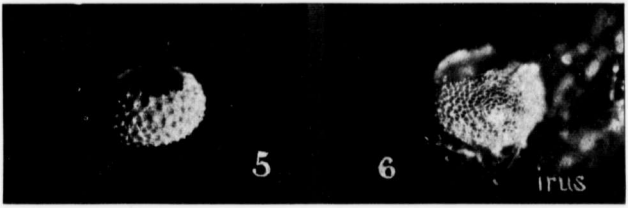

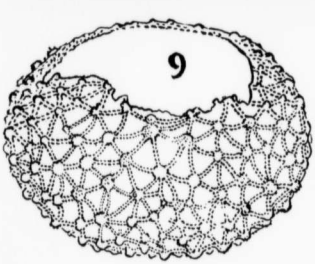

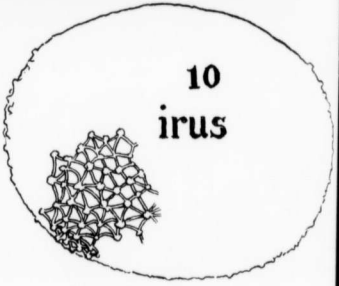

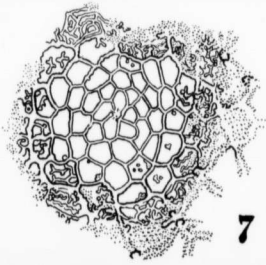

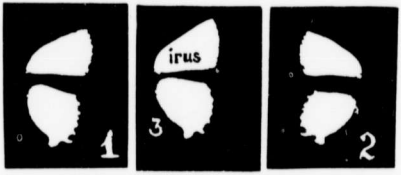

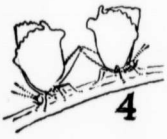

INCISALIA HENRICI, GROTE AND ROBINSON.

The Canadian Entomologist.

VOL. XXXIX. LONDON, JUNE, 1907. No. 6.

STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

III.—INCISALIA HENRICI.

Previous Paper.—In the CANADIAN ENTOMOLOGIST for June, 1905 (Vol. XXXVII, No. 6, p. 216), I published an article in which I pointed out the more obvious differences which serve to distinguish this species from *I. irus*, with which it has been confused. In addition to the characters supplied by the coloration of the wings, I mentioned that the male *Henrici* has no discal stigma,* a fact which seems to have been overlooked by other observers. I stated further that this furnished a reliable diagnostic character for the identification of the species, and, inasmuch as *irus* males invariably have the stigma, the specific validity of *Henrici* should be recognized "at least until the test of breeding could be applied." Being, at the time, unacquainted with the life-history of either species, and being unwilling to express hasty and possibly premature conclusions, I did not feel wholly warranted in holding that W. H. Edwards was right and Dr. Scudder wrong in their respective opinions concerning the butterfly bred by the former. Edwards described the early stages as those of *Henrici*, but Scudder, not recognizing *Henrici* as a species, applied them *(all excepting the egg)* to *irus*. I took the ground that we were justified in withholding judgment in the matter until further facts were discovered. Since there did not appear to be any strong probability that another would supply me with the necessary facts, I set about getting them for myself. Having succeeded in breeding both species side by side, from egg to imago, both parents being known in each case, I can now state positively that Edwards bred *Henrici* (as he stated) and not *irus*, and that his descriptions of the early stages are correct to the minutest detail. Moreover, Scudder was in error in quoting the descriptions of the larval and pupal instars under the caption *irus*. The two species differ so

*In his "Bibliography of Canadian Entomology for the year 1905." Dr. C. J. S. Bethune has credited me with having stated that "*some* males . . . . . are without the characteristic stigma." A careful reading of the article will, I think, make it apparent that the statement was intended to cover *all* the males.

markedly as eggs, caterpillars and chrysalids, that a schoolboy collector could not fail to separate them properly.

The Type.—This species was first described by Grote and Robinson in 1867 (Trans. Am. Ent. Soc., I, 174), and the type specimen is now in the collection of the American Museum of Natural History in New York City. After a careful comparison with the butterflies in my own collection, I have no hesitation in affirming that *it is a male*,* although, the abdomen having been lost, positive determination is impossible.

An Error Corrected.—In his Catalogue of Butterflies (1878) Strecker places *Henrici* as variety b of *irus*, and adds: "Smaller. Inferiors tailless." Since this characterization is altogether misleading, I have thought it worth while to direct attention to the error. It is true that averages made from a large number of specimens will show that *Henrici* is a trifle the smaller, but many of the larger *Henrici* have a broader alar expanse than the majority of *irus*, so the knowledge of averages is not of much assistance to the collector. As for the statement that the secondaries of *Henrici* are without tails, and the implication that tails are always to be found in *irus*, I can only say that such is not the case. In this respect *irus* is variable, occasional specimens (bred) appearing from chrysalis, with merely a slight projection at the end of the nervule as in *niphon*; again, though more rarely, the tails are quite pronounced. Fig. 3 (Plate 4) represents the outline of *irus* wings usually met with; fig. 1 is the male and fig. 2 the female of *Henrici*, showing that well-developed tails are present in both sexes.† Of this species no individuals with tailless inferiors have come to my attention except where the tails have obviously been lost.

Time of Flight.—Species single-brooded, the butterflies appearing with *irus; i. e.*, at the very end of April. Never so abundant (here) as the latter, and to be sought with greatest success in sunny spots in the open pine woods, where *Vaccinium vacillans* is the dominant shrub of the undergrowth, and around the edges of swamps where *V. corymbosum* is to be found. Its season of greatest abundance and time of disappearance

*My determination is based principally on the fact that the type is marked with red-brown near the anal angle of the secondaries above, while the primaries are not suffused. In my series of nearly 200 butterflies this combination is found only in the males, the females showing more or less suffusion on all the wings, and when this is reduced on the primaries it is about equally reduced on the secondaries, never remaining, as in the males, a rather conspicuous patch near the angle.

†These figures, natural size, are from blue prints made directly from the insects' wings.

appear to be the same as the corresponding seasons of *irus*, the butterflies rarely enduring into June. From the observations of W. H. Edwards, it is evident that the species is flying in West Virginia nearly a month before it appears at Albany.

Securing the Eggs.—Edwards was led to imprison a female over wild plum (*Prunus Americana ?*) by having once discovered an unknown *Lycænid* larva boring into the fruit of that plant. He secured eggs. Since there are no plums, wild or cultivated, on the uninviting and almost uninhabited pine-barrens where *Henrici* is most abundant in this region, the local food-plant had to be determined.

During the spring of 1905 every female captured was confined over plum and *Lupinus perennis* (the food-plant of *irus*), but no eggs were laid. About noon on the 28th of May a worn specimen was observed flying weakly among the low shrubbery, and in the hope that it might prove to be a fertile female I followed it. Several times during the afternoon the insect alighted on *Vaccinium vacillans*, curled its abdomen and pressed the tip against some part of the plant, usually a bud, but no eggs were extruded. This and another fresh-looking female taken on the 24th were then confined over *vacillans*. The next day both were dead. Dissection showed that the abdomen of the worn butterfly contained a single egg, while that of the other contained fourteen. The ova were very soft, and it was impossible to determine more than that they differed considerably from *irus* eggs.

Henrici first appeared in 1906, on the 28th of April, and on the 7th of May I had the good fortune to disturb a pair *in copulo*. The flight was short, and the insects alighted on one of a number of long straws lying among the dry persistent stems of a clump of *Ceanothus* in such a position that it was not advisable to risk an attempt to cover them with the net. The posture of the butterflies during *coitus* merits attention, as it doubtless explains or is explained by the peculiar modification of the genitalia found in the Theclidi. I have witnessed the *coitus* of all our local Chrysophanidi and Lycænidi, and in every instance the abdomens of the copulating insects were held approximately in the same line; these butterflies held their abdomens high so that they formed an angle of about ninety degrees, as illustrated in the plate (fig. 4). The wings were closely appressed, the secondaries lifted away from the body, and the primaries dropped backward between them so that, except for the projecting apices, they were completely hidden. Whenever the female moved forward even

a little the male would immediately back up until the position described was regained, acting as though any other position was painful, or at least uncomfortable.

