlarge and commence to heal, or form cork cells, as soon as all of the larvæ are removed.

Figs. 19 and 20 (Experiment 6520a) show result of scarified tuber placed in breeding-jar with tuber infested with larvæ. Experiment commenced March 3, 1894. The initials A. D. H. were made with the point of a needle, by just breaking through the skin of a healthy tuber. On March 10th large number of larvæ were feeding in the wounds. On March 15th the larvæ had entered deeply into the substance (Fig. 20); photographs and drawings made and experiment ended. Specimens as illustrated preserved in alcohol.

Dr. Williston, to whom I sent specimens of this species, refers to it, in a letter dated March 20, 1894, as follows:

"The form is of especial interest, as the male has been heretofore unknown. But a single species of the genus is known (*Epidapus venaticus* Haliday), and that has been rarely seen. I have gone over the subject very carefully, and have no doubt whatever but that it is a true Epidapus. Schiner and Winnertz both thought that the female was a wingless Sciara, but the male offers sufficient characters to distinguish the genus in itself."

The long wing of one form of the male would place the species with the Sciara, but the difference in the mouth-parts and genital organs, antennæ, tibial spurs, and tarsus are sufficiently distinct to separate it from Sciara.

The only difference I find from Schiner's description of Epidapus is in the palpi, which are referred to by him as having four joints. In the large series of examples examined, I have in every case utterly failed to find a jointed palpus, but, instead, the inverted cone-shaped organ described and figured. However, I am not ready to say that the joints are obsolete.

The fact that a large percentage of the males have short wings, while others have very long ones, is of interest. I have reared and taken these short-winged forms under the most favorable conditions for the full development of the wings, yet we often find all of them with short wings. I also find the long-winged forms developing under unfavorable conditions. What seems most remarkable, however, is that in a large number of specimens reared from eggs taken from a jar, in which all of the males apparently had short wings, all of the males hatching from the eggs had long wings.

Three species of Sciara have been bred from potato tubers during the investigation referred to. One of them was determined by Dr. Williston as *Sciara aliata*. Another he determined as probably a new species, which I will refer to, in this connection, as Sciara species No. 1. I have recently reared the other species, which I will mention as Sciara species No. 2. The larvæ of species No. 1 were found to have similar habits to those of *Epidapus scabiei*, and can scarcely be distinguished from them, except that the Sciara larvæ are larger. The abundance of this species in flower-pots in the greenhouse and in windows and flying in the open air indicates that it must be quite common.

Sciara species No. 2 was reared from tubers showing the characteristic injuries caused by Epidapus and Sciara species No. 1. The larvæ and pupæ were found in the dead tissue, but the larvæ were not observed, like the others, to feed on the living tissue.

With the mass of evidence resulting from the extensive modern investigation of the so-called potato-scab and the potato-rot, which goes to prove that all forms of both these troubles are due to parasitic fungi and bacteria, together with the fact that the insect theory, with reference to their cause, has, it would appear, been universally discarded by European and American investigators, it would seem the height of presumption upon my part to claim that these insects are the cause of certain forms of both scab and rot, or at least what are recognized as such.

While I admit that one or more forms of the so-called potato-scab may be due to the action of fungi, and that the true potato-rot is a fungous disease, I am confident that there are forms heretofore recognized as scab and rot which are not due to fungous disease, but are the direct result of the attack of insects belonging to the family Mycetophilidæ and to the genera Sciara and Epidapus.

Morgantown, West Va., *May 1, 1894.*

The paper was briefly discussed by Messrs. Riley and Gill. Professor Riley asked whether it was necessary to make a wound in the potato before the larva would feed upon it. Mr. Hopkins replied that this was necessary with old potatoes, but that the larvæ do not need an artificial orifice in feeding upon sound young potatoes. Prof. Riley remarked that the statement that the entomologists had abandoned the idea that scab is caused by insects was incorrect. He thought that no one insect is concerned in the work. Several larvæ are in the habit of wounding potatoes, and just as the so-called scab upon apple is variously caused, so does scab upon potatoes arise from several different causes. Mr. Hopkins said that he had been misapprehended, and that mycologists—Thaxter and Bolle, for instance—had contended that the insect theory must be abandoned. Mr. Gill asked how long the scab is in developing. Mr. Hopkins replied that the feeding period of the larva is about seven days. It may work a short time and produce a scab of one appearance, or it may work a longer time and produce a larger and more serious scab. It may also work until the potato is practically destroyed, and resembles one affected by an advanced stage of rot. The true potato-rot, however, has a very offensive odor, whereas potatoes destroyed by these larvæ have no such odor. No mould or rot sets in while the insects are at work, but when they cease feeding both mould and decay set in.

—Professor Riley exhibited a series of West Indian Termites, comprising *Eutermes morio* and *E. rippertii*, the latter having been found in Jamaica. He briefly distinguished the species and said that he had opened more than forty nests. He showed that there is no regularity in the sexed occupants, some of the nests being queenless while others had several queens. Sometimes the queen would be without escort, and sometimes she would have two or more males.

—Mr. Benton exhibited a nest and living specimens of a Melipona, possibly *M. favosa*, ordinarily known as the Bottle Bee of the West Indies, which had been brought home by Mr. Hubbard from the Island of Montserrat. These were actively at work and Mr. Benton explained the structure of the hive. Some little excitement was caused by the exhibition of a colony of free live bees until it was remembered that the Meliponæ are stingless.

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JUNE 7, 1894.

The President, Mr. Ashmead, in the chair, and Messrs. Riley, Schwarz, Coquillett, Marx, Sudworth, McGee, Stiles, Johnson, Pergande, Heidemann, Fernow, Benton, De Schweinitz, Chittenden, Waite, Linell, Pratt, Gill, Howard, Marlatt, Kuehling present. Mr. Chas. Palm, of New York city, was elected a corresponding member.

President Ashmead made some brief remarks, congratulating the Society upon having attained its one hundredth meeting and upon its prosperous career and prospects.

—The Recording Secretary, Mr. Howard, read the following:

A REVIEW OF THE WORK OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

During the First Ten Years of its Existence.

By L. O. HOWARD.

It is so true and self-evident as to be almost trite that those exalted personages who have charge of the destinies of nations should be thoroughly informed in the history of the nations which they govern, in order to be best fitted to control their future intelligently and successfully. It is equally true that it behooves the individual to pause at certain periods of his career and indulge in retrospect—to weigh his past actions and their results; to indulge, it may be, in regrets, vain in semblance, but instructive and useful in their possible influence upon his future. So, since this Society, which we have all helped to build up, has worked steadily away for ten years without a stop, this one hundredth meeting affords us a chance to look back over what we have done and to acquaint ourselves with the results and with the means by which they have been brought about, and such a review of our uneventful but steadily prosperous career it has fallen to me to prepare.

For several years before the foundation of this Society there had been a strong feeling among the few of us associated in the Department of Agriculture that an entomological society was almost a necessity, and in February, 1884, Dr. Riley, Mr. Schwarz, and the writer drew up the call which resulted in the founding of the "Entomological Society of Washington." The prime mover and person with whom the idea really originated was Professor Riley.

The meeting for organization was held at Professor Riley's house, February 29, 1884, and was attended by Dr. W. S. Barnard, Mr. Albert Koebele, Judge Lawrence Johnson, Mr. B. P. Mann, Rev. Dr. J. G. Morris, Prof. C. V. Riley, Dr. A. J. Shaffirt, Mr. E. A. Schwarz, Mr. A. H. Stewart, and Mr. L. O. Howard. Letters were read from Capt. T. L. Casey, Mr. C. R. Dodge, and Prof. John Murdock. That Nestor of North American entomology, Dr. J. G. Morris, occupied the chair.

Salient events in the history of the Society have been almost entirely lacking. We have worked steadily along, making no particular noise in the world. We have been satisfied with a small beginning and in a slow but steady improvement, believing that the safest method is to feel our way slowly and establish ourselves upon solid ground as we proceed. There is little, then, in our history except a recital of those slow steps and a grouping of dry figures. We met for a while in the lecture-room of the National Museum, through the courtesy of Prof. Baird and Prof. Goode, but the desirability of introducing the social element soon forced itself upon us, and the ease with which this could be accomplished with so small a society was so apparent that at the close of the second year the meetings began to be held at the houses of members. The three preliminary meetings for organization were held at Professor Riley's former residence, 1700 13th street, and the seventeen meetings immediately succeeding were held in the Council Room of the National Museum. The change just indicated was signalized by the eighteenth regular meeting, which was, upon invitation, held at the residence of Dr. Marx. Dr. Marx was followed in regular order by Messrs. Howard, Schwarz, Smith, Heidemann, and Mann, and these six members, together with Professor Riley, took turns in entertaining the Society up to the thirty-eighth meeting, when Dr. Fox entered the list of hosts. The 62d meeting was held at Mr. C. R. Dodge's and the 70th and three later meetings at Mr. Fernow's. When the 76th meeting was reached the so-called "bachelor members" of the Society, having accepted for so many months the hospitalities of the married members, entertained the Society at Faber's Hall, and this they have done three times since. Mr. Ashmead acted as host at the 84th meeting and Professor Gill at the 99th. The list, then, stands as follows: National Museum, 17; Professor Riley, 14; Mr. Schwarz, 12; Dr. Marx, 12; Mr. Howard, 9; Mr. Heidemann, 8; Dr. Fox, 8; Mr. Smith, 4; Mr. Mann, 4; Mr. Fernow, 4; the "bachelor members," 4; Mr. Ashmead, 2; Mr. Dodge, 1; Dr. Gill, 1. Out of this whole list Dr. Fox's hospitality stands out, since he was a member of the Society for a comparatively short time and yet entertained it on no less than eight occasions. In corresponding proportion Professor Riley, Dr. Marx, and Mr. Schwarz follow close behind. All of the annual meetings have been held at the residence of

Professor Riley, with the exception of that for 1892, which was held at Mr. Howard's. Too much cannot be said in support of the semi-social feature which the Society has introduced in its meetings. It would be difficult to estimate the influence which this move has had upon the success of the Society, but it must have been great. Scientific men of other societies who have attended our meetings, and who have, in fact, joined our ranks, have said that the Entomological Society of Washington is the livest society in the city and that its meetings are the most interesting.

Our present plan, however, is possible only with a small society and cannot be followed by an organization having an average attendance of much more than 20.

This brings me naturally to a consideration of the attendance at our meetings. I find that at the 99 meetings which we have held there has been a total attendance of 1,090 and that the average attendance at each meeting has, therefore, been 11. The highest number attending any one meeting was at the 97th, when we were addressed by Professor Poulton, of Oxford, England, when 27 persons were in attendance. The smallest number at any one meeting has been four. If we take it right through the whole ten years, this attendance has been very satisfactory, since we began with a resident membership of 17, several of whom took a very slight interest in the subject and never attended a single meeting, and since we have now a resident membership of about 30.

Our list of non-resident or corresponding members was begun by the removal of resident members from Washington, and it was not until 1893 that a special effort was made to increase this list. At that time letters were written to a number of entomologists, suggesting that they might consider it advantageous to join the Society, and as a result our corresponding list now numbers 86, including nearly all of the most prominent entomologists in this country and a number from other parts of the world. The total number of members of all classes who have been connected with the Society, either as residents or correspondents, reaches 133.

The standing of a society, however, must be judged not by the number of its members, but by the character of the papers presented before it and by the comparative number of its members who have taken an active part in its discussions. In these respects our Society need not fear comparison with other working societies. A careful analysis of the facts as displayed in our minutes shows that 47 persons have read papers before the Society, having presented 341 more or less formal communications. Ninety-four persons have exhibited specimens and many have presented short notes. Of the 341 formal papers, all of which have been published, either in full or by abstract, in our proceedings, 257, or more than $\frac{2}{3}$, have been read by 9 members, viz., Messrs. Schwarz, Riley, Howard, Marx, Smith, Ashmead, Townsend, Marlatt, and Lugger. We need not look far for the most prolific member of the Society. Every one present could pick him out without a suggestion from me. Mr. Schwarz has read 65 papers before the Society, or more than $\frac{1}{5}$ of the whole number of papers presented. He has averaged about $\frac{2}{3}$ of a paper at every meeting. Not very far behind him comes Professor Riley with 49 papers. Frequent absence from Washington, no doubt, accounts for the fact that Professor Riley does not head the list. He has, however, nearly made up for these absences by activity when present, and on one occasion he read no less than four papers at the same meeting. Following Professor Riley come Mr. Howard with 37 papers, Dr. Marx with 33, Dr. Smith with 23, Mr. Ashmead with 15, Mr. Townsend with 13, Mr. Marlatt with 12, and Professor Lugger with 10. Dr. Fox in the comparatively short term of his membership read six papers, and Mr. Hubbard has read the same number. Mr. Heidemann has presented five, and Mr. Hopkins, with an active interest in the Society which other neighboring corresponding members should imitate, has also presented five. Mr. Mann, Judge Johnson, Mr. Banks, and Mr. Fernow have each presented four papers. Dr. Horn, Mr. Dodge, Mr. Ulke, Professor Uhler, Mr. Chittenden, and Dr. Stiles have each presented three papers. Captain Casey, Mr. Pergande, Mr. Sherman, Dr. Bergroth, and Mr. Benton have read two each, while Dr. Barnard, Professor Murdoch, Professor Osborn, Mr. Liebeck, Mr. Coville, Baron Osten Sacken, Mr. Linell, Mr. Richardson, Mr. Mally, Professor Summers, Dr. Gill, Professor Doran, Professor Poulton, Mr. Cockerell, Mr. Davis, Mr. Masius, and Mr. Webster have read one each; making a grand total of 341, or an average of from three to four papers at every meeting which the Society has held.

It is in the character of the papers presented that our Society differs rather widely from any other entomological society in existence, so far as I am able to judge, and the most distinguishing feature, when we glance over the list of papers as a whole, lies in the fact that the habits of insects, their life-histories and transformations, and topics of wider range have engaged our attention to a much greater extent than bare, systematic papers. It has resulted from this fact that our proceedings are widely read and are found to be of more general interest than the publications of other societies. A well-known entomologist, writing to the Corresponding Secretary in acknowledgment of the receipt of one of the numbers of our proceedings, stated that he picked it up after dinner and only laid it down at midnight having read carefully every word within its covers. Can you imagine that any entomologist, no matter how strong his interest in the subject, could keep himself from falling asleep over the pages of the publications of any of our contemporary societies after a hard day's work and a good dinner?

Of the papers read 107 have treated of the habits or transformations of insects; 24 have treated of the geographical distribution of insects or of the characteristics of the insect fauna of more or less restricted regions; 13 may be classified under the head of economic entomology; 9 have delt with bibliographical topics; 9 can be classified only as general papers, including a variety of topics; 9 have been devoted to the consideration of some one or many phases of parasitism; 6 have been biographical in their character; 5 have been devoted to questions of technique; 4 have considered insect physiology; 4 have treated of the insect faunas of certain plants; 4 have been devoted to evolutionary topics as evidenced in entomology; 3 have discussed collecting methods; 3 have touched upon insect products; questions of synonymy have received treatment in 2 papers; the relations of flowers and insects have been discussed in 2; poisonous insects in 2; cave insects, the edibility of insects, the relations of birds and insects, and mimicry have been treated in 1 paper upon each topic. One paper has been historical in its character. The seasons of insects have been treated in 1 paper, and 1 paper has been given before us on the subject of Nematodes.

Among the orders of insects, we have paid the most attention to the Coleoptera. Messrs. Schwarz, Riley, Smith, Lugger, Horn, Ulke, and Linell are responsible for this preponderance of coleopterological papers. In all, 91 papers relating to this order have been read. Second in rank comes the order Hymenoptera. Messrs. Ashmead, Marlatt, Riley, Pergande, and Howard, with one or two others, have presented 58 papers referring to this order. The order Lepidoptera has been presented by 36 papers, which were mainly presented by Messrs. Smith and Riley, although Messrs. Lugger, Marlatt, and Schwarz are also represented in this list. Upon the insects of the order Hemiptera we have listened to 22 papers. On Diptera 19 papers have been read. Upon Orthoptera 7 papers have been read, and upon Neuroptera and Pseudo-Neuroptera 4. There has been a very large number of papers presented upon different phases of the study of the Arachnida. The Society has been fortunate in possessing among its members so eminent a student of this group as Dr. George Marx. He and his co-laborers, Messrs. Fox and Banks, have read 49 papers upon this class, and to this fact is due the presence upon our list of corresponding members of the names of Thorell, of Montpellier, and Kulszynski, of Cracow.

The lack of systematic papers is evidenced by the fact that in running over our Proceedings I notice descriptions of but 95 new species and 13 new genera. The absence of papers of this character undoubtedly adds to the readability of our Proceedings, but it is a question whether a more frequent publication of careful work of this character would not establish for the Proceedings a more ready sale. Most entomologists are systematists, and the possession of copies of the descriptions of all species in the group which one is studying is almost a *sine qua non* to one who is working upon classification.

Upon this point it may be stated that the majority of the active members of the Society are entomologists by profession. Our Proceedings offer a channel of publication for notes of the character indicated above, but these notes by no means comprise even a large proportion of the working output of the contributors. Their economic results find space in the publications of the Department of Agriculture, while the results of their systematic labors are published in the Proceedings of the U. S. National Museum or in the transactions of learned societies. Our own Proceedings would be overwhelmed with matter of a systematic character had we the means to publish more extensively, and this brings us to the question of funds.

We have published in all, in the ten years of our existence, 785 pages, and this has cost us $1,457.43, as I am informed by the Treasurer, Mr. Schwarz, who has drawn up for me the figures which I shall now use. The cost of printing has been divided as follows:

April 6, 1886, Vol. 1, No. 1, - -	$52.58	
March 19, 1888, " 2, - - -	146.88	
April 6, 1889, " 3, - -	128.25	
June 6, 1890, " 4, - - -	207.25	
Volume I complete, - - - - - -		$534.96
April 8, 1891, Vol. 2, No. 1, - -	$273.27	
July 2, 1892, " 2, - -	216.35	
January, 27, 1893, " 3, - -	157.00	
July 19, 1893, " 4, - -	144.00	
Volume II complete, - - - - -		$790.62
April 6, 1894, Vol. 3, No. 1, - -	$131.85	131.85
Total Proceedings, - - - - - -		$1,457.43

Printing has naturally been the main expense of the Society. The other expenditures have amounted in all to $65.06, or an average of about $6 per year. Of this amount the Society's share in the publication of the Joint Directory of the Scientific Societies of Washington has, in the three years in which we have been represented, consumed nearly $32. The total amount which has been collected since the Society started has been $1,643.76, of which, as above stated, $1,457.43 has been expended for publications and $65.06 for other expenses, leaving a balance of $121.27 still in the treasury. Of this amount $770.69 was contributed for the specific purpose of publication, voluntarily and by a comparatively few members of the Society, and the balance was derived from dues and the sale of Proceeding,—$630.14 from dues and $235.49 from sale of Proceedings.

The great need of the Society at the present time is a permanent publication fund of from $10,000 upwards, and members are earnestly requested not to lose a single opportunity to press the importance of such a donation to science in particular, and to the world at large, upon chance millionaires of their acquaintance. This reminder may seem somewhat farcical, but I happen to know that one enthusiastic member has already approached two men of large means, without, I am sorry to say, accomplishing the result. He has retired from each encounter filled with the idea that the average millionaire is poorer than the average government clerk.

So long, however, as this country possesses men of the stamp of Smithson, Rockafellar, Stanford, Clark, Cornell, Jesup, and many others who might be mentioned, the Society need not despair.

Who knows but a clause may be found in the will of some one of the men who are already active members of our Society, which will put us upon a firm financial basis? We are not looking for ward to the demise of any of our wealthy members, and hope that they may be with us for many years to come. When, however, full of years and full of honor, they prepare themselves for the inevitable end, let us hope that, while the claims of family must be paramount, a little slice of their accumulated riches may be left to the struggling organization upon which they have shed the lustre of their names.

This one hampering question of means settled, the Society possesses within itself the qualities of strength, vitality, and ability which will, without doubt, place it among the foremost entomological organizations of the world.

—Mr. Pergande read the following:

ADDITIONAL OBSERVATIONS ON THE HABITS OF AMMOPHILA GRYPHUS SM.

By THEO. PERGANDE.

Since my observations on the habits of this species, published in the Proc. Ent. Soc. of Washington, Vol. II, No. 2, June 27, 1892, I was fortunate to meet this species again in the same locality and to note a few more of its characteristics while in the act to provide for its future offspring.

On the twenty-ninth day of September, while leisurely walking up hill on the same slope where the first observation was made, and while near the top of this slope, I noticed suddenly, in a rather sandy section, which was almost bare of vegetation, save a few isolated tufts of grass or a few other plants, one female of this species, running briskly about, with her head quite close to the ground, as if in search for something of more than usual interest. After travelling about twenty feet, in a more or less straight line, stopping here and there to investigate the surface of the soil and its surroundings, she came to a perfectly bare spot, where she stopped for a few moments and scratched the surface slightly, so as to form a very shallow depression, after which she commenced to retrace her steps in a somewhat roundabout way, describing in her wanderings an elongated ellipse, stopping again here and there to investigate the surroundings, till she reached a bare spot in the vicinity of an oak, where a larva of *Heterocampa subalbicans* was stretched out on the sand, dead to all appearances, though perfectly fresh, as if but recently killed, and which, no doubt, had been stung and temporarily deposited on the sand until it could be disposed of. After finding it again, she straddled it, took hold of it not far from the head and travelled with her load in an almost direct line to the spot which she had marked previously. Arriving at her destination, she laid down the larva and commenced in earnest to dig a hole for its reception; the whole operation lasting but a few seconds. After finishing the chamber, she came out, took hold of the larva, dragged it to its destination at the bottom of the chamber, and remained with it for about two minutes; after emerging again, she remained in front of the opening for a moment and uttered a sound like "ched ched," then took a small pebble, rolled it into the opening and scraped a little sand after it; another pebble was added and more sand scraped in, the insect uttering meanwhile the same sound. After this, the hole was gradually filled up and the sand tightly pushed in, till full, when the remaining material was carefully scraped over the entrance so that scarcely a trace of her work was left, the whole operation lasting about twelve minutes. After this was done, she left, but I caught her.

—In a paper entitled "Observations on the mating of queens of *Apis mellifica*," Mr. Frank Benton alluded to the great interest which ancient naturalists manifested in regard to reproduction among bees and the mystery surrounding the subject, and cited the views of Swammerdam, De Braw, Réaumur, Huber, and other noted investigators of bee-life during the past century. He described experiments made by Réaumur and Huber to secure artificial fertilization of queens. This was followed by a brief statement of the facts as now known regarding the flights and mating of queens of various races of *Apis mellifica*, especial mention being made of the view universally accepted at this time that the queen mates but once during her life. In proof of the error of this view, Mr. Benton quoted from his note-book for 1886 the records, unpublished as yet, of two queens bred by him in Cyprus which he had watched closely and which mated the second time; and he also cited a record published in the *Deutsche illustrierte Bienenzeitung* for August, 1893, by K. Befort, wherein it was stated that a certain queen had mated twice, the second time two days after the first. Mr. Benton believed these three observations were made with sufficient accuracy to prove beyond doubt that queens do in some instances mate twice, notwithstanding the fact that for a half century or more the opposite view has been held.

The paper was discussed by Messrs. Riley, Benton, Gill, Schwarz, and Pergande. Professor Riley stated that with the bottle-bee of the West Indies two or three or even five eggs are enclosed in each cell and that all but one of these must perish. Mr. Benton said that with Melipona all of the eggs are laid in cells, which are sealed before the larvæ hatch, but in the hive-bee the cells remain open even to the end of the feeding period and the workers remove the superfluous eggs. Dr. Gill remarked upon Mr. Benton's ability to recognize individual queens and asked whether he could explain how he did it. Mr. Benton replied that it was very hard to say. It is a question of general appearance, size, color, shape, actions, and other points combined to produce an individual. Mr. Schwarz asked whether there is a double mating among the ants. Mr. Pergande replied that the queens live several years, but nothing is known as to whether they mate more than once. In his belief a single mating suffices. Mr. Schwarz stated that with the white ants all observers agree that no one has ever seen a copulation. This must take place within the nests, and the queens are so long-lived that there must be several matings.

—Mr. Schwarz spoke on the composition and extent of the Coleopterous fauna of Alaska in connection with Dr. Hamilton's recently published catalogue. He gave an outline of the history of the entomological exploration of that country, commenting more especially upon the thoroughness of the Russian explorations in the earlier half of the present century. The greatest number of the species, as described or enumerated in ount Mannerheim's well-known "Contributions," form an extremely well-defined division of the boreal faunal zone, the extent of which is much larger than it has hitherto been accepted by entomologists. As a result of a short trip undertaken by Mr. H. G. Hubbard and Mr. Schwarz in 1892, through parts of Oregon, Washington, and British Columbia, Mr. Schwarz stated that along the coast range of Oregon and Washington this Alaskan fauna still predominates, so that the number of species said to be peculiar to Alaska must be greatly reduced. This fauna extends from the base of the peninsula of Aliaska into northern California, its southernmost representatives occurring in the more elevated portions of the Santa Cruz Mountains. It occupies the narrow strip of the coast range region, which, north of Puget Sound, is broken up into numerous islands, and the western slope of the Cascade Mountains south to a point not yet definitely ascertained, but probably not attaining the Columbia river. It is very rich in characteristic species which do not occur elsewhere. Another faunal region includes the peninsula of Aliaska, the Aleutian Islands, and the southern part of the west coast of Alaska. It extends to the Asiatic side of Behring Sea, but contains but few characteristic species. The fauna of continental Alaska, although but little explored, does not appear to possess any species peculiar to itself and is plainly only a westward extension of the boreal fauna of North America and in no way different from the fauna of the Rocky Mountain system or that of the Lake Superior region.

This paper was discussed by Dr. Gill, who stated that the distribution mentioned by Mr. Schwarz is somewhat reinforced by the distribution of other animals, and that it was also somewhat variant. Mollusks and fishes of Alaska are European and Siberian, and same may be said of certain of the mammals. Mr. Schwarz added that the Alaskan fauna constitutes a well-marked faunal region of the country, comprising one peculiar family, the Ægialitidæ, and a host of genera and species which do not occur elsewhere.

—Mr. Schwarz also read some remarks on the West Indian sugar-cane borer (*Xyleborus perforans* Woll.) and dwelt upon the difficulties in ascertaining whether or not this species really occurs in the United States. The females of quite a number of species of Xyleborus are utterly indistinguishable, for the present at least, and reliable determination can only be made from the males, which are very rare and difficult to obtain. He had never seen in North American collections a male which exactly corresponded with that of *X. perforans*, and the description of *X. retusicollis* Zimm. leaves some doubt regarding its identity. Eichoff's *X. affinis* is said to be identical with *X. perforans*, but it is doubtful whether the type of the male of *X. affinis* came from the West Indies or the United States. As a peculiarity in the history of *X. perforans*, Mr. Schwarz pointed out the sudden and simultaneous appearance of the species in the sugar plantations throughout the West Indies. The cultivation of sugar-cane in the West Indies is very old, but until quite recently nothing was heard of the attack of the beetle on sugar-cane in any of the islands.

This communication was briefly discussed by Messrs. Riley and Howard. Dr. Riley said that the sudden appearance of the sugar-cane borer was probably due to the general introduction of the ribbon-cane from Ceylon or some other East Indian point.

—Under the head of short notes and exhibition of specimens, Prof. Riley announced the breeding of perfect females of Margarodes and stated that this rearing showed the synonymy of Margarodes with Porphyrophora. The female is active and crawls out of the ground. The male, however, has not yet been reared. Further confirmation of the ideas which he expressed concerning the formation of the scale at the last meeting has been found as pores of a specialized character have been observed through which the scale material is probably secreted. Two forms of the female have been observed,—the one not forming a nidus of wax-like secretion; the other encloses itself like a mealy-bug and lays eggs. He has also received specimens of another species from South America since the last meeting. Some further discussion ensued on the male of Porphyrophora and the probable male of Margarodes.

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101 OCTOBER 11, 1894.

President Ashmead occupied the chair, and there were also present Messrs. Riley, Schwarz, Waite, Chittenden, Linell, Stiles, Hubbard, Patten, Marlatt, Heidemann, Marx, Dodge, Coquillett, Mann, Gill, Fernow, and Howard.

The following new members were elected: Active, J. D. Patten, 3033 P St., West Washington; corresponding, C. E. Chambliss, University of Tennessee, Knoxville, Tennessee, and Dr. A. B. Griffiths, 12 Knolles Road, Brixton, London, England.

—Mr. Marlatt presented the following note:

ON THE FOOD-HABITS OF ODYNERUS.

By C. L. MARLATT.

Early in October, 1894, while making some observations on certain insects affecting the black locust, *Robinia pseudacacia*, my attention was attracted to the peculiar actions of a small species of Odynerus. The insect was observed to examine, apparently with some care, the sewed-together leaves of the locust, which contained, or had contained, the larvæ of *Pempelia gleditschiella*. The little wasp eventually rested for a moment on the upper surface of one of these tied-together leaves, seemed to make a careful examination, and then immediately ran to the under side, where examination showed that it was vigorously biting through the lower leaf. In a very few seconds it had cut a small opening, something less than $\frac{1}{8}$ inch in diameter, seized the Pempelia larva and gave it a few turns between its mandibles, immediately taking flight. Examination of the tree showed that nearly every one of these tied-together leaves, of which there were many, had from one to two of these irregular holes in the under surface, undoubtedly indicating the very thorough manner in which the tree had been worked by these or other Odyneri. All of the Odyneri provision their cells with the larvæ of small Lepidoptera, or in some cases the larvæ of leaf-eating Coleoptera and of sawflies. A very curious case is mentioned by Westwood, in which an Odynerus was seen to adopt a peculiar method to secure a Tortricid larva. He says that the wasp was seen to thrust its sting into one end of the roll made by a little leaf-roller, and then to run immediately to the opposite end to see if the larva had been thus frightened from its quarters. It is a very reasonable supposition, in view of these observations and the known habits of the group, that the smaller species, at least, of Odynerus prey very largely on the larvæ of Microlepidoptera, particularly those in the leaf-tying or leaf-rolling groups.

The note was discussed by Messrs. Riley, Ashmead, and Schwarz. Professor Riley said that the habit must be nearly universal, since examination of the cells of Odynerus shows that as a rule they store up Tortricid larvæ. Mr. Ashmead discussed the habits of the genus in general, and said that he had found in the cells of this wasp the cocoons of Meteorus and Microgaster. The larvæ which spun these cocoons, however, must have been parasitic upon lepidopterous larvæ stored up by the wasp. This is an indication of the difficulty of ascertaining the true host of certain parasites. Mr. Schwarz said that the Odynerus the cells of which are found in the old burrows of Anthophora around Washington always stores Tortricid larvæ.

—A paper by Mr. T. D. A. Cockerell, entitled "Some Observations on the Distribution of the Coccidæ," was read by the acting Corresponding Secretary. It was discussed by Mr. Schwarz, who said that, on account of the ease of commercial distribution of the insects of this family, it is now almost too late to generalize on the natural geographical distribution of the group. Where we collect species in uninhabited regions, or at least in countries as yet undisturbed by civilization and cultivation, we may reasonably assume them to be indigenous; but in most localities any species discovered may have been introduced.

—Mr. Ashmead read the following paper:

NOTES ON THE GENUS LIOPTERON PERTY.

By Wm. H. Ashmead.

The genus *Liopteron* was described by Dr. M. Perty, in his sumptuous work "Delectus animalium articulatorum, etc.," published during the years 1830–'34, with one species, *L. compressum*; and for forty years this was the only representative of the genus known. In 1837, in Guerin's Magazine de Zoologie, Prof. John O. Westwood redescribed the genus and its type, and erected the genus *Peras* for a new and closely allied form with a single species, *P. nigra*.

Again, in 1874, Westwood, in his "Thesaurus Entomologicus Oxoniensis," treats of the genus *Liopteron* and now adds eight new species to the genus, viz., *Liopteron abdominale*, *L. apicale*, *L. bifasciatum*, *L. clavicorne*, *L. fuscicorne*, *L. nigripenne*, *L. subpetiolatum*, and *L. unifasciatum*.

Since this appeared, Mr. Peter Cameron, in Biologia Centrali-Americana, in the part published in 1883, added one more species to the genus, *L. westwoodii*, and the first species to be described from North America, all the others having come from the Amazon region in South America.

Up to the present time, therefore, only ten species are known.

In Mr. H. Herbert Smith's collection of South American Chalcididæ, now in my hands for determination, several species of this rare genus were discovered, three of which are apparently undescribed, and the present paper is the outcome of a study of this material.

Prof. Westwood considered *Liopteron* and his genus *Peras* to be closely allied to the genus *Anacharis* Dalman, and late authorities have followed him in these views, Dalla Torre, in his recent catalogue, having placed the genus in the subfamily Anacharinæ.

A careful study of the Herbert Smith material, mentioned above, convinces me *Liopteron* represents quite a distinct group, and possibly an ancient phyla of the Cynipidæ from whence originated some of the Chalcididæ (*Eurytoma*, etc.), and I believe it should be kept separate from the other parasitic *Cynipidæ*.

In the shape of the head and abdomen (in some species), and in the coarse sculpture of the thorax, it recalls many forms to be found in the family *Chalcididæ*, in the subfamilies *Eurytominæ* and the *Chalcidinæ*, and it may possibly be the stem from whence some of these forms originated.

I shall enter more particularly into the subject in my monograph of the North America Cynipidæ, a work upon which I have now been engaged for several years, and at present shall give merely a table of the subfamilies of one section of the family, as follows:

SECTION I—CRYPTOGASTRI ASHMEAD.

Table of Subfamilies.

Abdomen short, globose or semiglobose, the second segment the longest...3

Abdomen ovate, compressed or subcompressed, often longly petiolated, the apex usually pointed.

Scutellum cupuliform, *i. e.*, with a cup-like elevation on its disk.........2

Scutellum not cupuliform, of ordinary shape, or grooved, spined or cone-shaped, and usually foveated at base.

Abdomen subsessile or with a short petiole, the second segment shorter than the third.

Second abdominal segment not prolonged dorsally, not tongue-shaped..Subfam. I.—Figitinæ.

Second abdominal segment prolonged dorsally, or tongue-shaped..Subfam. II.—Onychiinæ.

Abdomen with a long petiole, the second segment somewhat longer than the third.

Petiole attached to the metathorax between the hind coxæ; fourth segment not longer than either the second or third.
Subfam. III—Anacharinæ.

Petiole attached to the metathorax far above the hind coxæ; fourth segment much longer than either the second or third.
Subfam. IV—Liopterinæ.

2. Second abdominal segment always the longest and usually occupying most of the surface; hind tibiæ with two spurs. Subfam. V—Eucoelinæ.

3. Scutellum rounded, smooth, convex; hind tibiæ with one spur.
Subfam. VI—Allotriinæ.

SUBFAMILY IV—LIOPTERINÆ.

This subfamily contains but two genera, which may be separated as follows:

Table of Genera.

Discoidal nervure interstitial with the median nervure; ♂ antennæ 14—♀ 13-jointed...Liopteron Perty.

Discoidal nervure not interstitial with the median nervure, issuing from the transverse median nervure; ♂ antennæ 13-jointed (♀ unknown).
Peras Westw.

Liopteron Perty.

1833. Delect. anim. artic. Brasil, p. 140.
1837. Westwood, in Guer. Mag. and Zool., No. 179.
1874. Thes. Ent. Oxon., p. 132.

(Type L. compressum Perty.)

The following table will assist in determining the species known at present:

Table of Species.

Body mostly rufous, the abdomen sometimes black............................4.
Head and thorax black, abdomen rufous...3.
Body black.
  Wings black, tinged with purple.....................L. nigripenne Westw.
  Wings dusky, the submarginal cell nigro-fuscous...L. compressum Perty.
  Wings hyaline or subhyaline, sometimes maculate or fasciate.
    Legs rufous..2.
    Legs black.
      Scutellum truncate posteriorly and sinuate medially, the angles subtuberculate.
        Anterior wings with a transverse fascia just beyond apex of marginal cell and extending to middle of wing; petiole of abdomen about 4 times as long as thick...L. clavicorne Westw.
        Anterior wings with the extreme base, apex, and the submarginal cell dusky, no fascia; petiole of abdomen about $4\frac{1}{2}$ times as long as thick.....................L. fuscicorne Westw.
      Scutellum posteriorly subtruncate, not sinuate medially.
        Anterior wings nearly hyaline, their apex faintly but somewhat broadly dusky; petiole about $2\frac{1}{2}$ times as long as thick.
L. subpetiolatum Westw.
  Wings hyaline, with the base and apex dusky, venation in middle of wings yellowish; scutellum bituberculate at apex.
L. apicale Westw.
  Wings subfuscous, maculate with hyaline.
    Scutellum truncate posteriorly and slightly sinuate medially; legs entirely black; petiole about 5 times as long as thick; antennæ 14-jointed, as long as the body, much incrassated toward apex. ♂
L. fenestratum sp. n.
  Wings fuscous, with apical one-third and a band extending through the basal half of marginal cell to nearly the hind margin, hyaline; legs black, but with the anterior and middle tarsi piceous-brown; scutellum subbidentate posteriorly; body of abdomen not long, obtuse or truncate at apex, the petiole about 4 times as long as thick.....................L. tarsale sp. n.

2. Scutellum posteriorly bidentate or obtusely bituberculate; body of abdomen short, subcompressed, the petiole long.

Wings hyaline, with two transverse fuscous bands.
L. bifasciatum Westw.

Wings hyaline, with a single broad transverse band beyond the middle..L. unifasciatum Westw.

3. Abdomen much compressed, produced into an acute point at apex as in *Eurytoma;* petiole very long; legs black.

Wings smoky, with the basal one-third and a broad band across the disk fulvo-ferruginous......................................L. abdominale Westw.

4. Abdomen black; anterior coxæ, trochanters, the hind legs, except tarsi, the pectus and metathorax behind black; wings hyaline, with a large smoky macula toward apex..... ....L. westwoodii Cam.

Abdomen and legs entirely rufous; wings hyaline, with a broad fascia across the disk of wings; the basal half of marginal cell and the disk of wing directly beneath it, hyaline ....L. rufum sp. n.

Liopteron fenestratum sp. n.

♂.—Length 6 mm. Entire body, except head in front and the cheeks, black, shining, clothed with long, sparse, whitish hair, denser on cheeks and legs; head and thorax coarsely rugose, with deep, large punctures; head with a sharp carina between antennæ, the face and cheeks honey-yellow; antennæ 14-jointed, strongly incrassated toward tips, a little longer than the body, the first four joints of flagellum long, cylindrical, very nearly equal, the second very slightly the longest joint, the fourth thicker, the joints from fourth are shorter and somewhat rapidly increase in thickness, so that the last eight joints form a long fusiform club; thorax with three complete grooved lines, but somewhat obscured by the coarseness of the sculpture, the collar anteriorly abruptly truncate, the superior margin sharp, the anterior face polished; scutellum obtusely truncate posteriorly, not tuberculous; wings fuscous with hyaline spots; abdomen clavate, the petiole long bisulcate above, about two-thirds as long as the body of abdomen, the latter oblong, subcompressed, smooth and polished, except the three short apical segments, which are pitted with coarse punctures.

Hab.—Santarem.

Described from 1 ♂, collected by Mr. Herbert H. Smith.

Liopteron tarsale sp. n.

♀.—Length 5 mm. Agrees with *L. fenestratum* in stature and sculpture, but the entire insect, except the anterior and middle tarsi, is black; anterior and middle tarsi piceous-brown; antennæ 13-jointed, subclavate, two-thirds the length of body, the first flagellar joint only two-thirds the length of the second; the mesopleura are polished, with a large depression just beneath the tegulæ covered with an appressed pubescence, below this is a deep longitudinal furrow terminating in a little curve behind;

the mesosternum is finely punctate near the insertion of middle coxæ; scutellum bituberculous posteriorly; wings fuscous, with the apical one-fourth, basal two-thirds of marginal cell and a spot in the discoidal region, hyaline; abdomen with a long petiole bisulcate above; body of abdomen oblong, subcompressed, obtusely rounded behind, not pointed, the three short apical segments smooth, not punctate, but fimbriate with whitish hair.

Hab.—Santarem.

Described from 1 ♀, collected by Mr. Herbert H. Smith, in month of February.

Liopteron rufum sp. n.

♀.—Length 6 mm. Rufous, clothed with sparse, glittering white hair; head with a sharp carina between antennæ, the face finely punctate; antennæ 13-jointed, subclavate, about as long as the head and thorax united, blackish toward tips, the first flagellar joint two-thirds the length of the second, the latter the longest joint except the large oblong terminal joint; third flagellar joint a little longer than the first, the joints beyond imperceptibly shortening and broadening to the last joint, the last joint is oblong and twice as long as the penultimate; thorax coarsely sculptured, the scutellum truncate posteriorly, the hind angles subtuberculous; wings hyaline, with a broad fuscous band across their disk, extending from basal vein to beyond apex of the marginal cell, but the basal half of the marginal cell (or a little more) and a large spot on the hind margin of wing directly opposite the marginal cell are hyaline; abdomen shaped as in *L. tarsale*.

♂.—Length 4.5 mm. Agrees with ♀, except in the usual sexual differences and in having the disk of the mesonotum dusky: antennæ 14-jointed, longer than the body, black, with only the two basal joints rufous, the flagellum only slightly thickened at apex, the first joint less than two-thirds the length of the second, the following joints very gradually, decreasing in length to the last; the last three abdominal joints are fimbriate as in ♀, but all are punctate toward apex; otherwise the abdomen is smooth and highly polished.

Hab.—Chapada.

Described from 1 ♂, 1 ♀, collected by Mr. Herbert H. Smith in November.

—Mr. Schwarz presented certain notes on an insect pest, *Hippelates pusio*, in the Southern States. This is a small fly of the family Oscinidæ, which, during the summer months, swarms in great numbers in many of our Southern States, almost solely in regions which have a sandy soil. It is particularly abundant in Florida, and is annoying to man and animals from the fact that it is attracted to eyes and to the natural openings of the body, as well as to sores. During his two recent trips through the South, Mr. Schwarz endeavored to ascertain the life-history of the species, but without success. Judging from the habits of all other Oscinidæ, it must be a leaf or stem miner. The possibility of this insect carrying disease germs was brought out by the speaker.

These notes were discussed by Messrs. Stiles, Riley, Howard, Hubbard, and Marlatt. Dr. Stiles said that the Bureau of Animal Industry had received complaints from the South of the annoyance caused to animals by this fly, but that he had made no investigation of the species. He was impressed by the possible importance of this insect as a conveyer of contagion. Professor Riley spoke of the curious fact that this extremely common insect, which he himself had often seen in his journeys through the South, was not mentioned in entomological literature. It was, however, another exemplification of a very common state of affairs. Referring to the habit which the insect has of gathering in the corners of the eye of human beings, he suggested that eye-diseases in particular would be conveyed by the insect. He spoke of the extraordinary prevalence of ophthalmia among the Egyptians and other eastern people, and suggested that this disease was spread by the agency of dipterous insects. Mr. Howard referred to a recent article by an eminent English army surgeon in an English review, in which this very subject is treated, and the medical man expresses himself as of the opinion that flies are largely responsible for the spread of this particular eye disease in Egypt. Mr. Hubbard said that in Florida a serious disease of the eyelid is often prevalent. It is known as "sore-eye" and it becomes absolutely epidemic from time to time. He feels certain that this Hippelates carries the disease, since it is well known that even the use of the same handkerchief will convey the disease from a sore-eyed person to a healthy one. He has known it to start with a single individual and run through an entire school or community, and he thinks Hippelates alone accounts for the rapid spread. Moreover, the irritation caused by the fly greatly aggravates the disease, which becomes very serious, the patient seldom recovering entirely from it, but being affected by weak eyes ever afterwards. He also had made efforts to ascertain the life-history of the fly, but without success. He is of the opinion that if the insect is really an above-ground leaf-miner its work would have been noticed by him, as, on account of the great numbers of the flies, the work of the larvæ must be very extensive and readily seen. Mr. Marlatt said that he had been similarly annoyed by a fly of the same general appearance around Washington. He thought that the attractiveness of the moisture of the eyes and of sores would indicate that the larva is perhaps saprophagous in its habits and may be found in decaying vegetation. The question of the northern range of the fly having been called up, Mr. Ashmead stated that he had found it in the vicinity of Jacksonville. Mr. Howard said that a very minute fly swarms in extraordinary numbers about the eyes of domestic animals in the vicinity of Washington during the summer months. This insect is also probably an Oscinid. He had collected specimens and endeavored to determine them, but without success. It is another instance of an extremely common insect which does not seem to have attracted the attention of entomologists.

—Under the head of exhibition of specimens, Mr. Howard showed two scale-insects which he had collected on the summit of Onteora Mountain, in Greene county, N. Y. One was the common scurfy bark-louse of the apple, *Chionaspis furfurus*, which he found in great abundance upon mountain ash; and the other was an undetermined Lecanium which affects the striped maple (*Acer pennsylvanicum*) to such an extent that hardly a twig of this little maple can be found which is not partially covered with this scale-insect. The most interesting thing about it was that he failed, among the thousands of specimens seen, to find one which was living; all had evidently been killed by a fungus disease. The female scales carried the fruiting form of the fungus, while the male scales were simply destroyed by the mycelium.*

* This fungus was subsequently determined by Mr. A. F. Woods and M. B. Waite as *Cordyceps clavatula* (Schw.) Figures and description will be found in Journ. New York Micr. Soc. I, 4, April, 1885.

This note was discussed by Messrs. Marlatt, Riley, and Waite. Mr. Marlatt stated that the division of Entomology had recently received a Lecanium scale from California on prune which had apparently been destroyed by a fungus. The correspondent suggested the practical use of the fungus to destroy other scales. Examination by Mr. Galloway, however, showed that the scales were filled by the mycelium of a smut fungus, genus Fumago, which itself is an enemy to plants, and it was by no means certain that the fungus had killed the scales. Mr. Waite had examined the specimens referred to by Mr. Marlatt, and substantiated his statement. Dr. Riley said that in the East Indies, and the West Indies as well, a fungus is known which is destructive to Lecaniids, and in Ceylonese and Indian reports a suggestion as to the practical use of it has been made. He had noticed it abundantly in the West Indies during a recent journey. The fungus presented a very similar appearance to that exhibited by Mr. Howard.

—Professor Riley exhibited specimens of the supposed larva of *Lymexylon sericeum* and a Hylecœtus which had been mentioned by Mr. Hopkins in a communication before the Society last spring. He referred to his figure of an undetermined larva in the Sixth Missouri Report, which was identical with the chestnut timber worm discussed by Mr. Hopkins, from which Mr. Hopkins later reared *Lymexylon sericeum*. Owing to the fact that this larva differs radically from the well-known European larva of *Lymexylon navale*, he suspected that there had been some mistake. Possibly Mr. Hopkins has made an error in his rearing, but if this is not the case he is of opinion that *L. sericeum* will prove, upon careful examination, to be distinguishable generically from the European *L. navale*. While visiting Dr. Meinert in Copenhagen, the latter showed him a larva of very similar appearance which had been received from Venezuela, from which the beetle was reared, which had been erroneously named as *Hylecœtus braziliensis*, but it proved not to be a true Hylecœtus.

In discussing this note, Mr. Schwarz agreed with the speaker that *L. sericeum* will prove not to be congeneric with *L. navale*. The larvæ, he stated, of the Lymexylonidæ have never been carefully examined except for the mere external characters. If we look for resemblances in the more obscure parts, what seem to be distinguishing characters will be more nearly harmonized. Dr. Riley agreed with Mr. Schwarz in his last remark, and stated that if, for instance, we examine the larvæ of Brenthis and of Eupsalis, we shall find differences which emphasize the separation of these two genera.

—Mr. Hubbard presented some unelaborated notes on the fertilization of the tropical Aroids, showing that a Nitudulid beetle, *Macrostola lutea*, accomplishes partial cross-fertilization and complete self-fertilization with these plants. He illustrated his remarks by the exhibition of specimens and drawings of the plant, and showed that the plant adapts itself to the easy entrance of the first pair of beetles, which bring with them pollen from a different plant, thus bringing about partial cross-fertilization. The offspring of these beetles, to the number of several hundreds, live within the spathe and accomplish self-fertilization of the plant. After the entrance of the first pair of beetles, a fungus disease attacks the spot of entrance upon the spathe and, by increasing, facilitates the exit of the next generation of beetles.*

—Professor Riley also exhibited what he considered to be a diurnal termite with faceted eyes, which he considered might confirm old Smeathman's observation upon a species of African Termites which he represented as travelling by day and resembling ants upon the march, an observation the accuracy of which had been seriously doubted. The specimen which he exhibited had been given him in Europe, and had been captured in Natal by daylight by Haviland. Mr. Schwarz suggested that the specimens exhibited might not be termites but Embiids. Mr. Heidemann exhibited certain new and interesting Capsidæ, Coreidæ, Lygæidæ, and Pentatomidæ, which he had found during the summer in the vicinity of Washington.

—Mr. Ashmead exhibited a large box of fig-insects, many of which were typical. He had been accumulating the material for some years and had specimens received from Dr. Mayr of

* An article upon this subject by Mr. Hubbard is published in *Insect Life*, Vol VII, No. 4.

Vienna, Mr. E. T. Atkinson of Calcutta, and Messrs. Hubbard and Schwarz from Florida. He said that the group is still in a confused condition, and that many of the forms were undoubtedly Toryminæ and Pteromalinæ, and either parasitic or inquilinous in figs. The true fig-insects are comparatively few in number.

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102 NOVEMBER 1, 1894.

President Ashmead occupied the chair, and Messrs. Schwarz, Chittenden, Heidemann, Hubbard, Linell, Patten, Waite, Benton, Marlatt, Stiles, Gill, Riley, Fernow, and Howard were also present.

Mr. H. G. Barber, of the University of Nebraska, was elected a corresponding member.

—Dr. Gill presented a paper on a remarkable new family of crabs. He stated that he thought himself justified in presenting this paper before an entomological society, since, in his opinion, the Crustacea are more closely related to the Insecta than are the Arachnida. He exhibited plates and descriptions of *Archeoplax notopus*, new genus and species, described by Alcock and Anderson in the Natural-history Notes of the Investigator. This remarkable new crab was taken taken off the coast of Coromandel at a depth of 150 to 200 fathoms. Dr. Gill pointed out several extraordinary features which, in his opinion, justified the erection of a new family for the form. He proposed the new generic name Retropluma, on account of the preoccupation of Archeoplax, and the new family Retroplumidæ.

The paper was discussed by Messrs. Howard, Riley, and Hubbard. Mr. Howard stated that he had voted against the reception of the paper by the program committee on the ground that, however loose the definition of the word "entomology" may be, it was generally understood to refer to the class Insecta, and that the scope of this class is so enormous that the tendency of the Society should be to contract rather than to expand in the range of topics considered at its meetings. The admission of papers on Arachnida had been, from the beginning, largely a matter of courtesy and precedent. Dr. Gill argued that entomology should apply to the whole group Arthropoda. Mr. Schwarz agreed with the ideas advanced by Mr. Howard, and stated that arachnologists had affiliated with entomological societies largely because they were so few in number, and because there were no more nearly related associations of specialists. Dr. Riley said he had been much interested in Dr. Gill's paper, and particularly in the point brought out that the hind legs have apparently developed into breathing organs, referring to the somewhat similar state of affairs with Chauliodes and Eristalis, where anal pedal organs had been modified into branchial organs. Mr. Hubbard expressed himself as not surprised at the modification just mentioned, since the modification of stylets into branchiæ with larval insects is common. He called especial attention to the larvæ of the Adephagous series of the Coleoptera and their possession of branchiæ which in related land forms are stylets. He referred also to a similar state of affairs in the larvæ of Amphizoa and Pelobius. He prophesied that when the newly hatched larvæ of Coleoptera are well known it will be found that this change takes place quite frequently.

—Mr. Hubbard exhibited specimens of the larvæ, pupæ, and adults of a dipterous insect, determined by Mr. Coquillett as a species of Drosophila, which he had found living in the larval state in the mouth of the common land-crab on the Island of Montserrat, B. W. I. He found the pupæ of the same insect on the inner side of one of the maxillary lobes of the crab. The larva was rather remarkable in its side projections.

Dr. Gill discussed the probable species of crab referred to by Mr. Hubbard, concluding that it was *Cardisoma quamhami*. Mr. Howard asked as to the normal food of these crabs, with a view to determining the probable origin of this messmate habit on the part of the Drosophila larvæ. Mr. Schwarz asked for an explanation of the rapid movements of the larvæ in the crab's mouth. Mr. Hubbard replied that it was a swimming movement, assisted by the lateral projections of the larva. Dr. Gill pointed out that these larvæ were probably not stationed in the mouth of the crab, but in the branchial cavity.

—Under the head of exhibition of specimens, Dr. Riley showed a Curculionid which he found recently injuring certain aquatic plants in the Missouri Botanic Gardens. The plants were a Salvinia and *Azolla caroliniana*. He found cocoons of the beetle, but only one injured larva. This larva looked like that of Phytonomus. The cocoons are spherical, composed of a dense, gluey substance, somewhat disguised by cut leaves. They are perfectly impervious to water, although submerged in many instances. The beetle he believed to be *Stenopelmus rufinasus*, which, according to Dr. Le Conte, is widely distributed in North America. Dr. Riley's St. Louis specimens are larger and darker than a series in the National Museum, from southern California, and probably form a distinct variety, possibly a new species.

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103 DECEMBER 6, 1894.

President Ashmead occupied the chair, and the other members present were: Messrs. Gill, Marlatt, Benton, Schwarz, Hubbard, Linell, Vaughan, Test, Heidemann, and Coquillett. Prof. A. D. Hopkins, of Morgantown, W. Va., a corresponding member, was also present.

Richard Heymons, Ph. D., of the University of Berlin, Berlin, Germany, was elected a corresponding member.

The election of officers to serve during the ensuing year then took place. On motion of Mr. Hubbard, seconded by Mr. Schwarz, the Secretary was instructed to cast a ballot for the re-election of all the present officers.

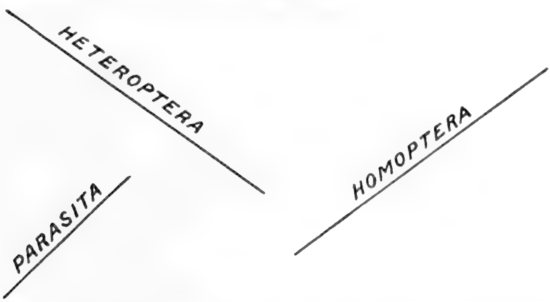
—The following paper, by Prof. Herbert Osborn, was read by Mr. Benton:

THE PHYLOGENY OF HEMIPTERA.

By HERBERT OSBORN, Ames, Iowa.

For some time it has seemed to me that the current classifications of Hemiptera are very far from representing the true phylogeny of the families of this group, and the present paper, giving substantially the views I have stated to my advanced classes in entomology for the last two or three years, is an attempt to express what seems a more rational relationship between these families. The scheme adopted by Uhler and Comstock may be considered as representative of the current ideas, and comparisons may be conveniently made with their systems in this discussion.

The subdivision of the order into the three suborders Parasita, Homoptera, and Heteroptera, with the Parasita placed as the lowest, while possibly representing the comparative rank in organization, is entirely unfounded in phylogeny, and it seems to me that the proper relationship of these suborders is to place the Homoptera as the first division, as it includes the more generalized types, and the Heteroptera as the secondary division, and to consider the Parasita as simply a degraded branch of the Heteroptera, having its origin near the group of families represented by the Acanthiidæ. Such a view as to the Parasita is, indeed, expressed by Uhler, though not adopted in his classification.* With reference to the generalized features of the Homoptera as compared with the Heteroptera, it may be objected that such specialized forms as contained in some of the families should outrank the Heteroptera. The wing structure being certainly of a more primitive type, and the position of the head, while in some cases apparently very much specialized, seems to me, on the whole, to correspond more nearly with the generalized Orthoptera and Pseudoneuroptera, or, it might be said, also with the Physopoda, which possibly is the modern representative of the ancestral form of Hemiptera. The development of the scutellum in Heteroptera may be looked upon as of importance, and the horizontal position of the head, with the beak arising anteriorly, while it may appear at first sight to be more generalized, will, I think, from careful comparison with other groups, be recognized as the derivative form. The relationship of these special divisions I would represent by the following diagram :



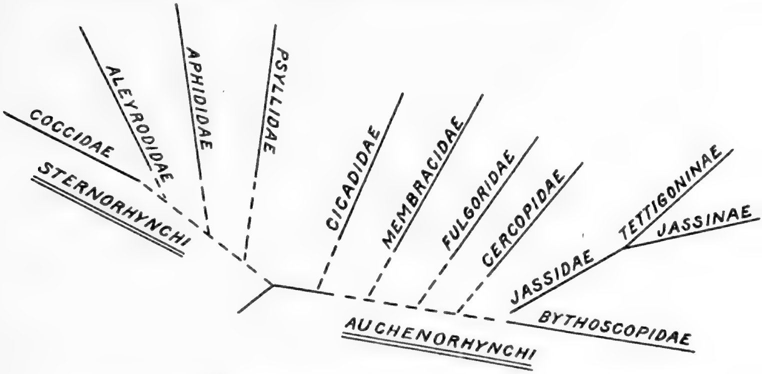
In the division of Homoptera the current system of placing the Coccidæ as the lowest, and, presumably, the simplest group, is certainly a wide departure from the facts as apparent in the comparative study of the groups. If we separate the division Homoptera into two subdivisions, Sternorhynchi and Auchenorhynchi,

*Stand. Nat. Hist., vol. ii, p. 209.

which is evidently the most fundamental basis of separation presented in this suborder, there seems to be every reason to consider the Sternorhynchi as the derivative form and the Auchenorhynchi as the basal form. The position of the rostrum upon the sternum, or, more properly, the coalescence of the rostrum with the sternum, must certainly be considered as a more specialized condition than the free form and, in fact, the derivative form, the consolidation of the rostrum with sternum being the result of the close approximation of beak and sternum resulting from their food habits. This division includes the families Psyllidæ, Aphididæ, Aleyrodidæ, and Coccidæ, and if we arrange them with reference to their successive steps of departure from the generalized form, or the form most nearly approaching the Auchenorhynchous type, it seems to me they would be placed in the order named, the Coccidæ being evidently the more specialized or the most extreme form, and their apparent simplicity being only the degradation or reduction resulting from the habit of permanent attachment to the food-plant so general in this group. It is true that in each of these families we find extremely specialized forms, but in looking at the more generalized ones of each group there is no inconsistency in the idea of their developing from the single primary stem.

The other division, beginning with those forms which have the most generalized condition of wing venation and body structure, would commence with the Cicadidæ and follow the ascending order which is given in the current systems. It is true that the Cicadidæ are themselves a specialized group, particularly in the forms possessing musical organs, but in their approach to the Psyllidæ in wing venation and structure of the head and thorax they seem on the whole to present more generalized characters than can be found in any of the other families of the Homoptera.

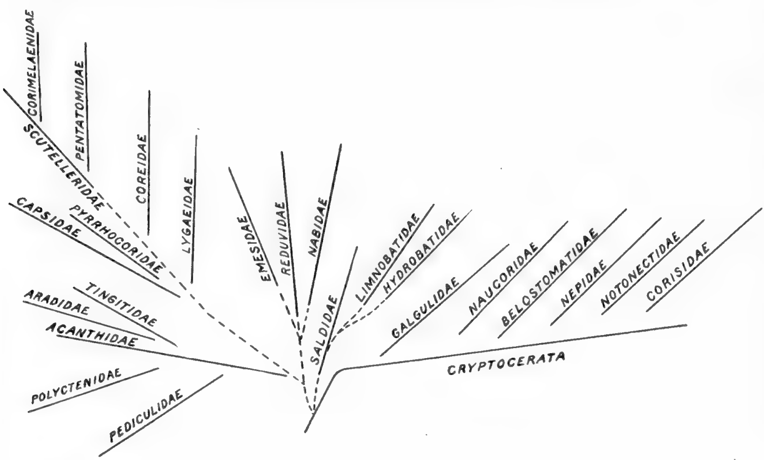
The Membracidæ, except in extremely specialized pronotum, are easily seen to be related to the Cicadidæ and naturally take their position next to them. The Fulgoridæ, while possessing specializations of the head, are in thoracic structure and venation more generalized than the remaining families, and while possessing many highly differentiated sub-groups, may very probably be interposed between the preceding families and the Jassoid division. The Cercopidæ in development of scutellum and in texture of elytra, as well as in the specialization of the tibiæ, show characters of rather high rank, and, if placed as subordinate to the Jassoidea, they must at least be considered as a branch of nearly equal or parallel rank. The Jassoidea, separable into the Bythoscopidæ and Jassidæ proper, may, on the whole, be considered as the most highly organized of the series, and as somewhat equivalent branches, the Bythoscopidæ being in some respects extremely specialized, while the Jassidæ are subdivided into nearly equal branches, Jassinæ and Tettigoninæ. The relations of all these groups can be expressed in the following diagram:



The Heteroptera have in like manner been arranged more with reference to convenience than upon a phylogenetic basis, the strictly aquatic forms being made to occupy the lowest position, and the series passing from these to the semi-aquatic, littoral, terrestrial, and arboreal—a plan which does not seem to me to correspond in any sense with the probable line of descent. It appears evident, even upon a very hasty examination of the group, that the aquatic forms are descendants of non-aquatic forms and that the derivation of the non-aquatic and terrestrial forms from the aquatic groups is out of the question. Not only does the structure of the groups oppose such an idea, but, on any theory of the origin of the Hemiptera from the simpler groups of insects, we must assume that they connect with the non-aquatic groups. It is only necessary to mention the specialized condition of the antennæ in the whole series of Cryptocerata and the extremely specialized mouth-parts of Corisidæ to show the nature of the morphological evidence, and to attempt to find a generalized aquatic ancestral form, to see the force of the latter argument. It may be in place to call attention further to the general fact that all aquatic insects are such by secondary adaptation and trace their ancestry to terrestrial forms, just as certainly, I believe, as that all aquatic mammalia, such as whales, seals, &c., trace their ancestry to terrestrial forms.

The more probable line of descent is that the strictly aquatic forms are descended from semi-aquatic forms, and these from non-aquatic or littoral species, and in some such generalized form as may be represented now by the Saldidæ we may find the stock from which the group is branched, one line becoming more aquatic and reaching the extreme of specialization in this direction, in such groups as Nepidæ, Notonectidæ, and Corisidæ, the other branch furnishing the terrestrial and arboreal families, while they seem a generalized offshoot. We have further the carnivorous division Reduviidæ, which presents extreme branches in Nabidæ and Emesidæ.

As already mentioned, the Pediculidæ may be considered a retrograde branch connected with this portion of the Heteropterous stem. These relations may be exhibited as follows:



While not expressing details in relation of sub-groups, this sketch will call attention to the characters and plan which seem to me must be recognized in arriving at a correct expression of relationship. So far as catalogues or linear arrangements are necessary, the present system may be retained without great change, as no linear arrangement can express correctly the relations stated.

In the discussion Dr. Gill said that he considered the Homoptera to be the forms from which the Heteroptera were derived. The aquatic forms were evidently derived from the terrestrial, and should not be placed in a group by themselves, but should be distributed among the families of terrestrial Hemiptera, with which they are severally the most closely related. Mr. Schwarz fully agreed with the speaker to the latter proposition, and instanced the absurdity of placing all of the aquatic Coleoptera in a single group. Mr. Marlatt asked if the Psyllidæ are not more nearly related to the Coccidæ than they are to the Cicadidæ, adding that the Psyllid larva by its broader form and less distinctly segmented abdomen more nearly resembles that of the Coccidæ than it does the larval Cicadid. Mr. Schwarz did not agree with this view of the case, stating that, with the exception of the fossorial legs, the Cicada larva does not differ in any marked degree from the larva of the Psyllidæ.

Mr. Ashmead considered that the wingless Parasita, or the Pediculidæ, are the oldest forms, representing the stem from which sprang the Homoptera in one direction and the Heteroptera in another. In the Homopterous series he would place the Coccidæ, which are winged in the male sex only, next to the wingless Parasita, to be followed by the Aleyrodidæ, and these by the Aphididæ. He mentioned a dimorphic species of Aphis which in its early stages very closely resembles an Aleyrodid. In the Heteroptera Mr. Ashmead would place the Cimicidæ next to the Parasita, following them with the Anthocoridæ, Tingitidæ, &c. Omitting some of the families, the two suborders of the Hemiptera would be arranged in an ascending series as follows:

Parasita,	Coccidæ, Aleyrodidæ, Aphididæ, Psyllidæ.	Cicadidæ, Jassidæ, Membracidæ, Fulgoridæ.
	Polyctenidæ, Cimicidæ, Tingitidæ, Reduviidæ, Nepidæ, Saldidæ, Galgulidæ, Neocoridæ, Corisidæ, Notonectidæ.	

Mr. Ashmead also spoke of the impossibility of arranging all of the families of Hemiptera in a linear series, since it not infrequently happened that two of the families were so closely and equally related to a third group as to make it quite evident that both of them sprang directly from the latter.

Dr. Gill did not think that parasitism of itself indicates relationship, but was of the opinion that the wingless parasites had been derived from winged ancestors. He would not locate the Parasita in either the Homoptera or the Heteroptera, but would be inclined to erect a separate suborder for their reception.

—The following paper by Mr. Howard was read by Mr. Benton:

ON GOSSAMER SPIDERS' WEB.

By L. O. Howard.

It will be remembered that at the meeting of this Society held November 3, 1892, Dr. George Marx presented a paper with the title "On Spiders' Web," the text of which was the receipt of a curious substance, from one locality in California and one in Florida, which had rained down over a considerable section of the country during rain-storms. Dr. Marx concluded, after a careful chemical and microscopical examination, that this substance was composed of the massed-together strands of gossamer spiders' web.

Since that date I have received further samples of this same substance, which was collected during the same 1892 storm at Gainesville, Fla., and within the past few weeks have been in correspondence with Mr. J. B. Lembert, of Yosemite, Calif., about a phenomenon which he has described to me at great length, and which throws some light on the subject of Dr. Marx's communication.

It seems that in the Yosemite Valley, over the crest of the southern wall, there is a series of arches of silken substance which Mr. Lembert shows is spiders' web.* These arches are of yearly occurrence. The most noticeable are two, one over the Bridal Veil Fall, is fully one-third of a mile in width and about twelve hundred feet in height and reaches from the Leaning Tower on the west side across in a graceful arch to the east side, and is fastened there to the brush, shrubs, and trees that surmount the top of the Three Graces. The second extends over the gorge between Sentinel Rock on the west side and the ridge on the east side over which the Glacier Point trail is built. At this point all the shrubs, bushes, and trees are webbed about in such a manner that the trunks of the largest trees are but faint shadows, while limbs and foliage resemble a glistening mass of crystal. In the midst of this mass are bunches of rolled-up web that are as white as cotton and quite thick. When the mass is disturbed by a gentle breeze it moves throughout its entire length with a graceful, undulating motion. It is four thousand feet above the floor of the valley and fully a mile wide at its base. Mr. Lembert shows that the wind which sweeps up the gorge is an important factor in this arch-work. When the spider launches out on his gossamer thread he is carried upwards until the current has lost its

* The only specimen which Mr. Lembert has sent on as probably being concerned in the construction of this web is a species of Pardosa, but possibly many species are concerned in the work.

strength. The pressure is upwards in every direction to the summit of the gorge. There a western current of air is met which causes, in all probability, the impingement of these hundreds of thousands of gossamer strands upon a given space of greater or less dimensions. I wrote to Mr. Lembert asking for specimens, but, on account of its inaccessible location, he was able to get only a small sample, which I exhibit herewith.

The note is of interest as showing the fact that there are localities where the webs of gossamer spiders are massed together to an extraordinary amount. Mr. Lembert says that the arches recur year after year. What becomes of them? They are plainly blown away by the winter storms. They are excessively light; the distance to which they could be carried is indefinite, but it is perfectly conceivable that they might be carried for enormous distances, either directly by the wind or in dense clouds; and that they should be precipitated with rainfall from heavy clouds at almost any distance from the point of origin is perfectly within the bounds of possibility, and even probability. I have little doubt that the California and Florida falls were brought about in this way. Perhaps the California falls may have come from one of these very arches, although Vallecita, the locality from which Dr. Marx received his specimens, is three hundred miles south of Yosemite.

In discussing this paper Mr. Schwarz read an abstract of Mr. J. Muir's work on the Sierras of California, in which this well-known mountaineer vividly describes as follows what he pronounces the most magnificent of all storm phenomena: "Silvery banners of snow dust attached to the peaks of the Merced group like streamers at a masthead, each from half a mile to a mile in length, slender at the point of attachment, then widening gradually as it extended from the peak until it was about 1,000 or 1,500 feet in breadth. Some of these snow banners extended from peak to peak, while others overlapped." Mr. Schwarz remarked that there was, to say the least, the most remarkable resemblance between the phenomena described by Mr. Lembert and Mr. Muir.

—Mr. Hopkins referred to his forthcoming list of North American pine-insects, which contained forty-one species of Scolytidæ—about twice the number of those previously recorded as depredating on pines. His list already contained the names of three hundred and thirty-six different kinds of insects which infest pine trees in this country, and he was of the opinion that when the subject had been thoroughly investigated this number would be nearly doubled.

Mr. Schwarz stated that the pine-feeding Scolytidæ would include about two-thirds of the entire number of species, and that in North America this included fully one hundred and fifty species. Whole genera of Scol ytid sometimes feed exclusively upon pines.

—Asked by Mr. Schwarz if he had recently seen in West Virginia specimens of the introduced *Clerus formicarius*, Mr. Hopkins replied that he had not, but specimens had been seen by lumbermen, to whom figures and description of the Clerid had been communicated.

—Mr. Hopkins also referred to a Dipteron which he had bred from larvæ found in the body of an adult bee that nests in clay banks. From a pencil sketch the parasite was identified by Messrs. Coquillett and Ashmead as belonging to the Conopidæ. From some of the Conopid larvæ Mr. Hopkins had bred a large number of specimens of a species of Chalcid fly.

—Under the heading of short notes and exhibition of specimens, Mr. Hubbard exhibited pupæ and larval skins of *Amphicoma vulpina* found by Mr. Schwarz and himself near Asheville, N. C. The larva differs from the related forms quite as much as is known to be the case with the adults. The species had heretofore been recorded only from Massachusetts and other northern localities.

—Mr. Hubbard also exhibited an apparatus for use in the examination of alcoholic specimens. This was formerly used by Dr. Hagen, and consists of two watch-cases placed together in such a manner that their concave surfaces are next each other, the two glasses thus forming a single cell, being held in place by a spring clamp. The glasses act as a parabolic reflector, thus aiding in the examination of the objects placed between them. These, in the present case, consisted of several larvæ of *Hemipeplus marginipennis*, found by Mr. Hubbard between the ribs of unfolded palmetto leaves in Florida. Mr. Hubbard stated that there were various points of interest connected with the structure and life-history of these larvæ which he intended to lay before the Society at a future time.

—Mr. Schwarz exhibited a series of specimens of *Cicindela striga* and *C. severa* which were collected on July 11, near Punta Gorda, in southwestern Florida. These species occurred promiscuously on a salt marsh, which, on account of the prevailing rainy season, was completely submerged for several hours each day. They were equally active in the hot sunshine of midday and toward night, and made use of their wings only when hard pressed. Mr. Schwarz pointed out the structural differences between these two Cicindelas and said that they could not possibly be regarded as races or varieties of the same species.

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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON.

Volume III, No. 4.
(January 3, 1895, to June 6, 1895.)
[Issued June 22, 1895.]

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FRANK BENTON, Corresponding Secretary,

Department of Agriculture,

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Gromary.

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January 3, 1895.

President Ashmead occupied the chair, and the other members present were Messrs, Riley, Schwarz, Marlatt, McGee, Stiles, Gill, Benton, Patten, Heidemann, Howard, and Dodge.

President Ashmead announced the death of Dr. George Marx, on January 3, and made a few remarks indicative of the great loss which the Society had sustained.

On motion by Mr. Schwarz, a committee was appointed to draw up resolutions expressing the sense of the Society. The chairman appointed Messrs. Riley, Howard, Schwarz, and Gill.

The committee submitted the following resolutions, which were unanimously adopted:

Whereas, The Entomological Society of Washington has just learned, with deep sorrow, of the sad death of Dr. George Marx, one of the most learned members of the Society, one of its founders, for two years its President, and the warm personal friend of all of its members, therefore be it

Resolved, That this Society, through its Secretary, transmit to the family of its late member its deepest sympathy and an expression of profound sorrow.

Resolved, That the published proceedings of this meeting of the Society consist only of a biographical sketch of our late President and fellow-member, with a list of his published writings; that all further business at this meeting be postponed, and that in respect to his memory we do now adjourn.

C. V. RILEY.
L. O. HOWARD.
E. A. SCHWARZ.
THEO. GILL.

Dr. GEORGE MARX.

Dr. George Marx was born in Laubach, Grand Duchy of Hesse, June 22, 1838. He was the son of George Marx, who was court chaplain at Laubach, and his boyhood was spent at that place. In 1845 his father received an appointment at Leeheim, where he went with his family.

At the age of fourteen George Marx entered the gymnasium at Darmstadt. It was his father's wish that he should fit himself for the ministry, and he began at this time to study Hebrew. He had always shown a great love of nature, which had been fostered by a private tutor employed by his father at Laubach to train his sons. While studying at the gymnasium, Dr. Marx proved himself so proficient in botany, and at the same time so able an artist, that to him was assigned the task of making the illustrations for the Flora of Gross-Gerau. He became intensely interested in this work, and began seriously to question his fitness for the ministry. Soon after, he decided to change his career, against his father's advice. He therefore took up the study of pharmacy, as offering an opportunity for work in the line of botany. After completing his pharmaceutical studies at Giessen, he came to America, in 1860. The civil war breaking out soon afterward, he enlisted as a private in Company K, 8th New York Volunteers, and remained with his company until after the battle of Bull Run, July 21, 1861. His pharmaceutical and medical knowledge becoming observed, he was transferred to the medical corps as assistant surgeon shortly after Bull Run. It is said that his letters to his parents during his early service contain such able and graphic accounts of army movements and army life, that they were printed in many German newspapers and excited a great deal of attention. In July, 1862, he became disabled through illness and through a severe wound, and was honorably discharged. He returned to New York and began life as a pharmacist. In 1865 he took up his residence in Philadelphia, where he was engaged in business until 1878. It was during his residence in Philadelphia that he began to take an interest in the Arachnida and commenced to form a collection. Here, also, in May, 1869, he was married to Miss Minnie Maurer. In 1878 he came to Washington to accept the position of natural-history draftsman in the Department of Agriculture, and was attached to the force of the Division of Entomology. Many of the plates and smaller figures published by this division during the years 1878 to 1883 were from his hand, and as a fair example of his skill as a natural-history artist we would point out the plate on the Catalpa Sphinx (Agric. Rept. for 1881–'82, plate xiii). In subsequent years he worked more for other divisions. He remained in this position until 1889, when he was made chief of the newly established Division of Illustrations. This position he resigned shortly before his death, which occurred January 3, 1895.

Inspired by his intercourse with the members of the force of the Division of Entomology, during his entire residence in Washington Dr. Marx devoted a great deal of time to the study of the Arachnida, as his magnificent collection and valuable library, as well as the list of his published papers, will testify. He became known as one of the foremost living authorities upon this class of animals, yet he also found time to study medicine at the medical school of the Columbian University, from which institution he was graduated with the degree of M. D. in 1885. He was a charter-member of the Entomological Society of Washington, and its fourth President. He presented many valuable papers before the Society, and was from the start one of its foremost members. He maintained intimate relations by correspondence with the foremost arachnologists of Europe, and was selected by the publishers of Count Keyserling's *Spinnen Amerikas* to complete the work on the death of the distinguished author. Keyserling, Thorell, Simon, and Kulszynski have received much valuable material and information from Dr. Marx, and American students—notably McCook, Emerton, and Peckham—have been under obligations to him in similar relations. His artistic talent, of course, greatly helped him in his studies, and the various plates and figures which adorn his contributions to science are by far the best illustrations of Arachnids that have ever been produced in America.

Nearly three years before his death he began to devote his spare moments to the study of the ticks, of which he contemplated publishing ultimately a monograph. A few preliminary papers on the subject were read by him before the Entomological Society of Washington, but the attacks of the dreadful disease to which finally he was to succumb, after many months' suffering, frustrated all his plans. Still, the hope of restoring his health never abandoned him, and at the last meeting of the Entomological Society which he attended (October, 1894) he exhibited and explained in an informal way a plate which was to accompany a paper on ticks. This plate we reproduce as an example of his later style of work, as well as on account of its scientific value. The accompanying explanation is from his pen.

Personally, Dr. Marx was the most companionable of men. Genial and witty, he was at the same time earnest, and a man of wide reading and general information. American science can ill afford his loss.

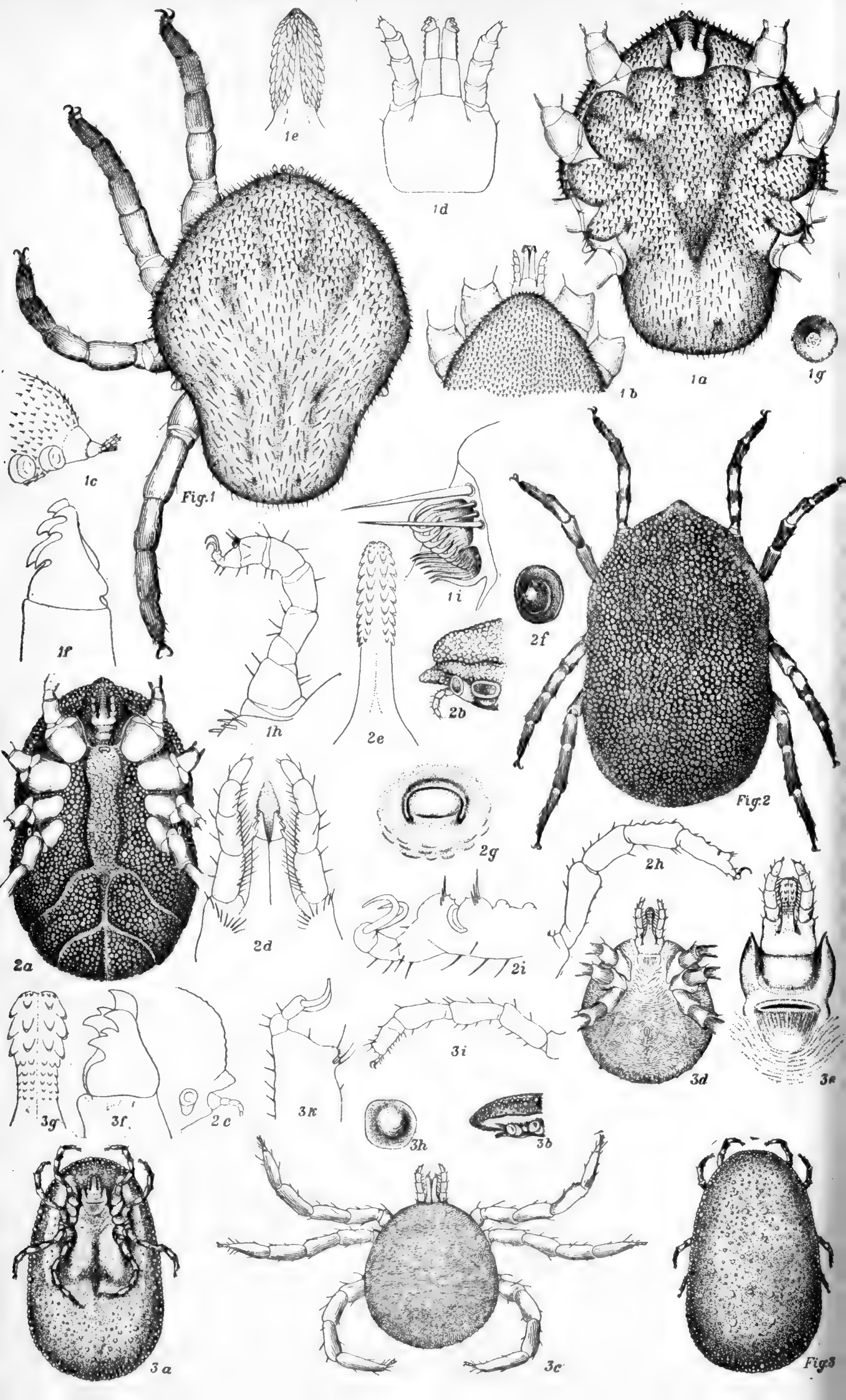
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Fig.3

EXPLANATION OF PLATE II.

FIG. 1.—RHYNCHOPRIUM SPINOSUM, dorsal view.
1*a*. Ventral view.
1*b*. Young, Capitulum not redrawn.
1*c*. Full-sucked individual, Capitulum projected.
1*d*. Capitulum, dorsal view.
1*e*. Maxillæ.
1*f*. Mandibles.
1*g*. Stigma.
1*h*. Front foot.
1*i*. Haller's organ of hearing.

FIG. 2.—ORNITHODORUS AMERICANUS, dorsal view.
2*a*. Ventral view.
2*b*. Side view of anterior portion.
2*c*. Position of Capitulum in full-sucked state.
2*d*. Capitulum, dorsal view.
2*e*. Maxillæ.
2*f*. Stigma.
2*g*. Female sexual orifice.
2*h*. Front foot.
2*i*. Haller's organ of hearing.

FIG. 3.—ARGAS AMERICANUS, dorsal view.
3*a*. Ventral view.
3*b*. Side view of anterior portion.
3*c*. Larva, dorsal view.
3*d*. Larva, ventral view.
3*e*. Capitulum, ventral view.
3*f*. Mandibles.
3*g*. Maxillæ.
3*h*. Stigma.
3*i*. Front foot.
3*k*. Haller's organ.

LIST OF THE ENTOMOLOGICAL WRITINGS OF GEORGE MARX.

1. On some new tube-constructing spiders.
Amer. Naturalist, vol. 15, May, 1881, pp. 396–400; 8 figs.

2. [List of spiders observed to feed on the cotton worm (*Aletia argillacea*), with a biological note on *Theridula sphærula*.
Fourth Report U. S. Entomol. Comm., Washington, D. C., 1885. *Appendix*, pp. [106]–[107]; plates XIII and XIV.

3. Description of *Gasteracantha rufospinosa*.
Entomol. Americana, vol. 2, no. 2, May, 1886, pp. 25–26; fig.

4. Notes on Thelyphonus Latr.
Entomol. Americana, vol. 2, no. 2, May, 1886, pp. 38–40; plate I.

5. Notes on Phrynus Oliv.
Proc. Entomol. Soc. Washington, vol. 1, no. 2, March, 1888, pp. 46–47.

6. [Remarks on the types of Scorpionidæ described by Wood.
Proc. Entomol. Soc. Washington, vol. 1, no. 2, March, 1888, pp. 90–91.

7. On the morphology of Scorpionidæ.
Proc. Entomol. Soc. Washington, vol. 1, no. 2, March, 1888, pp. 108–112; figs. 1–3.

8. Eurypelma rileyi Marx, n. sp.
Proc. Entomol. Soc. Washington, vol. 1, no. 2, March, 1888, pp. 116–117.

9. On a new and interesting spider [*Hypochilus thorellii*].
Entomol. Americana, vol. 4, no. 8, November, 1888, pp. 160–162; plate.

10. On a new and interesting spider from the United States [*Hypochilus thorellii*].
Proc. Entomol. Soc. Washington, vol. 1, no. 3, March, 1889, pp. 166–167.

11. On the importance of the structural characters of Hypochilus in the classification of spiders.
Proc. Entom. Soc. Washington, vol. 1, no. 3, March, 1889, pp. 178–180.

12. Arachnida [List of species collected by the "Albatross" expedition, 1887–1888].
Proc. U. S. Nat. Mus., vol. 12, 1889 (Feb. 1890), pp. 207–211.

13. A contribution to the knowledge of the spider fauna of the Bermuda Islands.
Proc. Acad. Nat. Sc. Philadelphia, 1889 (1890), pp. 98–101; pl. IV.

14. Count Eugene Keyserling [Obituary and bibliography].
Entom. Americana, vol. 5, no. 8, August, 1889, pp. 159–160.

15. On a new species of spider of the genus Dinopis from the southern United States.
Proc. Acad. Nat. Sc. Philadelphia, 1889 (1890), pp. 341–343; pl. XI.

16. Catalogue of the described Araneæ of temperate North America.
Proc. U. S. Nat. Mus., vol. 12, 1889 (May, 1890), pp. 497–594.

17. A contribution to the knowledge of North American spiders.
Proc. Entom. Soc. Washington, vol. 2, no. 1, April, 1891, pp. 28–37; pl. I.

18. On the effect of the poison of *Lathrodectus mactans* Walck. upon warm-blooded animals.
Proc. Entomol. Soc. Washington, vol. 2, no. 1, April, 1891, pp. 85–86.

19. Die Spinnen Amerikas—Brasilianische Spinnen—von Graf Keyserling nach dessen Tode herausgegeben von Dr. George Marx, Dritter Band.
Nürnberg, 1891. Verlag von Bauer & Raspe (Emil Küster).

20. Annual Address of the President: A List of the Araneæ of the District of Columbia.
Proc. Entom Soc. Washington, vol. 2, no. 2, June, 1892, pp. 148–161.

21. A contribution to the study of the spider fauna of the Arctic regions.
Proc. Entomol. Soc. Washington, vol. 2, no. 2, June, 1892, pp. 186–200.

22. Note on the classification of the Ixodidæ.
Proc. Entomol. Soc. Washington, vol. 2, no. 2, June, 1892, pp. 232–236.

23. Contributions to the knowledge of the life history of Arachnida.
Proc. Entomol. Soc. Washington, vol. 2, no. 2, June, 1892, pp. 252–255.

24. Die Spinnen Amerikas—Epeiridæ—von Graf E. Keyserling nach dessen Tode herausgegeben von Dr. George Marx, Vierter Band.
Nürnberg, 1892. Verlag von Bauer & Raspe (Emil Küster).

25. Annual address of the President: On the morphology of the Ticks.
Proc. Entom. Soc. Washington, vol. 2, no. 3, December, 1892, pp. 271–287.

26. On spiders' web.
Proc. Entom. Soc. Washington, vol. 2, no. 4, June, 1893, pp. 385–388.

27. On a new genus and some new species of Araneæ from the west coast of Africa, collected by the U. S. steamer Enterprise.
Proc. U. S. Nat. Mus., vol. 16, October, 1893, pp. 587–590; pl. LXX.

28. Degeneration by disuse of certain organs in spiders.
Proc. Entom. Soc. Washington, vol. 3, no. 1, March, 1894, pp. 26–27.

29. Continuation of the life history of the Whip-tail scorpion.
Proc. Entom. Soc. Washington, vol. 3, no. 1, March, 1894, p. 54.

30. [Amblyomma tuberculatum Marx, n. sp.]
Insect Life, vol. 6, no. 4, May, 1894, pp. 314–315.

To this list should probably be added a paper on the Arachnida collected by Dr. G. Bauer on the Galapagos Islands, written in the German language and sent for publication to the Zoologische Jahrbücher. The exact title, however, is not known.

JANUARY 4, 1895.

(*Special Meeting.*)

President Ashmead occupied the chair, and Messrs. McGee, Schwarz, Riley, Stiles, Benton, Marlatt, Gill, Heidemann, Dodge, Patten, and Howard were present.

The Treasurer read his annual report, showing a balance of cash on hand to the amount of $144.92.

Mr. F. W. Urich, Honorary Secretary of the Trinidad Field Naturalists' Club, Port of Spain, Trinidad, B. W. I., and Mr. H. Soltau, 251 E. 53d St., New York, were elected corresponding members.

The retiring President, Mr. Ashmead, then delivered his annual address:

ANNUAL ADDRESS OF THE PRESIDENT.

SOME IMPORTANT STRUCTURAL CHARACTERS IN THE CLASSIFICATION OF THE PARASITIC HYMENOPTERA.

By WILLIAM H. ASHMEAD.

Until within a few years, we have had, in America, comparatively few systematic workers in the order Hymenoptera, but since the publication, in 1887, of "A Synopsis of the Families and Genera of the Hymenoptera of America, north of Mexico," by our leading Hymenopterist, Mr. E. T. Cresson, considerable activity and interest in the order has been manifested, and to-day new workers are taking up the work where Cresson left off.

It is this aroused interest in the order which induces me to select the subject for my address, "Some important structural characters in the classification of the parasitic Hymenoptera," although other reasons and considerations weigh equally with me in my choice.

Many of our students appear to be unfamiliar with the extensive and rapidly increasing European Hymenopterological literature, and, judging from some recent work, in which the old lines of classification are still adhered to, seem to imagine that Cresson's work contains all the essentials for systematic work. The excellent classificatory work done by Förster, Thomson, Schletterer, Schmiedeknecht, Mayr, Kriechbaumer, Mocsary, Gribodo, Konow, Kohl and others are entirely overlooked, and important structural characters pointed out by these masters of our science are ignored.

It is to draw attention to some of these important characters, therefore, that I address you to-night, and also to point out a few others which I have discovered in over 15 years' study in the order, and which I am only just beginning to use and appreciate in my own systematic work.

In other departments of zoology, and indeed also by the public at large, the immense work being done by entomologists throughout the world—the greatness and grandeur of their task—is not at all appreciated, when in reality there are probably no more difficult or trying animals in the world to study than the Insecta. They are numbered by millions, although a rough estimate of the number of insects described in the world to-day foots up only a little under 300,000 species, or, more accurately, about 284,000 species, as follows:

Coleoptera, ...	120,000
Orthoptera, ...	9,000
Neuroptera, ...	5,000
Lepidoptera, ...	60,000
Hymenoptera, ...	38,000
Hemiptera, ...	20,000
Diptera, ...	30,000
	284,000

From this estimate it will be seen that the Hymenoptera known at present are far less numerous than the Coleoptera or the Lepidoptera; but this great discrepancy is due entirely to the few students at present working in the order, as I firmly believe that their number, when all the parasitic forms are worked up, will be greater than these two great orders combined.

This rough estimate will also enable you to form some idea of the great task before us—the value and necessity of a minute analysis of all their structural characters, and the many difficulties to contend with—before our system of classification can be at least approximately correct.

I should like, also, to draw your attention briefly to the great economic importance attached to their study, for this also, by many entomologists and the public, is only slightly appreciated, although to the farmer, fruit-grower, and agriculturist it is of the most urgent importance.

It is estimated that between three and four hundred millions of dollars are annually lost in the United States from the depredations of insect pests. Think of it; more than double the amount now in the United States Treasury! Now, all of these insect pests have their natural Hymenopterous parasites—true, many of them still unknown to us—that prey upon and destroy the eggs, larvæ, pupæ, and sometimes the imagoes themselves. Were it not so, not a crop of any kind could be raised in the United States. Few of us can estimate or appreciate the value of the services that thousands of these little parasites are daily performing for us in our midst—in our fields, our orchards, and our forests—in destroying and ridding us of the numerous Lepidopterous, Coleopterous, Hemipterous, and Dipterous insect pests so destructive to our forests, fruits, cereals, and our garden and field crops.

I am sorry to say, some of our entomologists, who having paid little or no attention to these insects, or who have given them but little thought, are disposed to belittle the services of our Hymenopterous parasites and, because they do not totally exterminate their hosts, claim they are of little economic importance. Now, I believe if we were to take away our Hymenopterous parasites, scarcely a single crop of any kind could be raised in the United States—certainly no cereal could be raised, as Aphides alone would destroy all—so rapid and prolific are they in their development.