I began cautiously to cut away the branches which would prevent my net rim from reaching the ground, intending to lower the bag over the pair so carefully that they would not take alarm and separate, and then to sit quietly by until copulation was finished, or, if necessary, to leave them undisturbed overnight. I had succeeded in clearing away the inconvenient branches without frightening the butterflies, and had just laid hold of the net when my plans were suddenly upset by the male, who released the body of the female and flew to a dead twig a few yards away. This happened at 10.40 a.m., exactly ten minutes after I first sighted the pair. It was then an easy matter to capture the insects. Not being confident of the sex of either, I brought both to the laboratory alive, and after noting such differences as appeared on the visible wing surfaces, I put them together in a cage over a growing plant of *vacillans*.* On the 13th one of the butterflies died; it proved to be the male. About noon on the 15th I examined the plant with a lens without finding any eggs. Shortly before two o'clock I transferred the female to a cage containing twigs of plum (cultivated), *V. corymbosum*, *V. vacillans* and *V. pennsylvanicum*, and on looking over the plant from which she had been removed, I discovered an egg on the outside of one of the opening leaf-buds. I straightway turned my attention to the imprisoned butterfly.

Oviposition.—Observation began at 1.57 p.m., at which time she was resting quietly on the gauze. Four minutes later she began to walk about nervously, and at 2.05 dropped to a spray of *vacillans*, and almost immediately oviposited on the outer scale of an unopened bud. A few seconds afterward she returned to the gauze, but continued to move about actively as though seeking a way of escape. At 2.07 she again dropped to the plants, this time alighting on a plum leaf, from which she walked up the stem and over the flowers, jumped to an open flower of *vacillans*, and, with more deliberation than before, oviposited on the calyx (2.08), returning shortly to the gauze. Wishing to determine the minimum interval between the laying of two eggs, I removed two of the four uprights which held the netting in position, and by bringing the butterfly close to the plants I was

*The weather for the next few days may be of interest, as it possibly influences to some extent the length of time elapsing between *coitus* and ovipositing. May 8th, 9th and 10th cold, cloudy, with rain at intervals; 11th fair but cold; 12th hazy, with keen wind, rain in afternoon; 13th cold, rain; 14th fair and warm; 15th fair and warm.

able to induce her to walk on to them every thirty seconds. Six times she returned to the gauze immediately; at the seventh trial she oviposited (2.12) on *V. corymbosum* (calyx). The same course was followed again, and resulted in seven returns to the gauze, and an egg (2.16) on *vacillans* (coroila); then seven returns and another egg on *vacillans* (calyx). The butterfly then refused twenty successive invitations to oviposit, and upon being left undisturbed took up a position on the netting, concealing the primary wings as far as possible between the secondaries, which also hid the abdomen. This appeared to signify that the performance was ended, and, as my duties called me away, I made note of the location of each of the five eggs, and brought my observation to a close.

The growing plant oviposited upon between 11.40 a.m. and 1.40 p.m. was searched (as was also the box and netting), with the result that seven eggs, besides the one first noticed, were found as follows: terminal leaf-bud of longer stem, 4 (2 at base of inner leaf, on lower surface; 2 close together at apex of outer leaf, on upper surface); terminal flower-bud of shorter stem, 2 (at base of cluster, on scales); next lower flower-bud, same stem, 1 (same position).

Two days later another confined female laid an unfertilized egg on the calyx of a *vacillans* flower, and this may be assumed to be the location usually selected when the buds are sufficiently open, otherwise the eggs are placed on the scales of flower-buds, and possibly also on those of leaf-buds.

Number of Eggs.—Edwards obtained fifteen eggs; my female yielded thirteen, and the butterfly dissected in 1905 contained fourteen.

The Egg.—In my discussion of *Incisalia irus* I stated* that the "only published account of the early stages of that species, *except Scudder's description and figures of the egg*" (and, I neglected to add, his description of the larva at birth, the figure of its head, and the *coloured* illustration of the chrysalis), was to be found in the work of Boisduval and Leconte. As I have pointed out, Scudder borrowed Edwards's descriptions of the other larval instars and of the pupa of *Henrici*, and applied them to *irus* under the impression that they were one and the same species. *He did not quote Edwards's description of the egg*, but gave his own, based undoubtedly upon personal examination.† There would be nothing

*CANADIAN ENTOMOLOGIST, Vol. XXXVIII, No. 6 (June, 1906), p. 181.

†Dr. Scudder says that he has "in two instances known eggs to be laid by females (*irus*) shut up in chip boxes." Presumably one or more of these furnished the basis of the description and figures.

remarkable in this were it not for the fact that *in one vital point Edwards's description does not correspond to Scudder's.* And yet the discrepancy is not mentioned, and was probably overlooked, though it was presumptive evidence of error. The solution is that *Scudder described and figured the egg of irus, while Edwards described the egg of Henrici.* To assist any who may be inclined to doubt the worth of my judgment in the matter, I have reproduced in the plate photomicrographs of the egg-shells of *irus* (fig. 6) and *Henrici* (fig. 5).* The shells are magnified equally.

Edwards† described the egg of *Henrici* as follows: "Shaped like that of *Lycæna pseudargiolus (Cyaniris ladon)*, and marked very much in the same manner; the top flattened, and at the micropyle depressed; about this last are three concentric rows of minute spaces, rhomboidal to irregularly pentagonal; the remainder of the surface is covered with a *frosted* network, the meshes of which are triangular, and from each angle rises a low rounded knob; colour whitish-green. . . . ."

Comparison with Irus Egg.—The value of a description is greater in proportion to the emphasis placed upon comparative characters, and although the egg of *Henrici* has a greater general resemblance to that of *niphon* than to either *augustus* or *irus*, I have, for obvious reasons, chosen to contrast it with the egg of the last-named species. The most striking difference between them is that the primary ornamentation (consisting, in both, of bosses connected by slightly raised ridges), which in *irus* is clear, unobscured and easily made out, is in *Henrici* covered and greatly obscured by a secondary ornamentation difficult to analyze, but rendering the shell nearly opaque, and giving the appearance described as "frosted" by Edwards (and by Scudder in his description of *niphon*). Under a moderate power the new-laid egg is green, flecked with minute white points where the irregular surface catches the light, and studded with large and prominent white bosses. New-laid *irus* eggs are of about the same shade of green, the smooth surface not catching points of light, studded with small, more numerous bosses not at all prominent. As the embryo larva develops, the green colour is lost, but in *irus* the colour of the caterpillar (yellowish) is visible through the transparent shell, while in *Henrici* this is

*Since the photomicrographs have unavoidably lost somewhat in being reproduced, I have made arrangements with the maker, Mr. Jas. A. Glenn, 63 North Pearl Street, Albany, N. Y., whereby any who may desire to do so can purchase prints from the negatives (slightly larger and showing detail more clearly) at ten cents each.

†Papilio, I, 150.

not the case, the whole surface appearing white and as though dusted over with microscopic grains of quartz. The bosses may be studied by reflected light; the primary reticulation is visible as dark but well-defined, clear-cut lines when viewed under a moderate power by transmitted light; and the secondary ornamentation can be satisfactorily made out in prepared sections only. Fig. 8 is a composite drawing made by combining the results of all three methods.

Other and more important differences are these: (1) *Henrici* eggs are smaller than *irus* eggs in the proportion of 8 to 9 (equatorial diameter), and yet (2) the "hexagons" (Scudder) formed by the roughly equilateral triangles of the reticulation are larger in *Henrici* in the proportion of 5 to 3, and (3) the bosses are in *Henrici* broader in the proportion of 2 to 1. These facts are brought out in fig. 9 (primary reticulation *Henrici*), and fig. 10 (outline *irus*, and part of reticulation*). Moreover (4), the reticulation of *Henrici* is far more regular than that of *irus*, which latter is often broken up by areas without or with greatly reduced bosses, and the "cells" (Scudder) not arranged in hexagons. Compare figs. 5 and 6. Again (5) the "cells" of *Henrici* are sunken so that the lines connecting the bosses are bowed inward, giving each boss the appearance of being raised on a rude pyramid. (6) In an *irus* egg the reticulation is continued (without bosses) over the bottom, while the bottom of the *Henrici* egg is nearly clear, transparent, and without reticulation. (7) The micropyle of *irus* is clear, and merges almost imperceptibly with the surrounding "cells."† That of *Henrici* (fig. 7) contains occasional refractive corpuscles (nobis), and is strongly demarked from the surrounding area by the rather ragged edge of the secondary ornamentation.

(To be continued.)

A FOSSIL CATERPILLAR.

BY T. D. A. COCKERELL, BOULDER, COLO.

Among the materials obtained in the summer of 1906 in the Miocene shales of Florissant, Colorado, is a beautifully-preserved caterpillar. It was collected by my wife at Station 14 (of Bull. Amer. Mus. Nat. Hist., 1907, p. 131). It appears to belong to a distinct genus, and may be characterized as follows:

*For a complete figure of *irus* egg see Scudder's Butterflies of the Eastern U. S. and Canada.

†Figured in Scudder's Butterflies of the Eastern U. S. and Canada, Plate 68, and in the CANADIAN ENTOMOLOGIST, Vol. XXXVIII, Plate 1 (May, 1906).

Phylledestes vorax, n. g., n. sp. (Fig. 9.)

Length, 27 mm.; with the general proportions of a Noctuid larva, the body fairly stout, cylindrical, with the usual legs and stigmata; head rounded, ordinary, not very large, its vertical length 3¾ mm.; body smooth, as preserved rather light reddish-brown, without spots or lines, but pallid ventrally; first body segment, in the anterior subdorsal region on each side, with a patch of six or seven minute round spots resembling ocelli, not bearing any hairs; no sign of a prothoracic plate; tubercles all absent (or not visible, though the skin is very well preserved, showing the spiracles, etc., clearly) except tubercle 1 (as I take it to be, since it is always directly above the spiracle), which is recognizable on body-segments 2 to 10 because it emits very stout bristles, those on segments 2 and 10 smaller and in bundles, of three on the former, two on the latter; the others large, stout and black, a single one on each side of each segment. This armature may be expressed by a formula, 0, 3, 1, 1, 1, 1, 1, 1, 1, 2, 0. The bristles, though very stout, and the longer ones about 3½ mm. long, are distinctly bristles, capable of bending, not spines; and they do not show the least spinulation or branching. The distance between the spiracles and the bases of the bristles is on the middle abdominal segments a little over 2 mm.

FIG. 9.—Fossil Caterpillar.

In the figure I have represented the caterpillar as walking on a twig, and have enlarged it, but have shown nothing that is not plainly visible in the fossil.

Scudder described eight species of butterflies from the Florissant shales, finding them all to belong to extinct genera. I am totally unable to place the larva now described in any existing genus, and even the family remains in doubt. There is an obvious superficial resemblance to some of the Nymphalids, but it appears to be only superficial. I should rather seek to place the insect somewhere in the neighbourhood of the Arctiid-Noctuid stem, but just where I do not know. May I ask for the advice and criticism of those who have a better knowledge of lepidopterous larvæ?

LIST OF HEMIPTERA TAKEN AT COMO, QUEBEC, DURING THE SUMMER OF 1906.

BY GEO. A. MOORE, MONTREAL.

(Continued from page 163.)

HOMOPTERA.

Membracidæ.

Entilia bactriana, Germ.—July 8. Common on Thistle.
Ceresa bubalus, Fabr.—July 23. Common.
Ceresa brevicornis, Fitch.—July 27. Several.
Ceresa diceros, Say.—July 26. Common.
Thelia univittata, Harr.—July 27. One specimen.
Archasia galeata, Fab.—July 7. One specimen.
Acutalis dorsalis, Fitch.—Aug. 4. Scarce.
Cyrtolobus varius, Godg. ?—July 14. Oak, common.
Ophiderma salamandra, Fairm.—Aug. 3. One specimen.
Carynota marmorata, Say.—July 23. Several.
Enchenopa binotata, Say.—July 25. Several.
Campylenchia curvata, Fabr.—July 15.

Fulgoridæ.

Bruchomorpha oculata, Newm.—July 25. Several.
Lamenia vulgaris, Fh.—July 23. Common.
Scolops sulcipes, Say.—July 24.—Common.
Cixius stigmatus, Say.—Aug. 2. Three specimens.
Cixius pini, Fh. ?—Aug. 2. One specimen.
Otiarus 5-lineatus, Say.—July 26. One specimen.
Pissonotus marginatus, V. D.—July 8. One specimen.
Laccocera vittipennis, V. D.—July 25. One specimen.
Phyllodinus nervatus, V. D.—July 14. One specimen.
Liburnia pellucida, Fabr.—July 20. Several.
Liburnia campestris, V. D.—July 6.
Liburnia lutulenta, V. D.—July 20.
Liburnia puella, V. D.—Sept. 2.
Liburnia furcata, Prov. ?—July 20.

Cercopidæ.

Aphrophora 4-notata, Say.—July 15. Common.
Philænus spumarius ustulatus, Fall.—July 8. Common.
Philænus lineatus, Linn.—July 2. Common.
Clastoptera obtusa, Say.—July 15. Common.

Clastoptera proteus, Fh., var. flava, Ball.—July 24. Several.
Clastoptera proteus, Fh., var. vittata, Ball.—July 25. Several.
Clastoptera proteus, Fh., var. nigra, Ball.—July 25. Several.

Bythoscopidæ.

Bythoscopus variabilis, Fitch.—July 14. Several on Oak.
Bythoscopus nigrinasi, Fitch.—July 15.
Pediopsis viridis, Fitch.—July 25. Several.
Pediopsis insignis, V. D.—July 20.
Idiocerus Provancheri, V. D.—July 28. Several.
Idiocerus alternatus, Fh.—July 26.
Agallia 4-punctata, Prov.—July 15.

Tettigonidæ.

Oncometopia costalis, Fabr.—July 27. Two specimens.
Tettigonia bifida, Say.—July 25. Common.
Tettigonia gothica, Sign.—Aug. 4. Common.
Diedrocephala coccinea, Forst.—July 14. Common.
Dræculacephala novæboracensis, Fitch.—July 2. Common.
Helochara communis, Fitch.—July 14. Common.
Eucanthus acuminatus, Fabr.—July 8. Two specimens.
Gypona Quebecensis, Prov.—July 24. Common.
Xestocephalus pulicarius, V. D.—Sept. 2. One specimen.

Jassidæ.

Paramesus vitellinus, Fitch.—July 26. Several.
Platymetopius acutus, Say.—July 20 and Aug. 4.
Deltocephalus Sayi, Fitch.—July 8 and Sept. 3.
Deltocephalus Minki, Fieb.—July 20.
Deltocephalus inimicus, Say.—July 2.
Scaphoideus auronitens, Prov.—July 30. One specimen.
Scaphoideus immixtus, Say.—July 23. Common.
Athysanus plutonius, Uhler.—July 2.
Athysanus Curtisii, Fitch.—July 2. Common.
Eutettix seminuda, Say.—July 8. One specimen.
Phlepsius fulvidorsum, Fitch.—July 27.
Thamnotettix clitellaria, Say.—July 2. Several.
Chlorotettix unicolor, Fitch.—July 14. Several.
Chlorotettix lusoria, Osb. and Ball.—July 25.
Jassus olitorius, Say.—Aug. 12.
Gnathodus punctatus, Thunb.—July 25.
Gnathodus viridis, Osb.—July 2.

Typhlocybidæ.

Dicraneura communis, Gill.—July 14.
Empoasca atrolabes, Gill.—July 8.
Empoasca mali, LeB.—July 23. Several.
Empoasca unicolor, Gill.—July 8. Two specimens.
Empoasca viridescens, Walsh.—July 31.
Eupteryx flavoscuta, Gill., and var.—July 15. Several.
Typhlocyba tricincta, Fitch.—July 2.
Typhlocyba bifasciata, G. and B.—July 21.
Typhlocyba sp., near tenerrima, H. S.—Sept. 2.
Typhlocyba comes, Say.—Sept. 2. Common on wild grape.
Typhlocyba comes, Say, var. 8-notata, Walsh.—Sept. 1. Wild grape.
Typhlocyba comes, Say, var. vitifex, Fh.—July 8.
Typhlocyba comes, Say, var. vitis, Harr.—July 31.
Typhlocyba comes, Say, var. ziczac, Walsh.—July 30. Wild grape.
Typhlocyba vulnerata, Fitch.—July 31 and Sept. 1.
Typhlocyba querci, Fh.—July 2. Oak.
Typhlocyba sp, near querci, Fitch.—July 15.
Typhlocyba rosæ, Linn.—July 7.

Psyllidæ.

Psylla carpini, Fh.—Aug. 2.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 21.

The Scolytidæ or Engraver-beetles.*

BY J. W. SWAINE, ITHACA, N. Y.

Scolytidæ have been described from almost every portion of this continent from Mexico to Alaska, and will probably be found wherever their food-plants occur. Many species are described from the West Indies, and a very large number from Central and South America, and from Europe. Many are known from Japan, Australia, Ceylon, South Africa and elsewhere. A few species seem almost world-wide in distribution; others are known only from small regions. A number of injurious species, *e. g.*, Scolytus rugulosus and Xyleborus dispar, have been introduced into America from Europe. Over 1,400 species of Scolytids are already described.

The North American members of the family Scolytidæ are usually somewhat elongate and cylindrical in form, and brown or black in colour.