To illustrate the wonderful prolificness of an Aphis I will quote from Buckton. He says:

"A single insect hatched from one of these shining black ova may be the mother of many billions of young, even during her lifetime. Latreille says one female during the summer will produce young at the rate of 25 in a day; and Réaumur calculates that one Aphis may be the mother of the enormous number of 5,904,900,000 individuals during the month or six weeks of her existence. Probably the daily birth, as given by Latreille, is above the truth, yet I have witnessed the birth of eight young from the same mother in six hours, viz., from ten o'clock in the morning to four o'clock in the afternoon. However this may be, neither Tougard nor Morren is satisfied with Latreille's billions; both state that quintillions are within the capabilities of a single mother's efforts. Prof. Huxley makes a curious calculation, though for a different purpose, which at any rate affords some approximate idea of what a quintillion of Aphides might mean. Assuming that an Aphis weighs as little as $\frac{1}{1000}$ of a grain, and that it requires a man to be very stout to weigh more than two million grains, he shows that the tenth brood of Aphides alone, without adding the products of all the generations which precede the tenth, if all the members survive the perils to which they are exposed, contains more ponderable substance than five hundred millions of stout men; that is, more than the whole population of China!"

In a foot note he then goes on to show—

"that Prof. Huxley's graphic illustration, nevertheless, much underestimates the real quantity of animal matter capable of elaboration from one single rose Aphis in a year.

"Basing the calculation, for simplicity, upon the supposition that every Aphis lives twenty days, and that at the expiration of that period each Aphis shall have produced twenty young and no more, then, at the expiration of three hundred days *only*, the living individuals would be 32,768,-000,000,000,000,000, or equal to the weight of 1,638,400,000 men."

* * * "A mathematical friend remarks that this calculation does not express the real rate of increase, since it supposes the progeny of the first Aphis to be produced *at once*, and not to commence producing until the expiration of the first twenty days. To this same friend I am indebted for the annexed calculation.

"If we suppose the progeny of the first Aphis to equal 20 in twenty days, and this progeny to begin producing, when five days old, 20 young, each of which on attaining the age of five days begins the propagation of 20 young, and completes, also, that number in twenty days;

"Then, at the end of twenty days from the commencement of first Aphis production there would be direct issue........................ = 20 A

"At the end of fifth day, progeny A begin to produce, which at the end of first twenty days will altogether equal 15 + 14 + 13, + 12, &c., + 2 + 1 .... = 120 B

"At the end of tenth day, progeny B begin to produce, which at the end of the first twenty days will altogether equal 10 + 9 + 8, &c., + 2 + 1 .... = 55 C

"At the end of fifteenth day, progeny C begin to produce, which at the end of the first twenty days will altogether equal 5 + 4 + 3 + 2 + 1.. = 15 D

"Total at the end of 20 days equals A + B + C + D...... = 210

"This amount, therefore, at the end of 300 days (or 20 $\times$ 15) would not be less than the fifteenth power of 210, which is almost impossible to express in figures. 'There would be room in the world for nothing else but Aphides!' Truly, 'Nature is most wonderful in small things.'"

These estimates, given above, are founded upon mathematical exactness and cannot be refuted. But you will say: "If this is so, why do not our Aphides increase and become more of a pest than they are to-day?" I reply: Because of their parasites. Most of our fruit trees and vines—the apple, the peach, the orange, the grape, watermelon, etc.—and our more important field crops, such as cotton, wheat, corn, etc., have distinct species of Aphides, which destroy annually thousands of dollars' worth of these products, but which, fortunately, are more or less kept under control by their natural enemies—these parasitic Hymenoptera and other predaceous insects.

From the orange Aphis in Florida, I have reared five distinct species of parasites; from the cotton Aphis, three or four; from the wheat Aphis seven or eight; from the corn Aphis four or five; and from other Aphides parasites in like proportions. Fourteen years ago, from three or four large orange leaves taken from an orange tree in my yard and badly infested with the orange Aphis, I reared between three and four hundred specimens of a parasite, and a careful examination of the leaves afterwards showed that every Aphis had been parasitized. Thousands of these little parasites were found running about on my trees, and within a very brief period after their appearance my trees were comparatively free from the pest.

These are only a few instances out of hundreds that could be cited in illustration of the benefits derived from our Hymenopterous parasites.

It would be well here, also, to draw attention to another side of this important question of parasitism, that is, to the introduction of the exotic, natural enemies of such of our insect pests as have been imported from foreign countries. Scarcely any attention at all has been given to this side of the question, although lately the subject has been agitated and some efforts are now being made towards its accomplishment. Let me urge, therefore, upon all those who are in a position to influence action upon this good work, to do so without further delay, as much good will result therefrom.

Some years ago, in Insect Life (vol. II, p. 210), Mr. L. O. Howard called attention to the European parasites bred from the Gypsy Moth (*Ocneria dispar* Linn.), an introduced European pest now depredating places in Massachusetts, and for the extermination of which the Massachusetts legislature is spending annually thousands of dollars. Mr. Howard gave a list of no less than 24 distinct species of Hymenoptera bred from it in Europe, of which number 16 were primary parasites. It has always appeared to me singular why, with this knowledge before them, no effort has ever been made, on the part of those in charge of the work of destruction, to introduce some of these parasites. This might have been done, some years ago, at a comparatively small outlay—between three or four thousand dollars at the most—and certainly, had this been done, the parasites would have aided materially in the destruction of the pest and in keeping it within reasonable bounds.

In these introductory remarks I believe I have now said sufficient to demonstrate to you all the economic importance of these parasites, and to impress upon you the benefits to be derived from a thorough study of their habits and structure, although connected with them are many other problems of great biologic interest, upon which I would like to say a few words, but which must be left unsaid for want of time; and I will therefore leave these untouched and proceed with the substance of my address—some important structural characters of these parasites.

The Head.

The head has always been considered of great importance in classification—its size, shape, and various appendages entering quite largely into all our systematic work, but it is not yet exhausted, and there are still important characters which may be used by us in our work.

On the accompanying Plate III, I have made some rough outline figures of a few of the different shaped heads, in order to draw special attention to some characters which should not be overlooked in classification, as they are frequently correlated with other characters of primary importance.

Figs. 1, 2, and 3 represent the head of three different Braconids. The first is quadrate, with head behind eyes very long; the second is transverse-quadrate, the head behind eyes not narrowed; the third is also transverse, but with head convergent behind eyes.

Now, strange to say, all three forms, with some others, are still retained to-day in the genus Bracon, according to the present classification in vogue, and they will illustrate what I mean when I say the head and appendages, for use in classification, are still unexhausted. In my recent studies in the Braconidæ, these different shapes at once attracted my attention, and I soon found they were correlated with other characters, which will enable a subdivision of this extensive genus into half a dozen or more new genera—the other characters being found in the antennæ, shape of scape, in the palpi, and in the thorax and abdomen.

Figs. 4 and 5 represent two forms of head in the family Evaniidæ, while figs. 6 and 7 represent two characteristic forms to be found in the Chalcididæ, belonging to the subfamily Pteromalinæ, as seen from in front, all the others having been shown from above.

In this last family not enough attention has been given, in descriptive work, to the shape of the head as seen from in front, and to the shape of the clypeus, shape of eyes, mandibles, the character of the maxillary and labial palpi, and to the insertion of the antennæ.

In fig. 6 the head, as seen from in front, is nearly round, slightly wider than long, the clypeus being bidentate, the antennæ being inserted on the middle of the face; in fig. 7 it is oblong, nearly twice as long as wide, the clypeus being truncate, while the antennæ are inserted just above the clypeus or the mouth.

I would call special attention here to the great difference observable in the clypeus and to its importance in classification. Sometimes it is entirely separated from the face by grooved lines, or separated only at the sides or not at all, as shown in fig. 6. Its anterior margin may be unidentate, bidentate, tridentate, truncate, rounded or emarginated, and these differences should always be mentioned in descriptive work.

The position of the antennæ should always be mentioned, as I have only illustrated two forms of insertion of these important organs. Sometimes they are placed far above the middle of the face, on the frons, or much below the middle of the face, on a line with the base of the eyes.

In figs. 8 and 9 I represent two remarkable shaped heads representing a male and female fig-insect belonging to the Agaonidæ or Blastophagidæ.

All females in this group have a more or less oblong head, which is grooved above, with a small curved tubercle at base, and with peculiar saw-like appendages to the mandibles as shown in fig. 8.

Fig. 9 represents a male. The males are always apterous, with slender, weak, or aborted middle legs and stout, strong, much swollen front and hind legs; the abdomen is long and tubular, being curved under the thorax.

These remarkable insects live entirely on various fig-trees and are essential to their pollenization.

Other important characters connected with the head are the mouth-parts, the mandibles, palpi, etc.

The Swedish entomologist, C. G. Thomson, seems to have been the first to make extensive use of the mandibles in classifying the Chalcididæ.

After a careful study of them, I agree with him in regard to their value as aids in classification, although neither in this country nor abroad has their value been fully appreciated.

Figs. 10 and 11 represent the typical forms found in the *Eucharinæ*, a group of the Chalcididæ parasitic on ants.

These are long, sickle-shaped, with one or two teeth on the inner margin, near the middle.

Figs. 12 and 13 represent the two types found in the *Perilampinæ*, and figs. 14 and 15 represent two inquilinous or parasitic fig-insects, Sycorectes.

Figs. 16 to 22 also represent different types in the Chalcididæ. You will observe that they have four, three, and two teeth respectively; also that the shape and character of the teeth differ materially in the several forms shown.

In fig. 16 the outer tooth is the largest, the three following being nearly equal; in fig. 17 the outer and the inner are equal, or nearly so, and larger than the two middle teeth; in fig. 18 the teeth are much smaller and all about equal; in figs. 19 and 20, the one with four, the other with three, the inner tooth is blunt or truncate; while in figs. 21 and 22 both are bidentate, but the outer tooth in one is much longer than in the other.

In some genera both mandibles may be 4-dentate or 3-dentate; in others they are 3-dentate in one mandible and 4 in the other. All these characters are important in descriptive work.

Our systematic workers have not given enough attention to the structure of the mouth-parts of our parasites, although they undoubtedly afford excellent characters for generic diagnoses.

To show how variable and valuable they are in systematic work, I have given some rough drawings, Plate IV, representing types found in three different families—the Ichneumonidæ, Braconidæ, and Chalcididæ.

Fig. 1 represents the mouth-parts of Ichneumon (after Ratzeburg). Here the labial palpi are 4-jointed, the maxillary palpi 5-jointed, the galea being developed into strong, broadly rounded lobes, while the mentum, maxilla, and other parts have shapes peculiarly their own.

Fig. 2 represents the same parts of a Braconid belonging to the genus Microgaster. The labial palpi are only 3-jointed, the galea less strongly developed, while the other parts are quite differently shaped from those in Ichneumon.

Figs. 3 and 4 represent the mouth-parts of two Chalcids—one a Pteromalus, the other a Eurytoma. Here the maxillary palpi are only 4-jointed; the labial palpi, although 3-jointed, have the second joint very small; while the mentum and galea are quite distinct from both Bracon and Ichneumon.

Fig. 4 represents Eurytoma. You will notice a marked difference in the shape of the galeæ between it and Pteromalus. These are long and acuminate or lanceolate, while the other parts are correspondingly different.

All through this immense family, comprising thousands of species, many different types of mouth-parts occur, which I believe, in connection with other characters, justify us in dividing it into several distinct and well-marked families. The labial palpi vary in the number of joints from 3 to 1, the maxillary from 4 to 1, while the shape of the mentum, paraglossa, galea, and maxilla exhibit several distinctly marked types.

The Thorax.

In the second division of an insect, or the thorax, two distinctly marked types of the pronotum occur, which I believe to be of primary importance in classifying all insects in this order.

In one type the pronotum does not extend back to the tegulæ, or the scale at the insertion of the front wings—there is always a small sclerite thrust in between them; while in the other type the pronotum always extends back and touches the tegulæ.

This simple character enables us to at once bring together all the closely allied families in the two great sections—into which the Hymenoptera are divided—in a way no other single character will do, and it must not be overlooked by the student.

In this connection I should like to say something of the side pieces of the thorax—the pleura, episterna, epimera, etc.,—characters found to be of primary importance in the classification of the Coleoptera, and which will be found to be of the same importance in the classification of this order; but these characters are still unanalyzed, in my mind, and while I might point out their value in some particular cases, until I have satisfied myself of their value in all the groups, I prefer, for the present, to say nothing about them.

With the metathorax, however, I can do better. In the metathorax of a Hymenopterous insect are to be found some of the most important characters, suitable for classification, found nowhere else, and, strange to say, in America these important characters are entirely overlooked, or only used to a limited extent. Their value and importance are not fully appreciated by us.

We are in reality indebted to the learned Dr. Arnold Förster for first calling attention to them, or, rather, making use of them, in his Essay Synopsis der Familien und Gattungen der Ichneumoniden, published in 1868; but to the Swedish entomologist, C. G. Thomson, for first really analyzing their value and making use of them largely in his systematic work.

Every natural group in the Parasitica seems to have an individualized type of metathorax, and this has been most admirably brought out recently by Thomson.

Take the Ichneumonidæ for instance. In the group *Ichneumoninæ* all have a more or less distinctly areolated metathorax, caused by raised lines, or carinæ, variously arranged and modified to form different shaped cells or areas.

On Plate V, in the figures, I have attempted to illustrate these areas and their value to us in classification.

You will notice there are five series of cells—three median and two lateral. To these the following names may be applied:

No. 1. Basal area or first median area.
2. Areola, upper median area or second median area.
3. Petiolar area, apical area, or third median cell.
4. External area or first lateral basal area.
5. External median area or the second lateral area.
6. Internal area, the middle apical area, or the third lateral area.
7. The spiracular area or the first pleural area.
8. The middle pleural area or the second pleural area.
9. The angular area or the third pleural area.

The carinæ or raised lines may also be named:

M. M. are the two median longitudinal carinæ.

L. L. are the two lateral longitudinal carinæ.

P. P. are the two pleural carinæ.

The transverse carinæ are—

B. The basal transverse carina.

A. A. The apical transverse carina.

These names will enable us to properly define the areas and carinæ in descriptive work. For instance, these carinæ are sometimes wanting between the areas. If the basal transverse carina between the basal area and the areola or the median cell (2) is wanting, we say basal area and median cell confluent; if the median transverse carina be wanting, we then say median and apical or the petiolar areas confluent—and thus through the whole series.

In fig. 2, I show the metathoracic character of a Cryptid.

Here there are only two transverse carinæ, the areas being wanting.

In figs. 3, 4, 5, and 6 I show some of the characteristic forms of the metathorax observed in the family Chalcididæ. In fig. 3 the metathorax is produced into a subglobose neck at apex, while there are three longitudinal carinæ, the two lateral usually being designated as the lateral folds.

In fig. 4 the median carina is wanting, while in fig. 5 is exhibited a form entirely without carina. In both of these figures the metathorax is not produced into a subglobose neck.

In fig. 6 I show a character not apparent in any of the others. This is a grooved line or channel extending from the spiracle to the apical margin, which is termed the spiracular sulcus. It is a valuable character in the classification of the Chalcididæ.

In figs. 7, 8, 9, and 10 I show some typical forms of the metathorax observed in the subfamily *Microgasterinæ* in the family *Braconidæ*, which I find to be of great importance in dividing this group into sections. In fig. 7 we have a median area or areola, in fig. 8 a median longitudinal carina, in fig. 9 it is perfectly plane without either areola or carina, while in fig. 10 the apical margin is deeply bisinuated.

While on the subject of the metathorax, I desire to call special attention to another character of primary importance, entirely, or almost entirely, neglected by systematic workers; that is, the shape and position of the metathoracic spiracles. These should always be defined, at least in our generic descriptions.

On the plate I have figured some of the more important forms: Fig. 11 is round or circular; fig. 12 oval; fig. 13 ovate; fig. 14 elliptical; fig. 15 reniform or kidney-shaped; fig. 16 linear; fig. 17 curved linear.

The wings and their venation have always been considered of the first importance in classification, and their value is not overestimated. In fact, our system of classification in all orders to-day, except in the Coleoptera, is based mainly upon venation.

To enter fully into the subject of venation, as found in the Parasitica, would occupy much time, and I shall only be able to-night to draw attention to a few special types and point out to you the value of some characteristic features of these in systematic work.

In figs. 1 to 12, on Plate VI, I illustrate a few of these types. Figs. 1 and 2 represent two typical forms of the front wings found among the Braconidæ. Here, you will notice, the stigma in one is greatly thickened; in the other it is long and slender, although otherwise there is a close resemblance between the two. On a closer inspection, however, we will see there are marked differences. In fig. 1 the submedian cell (2) is not longer than the median (1), while in fig. 2 this same cell is longer than the median.

Another difference is in the recurrent-nervure (l). In one it enters the first submarginal cell; in the other it is received by the second submarginal cell. There are also other differences. In fig. 1 the discoidal nervure (j) is straight; in fig. 2 it is angularly broken; still another great difference is in the radial cell, the one being much smaller or shorter than the other, the radius in one not extending to the apex of the wing. These slight differences are of the greatest importance in a study of these insects.

Fig. 3 represents the typical hind wing of a Braconid, while figs. 4 and 5 represent hind wings of Ichneumonids. Fig. 6 represents the hind wing of the peculiar and rare genus *Rhopalosoma*, still classed with the Braconidæ. Observe what a marked difference there is between these forms, and what admirable characters they present for classificatory purposes! Why is it that American students have made no use of these excellent characters found in the venation of the hind wings of these insects?

Is it not time for us to begin to make use of them in our tables?

The Abdomen.

In the third division of an insect, or in the abdomen, may be found a host of most excellent and valuable characters for use in systematic work. These lie in its shape, the relative length of the segments—the tergites and sternites, and in the position of the spiracles.

The value of these I will attempt to show by the use of the few rough figures on Plate VII.

In the family Braconidæ we have an extensive subfamily, termed the *Microgasterinæ*, comprising an excessively large number of minute species of great economic importance, as all, with but few exceptions, are primary parasites on destructive Lepidopterous larvæ.

This group has always been considered the most difficult one to study in this family, and up to the present time remains in the greatest confusion, as no one has been able to seize hold of salient characters that will readily separate the species.

This, I think, can now be done, without much difficulty, from the use of characters pointed out to-night.

In my remarks under the thorax I have already called attention to the great differences observable in the metathoracic characters of this group, and these differences taken in connection with structural peculiarities of the abdomen, now to be pointed out, will enable any one to readily separate these insects into sections, subsections or divisions, and then into species.

In figs. 18, 19, 20, 21, and 22 I show the structure of only five different types of abdomen observable in this group, although many others exist.

On the first or basal segment of all the species in this group, as well as sometimes in some species of other groups, is a raised chitinous shield or plate of various shapes or forms.

This plate I find to be exceedingly valuable in classification, and I have made extensive use of it in my forthcoming monograph of the North American Braconidæ.

This plate, you will notice in fig. 18, is about three times as long as wide, the sides being parallel; in fig. 19 it is trapezoidal, scarcely as long as wide, or a little wider at apex than at base; in fig. 20 quite a different shape is seen; here it is much longer than wide, or long trapezoidal, with the hind angles rounded; in fig. 21 we have a quadrate-shaped plate, covering almost entirely the upper surface; while in fig. 22 still another quite different shaped plate is seen; here we have a narrow, sharply pointed, wedge-shaped or lanceolate-shaped plate.

These are only a few of the many forms occurring in this group.

In this connection I would also call attention to another character of primary importance, which should be more extensively used in classification; that is, the relative length of the tergites or dorsal segments.

Take fig. 18, for example. Here, you will notice, the second segment is very short—about half the length of the third, with two oblique grooved lines. Compare this now with the others figured and see what a great difference there is.

In fig. 19 the second segment is almost twice as long as the third, while the oblique grooved lines are wanting. In fig. 20 the second and third are nearly equal; in fig. 21 it is about 2½ times longer than the third; while in fig. 22 it is only a little shorter than the third, with two oblique grooved lines that are approximate at base.

To still further illustrate the value of these charaters, which I find to be of the greatest importance in classifying most of the groups in the Microhymenoptera, I have illustrated the abdominal characteristics of five different genera in the group Eurytominæ.

Figs. 23 and 24 illustrate the female and male of *Isosoma;* figs. 25 and 26, female and male of *Decatoma;* figs. 27 and 28, female and male of *Bruchophagus;* figs. 29 and 30, female and male of *Eurytoma;* while figs. 31 and 32 represent the female and male of the rare genus *Axima*, represented at present by only two species—one described by Walker, from Brazil; the other by Howard, from New York.

A few words more, and I am done. The subject to which I have called your attention is both an extensive and an important one, and in my remarks to-night I have only barely touched upon some of the more important characters. I have said nothing of the antennæ, the shape and structure of the legs, the tibial spurs and the claws, and their importance in classification, while I have but briefly touched upon venation.

To say all I should like to say would fill a volume, but I trust I have said sufficient to show the importance of the subject and to bring our students in line with the work being done abroad.

I have described many species in the groups spoken of this evening, and have myself been described as a *species maker*.

In conclusion, however, allow me to say that there is no entomologist who knows better or appreciates more thoroughly than I the work that is before us. I know and feel there is something higher, something grander, something more ennobling than mere species making, and that is the utilization of nature's laws for the benefit of mankind. By this I mean systematic work—the bringing of order out of chaos, the discovery of reliable structural characters which may be depended upon for the founding of families, genera, and species, and their arrangement in such manner that the student the world over can readily recognize them; also the search after and the discovery of the laws or principles underlying and influencing this mighty host of insect life—the discovery of their habits and life-histories, the morphological changes undergone in their struggle for existence, by change of food, environment, or climate—their migrations, their geographical distribution, whence and how it came about, and the laws governing their increase and decrease.

All of these things are of the greatest importance, looked at from any standpoint—philosophically, biologically, or economically—and any life is well spent that is devoted to the discovery of these laws, and the unravelling of the lives and habits of the millions of these minute organic beings that teem in field and forest.

The address was discussed by Messrs. Marlatt, Schwarz, Riley, Howard, and Gill.

Mr. Schwarz congratulated Mr. Ashmead upon the results of what had evidently been a very great labor. He discussed briefly and comparatively a few of the characters mentioned by Mr. Ashmead, and spoke of their significance with the Coleoptera. He stated that with the latter order the hind wings have not been used to any great extent, and that only family characters have been derived from them.

Dr. Riley complimented the address highly, but called attention to the fact that the great majority of the characters pointed out by Mr. Ashmead had been used before by European systematists. He agreed as to the value of a great majority of the characters described, although he was not inclined to give much weight to the variations in the shape of the spiracles and the dentation of the mandibles. The abdominal characters, as illustrated by the figures of Eurytoma, Decatoma, and Isosoma had always been used, and he had carefully drawn them for the

American Entomologist, years ago, in connection with some of Walsh's studies. He also spoke of the extraordinary fecundity of the Aphididæ, giving examples of recent experience in his own greenhouse, and also referred to what he had recorded from actual observation in reference to *Phorodon humuli*.

Mr. Howard said that it might seem strange, to the majority of systematists in other groups who were present, that the students of parasitic Hymenoptera had so long confined themselves in their descriptive work to the differentiation in a few obvious characters, and went on to state that this was due to the fact that, with the comparatively small number of forms which had hitherto been under observation, classification could be accomplished by the study of these few alone. Moreover, many of the important characters just pointed out by Mr. Ashmead are difficult of observation, and certain of them involve a partial dissection of the specimens. With the extraordinary increase of the number of forms collected which has been brought about of late years, however, the necessity arises for the discovery of new characters for their separation. The necessity is becoming greater every day, and in Mr. Ashmead we evidently have the man for the emergency. The address, as a whole, is of the greatest value, and will undoubtedly be of great assistance to students in the parasitic Hymenoptera.

Dr. Gill expressed some dissatisfaction with the President for having apologized for going into such minute details. The speaker considered that this study of minute detail is exactly what we need. Our modern school of zoologists have drifted away from this necessary class of work and have in fact frowned down systematic study. It is becoming the custom, in fact, to study a few types and to write a text-book about them, whereas what we need is a multiplicity of details about a multiplicity of forms. Mr. Ashmead's address is typical of the best kind of systematic zoology.

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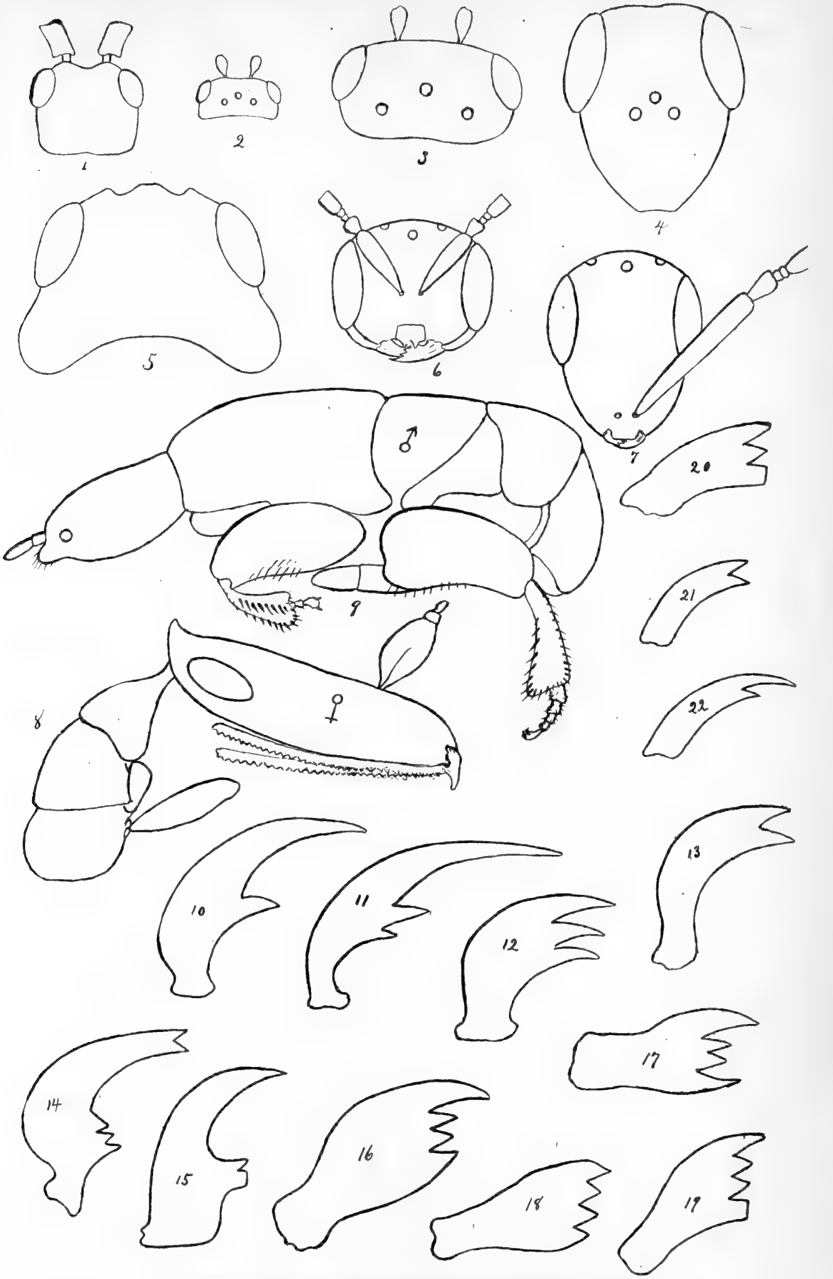
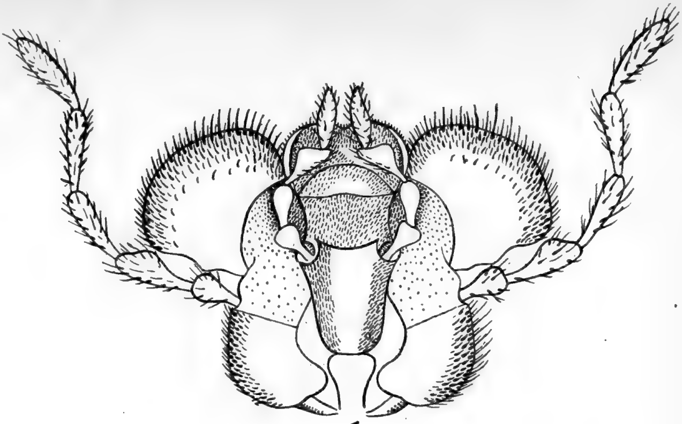
105 FEBRUARY 7, 1895.

President Ashmead occupied the chair, and Messrs. Schwarz, Benton, Coquillett, Marlatt, Gill, Howard, C. Hart Merriam,



STRUCTURAL CHARACTERS IN HYMENOPTERA.



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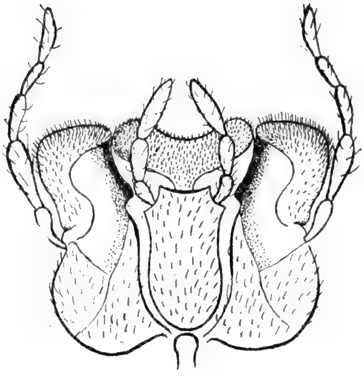

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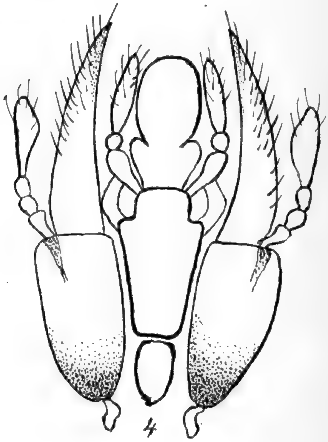

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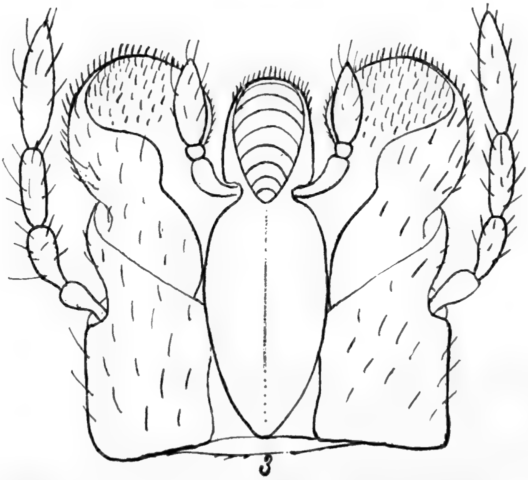

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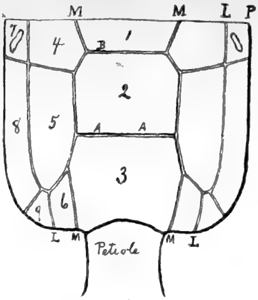

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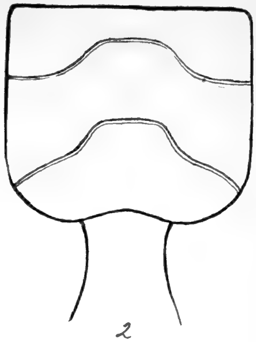

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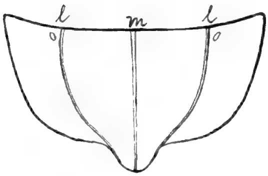

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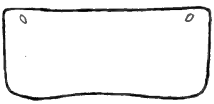

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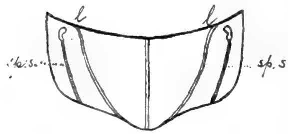

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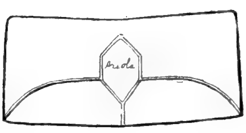

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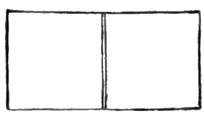

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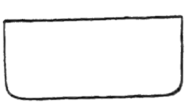

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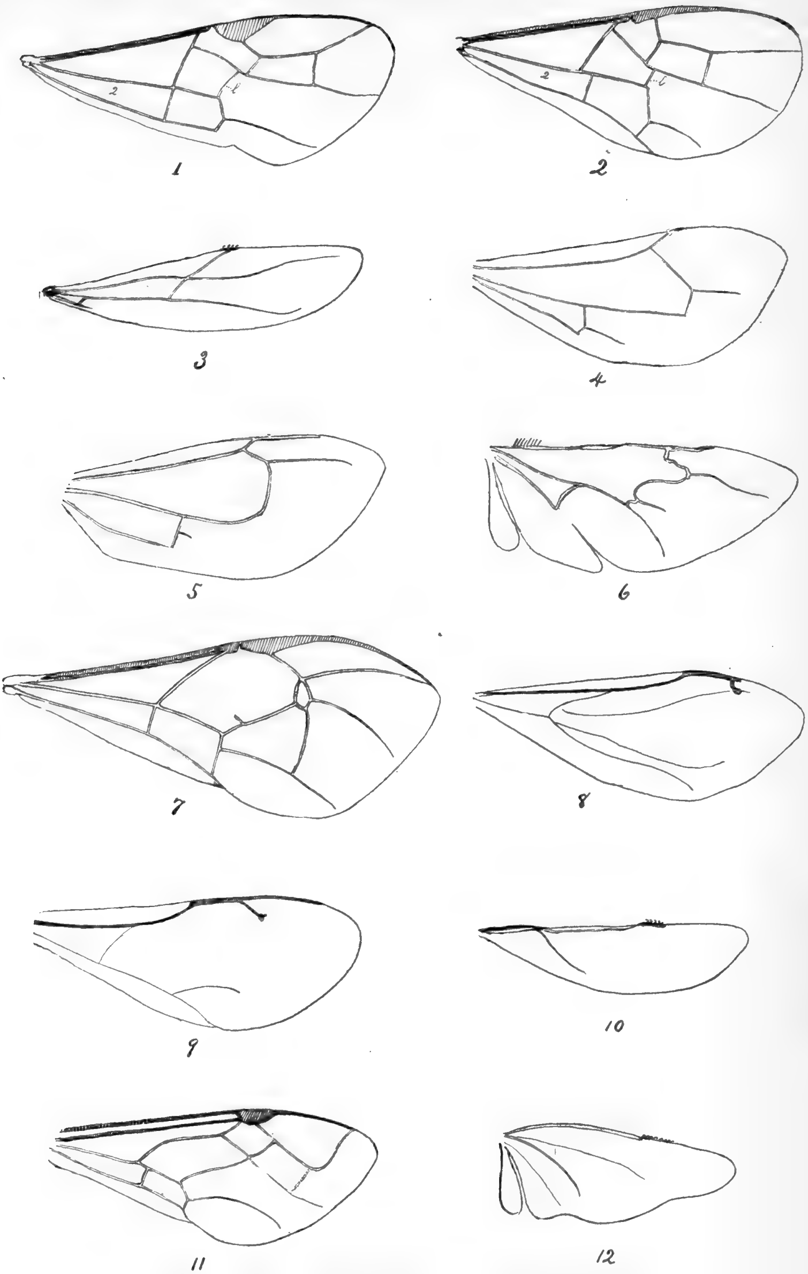

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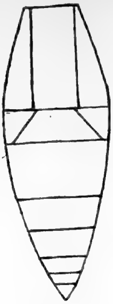
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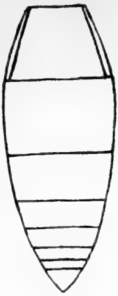
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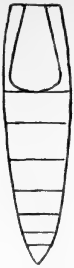
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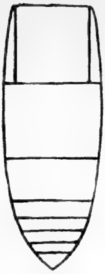
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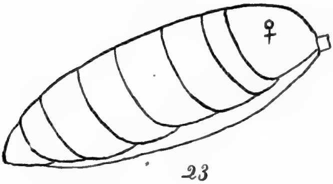
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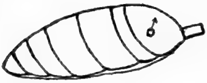
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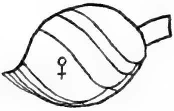
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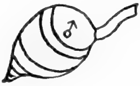
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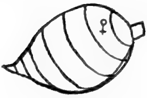
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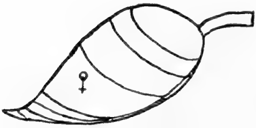
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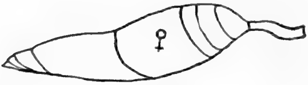
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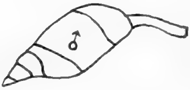
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STRUCTURAL CHARACTERS IN HYMENOPTERA.

R. S. Clifton were present, the small attendance being due to a blizzard.

The Corresponding Secretary announced the deaths of Berthold Neumögen and George D. Bradford, both of New York city and both corresponding members of the Society.

On motion, the President appointed Messrs. Schwarz, Howard, and Gill a committee to take charge of the sale of the collection of Arachnids left by the late member of the Society—Dr. George Marx, as well as to prepare a biographical sketch and a list of his writings for the proceedings.

Mr. Coquillett was elected a member of the Executive Committee to fill the vacancy caused by the death of Dr. Marx.

Mr. Howard read a paper entitled—

NOTES ON THE GEOGRAPHICAL DISTRIBUTION WITHIN THE UNITED STATES OF CERTAIN INSECTS INJURING CULTIVATED CROPS.

By L. O. Howard.

The broad subject of the natural geographical distribution of animals and plants is a sufficiently complicated one, but it becomes still further complicated when we come to consider the actual and possible distribution of cultivated species. One small phase of this subject enters naturally into the work of the economic entomologist, although it has as yet received no attention. This phase is expressed in the query, How far will a given injurious insect follow its natural food-plant when the geographical range of the latter is extended by artificial means? This is a question which can be answered satisfactorily only by a study of each individual injurious species and the facts concerning its origin and present spread, as well as by a consideration of the laws governing the distribution of the food-plant.

It is reasonable to suppose that in many cases insects will be unable to follow their food-plants to the limits of their possible range, notwithstanding the fact that the geographical distribution of animals and plants is governed by the same general laws of temperature, humidity, exposure, and geological characteristics. The obvious reason for this is, that purely artificial features are introduced in cultivating plants, varieties are propagated which develop resistant powers lacking in the parent stock; seeds, in the case of annuals, are carefully collected and selected, the soil is prepared for their reception, and is artificially fertilized; while with perennials the same general care is taken. It follows, therefore, that the natural range of cultivated species is widely extended in every direction, and in the teeth of the very barriers which naturally would have held them rigidly in check. Plant-feeding insects in general follow the natural distribution of their specific food. Experience has shown that as this natural food becomes a cultivated crop they increase. As the cultivation of the crop is spread along natural lines of distribution, they follow it. When, however, by artificial selection, hardy varieties of the crop plant have developed, and the range becomes thus extended along what may be termed unnatural lines, with certain species, at least, and within certain limits with them, their insect enemies will naturally be unable to follow them. The result will be, theoretically, natural selection with the insects trying to catch up with the results of artificial selection with the plants.

It will be interesting to follow the geographical distribution in the United States of a few important insect enemies of cultivated crops, to see what geographical limits apparently exist with the insects, which do not exist with the crops on which they feed.

My attention was first called to this matter by the somewhat peculiar spread in the east of *Aspidiotus perniciosus*. This insect, the original home of which is unknown but which may be South America or Australia, made its first appearance in the vicinity of San José, California. It spread rather slowly north and south through that peculiar life-zone on the Pacific coast of our country which combines throughout its entire extent forms belonging to the boreal and upper Sonoran regions. Brought across the entire country to New Jersey upon nursery stock, it spread rapidly through two large nurseries, and then for a number of years was sent out, ignorantly, upon nursery stock to the North, South, East and West, probably to nearly all of the thousands of customers of two of the most prominent nursery firms in the country. Not until the summer of 1893 was its presence in the East recognized by entomologists. Traffic in infested stock, however, had been going on for five or six years, and it was soon ascertained that the insect had taken a foothold at a number of points. Many of these points have been definitely located, and the occurrences of the insect studied. The species occurs upon all deciduous fruit trees. Apples and pears, and to a certain extent peaches, are, as every one knows, extensively grown in portions of the transition life-zone; in certain of these localities, in fact, fruit-growing is a great industry, and we may accept it as practically certain that nursery stock was sent to many points in this zone. The facts so far collected, however, fail to reveal a single locality within the limits of this zone in which the insect has established itself. Many points have been found in the upper austral, others occur in the austro-riparian and lower Sonoran, but not one has been found in the transition. The accuracy with which the difficult northern border line of the upper austral has been mapped by Dr. Merriam is indicated by several interesting occurrences of the San José scale which have been investigated. The southeastern one-fifth of Pennsylvania is upper austral, the zone taking a loop up at this point. Near the bottom of this loop the San José scale has been found, and at its extreme northwestern limit another occurrence has been ascertained.

Across the northwestern corner of New Jersey the Alleghanian region extends in a diagonal line from southwest to northeast. In this corner the scale has not established itself, although below New Brunswick, as I learn from Dr. J. B. Smith, the orchards of the State are generally affected. Dr. Smith, in his paper read before the Association of Economic Entomologists last August, correlated this dividing line with the so-called "red shale" line of New Jersey, and seemed of the opinion that the scale would not permanently establish itself north of this line. That it might so establish itself for a time, he said, was indicated by the occurrence of the insect in Columbia county, New York. The real significance of this occurrence in Columbia county, however, is shown by the fact that up the Hudson river nearly to Albany there extends a narrow finger of the upper austral zone. On Long Island the scale has also been found, but this, too, is upper austral. Across through the mid-region of the upper austral or Carolinian there are occasional points where the scale has established itself, and other significant occurrences have been found in Idaho. A narrow band of the upper austral or upper Sonoran extends along the Snake River valley, and at two points in the western part of the State within this band the scale has become established. The other Idaho point of establishment is also very interesting. This is the immediate vicinity of Lewiston, at the only point in the pan-handle of Idaho where the upper austral dips in from Washington.*

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*Since the reading of this paper this peculiarity in the distribution of *Aspidiotus perniciosus* has been mentioned by the writer in Insect Life, volume VII, p. 292. Immediately after the publication of this record, specimens of this species were received from Professor C. H. Fernald, collected at Amherst, Mass. This was apparently a refutation of the probable limitation of spread suspected. Investigation, however, showed that the infested trees had been brought from New Jersey and planted at Amherst in the spring of 1894, and examination in the spring of 1895 showed that all of the scale insects were dead. The instance, therefore, becomes a confirmation rather than a refutation. Moreover, the south Connecticut band of the upper austral extends for some distance up the Connecticut river, as is quite to be expected from the general law concerning river-banks. Quite up to the Massachusetts line, and beyond, plenty of upper austral forms are found mingling with transition forms.

From our present information it seems that the spread of this destructive insect is likely to be limited, for a time at least, by the boundaries of the upper and lower austral zones; and if future observations prove that this supposition—based upon so few observations, it is true—be correct, it will afford immeasurable relief to the thousands of fruit-growers in New England, large portions of New York and Pennsylvania, and the northern portions of the lower peninsula of Michigan.

The older history of the eastern spread of the Colorado potato-beetle affords another exemplification. Potatoes are grown from the northern limits of the transition zone in British America south to the Gulf of Mexico. The Colorado potato-beetle, originally an inhabitant of the transition zone in the West, and feeding upon native solanaceous plants, spread straight east through the upper austral zone to the Atlantic ocean. It spread to the north, into the transition region, more slowly than towards the southern boundary of the upper austral. The centre of the army travelled the fastest, the north wing more slowly, and the south wing still more slowly. The insect established itself for a series of years, at least, at every point along the journey, and at many points permanently. Reaching the northernmost limit of the lower austral, however, it found its limit for a time, and in the southern range of this species we find a very interesting study. Bordering the southward extension of the Alleghanian fauna is a downward loop of the upper austral zone which includes the northeast corner of Alabama and the northwest corner of Georgia. So accurately were the limits of the spread of this species gauged to the limits of the upper austral that the only points in the Gulf line of States where the species had established itself as a crop pest were, until within the last year or two, in the northeast corner of Alabama and the northwest corner of Georgia.*

The asparagus-beetle, *Crioceris asparagi*, was brought over from Europe and became noticeable on Long Island in 1856 to 1859. This insect spreads readily by flight and is carried, in the egg state and as young larva, on bunches of the cuttings sent to market. Its original spread was westward upon Long Island, out into southern Connecticut, down through New Jersey and eastern Pennsylvania, through Delaware and Maryland to Wash-

*In April, 1895, word was received of the occurrence of this species at Charleston, S. C., where it is said by Mr. H. M. Simons to have been destructive in 1894. Whether this is a permanent establishment will require two or three years' test; but at all events the restriction has lasted many years. The same may be said of Arkansas and northern Louisiana. The insect occurs rarely at Auburn, Ala., and still more rarely, and only upon native food-plants, in the Mesilla valley, in New Mexico.

ington, and inland it has reached Fredericksburg, Va. Down the coast it has proceeded as far as Fortress Monroe. Mr. Schwarz has recently called attention to the earlier introduction of the species, about 1800, at Hanover, York county, Pennsylvania. All these occurrences are upper austral; the insect has not spread to any very great extent into transition regions. In order to reach the continuation of the upper austral in western Pennsylvania, northwestern New York, and midwestern States, it has had to traverse the broad barrier of the Alleghanian region. This, it is reasonable to suppose, it could do only or mainly by the aid of commerce. Not until within the last ten years is it known to have taken this jump. In 1884 a few specimens were found at Geneva, N. Y., and in 1892 it was found about Rochester, where later Dr. Lintner ascertained that it had been troublesome to asparagus growers for some little time. Its westward spread may now reasonably be supposed to be comparatively rapid. In 1893 Mr. Webster reported it at Cleveland and Akron, Ohio, and announced its prior occurrence in Columbiana county, in the same State. To say, however, as Mr. Webster does, that it doubtless reached this latter place via the Ohio river is hazardous, since no locality along the Ohio east was previously known to be infested. It was evidently a commercial jump across the Alleghanian barrier and a settlement in the first available upper austral spot. From now on its spread to the west may be steady, and we shall expect that year after year it will extend its westward range.

The Geneva and Rochester localities, it will be remembered, are included in the eastward bend of the upper austral, which introduces a more southern character into the fauna and flora of western New York. So far, there is nothing to conflict with the idea that the species will not establish itself in the true transition region. There remains, however, the fact that specimens have been received from several Massachusetts localities and Nashua, N. H. At Nashua it transpires that the insect was introduced in 1892, was rather numerous in 1893, and appeared to be *dying out* in 1894. Massachusetts reports are worthy of similar investigation. If the insect has permanently established itself at Amherst and other points as an injurious species, it possesses to some extent the power of ranging beyond the line where many upper austral forms cease. It is well to state, however, that the northern boundary line of this zone in Connecticut is an uneven one, and is not established with absolute definiteness.

The spread of the imported elm-leaf beetle (*Galeruca xanthomelæna*) is also significant in view of the peculiar dividing line between the upper austral and the transition in the general region between Washington and Albany. Its well-known oc currences throughout New Jersey, southeastern Pennsylvania, southern Connecticut, and in the upper austral finger which extends up the Hudson river, lead to the opinion that it is more or less strictly confined by the limits of the upper austral zone. A problematical occurrence has been reported to me from Middlebury, Vermont, some ninety miles to the northeast of the Hudson River loop, and this locality needs investigation.

Judging from what we know of the distribution of the sugar-cane and corn-stalk borer (*Diatræa saccharalis*), it is a tropical or sub-tropical species which extends with ease through the austro-riparian zone. Following up the Atlantic coast extension of the austro-riparian, it occurs abundantly through Georgia, South Carolina, North Carolina, and southern Virginia, and no complaints of its damage have been received from the corn-growing upper austral belt which bounds on the east the downward extension of the Alleghanian. However, that it also possesses the power of reproducing itself to some extent in the upper austral is shown by the fact that it has extended north of the northern limit of the lower austral in Virginia by some 75 or 100 miles, and has also established itself on the north bank of the Potomac river in southern Maryland. It is not likely, however, that the species will establish itself injuriously to any serious degree in upper austral regions, although one of its prominent food-plants is most extensively grown all through this zone.

The chinch-bug (*Blissus leucopterus*), while a very wide-spread species, occurring from North Dakota on the northwest to southern Florida on the southeast, and from northern Maine on the northeast to southern Texas on the southwest, occurring also, sparingly, on the Pacific coast from north California down into lower California, reaches its climax as a destructive species only in the upper austral zone. The band of upper austral on the east side of the Alleghanian, from northern Virginia to the borders of South Carolina, is a portion of this territory; but from eastern Ohio westward through Kansas, limited on the north by the transition and on the south by the austro-riparian, is its proper home as an injurious species. Curiously enough, Mr. Schwarz has recently concluded that this species is originally a sea-coast form.

The permanent breeding grounds of the Rocky Mountain locust are in the transition downshoot from British Columbia into the northwestern States.

So far as our information goes, the wheat straw-worm, *Isosoma tritici*, is confined to the upper austral and makes the proper bend around the lower end of the Alleghanian to the south, in northeast Alabama and northwest Georgia. It occurs in the

Carolinian and upper Sonoran belt to Colorado, and is again found upon the Pacific slope north to Washington.

The American locust (*Schistocerca americana*) is a tropical and austro-riparian form, which apparently extends with ease through many upper austral regions. It is common throughout the southern States, from the District of Columbia to Texas, and injurious broods have occurred in Illinois, Indiana and southwest Ohio. It has been doubtfully reported from the vicinity of New York city, and specimens have been taken in New Jersey as far north as Newark and New Brunswick. The last number of the *Canadian Entomologist* records the capture of a single specimen in Canada. The note is by Mr. J. Alston Moffat, who lives at London, in lower Ontario, at the borders of the upper austral, and presumably the specimen was captured in the Canadian strip of this zone, although the actual locality is not given.*

This species is one of the forms which would seem to indicate that in a few cases, at least, the winter temperature must have some effect in determining distribution. It is exceptional from the fact that it hibernates in the adult condition, and we can hardly avoid the conclusion that it is limited in its northern range by circumstances which influence successful hibernation. Nothing is better known than that exceptional freezes may kill off thousands of insects; there must therefore be species whose successful hibernation is limited by certain degrees of cold.

There are, then, among these species which we have just considered, several enemies to cultivated crops which are apparently unable to follow their food-plants into certain regions into which their cultivation has been successfully carried. They are species which occur to me at first glance over the field, and closer study will doubtless show others. There are, however, scores of species in which no such limitation exists. Such are *Leucania unipuncta*, *Heliothis armiger*, *Pieris rapæ* and many others which will readily occur to you. There are many potentially cosmopolitan species. Even in the case of *Leucania unipuncta* and *Heliothis armigera*, however, there seems at least a partial end to injurious occurrences at the borders of the transition zone.

The few facts just mentioned indicate that results of interest as well as of practical importance can be gained from the plotting of the spread and range of crop enemies. The fact that there are limitations not dependent upon food with even a few species, is of great importance, and it is a line of investigation which must be followed up.

Mr. F. M. Webster in his suggestive paper, "Some insect

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* Mr. Moffat has since written me that the specimen was taken in the immediate vicinity of London.

immigrants in Ohio," published in *Science* for February 3, 1893, and subsequently in Bull. 51 of the Ohio Experiment Station, has brought out some interesting facts regarding the probable methods of introduction and lines of spread of certain species through Ohio; but he has failed to appreciate the fundamental truths which govern the distribution of species in his region. Among other things, he has failed to point out the important fact that certain species to which the transition forms a barrier coming from the east can seldom reach Ohio by natural spread. The carriage of infested plants or the steam transportation of individuals across the Alleghanian barrier is necessary for their introduction, and upper austral forms are quite as liable to reach Ohio from the east by means of the great commercial paths to midwestern New York and thence by natural spread through lower Ontario and southern Michigan, or by the lake from Buffalo to Cleveland, Sandusky, or Toledo, as by commercial jumps across the mountainous regions of Pennsylvania.

The whole subject is one which is fraught with the greatest difficulty as well as interest. What I have just said is of the most preliminary character and is advanced in this hurried way only on account of its suggestiveness, and to induce consideration and discussion of a comparatively new field. I have planned an extensive investigation of the question, and am engaged in plotting on a large scale the actual distribution and injurious occurrences of about 150 of our most destructive species, and in this work hope to have the assistance of many of our entomologists.

The paper was discussed by Messrs. Schwarz, Ashmead, Merriam, and Gill. Mr. Schwarz spoke of the fact that there is a large class of cosmopolitan species which defy all laws of geographical distribution. Local influences may cause their absence at certain points. He defined a cosmopolitan species as one that occurs in both temperate and tropical zones of both hemispheres. The scale-insects also seem to be not amenable to laws which affect other species. In the case of introduced insects he had noticed that, in general, forms introduced into the boreal regions of this country are unable to spread into other zones. In the same way species introduced into the southern States do not spread in the more northern regions. This restriction seems irrespective of spread in Europe. If species are introduced into the middle States, however, they are more liable to spread both to the north and the south. Mr. Ashmead spoke principally about the possible spread of the parasites of injurious species. In his opinion parasites will always follow their hosts, no matter what the spread of the latter may be. He mentioned particularly *Isocratus vulgaris* and *Euphorus sculptus*, as well as some of the parasites of wood-boring Coleoptera, which occur apparently in all parts of the world. He mentioned also the Spalangia parasite of the house-fly, and the fact that the European *Opheltes glaucopterus*, originally an European species which occurs all through the United States, had recently been found by him in a collection of insects from Japan. These facts, he thought, emphasized the importance of efforts to introduce parasites of introduced injurious species.

Dr. Merriam expressed his pleasure at the opportunity of listening to the paper just read, not only on account of his long study of the problem of distribution, but also because he had always believed that there is a direct practical bearing of the question in just this direction. In 1868 he had made an appeal before the New York State Legislature for the establishment of a biological survey, arguing that when we became familiar with the life-zones we could predict the spread of injurious species. He had also referred to the same point in one of his official reports. The paper just read, however, was the first direct proof of the correctness of his idea which had been advanced.

Apropos to the occurrence of Opheltes in Japan, Mr. Schwarz added that it is remarkable that so few Japanese insects have been introduced into California. Referring further to the supposition that *Aspidiotus perniciosus* was introduced from Australia, he thought that the original home of many of our injurious Coccidæ must be China. The Coccid fauna of China has not been studied, but, on account of the extremely old civilization and cultivation of plants, many injurious forms which have since spread widely must have originated there. Mr. Ashmead agreed with the last speaker and stated that the most injurious among orange-scales—*Mytilaspis citricola*—was brought direct to Florida from China many years ago upon orange plants. Dr. Gill stated that the most ancient civilization was not Chinese, but Indian, Assyrian, and north African. Our domestic animals in the main came from Egypt and the adjoining parts of Asia. He mentioned particularly the domestic cat and the domestic dog. Referring to Mr. Ashmead's statement as to the spread of parasites, he incidentally mentioned the house-fly and the bed-bug, whereupon Dr. Merriam stated that he had never known the bed-bug to occur in the boreal zone. Dr. Gill was inclined to think that he had heard of its occurrence in St. Johns, Newfoundland, and he remarked that we cannot trust to negative evidence, such as that just advanced by Dr. Merriam, for upon negative evidence alone he would be inclined to say that the bed-bug does not occur in the city of Washington! Mr. Schwarz stated that the chicken-flea—*Sarcopsylla gallinacea*—had recently been traced by Julius Wagner (Horæ Soc. Ent. Ross. 28, 1894, pp. 440) to central Asia, which is probably its original home.

—Mr. Marlatt read a paper entitled:

FURTHER NOTE ON THE CODLING MOTH.

By C. L. Marlatt.

A very interesting and satisfactory explanation of the variation in the number of broods of the Codling Moth in different parts of the United States is given by the maps illustrating Dr. C. Hart Merriam's Laws of Temperature Control of the Geographical Distribution of Terrestrial Animals and Plants.* Dr. Merriam's first map, showing the distribution of the total quantity of heat during the season of growth and reproductive activity, presents an interesting agreement in its zones with the available records in regard to the number of broods of this insect, and gives a basis of fact for my statement, in *Insect Life*, (vol. VII, No. 3, pp. 248–51,) that "it must be inferred that the climate of New Brunswick differs in the *summer season* sufficiently from that of the middle and western States—even of Iowa and northern Illinois—to lead to the development of but one yearly brood." The data so far obtained indicates one annual brood for the region over which the total summer heat exceeds 5,500° C., corresponding pretty closely with Dr. Merriam's transitional zone, and including, in general, the northern tier of States, with a southward extension along the main mountain systems, most of New England, and northern New Jersey. Two annual broods may be expected

* National Geographical Magazine, vol. VII, pp. 229–238; pl. XII–XIV.

throughout the region with summer heat exceeding 6,400° C., approximating the upper austral life-zone, and including in general the middle section of the United States, together with southern Michigan and Wisconsin, and the western half of Oregon and Washington. The records of southern California lead us to expect three broods for the region with total summer heat exceeding 10,000° C., corresponding pretty closely with the lower austral life-zone, and covering the cotton belt and most of California. The unexpected occurrence of but one annual brood in northern New Jersey, as opposed to two in northern Illinois and Oregon, and three in California, receives here a valid explanation. Doubtless there are many exceptions within the zonal regions indicated by Dr. Merriam, in the number of broods of this insect; but, normally, they will probably be found to conform to the zones as indicated; and, at least, a good basis is furnished for future observations.

The important economic bearing of the variation in the number of broods of the Codling Moth for the zones as thus approximately limited comes in connection with remedial treatment.

Experience has abundantly shown that where there is more than one annual brood it is the second or later broods that are especially to be feared—the damage of the first, except on very early apples, rarely amounting to much. Therefore, in the northern of these zones, or where there is but one brood annually, the infestation will be slight, because accomplished by the comparatively few female moths which successfully hibernate, and will be comparable to the work of the first brood only of the warmer zones. For the northern zone, spraying, except for the early summer varieties, which will attract the majority of the moths, may prove unnecessary; while for the middle and southern zones remedial effort is at once more necessary and more difficult of successful accomplishment.

In discussing this paper, Dr. Merriam stated that the case described by Mr. Marlatt was paralleled by the distribution of the seventeen and thirteen-year broods of the periodical cicada. Mr. Howard referred to the discussion between Professor Riley and Professor J. B. Smith on the number of broods of the elm leaf-beetle and to the suggestion made by Professor Riley that it would be important to study intermediate points between Washington and New Brunswick, N. J., to ascertain where the single-broodedness begins. He thought that the double-broodedness would be found to cease near the borders of the transition. Mr. Schwarz stated that many similar instances might be mentioned, and in the fact of our greater summer heat in this country, as compared to Europe, we have one of the reasons for the greater damage accomplished by introduced insects, since here they have more generations annually. *Scolytus rugulosus*, for example, is double-brooded in Europe, while here it may have six generations annually. Dr. Gill, referring specifically to Mr. Marlatt's paper, asked whether it did not indicate that early apple culture should be abandoned in the transition zone. Mr. Marlatt stated that it indicated, rather, a necessity for spraying summer apples only. Mr. Howard spoke of the possible spread of the gypsy-moth, and Mr. Schwarz called attention to the fact that insects introduced in the vicinity of Boston rarely spread.

—Mr. Ashmead read the following paper:

ON THE GENUS PELECINELLA WESTWOOD, AND ITS POSITION AMONG THE CHALCIDIDÆ.

By William H. Ashmead.

Nearly twenty-seven years ago the genus *Pelecinella* was erected by the late Prof. John O. Westwood for the reception of a peculiar Chalcidid collected by Bates along the banks of the Amazon in Brazil, the description being published in the Proceedings of the Entomological Society of London for the year 1868.

In his classical work "Thesaurus entomologicus oxoniensis," published in 1874, Westwood redescribes the genus, and on plate xxvi, fig. 8, gives an admirable illustration of the type *Pelecinella phantasma*.

Up to the present time this single species is the only one known and it is probably extremely rare, as, during this long interval of twenty-seven years, no other authority, that I am aware of, makes mention of its capture. The types in the Hope Museum at Cambridge must therefore be the only ones in existence.

It affords me, therefore, the greatest pleasure to exhibit to you tonight two new species belonging to this rare genus, discovered in the Herbert Smith collection now in my hands for naming, and to dedicate one of these to the grand old English entomologist, John O. Westwood, the other to our fellow-member, Mr. L. O. Howard.

Before describing these two species—which may be known as *Pelecinella westwoodi* and *Pelecinella howardi*—a few remarks in regard to the peculiar characteristics of the genus and its proper position among the family Chalcididæ will be apropos.

Westwood, in his characterization of the genus, stated its affinities were with *Callimome*, an old name for the modern genus *Syntomaspis*, belonging to the subfamily *Toryminæ;* but in his Thesaurus he has placed it with his subfamily *Perilampides*. Prof. Westwood was probably influenced into assigning it an affinity with the Toryminæ from a fancied resemblance due to the very short subsessile stigmal vein, and by the long ovipositor, characteristics more particularly found associated with members belonging to this group; but why he finally placed it with the Perilampides I cannot imagine, unless it is on account of the shape of the head, the head having a deep antennal emargination, and the coarse sculpture of the head and thorax.

A careful study of the two species exhibited tonight convinces me, however, that the genus has not the slightest affinity with either the *Toryminæ* or the *Perilampinæ*, but, on the contrary, all its affinities are with the subfamilies *Cleonyminæ* and the *Eupelminæ*, and I believe it forms a connecting link between these two subfamilies, but with characteristics sufficiently well marked to warrant us in elevating the genus into a distinct subfamily, intermediate between the two aforementioned groups.

It differs from all genera in the Cleonyminæ by the very slender legs, which increase successively rapidly in length and size; so that the hind pair are more than twice longer than the anterior pair; by the anterior and posterior coxæ being very long; by the very short subsessile stigmal vein; and by the long petiolated, strongly compressed sword-shaped abdomen.

It differs from all genera in the *Eupelminæ* by venation; by the shape and structure of the abdomen and thorax, the mesopleura having a long femoral furrow; by the proportionate length of the legs, and in having the middle tibial spur small and their tarsi not dilated; and by the two broad claspers at the base of the ovipositor.

In the Eupelminæ two genera, *Polymoria* Förster and *Metapelma* Westw., have the tarsi of the middle legs slender, not dilated, but the tibial spurs are large, and, besides, both have the large, non-impressed mesopleura and the characteristic mesonotum of the Eupelminæ, and their position cannot be mistaken.

The groups showing the closest affinities with the Cleonyminæ may therefore be arranged in the following order:

Subfamily Chalcedectinæ = Polychrominæ.
Subfamily Cleonyminæ.

Subfamily Pelecinellinæ.
Subfamily Colotrechninæ.
Subfamily Eupelminæ.
Subfamily Encyrtinæ.

Pelecinella Westwood.

1868. Trans. Ent. Soc. Lond., Proc., p. 36.
1874. Thes. Ent. Oxon., p. 142.

(Type *P. phantasma* Westw. ♀.)

♀.—Body very long, linear; head subglobose, with deep antennal furrow; eyes very large, convex; antennæ 11-jointed, longer than the thorax, joints 2 and 3 minute, fourth joint very long, the following joints gradually shortening; mandibles broad; maxillary palpi 4 or 5-jointed (the last two joints connate); labial palpi 3-jointed, the last joint long, clavate.

Thorax elongate, the anterior half transversely striated; pronotum very long, longer than the mesonotum but narrower, and narrowed anteriorly; mesonotum with complete parapsidal furrows; scutellum large, obconical, the axillæ approximate; metanotum long, longer than wide, without carinæ or spiracular sulci, the spiracles oval; wings with the stigmal vein not developed, sessile or punctiform, the postmarginal very long, extending to the apex of wing and fully twice as long as the marginal; legs increasing in length and size posteriorly, the hind pair more than twice larger than the anterior pair; anterior and posterior coxæ long, conical, the latter much the larger; anterior tibiæ above and hind coxæ above serrated; tibial spurs 1, 2, 2; tarsi on front and middle legs much longer than their tibiæ, those of the hind legs much shorter than their tibiæ.

Abdomen petiolated, very long, slender, compressed, sword-shaped, terminating in a long prominent ovipositor, which is more or less protected at base by two large foliaceous plates or lobes.

♂.—Unknown.

The following table will aid in separating the species:

Table of Species.

Females.

Mostly rufous.. 2.
Mostly black.
  Abdomen purplish or chalybeous; legs black, the 4 apical joints of hind tarsi white; ovip. 10 mm....................*P. phantasma* Westw.
  Abdomen toward base and above the venter rufous or rufo-piceous, otherwise, including the petiole, black; legs black, but with the tibiæ and tarsi of anterior and middle legs and hind legs, except tibiæ and

tarsi, rufous; hind tibiæ black, with an annulus at base and their tarsi white; ovip. 15–16 mm.............................*P. howardi* sp. n.

2. Head above, the antennæ, the thorax above (rarely entirely) and ovipositor, except tips, black.
Abdomen except tip of claspers, and legs except hind tarsi, rufous; ovip. 7–8 mm..*P. westwoodi* sp. n.

(1) **Pelecinella phantasma** Westw.

Trans. Ent. Soc. Lond., 1868, Proc., p. 36, ♀.
Thes. Ent. Oxon., 1874, p. 142, pl. xxvi, fig. 8.

Hab.—Amazon river, Brazil, (Bates).

Types in Hope Museum at Oxford.

(2) **Pelecinella howardi** sp. n.

♀.—Length to tip of claspers 24 mm.; to tip of ovipositor 38 mm. Black; anterior tibiæ and tarsi, hind coxæ and femora, rufous; hind tibiæ, except a white annulus at base, black or fuscous; hind tarsi, except basal one-third of basal joint, white. Wings subhyaline; tegulæ rufous; submarginal, marginal, the sessile stigmal, and the postmarginal veins black; spurious veins fuscous. Abdomen much longer than the head and thorax united, mostly black, the second and third segments rufous, the latter more or less stained with black and becoming black towards apex; ovipositor as long as abdomen, its tip white.

Hab.—Chapada.

Described from 2 ♀ specimens in Herbert Smith collection. It is at once distinguished from *P. phantasma* Westw. by the color of legs and abdomen and by the much longer ovipositor.

I have dedicated this grand Chalcidid to my friend Mr. L. O. Howard.

(3) **Pelecinella westwoodi** sp. n.

♀.—Length to tip of claspers 16–17 mm.; to tip of ovipositor 19 to 22 mm. Mostly rufous, the thorax more or less marked with black or sometimes entirely black except a rufous spot at sides; antennæ, the bottom of antennal furrow, vertex, occiput, veins in wings, tips of the broad claspers at tip of adbomen, and the ovipositor, except extreme tip (which is white), black; hind tarsi white, the basal one-fourth of the first joint, including the extreme tip of the tibiæ and the tibial spurs, black.

Hab.—Chapada and Port Branca.

Described from 2 ♀ specimens in Herbert Smith collection.

This species is quite distinct in the color of the legs and abdomen and in size from the other forms mentioned here. The anterior and middle legs, especially their tibiæ and tarsi, are paler than the posterior pair, and rather more of a brownish-yellow than rufous.

It is dedicated to the late Prof. John O. Westwood.

The paper was briefly discussed by Dr. Gill, who stated that he was glad to see that the author was not afraid to erect a subfamily for a single genus. So many systematists seem to be influenced in their erection of higher groups quite as much by the number of forms as by morphological significance.

—Mr. Marlatt read the following paper:

THE AMERICAN SPECIES OF SCOLIONEURA KNW.

By C. L. Marlatt.

The genus Scolioneura belongs to the subfamily Blennocampinæ and was separated by Konow from the genus Blennocampa on what appear to be valid grounds. The important characters separating the genus Scolioneura from Blennocampa are, the curved basal vein which converges with the first recurrent, and the broad inner tooth which projects from near the base of the claw. In Blennocampa the basal vein is straight and parallel with the first recurrent, and the claws are bifid or nearly so, the inner tooth being large and almost as long as the outer. In the Tenthredinid material now in my possession I find two species which may be properly assigned to Scolioneura, and of the described American species of Blennocampa *B. capitalis* Norton may also be so referred. The following characterization of the genus is given by Konow: *

Body small, ovate, compound eyes reaching base of mandibles, antennæ rather slender, filiform, basal nerve of upper wings curved, not parallel with first recurrent vein, transverse radial often not interstitial, posterior lower angle of third cubital cell acute, discal cells of lower wings wanting, inner tooth of claw near base and broad.

Scolioneura capitalis Norton.

Female.—Length 4 mm. Soft, delicate species; clypeus broadly, squarely truncate; vertex smooth, shining, sutures indistinct. Antennæ filiform or very slightly thickening towards tip, 3d and 4th joints subequal; basal vein strongly converging with 1st recurrent, distinctly bent near origin; 1st cubital cross-vein wanting, or indicated by a minute stump on cubital vein; stigma broad, rounded; hind wings without discal cells or bordering veins; claws with broad but short basal inner tooth; sheaths projecting, narrow, obliquely truncate at tip; color light honey-yellow; antennæ, except two basal joints, head, epimeræ and more or less of tip of abdomen, brown; wings hyaline; veins yellowish-brown.

Redescribed from one specimen collected in New York (Norton's type).. Type in collection Amer. Ent. Soc., Philadelphia.

* Deutsche Ent. Zeits., 1890, p. 239.

This insect has the venation of Fenusa if the rudimentary stump of the 1st cubital cross-vein be ignored.

Scolioneura canadensis n. sp.

Female.—Length 3.5–4 mm. Rather robust, smooth, shining. Clypeus truncate, head smooth, sutures not distinctly defined; antennæ shorter than thorax alone, scarcely tapering: inner tooth of claw short, inconspicuous; radial cross-nerve not interstitial.

Color.—Head, thorax except anterior and lateral lobes, and abdomen, brownish-black; legs pallid; femora, especially middle and hind pair, brownish; clypeus and mouth-parts pallid; anterior and lateral lobes of thorax reddish-yellow; eyes green iridescent; wings hyaline; veins brown.

Described from two specimens collected in Canada. Types belonging to the American Entomological Society of Philadelphia.

Scolioneura populi n. sp.

Female.—Length 4 mm.; very robust, glistening; clypeus broad, truncate, projecting over labrum; prominent sutures running from base of antennæ to occiput; basin of anterior ocellus small, circular and connecting with elongate posteriorly-tapering antennal fovea; antennæ very short, not twice length of head, third joint twice as long as fourth, others subequal, shortening but little towards terminal ones; transverse radial and third transverse cubital veins interstitial or nearly so; sheaths moderately robust, truncately rounded, somewhat pointed at upper apical angle; claws with large sub-apical tooth, below tooth greatly broadened.

Color.—Yellowish ferruginous inclined to whitish on head, thorax and abdomen; lateral and basal sutures of vertex, antennal fovea, ocellar basin, occiput, thorax dorsally except distinctly defined border of anterior and the sides and apex of lateral lobes of mesothorax, two spots on scutellum, abdomen dorsally except two or three terminal segments, meta-episterna, lower third meso-epimera, black; legs, meso-epimera and light area of lateral lobes of mesothorax inclined to ferruginous; antennæ black, obscured by white pubescence, fulvus beneath; wings hyaline, veins and stigma brownish, costa pale.

Male.—4 mm. long; less robust than female; structurally as in female; lateral lobes of mesothorax marked with white laterally, scutel black, terminal abdominal segments light apically; abdomen infuscated beneath, especially basally, hypopygium pale; ferruginous limited to legs—otherwise color as in female.

Described from three females and one male, from C. H. T. Townsend, Las Cruces, N. M. Types in the Coll. U. S. Nat. Mus.

This species is supposed by Mr. Townsend to be the parent of the larva which mines the leaves of *Populus fremontii* injuriously throughout the Mesilla valley in New Mexico.* Mr. Townsend has failed to rear the adults, but has collected these saw-flies on the cottonwoods just as the leaves were beginning to expand, early in April. He also reports that they were very abundant, flying everywhere during the latter part of March. A saw-fly belonging to a different genus, however, mines the poplar leaves in the larval state in exactly the manner described by Mr. Townsend; and the reference of the New Mexican species to the poplar-leaf miner is therefore still open to question.

So far as known, the larvæ of the European species feed exposed on the surface of leaves of Betula and Tilia.

—Mr. Coquillett read the following:

ON THE NESTING HABITS OF THE DIGGER-WASP, BEMBEX CINEREA HANDLIRSCH.

By D. W. Coquillett.

On September 11, 1891, in company with an enthusiastic naturalist, Dr. A. Davidson, of Los Angeles, California, the writer spent several hours in digging out the nests of this wasp in a sand-bank near the ocean beach adjoining the little village of Redondo, a summer resort distant about ten miles from Los Angeles. The sand-bank in question is in the form of high ridges with intervening depressions, and the nests were located in or near the bottom of these depressions. The mouth of the burrow leading to the nest was closed, and the only indication of its presence was a more or less circular pile of loose sand surrounding it. The burrow extended obliquely downward a distance of from sixteen to twenty inches, passing entirely through the loose surface sand and entering the moist, hard-packed sand beneath. At a point about four inches before its terminus a branch was formed which passed beneath the main burrow, going still deeper into the earth. The entire burrow had somewhat the form of an obliquely inverted Y, one arm of which lay directly beneath the other. Nothing was found in the main burrow, the nest being invariably located at the farthest end of the branch.

A large number of the burrows were examined, and all of them were constructed on this same plan, the philosophy of which is not very apparent. It cannot be for the purpose of excluding

* *Canadian Entomologist*, vol. xxv, p. 304, December, 1893. *Zoe*, vol. iii, pp. 234–236, October 1892.

the rain from the nest proper, since the latter was always placed in that branch which would be certain to catch any water that might find its way into the burrow. Nor could it be for the purpose of misleading intruders, since these, by following the burrow, would be led directly into the nest, with the possible exception, if any such exist, of those that make their way along the upper side, or roof of the burrow; these would be led into the empty end of the main burrow. No parasites of any kind were found in any of the numerous nests examined by us.

Only one Bembex inhabited each burrow, and at the time of our visit, larvæ, pupæ, and recently excluded imagos occurred. The terminal portion of the burrow which contained the nest did not differ in character from the remaining portion. The nest proper was stored with Diptera only, among which were *Musca domestica*, a second, undetermined species of *Musca*, *Lucilia cæsar*, *Sarcophaga* sp. (?), and *Psilocephala costalis.* One of the nests contained one specimen of each of these flies, with the exception of the Psilocephala, of which there were two, and of the Musca sp. (?) eight specimens, or thirteen flies in all, and these were to serve as food for the single Bembex larva.

After attaining full gowth this larva spins a dense black, very elongate oval silken cocoon. Many of the empty cocoons were lying about on the surface of the sand, either having been brought from the burrow by the wasp in its efforts to escape therefrom, or else they had been unearthed through the combined action of the wind and rains.

The species is rather rare in southern California, where I have observed it only in the vicinity of the sea-coast. The adults are seen resting upon the bare sand during the warmer portion of the day; they are very active and shy, seldom permitting a near enough approach to allow of being captured by means of an ordinary butterfly net.

Mr. Howard asked how the habits of this species differ from those of other species of the same genus. Mr. Ashmead stated that Bartram, over 100 years ago, observed that Bembex will supply its larvæ with fresh food from time to time and that this observation had been substantiated more recently by European observers. Mr. Coquillett, however, had not noticed this with the present species, and stated that at the time of his visit the mouth of the nest was closed with sand by the adult wasp. Mr. Ashmead remarked that all species of Bembex store up Diptera.

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MARCH 7, 1895.

President Ashmead was in the chair, and Messrs. Marlatt, Vaughan, Benton, Gill, Patten, Schwarz, Linell, Chittenden, Coquillett, Howard, Riley, Heidemann, Stiles, DeSchweinitz, and Fernow were also present.

—Mr. Ashmead read the following paper:

ON THE GENUS BARYCNEMIS FÖRSTER.

By WILLIAM H. ASHMEAD.

The genus Barycnemis was erected by Dr. Arnold Förster, in his "Synopsis der Familien und Gattungen der Ichneumonen," published in the Verhandlungen des natur-historischen Vereins der preussische Rheinlande und Westphalens, vol. xxv, 1868, p. 147.

The type is not mentioned and, so far as I am aware, the genus has not since been recognized.

In Mr. W. Hague Harrington's collection of Braconidæ, kindly loaned me for study and comparison, during the progress of my work in monographing the North American Braconidæ, I found a most singular looking Ichneumonid, bearing a superficial resemblance to some of the Euphorinæ, which, for a time, was exceedingly difficult to place. Finally, however, after many trials and tribulations and the expenditure of much time in going over the literature, with the aid of Förster's Synopsis, I have been able to place it. It belongs, without doubt, in his genus *Barycnemis*.

The genus was briefly characterized by Förster among the genera belonging to his family *Porizonoidæ*, which, however, is not a distinct family, according to my views, but should be considered as a tribe in the subfamily *Ophioninæ*.

The genus appears most closely allied to *Porizon* Grav., but is readily separated from it and all other genera in the group by the much longer, more linear body, the short swollen femora and tibiæ, and by the very long, slender tarsi, which are as long or even longer than the femora and tibiæ combined.

Our species may be briefly characterized as follows:

Barycnemis linearis sp. n.

♀.—Length 4 mm.; ovipositor a little longer than the petiole, recurved. Body elongate, slender, polished black; abdomen more or less along the sides and beneath dark honey-yellow or reddish; antennæ filiform, brown; legs honey-yellow, or reddish-yellow, the hind femora more or less brownish above. Wings hyaline, the stigma large, triangular, brown;

basal nervure rather strongly curved inwardly; median and submedian cells equal; radial cell triangular, a little longer than the stigma; areolet wanting. The head, when viewed from in front, is oblong, smooth, polished; eyes large, extending to base of mandibles; antennæ broken at tips, but the basal joints of the flagellum are more than twice as long as thick; thorax narrowed anteriorly, without parapsidal furrows, the surface, except just in front of scutellum, smooth and polished; metathorax very long, smooth and polished, except an oblong space at base above which bears a median sulcus.

Hab.—Ottawa, Canada (W. H. Harrington).

—Mr. Howard read the following paper:

ARRHENOPHAGUS IN AMERICA.

By L. O. Howard.

It is with peculiar pleasure that the American systematist recognizes for the first time an American representative of a European genus; but when, as in the present case, the European genus is monotypical, and its single representative is one of those extraordinary insects which upset preconceived systematic views, the pleasure becomes doubly great. In 1888 Dr. Christopher Aurivillius, in the *Entomologisk Tidskrift*, described the genus Arrhenophagus, devoting a full-page plate to its structural characters. The insect was bred in large series from the males of *Chionaspis salicis*. So peculiar was the form that Aurivillius was at a loss when he attempted to place it in its proper subfamily. In its general facies the insect resembles the Encyrtinæ; its habits are those of this group. To the Encyrtinæ it is further related by its wing venation, the tarsal claw of the middle legs, the undivided mesopleura, and the undivided mesoscutum. The Encyrtinæ, however, is one of the subfamilies of the pentamerous group of the Chalcididæ, and it is further characterized by the possession of more than eight antennal joints. Arrhenophagus proved to be tetramerous, and its antennæ were but three-jointed. On the whole, Aurivillius was inclined to retain the insect, temporarily at least, among the Encyrtinæ.

Having in mind the somewhat similar state of affairs with regard to the number of tarsal joints in Coleoptera, and its peculiar history in classification, it occurred to me that we might have in this insect a cryptopentamerous group of the Chalcididæ; and that further proper mounting and clearing of specimens would reveal additional antennal joints. I therefore wrote to

Dr. Aurivillius and asked him whether he could spare me specimens of this remarkable insect. Promptly, by return mail, he forwarded a large series in alcohol and others dry. These were carefully studied, and his conclusions verified in every case. After two years in Canada balsam, however, the specimens have cleared very considerably, and one can trace at the base of the antennal club the evanescent remnants of former funicle joints. The tarsi, however, are undoubtedly four-jointed; no hidden fifth joint can be found.

A few days ago, in looking over some slide mounts of Chalcididæ, I was delighted to find three specimens of an insect which not only belongs to this remarkable genus Arrhenophagus, but which corresponds exactly with Aurivillius' species, *A. chionaspidis*. The label on the slide indicates that these specimens were reared by Miss Mary E. Murtfeldt at Kirkwood, Mo., in May, 1888 (the same year in which the species was described by Aurivillius), from a barklouse on rose. It is altogether probable that the Missouri and the Swedish specimens had a common, more or less immediate, ancestry; in other words, the species was probably carried from America to Europe or from Europe to America. At present it seems probable that the form is European, and it may readily have been carried to this country upon rose bushes or other imported plants, while living beneath scale-insects attached to the plants. There is no doubt that the insect is a degraded Encyrtine. Its four-jointed tarsi upset the old main division of the Chalcididæ into pentamera, tetramera, and trimera; and in this iconoclastic work it is not alone, since recent investigations have convinced me that the genera Pteroptrix Westwood, and Eretmocerus Haldeman, both tetramerous, belong properly to the subfamily Aphelininæ, all the other representatives of which are pentamerous.

Dr. Riley said he was much interested in the paper, and fully agreed with the conclusions of the writer, especially as to the introduction of the form from Europe to America or *vice versa*. So curious a monotypical genus could hardly have originated independently in the two countries. He was glad to see that the author was not inclined to give undue weight to the number of tarsal joints. He had been impressed with the futility of podomeral variation unassociated with other important characters in recent studies of the Termites and Embiids. Dr. Gill said that in such cases we should be influenced by the assemblage of characters in each particular case, and should not be led to generalize from isolated structural characters. He brought up certain allied instances among the fishes. Dr. Stiles spoke of the number of hooks on the head of the Tæniidæ.

—Mr. Marlatt read the following paper:

THE HEMIPTEROUS MOUTH.

By C. L. Marlatt.

The hitherto accepted idea of the structure of the mouth of hemipterous insects has been called in question by Prof. J. B. Smith, and an explanation offered which entirely overturns the old conceptions of the homologies of the mandibular, maxillary, and labial structures of these insects.* Some observations which

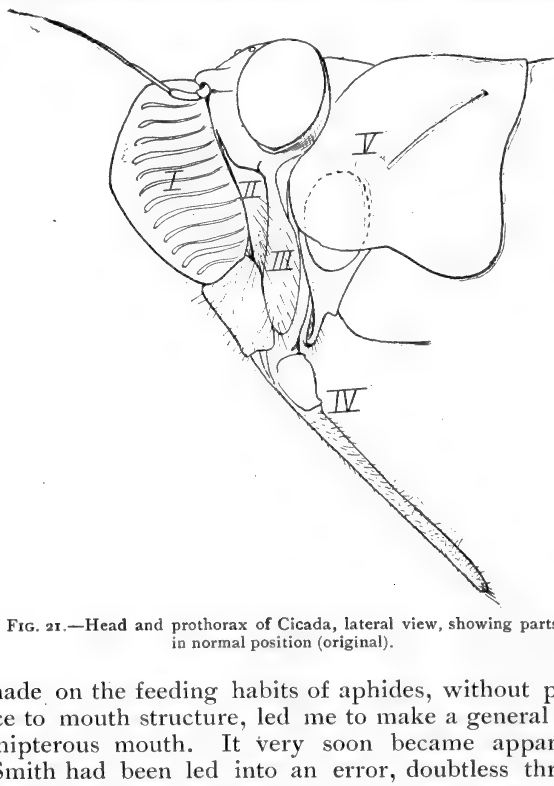

Fig. 21.—Head and prothorax of Cicada, lateral view, showing parts in normal position (original).

I had made on the feeding habits of aphides, without particular reference to mouth structure, led me to make a general study of the hemipterous mouth. It very soon became apparent that Prof. Smith had been led into an error, doubtless through an

* *Science*, April 1, 1892, pp. 189-190.

accident in his dissections, by means of which parts normally connected were torn apart and applied to others with which they had no intimate relation. By this means it was made to appear that the hemipterous mouth agreed with his previously conceived idea of the mouth of the dipterous insect. Previous to Prof. Smith's studies, the mouth structure of the Hemiptera,* while not elaborated in detail, was well understood, and the major features had been described by all the older writers on insect morphology, all agreeing, practically, in the following characterization, which I quote from Westwood:

"The mouth is of the Promuscid construction, the labium or canal being occasionally greatly elongated and extending beneath the body, and is either 3 or 4-jointed. The four internal delicate setæ represent the mandibles and maxillæ; the maxillary and labial palpi are obsolete. The labrum is distinct, triangular, more or less elongated, closing upon the upper side of the labium at the base, when the setæ enter the labial canal."†

Prof. Smith's explanation of the mouth-parts is, in brief, as follows: Accepting the clypeus and labrum as hitherto conceived, the first following sclerite on either side represents the mandibles, and the two pairs of setæ with the lateral sclerites, posterior to the mandibles, together with the sheath (the labium or main part of the beak), represent altogether the maxillæ. Of these the setæ, both of which are incorrectly made to attach to the sclerite following the mandible, represent the lacinia and stipes, the sclerite itself the palpus, and the sheath the subgalea and galea. Prof. Smith's mentum, which is rather indistinctly described, seems to be the hypopharynx.

The studies which I have made of the mouth structure of the Cicada have convinced me that the older authors were in the main correct in the understanding and description of the homologies of the mouth of this order; and the most interesting result is the striking similarity, in spite of seeming divergences, in the mouth structure of the true bugs with the biting orders, and, indeed, with the typical insect mouth, which in all orders presents a fixed and uniform plan of structure.‡

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* This term applies throughout to both the Hemiptera and to Homoptera.

† Westwood, Classification of Insects, II, p. 452.

‡ The terms "mandibulate" and "haustellate," used to separate into two groups the class Insecta, are misleading, since insects falling under the latter appellation also possess lateral jaws representing mandibles and maxillæ. The misconception in these two terms was pointed out by Westwood (I, p. 8), who emphasized the fact that the variation in mouth structure was rather in the action of the various organs than in any important difference in type of structure. He says, "When the lateral pieces

The results hereinafter detailed are based upon dissections of the periodical cicada, which, on account of its large size and the abundance of material available, immediately suggested itself as a convenient subject for study.

All of the main parts of the mouth of the biting insect occur in the mouth of the cicada. Beginning anteriorly and naming them in the order of their occurrence, they are: (1) the clypeus, (2) the labrum, (3) the mandibles (the inner part of which are the upper and stronger setæ), (4) the maxillæ, with which belong the two following and more slender setæ, and (5) the labium or sheath beneath. Within the mouth are the epipharnyx, project-

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are short and inserted at a distance apart, and have a horizontal motion, the action is that of biting; when, on the other hand, the lateral pieces are elongated, originating near together and having a longitudinal motion (by means of strong, elongated muscles at their base), the action is that of sucking." He suggests the terms *dacnostomata* (biting mouth) and *antliostomata* (sucking mouth) to express the characteristics of the two groups, without involving the contradiction suggested by the terms in use.

Adopting for convenience the old comprehensive ordinal names, the Dacnostomata comprise the Coleoptera, the Orthoptera, the Neuroptera and the Hymenoptera; and the Antliostomata the Diptera, Hemiptera, and Lepidoptera.

To appreciate the modification of mouth-parts in the orders of sucking insects, the main features of the biting mouth may be noted. They comprise two pairs of laterally-working, shear-like jaws (mandibles and maxillæ), inclosed above and beneath respectively by the upper lip (labrum), the lower lip (labium), the latter bearing on its inner surface the tongue (ligula) with sometimes, also, a false tongue-like appendage originating from the roof of the mouth, or labrum. The principal modifications of this mouth structure in sucking insects are as follows: In the Hemiptera the four jaws are elongate, setiform, and are inclosed within the under lip, forming what has been termed the promuscis or beak. In the Diptera (in the more fully developed mouth) the upper lip, the four jaws, and the tongue are elongate, setiform, and inclosed within the elongated enlarged lower lip, forming what has been known as the proboscis or rostrum, approaching very closely the type of mouth found in the Hemiptera. In the Lepidoptera the outer lobes (galeæ) of the maxillæ only are elongated, and closely applied and interlocked to form the spiral tongue or sucking tube, the madibles, labium, and other parts remaining rudimentary or not specially developed. Numerous and important variations in structure occur in each order, as, for illustration, most Hymenoptera are somewhat intermediate between the biting and sucking groups, and in the Lepedioptera the larvæ are biting and in the Hemerobidæ (Neuroptera) the larvæ are sucking.

ing from the inner surface of the clypeus and labrum, and the hypopharynx, projecting from the inner face of the base of the labium. A more detailed description of these parts follows. For the careful drawing illustrating the studies and for very material aid in working out details of structure, I am indebted to Miss Lillie Sullivan.

Clypeus.—In the cicada the clypeus (I *a*) is enormously enlarged, and forms the bulk of the anterior portion of the head, extending from the base of the antennæ to the labrum. Exteri-

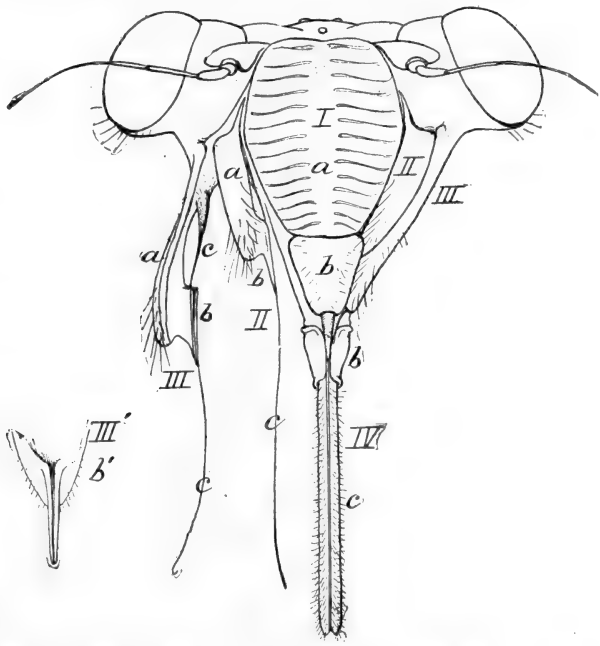

Fig. 22.—Head of Cicada, front view, showing the normal position of mouth-parts on the left, and with the mandible and maxilla drawn out on the right (original).

orly it is ornamented with a number of parallel grooves, arranged in two longitudinal rows.

Labrum.—This sclerite (I *b*, *c*) is attached to the anterior edge of the clypeus and is triangular in shape, truncated at the apex with the anterior angles bent under, and developed into a projecting, sheath-like appendage (I *c*, and I′ *c*′—Fig. 23) which covers the base of the labrum and closes over the bases of the setæ.

Mandible.—Viewing the head laterally, a small elongate sclerite (II *a*) is seen extending from near the base of the compound eye to a little beyond the base of the labrum. This is the exterior face of the mandible, and when dissected free from the adjoining parts is found to consist of this exterior portion, with a flange-like projection apically (II *b*), which passes under the labrum. This anterior expansion extends apically in a narrow tongue analogous to the similar projection from the apex of the labrum, and the inner edge of this expansion or tongue is grooved to receive the mandibular seta (II *c*) which originates in a large, bulbous, fleshy expansion (II *c'*), attaching near the base of the mandible interiorly. The mandibular setæ are very much the stouter of the two pairs, and the tips are serrated for a short distance. The exterior face of the mandible, especially apically, is clothed with long hairs.

Maxilla.—Viewed again laterally, and following the mandible, a more elongate sclerite is seen (III *a*), which expands somewhat apically. On dissecting this out, it is found to be almost identical in general structure with the mandible, having a similar apical expansion (III *b*), with pseudo-sheath (III' *b'*—Fig. 22), through which the seta (III *c*) passes, and the bulbous expansion of the seta (III *c'*) which merges into the base of the maxilla. The maxillary seta is much more delicate than the mandibular one, and is simple at tip, though somewhat hooked.

I have made no effort to homologize the parts of the maxilla just described with the maxilla of biting insects, as the modification in the present case has been so great, in the process of the evolution of the sucking mouth, that any homologies suggested would be largely fanciful. The striking similarity between the upper and lower jaws in the cicada discourages the applying of names to the parts in the maxilla which, in the biting insects, are known only in the maxilla, and in this case would have to apply to both jaws.