*Contribution from the Entomological Laboratory of the Cornell University. June, 1907

They vary from one to a little over eight millimeters in length. *Crypturgus pusillus* is one of the smallest species, and *Dendroctonus valens* probably the largest. The legs are rather small and weak, as becomes their habits. The antennæ are short and geniculate, with an extremely large club, which is usually annulated. The vast majority of Scolytids cut their breeding-tunnels in the bark or wood of trees or shrubs. The chief North American exceptions are referred to below.

The burrows of the Scolytidæ are of great interest, and often of remarkable regularity and beauty. The burrows of many species are so characteristic that it is often easy to guess which species has been at work from an examination of the tunnels and galleries alone. (Figs. 10 and 11.)

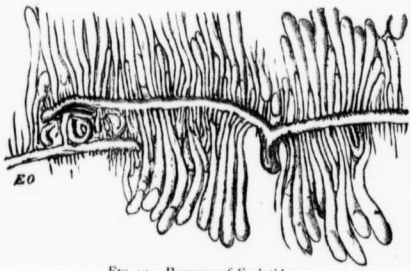

FIG. 10.—Burrows of Scolytidæ.

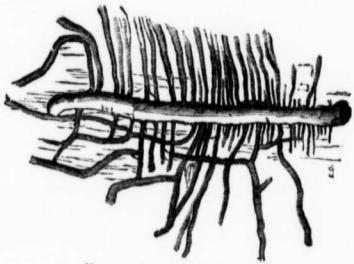

FIG. 11.—Burrows of Scolytidæ.

About one-quarter of our North American species infest coniferous trees, the Pines and Spruces being especially subject to attack. Of

deciduous trees, the Oak, Beech and Hickory suffer severely, and there is scarcely a northern tree but serves as food-plant for one or more species of this family. As a rule each species has a limited number of food-plants, but some few, like *Pterocyclon mali*, feed in many trees, both coniferous and deciduous.

According to their habits, the North American Scolytids may be separated into four fairly well-marked groups: the Bark-beetles, the Timber- or Ambrosia-beetles, the Twig-beetles, and a fourth group containing a few species of varying habit.

THE BARK-BEETLES.—The first of the above-named groups includes those forms which burrow in the bark, or between the bark and the wood. The adults enter through a hole in the bark, cut in many cases by the male, and drive a primary-tunnel, usually partly in the bark and partly in the wood, and generally either parallel with or at right angles to the wood-fibres. A few species burrow entirely in the bark, and a few species, included here in the Bark-beetles, cut their tunnels just below and parallel to the wood surface. The length of the tunnels varies in the different species from less than an inch to more than a foot. The female, at least in many species, does the greater part of the work, while the male guards the opening and removes the chips and refuse. These main-tunnels are always kept strictly clean. In sweeping the tunnels the beetles move backwards, scraping the refuse with the mandibles back to the fore legs, which pass it on to the middle, and these to the hind pair. When the opening of the tunnel is reached the tip of the abdomen is protruded and the refuse passed up to the hind pair of legs in the manner just indicated, and by the hind legs pushed away from the opening. During this operation the beetle turns in the burrow, thus distributing the refuse evenly about the opening. In cutting the tunnels also, the beetles constantly revolve, thus obtaining such perfectly cylindrical burrows.

When not at work one beetle is usually guarding the entrance. By backing into the entrance-hole the declivity of the elytra plugs the opening, and thus presents a complete protection from many enemies. The truncate character of the elytra serves well for this purpose, forming a continuation of the surface of the wood.

In niches along the sides of the primary-tunnel the whitish, almost transparent, eggs are laid, usually one, though sometimes several, in each niche. In some species, however, *e. g.*, *Dendroctonus terebrans*, they are laid in clusters along the sides of the primary-tunnel.

When egg-laying is completed the adults usually die, and their remains may frequently be found long after in the tunnel. Some species, however, cut a new tunnel and rear a second brood. With certain species, *e. g.*, *Chramesus icoriæ*, one sex, usually the male, backs into the entrance-hole, and, dying in this position, helps to guard the larvæ from such enemies as might wish to enter the burrow.

In those species which lay the eggs in masses along the sides of the primary-tunnel, the larvæ burrow in congress through the bark, forming irregular cavities extending laterally from the primary-tunnel.

When the eggs are laid in niches the larvæ burrow separately through the bark or between the bark and the wood, at right angles to the primary-tunnels; these side tunnels, larval galleries or mines thus formed increase in size as the larvæ grow, and are left completely filled with wood or bark fragments which have passed through the body of the larvæ. The latter feed entirely upon bark or wood.

If the direction first assumed by the larvæ is not parallel with the wood-fibres, the larval-mines are usually found to turn, tending to follow the direction of the fibres. The larvæ at and near the ends of the primary-tunnel swing around almost immediately, while those nearer the middle do so as rapidly as is possible without encroaching upon the mines of their neighbours. Usually the larvæ keep carefully to their own preserves, only crossing a neighbour's gallery when necessity compels them to do so. When the larval mines are entirely in the bark their direction has no definite relation to that of the wood-fibres.

After the larval development has been passed, varying in length with the species, the ends of the larval mines are enlarged and sometimes driven down into the wood to form the pupal chamber. In some species the pupal period lasts but a week or ten days, in others the winter is passed in this condition. After transformation is completed, the young adults cut their way out through the bark, forming the openings known as "shot-holes."

While the primary-tunnel and also the egg-niches are usually deeply engraved in the wood, the larval-mines are often entirely in the bark, or only cut the wood at the pupil-chambers. On Ash trunks, where the bark is thick, the larval-mines of *Hylesinus aculeatus* but slightly engrave the wood surface, while on small branches, where the bark is thin, the mines often cut the wood as deeply as they do the bark.

Frequently a number of primary-tunnels, not always cut by the same individual, radiate from a common "nuptial-chamber" situated just beneath the common entrance-hole. In such cases, at least with some species, the male cuts the entrance-hole, the nuptial-chamber and often the beginnings of three or four primary-tunnels. The male is then joined by one or more females, which finish the primary-tunnels and the egg-niches; the work of the male after the entrance of the females consists mainly in removing the chips and refuse and guarding the entrance-hole.

When the primary-tunnel is long, as is the case, *e. g.*, with several species of Tomicus, there may be one or more "ventilation holes" through the bark.

After the labours of egg-laying are over, the adults of some species of Bark-beetles cut irregular, winding "food-tunnels," deeply engraving the sap-wood. Some species hibernate in their food-tunnels, and others in short burrows apparently cut for the purpose.

A number of species hibernate as larvæ, some as pupæ, others as adults, and with some species all three stages may be found in the burrows during the winter.

The Bark-beetles include by far the largest number of our North American species.

(To be continued.)

THE AMBROSIA BEETLE (XYLEBORUS XYLOGRAPHUS, SAY), AS AN ORCHARD PEST.

BY O. E. BREMNER, SAN FRANCISCO, CALIFORNIA.

During the early spring of 1904 my attention was called to the injury being done to Peach and Prune trees in the Dry Creek Valley, Sonoma County, California, by a minute beetle which proved to be one of the Ambrosia Beetles, *Xyleborus xylographus*, Say.

The most interesting fact to me was the nature of the attack, for contrary to all former reports of the depredations of this beetle, I found it attacking perfectly healthy Peach trees, and also Prune trees in a perfectly healthy state, as well as those which seem to be suffering from an excess of moisture, heat or cold, as the case might be. In the case of the Peach trees there was a marked exudation of gum, but this did not seem to hinder the onward work of the borer, but did, however, prevent the mouth of the gallery from being kept open, which resulted in the healing

of the wound, and no damage could be seen the following year from the attack.

With the Prunes it was different; there was no gumming, and only the very small pin-hole, with its little trail of wood-dust to mark the spot where the little borer was industriously working within; but six such holes were sufficient to cause the death of the tree.

The food of these beetles is a fungus grown on the walls of the galleries and chambers made by the beetles, and develops only under certain conditions, namely, when the tree is in a diseased or dying condition, and in the case of these fruit trees this condition is brought about by the attack of the beetle itself. On each side of the hole for more than a quarter of an inch and extending up and down the body of the tree for from six inches to two feet, and continuing inward as far and as fast as the gallery progresses, the wood of the tree turns brown, and gives off an odour, exactly similar to those conditions arising from the so-called sour-sap disease, and under this condition the Ambrosia seems to develop even better than where the trees seemed to have been attacked, after having partially succumbed to some other cause.

There seems to be no special time for attack, but from early spring until late fall I found trees being attacked, and galleries containing beetles in all the stages of development. As to remedies I found all those prescribed to be of no avail. Plugging, opening the galleries to the light, external and internal applications, seemed to have no effect. The only remedy, other than that of removing the affected trees and burning, would be a heavy fumigation with hydrocyanic acid gas when the trees are dormant.