It suggests, however, that in the original or early type of insect mouth, the two pairs of lateral jaws were of similar construction, probably both serving the purpose of biting or gnawing, and that the present wide divergence between the comparatively simple mandible and the very complex maxilla of biting insects is the result of a long line of variation in which the original function of the mandible has been largely retained, while the maxilla has been so modified as to make it an organ adapted to and used for holding and adjusting the food material, rather than for breaking it up or masticating it, and also as an organ of taste and touch.

Labium.—The labium (IV *a*, *b*, *c*) applies directly against the maxillæ and forms the floor of the mouth. It is three-jointed, the joints being homologous, probably with the submentum (*a*), mentum (*b*), and ligula (*c*) of the biting insect mouth. From the base of the last joint extend three strong bundles of muscles, which attach the labium to the base of the head on either side and to the prosternum. The upper surface of the labium is deeply grooved, forming a channel which encloses the two pairs of setæ.

The base of the labium is supported by a tongue-like expansion of the prosternum (V *a*), which is concave on the anterior face, so as to receive and strengthen the basal joint of the labium.

Epipharynx.—What I deem the epipharynx is a keel-like structure (fig. 23, I *d* and I′ *d′*) projecting from the centre of the

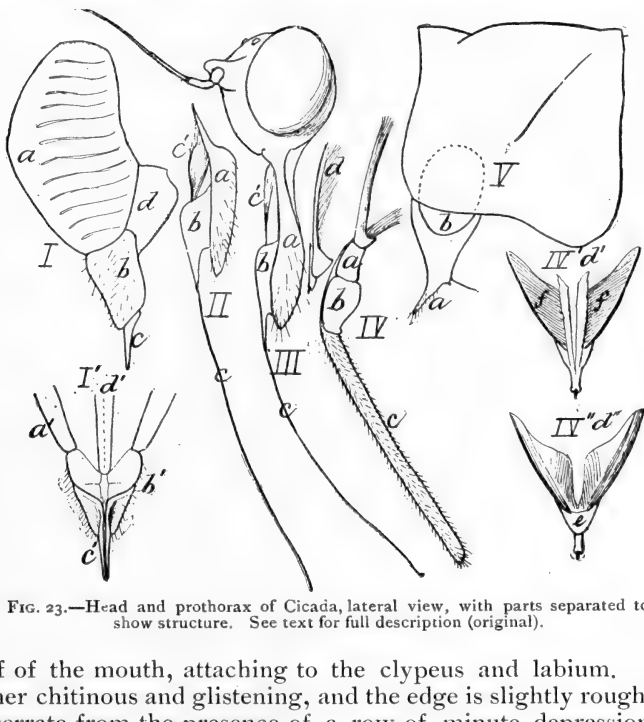

FIG. 23.—Head and prothorax of Cicada, lateral view, with parts separated to show structure. See text for full description (original).

roof of the mouth, attaching to the clypeus and labium. It is rather chitinous and glistening, and the edge is slightly roughened or serrate from the presence of a row of minute depressions or foveæ.* The inner lobes of the mandibles close up against the epipharynx on either side.

Hypopharynx.—This is a small, tongue-like expansion (IV *d*), forming the upper face of the labium or the floor of the mouth, and projects apically as a short, free cylindrical tongue

* This seems to be the so-called gland attaching to the labrum mentioned by Professor Smith.

which bears centrally a minute seta or spine. This latter seems to be the rudiment of what in certain Diptera is developed into a 5th piercing seta. Viewed from beneath (IV″ *d*″) the hypopharynx appears as a triangular piece (*e*) which closes against the pseudo-sheaths of the maxillæ, and large devaricating muscles. Viewed from above it is seen to expand basally as two glistening surfaces (*ff*) which apply to the lower face of the maxillæ, just as the similar face of the mandibles applies to the hypopharynx.

The epipharynx and hypopharynx are intimately connected with the clypeus and labrum and the labium respectively. The mandibles and maxillæ are, however, freely separable, with a little care in dissection, and do not coalesce or come together in any way, but have smooth, glistening faces along the line of contact. They are, however, so intimately associated that, while really free, they have no lateral play upon each other, or but very little, and do not perform at all the functions of the true biting mouth. The shining inner surfaces of the hypo- and epipharynx indicate that there may be a slight lateral motion, at least of the apical expansion both of the mandibles and the maxillæ; but this motion is probably confined to the more fleshy, inner portion of these jaws, the chitinous exterior being probably fixed.

With the mouth-parts all brought together in a state of rest, as shown at figure 1, the two expansions of the apex of the mandibles with pseudo-sheaths apply together beneath and within the labrum, and the mandibular setæ, pass through the double canal thus formed. The similar expansions of the maxillæ also apply very closely and project a little beyond the labrum, forming with the sheath-like projection from the apex of the latter a short tube, which includes the bases of all the setæ. The relation of the parts described and the details of structure are accurately shown in the accompanying illustrations.

Throughout all the higher families of the Hemiptera and Homoptera the type of mouth structure detailed above is constant. In some of the families the labium varies in the number of joints, having apparently four in the Aphididæ, two in the Aleyrodidæ, and is obsolete or nearly so in the Coccidæ. The setæ are, however, always present, and in the Coccidæ are free. The number of setæ is constant, but in some of the lower families, particularly in the Aphididæ and the Coccidæ, the mandibular setæ are very apt to be rather intimately united, so that they do not separate readily, giving the appearance of but three setæ; and in fact Buckton failed to recognize this union, and said of aphides that they have but three setæ instead of four.

From the details of structure given above, with the accompanying figures, which were based on dissections of a great many insects, it is difficult to understand how Prof. Smith was led to such an erroneous conception as would make the two pairs of setæ and the maxillary sclerites, together with the labium, which is not a paired organ but a simple one, all represent the maxillæ. The true homology is so simple and obvious that it is not necessary to take up Prof. Smith's argument in detail. It is gratifying to find, however, that the homology of mouth structure worked out by such careful students as Burmeister, Westwood, and many others of the old school of entomologists, whose work in the main in this direction has not been improved upon, should in this instance prove to be correct in essential features. To Prof. Smith, however, belongs the credit of having called attention to certain features of the hemipterous mouth which had not been previously noted, namely, the mandibular sclerite and the following maxillary sclerite, both of which he correctly described, so far as their exterior face is concerned. Previous to Prof. Smith's studies the mandibles and maxillæ were supposed to be represented by the setæ alone, and in fact in the lower families the exterior sclerite of the jaws so prominent in the Cicadas are either obsolete or minute and very difficult of detection.

There is a very general misapprehension, popularly at least, of the manner in which the hemipterous insect draws up nourishment from animals or plants. It is ordinarily conceived that the beak, meaning the labium with inclosed setæ, is thrust more or less deeply into the food substance and the juices sucked or pumped up into the mouth. My own observations of the habits in this particular of a number of species of predaceous hemiptera, together with the structure of the labium itself, convinces me that the beak proper, namely, the labium, is never thrust into the food substance in the least, unless accidentally where the material is so soft that the beak enters without effort on the part of the insect; but that, on the contrary, the beak is merely applied closely to the exterior of the food and the setæ are thrust in and the resulting flow of juices drawn by suction, probably accomplished by expansions and contractions of the fleshy interior of the mouth-parts, into the canal formed by the labium and the setæ. That the labium is never inserted is borne out by observation in the case of Hemiptera sucking juices from larvæ, the larvæ invariably being suspended or seemingly attached at the very extremity of the beak.* In the case of plant-feeding Hemiptera the same is true even of the Aphides. In the cicada, for instance, which passes its long subterranean existence on the roots of plants, although the beak is very large and robust, the roots themselves show no signs of puncture other than a slight

* Mr. Pergande informs me that his own observations on predaceous Hemiptera are in full accord with this statement.

discoloration of the bark which results from the entrance of the very fine, almost microscopic, setæ. If punctured by the beak itself comparatively large holes would be at once apparent.

If observations on this point were wanting, the structure of the beak itself would at once indicate that it could not be employed as a piercing organ. The beak or labium of all hemipterous insects, so far as I have examined them, is clothed to and on the very tip with numerous hairs projecting anteriorly, which would make the piercing of any hard substance quite impossible without tearing of and rupturing the hairs; and what is more, the beak is never very sharply pointed, or smooth or chitinous at the tip. Nearly every collector, also, has experienced the sting of some large hemipterous insect, and has doubtless mistaken the quick thrust of the maxillary setæ for an actual puncture by the beak.

Dr. Gill asked as to the true function of the beak. Mr. Marlatt stated that it was simply a support for the setæ. Dr. Gill asked whether, with the Heteroptera, as with Reduvius and Nepa, it is not the beak which pierces. Mr. Marlatt thought not, and was of the opinion that in these cases, while it is generally supposed that the beak actually penetrates, in reality the puncture is made by the setæ contained in the beak. Dr. Riley said he would much like to know how the Homoptera draw up their nourishment, particularly in the case of the Coccidæ. He agreed with Mr. Marlatt that, in the Homoptera, the beak does not penetrate, but he thought that with the Heteroptera it does puncture. How the setæ work in the Homoptera is a puzzle. Mr. Marlatt replied that the four bristles are probably closely applied to form a sucking tube. The suction is probably the reverse of the operation of oviposition with Thalessa and other long-tailed Ichneumonids.

Mr. Howard stated that Mr. Marlatt's demonstration convinced him fully of the incorrectness of Dr. Smith's views in considering the beak to be the homologue of the galea of the maxillæ. Dr. Smith had evidently been misled by his own conclusions from the study of the dipterous mouth, and had begun the study of the homopterous mouth with the preconceived idea that the beak must be a galea. He said that while Mr. Marlatt's proof was perfect as regards the Hemiptera, it by no means necessarily follows that the dipterous beak is also a labium, but the question of the dipterous mouth is obviously re-opened, and Dr. Smith's homologies must be most carefully tested. The mandibular seta is a puzzle, but if we homologize the two pairs of jaws there is no reason why it should not be called a mandibular lacinia.

—Dr. Riley presented a paper of which the following is an abstract:

NOTES FROM CALIFORNIA: RESULTS OF MR. KOEBELE'S SECOND MISSION TO AUSTRALIA.

By C. V. Riley.

[*Author's abstract.*]

Dr. Riley, under this head, gave an account of his observations upon his recent trip to California as to the results of Mr. Koebele's second mission to Australia. He briefly narrated the history of this mission as recorded in official publications of the Department of Agriculture, and to the unpleasant controversy between the California State Board of Horticulture and the Department which had grown out of this mission. Said State Board had obtained an appropriation from the State legislature for the importation of beneficial insects and had appealed to the Secretary of Agriculture to have Mr. Koebele sent over to Australia for this purpose, the appropriation being placed at the service of the Department. The then Secretary, Hon. J. M. Rusk, being absent, Acting Secretary Edwin Willets courteously declined, for reasons, the proposed arrangement. Upon his return, however, Secretary Rusk, having in the meantime, while in California, promised that Mr. Koebele should be sent, reversed Mr. Willets' decision. Mr. Koebele was consequently sent under Dr. Riley's direction. As time went on, the results of the introduction through Mr. Koebele's efforts, as a consequence of this second mission, caused much discussion in California, the State Board and its adherents claiming great success, while the practical fruit-growers as a rule began to lose faith. Dr. Riley alluded to several incidents which showed the baneful effects which political influence and methods sometimes have on scientific investigation. In the fall of 1893 he had Messrs. Coquillett and Koebele directed to carefully examine and report on the condition of the importations and the work they were doing. Their reports were published in Insect Life, Vol. VI, pp. 24–29, and showed on the whole that the imported insects had, up to that time, failed to produce any marked beneficial results. There were exceptional instances, and one particularly, at Santa Barbara, where *Rhizobius ventralis* was reported to be doing much good in clearing olive trees of the Black Scale, *Lecanium oleæ*.

The controversy as to what these insects were doing continued, however, and he made it a point in his recent trip to study as far as possible the actual state of things. For this purpose he had made observations around Sacramento, San Francisco, Los Angeles, and in various parts of Orange and of Santa Clara counties, as well as in and around Santa Barbara. At Los Angeles he examined with special interest the Kercheval orchard, where *Orcus chalybeus* bad been extensively colonized and cared for with much assiduity. He found there that the original trees upon which the ladybirds had been colonized still contained many specimens of the Red Scale, *Aspidiotus aurantii*, which it was expected to exterminate, while the orchard, as a whole, was in a sorry plight both from the scale and from neglect. A few specimens of the ladybird were found after considerable search. In several orchards around Santa Barbara which were very carefully examined he found but very little evidence of the work of Rhizobius, and none of any of the other introduced species. The same was true at Redlands, Riverside, Pasadena, Altadena, and other places where he had been able to make careful examinations.

All over California the Black Scale is present this winter in smaller numbers than usual. This is the case in localities where Rhizobius has not been introduced, as well as in localities where it has been introduced, and this is probably the result of the extremely hot, dry summer of last year. Many of the young scales, however, are still alive, even in localities where Rhizobius had been colonized. He found a few specimens of *Leis conformis*, but none of the introduced species were present in any locality in anything like the same numbers as the native ladybirds, notably *Chilocorus bivulnerus*.

Dr. Riley called attention to the fact that in Europe and America our predaceous insects have, as a rule, some property that protects them from the attacks of other animals. In the case of the Coccinellids this protection is believed to be due to some acrid secretion unpalatable to predaceous animals and other predaceous and parasitic insects. The Australian Coccinellids, however, seem to be of a lower type and not to share in such immunity. They are known in the larva state to be quite commonly parasitized, and, what is more singular, are extensively eaten both in the larva and imago states by birds, the English sparrow being conspicuous in this respect, as recorded by French and other Australian writers.

Considering that over 50 species of ladybirds were sent over by Mr. Koebele, it is remarkable that so few of them have held their own in California or multiplied so as to accomplish any good. *Orcus chalybeus* and *O. australasiæ*, of which so much was expected by Mr. Koebele and by the State Board of Horticulture, are practically unknown to-day among fruit-growers, and only found in comparatively few numbers where they were introduced. The two species of Rhizobius which have maintained themselves show great variation in different localities. As a consequence, the gas treatment is still being vigorously employed by most of the people concerned, and by the county commissioners, and where some insecticides or other preventive means is not adopted, the orange groves are yet suffering from both the Red and the Black Scales. The policy, however, of introducing parasites and predaceous insects from abroad has a very strong hold on the people of the State, but the present condition of things fully justified the position which he had taken, and confirmed the general conclusions in his paper on "Parasitic and Predaceous Insects in Applied Entomology," read at the meeting of the Association of Economic Entomologists at Madison in August, 1893 (*vide* Insect Life, Vol. VI, No. 2, pp. 130–141).

As the speaker had often insisted, he was strongly of the opinion that careful study should always precede any attempt at introducing species for practical purposes. We should satisfy ourselves first as to the country of origin on the introduced injurious form; we should then satisfy ourselves that in that country it is held in check by natural enemies which do not occur in this country. These facts having been ascertained, we may then endeavor to introduce such natural enemies, with some hope of beneficial results, especially if care be taken to introduce them without *their* natural enemies. This favorable situation exists in the case of the Gypsy Moth, and he expressed himself as surprised that the Gypsy Moth Commission had not sent over to Europe for the natural enemies of this insect, as he had himself urged them to, several years ago.

As experience with the last introductions from Australia varied somewhat with locality, he believed it would be advisable, even though the chances might be against important practical results, to introduce the Australian Rhizobiids that had maintained themselves in California to the Atlantic coast, since one of them had been found also to feed upon *Aspidiotus perniciosus*, which was just now spreading in the Eastern States. He also believed that good would result by introducing some of the insects of this genus, as well as the two species of Orcus just mentioned, to Montserrat, as they might do better there than they do in this country in competition with our indigenous species.

In discussing this paper Mr. Schwarz said that the Coccinellidæ are separated by extremely feeble characters. The Australian genera are therefore closely related structurally to American genera. He believes that the Australian species are therefore not more susceptible to bird and insect attack, but that, in the case of the English sparrow particularly, the habit of feeding upon ladybirds is an acquired character. In introducing a species from one part of the world into another, we should bear several facts in mind. If the relationships of the proposed introduced species to forms already existing are obvious, the success of the importation becomes probable; if not, the result cannot be predicted. Experiment must be the test. The point of Gray's law regarding east and west coasts should always be borne in mind. European species can be taken to California with better hope of success, while Asiatic forms can be taken to the eastern United States. As a rule, Australian species are weak and cannot stand competition, judging from the fact that they do not well resist the inroads of plants and animals. Mr. Fernow rather contradicted the last speaker, and stated that many entirely foreign genera had been introduced into England with success, and, further, that many European trees have been introduced into the eastern United States and flourished there better than in their original home.

Dr. Gill said that the Gray coast law must be modified in many respects, since the west-American forms are really more closely related to those of east Europe and northern Asia than to west-European forms. Mr. Schwarz said that with the Coleoptera the old rule will hold, and Dr. Gill stated that he knew of many supporting instances, but also of many contradictory instances. It is simply a case of a fascinating idea which has taken hold of scientific men generally, and all the supporting instances had been brought forward, but almost no one has taken the trouble to bring up the contradictory instances, which, in his opinion, are quite as numerous. Mr. Schwarz said that for many years Mr. Hubbard had been attempting to introduce into Florida all sorts of plants from all parts of the world. He has found, however, that the European plants do not flourish; they die out. So do the insects which are accidentally introduced with them, but Japanese plants, on the contrary, flourish extremely. Dr. Riley supported Mr. Schwarz, and said it was a well-known fact that Japanese plants flourish better in the east than in the west. His first impression of the Californian flora was that it was European in its character. Referring to the susceptibility of Australian ladybirds to the attacks of enemies, he stated that in Australia birds in general prey upon ladybirds, and in his opinion this was due to the lack of certain protective influences on the part of the ladybirds themselves. The Australian fauna is composed of weak forms. He once more insisted upon the fact that we must not expect good results from miscellaneous introductions of beneficial insects; all the facts concerning them must be known. Mr. Fernow spoke of the introduction of the Douglass spruce into Europe from California and from Colorado. It was found that those from the Pacific coast do not flourish in Europe, while those from Colorado do. He was of the opinion that it was a question of resemblance of climate between the original country and that to which the species was introduced. Dr. Gill said that Prof. Riley's recognition of the European character of the Californian flora is due to the extension of the European flora through northern Asia, making it thus really the flora of an adjoining country. We are accustomed to associate the Indian fauna and flora with the Asiatic idea, but they are in reality quite distinct, and the true European forms extend to the Pacific Ocean at a point above the limit of the Indian life-zone.

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April 4, 1895.

President Ashmead was in the chair and Messrs. Schwarz, Stiles, Stetson, Marlatt, Benton, Howard, Pratt, Linell, Chittenden, Heidemann, Vaughan, Riley, Dodge, and Gill were also present.

—Prof. Riley read the following paper:

ON OVIPOSITION IN THE CYNIPIDÆ.

By C. V. Riley, Ph. D.

Having made a special study of galls and gall insects, and having accumulated a large number of notes on the habits of the species in different Orders, especially in the Cynipidæ, I have been deeply interested in many of the questions that were treated rather fully by Hermann Adler in his epoch-making work on "Alternating Generations: a biological study of Oak Galls and Gall Flies," published some fifteen years ago. At the time (1881) Lichtenstein published his excellent translation I was in correspondence with him, and also had on several previous occasions the pleasure of joining in some of his observations at Montpellier and in discussing with him some of the questions involved.

One of the most interesting points in the economy of the Cynipidæ is the mechanism of oviposition. It is interesting not only because of the almost universal but erroneous assumption by older authors that Cynipid galls owed their growth to the action of some poison inserted in the plant tissue by the female in the act of oviposition,* but also because of the extremely long, curved and specialized nature of the ovipositor itself and of the difficulty in following all the steps in the act.

A number of years ago, desiring to make some original observations and, if possible, confirm Adler's on the subject of oviposition, as also to endeavor to connect some alternate agamic and sexual forms, I had a series of experiments instituted, placing them in the care of Mr. Pergande. A number of young oak trees of different species, in pots, were obtained for this purpose and to assist observations in the field. Frequent absences from the office, and other pre-occupations, prevented as much personal attention as I had desired to give to the matter, and the experiments were finally allowed to lapse. Some interesting observations, however, have been obtained on the subject of oviposition; and as the results seem to conflict with those obtained by Adler, I have concluded to put them on record, more particularly as an English translation of Adler's celebrated work has recently appeared from the Clarendon Press of Oxford, edited by Charles R. Straton.

Adler goes into details and seems to have made his observations so carefully that one may scarcely doubt the accuracy of his records. For instance, speaking of *Neuroterus lenticularis*, which is the agamous spring form of *Spathegaster baccarum*, he says: "It" (the female fly) "first examines the buds carefully with its antennæ until it finds one that suits it, when it takes up a different position. It advances toward the apex of the bud and pushes its ovipositor down under one of the

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*The ingenious dissertations of Walsh on the poison gland and the secretion therefrom (Proc. Ent. Soc. Phil., II, pp. 473-4) very well illustrate how firmly this view was fixed in the minds of naturalists up to that time.

bud-scales. After several attempts, the ovipositor is forced in and glides down under the bud-scales to the base of the bud-axis, which it penetrates from without inwards. This can only be accomplished by imparting to the ovipositor a direction at an obtuse or right angle to the course it followed when entering. The natural curvature of the ovipositor here stands the fly in good stead, but it requires a vast expenditure of time and strength before it can penetrate the heart of the bud."

Referring to *Biorhiza aptera* (which is the agamic form of *Teras terminalis*), he says that the female seeks by preference the greater terminal buds and seeks to bore into them. "The pricking is done in a very different way from that of other gall-flies. After a suitable bud has been found, the fly stops, turns its head downwards, and directs its abdomen to the point of the bud. In this position it inserts its ovipositor somewhat below the middle of the bud, in or upon the tissue from which terminal growth proceeds. After the fly has pushed in its ovipositor it withdraws it, and goes on boring one canal after another in the stratum which the egg is to occupy, until the whole layer is riddled like a sieve. When the operation is finished, the eggs are successively pushed into the pricked canals, where they lie so thickly together that they look like a continuous mass. The amount of work which the fly goes through in laying its eggs in this way is astonishing. After having been occupied for hours in boring these numerous canals, it appeared to me inexplicable that it had as yet laid no eggs; I found, however, that it bores all the canals for their reception before actually laying a single egg. This part of the work requires much time, as to which I have made the following observations.

"On January 27, 1878, a fly was put upon a little oak, and soon began to prick a bud; when it had finished the first bud, it went on without interruption to another, and was altogether eighty-seven hours busily employed laying its eggs. In these two buds I counted 582 eggs."

The process of oviposition in the Cynipidæ is a very elaborate one and has been much written about. Adler gives a most full and elaborate description of the mechanism of the ovipositor, and particularly of the ventral plates and bundles of muscles by which the terebra is worked. The structure of the ovipositor is well known, and its parts homologize with those of the same organ in all Hymenoptera. It consists of a large bristle or seta and of two spiculæ which mortise into it and form the channel down which the egg passes. The seta occupies half the area of a transverse section of the terebra, and the two spiculæ occupy the other half. The seta has two tenons, and a central canal which contains an air vessel, a nerve branch, and some sanguineous fluid.

While appearing like a single piece, it is in reality double or composed of two parts which, indeed, are separated at the extreme base, but otherwise firmly soldered together. The spiculæ are serrate or notched at the tip, and the seta often ends in a slight hook. The two spiculæ play, by means of strong basal muscles, longitudinally up and down, by means of the grooves which embrace the tenons of the seta.

The eggs of Cynipidæ are characterized by having a stalk or pedicel of varying length according to the species, the egg-body pr6per, according to Adler, being at the apical or anterior end which first issues from the body, and the basal or posterior end being also somewhat enlarged or spatulate. In repose, the ovipositor is concealed within two sheaths, but in oviposition, according to Hartig's views, the spiculæ grasp the egg-stalk and push it to the tip, the fluids being pressed back in the operation, so that they come to be distributed along the stalk or to lie at the opposite or posterior pole of the stalk. The spiculæ then slightly separate at the tip from the seta and extend beyond it so that the apical end of the stalk becomes free. Now, by pressure, the fluid at the posterior end passes through the stalk into the opposite or apical end which is plunged in the plant, the basal portion becoming emptied, the swollen apical end thus remaining in the plant when the ovipositor is withdrawn, filling the distal end of the puncture, which is somewhat enlarged. The empty basal sack of the egg and a portion of the stalk are often left exposed, looking not unlike the empty egg of some lace-wing fly (*Hemerobiid*). In short, Hartig's view, very generally adopted, was that the extensile and ductile egg was driven through the ovipositor itself while this was in the plant, and that the contents of the egg-body were pressed back into the egg-stalk or pedicel during the operation and collected in the posterior end, and only after the apical end had reached the bottom of the puncture did these contents stream back into it.

Adler would refute this view, and draws attention to his own figures on Plate 3, where the eggs and ovipositor are illustrated side by side, all taken from photographs and drawn from the same amplification. These show that the ovipositor is, in every case, longer than the egg itself, the enlarged head of the egg corresponding in direction to the tip of the ovipositor. He argues from this fact that one end of the egg cannot be in the plant tissue while the other is in the canal. He further argues that it is not possible that the whole egg can be received into the ovipositor and glide through it in the way in which Hartig supposed. Let me give in his own words the description of the process which he has followed, particularly on *Neuroterus læviusculus* (the agamic vernal form of *Spathegaster albipes*), while ovipositing in an oak bud.

"We shall begin with the moment when the fly places its ovipositor on the bud. She always chooses the edge of one of the outer scales as a point of attack, and pushes her ovipositor under it. Then the ovipositor glides under the scales to the base of the bud-axis. Even this first act requires great strength on the part of the fly. We sometimes see it attack the bud repeatedly with its ovipositor before it succeeds in getting it under the scales. It does not succeed with buds in which the scales are closely imbricated, hence it always prefers buds with loose-lying scales. When the ovipositor has arrived at the base it is driven towards the bud-axis, so as to reach the rudimentary leaves; but the path made by the ovipositor is always more or less curved. By making a careful preparation of any pricked bud, the canal can be plainly seen, and the path taken by the ovipositor followed. After the fly has finished the first part of its work, and driven the ovipositor into the centre of the bud, there comes a moment of complete rest, and the fly sits motionless upon the bud. If it is fixed in this position by dipping it into chloroform, nothing is seen of the egg—it still remains in the vagina. Then follows the second part of the work, the pushing of the egg into the bud.

"The egg slips, with its enclosed egg-body, to the base of the ovipositor between the origin of the two spiculæ. The egg-body glides over the point where the two spiculæ embrace the tenon of the seta, since the space remaining open between the two spiculæ is too small to admit it. But the egg-stalk, which follows, slips between the two spiculæ, is seized by them and driven forward; in this way the egg is pushed downwards into the ovipositor, with the egg-body hanging out.

"When at last the egg is about to enter the canal which has been bored into the centre of the bud, it becomes evident that it is impossible for the canal to admit the ovipositor and the egg-body to pass in at the same time. The egg-body is always of much greater diameter than the ovipositor; on this account the ovipositor is next partially withdrawn by the fly, until the pierced canal becomes empty. The egg-body then enters the pierced canal, and the ovipositor follows, pushing it before it. In short, the whole forward motion is dependent on the egg-stalk being propelled by the to-and-fro movements of the two spiculæ, and the egg reaches the end of the bored canal, while the egg-stalk remains lying within it."

To sum the matter up, the operation according to Adler consists of three distinct stages: (1) the canal is first bored, after which the fly rests; (2) the egg is then passed from the ovarium to the base of the ovipositor, the swollen end or body of the egg hanging out, but being pushed along by means of the stalk behind being grasped between the two spiculæ; (3) finally, when the egg-body reaches the perforation, the ovipositor is partially withdrawn and the whole egg then pushed in till the egg-body reaches the bottom. Adler rightly expresses wonder that this complex procedure should be repeated so often with such great accuracy, and proceeds to describe the tactile hairs connected with the ovipositor which permit her to carry out the operation. He further states that while oviposition on the surface of leaves is, in its nature, easier, the mechanism of oviposition is exactly the same as that in buds.

As already stated, the observations are difficult and can only be made with satisfaction by observing a great number of individuals and by suddenly chloroforming them at different stages of the operation. Adler has done this to some extent, but there are several passages which leave some doubt in my mind as to the complete accuracy of his views. For instance, in controverting Hartig and referring to his (Adler's) figures of the eggs and of the ovipositor, there is no indication as to whether the eggs were taken from the buds after being deposited, or from the ovaries or from the ovipositor. My own experience with these and other ductile and extensile eggs with long egg-stalks would indicate that we have a very varying length of stalk according to these varying circumstances. Therefore, it is rather inaccurate to refer to these eggs as if they had a definite and uniform length as compared with the ovipositor. Moreover, the passages quoted show that the operation varies considerably in different species, his conclusions evidently being based on *Neuroterus læviusculus*.

Again, any one who will carefully read Hartig will see that Adler has totally misjudged him in assuming that he described the egg as passing down the minute channel of the seta; for Hartig's language, as well as his figures, makes it very plain that he had in mind the actual facts, viz., the passing of the egg down the channel formed by the connection of the two spiculæ with the seta. It is true that he calls the seta the egg-guide (*Eileiter*), and this in truth it is, but he distinctly shows by his figure and his description that it acts as a guide only by the passage which it makes when mortised into the spiculæ, referring particularly to this space (Tab. 1, Fig. 9, *c*) as "die innere Höhlung des Legestachels, in welche das Ei aufgenommen und hindurch geht."*

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* Incidentally I may state, as corroborative of Adler's liability to error, that he makes the sweeping assertion that the gall-gnats (Cecidomyidæ) cannot inject an irritating poison into the plant tissue as do the saw-flies (Tenthredinidæ), on the ground that the gall-gnats have no piercing apparatus. He is in good company in making this statement, but I have good

Such are some of the reasons which would make one question the accuracy of Adler's views, and I will now give the record of the observations which would seem to controvert those views and to comport most with those of Hartig, though showing yet a third method.

On April 20, 1894, my attention was called by Mr. Pergande to several specimens of *Callirhytis clavula* Osten Sacken ovipositing in the buds of *Quercus prinus*. This is a rather large, winged agamic form, which Mr. Ashmead informs me he has actually bred from the *clavula* gall. The same species also oviposits in the buds of *Quercus alba*. The flies were sitting on the buds with the head towards the tip of the bud, and were so absorbed in their work that they scarcely moved or altered their position, even when the twigs were allowed to sweep back with some force. The ovipositor was deeply inserted within the scale-like covering of the buds. On carefully removing the scaly covering of a bud that had been pricked, quite a number of eggs were found in clusters of three or four together, and a few singly, inserted in the tender, new, embryo leaves. It was further found that the eggs were inserted on both the upper and lower surfaces of the leaf and almost entirely hidden by the silvery pubescence of the newly formed leaf. They were attached by a short stout pedicel or stem which, however, upon very careful examination, was found to extend for a great length (six or seven times the length of the exposed egg-body) like a fine thread into the substance of the leaf. The distal or anterior end of the egg-stalk was also somewhat enlarged, looking like a bit of shrivelled skin. The exposed portion of the egg or egg-body was white, glistening, elongate-ovoid or bean-shaped in form and about .2 mm. in length. Two days later, or on the 22d, additional flies were observed ovipositing and the buds were marked. On the 27th

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reason to believe, nevertheless, that it is absolutely incorrect. Winnertz, Osten Sacken, and other writers have generalized in this matter from what may be considered the typical Cecidomyidous ovipositor, which is a cylindrical tube, being but a prolongation of the tip of the abdomen. The truth of the matter is, however, that many of the gall-making species have this tip of the abdomen almost as much specialized as in Pronuba among Lepidoptera, ending in a delicate, sharp lance, admirably fitted for piercing the soft tissues of tender vegetation, as I stated in the article on galls in Johnson's Universal Cyclopædia (1876), which Lichtenstein, by a curious error, referred to, in the Introduction to his translation of Adler, as *Le Dictionnaire Scientifique* de St. Louis—a purely imaginary publication. That they insert some special secretion which induces gall growth is also presumable from the fact that in some cases which I have studied the gall forms (as in the Tenthredinidæ) before the larva hatches.

these were examined and it was found that the pediçel had become shorter and stouter, while the anterior or buried end had greatly increased, the exposed portion being now half empty of its contents. Five days later, April 27th, the young leaves had formed from these same marked buds and the eggs were still in position, but mostly empty, and when removed and closely examined it was found that under the epidermis and below the base of the exposed egg-shell there had formed a soft, colorless, globular body, having a yellowish streak internally. This body, probably the first larval stage, is easily detached from the leaf, but no movement could be discerned and the thread-like pedicel had separated from it and disappeared.

So far, there is no trace of a gall or swelling to be seen, although the affected leaves appear more or less crumpled or distorted. May 4th the same leaves were again examined and the young galls had already formed, appearing as slight thickenings of the leaf, but scarcely elevated or prominent. The spot where the egg had been inserted forms a minute depression or hollow in the leaf, with the colorless and shrivelled egg-shell still in position, the cavity thus formed being in an oblique direction to the surface of the leaf. The cell or cells in each gall are removed from the egg-shells about twice the length of these last, but for which there would be little trace as to where the egg entered; they are ovoid or rounded, and each contains a perfect larva, semitransparent or colorless, with a brownish ventral spot. Most of the galls contain three to five cells.

From now on, the formation of the gall is rapid, the substance of the young gall being very juicy and succulent and of a yellowish color, its outer margin or edge being pale pinkish. On May 11th the galls were nearly full grown and proved to be *Callirhytis futilis* O. S., but no flies were reared until the middle of June, and from this time until the last of the month flies in both sexes were continually bred. A number of interesting subsequent observations were made upon this interesting species, but have no especial bearing on this communication. I ought, however, to state that Mr. H. F. Bassett (Psyche, Vol. 5, pp. 235–8, Dec., 1889) has described what is, apparently, the same insect as *Callirhytis radicis*, which he reared from a series of blister-like cavities in the bark of the root of *Quercus alba*, and identified with the fly which he had himself observed ovipositing in the buds of the same oak and producing the gall which gives forth *Callirhytis futilis* Osten Sacken. There is consequently some confusion as to the actual relations of this sexual generation, and either an error as to determination on the part of Mr. Bassett or else an erroneous record of rearing on the part of Mr. Ashmead. I have adopted the former as the more probable. There is, however, a third explanation, which, if verified by future investigation, would prove to be another interesting discovery in connection with these oak gall-flies, viz., that the same species may indifferently produce a gall on the root or on the twig. When we remember how closely these two parts of the plant are related physiologically and how readily the one in most trees may be converted into the other, such a discovery should not surprise us.

From the facts given in this case, although the act of oviposition was not carefully followed, it is yet obvious that the eggs could not have been inserted in the manner described by Adler. The facts as already suggested comport more with the conclusions of Hartig, though they indicate quite a different method of oviposition than that described by either, in that the fluid egg-contents are not passed from one pole to another rapidly during the act of oviposition as described by Hartig, but very gradually, the process not being completed till just before the hatching.

Again, a small, black, wingless species (*Biorhiza nigra* Fitch, subsequently described as *B. politus* by Bassett) is not infrequently found, during late winter, under the shelter of bark scales, and oviposits, during late winter, in the terminal buds of *Quercus alba* and *Q. obtusiloba*. The ovipositor in this case, as in most cases where eggs are laid in dormant buds, is thrust down between the bud-scales until it reaches the soft latent cell tissue toward the centre of the bud. And here it is easy to observe, by removing the scaly coverings, that the pedicel or stalk only, which is about ten times as long as the egg-body, is inserted in the leaf tissue, and the enlarged portion or egg-body is at first external, being pressed and somewhat flattened by the surrounding leaf-scales.*

In still a third case, of a small black inquiline (*Ceroptus politus* Ashm.), oviposition was observed by Mr. Pergande in the midrib of *Quercus rubra*, May 20, 1884, and in this case, as my notes show, the egg is thrust down into the puncture made by the terebra in the midrib until not a vestige of the egg is visible, the pedicel being very short.

There is, therefore, good reason for believing that oviposition in these insects follows no uniform system, and there is a serious question whether Adler's rejection of Hartig's views is justified.

* This fly produces, according to experiments made for me by Mr. J. G. Barlow of Cadet, Mo., an undescribed vesicular bud-gall, from which issues a small black-winged bisexual species (*Dryophanta vesiculoides* MS. mihi). The gall produced by this and from which the apterous agamic generation comes is not yet known, though it will probably be a leaf-gall similar to that of *Acraspis erinaceæ* Walsh.

In connection with Adler's views as to oviposition, he concludes from his own studies that the main purpose of the stalk is, by its posterior end remaining at the surface of the puncture, to supply oxygen to the egg-body in the plant tissues; but that this is also an erroneous conclusion is, I think, made manifest by some of the facts just stated. That the function of the egg-stalk is, rather, to facilitate the otherwise difficult mechanical operation of the passage of the egg down a narrow and elongate ovipositor in the manner indicated by Hartig is supported by the fact that the puncture is often closed at its mouth, as also from what we know of the similar oviposition in other orders of insects. The facts, for instance, connected with the oviposition of *Pronuba yuccasella*, where the egg is thrust deep into the ovarian cavity of the Yucca pistil, bear out this view. The egg, in this case, as it passes down the ovarium has not a definite pedicel or stalk, but becomes a mere thread in passing through the ovipositor (the nature of which precludes any external outlet during the passage), and the fluids gradually concentrate in the apical or anterior end as the embryo develops. Moreover, it is passed into the ovarian cavity of the pistil and has no connection through the pedicel with the exterior wound, which is closed before the larva hatches.

The paper was briefly discussed by Messrs. Marlatt, Ashmead, and Benton. Mr. Marlatt said that the mere fact that observations on this point are so difficult is sufficient in itself to explain any discrepancies. Mr. Ashmead expressed himself as inclined to accept the observations of Dr. Riley. In referring to dimorphism, he said that he was satisfied that the wingless species of the genera Acraspis and Biorhiza are agamic forms of some winged bisexual forms. He thinks, for instance, that there is a connection between Dryophanta and Acraspis. In Florida the winged bisexual form of Belonocnemus occurs on the roots of live oak, the agamic form appearing on the leaves in the fall.

—Mr. Marlatt read the following paper:

THE HIBERNATION OF NEMATIDS, AND ITS BEARING ON INQUILINOUS SPECIES.

During the summer and fall of 1894 large quantities of saw-fly galls on willow were collected for me by Mr. E. L. Horton, of East Steamburg, N. Y. These belong to both of the genera of Nematinæ (Euura and Pontania), the larvæ of which develop in galls on twigs or on leaves of willow. The experience gained in the study of these galls and of the habits of the larvæ, and in the rearings, has resulted in some interesting facts, the significance and accuracy of which have been substantiated by examination of the earlier breeding records contained in the Department notes, and in the records attached to specimens in the collections of the National Museum, the Entomological Society of Philadelphia, and Cornell University, together with the published records, particularly those of Walsh.

Proper reference of galls.—Examination of notes and records indicated at once that there had been considerable confusion in the references of galls received at vaious times, the result being that a great many Nematid (Pontania)* galls have been referred to the genus Euura, and, where parasites have been reared, these have in some instances been named *euuræ*, from an entire misconception of the host.†

Such errors of determination from the gall may be avoided if it be remembered that the species of the genus Euura, so far as we have any record, always produce galls on or in the twigs, one form (*E. salicicola* Sm.) developing in the pith without resulting gall formation. The bud Euura (*E. orbitalis* Norton) is only an apparent exception, as this gall is really formed in the young twig represented by the undeveloped bud. On the other hand, all the species of Pontania of which the habits are known cause galls in or on some portion of the leaf. The habit of these two genera in this respect is so constant that any of their galls may be properly referred with scarcely the possibility of error.

Hibernation of the larva.—The idea has hitherto obtained that the larvæ of most gall-making Nematids normally winter in the galls themselves, or that, abandoning the galls in the fall, they enter the earth to hibernate, or more rarely hibernate in rubbish on the surface of the ground. Hibernation within the galls was supposed by Walsh to be generally true of *pomum* and *desmodioides*, while *pisum*, he states, hibernates normally in the earth. Of the Euuras a common habit, at least of *ovum* and *nodus*, according to Walsh, is to hibernate in the galls. The experience gained from the specimens referred to above has indicated that this idea of hibernation is not the correct one for most species. The galls received from Mr. Horton, chiefly those of *Euura ovum* and *Nematus pisum*, were, in every instance, abandoned by the larvæ in September, while the leaves were still green and before cold weather had set in. In cages supplied

* All the gall-making species of the old genus Nematus are now assigned to Costa's genus Pontania.

† *Bassus euuræ* Ashm., reared from *Pontania resinicola* n. sp.
Pimpla euuræ Ashm., reared from *Pontania pyriformis* n. sp

with soil and more or less matted leaves, the larvæ of both these species wandered restlessly about for several days, without showing any inclination either to enter the soil or spin up in the substances provided. Supplying them, however, with bits of soft or rotting wood, bark, and dry bits of weeds or twigs having large pith, the larvæ began immediately to burrow into these substances with great industry and rapidity, the Euuras apparently preferring the pith of weeds and twigs, and very soon all of them had concealed themselves. This experience explains the failure, which has been a common one, in the attempts to breed these and other gall species, and, in connection with other available records, indicates conclusively that these insects normally hibernate in bark, pith, or wood. Very rarely the dry galls of their own species already deserted by other larvæ are entered, or they spin up between matted leaves. Other saw-flies are known to enter wood to hibernate, and this habit is doubtless very much more common than hitherto supposed. The larvæ of Tenthredinidæ are most difficult to carry through the winter successfully, and I am convinced that it is largely because the proper conditions have not been supplied.

Relations of these facts to inquilinous species.—This method of hibernation has an important bearing on the validity of the inquilinous species, and an examination of the records, as well as of the species themselves wherever obtainable, has convinced me that all the species designated as inquilinous cannot be so considered, but are really instances where the larvæ of various saw-flies, including those of the true gall-making species, and others which live exposed on the leaves, have entered deserted galls, frequently of the previous year's growth and of both dipterous and hymenopterous origin, to hibernate, and, these being collected and the saw-flies subsequently reared, the latter were very naturally described as inquilinous. All these inquilinous species are due to records obtained by Mr. Walsh, a most careful and conscientious observer, and in nearly every case he himself pointed out the close resemblance of these supposed inquilinous forms to the species with which they really belong, and the facts of rearing as recorded by him show pretty conclusively of themselves that my inference in regard to them is correct.

There are six inquilinous species of saw-flies described by Mr. Walsh. Two of these belong to the genus Pontania, and are synonymous with true gall-makers. (A third may be added here which Walsh referred to but never described.) Two belong to other subdivisions of the old genus Nematus, the larvæ of which live exposed on the leaves and had undoubtedly entered the galls simply to secure a convenient retreat—in some instances for midsummer transformation, and, in cases of the fall brood, for hibernation. A Euura and a Pristiphora complete the list.

The record of these species and synonymy is as follows:

True Gall-Makers.

Pontania hospes Walsh.—This species is synonymous with *P. pomum*, from which Walsh himself says it is absolutely indistinguishable, except in certain very slight and unimportant colorational features. It was reared from the gall of *Cecidomyia strobiloides* O. S. (see Proc. Entom. Soc. Phila., VI, p. 261). I have also received two specimens of *pomum* from Cornell University, labelled as having been reared from this same Cecidomyiid gall.

Pontania inquilina Walsh.—This species is synonymous with *P. desmodioides* Walsh, who says of it that it is very like a pale variety of the gall-making species *desmodioides*. It was reared from the gall of *Cecidomyia rhodoides* (l. c., p. 261).

Nematus quercicola Walsh MS.—This species Walsh apparently never described, although he refers to it on two occasions (l. c., p. 260; Amer. Entomologist, II, p. 73). It is undoubtedly, from Walsh's own statement, synonymous with *pisum*. He reared it from an undescribed cabbage-like gall of Cecidomyia on white oak. He says that it cannot be distinguished from *Nematus s. pisum*, and differs only in the fact that all of his species of *pisum* entered the ground to pupate and the oak species pupated within the gall. My own records of *pisum*, however, show that it hibernates in pith or other dry, soft woody material as described, and will not enter the soil except as a last resort. Walsh's specimens, after abandoning their willow galls, undoubtedly entered and transformed within this oak gall because of the lack of any more suitable material.

Euura perturbans Walsh.—This species is synonymous with *Euura ovum*, Walsh himself saying that it is "absolutely indistinguishable" by any reliable characters. A number of males and females were reared from the galls of *Cecidomyia strobiloides* O. S., and from *C. batatas* Walsh and *C. rhodoides* Walsh, all galls of the preceding year, and "two females bred many years ago, in the same season that the gall was produced, so far as I recollect, from an undescribed Cecidomyid bud-gall—*Vitis fusus* Walsh MS.—composed of bunches of 6 to 50 fusiform galls, occurring on the stem of wild grape vine (*Vitis cordifolia*), each gall attached by a single point and about one-half an inch long" (l. c., p. 252; pp. 254, 255).

From the experience with the larvæ of *Euura ovum*, already detailed, the significance of the above records is at once apparent. The larvæ of this species refuse absolutely to enter the soil or to spin up in leaves, but burrow into bark or pith or soft wood, or even into the galls of their own species, or of other insects, to hibernate, and in this way had entered, in the fall, the galls subsequently collected by Mr. Walsh.

Non Gall-Makers.

Nematus mendicus Walsh.—This is a good species, and will fall in the genus Pteronus. Mr. Walsh says of it (l. c., p. 262): "One female bred May 2, from a Tenthredinidous gall of *S. pomum* n. sp. of the preceding year's growth, and another female August 5, from the Cecidomyiidous gall of *S. brassicoides* Walsh of the same year's growth." The latter record is interesting, as showing that the larva of one of the early broods had entered the green gall of this Cecidomyiid to spin up, the inquilinous habit of the species being thus apparently strongly indicated. In the first instance one of the later broods had entered a gall in the fall for hibernation.

Nematus fur Walsh.—Walsh (l. c., p. 263) reared this species from the gall of *Cecidomyia batatas* Walsh on *Salix humilis*. He says: "As the mother saw-fly must have deposited her egg in this gall after the gall-maker had quitted it, or not long before, it is a question whether, if such be its general habits, this species can be properly considered as an inquiline." The type of this species has been lost, but, from the affinities pointed out by Mr. Norton, it probably belongs in the genus Amauronematus.

Pristiphora sycophantæ Walsh.—Mr. Walsh bred this species, August 9, from a cocoon found within the gall of *Cecidomyia brassicoides* of the same year's growth (l. c., p. 264). The type specimen seems to be lost, but Norton has already pointed out the close resemblance and probable identity of this species with his *P. tibialis*. In this Norton is probably correct, and it undoubtedly is another case where a larva of one of the early broods had entered the gall in question to spin up.

It will be noted that, in the case of every one of the inquilinous species cited above, the hibernating habit, so strongly marked, especially in the gall-making groups of saw-flies, of entering dry vegetable material for the winter, fully explains the occurrence of the cocoons or larvæ in foreign galls, and would render the claim that they were inquilinous very doubtful, even if the confirmatory evidence of their practical identity with other species were lacking.

The paper was discussed by Messrs. Schwarz, Riley, and Ashmead. Dr. Riley stated that, while he thought Mr. Marlatt's conclusions in the main were probably correct, he hesitated to condemn Walsh without the most careful consideration of all the circumstances. Where a full-fed saw-fly larva enters the gall of another insect, the entrance-hole must be perfectly visible, and it seems incredible that Walsh could have overlooked this entrance-hole. It is possible that the galls were collected in large numbers and that the saw-flies issued from the mass of galls, so that there was hardly an opportunity for investigating this point. He further said that the saw-fly might oviposit in the epidermis of a young Cecidomyiid gall quite as well as in the epidermis of a twig or leaf, and that the saw-fly larva might develop with the Cecidomyiid gall. He further said that the leaf-galls of Nematidæ fall to the ground with the leaves in autumn and that the full-grown larvæ issuing from them would not be apt to reascend the plant and bore into the galls.

Mr. Marlatt, in reply, said that in the species which he had had an opportunity to study, and in the available records of the rearings, the parent saw-flies issued too early in the spring to oviposit in the epidermis of Cecidomyiid or other galls. The Euuras emerge long before the time of leafing in spring, in late February or early in March, and the Nematids, producing galls on the leaves, issue in the latter part of March or early in April, with the first appearance of the leaves. He also said that the larvæ coming from both the stem-galls of Euura and the leaf-galls of Nematus abandon their galls early in the autumn, before the leaves fall and in fact while they are still green. He said, also, that many of these inquilines were reared from leafy galls, in which no entrance-hole would be necessary.

Dr. Riley, replying, said that while it is true that saw-flies generally issue early in the season, they come out very irregularly, and some are much later than others, and he saw nothing impracticable in the idea that oviposition might take place exceptionally on Cecidomyiid galls. Mr. Schwarz said that many saw-fly larvæ construct hibernating burrows in the dry bark of trees, and suggested that these burrows should be collected and studied, since they are characteristic with each species, in this way being somewhat analogous to Scolytid burrows. Other saw-fly larvæ bore in the hard wood, and he remembers having found the larvæ, probably of *Harpiphorus testaceus* Nort., burrowing to a depth of two or three inches in the solid wood of an oak near Rock Creek in the District of Columbia.

—Mr. Schwarz presented for publication the following paper:

NOTES ON NOMARETUS, WITH DESCRIPTIONS OF TWO NEW SPECIES.

By E. A. Schwarz.

The discovery of two undescribed species of Nomaretus, one of which differs remarkably from the nearest allied species in the tarsal characters of the male, led to a desire of examining and comparing the males of all our species. In this I was unsuccessful, owing to the scarcity of specimens in our collections, and the idea of contrasting the species according to the tarsal structure of the males had to be abandoned for the present. However, in the course of examination of the available material a number of other distinctive characters, irrespective of sex, were found, and the following synoptic table, which has been drawn up conjointly by Mr. H. G. Hubbard and myself, may be of some use in connection with that given by Dr. Horn (Bull. Brooklyn Ent. Soc., 1, 1879, p. 80).

Table of Species.

Body cychriform; humeri distinct; elytra with marginal row of punctures; epipleuræ either coarsely punctate or at least with marginal row of punctures.

- Sides of thorax with many punctures; under side of body more or less punctate; elytral epipleuræ coarsely, irregularly punctate; side margin of thorax not sinuate, hind angles obtuse; elytral striation complete.
  - Elytral striæ distinctly impressed, punctures approximate, *bilobus* Say.
  - Elytral striæ feebly impressed, punctures distant.
    - Thorax with many setigerous punctures on the disc, *cavicollis* Lec.
    - Thorax smooth on the disc...................... *fissicollis* Lec.
- Sides of thorax with a single setigerous puncture; under side entirely smooth; elytral epipleuræ with a single marginal row of punctures; thorax sinuate at sides, hind angles subrectangular.
  - Hind angles of thorax long; elytra convex, with complete striation; punctures of striæ not coarse and rather closely placed......... .... *debilis* Lec.
  - Hind angles of thorax short; elytra subdeplanate with seven abbreviated striæ; inner striæ coarsely punctate, *incompletus* n. sp.

Body slender; humeri obliterated; elytra without marginal row of punctures; under side and epipleuræ smooth; sides of thorax with a single setigerous puncture; elytral striation incomplete.

Front tarsi of ♂ widely dilated; elytra oblong-oval, with from five to six abbreviated striæ; fourth interstice with a series of setigerous punctures ....*hubbardi* n. sp.

Front tarsi of ♂ not dilated; elytra elongate-oval, with from three to four striæ, interstices without setigerous punctures. *imperfectus* Horn.

1. **N. bilobus** Say.

♂.—Front tarsi moderately dilated, densely papillose beneath, excepting base of first joint; joint 1 fully twice longer than wide at tip, joints 2-4 much decreasing in size, each slightly longer than wide; last joint of palpi much dilated; last joint of labial palpi with the apical edge much longer than the inner lateral edge and slightly longer than the outer lateral edge.

♀ not seen by me.

The post-ocular constriction is deeply impressed, and the vertex greatly convex; side of the prosternum and the pro-epimera, sides and side pieces of meso- and metasternum are coarsely punctate; sides of first abdominal joints with some indefinite punctures; second joint of labial palpi with four setæ.

The specimens before me are from the Lake Superior region (Marquette and Michipicoten Island), and I have seen others from Canada and New Hampshire, but none from Say's type localities, "Missouri" (probably northern Nebraska) and "Northwestern Territory" (probably Minnesota).

2. **N. cavicollis** Lec.

I have examined only a single female specimen from Texas: second joint of labial palpi with 5 setæ, last joint strongly securiform, with the apical edge slightly longer than the inner edge and distinctly shorter than the outer edge; last joint of maxillary palpi much more slender than that of the labial palpi; post-ocular constriction less impressed than in *bilobus*, and the vertex less convex. The punctures on the anterior part of the prothoracic disc are setigerous; those near the base simple; under side more punctate than in any other species.

3. **N. fissicollis** Lec.

Only a few specimens from Texas and Kansas have been seen by me. From a superficial examination of a male in Mr Ulke's collection I made the following notes: Front tarsi slightly less dilated than in *bilobus*, spongy, pubescent beneath, first joint more slender than in *bilobus* and pubescent only at apical half; last joint of palpi strongly dilated; last joint of labial palpi with the apical edge slightly longer than the inner edge. The female has the last joint of palpi distinctly dilated and securiform.

4. **N. debilis** Lec.

♂.—Front tarsi with joints 1–2 distinctly dilated but less so than in *bilobus*, joints 1–3 papillose beneath, joint 1, 2½ times longer than wide at tip, joint 2 almost twice as long as wide, joint 3 feebly dilated, more than twice longer than wide, joint 4 not dilated; second joint of labial palpi trisetose, last joint strongly dilated with the apical edge as long as, or shorter than, the inner edge.

In this and the following species the eyes are feebly prominent and the post-ocular constriction obsolete.

The type locality is Habersham Co., Ga.; the specimens before me were collected by Mr. H. G. Hubbard and myself at Round Knob, N. C. (altitude, about 1,800′), between June 23 and June 28.

5. **N. incompletus** n. sp.

Moderately slender, cychriform, shining, black; antennæ, mouth-parts, tibiæ and tarsi rufous, elytra rufo-piceous, with slight bluish tinge. Head with the post-ocular constriction obsolete; eyes feebly prominent, second joint of labial palpi trisetose. Thorax cordate, as wide as long, surface slightly depressed, smooth, except a setigerous puncture at the middle of the side margin and the usual puncture in front of the hind angles, sides much rounded, slightly sinuate behind, hind angles subrectangular, apical and ante-basal transverse impressions deep, basal longitudinal impression well marked and extending beyond the transverse impression. Elytra oblong-oval, decidedly deplanate on the disc, humeri well indicated though rounded, with seven striæ, all being greatly abbreviated, the outer ones gradually much more so than the inner ones; a wide smooth submarginal space extending from the humeri to the apex; marginal row of punctures distinct from the base to beyond the middle; striæ 1–5 deeply impressed and coarsely punctate, the punctures not closely placed, sixth stria less distinctly impressed and with the punctures small and indefinite, seventh stria feeble and not punctured; interstices wider than the striæ, convex and smooth; epipleuræ with a marginal row of punctures and with a few irregular punctures near the humeri; under side of body smooth; legs long and slender.

♂ unknown.

♀.—Front tarsi slender, first joint as long as the following three together, joints 2 and 3 each more than twice longer than wide, joint 4 distinctly longer than wide; last joint of palpi slender, feebly securiform, last joint of labial palpi with the apical edge at least twice shorter than the inner lateral edge.

Length, 10 mm.

Described from a single specimen found by Mr. H. G. Hubbard at Stone Creek, Lee Co., Va. (Cumberland Mts.), July 30, 1879.

In general appearance this species resembles a diminutive *Cychrus cordatus*. It is closely allied to *N. debilis*, the distinguishing characters being given in the table. The reddish color of the elytra is most probably only an individual character.

6. **N. hubbardi** n. sp.

Slender, black, shining, mouth-parts, antennæ and tarsi rufous, tibiæ piceo-rufous. Head with the post-ocular impression deep, vertex globose, eyes prominent. Thorax cordate, as long as wide, sides greatly rounded at apical third, posteriorly oblique and slightly subsinuate, hind angles nearly rectangular; surface smooth with a single setigerous puncture at the middle of the side margin and another near the hind angles; anterior transverse impression feeble, posterior transverse and basal longitudinal impressions deep. Elytra oblong-oval, moderately convex, declivity oblique; humeri entirely obliterated; sides moderately rounded; surface with five or six abbreviated striæ, the outer gradually much more so than the inner ones, and with a broad, smooth lateral space extending from the base to the apex; the four inner striæ anteriorly moderately impressed and punctate, the punctures not coarse and rather closely placed, fifth stria feebly impressed, either feebly punctate or smooth, sixth stria feebly impressed, not punctate and sometimes obsolete; interstices moderately convex, the fourth with a series of 5 or 6 setigerous punctures; a series of from two to four setigerous punctures in the smooth space between the outermost stria and the margin; marginal impressed line without punctures but with a few setæ near the humeri; epipleuræ and entire under side smooth; legs moderately slender.

♂.—Front tarsi spongy, pubescent beneath, and much more strongly dilated than in the other species, joint 1 slightly longer than wide at tip, joints 2–4 each as long as wide; last joint of labial palpi moderately dilated with the apical edge about as long as inner lateral edge and distinctly shorter than the outer lateral edge.

♀.—Front tarsi simple, moderately slender, joint 1 nearly as long as the three following joints united, joint 2 about twice longer than wide, joint 3 slightly longer than wide, joint 4 as long as wide; palpi very slender, last joint very feebly dilated with the apical edge fully twice shorter than the inner lateral edge.

Length, 8–9 mm.

Several specimens were found by Mr. H. G. Hubbard, to whom the species is dedicated, near Retreat, Haywood Co., N. C. (altitude about 3,000′), in May and June, 1893.

This is the only species with strongly dilated tarsi in the male, and the row of setigerous punctures on the disc of the elytra is also a character not found in any other species. It is evidently closely allied to *N. imperfectus*, which, however, is the only species with simple front tarsi in the male. In *N. hubbardi* the punctures of the elytral striæ are smaller, more numerous, and more closely placed than in *imperfectus;* the other more striking differences between the two are set forth in the table.

7. **N. imperfectus** Horn.

♂.—Front tarsi not dilated, tip of joint 1 and joints 2 and 3 beneath with spongy pubescence, joint 1 not increasing in width apically and about 2½ times longer than wide, joint 2 slightly longer than wide, joints 3 and 4 each as wide as long; last joint of palpi moderately dilated, last joint of labial palpi with the apical edge slightly shorter than the inner lateral edge and about one-third shorter than the outer lateral edge.

♀.—Front tarsi as in the male, beneath sparsely hairy; terminal joint of palpi extremely slender, that of the maxillary palpi not dilated and not securiform, that of the labial palpi with the apical edge at least three times shorter than the inner apical edge.

Widely distributed in the Allegheny Mts., but apparently not occurring below 1,800′ elevation. Type locality, Hampshire Co., W. Va. I have seen specimens from Cresson Springs, Pa.; Deer Park, Md. (Ulke); Ft. Pendleton, Md. (Schwarz); Mountain Lake, Giles Co., Va. (Ulke), and Round Knob, N. C. (Hubbard and Schwarz).

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MAY 3, 1895.

President Ashmead in the chair, and the following gentlemen were also present: Messrs. Stiles, Benton, Gill, Patten, Chittenden, Linell, Marlatt, Howard, Fernow, Waite, Swingle, and Dr. Deckert, of Leipzig.

The following new members were elected: Active—S. D. Judd and Henry Schoenborn; Corresponding—H. Schwarz, 1520 Lafayette avenue, St. Louis, Mo., A. H. Kirkland, Malden, Mass., Dr. Geo. W. Bock, 1319 Hickory street, St. Louis, Mo., and C. W. Johnson, Wagner Institute, Philadelphia.

—Mr. Howard read a paper on "An injurious parasite."*

—The following communication was presented for publication:

A LEAF-BEETLE OF THE GOLDEN-ROD.

By F. H. CHITTENDEN.

A low-growing species of golden-rod that occurs about Washington and which has been identified as probably *Solidago ar-*

* Withdrawn for publication in *Insect Life*, Vol VII, No. 5.

guta Ait. is yearly ravaged by a little chrysomelid beetle, which attacks it soon after the appearance of its foliage above ground, both larvæ and beetles cutting out large holes in the leaves, which become still larger with the plant's growth.

The beetle in question is *Galerucella americana* Fab., a robust little light brown species with its elytra lined with black and resembling the congeneric imported elm leaf-beetle, *G. luteola* Mull. (= *xanthomelæna* Schr.). Last summer this insect occurred in such abundance just above the Virginia shores of the Potomac opposite Georgetown that it was next to impossible to find a plant of this species of Solidago that had not been attacked by the beetle. It was almost equally difficult at the time of this observation to find the larvæ and, when found, to carry them safely over the larval stage. During the first days of June full-sized larvæ were observed and all that could be found taken home for rearing. After searching many plants that showed the characteristic large holes eaten out by this species and finding four specimens, I discovered the cause of their scarcity in a fungoid disease, which manifested itself in patches of mould of the size of the larvæ and dispersed about on the under-side of the leaves. All but a few of the larvæ taken at this time were light straw-yellow in color, and all thus colored died, some within a few hours after capture. They usually succumb to this disease upon arriving at maturity, but a few died at a younger age. In a very few hours after death ensues the larvæ become flattened and lose all semblance to their former selves.

Specimens of the diseased larvæ were shown to Mr. B. T. Galloway, Chief of the Division of Vegetable Pathology in the Department of Agriculture, who doubtfully referred the fungus to *Empusa sphærosperma*, a common species which often produces epidemics among various insects. The infected larvæ were found along the border of a shaded pathway, and it is not improbable that the shade may have afforded the most suitable conditions for the propagation of the fungus. At any rate, in an adjoining meadow more exposed to sunlight, larvæ were found free from infection. One of these, confined in a rearing jar, was found to have formed its cocoon on the morning of June 11. It pupated June 15, and the imago developed on the 22d, this individual having passed seven days as pupa. A second developed in six days, in extremely warm weather, June 20–26. The adult remains a few days in the pupal case and after issuing requires a few days longer for its outer chitinous parts to harden.

The new brood of 1894 began to appear June 14 and by the 17th the most of those found had fully matured. A good series was collected and fed, but no attempt at copulation was noticed, nor were any more larvæ found after June, from which facts it is quite plain that the species is normally single-brooded in this latitude. On the other hand, a pair of adults, without doubt of the new brood, was taken *in copula* as late as July 26, from which was obtained a mass of ten eggs on the following day. Thus it is probable that in the southernmost limit of the species we may sometimes have produced an exceptional second generation in one year. This is of interest as the number of yearly generations of the elm-leaf species has been the subject of considerable controversy, the outcome being that careful observations by Professors Smith and Riley in the latitudes of northern New Jersey and the District of Columbia, respectively, have developed the fact that for that species in the former locality about the same condition of affairs in regard to generations obtains as in the golden-rod species here, whereas in the latter locality two, three, and exceptionally four broods of larvæ have been noted (see Proc., vol. II, pp. 364–365).

The life-history of *G. americana*, according to my observations, may be summed up about as follows: The hibernated adults may be seen towards the end of April, or soon after the foliage of the Solidago appears, and egg-laying continues at least throughout the month of May. The larvæ attain full growth by the end of May. The pupal stage occupies a week and the inactive stage of the mature larva and newly-bred adult consumes another week. About the middle of June the adults leave the pupal case and, after feeding for several days, perhaps weeks, leave the plants and begin hibernation. In this locality, at least, this beetle feeds only on Solidago and has thus far been found to feed only on a single species of this genus.

—Mr. Ashmead read the following:

LYSIOGNATHA, A NEW AND REMARKABLE GENUS IN THE ICHNEUMONIDÆ.

By William H. Ashmead.

Among a lot of miscellaneous parasitic Hymenoptera, principally Braconidæ, sent me for determination by Prof. J. Henry Comstock, of Cornell University, Ithaca, N. Y., through his assistant, Mr. Alexander MacGillivray, I found a most anomalous ichneumonid, represented in both sexes, having the head and jaws similar to an Alysiine in the Braconidæ, but otherwise, in venation and abdominal characteristics, agreeing with many forms found in the family Ichneumonidæ.

This singular insect at first was very perplexing to classify, but, after a thorough study of all its characters, I am convinced it represents an ancient type of the family Ichneumonidæ, and probably the phylum from whence originated part of the Braconidæ —the Alsyiinæ. On account of its venation, however, it having a distinct areolet, two recurrent nervures, and its abdominal characters, I believe it should be placed as a distinct subfamily in the Ichneumonidæ.

This new genus may be thus characterized:

Lysiognatha genus nov.

Head, viewed from *above*, subquadrate, deeply emarginate posteriorly, full and broad behind the eyes, the vertex with a median sulcus extending to front ocellus; viewed from in *front* nearly twice as wide as long, the face therefore short, the clypeus extending from eye to eye and visible as a narrow transverse ridge; ocelli 3, rather close together in a triangle far away from the eye margin; eyes oblong oval extending to base of mandibles, the malar space entirely wanting; mandibles widely separated, attached to the side of the head as in *Alysia*, oblong, only slightly contracted at the middle, the apex being deeply emarginate and forming two nearly equal-sized teeth; maxillary palpi 5-jointed; labial palpi 3-jointed; antennæ inserted a little below the middle of the face, in ♀ very slightly thickened toward apex, 22-jointed, the last joint, however, apparently composed of 3 connate joints; in ♂ tapering towards tips, 25-jointed. Thorax ovate, the prothorax narrowed, triangular; mesonotum not longer than wide, without parapsidal furrows, the mesopleura convex, not impressed or foveated; scutellum subtriangular, with a deep furrow across the base; metanotum with two delicate median carinæ, divergent posteriorly, the lateral longitudinal carinæ subobsolete, the spiracles small rounded, placed toward the lateral middle; anterior wings as in *Pimpla*, with an oblique, subrhomboidal areolet, the second recurrent nervure entering the areolet near its apex, the median and submedian cells equal, the discoidal nervure angulate a little before the middle, legs normal, the tibial spurs 1, 2, 2, short, not strong. Abdomen in ♀ oblong-oval, sessile, subcompressed at apex and ending in a long ovipositor; first segment the longest, feebly bicarinate toward base, the spiracles very small, rounded, placed a little before the middle; the other segments smooth; the second segment is half as long as the first, the following gradually shortening. In the ♂ the abdomen is a more slender, with the first, second, third, and fourth segments with a ventral fold.

Lysiognatha comstockii sp. n.

♀.—Length 2.8 to 3 mm.; ovipositor longer than the abdomen. Reddish-brown, smooth and polished; anterior orbits broadly, face below antennæ, clypeus, mandibles, except teeth, mouth-parts, antennæ toward base, collar, tegulæ, legs and abdomen toward base, yellowish-white; ocelli, eyes, and tips of mandibular teeth, black. Antennæ 22-jointed, extending to base of abdomen, brownish toward apex and pubescent. Wings hyaline, the venation pallid. Abdomen sessile, oblong-oval, a little longer than the head and thorax united, subcompressed at apex and ending in a long ovipositor.

In the male the head and thorax are black, the abdomen reddish-brown; anterior orbits, face below antennæ, mouth-parts, two basal joints of antennæ, prothorax, tegulæ, legs and sutures of the abdomen, yellowish-white, while the antennæ are a little longer, more slender toward apex, and composed of 25 joints.

Hab.—Cayuga Lake, Ithaca, N. Y.

Types in Collection Cornell University and Coll. Ashmead.

Described from 1 ♂ and 2 ♀ specimens received from Prof. J. Henry Comstock, collected by Mr. Herbert H. Smith.

Mr. Smith's record of the capture of a pair of these insects reads: "Swept from foliage in woods, *in copula*, at Norton's Landing, Cayuga Lake, June 26, 1872."

For some years past I have given considerable study to the Ichneumonidæ, basing my studies upon those of Förster's Synopsis, and in order to show the position that this new subfamily should hold in the family I would propose the following arrangement of the subfamilies and tribes:

Family ICHNEUMONIDÆ.

Subfamily I. LYSIOGNATHINÆ.

Subfamily II. OPHIONINÆ.

Tribe I. *Anomalonini.*
II. *Trachynotini.*
III. *Porizonini.*
IV. *Pristomerini.*
V. *Cremastini.*
VI. *Hellwigiini.*
VII. *Ophionini.*
VIII. *Campoplegini.*
IX. *Banchini.*
X. *Mesochorini.*
XI. *Plecticini.*
XII. *Agriotypini.*

Subfamily III. TRYPHONINÆ.

Tribe I. *Mesoleptini.*
II. *Exenterini.*
III. *Ctenopelmini.*
IV. *Tryphonini.*
V. *Exochini.*
VI. *Trachydermatini.*
VII. *Orthocentrini.*
VIII. *Bassini.*
IX. *Sphinctini.*
X. *Metopiini,*

Subfamily IV. ICHNEUMONINÆ.
Tribe I. *Trogini.*
II. *Ichneumonini.*
III. *Alomyini.*
IV. *Listrodromini.*
V. *Phæogenini.*

Subfamily V. CRYPTINÆ.
Tribe I. *Stilpini*
II. *Hemitelini.*
III. *Phygadeuonini.*
IV. *Cryptini.*

Subfamily VI. PIMPLINÆ.
Tribe I. *Acœnitini.*
II. *Lissonitini.*
III. *Pimplini.*
IV. *Xoridini.*

My own collection is now arranged after the above scheme, and it appears to me a very natural one, so gradually do the subfamilies and tribes run into one another. The student must not forget, however, that at least sixty per cent. of our Ichneumonidæ are incorrectly placed in our lists and catalogues, and that an enormous amount of work must yet be done before our described species can be brought into their proper genera and tribes.

In discussion, Dr. Gill asked Mr. Ashmead to figure the typical mouth-parts of an ichneumonid so as to enable the Society to judge as to the limits of the variation. He further questioned Mr. Ashmead closely as to the significance of the extraordinary mouth of the new form, and concluded by suggesting that the insect deserves family rather than subfamily rank. Some discussion arose as to the use of the jaws in the Ichneumonidæ and Braconidæ. Mr. Marlatt stated that their sole use seemed to be to enable the insects to issue from their cocoons or from imprisoning substances; that, after issuing, the jaws are of little or no use, although he had known the larger Ichneumonids to bite when handled. Mr. Howard referred to the wing venation of the new form and stated that the presence or absence of the second recurrent nervure was, in his opinion, not a competent family character, and that from venation alone he would not consider the new form as necessarily an ichneumonid. Mr. Ashmead agreed with the last speaker, but stated that the abdominal characters, and in fact all of the characters except those of the head, were such that the form appears more closely related to the Ichneumonidæ than to the Braconidæ. Mr. Marlatt, apropos of the presence or absence of the outer recurrent nervure, stated that both were present in the Tenthredinidæ; that he considered the Ichneumonidæ to be lower in type and nearer to the Tenthredinidæ than are the Braconidæ. The presence of the second recurrent nervure in Lysiognatha, he thought, might simply be a reversionary character. Mr. Ashmead agreed with the view that the Tenthredinidæ are the lowest of the Hymenoptera. Many wing veins, in his opinion, indicate a low type. Thus the Chalcididæ, which have almost no veins, are recent developments. Lysiognatha, in his opinion, may be an old type of Alysiinæ. Dr. Gill expressed himself as of the opinion that we should discard the use of the terms "low" and "high" in this connection on account of the possible ambiguity, substituting the terms "generalized" and "specialized." This point was further discussed by Messrs. Fernow and Howard, and the latter speaker referred to the theories of wing development of Redtenbacher and Spuler as commented upon in recent papers by Comstock and Packard.

—A note by Mr. H. G. Barber, a corresponding member of the Society, entitled "Food-habits of *Hypatus bachmani*," was read by the Corresponding Secretary.*

—Mr. Swingle gave a short talk on the effects of the freezes of the past winter upon orange trees and upon orange insects in Florida, showing that the second freeze had resulted in the destruction of all insects upon the leaves. Mr. Marlatt suggested that in the course of a year or two there would probably be a marked increase rather than decrease in the number of injurious insects in the orange groves as a consequence of the weakened condition of the trees. Mr. Swingle said that with plant diseases this state of affairs will be brought about in many cases, but that the contrary effect will be produced in many other cases. Certainly with the Mytilaspis scales an enfeebled condition of the trees does not favor the multiplication of the insects. Vigorous dark green trees are most apt to be affected. He mentioned the

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See *Entomological News*, VI, No. 6, pp. 190-'91 (June, 1895).

curious point that in certain localities in Florida growers refuse to spray for the Mytilaspis scales on account of the fact that spraying increases their number. Experiments which he himself had made indicated the truth of this general idea, particularly when the spraying was done with fungicides. He was convinced that the fungus known as *Ophionectria coccicola* is a true scale parasite and that this fungus is destroyed by the spraying, allowing the scales to multiply unchecked. From the practical standpoint he considered that the *important* insect enemies of the orange tree, viz., the red scale and the white fly, have been greatly lessened in number and that only the unimportant ones were unharmed by the freezes. Mr. Marlatt said, however, that insects previously considered unimportant might now, and probably would, become important, owing to the enfeebled condition of the trees. This was particularly apt to be the case with bark-boring beetles. Mr. Ashmead agreed with Mr. Marlatt and stated that in his own experience of many years in Florida he had found very serious damage to result from bark-boring beetles following severe freezes. He also stated that after a check to the growth of a tree it might become attacked by new parasites which gradually might change their food-habit and become enemies of healthy trees.

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JUNE 6, 1895.

President Ashmead in the chair, and the following members also present: Messrs. Gill, Hubbard, Marlatt, Benton, Patten, Judd, Howard, Waite, Heidemann, Swingle, E. F. Smith, and Fernow.

—Mr. Ashmead read the following paper:

DISCOVERY OF THE GENUS ELASMOSOMA, RUTHE, IN AMERICA.

By WILLIAM H. ASHMEAD.

The genus *Elasmosoma* was described by J. F. Ruthe, in a paper entitled "Beiträge zur Kenntniss der Braconidæ," published in Vol. II of the Berliner Entomologische Zeitschrift, 1858, with one species, *E. berolinense*, and up to the present time the genus has remained monotypical.

The genus belongs in the subfamily Microgasterinæ, in the family Braconidæ, and Ruthe has recorded that his species was captured by Prof. Schenck with *Formica rufa*. He was of the opinion it was parasitic on this ant.

Ruthe briefly characterized the genus as follows:

Maxillary palpi 2-jointed, labial palpi unjointed. Antennæ 14-jointed, the scape abbreviated. Eyes smooth (bare). Occiput flat, the vertex narrowed. Front wings with 3 inconstant cubital cells, the radius evanescent towards apex. Abdomen depressed; ovipositor hidden.

Soon after my return from Germany, in 1890, among some chalcidids taken by Mr. E. A. Schwarz at Washington in 1889, I discovered a curious little ♀ microgasterine with a long abdomen, short, 13-jointed antennæ and a peculiar wing venation which I was unable to place in any known genus and to which I gave the MS. name *Paramirax schwarzi*, placing it away in my cabinet for future study.

Some months ago a ♂ of this peculiar braconid, with 14-jointed antennæ, was received from Mr. Carl F. Baker, taken at Fort Collins, Colorado, and only a few nights ago I finished studying it and the one taken by Mr. Schwarz and arrived at the conclusion that my MS. genus *Paramirax* would not hold, since it was identical with *Elasmosoma* Ruthe, the difference in the number of joints in the first species not being sufficient to justify the erection of a new genus.

It is very remarkable that, the very next morning after reaching this conclusion, Mr. Pergande sent word from his office, if I had time to spare, he would like to see me.

Judge of my surprise, therefore, when he brought out two specimens of a third species of this rare genus, mounted on a single pin with an ant, two myrmecophilous beetles, and a myrmecophilous cricket and asked me what it was.

Having just finished studying my own specimens, I replied at once, "Why, that is a species of the rare genus *Elasmosoma* Ruthe. Where did you take it?"

Mr. Pergande then told me that the day before, which was a holiday, he went out collecting myrmecophilous insects and that while inspecting the nest of *Camponotus melleus* Say, which was under a large stone, he was pestered with some little flies which were quite numerous and kept flying into his eyes and ever and anon alighting among the ants, during his examination of the nest. At first he paid no attention to them, mistaking them for small oscinids; but they were so persistent in alighting among the ants that finally his curiosity was aroused and he determined to find out what they were. Wetting the tip of his finger with his mouth, he captured two, placing them in a vial with the intention of examining and making out the species on his return home. When he got home and found out what a rare and curious insect he had found, he was quite surprised, and regretted he had not taken more.

Is the genus parasitic on the ants or on the myrmecophilous beetles?

It is truly significant that both in Europe and in America the genus is found only associated with ants, but as yet we have no authentic information as to the parasitic habits of the species. We trust Mr. Pergande will continue his observations on the species discovered by him and definitely settle the question as to its parasitism.

All other genera in the Microgasterinæ are parasitic only on lepidopterous larvæ, although two or three species of Apanteles and Microgaster are recorded as having been bred from rhynchophorous beetles.

The specimens spoken of above represent three distinct species and may be tabulated as follows:

TABLE OF SPECIES.

Antennæ 13-jointed............. 2

Antennæ 14-jointed.

Antennæ entirely and middle and hind coxæ, black, rest of legs pale ferruginous; abdomen as long as head and thorax united. *E. bakeri.*

2. All coxæ yellowish-white.

Abdomen twice as long as the head and thorax united, subpetiolated, the segments 1, 3, 4, 5, and 6 longer than wide; two basal joints of antennæ and legs pale yellowish...............*E. schwarzi.*

Abdomen only one-third longer than the head and thorax united, the dorsal segments 2 and 3 tinged with rufous, all the segments wider than long; two basal joints of antennæ brown; legs pale yellowish.. ....*E. pergandei.*

(1) **Elasmosoma bakeri** sp. n.

♂.—Length 2.5 mm. Black, subopaque, shagreened, the vertex with transverse striæ, the metathorax finely rugulose, the abdomen granulated. Antennæ 14-jointed, black, pubescent, extending to base of abdomen and tapering toward tips, the scape and pedicel small, not as thick as, and both united not as long as the basal joint of flagellum, joints of flagellum all longer than thick and gradually become more slender towards apex. Trophi whitish. Thorax without parapsidal furrows, flattened on disk in front of scutellum; axillæ not well separated, the scutellum laterally and the post-scutellum striated. Metanotum finely rugulose, not carinate. Wings whitish hyaline, the costa and stigma brown, the outer edge blackish, the internal nervures hyaline, subobsolete. Legs pale ferruginous, with the middle and hind coxæ black, the hind tibial spurs nearly as long as the basal joint of tarsi. Abdomen as long as the head and thorax united, elongate oval, depressed with pale colored ventral fold on first three segments, the surface above granulated, the segments 2 and 3 subequal, wider than long, the following much shorter.

Hab.—Fort Collins, Colorado.

Type in Collection Ashmead.

Described from 1 ♂ specimen, received from Mr. Carl F. Baker, and in honor of whom the species is named.

(2) **Elasmosoma schwarzi** sp. n.

♀.—Length 3 mm. Black, subopaque, shagreened, with the head less distinctly sculptured than the preceding species, the vertex shining and very delicately transversely aciculated. Ocelli white. Eyes large, strongly convergent anteriorly. Two basal joints of antennæ, trophi and legs, white or yellowish-white, flagellum brown, the first joint being a little shorter than the scape and pedicel united. Wings hyaline, the costa and stigma dark brown. Abdomen subpetiolate, much elongated and twice as long as the head and thorax united, with parallel sides, all the segments, except the second and the last two, are longer than wide, the second is a little wider than long, the last two very short; the upper surface is flat, finely shagreened black; beneath there is a ventral fold which is more or less tinged with piceous.

Hab.—Washington, D. .

Type in Collection Ashmead.

Described from 1 ♀ specimen and dedicated to Mr. E. A. Schwarz, who captured it on the outskirts of Washington, July 15, 1889.

(3) **Elasmosoma pergandei** sp. n.

♀.—Length 2 mm. Black, subopaque, shagreened; clypeus and mandibles, except teeth, brownish-yellow; palpi, middle and anterior legs and hind coxæ, yellowish-white; hind legs, except tarsi, brownish-yellow, their tarsi brown or fuscous Wings grayish-hyaline, the costa and stigma dark brown, the internal veins lighter brown or brownish-yellow, the radial cell closed and indistinctly separated by a faint cross-vein into two cells, the veins, however, only distinctly seen by transmitted light. The head is transverse, a little wider than the thorax, the frons and vertex finely transversely shagreened, the eyes strongly facetted, bare, convergent below and reaching almost to the base of the mandibles. Antennæ 13-jointed, filiform, tapering toward apex, black, with the scape and pedicel brown; the scape is not longer than the first joint of flagellum, the joints of the flagellum being a little longer than thick. Thorax ovate, finely shagreened, the collar not visible from above, the metanotum with some irregular raised lines. Abdomen one-third longer than the head and thorax united, shagreened, segments 1, 2 and 3 subequal in length, the first very slightly the longest, segment 4 two-thirds as long as the third, segment 5 a little shorter, the following still shorter, subequal. The abdomen is black but the second and third dorsal segments are tinged with rufous.

Hab.—Washington, D. C.

Described from 2 ♀ specimens, taken by Mr. Theo. Pergande, in the nests of *Camponotus melleus* Say, May 29, 1895.

The paper was briefly discussed by Messrs. Marlatt and Howard, the former bringing up the point of the difficulty of associating males and females in collected specimens, *apropos* to a question by the latter as to the possible association of the Colorado male with the District of Columbia female.

—The Corresponding Secretary read the following paper by Mr. F. M. Webster:

NOTES ON THE DISTRIBUTION OF SOME INJURIOUS INSECTS.

By F. M. Webster.

In his very interesting paper, "Notes on the Geographical Distribution within the United States of certain Insects Injuring Cultivated Crops" (Proc. Ent. Soc. Wash., Vol. III, No. 4), Mr. L. O. Howard has attempted to bring together some data to show that some of our injurious species are more or less restricted in their habitat to certain life-zones, as mapped out by Dr. Merriam. In doing this he has been obliged to criticise some statements made by myself, first in *Science* for February 3, 1893, and later in Bulletin 51, Ohio Agricultural Experiment Station, where I gave the distribution of some of these species in Ohio, with such information as I was able to obtain relative to their probable introduction and subsequent diffusion. Knowing, as I do, that Mr. Howard is as sincere in his position and as desirous of getting at the truth as I am myself, it appeared to me that it would be but just to myself and all interested to give the facts upon which my statements were based.

In August, 1892, at the meeting of the Association of Economic Entomologists at Rochester, N. Y., specimens of *Crioceris asparagi* were found near the city, and this was, at that time, supposed to be their extreme western point of occurrence. A year later I received specimens, in all stages of development, from near Cleveland, Ohio, and on mentioning the fact to Prof. E. W. Claypole, of Akron, was informed by him that he had observed the species at Salem, Ohio,* some six years before, fully 60 miles southeast of Cleveland, in a direct line, and not over 25 miles from the Ohio river. I had been on the watch for the insect in the extreme northeast corner of the State, but had not been able to find it, though I had examined every patch of asparagus that came in my way in that part of the State.

I visited Cleveland on a market day and took specimens with me, but could not find a gardener or truck farmer that had ever seen them before, and returned home more perplexed than ever regarding the probable introduction of the pest. I next wrote Mr. Ottomar Reinecke, of Buffalo, N. Y., who informed me that it did not occur there, and the nearest point where it did was at Rochester, 68 miles east. He stated, however, that Mr. A. Bolter had found it about Chicago some years before. I then wrote Mr. Bolter for information, from whom I received the reply that he had found five examples near the city 25 years before, and had seen specimens that had been collected by the late B. D. Walsh in the vicinity of Rock Island, Illinois. Mr. Walsh died in 1869, so that the collection must have been made at least 24 years previous. Mr. Bolter also stated that he had the year before, 1892, found the species literally swarming on the Island of Nantucket. My puzzle, instead of nearing a solution, was getting more puzzling. I then addressed letters to commission men in Cleveland, Sandusky, Detroit, and Chicago to learn if their supply of asparagus came from the east. The replies to my inquires gave the information that they received nothing from the east, but that it all came from the south, where the asparagus-beetle is not known to exist. The introductions at Rock Island and Chicago had undoubtedly died out, as it has not, to my knowledge, been again reported from the former locality, and Mr. Bolter stated that he had not observed it about Chicago since. Would the Cleveland occurrence, which was only in a private garden, and the Salem introduction also die out? And how in the world did the thing ever get into Ohio? The country about Salem is not devoted to truck farming, while there are hundreds of acres near Cleveland, Toledo, and Chicago that are and have been for years. Last year, 1894, I found the species breeding quite abundantly on runaway or volunteer stalks of asparagus growing in uncultivated fields about 15 miles east of Cleveland, and it was reported to me, with specimens, as very destructive at Lordstown, almost directly between Salem and Cleveland, but much nearer

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* In my paper, above referred to, Akron was given as a point of infection, but this has since proven to be an error.

the former, however, than the latter. Now, so far as I could then or can yet discern, there are but two ways that this insect could have been introduced into Ohio: first, by the hibernating adults being shipped in with plants, and, second, by being washed into some of the tributaries of the Ohio river, which we know intermingle with those of the Genesee, Susquehanna, and Potomac rivers. As I have before stated, the edible part of the plant comes from the south exclusively, and where the roots are shipped for transplanting they are removed either late in the fall or early in the spring, before the young shoots are put out, which would preclude transporting anything but the hibernating adults. If the introduction was by this means, there would be, it seems to me, a far greater likelihood of its becoming established in a section of country where the most asparagus was grown, instead of where the reverse was the case. Even if it were introduced about Cleveland first, by a "commercial jump," as Mr. Howard terms it, it would be difficult to find a good reason for its becoming destructively abundant 40 miles away, where little of its food-plant is grown, leaving acres untouched about its area of first colonization. Despite Mr. Howard's suggestion that my statement that the species doubtless entered the State via the Ohio river is "hazardous," I am still willing to hazard the statement.

Mr. Howard cites many instances where the asparagus-beetle inhabits the Upper Austral life-zone, and a few instances where it occurs on the Transition, yet the tenor of his argument is that the former life-zone, only, is congenial and that its introduction into the Transition is artificial, and cites one instance where it seems to be dying out. West of the Alleghenies the situation is somewhat different. According to Mr. Bolter, the species was established both about Chicago and Rock Island, Illinois, and has not been heard from for over 25 years in either locality, both of which are in Upper Austral. The locality of infection near Cleveland is in Upper Austral, and probably Salem also, but Lordstown, the only locality in Ohio where the species has been reported destructively abundant, is fairly and squarely on the Transition. The Ohio and Nantucket exceptions, with those given by Mr. Howard himself, would indicate that the statement "So far, there is nothing to conflict with the idea that the species will not establish itself in the true transition region" would have been a good confession with which to have opened his argument, and that the fact of their not having previously been known to occur in the transition-zone, along the upper Ohio river, is hardly proof of their non-occurrence, or that the species necessarily used a "commercial jump" in order to reach Ohio.

My critic further says that I fail to appreciate the fundamental truths which govern the distribution of species in my region; that, among other things, I failed, in my paper, to point out the important fact that the Transition forms a barrier to certain species coming from the East, and that such cannot reach Ohio by natural spread; that Upper Austral forms are quite as likely to reach Ohio from the East by means of the great commercial paths to middle western New York and thence by natural spread through lower Ontario and southern Michigan, or by lake from Buffalo to Cleveland, Sandusky, or Toledo, as by commercial jumps across the mountain regions of Pennsylvania.

In reply to these three separate indictments I will say that I have a profound regard for truths, fundamental or otherwise, when they have been proven to be such, but not when based on negative evidence. I did, in my paper, point out the fact that the Allegheny mountains formed an impassable barrier to some species, and that such had probably been introduced by the way of our trunk lines of railways in the transportation of articles of commerce. I did not term the barrier "transition life-zone," but gave some instances where the introductions were on the line of the railways. Now, commercial jumps, it seems to me, are all right provided we do not lean too heavily on them and use them as a solution of problems in geographical diffusion where they do not belong. In other words, we must exercise the utmost caution against being misled by them, and assume that their influence has been greater than it really has. It will be observed that I *do* have a little faith in "commercial jumps," which I could not possibly have if I were to concur with friend Howard in his third proposition. In this case I am, most assuredly, on the side of "commercial jumps," for it will not be at all difficult to prove that insects have reached Ohio, in some instances, by this avenue, while of the two others mentioned by Mr. Howard, in one case they have not, and in the other they cannot. I confess that, as I look over Dr. Merriam's map of life-zones, I cannot see why eastern species of insects should not pass westward through Ontario and southern Michigan, into Ohio, as indicated by Mr. Howard, but the fact that they *do not* remains stubbornly in the way. There is not a case on record where an eastern species has appeared in northwestern Ohio before it did in the eastern section. Then, too, Lake Erie looks as though it might convey some species from Buffalo to Cleveland, or even beyond. But there is a slow but steady movement of the water toward Buffalo instead of from it, and evidence of which may be found in the fact that the sewage of Cleveland contaminates the water of the lake for some distance to the eastward, but not to the westward. Then, again, the high winds that might aid in this method of transportation during the season when insects are most likely to be carried about are, almost without exception, either from the west, northwest, or southwest, or toward Buffalo instead of from it.

No one knows better than I do that Mr. Howard does not write such papers as his for the sake of theorizing, or for the purpose of getting into print, but with the sincere hope of furthering the interests of a science to which he is giving the best years of his life; and for this reason these facts are given as additional information on the subject, and probably not in his possession when he wrote his paper; and far more in the spirit of a colleague than that of an opponent. His paper is an excellent one, and would have been of value even had he not shown the growing necessity of keeping records of exact locations, and giving more exact information on that point than to say that a species occurs in such and such States, or from such a State to such a State, as we have been in the habit of doing heretofore.

There are so many factors that influence insects that the problem of geographical distribution, as well as the phenomena of their differentiation, becomes not only interesting but sometimes exasperatingly perplexing, especially in the case of introduced species. It would, indeed, be an achievement in economic entomology if we could say of a species, it will reach only a certain locality, or it will not prove destructive beyond a certain well-defined boundary. For my own part, some of our native species that are moving from the south northward are puzzling me quite as much as those that are reaching Ohio from the east, not that it is at all strange that southern species should, some of them, work northward, even from Central America, but I would like to know where the things are likely to stop in their migration, and if, when they appear to have reached their limit of range, they have stopped for good, or if, after I have stated beyond revision that they will not continue northward, they do not suddenly break out in destructive numbers far beyond the area that I have assigned to them. In short, I would be glad to learn, beyond a doubt, whether or not there is some natural barrier to their progress beyond certain lines that can be so clearly indicated that the public may see and understand.