The beetles always enter the tree from the north and east sides, and rarely more than six feet from the ground. Another point of interest is: As soon as a gallery terminated in a chamber, an adult of the colony took up its station at the door of the gallery with the tip of the elytra just flush with the surface of the bark, where it suffered death rather than admit an intruder, for in every case that I inserted a wire I found that this beetle died rather than escape, which it could easily have done by running along the gallery to the chamber. This sentinel also seems to act as garbage man for the colony, removing all excess of wood-dust and excreta not needed in the propagation of the Ambrosia.

A description of this beetle can be found in Bulletin 7, New Series Division of Entomology, U. S. Department of Agriculture.

CECIDOMYIIDÆ: A STATEMENT.

BY E. P. FELT, ALBANY, N. Y.

The Gall Midges, though extremely small in size and frequently of very uniform colouring, are, nevertheless, easily referable, for the most part, to family, genera and species, by characters found on the insects themselves. Inasmuch as two and sometimes three or four different species may inhabit the same gall or very similar galls on the same plants, it must be admitted that a system dependent largely upon plant deformations is not entirely satisfactory. Moreover, a number of species, including in this category practically all the members of two important subfamilies, produce no vegetable deformations. Obviously these latter species, if identified at all, must be separated by characters presented by the insects themselves. The minute we allow this, there must be some method of distinguishing them from the host of other species with which they might be confused if taken in the field away from the galls in which many forms breed. Our correspondents may be interested to know that the preliminary descriptions issued from this office have, in every instance, been condensed from more detailed characterizations (not to mention numerous photomicrographs and other illustrations), all bearing the same number and easily associated with specimens similarly marked, consequently there can be no question later on as to the identity of the forms described. Furthermore, we are now engaged in a serious systematic and biologic study of this group, and have already well in hand a series of tables for the separation of not only subfamilies and genera, but also species, in such a manner that all may be recognized irrespective of the plant or material in which they breed. This, it seems to us, is the only logical basis for a classification, and something that is imperatively needed, particularly when it is remembered that very few of the published descriptions are sufficient for the identification of adults, unless they are taken in connection with the galls. Obviously, progress must be seriously hindered if this condition is allowed to persist, since many of the earlier described species can be identified only by securing the galls and breeding the insects therefrom. We would not imply by the above that the biological study of this group should be neglected, far from it; this phase should be pushed with all possible vigour. We do urge the necessity of a thorough study of the adults and the replacing of the present more or less insufficient descriptions by characterizations that will bring out the specific differences most clearly.

The above statements are made at this time owing to the fact that

certain strictures* on our recent work have appeared. The critic seems to have overlooked the fact that the descriptions referred to in particular are simply preliminary; he was presumably unaware that they are based upon detailed descriptions, and appears to have ignored the fact that most species bear excellent generic and specific characters, and that a number, at least, can under no circumstances be associated with any vegetable deformation. There is no reason why adults of this group should not be studied independently of the earlier stages any more than in the Hymenoptera, Lepidoptera and other orders. It is regrettable that there must inevitably be some confusion between a system which, sooner or later, will break down on account of its own limitations, and the introduction of one based upon well-accepted systematic principles. The earlier the change is made, the better for this branch of entomology, and we hope shortly to have the pleasure of demonstrating the wisdom of this course.

THE CLASSIFICATION OF THE CULICIDÆ.

BY EVELYN GROESBEECK MITCHELL, WASHINGTON, D. C.

In Dr. Williston's article under the above head (CAN. ENT., Dec., 1906), he advocates uniting the Corethridæ and Dixidæ with the Culicidæ. Yet Schiner, praised by Dr. Williston as a model systematist, erected the family Dixidæ, while Brauer, whom Williston condemns, was in favour of its union with the Culicidæ.

Why should the Corethridæ, whose larvæ and pupæ differ greatly in structure and habits from those of the Culicidæ, be placed in the latter family? Not only do the early stages differ, but the mouth-parts of the adults, admittedly of importance in the classification of the Diptera, are not fitted for biting, and are comparatively short, in contradistinction to the long Culicid proboscis, which is so constructed as to enable not only the females but also males of certain genera to obtain blood. The palpi of Corethridæ are slender, very flexible and strongly recurved, whereas in the Culicidæ the palpi are robust, almost straight, rigid and directed forward. Corethridæ are said to deposit their eggs in a mass of gelatin, a method of oviposition unknown among the Culicidæ, and their pupæ float submerged or, in the case of Corethrella, on the surface, not being active like those of Culicids.

Mr. M. T. Thompson, of Clark University, who has been making special comparative studies of the internal anatomy of the adults and larvæ of many of the Diptera, the results of which he intends later to publish, has very kindly informed me of some of these results, giving permission to

*1907.—Beutenmueller, Wm., new species of Gall-producing Cecidomyiidæ. Amer. Mus. of Nat. Hist. Bull., Vol. 23, Art. 18, p. 385-400.

quote them in this paper. The Diptera he has studied seem to fall into two groups, those where the antlia or pumping stomach is simple, and those in which it is divided by a semisphincter muscle into two parts, the latter being the case with the more primitive forms, while among the higher forms (Dolichopodidæ, Muscoidea, etc.), the posterior division is wanting. In Corethra, Simulium, the Tabanidæ, Bombylidæ, Therevidæ, Asilidæ, etc., the preneural and the postneural parts of the antlia are thus divided, no trace of the separating semisphincter muscle being found in Culex or Anopheles. There are in Corethra four anterodorsal dilator muscles instead of two as in Culex and Anopheles. It has, like these, three œsophageal diverticulæ, but only four rectal papillæ, where these possess five. Furthermore, Mr. Thompson finds that Corethra differs from Culex and Anopheles in having the hypopharynx connate with the labium in both sexes; possessing four instead of five malpighian tubules; simple instead of tripartite salivary glands; no clypeus, this being replaced by an oval sclerite; and no "proboscis canal." He remarks that the internal characters would seem to indicate that Corethra is neither a Culicid nor a Simuliid, but a lateral branch low down on the Culicid stem; the larvæ, which lack flabellæ and differ in rostrum, place of attachment of antennæ, presence of air floats, form of body, division of foregut, etc., tend to confirm this. He at present regards the evidence, while pointing to a close relationship of Corethra to Anopheles and Culex, and showing notable relationship between Corethra and Simulium, as indicating that Corethra and Anopheles have the same common ancestor, the former and more primitive branching off at a lower point on the ascending scale, while Culex may be derived from Anopheles. Would there be any gain by merging such heterogeneous elements as Culex and Corethra in the same family?

Likewise, why should the Dixidæ, whose wing-veins are bare of scales, and whose larvæ and pupæ differ so from those of the Culicidæ, be included with the latter? Among the Dixidæ the antennæ of the adults are almost bare, and are quite similar in the two sexes, whereas in the Corethridæ, and with but one known exception in the Culicidæ, they bear long hairs, which, except in a few Culicid cases, are longer and much more numerous in the antennæ of the males than in those of the females. The subcosta of the Dixidæ is short, reaching only to a point opposite the first branching of the radius; in the other two families it is prolonged nearly half its length beyond the first branching of the radius. Moreover, the larvæ of the Dixidæ are distinguished by having the three thoracic segments always distinct and by two pairs of fleshy appendages, resembling prolegs, on the first and second abdominal segments, no trace of anything like prolegs being found in either of the other two families. The pupæ are inactive, floating quietly on the surface.

Had Dr. Williston personally investigated the early stages of these insects before writing his criticism, I feel certain that his view would differ widely from that which he now holds.

Admittedly, more than in any other order of insects, the early stages in the Diptera assume unusual importance in separating the order into the higher groups. Thus the primary divisions, Orthorhapha and Cyclorhapha, are founded entirely on larval characters and manner of pupation. The adults possess not one character whereby they may be separated from those of the opposite group, yet no one doubts the validity of the two divisions. In judging, therefore, of the value of groups in this order, it should be borne in mind that although the adult characters may sometimes appear but slight, still the group may be strongly marked as such by characters of the early stages.

This important fact Dr. Williston ignores, and overlooks also the serious disadvantages under which Mr. Theobald was working, in being obliged to deal almost entirely with the adult forms, and in not being a trained dipterologist. Under these circumstances it must be admitted that Mr. Theobald acquitted himself very creditably.

In criticising Mr. Coquillett's classification, especially that portion of it dealing with the subfamilies Psorophorinæ and Culicinæ, Dr. Williston may be pardoned for not being aware of the fact that these two subfamilies were separated chiefly by characters of the early stages. These, or any other characters of early stages of Culicidæ, however, Mr. Coquillett is forbidden to refer to or even to study further, in order that the field may be left clear for the nondipterologist, who claims it as "pre-eminently his own," and insists on its being reserved as such. Thus it happened that in Mr. Coquillett's classification only the weakest characters, those derived from the adults, were given. In passing be it noted that it is the outstanding scales *plus* the narrow wing scales which form the distinctive character of the adult of the Psorophorinæ, as well as the arrangement of the outstanding scales, not the narrow scaling *alone*, as Dr. Williston seems to think was intended. Narrow or broad wing-scales alone would certainly not distinguish a subfamily. Also, I agree with Dr. Williston that natural genetic characters, such as palpal ones, should be used when present. But if they are difficult of detection, and their finding involves the possible destruction of the specimen, it seems as if some other more prominent, even though artificial, character should be found if possible, to be used as an accessory character for easy identification.

In order that the standing of the two subfamilies, Psorophorinæ and Culicinæ, may be more clearly understood, their chief characters are here appended :

CULICINÆ.	PSOROPHORINÆ.
LARVÆ never insectivorous, their mouth-parts fitted for directing current of water into mouth, for sifting and brushing.	LARVÆ insectivorous, their mouth-parts fitted for seizing and tearing.
MOUTH-BRUSHES of many spreading, slender hairs, some of which are, in some cases, lightly pectinate on about the distal sixth; the hairs project forward.	MOUTH-BRUSHES a few appressed plates, heavily pectinate along the entire inner margin, and directed obliquely backward beneath head or held out at right angles to it.
MAXILLÆ conical, no hooked spines, but many long, movable hairs and short hairs.	MAXILLÆ trapezoidal, with many curved spines, a few short hairs.
LATERAL COMB of mandible of many movable, long, triangular plates, their base at an acute angle with top of mandible.	LATERAL COMB of mandible a few heavy, immovable spines, their base almost at right angles with top of mandible.
MARGINAL COMB of mandible 15–20 immovable spines.	MARGINAL COMB of mandible absent.
BITING part small.	BITING part very large.
ANTENNÆ near anterior margin of head, eyes near middle of sides of head.	ANTENNÆ near middle of sides of head, eyes near posterior margin.
PUPÆ with anal flaps longer than broad.	PUPÆ with anal flaps as broad as long.
ADULTS with femora devoid of outstanding scales except in the genus Ædeomyia, where they form a fringe along the upper and the lower side of the apices of the femora and the bases of the tibiæ. The wing-scales of this genus are broad, and its larval and pupal characters typically Culicid.	ADULTS with femora and tibiæ bearing many outstanding scales irregularly and thickly arranged around them, never a fringe. Wing-scales narrow.

The eggs of Psorophora are distinctive, being symmetrically ovate and distinctly differing from the thirty-odd of the Culicid eggs which I have seen, but the difference is easier to see and illustrate than to describe. The others are not nearly so ovate, generally unsymmetrical, and their small diameters proportionately less as compared with the long diameter than in the Psorophora eggs.

A NEW BUTTERFLY OF THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y., AND FRANK E. WATSON, NEW YORK CITY.

INCISALIA POLIOS* (new species).

Type ♂: Abdomen and thorax brown above, the former ashen beneath; antennæ dark brown, ringed with white, the club tipped with rufous, the basal third white beneath; eyes narrowly edged with white. Upper surface of wings dark brown (as in the congeneric species), with a little red-brown near the anal angle; fringes white, the long scales tipped with brown, interrupted with brown at the end of each nervule; next to the fringe two fine, parallel brown lines, between which is a lighter line interrupted by the nervules, and within which is *a continuous, distinct white line.* Secondaries somewhat produced at tips of nervules, but *not tailed.* Stigma present. Under surface of primaries warmer brown, with an irregular extramesial white stripe from the costa to the first median nervule, edged inwardly with dark brown; about midway between this and the outer margin a series of five small, distinct, dark brown, nearly circular spots, not more than one in any interspace; *outer half of area between these spots and the margin, hoary.* Two obscure dark lines crossing the cell. Under surface of secondaries: Basal half nearly uniform pitch brown, limited exteriorly by a fine broken white line (next to and within which the colour is deepest), obscurely variegated with lighter shades; outer half of wing with an arcuate series of eight rich chestnut-brown dots paralleling the outer margin, one to each interspace, except between the first and second median nervules, where there are two, the outer roughly crescentic, with tips toward the inner, which is smaller and round, the space between them lighter brown. Basal area with greatest projection between the second and third median nervules. Beyond the spots the wing is ashen gray as far as the inner of the two fine marginal lines, which are much as on the upper surface, except that near the outer angle the gray is present only near the margin. The same ashen colour fills the space between the dark basal area and the series of spots, from the third median nervule to the inner margin. At the end of each nervule this hoary border is indented by a small black triangle. Expanse, 29 mm.

Type ♀: Outer margins of all wings more strongly rounded than in ♂; white parts of margin and fringe above less distinct, especially on

*πολιός = hoary.

primaries. Beneath: Basal two-thirds of primaries darker than outer third, black lines in cell very faint; inner edge of hoary margin cleaner and in sharper contrast with the brown. Secondaries very much as in type ♂; white margin of basal area wanting, except for a dash near the costa; hoariness between arcuate series of spots and basal area extending from inner margin to the free nervule; basal area somewhat lighter near costa, and with a vague sprinkling of whitish scales. The browns of both wings brighter than in ♂. Expanse, 31 mm.

Type ♂ taken at Lakewood, N. J., on April 27, 1906; type ♀ taken at Lakewood, N. J., April 21, 1907.

These types were selected from a series of 84 (all from the same locality) with a view to avoiding extremes of coloration. Of the lot, 45 have been selected as paratypes, 32 males and 13 females. The following variations are found among them: The two fine, brown marginal lines are (rarely) merged into a single broad one (both sexes); the white line within these is (frequently) reduced, though never wholly absent; some specimens have a bronze or olivaceous reflection in certain lights; the rufous suffusion is often quite absent, and, on the other hand, is sometimes conspicuous, in one exceptionally brilliant ♀ (paratype No. 25) it extends to the primaries; basal area of secondaries sprinkled with yellow scales (paratype No. 15); variegation of this area (always slight) sometimes a little less, sometimes a little more, obscure than in types; extramesial stripe of primaries beneath variable in intensity, and in extension from costa (in paratype No. 25 it extends to the submedian vein); relative values of the browns beneath somewhat variable; submarginal spots on primaries occasionally rather faint, especially among the males, but always present; spots of the arcuate series on secondaries sometimes obscured or absent between the subcostal nervules.

During the winter of 1904-5 Mr. Wm. T. Davis presented the junior author with two males (April 30) and one female (April 26) of this species, taken at Lakehurst, N. J. The value of the form was not recognized by us until after two seasons of collecting, the constancy of the characteristic markings, coupled with the fact that *each year these butterflies appeared with augustus, and from a week to ten days earlier than either irus or Henrici* (both of which are found, though not commonly, at Lakewood), convinced us that it was entitled to specific distinction.

It is easily separated from *Henrici* by the presence of the discal stigma in the male, the absence of "tails" on the secondaries, the hoary margin and the prominence of the submarginal dots on the primaries beneath. The latter are in *Henrici* missing (usual) or at most represented by blurred clouds slightly darker than the yellow-brown ground.

From *irus* it may be distinguished by the relatively uniform colour of the basal area of the secondaries beneath (in *irus* this is strikingly variegated), the absence of tails, the hoary margin of the primaries, and by the almost total obliteration of the black-pupiled eye-spot, which in *irus* is a salient feature of the wing ornamentation, occupying the interspace between the first and second median nervules of the secondaries beneath.

Polios most nearly resembles *Mossi* (Hy. Edwards), from which it differs in the presence of the hoary margin of the primaries, the broad hoary area of the secondaries (in the type *Mossi* these whitish scales are confined to a small space along the inner margin, and elsewhere replaced by large chestnut-brown spots, surmounted by black crescents), and in the colour of the fringe.

Five specimens from other localities in the collection of the junior author are confidently referred to this species; they bear the following labels: ♂ and ♀, Calgary, Alberta (no date); ♀ ♀ ♀, Graham's Park, on Rio de los Pinos, Cal., May 11th and 12th, 1899. There are also specimens in the Museum of Natural History, New York City, and in the National Museum at Washington, labelled Colorado, which agree very closely with our specimens.