Murgantia histrionica, as is well known, has been steadily working its way northward from Texas since 1865. In the Sixth Report of the State Entomologist of Illinois Dr. Cyrus Thomas records the appearance of the species in Jackson county of that State, but in a recent letter from Prof. G. H. French, of Carbondale, I have the information that the announcement was probably a mistake. Prof. French says that he has a single specimen from somewhere in southern Illinois, he does not know just where, but that the insect is not destructive or even common, so far as he is aware. I think it was in 1890 that it was reported from Tobinsport, Perry county, Indiana, in December, where it was reported to have worked serious injury the previous summer. When I came to Ohio, in 1891, I found a single specimen in the collection of the Experiment Station marked from Lebanon, Warren county, about 30 miles north of Cincinnati. Up to the present year, 1895, I had been unable to learn of its being again observed in that locality, and had begun to hope that the single individual was either a stray or that the record had been a mistake, either of which may still be the case, and that Ohio was as yet free from the pest. A few weeks ago I received it twice within one week from two localities, Portsmouth and Racine, both along the Ohio river, with the statement that it had, last season, done widespread and serious injury. Now, any one who is at all familiar with the insect fauna and flora of southern Illinois knows that south of the watershed between the Big Muddy and Ohio rivers both are extremely southern in their nature, both plants and insects being found there whose natural habitat would seem to be much farther to the southward. Large areas of this section are devoted to truck farming, so much so that it is known as Chicago's vegetable and fruit garden. Here it would seem that we might expect to find Murgantia perfectly at home and in abundance. But, as shown, we do not. I have heard nothing more from the Indiana colony, as I most certainly should had it continued destructive to any extent. It would appear that, of all places in Ohio, the country about Cincinnati would be the place of all others where colonization would take place, such colonies originating in bugs introduced with southern-grown cabbage; yet here again we are disappointed, while farther up the river, and in a locality even farther north and where we would least expect it, the insect has appeared the most numerous. Now, what can an entomologist make out of such a muddle as this? We all of us know that this is not a haphazard world, and that there are, somewhere, good reasons for this condition of affairs. But what are they? This species comes to us, as it were, from out of the Tropical life-zone, through the lower Sonoran and Austroriparian, stopping in mid Upper Austral, but right along the line of division between the glaciated and unglaciated sections of the country. Only in the case of the single specimen from Lebanon, Ohio, has it, so far, been found within the limit of the southern range of the drift. It would, indeed, be grand if we could say to those who were fortunate enough to reside on the glaciated territory, "This pest will not reach your locality. Have no fear of its ravages." I believe that I here catch something of the spirit that prompted Mr. Howard's paper; but it is quite possible that were I to say these things to our people and publish the statements, ere the printer's ink had dried on the page the beastly thing would appear just where I had said it would not. It seems to me that the best we can do, for the present, is to record exact localities of occurrence, no matter how common or rare the species may be, and, some time, the laws that govern the movements of species among insects will begin to show. I would not for a moment discourage such papers as Mr. Howard's, though, possibly, a more conservative view would have been more judicious.

In my paper to which previous references have been made I stated that this insect occurred in northern New Jersey. This was corrected in my bulletin, but not in *Science*. I should have said southern New Jersey.

In discussing this paper, Mr. Howard stated that in his closing sentences Mr. Webster had caught very happily the spirit which prompted the original paper. The views expressed in this original paper he had made every effort to restrain within conservative bounds. No positive claims were made. It was a plea for exact records of injurious appearances of our principal insect foes, and the instances which were adduced and which, from the nature of things, must at the present time have been based upon negative evidence were brought forward as seeming to indicate restrictions in the spread of pests not holding with their food-plants, and thus indicating, in the most forcible way possible, the desirability of accumulating evidence which should not be negative. That the paper has already done much good is at once shown by the fact that it has stimulated so careful a rejoinder as this of Mr. Webster's. That it has excited widespread interest among economic entomologists is evidenced by extensive correspondence received. That the stimulus which it has given to investigation in this direction will ultimately bring about some good result cannot be doubted, whether the results confirm or overthrow the suggestions made in the original paper. As to the ultimate truth of the general idea that natural selection cannot contend with artificial selection but can only follow it after the lapse of years, the speaker had no doubt. One of the very cases brought up by Mr. Webster, viz., that of *Murgantia histrionica*, one which seems to puzzle Mr. Webster greatly, is confirmatory even at the present time. This insect reached Delaware 20 years ago, and yet since that time it has only been found at one more northern point. That it should appear in an isolated locality in Ohio, north of extensive truck regions in which it is unknown, is not surprising. In its spread during 10 years from Texas to Delaware it did not spread from farm to farm and from garden patch to garden patch. It went by commercial jumps, and at the present time hardly a week passes without the receipt of specimens of this insect from some locality within this already passed-over region, with the statement that it is a new enemy to cabbage at that point. In Ohio the insect has been commercially or accidentally introduced at a more northern point, but, as surely as time goes on, it will be found in the truck-farming region mentioned by Mr. Webster. He further expressed himself as welcoming close criticism of this kind when based on exact observation.

The paper was further discussed briefly by Messrs. Waite, Smith, Benton, and Gill. Messrs. Waite and Smith spoke of the commercial transportation of asparagus roots in the early spring, and even in the fall, as offering a possible means of transportation of the asparagus-beetle, and Mr. Benton said that the carriage of this insect from Buffalo to northern Ohio ports did not necessarily depend upon direction of wind or current, since it could readily be carried by lake vessels.

—Mr. H. G. Hubbard exhibited specimens of the borings of Xyleborus and Platypus, Scolytid beetles, in orange wood. He described the habits of these beetles, and showed that Platypus is capable of making extensive galleries of its own in hard-wood trees. The nature of the food of these timber beetles was discussed. In addition to reviewing and confirming the observations of European writers, Mr. Hubbard described the so-called ambrosia which nourishes the young, as welling up through the pores of the wood which are cut by the galleries in the shape of minute white buttons, giving a tesselated appearance to the walls of the passages. The substance sometimes accumulates in the galleries, and when puddled by the larvæ resembles half-melted snow, or slush. A growth of fungus forms upon the ambrosia and, closing the mouth of the galleries, causes them to fill up and suffocate the inmates. This method of treatment was found useful in Florida, to save from further injury the budded portion of trees killed back by the severe frost of February last. A piece of wire was pushed into the burrows as far as it would go, and then cut off and left there.

As to the nature of ambrosia, Mr. Hubbard made the conjecture that it was a ferment set up in the sap of the tree and augmented by the presence of the animals.

This communication was discussed by Messrs. Gill, Smith, Waite, Swingle, and Fernow, the discussion taking the form of questions and more or less unsatisfactory suggestions as to the nature of the ambrosia.

—Under the head of exhibition of specimens, Mr. Heidemann exhibited specimens of *Coriscus flavomarginatus* Reuter, a brachypterous species new to North America, which had been collected at St. John's, New Brunswick, some years ago, by the late Dr. Marx.

—Mr. Howard showed a female Scolia which had been sent from Texas by Mr. Schwarz, and which had become, in some manner, impaled upon a sharp thorn, the thorn entering the middle of the face. It was a question whether the insect became so impaled by flying violently against the thorn, or whether it had been stuck there by a shrike.

—Mr. Benton showed a comb of *Apis florea*, the smallest Apis known. The comb was collected in Ceylon some years ago by Mr. Benton himself. He called attention to the fact that there are 100 cells to the square inch with this species, and that *Apis florea* and *A. dorsata* are the only species which build in the open air. These are, curiously enough, the smallest bee and the largest bee known.

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PROCEEDINGS

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OF

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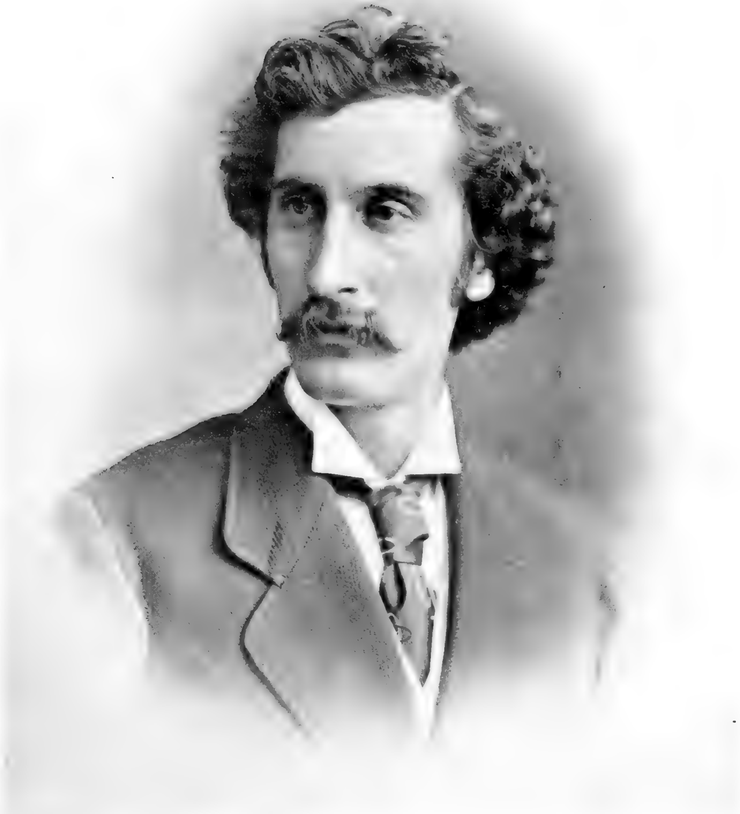

C. V. Riley

Special Meeting, Sept. 16, 1895.

President Ashmead, in calling the meeting to order, stated that it had been called to take appropriate action on the death of Dr. C. V. Riley.

Mr. Howard moved that the chair appoint a committee of three to draft the necessary resolutions. Seconded by Mr. Schwarz, and adopted.

The chair appointed Messrs. Howard, Schwarz, and Hubbard. This committee reported the following resolutions:

Whereas, The Entomological Society of Washington has lost by the hand of death its founder, its former President, and its most prominent member, Dr. Charles Valentine Riley, therefore be it

Resolved, That the Society, through its Secretary, transmit to the family of its late member its deepest sympathy and an expression of its realization of its own irreparable loss, in the future absence from its councils, of one of the most eminent entomologists of modern times, and of a man to whom most of the members owed much in the way of advice and encouragement.

Resolved, That the Society in the next number of its Proceedings shall publish an account of the life and work of its late founder.

Upon motion of Mr. Marlatt, the report of the committee was adopted.

Mr. Schwarz moved that the Publication Committee be charged with the preparation of a biography of Dr. Riley. Adopted.

The Society then adjourned.

CHARLES V. RILEY, Ph. D.

The sudden death of Dr. Riley, on September 14, 1895, was the severest loss which could possibly have befallen the Entomological Society of Washington, for he was the founder of the Society, the person in whom the idea of the establishment of the Society first orignated; he was by all means the most prominent and best known member of the Society; and he was, at the same time, one of its most active members. He was its first President and almost continuously during the eleven years of its existence, prior to his death, he held one office or another. During the first years of the existence of the Society he did not take a very prominent or active part in the proceedings. There were few members and the meetings were held in a large and gloomy hall, and the conditions were by no means favorable for producing an animated discussion. His health failed in 1886, and his frequent absences from Washington prevented regular attendance at the meetings. Later the Society passed beyond this critical period of its existence. The meetings began to be held at more congenial places, more papers were read, and the discussions became of a more general character. In the broadening of the scope of the discussions, Dr. Riley contributed perhaps more than any other member and he eminently enjoyed a vigorous participation in all discussions, particulary those of a general nature. His great knowledge in general and applied entomology, his wonderful memory, his easy and graceful manner of expounding his views, will not be forgotten by the surviving members. These qualities in discussion made him a formidable and usually victorous opponent to any member who happened to express a differing opinion. That his participation in these discussions is not more fully brought out in the published proceedings of the Society is explained by the difficulty experienced by all scientific societies in accurately recording discussions without the aid of a stenographer, and Dr. Riley himself was always averse to writing out afterwards what he had said in debate.

During his lifetime several biographic sketches were published, and a complete bibliography down to the close of the year 1889 was also put into print. Since his death obituaries have been published in nearly all scientific periodicals, no matter where published, or in what language. The best of these are those written by Dr. G. Brown Goode and by Dr. A. S. Packard, and published in *Science*, December, 1895, and January, 1896. The history of Riley's life, the importance of his contributions to scientific literature, his triumphs in the field of practical entomology, his remarkable power of organization, have all been fully brought out. In view of this fact, and since the publication of the Proceedings of this Society will be delayed, much which might otherwise have been written here would be but a repetition of what has already been published in many places. At this time and in this place, therefore, we need give but the barest summary of the facts of his life, dwelling, as we have already done, upon his services to our own Society, and calling attention to a few points in his career which have not elsewhere been brought out.

He was born at Chelsea, London, England, September 18, 1843, and received his education in England and later in France and Germany. At the age of 17 he emigrated to America, where he settled on a farm in Illinois. His first contributions to entomological literature appeared in 1863, in the columns of the *Prairie Farmer*, of Chicago. As editor of the entomological department of this journal he resided in Chicago until 1868. During this residence he made the acquaintance of Benjamin D. Walsh, a friendship which resulted unquestionably in a powerful influence upon his future career. In 1868 he was appointed State Entomologist of Missouri and continued to serve in this capacity until 1876, when he came to Washington to assume the office of Chief of the U. S. Entomological Commission, an organization created by Act of Congress, approved March 3, 1877. Early in 1878 he was appointed Entomologist to the U. S. Department of Agriculture, and, with the intermission of the years 1879–'80, he continued to fill this office until 1894. By depositing his private collection of insects in the U. S. National Museum in 1880, be became founder of the Department of Insects of that institution. In 1886 he gave the collection to the Museum and was appointed Honorary Curator of the Department. In 1889 he was appointed by the President of the United States an Expert Commissioner to the Paris Exposition and Representative of the Department of Agriculture. In 1892 he was appointed Biologist of the Maryland Agricultural Experiment Station.

It is scarcely a matter of wonder that under the constant strain of these multifarious duties his health began to be seriously impaired, and in May, 1894, he resigned his most onerous office, that of Entomologist to the U. S. Department of Agriculture. His energy and love for work, however, were not broken, and in the secluded rooms of the U. S. National Museum, undisturbed by the former constant stream of interviewers and assistants, he intended to pass the rest of his life, working upon the many scientific problems which had suggested themselves to him and which he had set aside for investigation when such a time should come. His accidental death in a little more than a year and before he had time to fairly concentrate himself upon the congenial work to which he had looked forward all of his life is a shocking example of the irony of fate.

An important point which has not been mentioned by any of his biographers may be briefly considered, viz: which of his numerous works was considered by Riley himself as the principal achievement of his life? The writers of these lines, associated with him for many years, have at various times conversed with him upon this subject; the last time was only a few days before his death, and he always pointed to his Missouri Reports as his principal work. That he earnestly believed this cannot be doubted by any one who has heard him speak, either at the meetings of this Society or at the meetings of the Biological Society of Washington. How often has he used the expression, "As I have shown in my —— Missouri Report," and how often in his subsequent writings did he quote passages from these Missouri Reports! Every worker on the biology of North American insects and every worker in economic entomology must candidly confess that these Missouri Reports are the most indispensable works of reference and that they are overflowing and never failing sources of information. More than twenty years have lapsed since the publication of the final volume of the series and they still remain as standards, and practically not only as the most necessary handbooks of workers, but as models for the younger generation.

It is true that he had predecessors in the field covered. Harris' classical treatise on the Injurious Insects of Massachusetts is a most charming account of a number of North American insects and possibly unsurpassed as an introduction to the study of entomology for the beginner, but nowhere does it enter deeply into the subject of the biology of individual species with the practical end in view. Fitch's reports, the most important of which had been published at the time Riley began to write, are also ventures into the same field, but there is lacking in Fitch's reports the eminent practicality which characterizes Riley's, and it is everywhere apparent to one who contrasts the work of the two men that the vigorous originality and independent nature of the author of the Missouri Reports could not fail to produce volumes of much more lasting value.

As has often been said, the illustrations of these reports added very greatly to their value. They were drawn by Dr. Riley himself with a fidelity to nature and at the same time with an artistic skill practically unknown in America at that period. They were engraved on wood by the best engravers who could be found. William Macwitz of St. Louis was always especially mentioned by Riley in speaking of these illustrations. In spite of his remarkable ability as a delineator of insects, however, Dr. Riley, after leaving Missouri, was forced, through lack of time, to entirely abandon this work, although with his great talent it was a pleasure rather than a task. In later years he took up portraiture as a pastime and produced a number of heads in chalk and in water colors of great merit.

One of Riley's cherished plans, and one which he constantly kept in mind, was to publish a second and revised edition of the Missouri Reports. For this purpose he had collected a large amount of additional notes upon the insects treated in the reports. These notes were written in the interleaved bound copies which he always kept on his revolving book-case, close at hand. These volumes, much worn by constant use, constitute perhaps the most valuable literary legacy which he has left, and it is to be hoped that at some future time his plan of republication will be realized. As early as 1880 he commenced negotiations with the Missouri authorities regarding the reissuing of the reports. The correspondence continued through several years, but, for reasons unknown to us, led to no result. During the last years of his life Riley altered his plan, intending to use the vast material thus accumulated as the basis for a text-book on entomology, and this work he hoped to accomplish when freed from the arduous cares and vexations of official duties.

The likeness which we use as a frontispiece has never before been used as a basis for an illustration. We mention it particularly in this connection since it represents him in the full maturity of his youthful vigor, at a time when his energy was unimpaired and his enthusiasm unabated, and at a time, too, when the publication of seven of his Missouri Reports had already marked him as a leader in entomological research and as foremost in economic work. The photograph from which it was reproduced was taken August 10, 1875, at Detroit, Michigan, at the time of the meeting of the American Association for the Advancement of Science.

Enough has not been said of Dr. Riley's social qualities. Away from his work he was the most approachable and genial of men, and this side of his character reached its highest plane perhaps at the meetings of this Society. At the close of our stated program it is our custom to spend an hour in general conversation, and here one saw one of the most delightful phases of his character. Official cares were thrown aside and all the geniality of his nature came to the front. It is probable that the picture of Riley which will last longest in the minds of most of us will show him seated at the head of his own hospitable table at some one of the many meetings of the Society held at his house, discussing in his versatile way almost any subject from politics to ethics, his face beaming with animation and good humor.

Thus it is as a genial companion, as well as the founder of the Society, its first President, and its most prominent member, that the Entomological Society of Washington will ever mourn the loss of Charles Valentine Riley.

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110 OCTOBER 10, 1895.

President Ashmead was in the chair and the following members and visitors were present: Messrs. Gill, Uhler, Patton, Schwarz, Hubbard, Marlatt, Heidemann, Chittenden, Benton, Judd, E. F. Smith, Linell, Schoenborn, Stiles, Howard, Waite, O. F. Cook, Henry Ulke, G. H. Hicks, and W. H. Fox.

—Mr. Hubbard read the following paper:

ADDITIONAL NOTES ON THE INSECT GUESTS OF THE FLORIDA LAND TORTOISE.

By H. G. Hubbard.

Since the publication of my paper on Gopher Insects, in vol. vi of Insect Life, May, 1894, I have made additional explorations in gopher burrows both at Crescent City and in other parts of Florida. Thus I examined burrows at De Funiak Springs, which is west of Tallahassee, on the mainland and in the extreme western part of the State, and at Clearwater Harbor, on the gulf coast, a short distance north of Tampa. Dr. John Hamilton also examined gopher holes at Lake Worth, Fla., which is probably the extreme southern limit reached by the tortoise on the Atlantic coast. Dr. Hamilton found three of the gopher beetles present in small numbers, viz: the *Copris*, *Aphodius*, and *Chelyoxenus;* the holes which he examined were, however, shallow, and probably not favorable for the full development of this peculiar fauna. In my explorations I found in abundance all the insects previously noted and added several new forms to the list. The larvæ of nearly all the beetles have now been discovered within the gopher burrows, and the moth has been bred in both sexes from the remarkable caterpillar which feeds upon the dung of the tortoise. Dr. John B. Smith has had the imago in his hands and will describe it as a new species of Deltoid belonging to the Pseudaglossa section of the genus *Epizeuxis* (old genus *Helia*). It therefore belongs almost exactly where it was tentatively placed from the resemblance of the larva to the myrmecophilous *Helia americalis*. The new discoveries are a very interesting Staphylinid beetle with exactly the facies of a *Stilicopsis*, but with a single tooth on the clypeus. It constitutes, therefore, a new genus, which I hope to describe under the name *Acrostilicus hospes* (n. gen. et n. sp.) Its larva has also been found, and with its imago it has the pallid color and all the characteristies of a true gopher insect. A new fly, a species of *Hylemyia*, family Anthomyiidæ, will be described by Mr. Coquillett. Its larva lives upon the dung of the gopher, and the imagos, which I had previously overlooked, prove to be quite abundant in each of the localities which I have investigated. There is also another much smaller fly, which Mr. Coquillett pronounces a *Limosina*, family *Borboridæ*, the thread-like larva of which is always common in the dung at the end of the gopher holes, but the imagos have not hitherto been bred.

3 Cotypes #22505. USNM.

I find also that I have overlooked one or two spiders of pale color and with a subterranean appearance which turn up so persistently in the burrows that I am forced to include them in the fauna. They have not yet been studied by an arachnologist. Another arachnid discovered in a gopher hole interests me greatly, since it belongs to a group of small harvestmen (*Phalangiidæ*) which are characteristically cavernicole in this and other countries. It is probably a new species, but congeneric with the cave harvestmen (*Phalangodes*) found in Mammoth Cave, Ky., Wyandotte Cave, Ind., and other great caverns in this country, although some of the species are also found under deep stones, etc. I have also found in a small cave near Istachatta, in eastern Florida, a *Phalangodes* very closely allied to the gopher harvestman but apparently distinct specifically.

In my former paper Dr. Marx described a tick found on the gopher under the name *Amblyomma tuberculatum*. The other tick which is found constantly associated with the tortoise was given a manuscript name, *Ornithodorus americanus* Marx. This species has since been published in our Proceedings, without description, in the posthumous plate appended to the obituary of our late lamented member. Dr. Marx considered this tick identical with a species found in the nostrils of mammals in Peru and in Texas. At my request Dr. Marx made most careful comparisons of my specimens with those from the horse and the llama in his collection, but was unable to distinguish them specifically. I regard this result as most surprising, since repeated observation shows me that this tick does not attach itself to the tortoise at any stage, but lives in the burrow like a bedbug, and I find repeatedly the gravid females, plethoric with ova, burrowed deep in the sand, beneath the floor of the burrows, as if incubating their progeny. I have not yet, however, secured the larvæ from these females. I have in years past, on several occasions, taken ticks from the bodies of the tortoise captured outside of their burrows, and I supposed when my paper was written that some of these would prove to be adults of *Ornithodorus*, but in hunting up the material, some of it collected 15 years ago, I find an abundance of specimens of the *Amblyomma*, but not one of the *Ornithodorus*. I find it difficult to believe that any tick could have a rostrum so constructed that it was capable of attaching itself permanently to the nostrils of a mammal, while it could be thrust into and withdrawn at will from the tough and leathery hide of the Florida gopher.

As a whole, the permanent connection of this insect fauna with the economy of the tortoise, has been firmly established by a more extended knowledge of the life histories of the several species. Thus *Philonthus gopheri* has been found fairly abundant in certain burrows, and a good series of its larva has been secured. The larva of the *Chelyoxenus* has been found in such numbers that I am now inclined to believe that it is carnivorous and preys especially upon the dipterous maggots in the gopher dung. The larva of *Onthophagus polyphemi* has not been definitely distinguished from some of the smaller specimens of the scarabæid larvæ collected, which may be confused with those of *Copris gopheri*. Several casual visitants have been observed in the burrows, and it is noteworthy that the number is so small. The list, appended, herewith includes a single specimen of a black species of *Philonthus*, a common *Saprinus* found on several occasions, and two species of *Ptomophagus*, both common species of these small Silphidæ, which are liable to occur in deep pits and cellars or within the mouths of caves. The whip-tailed scorpion, *Thelyphonus giganteus*, appears to be rather more than a casual visitor to the gopher holes, and is probably attracted thither by the abundance of the crickets (*Ceuthophilus*).

A list of the gopher guests which is given here below includes as regular inhabitants of the burrows 19 articulates and one vertebrate, with four coleoptera and one arachnid in additional considered as visitors of the domicile only. The full fauna, therefore, comprises 24 parasites and messmates of the tortoise.

LIST OF GOPHER INSECTS. OCTOBER, 1895.

COLEOPTERA.

(1) *Homalota* sp. indet.
(2) *Philonthus gopheri* and larva.
(3) *Acrostilicus hospes* n. gen., n. sp. and larva.
(4) *Trichopteryx* sp. indet.
(5) *Chelyoxenus xerobatis* and larva.
(6) *Copris gopheri* and larva.
(7) *Onthophagus polyphemi* larva (?)
(8) *Aphodius troglodytes* and larva.

DIPTERA.

(9) *Hylemyia* n. sp. (*Anthomyiidæ*) and larva (larger fly).
(10) *Limosina* sp. (*Borboridæ*) and larva (smaller fly).

LEPIDOPTERA.

(11) *Epizeuxis* n. sp. and larva.

ORTHOPTERA.

(12) *Ceuthophilus latibuli* Scud.

ARACHNIDA.

(13) Spiders uninvestigated, probably 2 species.
(14) *Phalangodes* n. sp.
(15) *Chelanops affinis* Banks.
(16) *Ornithodorus americanus* Marx.
(17) *Amblyomma tuberculatum* Marx.
(18) Mites (Orobatid) on *Copris*.

VERTEBRATA.

(19) *Rana æsopus* Cope.

VISITANTS

INSECTA.

(20) *Philonthus cautus.*
(21) *Ptomophagus ulkei.* [De Funiak.]
(22) *Ptomophagus consobrinus.* [Crescent City.]
(23) *Saprinus ferrugineus* Mars.
(24) *Thelyphonus giganteus* Lucas.

The paper was discussed by Messrs. Schwarz and Gill. Mr. Schwarz said that the only contribution published since Mr. Hubbard's original paper was by Mr. G. Lewis in the Entomologist's Monthly Magazine for January last. This consisted mainly of a letter from Dr. Hamilton and the advice to European entomologists to dig up European turtle holes in the hope of similar discoveries. Mr. Schwarz, however, was of the opinion that they have in Europe no turtle of similar habits. He further said that while Lake Worth is the most southern point at which gopher burrows have been examined, at least 60 miles south of this point gopher burrows will be found, viz: at Cape Florida. He further said that we have in this country three species of Gopherus—the one studied by Mr. Hubbard, *G. agassizii* in the Death Valley and adjoining regions, and *G. berlandieri* of Texas. The members of the Death Valley Expedition were unable to discover any holes of the first named, and almost nothing is known about the Texas form. On a recent trip he tried, with little success, to find out something about it. The only success he had was the statement from the inhabitants of Pena, near Laredo, on the Mexican National Railway, that a burrowing turtle exists in the large sand plains near that point, but he was unable to investigate.

Dr. Gill stated that the analogy in morphology is not necessarily connected with similarity in habits. The European land tortoises are not so closely allied to the American species as they seemed to be. The Testudos in Europe do not make regular burrows. They hibernate in holes not made by themselves, although probably enlarged by them, and under rocks. The species are smaller than Gopherus. Referring to the American forms, he said that we must not assume that *agassizii* and *berlandieri* burrow. They may differ in habit from the Florida species. He asked whether any other specimens of the frog had been found by Mr. Hubbard. Mr. Hubbard replied that he had taken several additional specimens, among them one gravid female, which he had given to Dr. Stejneger of the Smithsonian Institution.

—Mr. O. F. Cook made some general remarks under the head of "Insect Collecting in Africa." He spoke of some rarities which he had collected in Liberia in his work upon his own special group—the Myriapoda, exhibiting drawings of one remarkable form. He further spoke in general upon some of the more striking features of the insect fauna of Liberia and gave in considerable detail his experience with driver-ants. These insects, he thinks, have taken the place of a Liberian St. Patrick, *i. e.*, they are responsible for the almost total absence of snakes in Liberia. He concluded by asking if the driver-ants have any permanent domicile or whether they are invariably peripatetic. Mr. Schwarz said that no trace of a more or less permanent nest of Eciton has ever been found, and that, further, no queen has been found. They make temporary nests, but are more or less constantly travelling. The true nest, he thinks, will some time be found, owing to this very fact that no queen is yet known. He called attention to the fact that the Rev. P. Jerome Schmidt has found a species of Eciton in North Carolina and that the same gentleman had discovered several inquilinous species. Dr. Gill and Mr. Cook discussed the question of disparity in size in sexes of Myriapoda. Mr. Ulke spoke of some recent experiences with ants in Maryland.

—Mr. Ashmead read the following paper:

RHOPALOSOMIDÆ,* A NEW FAMILY OF FOSSORIAL WASPS.

By William H. Ashmead.

Recently, in monographing our North American Braconidæ, it became necessary for me to make a study of a most extraordinary insect, the *Rhopalosoma Poeyi*, originally described by

* I prefer this form to Rhopalosomatidæ.

Mr. E. T. Cresson, from specimens received from Cuba, and placed by him in the family Braconidæ.

The insect is extremely rare and has not yet been recorded in our faunal lists, although several specimens have passed through my hands, taken in various parts of the United States.

Mr. Theodore Pergande took a single specimen, many years ago, at St. Louis, Missouri. The American Entomological Society of Philadelphia possesses, besides the types from Cuba, one or two specimens collected by Mr. H. K. Morrison in North Carolina. Mr. Chas. W. Johnson took three specimens some years ago at St. Augustine, Florida (one of which he has kindly given to me), while recently I have identified a single male taken by Prof. H. Garman at Louisville, Kentucky.

These captures not only prove the extreme rarity of the insect but show that it is widely distributed throughout our fauna, and we may expect to hear of its being taken in many other localities in the United States.

It has also been recorded from Hayti and San Domingo.

The genus was erected thirty years ago by Mr. Cresson in his paper entitled "Hymenoptera of Cuba," published in the Proc. Ent Soc. of Phila., vol. iv, p. 58, where he placed it in the family Braconidæ.

Three years later, in the Proc. Ent. Soc. of London, Prof. Westwood, having overlooked Mr. Cresson's description, on account of the position assigned it, rechristened it *Sibyllina*, placing it among the Vespidæ.

In the discussion following the presentation of Prof. Westwood's description, Mr. Frederick Smith, at that time the highest British authority on the Hymenoptera, gave reasons for believing the genus should be placed in the family Ichneumonidæ, although he had previously considered it an ant and placed it in the family Poneridæ.

He says: "I had myself, after a somewhat cursory examination, referred it to the ants and had placed it in the family Poneridæ. A few years ago I had an opportunity of submitting it to Dr. Nylander, who thought I was right in so doing, but I must admit he had only time to give it a very slight examination."

Six years later, or in 1874, Westwood again treats of this remarkable insect in his sumptuous work "Thesaurus Entomologicus Oxoniensis," p. 130, and on plate xxiv gives us for the first time a most excellent figure of it with details.

In this work Prof. Westwood gave a complete summary of what had been written upon this insect up to that time, and from which I shall quote. He says:

"This curious genus was considered (doubtingly) by the late Mr. Haliday (one of the most profound hymenopterists) as one of the *Sphegidæ*, with smooth legs, near Pelopæus, as appears by a note attached to a specimen of the type in the collection of the British Museum. [Note.—Antennæ fœm. not geniculate; hind wings incised at end of the pobrachial vein; fore wings with a third discal areole. See also form of thorax. I think a sphegid with smooth legs, near Pelopæus. Haliday MS. in Brit. Mus.]"

Prof. Westwood on exhibiting a specimen of this insect at a meeting of the London Entomological Society recognized it as a new genus of Aculeates, with most perplexing structural affinities, but thought that it came closest to the family Vespidæ, although the male, in its elongated antennæ, was not unlike an ant.

Mr. F. Smith, on the same occasion, also considered that "it had more characters in accordance with those of the ants than with any other family." (Proc. Ent. Soc., Nov. 16, 1868.)

Prof. Westwood says, further, that Mr. Cresson, who first described this genus, placed it undoubtingly amongst the multitudinous genera of the *Ichneumonidæ* (which caused me to overlook it), remarking, "I am at present unable to define the true position of this remarkable genus. It seems to form a connecting link between *Ichneumones genuini* and the *Adsciti;* from the former it differs by the paucity of the antennal joints, and from the latter by the anterior wings having a faint indication of a second recurrent nervure. Its structure places it, beyond doubt, in the family *Ichneumonidæ*, whilst its general appearance, together with the arrangement of the wing-veins, seems to place it among the *Adsciti*, where I will allow it to remain for the present."

Subsequently, Mr. Smith (without being aware that the insect had been thus commented upon by Mr. Cresson), in a paper communicated to the Entomological Society on the 4th Jan., 1869 (Trans. 1868, Proc. p. li), discussed the affinities of this genus at length with great acumen, contending, "1st, That all wasps have the wings folded, whilst they are flat in Rhopalosoma. 2nd, Rhopalosoma has only two submarginal cells, whilst every known wasp has either three or four. 3rd, Every true wasp has three discoidal cells in the fore-wings, whilst Rhopalosoma has only one. 4th, The prothorax (collar) in all Vespidæ extends backwards to the tegulæ, which is not the case in Rhopalosoma. 5th, Lunate eyes (which Rhopalosoma possesses) are found in *Mutilla*, *Scolia*, *Sapyga*, *Pemphredon*, and *Philanthus* amongst the Aculeata, and in the Ichneumonideous genera *Pimpla*, *Campoplex*, *Anomalon*, *Ophion*, and some others. 6th, The tarsal ungues (toothed in Rhopalosoma) are simple in the social Vespidæ, although dentate in the solitary wasps." On the other hand, Mr. Smith regarded the insect as belonging to the

Ichneumonidæ. "7th, Because, amongst the minute (Adscitous) groups, species exist having only 12-jointed antennæ (Ephedrus) and others having 13-jointed antennæ (Trioxys)." 8th, Mr. Smith states "that in Rhopalosoma a distinct second joint in the trochanters is quite as visible as in the Ichneumonideous genus Metopius. 9th, The antennæ of every known species of wasp are geniculate, which is not the case in Rhopalosoma. 10th, The prothorax of Rhopalosoma is of the same structure as Ophion and Anomalon. 11th, The ocelli are large and prominent in Rhopalosoma, as in the two last-named genera; in the Vespidæ they are much smaller and usually more sunken than prominent. 12th, The broadly dilated tarsi in Rhopalosoma do not occur in Vespidæ, but are peculiarly characteristic of Anomalon. 13th, The basal segment of the abdomen of Rhopalosoma agrees with that of Ophion and Anomalon, as well as Belonogaster and Vespa."

Although thus pointing out the relationship of the genus with Ophion and Anomalon, Mr. Smith admitted its want of strong affinity with any other known insect.

Prof. Westwood, to these objections, replied as follows:

1. Some of the most aberrant wasp genera, and the remainder of the Aculeata, have flat wings.

2. Rhopalosoma has three submarginal cells. In all the genuine Ichneumons, the first submarginal and the anterior discoidal cells are thrown together. Even in those Adsciti which have three distinct submarginal cells, the first (and only) recurrent vein enters the first submarginal cell, and not the second, as in Rhopalsoma.

3. Rhopalosoma has three discoidal cells, the lower outer one having its extremity partially closed by a transverse, nearly obsolete vein.

4. The collar of Rhopalosoma extends back laterally to the tegulæ, although not seen dorsally at the sides of the thorax.

5. The eyes of Rhopalosoma are not lunate but oval, with a small emargination in the middle of the inner margin.

6. The ungues in Rhopalosoma are furnished beneath with two obtuse spines.

7. No species of Adscitous Ichneumon, nor indeed any other terebrant Hymenopterous insect, is known possessing 13-jointed antennæ in the males and 12 in the females. This is one of the leading characters of Aculeata.

8. I cannot discover a second joint in the trochanters of Rhopalosoma. Its existence is one of the leading characters of the terebrant Hymenoptera. In certain positions, a faint appearance of an articulation near the base of the femora may be observed.

In the Ichneumons the two joints of the trochanters are distinct, and nearly equal in size in many species.

9. The long, straight filiform structure of the antennæ of Rhopalosoma is unquestionably a strong character against its belonging to the Vespidæ.

10. The front of the thorax of Rhopalosoma is similarly formed to that of Ophion.

11. The ocelli of Rhopalosoma agree with those of Ophion.

12. I know of no Ichneumonideous, nor indeed any other Hymenopterous insect, with feet like those of the female Rhopalosoma, whereas they are simple in the male.

13. The pedunculated basal segment of the abdomen of Rhopalosoma occurs in many groups of Aculeata, as well as in many of the Terebrantia.

14. The sting of Rhopalosoma is a genuine aculeus, with a broad sheath.

15. The lobed base of the hind wing, and the 6-jointed maxillary palpi, which latter character occurs in no genuine Ichneumon, must not be overlooked in determining the relations of the genus.

After this very complete summary, for and against this insect being an Ichneumonid, Prof. Westwood ends up with the following remarks:

"From the preceding discussion it will doubtless be considered that whilst in several important respects the insect before us agrees with some of the Ichneumonidæ, it is in others, equally important, allied to the Aculeata, forming by itself a most exceptional and isolated section."

The above summary will afford you an admirable idea of how Doctors sometimes disagree, since the four mentioned—Haliday, Smith, Westwood, and Cresson—are among the highest authorities in the Hymenoptera.

What has been given above seems to be all that has been written upon this remarkable genus up to the present time, except that in my paper "On the Hymenoptera of Colorado," published in Bull. No. 1 of Col. Biol. Assoc., 1880, without specimens of my own for study. I made it the type of a new subfamily, the Rhopalosominæ, in the family Braconidæ.

Since that time, however, I have made a careful and thorough study of the insect and now believe it to be no Braconid, but agree with Haliday and Westwood and believe it to be a true Aculeate. I go even farther and believe it to be the type of a distinct family of fossorial wasps, with affinities allying it to the Vespidæ, Sapygidæ, and Scoliidæ, and propose for it the family name *Rhopalosomidæ*.

It is, according to my views, a connecting link between the

Vespidæ and the Sapygidæ and tends to confirm the correctness of my views, in having removed the Vespidæ from near the Apidæ, or bees, to a position among the fossorial wasps, between the Pompilidæ, Sapygidæ, and Scoliidæ.

It is hardly necessary for me here to enter into a description of the peculiarities of structure of this insect, since these may be ascertained from the excellent description and figures given by Westwood in his Thesaurus and in the discussions recorded above.

In closing, however, I will give my reasons for believing this insect to be neither a Braconid nor an Ichneumonid; my reasons for considering it to be an Aculeate; and why I consider it entitled to family rank.

My reasons for believing it to be neither a Braconid nor an Ichneumonid are as follows:

(1) Because the venter in the Ichneumonidæ and the Braconidæ is soft and membranous; in Rhopalosoma it is hard and chitinous like all true Aculeates; (2) because it has a true sting which issues from the tip of the abdomen; although the ovipositor in a Terebrant may sometimes be capable of inflicting a sting, it never issues from the tip of the abdomen; (3) because the venation is quite distinct from all Terebrants; (4) because the trochanters are 1-jointed, while, as already pointed out by Westwood, in the Ichneumonidæ and Braconidæ the trochanters are always distinctly 2-jointed; and (5) because the legs are strictly fossorial, although entirely different from any known Hymenopter.

I consider it to be an Aculeate Hymenopter:

(1) Because the ovipositor is short, stout and sharp, issues from the tip of the abdomen, and is in every sense "a sting;" (2) because of its convex, hard chitinous venter; (3) because the venation of the wings more nearly resembles that of the Scoliidæ, the curvature in the lower outer angle of the first discoidal cell being a peculiarity of Scolia, while the venation of the hind wings, except in some minute details, is exactly like that of *Dielis* and totally dissimilar to any known Terebrant; (4) because the emarginated eyes appear to me to resemble more closely those found in *Sapyga*, *Eumenes*, and *Myzine*, than those found in certain Ichneumonids; and (5) because the number of joints in the antennæ, 12 in ♀ and 13 in ♂, is a feature peculiar to the Aculeata and extremely rare with the *Terebrantia*.

Rhopalosoma is believed to be entitled to family rank: (1) because the venation of the front wings, although similar to some Aculeates, is really quite distinct from all other known forms; (2) because of the large prominent ocelli; (3) because of the structure of the antennæ, the flagellar joints all being very long and slender and all armed above with a slender spine at tip; (4) because of the abnormally developed legs in the female, the tarsal joints 2, 3, and 4 being dilated and deeply lobed at apex, the incision being filled with a membrane, which evidently materially aids the insect in making its burrows into light sandy soil; (5) because of the remarkable length of the tibial spurs in both sexes, the inner being almost as long as the long basal tarsal joint; and (6) because of the peculiarities of the spiny armature and the bifid claws.

RHOPALOSOMA CRESSON.

1865. Rhopalosoma Cr., Proc. Ent. Soc. Phil., vol. iv, p. 58.
1868. *Sibyllina* Westw., Trans. Ent. Soc. Lond., pt. iv (Dec.), p. 329. (S. ænigmatica.)
1868. Smith, l. c. Proc., Nov. 16, p. xli.
1869. l. c. Proc., p. li.
1874. Rhopalosoma Westw., Thes. Ent. Oxon., p. 130, pl. xxiv, f. 9.
1894. Dalla Torre, Cat. Hym. ix, p. 113.

(Type *R. poeyi* Cr.)

The paper was discussed by Messrs. Marlatt, Schwarz, Gill, and Uhler. Mr. Marlatt expressed his conviction as to the accuracy of Mr. Ashmead's conclusions, but took exception as to Mr. Ashmead's general statement that the sting of the aculeate Hymenoptera issues from the tip of the abdomen, whereas the ovipositor of the terebrant Hymenoptera does not issue from the tip. Mr. Marlatt said that while this distinction is apparent it is not real. Homologically, the two organs are the same and their point of issuing or attachment is also the same. In the aculeate Hymenoptera, the ventral segments fold in such a way as to obscure the point of origin of the sting.

Mr. Ashmead in reply said that Mr. Marlatt was undoubtedly correct and that the homology of the two organs has been strengthened by the recent finding of a poison gland among certain terebrant Hymenoptera. The character of which he had made use, however, was equally valuable as a means of distinguishing between the two groups. Mr. Marlatt had practically criticised simply the form of words, and not the validity of the character used. Mr. Schwarz said that, from the general appearance of the insect exhibited by Mr. Ashmead, he would by no means call it a fossorial species. The legs were not at all comparable to the legs of fossorial Coleoptera. Mr. Ashmead replied that many fossorial insects do not have fossorial legs. The legs of Rhopalosoma, however, he considers to be strictly fossorial. The spines on the tarsi are obviously for fossorial purposes. Mr. Schwarz, referring to the long spurs on the posterior tibiæ, said that when such spurs occur in Coleoptera they never occur in fossorial species. Dr. Gill remarked that nature is not limited in fossorial adaptations any more than it is in any other adaptations. It is not necessary, therefore, that hymenopterous fossores should resemble coleopterous fossores. He showed that the method of fossorial adaptation differs decidedly with different fossorial mammals. Professor Uhler stated that, as a general rule, fossorial insects may be distinguished by the fact that the joints of the tarsi of the front leg are crowned by a chaplet of spines, which seem to be absent in this species shown by Mr. Ashmead.

—Mr. Howard presented the following paper for publication:

A COLEOPTEROUS ENEMY OF CORYDALIS CORNUTUS.

By L. O. Howard.

Corydalis cornutus is the largest Sialid in the North American fauna and is one of the most conspicuous and curious of our commoner insects. Its anatomy was studied by Leidy as early as 1848 and its larva and pupa were known prior to that time. Riley completed the life history of the species by his discovery of the egg-masses in 1876. Almost every detail of the anatomy, physiology, and economy of the species has been carefully studied by Comstock and his students and assistants at Ithaca, and, in fact, were the graduation theses of his students for the last 20 years published, we should have a complete anatomy of the larva of this insect which would be almost comparable to Lyonnet's famous anatomy of the larva of Cossus. It may be briefly stated that the eggs are laid in midsummer in flat circular batches, covered with a tough calcareous substance, upon the leaves of trees, upon rocks, and wooden piles overhanging or in close proximity to the water; in such situations, in fact, that the larvæ on hatching may drop into the water. Each egg-mass contains about 2,000 to 3,000 eggs and the diameter of the mass is a little more than ¾ of an inch. The larvæ of the insect are familiar to fishermen under the names "Dobson," "Crawler," and "Hellgrammite," and are commonly used for bait for black bass and other fish. The insect is thus of some slight economic importance and derives some additional importance from the fact that while it is eaten by large fish, it retaliates by destroying smaller fish. No natural enemies of this species have ever been recorded. The species breeds rather abundantly in the Potomac river and in Rock Creek, and the egg-masses, looking like accidental splashes of whitewash, are often seen on the rocks along the shores of these streams.

In the latter part of July of the present year, Mr. R. S. Clifton, of the Division of Entomology, an enthusiastic boatman, noticed that certain egg-masses upon rocks on the Virginia side of the Potomac river above Georgetown contained small round holes, and suspected from this fact the existence of some parasitic or predaceous enemy. Upon close examination he saw a small beetle engaged in eating into an egg-mass. He did not capture the specimen, but, thinking that the observation might be of importance, he mentioned it to the writer, who, on August 4, joined him in an investigating expedition. This was about two weeks after the original observation. At the date of our visit we found hardly one egg-mass out of a very large number which had not been eaten into. The beetle was captured and later determined by Mr. Schwarz to be a variety of *Anthicus haldemani*.* Upon opening the egg-masses we were greatly interested to find the larva of the beetle. In some cases only one or two large larvæ were found in a single egg-mass; in other cases a large number—certainly more than a dozen—smaller larvæ were found, and in others larvæ of several distinct sizes were noticed. Living specimens were brought home and fed in confinement. It was at first supposed that the larvæ would transform without issuing from the eggs. This, however, proved to be incorrect. When fullgrown they wandered restlessly around and this fact was sufficient to indicate to Mr. Pergande, in whose care they had been placed, that they needed certain conditions for pupating which were not present in the open-mouthed vials in which they had been kept. He therefore transferred them to vials containing sand, into which they immediately crawled and in which they soon pupated. Two larvæ were placed with the sand on August 15. On August 19 they were still unchanged, but one of them had formed a kind of cocoon from the grains of sand. On August 22 this individual had transformed to pupa. On August 24 Mr. Schwarz went with Mr. Clifton to the same locality and secured further material. August 31 three larvæ obtained on this trip transformed to pupæ, and September 3

* Later Capt. Casey informed the writer that the species is his *A. heroicus*, described in Annals N. Y. Ac. Sc., 8, 1895, p. 712.

two more transformed. On account of the interest attaching to the early stages of the Anthicus, no effort was made to rear the adult from material gathered, but all pupæ and larvæ in different stages were preserved in alcohol. Without doubt the beetles would have emerged before fall and the insect would have hibernated in the adult condition, as do its relatives. From these observations we judge that there is more than one generation, depending upon the amount of food and the length of time that these egg-masses are available for food. The larva grows rapidly and there must be other food than the Corydalis egg-masses for early individuals. It seems likely that the beetle ordinarily gnaws a hole in the egg-masses before laying its eggs, and it seems, further, that few eggs are laid by each beetle in a single egg-mass. Other beetles, however, visit the egg-mass subsequently in many cases, as the fact that larvæ of different sizes were found would show. In lifting apparently unattacked egg-masses for food for the larvæ taken, we were surprised to find in several cases that these masses contained young larvæ of the Anthicus, so that the beetle does not necessarily gnaw the characteristic large round hole in the egg-mass before ovipositing. Careful observations were not made on this point, but it is likely that the eggs in these cases were thrust under the edge of the egg-masses where no orifice existed, or perhaps a small hole which was unnoticed was made at such a point. The extent of the destruction of the Corydalis eggs in this way was extraordinary. An uninfested egg-mass could hardly be found among the hundreds which occurred upon the rocks along the stream and upon the piers of the Aqueduct Bridge.

There are three very interesting features connected with this observation: First, that the eggs of *Corydalis cornutus* have never before been known to be attacked by any insect; second, that this species of Anthicus is rare in collections; and, third, that very little is known about the early stages of any Anthicid. Messrs. Hubbard and Schwarz say that they have seen the leaves of trees overhanging the waters of the Grand river at Grand Ledge, Mich., white with Corydalis egg-masses, but with no signs of any insect attack upon them. The writer has seen the leaves of trees overhanging several streams in the vicinity of Ithaca, N. Y., similarly plastered with egg-masses, and, as above stated, the Corydalis has for many years been studied by Professor Comstock and his assistants, but Professor Comstock has written me, in reply to an inquiry upon the subject, that he has not noticed that the eggs are attacked by any insect at Ithaca. The immunity in these two cases may be due to the fact that the eggs are laid more commonly upon leaves and trees where the larvæ of Anthicus on emerging could not find a proper place to pupate, or it may have something to do with the geographical distribution of the species. Mr. Schwarz informs me that up to this summer, neither Mr. Ulke nor himself had ever taken this species at Washington, yet on August 4 the writer could easily have captured a hundred had he so desired. Mr. Schwarz further informs me that with Mr. Hubbard he noticed a closely allied species—*Anthicus quadrilunatus*—in extreme abundance along the rocky shores of the canyon streams in Colorado and Utah, and that Chauliodes and large Perlids were extremely common at the same time. He is inclined to think, since Mr. Clifton's discovery, that the related species may feed upon the eggs of these Pseudoneuroptera. The discovery will, in fact, probably lead to the discovery of the early stages of other Anthicidæ which frequent the margins of streams.

On the occasion of Mr. Schwarz's trip, on August 24, most of the egg-masses had been destroyed and there were abundant indications of subsequent feeding upon the remains of the egg-shells by several insects. He found the larva and the imago of a large Psocid engaged in this work and he also found two larvæ of an Anthrenus similarly engaged. One specimen of another species of Psocid was also found and a mite was seen feeding upon the egg remains. As the larvæ of the Anthicus grow and demolish the interior of the egg-masses, the cover becomes gradually lifted from its closely fastened border on the rocks, allowing easy entrance to these other insects, which feed upon the leavings. The cocoons of a small Drassid spider were also found in a few demolished egg-masses.

NOVEMBER 7, 1895.

President Ashmead in the chair and the following members also present: Messrs. Mann, Linell, Hubbard, Gill, Heidemann, Marlatt, Benton, and Howard.

By unanimous vote Prof. Dr. Rudolph Leuckart, of Leipzig, was elected an honorary member. Dr. William Barnes, of Decatur, Illinois, was elected a corresponding member.

The President announced the death of the Rev. Dr. J. G. Morris, one of the founders of the Society, and made a few remarks about Dr. Morris's long and prominent career.

—Mr. Hubbard read the following paper:

SOME INSECTS WHICH BRAVE THE DANGERS OF THE PITCHER-PLANT.

By H. G. HUBBARD.

Since Prof. Riley published in Trans. Acad. Sci., St. Louis, 1874, iii, pp. 235–240, his account of the insects which he observed in connection with the common pitcher-plant, *Sarracenia variolaris*, I believe few new observations upon this subject have been made. In July, 1894, I had the opportunity of making a brief study of the insects associated with the large trumpet-shaped leaves of *Sarracenia flava*, a species of pitcher plant as common in the low sandy savannas and on springy hillsides in Georgia and Florida as *S. variolaris* is in our northern bogs and marshes. At De Funiak Springs, in western Florida, I found an unusually fine collection of these plants in the boggy meadows and springy hillsides forming the valley of a small streamlet. I first noticed that many of the pitchers, thousands of which rose above the sod, standing erect to a height of over two feet, were attacked and eroded, chiefly in the upper part, by caterpillars of a most brilliant carmine red color. I afterwards bred from these both species of *Xanthoptera* mentioned by Prof. Riley from *Sarracenia variolaris*, viz: *X. semicrocea* Gn. and *X. ridingsii* Riley. The moth of *X. ridingsii* has upon the upper wings transverse bars of fuscous, while *X. semicrocea* has the fore wing half black and half orange-yellow. The latter is the smaller and the more distinctly marked species. Its larva is much the brighter in coloration and all the markings are more sharply defined than in *ridingsii*. It is a most beautiful creature, gayly decorated with carmine, white, and velvety black. The moths of both species were entirely at their ease within the pitchers and made themselves at home there, resting in copulation upon the spine-clad walls or flitting over the dangerous surface as easily as upon ordinary leaves. Evidently the death-trap has no terrors for them. I noticed that the larva of both species takes the precaution to empty the pitchers of their liquid contents by cutting a small hole from the outside near the base. This insures a dry interior which becomes partly filled with the excrementary pellets, and among these the pupa is usually formed. The drowned insects ensnared by the plant include species of all orders—in fact, representatives of almost the entire fauna of these swampy meadows, ants predominating, as Prof. Riley remarks; but, contrary to his experience in the case of *Sarracenia variolaris*, I find that *S. flava* captures not only the honey-bee but even Bombus and Megachile, together with sand-wasps (Bembecidæ), and other aculeate Hymenoptera of the largest size. I was therefore the more surprised to discover that a large Sphecid wasp, which Mr. Ashmead has kindly determined as *Isodontia* (*Sphex*) *philadelphica* St. Farg., utilizes the pitchers, in their most active and formidable condition, as a resting-place for the rearing of its young. Hundreds of the pitchers had been thus appropriated, but at the time, July 4th, I found only the capsules from which the wasps had emerged, and secured a single pupa only, far advanced towards maturity.

The mother wasp stuffs the pitcher more or less compactly with blades of grass and the fibrous threads of plants, which float above the stygean lake in the bottom of the cup and safely bridge its dangers. I suspect that the food which is supplied to the larva of this wasp consists principally of the caterpillars of the Sarracenia moths (*Xanthoptera*), but I did not satisfactorily ascertain the fact, as I only found the spun pupa cases resting upright in the midst of a loose packing of grass.

Notwithstanding that many species of spiders are found drowned within the pitchers, there is nevertheless at least one species of *Lycosa* that has thoroughly mastered the difficulties of the situation, and habitually spreads its web within the tubes, not only taking toll of the plant in the insects which it allures, but also utilizing it as a safe retreat in which to rear its young. The spider spreads a diaphragm of web half way down the tube, and its egg-mass may be found suspended there a short distance above the water.

The maggots of the pitcher-plant fly, *Sarcophaga sarraceniæ* Riley, are so uniformly present and so abundant in every species of pitcher-plant which I have examined from the swamps of Lake Superior to the bay-heads of Florida that I am constrained to think they have a more intimate connection with the economy of the plant than has been assigned to them. They certainly aid materially in disintegrating the mass of accumulated insects in the pitchers, and I see no reason for considering that they rob the plant of its proper food, since they must add their own excreta to the macerated digestive material, and this may serve the needs of the plant as well, or even better, than the disintegration of the animal matter produced by its own fluids.

A species of the interesting and little known parrot-beak pitcher-plant, *S. psittacina*, was common at De Funiak, growing low in the wet grass about the roots of the giant tubes of *S. flava*. The curious bladder-like pitchers of this species are constricted at the lip in a narrow opening, and I found the contained liquids received only insects of the smallest size, chiefly minute gnats, Cecidomyiidæ; the smaller Staphylinidæ, such as Atheta and Trogophlœus, were also represented there, together with minute semi-aquatic Hemiptera and Thrips. The accumulation of dead insects was relatively rather less than in its gigantic relative. No maggots of Sarcophaga and no intruders of any kind were found in these tiny pitchers.

In discussing this paper Mr. Ashmead stated that in Jacksonville, Florida, he had studied the insects found in the pitchers of several species of the pitcher-plant and could corroborate Mr. Hubbard's statement of the enormous number of insects which were found in such locations. He himself had found some rare Coleoptera in this way. He had never heard, however, of species of Sphex in such situations, and doubted Mr. Hubbard's theory that this insect feeds upon the lepidopterous larvæ in the pitchers, since Sphex is almost invariably a storer of orthopterous insects. The genus Isodontia has recently been suppressed; but if Mr. Hubbard's observation that this insect feeds upon lepidopterous larvæ is correct, this difference in habit from the ordinary Sphex may warrant the revival of the genus. Mr. Hubbard, however, stated that he did not observe the food of Sphex and it was a mere supposition that it fed upon Lepidoptera. Grasshoppers were very plenty in the pitchers. Mr. Mann said that, following the general rule, caterpillars of such bright colors as those found in the pitcher-plant were apt to be distasteful to other insects.

—Mr. Howard read a paper entitled "Notes on the Life-history of *Culex pungens*, with remarks about other Mosquitoes." *

In discussion Dr. Gill said that he wished that some one would make an effort to determine the species of other common dipterous genera, and referred to the fact that he had caught upon sticky fly-paper in his office room about a dozen different species of Diptera and that Mr. Schwarz had told him that very few of them could be determined offhand. Referring to mosquitoes as fish food, he stated that a very large proportion of the food of newly hatched fresh-water fish consisted of mosquito larvæ. The Trinidad fish referred to by the speaker probably belongs to Rivulus or to Pœcilia. Mr. Hubbard stated that he had noticed that adult mosquitoes take some time in issuing from the pupa

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* Published in Bulletin 4, New Series, Division of Entomology, U. S. Dept. Agriculture.

and that they rest upon the pupa skin for quite a while extending their wings. At this time if the surface of the water is ruffled by wind many are upset and drowned. With other aquatic Diptera living in more rapid streams the maturation must be brought about much more quickly. Recently, at Niagara Falls, he had picked up a rock from the rapids and a dipterous insect had actually burst out of the pupa and flown away like an arrow from a bow. He thought this must be common among Diptera living in such localities. Mr. Howard said that this was undoubtedly the case with Simulium, a statement which Mr. Marlatt substantiated by quoting Mr. G. L. Frierson, who said that he had seen adult Simuliums popping out of water in such numbers as to give the water the appearance of boiling. Mr. Howard said that the adult Simulium was almost virtually aquatic, referring to its egg-laying habits where the adult certainly enters the water to oviposit. Mr. Benton, referring to the food habits of adult mosquitoes, said that they are very fond of honey. He has frequently seen them feeding upon exposed honey in great numbers. Apropos to the slow expanding of the wings of adult insects, he stated that where the issuing of the adult from a pupa with the honey-bee is retarded to any considerable extent the bee finally comes out ready for immediate flight. Where there is no retardation, however, it takes some time to expand and harden its wings. The question of the food of the male mosquito was brought up and Mr. Mann stated that according to Dr. Dimmock experiments failed to prove that it can pierce the skin. A study of the mouth-parts substantiated this idea. While the male mosquito has a mouth which will allow it to suck up liquids, it apparently is not capable of piercing either skin of warm-blooded animals or tissues of plants. Mr. Ashmead referred to the so-called blind mosquito of Florida which some people down there thought to be a male mosquito. It is, however, a species of Chironomus.

—Mr. Heidemann exhibited specimens of *Rheumatobates rileyi* in the fully winged form and said that only four specimens are known, two of which he has collected near Washington and two collected by Mr. C. E. Chambliss, in Tennessee. Dr. Meinert doubts the existence of winged specimens. Mr. Heidemann's series, however, shows both the normal and abnormal forms (so called by Riley), or *R. tenuipes* Meinert and *R. rileyi* Bergroth. Of the former he had both sexes in the winged form, but of the latter only the males.

—Mr. Ashmead submitted some Mutillidæ and called particular attention to the difference between Sphærophthalma and Photopsis, the latter having been considered by Fox a synonym of the former. Mr. Ashmead is of the opinion that one section of the genus Photopsis is composed entirely of males of Cyphotes.

—Mr. Hubbard stated that he had found the brood cells of *Xyleborus xylographus*, a species which burrows directly and for a long distance into hickory wood. In the brood cell he found a large colony of females and several males. In one corner of the brood cell he found what is obviously a cemetery, containing dead larvæ and adults, comparable to the cemeteries which he had found in ants' nests. Mixed with the dead bodies were thousands of eggs of a Tyroglyph mite. He further found the body of the mother of the colony walled into a side burrow. From this observation he inferred that the presence of dead animal matter would interfere with the growth of the ambrosia upon which the young Scolytids feed, and that we have here the obvious beginning of a cultivation of ambrosia, a step towards the condition of affairs which has recently excited so much attention with certain ants. He considers that this indicates that the Scolytidæ have a very high order of intelligence.

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December 5, 1895.

The following members were present: Messrs. Gill, Fernow, Test, Marlatt, Hubbard, Coquillett, Stiles, Linell, Heidemann, Benton, and Vaughn; also three visitors.

Mr. Hubbard then read a paper of which he has presented the following abstract:

ON THE DISTRIBUTION OF CERTAIN SPECIES OF MYTILASPIS.

By H. G. Hubbard.

[*Author's abstract.*]

Mr. Hubbard spoke of the unreliability of tradition and early records as a source of exact knowledge concerning the introduction and spread from one country to another of pests like Scale Insects, which are so easily transported upon living plants and so difficult of specific identification even by expert observers. He said that the published accounts of the introduction into Florida of the two common orange scale insects, *Mytilaspis gloveri* and *Mytilaspis citricola*, were apparently exact and circumstantial; the Long Scale having, it is said, been brought to Mandarin in 1838, by Mr. Robinson, on two small mandarin trees which were obtained in New York from a ship which came from China; and the Purple Scale, according to Glover's account, brought into the State some years later upon lemons imported from Bermuda.

Notwithstanding these very positive statements, which have passed unchallenged into our literature, it is almost certain that both are erroneous. The insects mentioned by Glover as coming from Bermuda are clearly not Mytilaspis Scales; and the Purple Scale, to which his record has been supposed to refer had at the time of which he wrote not yet reached Europe from the East. It was not until the middle of the present century had been reached and passed that it continued its westerly course and spread over the islands of the Atlantic and the Carribean Sea, attaining the continent of North America not much before the year 1880.

As to the Long Scale (*M. gloveri*), the fact that it is to-day the principal pest of the orange in the interior of Mexico renders the tradition of its introduction upon the North American continent in 1838 altogether improbable. It is probable that this scale was intoduced with the orange into Florida and Mexico by the Spaniards at the end of the 16th or beginning of the 17th century. Its irruption in 1838 was in fact but a continuation of an epidemic of coccid pests of the orange which is known to have overwhelmed the citrus plantations of Europe and the Mediterranean in the early part of the century and to have spread westward somewhat later, to the Azores, the Canaries, and finally to Bermuda.

In these days of rapid transit, which facilitates the interchange of living plants between the most distant countries, insects of economic importance easily and quickly girdle the earth. It has, therefore, no especial significance when these orange scales are discovered in the botanic gardens of Australia, Tahiti, Fiji, Ceylon, India, and other distant colonies of the British Empire where the importation of living plants is actively carried on. The researches of Mr. Maskell and the official entomologists of the various stations give a very clear idea of the character of the indigenous coccid fauna of Australia and the islands of the Indian Ocean, and it appears that while our typical orange scales have been introduced into many of these countries they have no place in their original fauna, but are represented there by intermediate species, or perhaps only varieties of one species, which unite three principal types of Mytilaspis scales that in the Northern Hemisphere have become more fully differentiated and form as many distinct species, viz.: the apple scale, *Mytilaspis pomorum*, having the thickest scale and darkest color; *M. citricola*, with an equally broad scale, but thinner and lighter in color; and *M. gloveri*, with linear form and still thinner and paler scale. Mr. Hubbard showed that these variations in the scale covering were necessarily accompanied by differences in the structure of the insect, and pointed out that the thin and elongate forms were adapted to life in tropical thickets; that the broader form and thicker scale was better suited to existence in uplands where there is greater exposure to sun and air and less moisture; and finally that the heaviest and darkest coverings were necessary to resist the sudden changes of winter. He suggested the hypothesis that a tendency to vary in these three directions on the part of an originally tropical species of *Mytilaspis* had in the North produced as three distinct species the apple scale, the purple scale, and the long scale, while in the Southern Hemisphere, and in islands like Japan, the preponderance of water and the abrupt termination of the land areas, giving a more restricted range into colder regions, these variations had not become fully differentiated and still existed as varieties of the original species.

—Dr. Stiles exhibited a Dermestes larva from a corpse from three to six months after death. He also called attention to the French work entitled "La Faune des Cadavres," by P. Mégnin. This author divides the period from the burial of the corpse to its final dissolution into eight portions, and states that during these different periods a different series of insects infests it, and that in some instances the insects present in one period may be absent during the succeeding one, but will sometimes be found again at a later period. In this way he says that the length of time the corpse has been buried can be definitely ascertained from the insects found infesting it. Mr. Marlatt doubted that any kind of insect which once infested a corpse would leave it for a certain length of time and then return. He also doubted that data obtained in this way could be implicitly relied upon, since the conditions are so seldom the same.

In regard to the manner in which the insects gain access to the corpse, Mr. Hubbard stated that in the case of the Diptera the eggs were evidently deposited on the outside of the coffin or casket before burial and the young larvæ made their way through any small opening. He did not believe it possible for the young larva to make its way through the soil after burial. Dr. Stiles stated that he does not agree with the conclusions arrived at by the author of the work in question, but thought that the field was a very interesting one and desired to bring it to the attention of entomologists.

—Mr. Coquillett presented for publication in the Proceedings the following paper:

A NEW DIPTEROUS GENUS RELATED TO GNORISTE.

By D. W. Coquillett.

In a small collection of Diptera recently received from Prof. T. D. A. Cockerell is a Mycetophilid having an extremely long proboscis. The only described genus having this character so far reported as occurring in our fauna is *Gnoriste* Meigen. But the present form differs from the latter genus in having the palpi attached to the proboscis near its base instead of near its apex, and the fourth vein forks far beyond the forking of the fifth instead of almost opposite it. The new form will be easily recognized by the accompanying figure and description:

Eugnoriste new genus.—Head small, much narrower than the thorax; antennæ slightly longer than the thorax, filiform, pubescent, sixteen-jointed; proboscis rigid, filiform, directed downward and backward, longer than the head and thorax taken together; palpi four-jointed, the first joint very short, the second as long as the two following taken together; three ocelli; eyes deeply emarginate next the antennæ. Coxæ nearly as long as height of thorax, legs destitute of strong bristles, spurs at tips of tibiæ well developed. Wings bare, costal vein reaching half way from tip of third vein to apex of upper branch of the fourth, auxiliary vein obsolete toward its apex, third vein not forked, fourth issuing from the fifth close to the base and forking far beyond the base of the third; fifth vein forking near its base. Type, the following species:

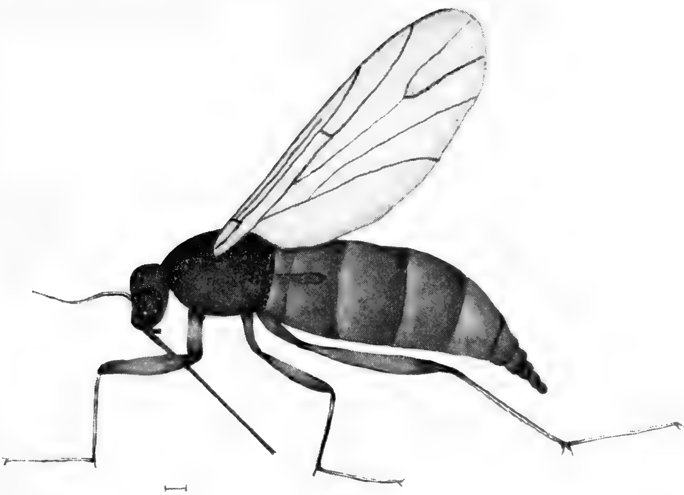


Fig. 24.—*Eugnoriste occidentalis* Coq.—greatly enlarged (original).

Eugnoriste occidentalis new species.—♀—Head and thorax black, subshining, antennæ, proboscis, palpi and halteres blackish brown; abdomen dark brown, sutures of the segments yellow; legs, including the coxæ, yellowish, tarsi brown toward the tips. Wings hyaline, veins brown, second section of fourth vein sub-obsolete. Length 2.5 to 3 mm. Las Cruces, New Mexico.

Three specimens collected June 8, by Prof. T. D. A. Cockerell.

Special Meeting, Dec. 26, 1895.

A meeting of the Society was held in the assembly hall of the Cosmos Club under the auspices of the Joint Commission of the Scientific Societies of Washington. Major J. W. Powell of the Joint Commission presided, and 25 other persons were present.

The retiring President, Mr. Ashmead, then delivered his annual address:

ANNUAL ADDRESS OF THE PRESIDENT.

THE PHYLOGENY OF THE HYMENOPTERA.

By William H. Ashmead.

You are all probably aware that the order Hymenoptera includes those insects known to us under the popular names of bees, wasps, hornets, ants, saw-flies, gall-flies, Ichneumons, and Chalcid-flies, and to-night I shall attempt to give you some idea of their origin, history, and development, their affinities with other orders, and their classification into groups, families, and tribes. I shall also attempt to show how the phytophagous species, under the great law of evolution, gave place to parasitic and predaceous species; and while I should like to mention some of the interesting and unsolved problems in their life-history, I shall be compelled, for want of time, to confine myself to the subject of my address and merely call your attention to the economic importance of the order.

A study of insects demonstrates that the same general laws of development that govern the higher animal life govern insect life and that there is ever an upward tendency to a higher or more specialized type; since man is the highest type of animal life, so a bee or an ant is the highest type of insect life.

Both in their way are remarkable productions of nature.

The surprising instincts and wonderful intelligence displayed by many Hymenoptera, particularly among the social species, in the construction of their habitations, in the care of their young and in gathering their food have been noticed and commented upon by many observers.

The late Prof. John O. Westwood as early as 1840 says: "If interesting habits and economy, great development of instinctive powers and social qualities be considered as indicating superiority in their possessors, the insects composing the order Hymenoptera have certainly far greater claims to be placed in the foremost ranks of insect tribes than any of their brethren."

Sir John Lubbock, known to us all for his researches in many departments of science, also says: "If we judge animals by their intelligence as evinced in their actions, it is not the gorilla and chimpanzee, but the bee and above all the ant, which approach nearest to man."

The Hymenoptera are also among the most useful and beneficial insects to man, since it is mostly only among the phytophagous species, or the saw-flies, horntails, etc., that we find those that are injurious; the vast majority of the species known to us being beneficial in various ways.

The hive-bee and other wild bees furnish us with wax and honey; while other bees are useful in the pollenization of plants and fruit trees, the legs of these insects, with their hairy covering, being specially adapted for carrying pollen from one flower to another. In fact, modern research has shown that many plants cannot be pollenized without the bees, and if it were not for these useful insects our orchards would be unproductive, since they are essential to the pollenization of the apple, the pear, the peach, and other fruit trees. It has also been shown that the bumble-bee is essential to the fertilization of red clover and other plants.

The oak-gall of commerce, the product of a cynipid, or gall-making wasp, has been for years utilized in the manufacture of ink, and, although to-day somewhat superseded by chemical products, is still much used in the manufacture of this important article of modern civilization.

The fig insects, the Agaonidæ or Blastophagæ, a most remarkable group of hymenopterous insects, belonging to the family Chalcididæ, are also important to man, since from time immemorial they have been made use of in the fertilization of the fig.

They are still made use of in the Orient, although it has been demonstrated that some varieties of figs—the artificial product of man through centuries of cultivation—will produce fruit without their intervention. All wild fig trees, however, are diœceous and it has been fully demonstrated that each species of fig tree has one or more species of these insects attached to it, which are essential to its fertilization.

All wasps—the wood-wasps, the digger-wasps, the social wasps, etc.—are also beneficial, and very few persons, outside of entomologists, can conceive of the immense services performed by these gayly-colored insects. All are predaceous or parasitic, and destroy annually thousands and thousands of destructive insect pests.

The economic value to us of the wasp and bee, however, is probably much less in comparison with the benefits we derive from innumerable parasitic ichneumon and chalcid flies. These are numbered by millions and are found everywhere. Most of them, too, are so minute or microscopic in size as to escape our notice, and it is only by the most careful observation in the field and by breeding in the laboratory that we are able to obtain a knowledge of their obscure mode of life.

These belong principally to five families, the Proctotrypidæ, Cynipidæ, Evaniidæ, Chalcididæ, Braconidæ, and Ichneumonidæ, and all of them except the gall-making cynipids and a few phytophagous chalcidids, are genuine parasites, living in and destroying the eggs, larvæ, pupæ, and imagoes of the destructive insect pests of the forest, field, and garden.

The obscure habits of these parasitic Hymenoptera are now being slowly worked out in various countries of the globe, and more particularly in Europe and America.

In recent years great interest in a study of these microscopic species has been manifested, and it is gratifying to us to know that in no country in the world is so much being done to make known the habits and economic value of these insects as in our own country. I allude particularly to the great work being done in the U. S. Department of Agriculture, by its field agents, and by our numerous Agricultural Experiment Stations.

Our knowledge of the habits of certain groups and genera of these insects is now sufficient to give us a good idea of those species which are most important to the agriculturist and fruit-grower.

For example, we have found out that whole groups of genera and species are parasitic in the eggs of other insects and that these are the most important.

The species belonging to the family Mymaridæ are parasitic in the eggs of Hemiptera, Diptera, Neuroptera, &c. Certain Proctotrypids belonging to the tribe Scelionini destroy the eggs of destructive orthopterous insects,—grasshoppers, katydids, locusts, &c.; the tribe Telenomini destroy lepidopterous, hemipterous, dipterous, and neuropterous eggs; the tribe Bæini, spider eggs; the tribe Teleasini, beetle eggs; while the family Trichogrammidæ destroy the eggs of moths, butterflies, beetles, bugs, &c. The species belonging to the genus Evania in the family Evaniidæ destroy the eggs of cockroaches; while some Chalcidids are also egg-destroyers, species of Encyrtus and Anastatus (= Antigaster).

The tribe Bethylini in the Proctotrypidæ are parasitic on the larvæ of the Micro-lepidoptera and on coleopterous larvæ; the subfamily Dryininæ on homopterous larvæ; the subfamily Platygasterinæ on dipterous larvæ; the subfamily Helorinæ on neuropterous insects; the subfamilies Proctotrypinæ and Belytinæ on coleöpterous larvæ; while the Diapriinæ attack dipterous larvæ.

The parasitic Cynipidæ attack principally dipterous larvæ, although one subfamily, the Allotriinæ, destroy plant-lice belonging to the homopterous family Aphididæ.

The species belonging to the families Chalcididæ, Braconidæ, and Ichneumonidæ, comprising thousands and thousands of species, destroy the larvæ, pupæ, and imagoes of nearly all orders.

And we find in these families, just as we have found to be the case in the Proctotrypidæ, whole tribes and genera with a unity of habit that is universal. The genera Bracon, Spathius, Meteorus, Euphorus, Ichneumon, Pteromalus, Eupelmus, Aphelinus, Coccophagus, Tetrastichus, Melittobia, etc., have the same habits in Europe, Asia, Africa, or Australia as they have in America; and I hope to see the knowledge we are acquiring of these parasitic insects put to practical use.

I hope to live to see these parasites bred in great numbers in the laboratory and then transported into regions where they do not exist and where they will do the most good, in destroying their destructive insect hosts.

There is no reason why we cannot send our American parasites to other countries and receive in return other parasites not in our fauna.

Some of our most destructive insect pests were imported from foreign shores, and we should look to the original habitat of these insects for their natural enemies and parasites; and if these are not already with us, they should be imported.

The Phylogeny of Hexapous Insects.

From what I have said, I think I have clearly demonstrated the high rank of the order and its great economic importance, and will now proceed to show its phylogenetic developments and its position among other orders.

Dr. A. S. Packard, one of our best systematic entomologists, says: "There is nothing like a linear series in the animal kingdom, but it is like a tree. The higher series of orders form more of a linear series than the lower series, so that the Neuroptera, Orthoptera, Hemiptera, and Coleoptera form a more broken series than the Hymenoptera, Lepidoptera, and Diptera. A bee, butterfly, and house-fly are much more closely allied to each other than a beetle, squash-bug, a grasshopper, and a dragon-fly are among themselves."

This is quite true and a principle now almost universally accepted by zoologists.

Before proceeding with the phylogeny of the Hymenoptera, I shall, therefore, first attempt to show briefly the phylogeny of hexapodous insects, in an ideal genealogical tree.

This ideal tree is shown on my diagram No. 1.

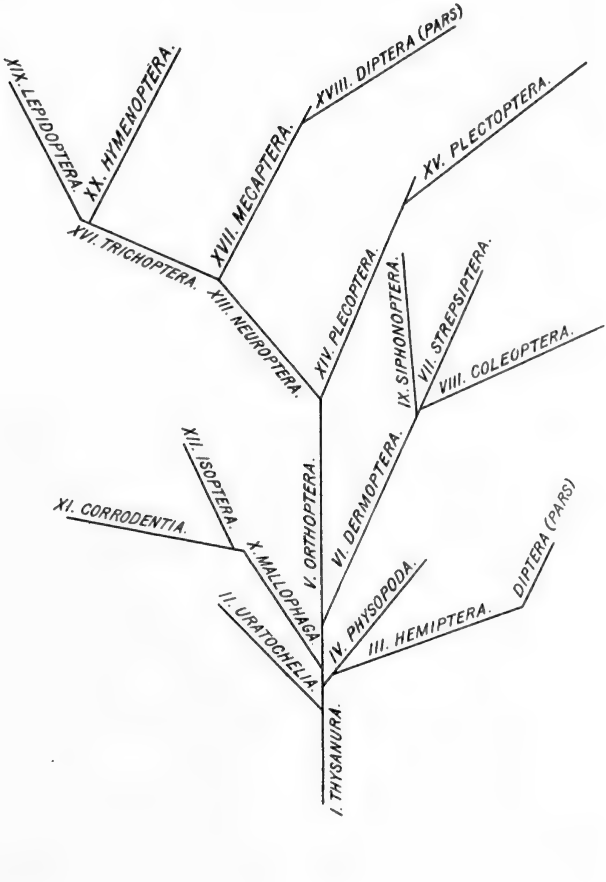
It will be observed that I agree with Brauer, Packard, Lubbock, and others in considering the order Thysanura as representing the less specialized type of insects and from which developed all others, which is emphasized again and again in the larval development of the different orders.

Twenty distinct orders are recognized, *Uratochelia* being a new order proposed for the family Japygidæ since I believe these insects, although closely allied, are quite distinct from other thysanurians.

This ideal genealogical tree will, I hope, enable you to at once grasp the affinities of the different orders and will show you the evolution that has taken place in their development.

It will also demonstrate to you more clearly than pages of

DIAGRAM No. 1.



Ideal Genealogical Tree of Insects.

text the evolution of insects from a primitive wingless type, without metamorphosis, into more specialized types of winged and wingless insects, with incomplete or complete metamorphosis.

The thysanurians, or springtails, are always apterous and undergo no distinct metamorphosis.

If in this ideal sketch of the phylogeny of insects I have drawn somewhat upon my imagination, instead of depending always upon facts, for my conception of their development, I have no apology to make; but, on the contrary, claim it is just as permissible for naturalists, as it is for philosophers to draw sometimes upon their imagination in order to interpret nature correctly.

This ideal genealogical tree is given merely to illustrate the origin of the Hymenoptera, and the position which I believe these insects should occupy among other orders, and I will now proceed to say something about this order.

The geological history of the Hymenoptera is very meagre. Some authorities, and especially Mr. Samuel H. Scudder, of Cambridge, Mass., our highest authority on fossil insects, consider that hexapodous insects were not ordinarily differentiated until post-palæozoic time, and class all fossil insects before this time in a single order, termed Palæodictyoptera, since these fossils cannot be referable to any of our modern orders.

Most of these insects, however, show neuropterous and orthopterous affinities and demonstrate the great age of these insects. As we ascend the geological strata, insects become better differentiated and other orders appear—the Hemiptera, Coleoptera, etc., but no trace of hymenopterous insects appears until the tertiary formation is reached.

The earliest known fossil Hymenoptera occur in England in the middle Oölite, while in this country they have been obtained from different localities in the tertiary formation. Scudder in his Tertiary Insects of North America (U. S. Geol. Surv., 1890) describes 15 fossil terebrants and 8 aculeates from the Florissant beds of Colorado.

These fossils, however, are of so recent a date that, with one or two exceptions, all are referred to modern genera, and all belong to well-defined modern families, so that no clew as to the origin of the order is obtainable from geological strata and we must look to other sources for this information.

This clew, I believe, may be obtained, at least approximately, from living forms and from the position assigned the order by various systematic workers.

Position Assigned the Hymenoptera by Different Authorities.

The older authors divided insects into two principal groups: (1) The Mandibulata, or insects with jaws fitted for biting; and (2) The Haustellata, or insects with the mouth-parts fitted for sucking. From Westwood I find that Lamarck thought the Hymenoptera were the connecting order between the two series. Latreille placed it between the Neuroptera and the Lepidoptera, regarding Phryganea and Termes as forming the link between them, considering the long-tongue bees as approaching nearest to the Lepidoptera.

MacLeay, on the other hand, placed the Hymenoptera between the Coleoptera (with which they are supposed to be connected by the osculant order Strepsiptera) and the Trichoptera, the Tenthredinidæ being considered as trichopterous and the Uroceridæ as forming an osculant order, Bomboptera, between Trichoptera and Hymenoptera, which last order is reduced to the species possessing apodal larvæ: thus by means of the connection between the ants (Formicidæ) and white ants (Termitidæ), and the caddice-flies (Phryganeidæ) and the saw-flies (Tenthredinidæ), a strong relationship is shown to exist between the Linnæan orders Hymenoptera and Neuroptera.

Packard in his paper entitled On Synthetic Types in Insects (Bost. Journ. Nat. Hist., vii, p. 591–22, 1863) says that the Coleoptera, Hemiptera, Orthoptera, and Neuroptera "seem bound together by affinities such as those that unite by themselves the bees, moths, and flies," and to the latter or what he considers the higher series he has since applied the term Metabola, and to the former Heterometabola. He says: "The Metabola are unquestionably more homogeneous than the other group. One of their primary features is found in the more clearly marked regional divisions of the body; this is a consideration of great significance, since in the progress of structure, from the worms, through the crustaceans to the insects; or with the progress of structure, from myriapods, through the arachnids to the hexapods; or in the developmental history of the Metabola themselves, from the larva, through the pupa to the imago, we discover constantly increasing concentration of the segments of which the body is composed into distinct regions, culminating in the Hymenoptera, where head, thorax, and abdomen are most sharply defined."

All the orders of the Heterometabola and none of the Metabola are represented in the palæozoic rocks. Scudder states: "This is the more striking from the fact that if we omit mention of the single discovery of insect wings in the Devonian, the three orders of insects—hexapods, arachnids, and myriapods—appear simultaneously in the Carboniferous strata. The Metabola are then later in time and more perfect in development than the Heterometabola."

Packard also believes the Hymenoptera are descendant from the Lepidoptera.

Thus we see that most authorities are agreed as to the affinities existing between the Hymenoptera and Lepidoptera, and there is scarcely any doubt in my own mind now that this is the correct view, and that these two orders with the Trichoptera and part of the Diptera had a common ancestry.

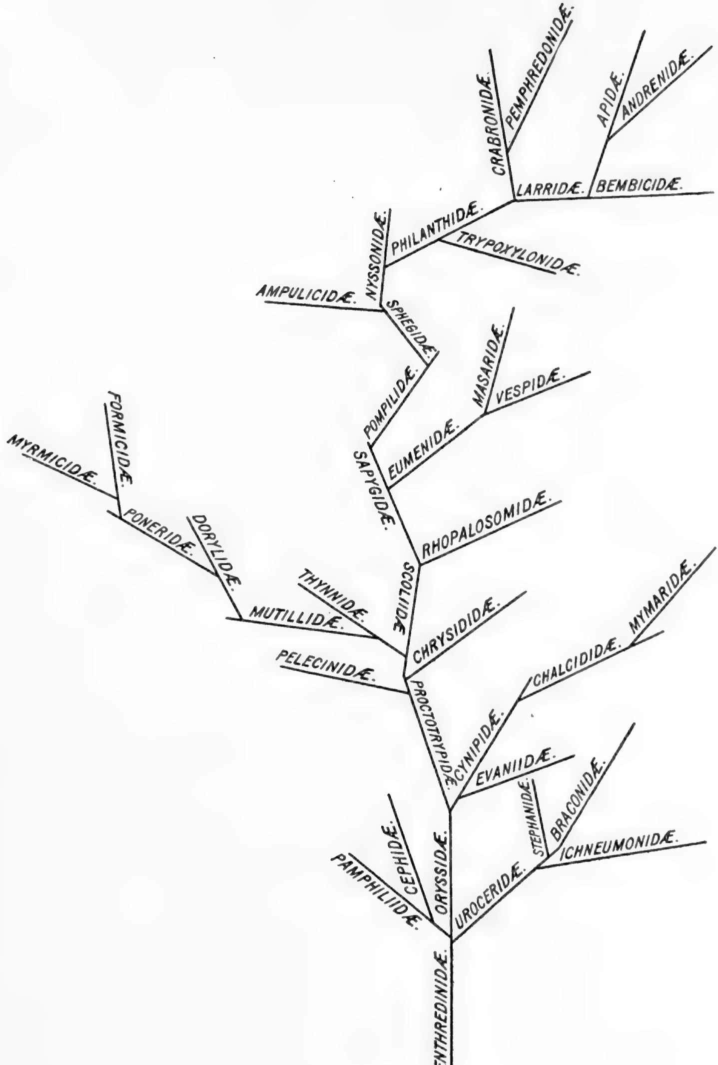
This relationship is shown in the close resemblance between the larvæ of the phytophagous Hymenoptera and those of certain lepidopterous larvæ, although the direct line of descent cannot be pointed out absolutely.

The relationship will probably be found among some of the wood-boring Lepidoptera, *Cossidæ*, *Ægeriidæ*, *Hepialidæ*, etc., and more particularly among those lepidopterous insects furnished with an ovipositor.

The larvæ of the Mecaptera (Panorpidæ) also approach close to the Hymenoptera, and the peculiar rostrate head of the imagoes of this order is frequently reproduced among the parasitic species (Agathis, Cremnops, etc.).

Mr. Nathan Banks has suggested that the Megaptera were the

Diagram No. 2.



Phylogeny of the Hymenoptera.

ancestors of the Diptera. There is apparently a close relationship between these insects and certain *Tipulidæ.*

In my diagram No. 2, I have attempted to show the development and relationship of the different families of the Hymenoptera, and to illustrate how the phytophagous species, whose larvæ are furnished with legs, in time gave place to higher and more specialized forms, whose larvæ are apodous.

I consider the Tenthredinidæ to be the lowest of hymenopterous insects, and from these in time were evolved on one hand the Cephidæ and Oryssidæ, on the other hand the Uroceridæ.

From the latter probably evolved the Braconidæ and Ichneumonidæ, in which the egg-boring apparatus is usually well developed. From the Oryssidæ were evidently evolved other forms, in which the egg-boring apparatus becomes variously modified and gradually develops into a true sting, and from which in time came the true aculeates—wasps, bees, etc. It is the stem of three or four different families.

The family Stephanidæ is evidently a branch of the Oryssidæ, with strong braconid affinities. The Cynipidæ, Proctotrypidæ, and Evaniidæ also had a common origin and in time evolved other forms.

From the Cynipidæ came the Chalcididæ, a recent type; while from the Proctotrypidæ, which I believe represent some of the most ancient types of hymenopters, we have a distinct line of descent into the Scoliidæ, Mutillidæ, and the higher Aculeata.

My diagram will sufficiently show my conception of the relationship of these families, and I will therefore close with a brief synopsis of a new classification of these insects, based upon their relationship as illustrated in my diagram.

I. Sub-order Heterophaga.* Abdomen petiolate or subpetiolate, never broadly sessile; larvæ apodous.

* Hypopygium entire and closely united with the pygium, the sting or ovipositor always issuing from tip of abdomen.

a. Pronotum not extending back to tegulæ.
Tarsi dilated or thickened.. I. Anthophila Hartig.
Tarsi slender, not dilated...II. Entomophila Ashm.

aa. Pronotum extending back to the tegulæ.

† Apical segments of abdomen normal.

° Petiole or first segment of abdomen simple, without scales or nodes.
Wings usually folded longitudinally in repose; if straight the antennæ ending in a large club.
III. Diplopteryga Latr.

Wings not folded longitudinally in repose............IV. Fossores Latr.

° Petiole or first segment of abdomen with one or more scales or nodes; sexes usually 3, ♂ ♀ ☿.........V. Heterogyna Latr.

†† Apical segments of abdomen tubular and retractile, telescopic-like, visible dorsal segments from 3-5..........VI. Tubulifera Latr.

††† Apical segments of abdomen usually tubular, but not retractile or telescopic-like.
VII. Oxyura Latr.

** Hypopygium divided or never united with the pygium; ovipositor originating some distance before tip of abdomen.
Front wings without a stigma...VIII. Stenospili Ashm.
Front wings with a stigma...... IX. Megaspili Ashm.

II. Sub-order Phytophaga.** Abdomen broadly sessile: larvæ with legs.
Anterior tibiæ with 1 apical spur..................... I. Xylophaga.
Anterior tibiæ with 2 apical spurs ....II. Phyllophaga.

The series indicated above represent the following families, which may be arranged consecutively thus:

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* Petioliventres Haliday. ** Sessiliventres Haliday.

Anthophila	I.	Apidæ.
	II.	Andrenidæ.
Entomophila	III.	Crabronidæ.
	IV.	Pemphredonidæ.
	V.	Bembicidæ.
	VI.	Larridæ.
	VII.	Trypoxylonidæ.
	VIII.	Philanthidæ.
	IX.	Nyssonidæ.
	X.	Sphecidæ.
	XI.	Ampulicidæ.
Diplopteryga	XII.	Masaridæ.
	XIII.	Vespidæ.
	XIV.	Eumenidæ.
Fossores	XV.	Pompilidæ.
	XVI.	Sapygidæ.
	XVII.	Rhopalosomidæ.
	XVIII.	Scoliidæ.
	XIX.	Thynnidæ.
	XX.	Mutillidæ.
Heterogyna	XXI.	Poneridæ.
	XXII.	Dorylidæ.
	XXIII.	Formicidæ.
	XXIV.	Myrmicidæ.
Tubulifera	XXV.	Chrysididæ.
Oxyura	XXVI.	Pelecinidæ.
	XXVII.	Proctotrypidæ.
Stenospili	XXVIII.	Cynipidæ.
	XXIX.	Chalcididæ.
	XXX.	Mymaridæ.
Megaspili	XXXI.	Evaniidæ.
	XXXII.	Trigonalidæ.
	XXXIII.	Stephanidæ.
	XXXIV.	Braconidæ.
	XXXV.	Ichneumonidæ.
	XXXVI.	Agriotypidæ.
Xylophaga	XXXVII.	Oryssidæ.
	XXXVIII.	Siricidæ.*
	XXXIX.	Cephidæ.
Phyllophaga	XL.	Pamphiliidæ.
	XLI.	Tenthredinidæ.

Tables defining the above families are already prepared and will be published in a separate paper. This arrangement is given now, in connection with the diagram, merely to show how these families are arranged in my collection, so as to exhibit their true relationship.

* Uroceridæ of American authors.

You have now had a modern opinion as to the origin and development of the Hymenoptera, and, in conclusion, I shall bring my address to a close by a quotation from Cowan, as to the opinion held by the ancients, respecting the development of the bees and wasps:

He says: "It was the general opinion of antiquity that Bees were produced from putrid bodies of cattle. Varro says they are called *Βουγόναι* by the Greeks, because they arise from putrefied bullocks. In another place he mentions their arising from these putrid animals, and quotes the authority of Archelaus, who says Bees proceed from bullocks, and Wasps from horses: Virgil, however, is much more satisfactory, for he gives us the recipe in all its details for producing these insects:

"First, in a place, by nature close, they build
A narrow flooring, gutter'd, wall'd, and til'd.
In this, four windows are contriv'd, that strike
To the four winds oppos'd, their beams oblique.
A steer of two years old they take, whose head
Now first with burnished horns begins to spread:
They stop his nostrils, while he strives in vain
To breathe free air, and struggles with his pain.
Knock'd down he dies: his bowels bruis'd within,
Betray no wound on his unbroken skin.
Extended thus, in his obscene abode,
They leave the beast; but first sweet flowers are strow'd;
Beneath his body, broken boughs, and thyme,
And pleasing Cassia, just renew'd in prime.
This must be done, ere spring makes equal day,
When western winds on curling waters play:
Ere painted meads produce their flowery crops,
Or swallows twitter on the chimney tops.
The tainted blood, in this close prison pent,
Begins to boil, and thro' the bones ferment.
Then wondrous to behold, new creatures rise,
A moving mass at first and short of thighs;
Till shooting out with legs, and imp'd with wings,
The grubs proceed to Bees with pointed stings:
And more and more affecting air, they try
Their tender pinions and begin to fly."

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