Undoubtedly *polios* has been confused by collectors with *irus*, *Henrici* or *Mossi*, and it is quite possible that the specimens mentioned by Scudder* as varietal forms of *irus*, having "the outer margin of the primaries . . . . narrowly hoary," should be referred to this species.

The types have been deposited in the U. S. National Museum; paratypes Nos. 1 and 2 have been sent to the Museum of the Entomological Society of Ontario; paratypes Nos. 3 and 4 were presented to Dr. Henry Skinner, of Philadelphia; paratypes 5 and 6 are now in the New York State Museum at Albany, and the other paratypes remain for the present in the collections of the authors.

*Butterflies of the Eastern U. S. and Canada, p. 837.

THE LIFE-HISTORY OF APANTELES GLOMERATUS, L.*

BY ROBERT MATHESON, CORNELL UNIVERSITY, ITHACA, N. Y.

During the past summer, while doing some work on the larva of the cabbage butterfly (Pieris rapæ), I was struck by the lack of information regarding the life-history of one of its most important parasites, *Apanteles glomeratus*, L. In none of the publications on Economic Entomology could I find any definite information, and the text-books were equally as unsatisfactory.

Reaumur, in his Memoirs, Vol. 2, pp. 417–, states that the females of this parasite deposit their eggs, one at a time, laying in all about thirty eggs in each larva. He further adds that they select the intersegmental areas as the place of oviposition, particularly between the eighth and ninth and ninth and tenth segments. W. T. Bree, in the Mag. of Nat. Hist. for 1832, pp. 105–109, states that he observed several females in the act of oviposition, and his description corresponds closely with that given by Reaumur. Both writers emphasize the fact of the fearlessness of the parasite during oviposition, and that only one egg is deposited each time. Evidently what Reaumur and Bree observed was the oviposition not of the true *Apanteles glomeratus*, L., but of *Pteromalus puparum*, L.†

Seurat, '99, in his "Contributions a l'étude des Hyménoptères Entomophages," states that the females of *Apanteles glomeratus* oviposit in the young larvæ, depositing a large number of eggs in each.

In rearing a large number of these parasites I was able to observe the act of oviposition as well as to trace their life-history. The adults, on emerging, do not immediately fly away, but remain walking back and

*Contribution from the Entomological Laboratory of Cornell University.

†(I had an excellent opportunity for observing the manner of oviposition of this latter parasite, and it corresponds exactly with that given by Reaumur and Bree for *Apanteles glomeratus*. I found *Pteromalus puparum* at work late one afternoon. It was not at all disturbed by my removing the larva to a small box. Taking them to the laboratory, I was able to observe the act of oviposition under the microscope, without in the least disturbing the insect. I watched it oviposit at intervals of about twenty minutes till nearly 11 p.m., and next morning I found it still ovipositing. It ceased early in the forenoon, so that in all probability it had laid over thirty eggs in the one larva. The conclusion, that both Reaumur and Bree had observed the oviposition of this species rather than of *Apanteles glomeratus*, is strengthened by the fact that Reaumur states that the larvæ of these parasites are sometimes found in the chrysalids of Pieris rapæ, but after the fourth day exhaust the food supply, and do not transform. This is the condition we would expect to find in the case of *Pteromalus puparum* during the latter part of August and the first of September, as it passes the winter in the larval state, and does not spin its cocoon till the following spring.)

forth over the cluster of cocoons, the males evidently waiting for the females and the females waiting to be fertilized. Mating takes place a short time after emergence, within 12–24 hours.

Immediately after fertilization the females go in search of their host larvæ. Any cabbage leaves placed in the breeding cages soon attracted their attention, and, if any unfortunate larvæ were present, they soon fell victims to these parasites. Walking back and forth over the cabbage leaves, the females kept their antennæ in constant motion. As soon as one found a larva, not too large, preferably in the first, second or third stages, she prepared to oviposit. Bending her abdomen almost at right angles to her body, the parasite rushed upon the *Pieris* larva and drove her ovipositor through the skin, while her wings, in nearly all cases, were extended dorsally, closed above the thorax. I never observed them oviposit on the dorsum, always on the latero-ventral region, and it was not infrequent to observe two or three ovipositing in a single larva at the same time. The host usually objected most vigourously to such treatment, but the parasites remained unmoved, stroking the larva with their antennæ or remaining motionless. Sometimes they endeavoured to oviposit in an older larva, but it succeeded in knocking them off, though undoubtedly some eggs were deposited. The time of oviposition varied from fifteen to twenty seconds. At each act of oviposition from fifteen to thirty-five eggs are deposited just beneath the epidermis, so that with the moulting of the host the eggs are not shed also. In one larva oviposited in three times I counted, when dissected, sixty-five eggs, and undoubtedly there were a few more which I did not succeed in finding. These eggs were found floating freely in the body cavity, and were not inclosed in packets. These facts stand in striking contrast with Reaumur's and Bree's observations.

These eggs hatch in from three to four days. The larvæ feed upon the lymph and fatty tissue of their host, carefully avoiding the vital parts. They become mature during the latter part of the larval life of their host—that is, in about eight to twelve days—and emerge by cutting their way through the skin. The spinning of their cocoons occupies scarcely over three-quarters of an hour, often less. Reaumur, Vol. 2, p. 422, gives an excellent description of the manner of spinning the cocoons.

The number of parasites reared from a single caterpillar varies greatly. The smallest number that I have reared was sixteen, and the largest was fifty-two. Bignell reports having reared one hundred and forty-two from

a single larva. In view of the recent work on polyembryony in several Hymenopterous parasites, it is interesting to note that this does not occur in the development of *Apanteles glomeratus*.

Seurat observed what he considered the moulting of these larvæ while still within their host, but Kulagin, '92 (Zoologischer Anzeiger, Vol. XV, pp. 85–87), who studied their embryological development, states that they do not moult till they emerge from their host. In none of the sections which I examined, did I find any indications which would go to show that they moulted while within the host.

At time of emergence from the host the stigmatic trunks, with the exception of the second pair, open to the exterior. About two days later they moult inside the cocoons, changing to the pupal state. The pupal period lasts from five to ten days, varying in length according to weather conditions, being longer when the temperature is low. The adults emerge by cutting a circular lid at one end of the cocoon and pushing it off. They live, in all probability, only a short time. Those reared in confinement lived only a few days, in most cases all would be dead on the sixth day after emergence.

This parasite is, undoubtedly, of great economic importance in destroying large numbers of the larvæ of the cabbage butterfly. Chittenden records in Bull. 54 of the U. S. Dept. of Agriculture a case of complete parasitization in a large number of *Pieris* larvæ examined. During the summer of 1906 I visited several small cabbage fields at various intervals from June till the last of October. During the early part of the season the number of caterpillars parasitized was very small, but later, in July and August, sometimes nearly 50 per cent. of those brought in would be parasitized. In September and October the majority of the larvæ examined were parasitized, probably on the average between 60 and 75 per cent. at that season of the year.

A NEW PHORID GENUS WITH HORNY OVIPOSITOR.

BY D. W. COQUILLETT, WASHINGTON, D. C.

Among the Dipterous family Phoridæ is a small group, characterized by the females having a large, exserted, horny ovipositor. This group is represented on this continent by two described genera, *Apocephalus* from North America, and *Melaloncha* from South America. To these is now

added a third genus, differing from the first by the simple third vein, from the second by the absence of the fringe of bristles along the outer side of the hind tibiæ, and from both by the greater number of frontal bristles, also in that the median pair in the lowest row is proclinate instead of reclinate. Some idea of the appearance and structure of this interesting form may be gleaned from the accompanying description and figures.

PSEUDACTEON, new genus.

Front slightly broader than long, bearing four transverse rows of four setæ each, the latter reclinate except the median pair in the lowest row, which are proclinate (fig. 12). Third antennal joint oval, about one-third longer than broad, the arista apical. Palpi well developed, clavate, bearing about four bristles at the apex, proboscis robust. Female with a horny ovipositor about half as long as the abdomen. Legs devoid of bristles except at the tips of the hind and middle tibiæ. Venation normal, the third vein simple. Type, the following species:

FIG. 12.—Front of Pseudacteon.

Pseudacteon Crawfordii, new species.—(Fig. 13.) Black, the pleura dark brown, the mouth-parts, legs and halteres light yellow. Wings hyaline, veins brown, the four light ones noticeably paler toward their bases. Length about 1 mm.

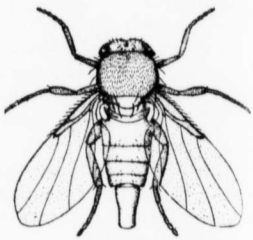

FIG. 13.—Pseudacteon Crawfordii.

Dallas, Texas. Three males and seven females collected, June 17, July 19 and October 22, 1906, by Messrs. J. C. Crawford and W. D. Pierce. One of the females was observed to apparently deposit an egg in the head of an ant, *Solenopsis geminata*, and as the Phorids were found only in the company of ants of this species, it is altogether probable that they infest the heads of the latter after the manner of *Apocephalus Pergandei*, which is known to live within the heads of another kind of ant.

Type No. 10294, U. S. National Museum.

GEOMETRID NOTES.

BY HARRISON G. DYAR, WASHINGTON, D. C.

In CAN. ENT. for April, 1907, Mr. Taylor has a note on *Euchœca perlineata*, Pack. It appears to me that he is clearly in the right in his conclusions, for in any case where published descriptions and figures contradict an alleged type, it is the evidence from the publication that must prevail. Types, even when labelled by the author himself, cannot take precedence over a published description, except in cases where an error of observation can be demonstrated.

I think it has not been put on record that *Cosymbia albocostaliata*, Pack., is a Noctuid. It will be probably best placed in *Pleonectyptera*, Grote, and, to follow Professor Cockerell's recommendation (CAN. ENT., XXXIX, 136, 1907), I hereby provisionally nominate it *Pleonectyptera albocostaliata*. There is a specimen in the Neumœgen collection in the Museum of the Brooklyn Institute, and two in the U. S. National Museum, the latter collected by Mr. W. F. Fiske at Tryon, North Carolina. I have not seen the type, but the specimens agree perfectly with Packard's figure.

LAERTIAS (PAPILIO) PHILENOR (LINNÆUS).

BY A. A. GIRAULT, BLACKSBURG, VA.

On June 20th, 1903, at Blacksburg, Virginia, a colony of the larvæ of this species was obtained from vines of the Dutchman's Pipe (*Aristolochia*) growing over the ruins of an old stone building. The majority of them were nearly full-grown, and the whole colony was placed in a breeding cage and supplied with food I offer the following notes at the risk of repeating :

The Larva.— Nothing especially important was noted concerning the caterpillar, excepting a variation in the number of spots in the dorso-lateral line. This line of orange spots or tubercle areas consists usually of a tubercle on the first abdominal segment just above the spiracle, and four tubercle areas, one on the 4th, 5th, 6th and 7th abdominal segments respectively, and all about the same size, but varying somewhat in colour. In the case of one larva, an additional area was present on the 8th abdominal segment, but was faint; in another larva, after the first segment, the areas began on segment 3 instead of the 4th, continuing to the 7th (inclusive). Two larvæ were found with the spots running from the 3rd to the 8th abdominal segments, but those on the 3rd and 8th segments were faint. Apparently, when there are more than the usual number present the additional ones are faint. All of the larvæ were in the last

instar. The line of areas in the dorsal region may be unsymmetrical, which is often the case in lepidopterous larvæ. The osmateria secrete a bright yellow liquid of a sweetish, disagreeable odour, which is non irritating to the hands.

In this larva the antennæ are very short as usual, but the long fleshy processes on the prothorax seem to function in their stead. When in locomotion they are held before the head, waving up and down, and the larva is guided by them. The caterpillars occasionally leave a silken trail behind them.

The larvæ may become carnivorous when hungry. Some young larvæ, more than half-grown, were placed in a breeding cage with chrysalids, and kept well supplied with food for several days until it gave out. After the growing larvæ had been without food for about 24 hours, they began to attack the chrysalids, generally eating away the entire upper half. In one case one whole side of the pupa from prothorax to abdomen was eaten, including most of the viscera, and two of the caterpillars, evidently concerned in this, were resting quietly beside the remains, plump as if surfeited. The chrysalids were eaten with apparent relish. This habit can hardly be termed cannibalism, as it was appeasance of abnormal hunger, and the larvæ did not attack the chrysalids in the presence of an abundance of their natural food.

Method of Girdling.—The larvæ began to prepare for pupation on June 23rd, along the wire gauze sides of the breeding cage. In preparing the girdle with which the pupa is suspended, the caterpillar first spins a loose web or mat of silk under its body. The girdle is then commenced by fastening a thread to this mat well under the side of the body, and then bringing it over across the venter of the thorax, inclosing the legs (the venter of thorax being arched), by bending the head backward, and then attaching the other end of the thread on the other side of the body about the same distance back and under, or just opposite the first attachment. This forms a loop of silk over an arch or curve of one side of the body. These movements are repeated five or six times, a single thread being added each time to the girdle, and the larva in fastening them from side to side has to be very careful and agile in movement. The head is thrown back, the thoracic venter arched, while the rest of the body is straight and flat against the support; therefore, the movements are nearly all cephalic and thoracic. When the girdle is finished, consisting of five or six threads of closely-applied strands of silk, the larvæ pushes or works its head under it, and by a forward and then a backward movement of its body, incloses the latter also within the loop or girdle. It is then gradually worked back to its usual position, passing

around the body in the incision between the second and third abdominal segments. After the girdle is in place, the caterpillar settles into a somewhat crouched position, and then finally arches its body as it awaits the time of ecdysis, several days afterwards. The placing of the girdle occupies about two minutes; if placed too far caudad it is liable to interfere seriously with ecdysis. Unfortunately, no observations were made during pupation, so that the method of placing the girdle by the chrysalis was not seen. Described from 13 specimens.

Duration of Pupal Instars.—The duration of pupal life for fifteen individuals reared averaged 16 days, from June 28th to July 14th, and ranged from 14 to 21 days. The males issued before the females.

NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

(Continued from page 160.)

Cerostoma dorsimaculella, sp. nov.—Expanse, 18.5 to 19.5 mm.

Head whitish-gray, in which are mixed a few dark gray scales; palpi whitish-gray, tuft of second joint clouded with brownish-gray at the outside and at the ends, apical joint dark brown beneath and less so on the sides, whitish-gray above; antenna white, annulated with brownish-gray; thorax cinereous-gray, posterior tip whitish, inner edge and base of patagia dark brown; abdomen whitish-gray, anal tuft with a cinereous tinge; legs cream-white, heavily dusted with brownish-black in front.

Fore wing very light gray, with a slight yellowish tinge, strigulated and marked with bronzy-black. The most conspicuous marks are on the dorsal margin, below the fold; the inner is a narrow triangle, with base on dorsum at inner fourth, and apex touching fold at inner third; the outer spot rests on dorsal margin between middle and outer fourth, its upper edge is slightly concave, causing an enlargement at the inner end and a linear extension at the outer end that rises, obliquely outward, above the fold. There are two curved transverse lines from costa, before middle of wing, not reaching fold, beyond them are five shorter costal streaks, before the outer fourth. Below these latter, at the end of cell, is an angulated line, with a few blackish scales above and below it. There are a few dark dots in the line of the middle of the wing, one at base, one a little beyond base, and two near middle of cell. There is a large dark dash in apex, which extends into cilia, becoming paler at the tip. A few dark scales at end of cell, and another small cluster above tornus. Cilia concolorous.

Hind wing paler gray than fore wing, slightly darker around termen, cilia paler, with a faintly darker basal line. Under side the same, a black dot on costa before apex. Under side fore wing darker gray, with a few black dots on costa before apex.

Four specimens, Rounthwaite, Man., July 11 and 12, L. E. Marmont.

Co-type in U. S. Nat. Mus., Cat. No. 9870. I am indebted to Mr. Busck for correcting my generic determination of this species.

Mompha Claudiella, sp. nov.—Expanse, 20 mm.

Head and patagia white, with a faint rosy tinge; palpi white, with a few dark scales on outside of tuft of second joint; antenna fuscous, with a whitish bloom; thorax leaden-black in centre, narrowly edged in front with rosy-white; on posterior half there is a patch of deep rosy-white, and the middle scales at their posterior end are of the same colour; abdomen gray, anal tuft with an ochreous tinge; legs cream-white, heavily shaded with black in front.

Fore wing white, with a faint rosy tinge, shaded with bluish-gray on inner fifth of costa, and a shade of the same colour through middle of wing from inner tuft to end of cell. A small shade of this colour on outer third of costa, and a similar one below it on dorsal margin. The upper half of termen and apex are shaded with gray, in which are sprinkled whitish, black and brown scales; there is a dark brown dot in cilia at apex, and two before apex in costal cilia, and one below apex in the long cilia; the outer ends of the apical cilia are gray, otherwise the cilia is ochreous. The tufts are very large and high; the three most prominent ones are white towards base and ferruginous at their outer ends. There are two close to base of wing, one in middle of wing, and one below it and obliquely outward from it close to dorsal margin; before the latter, and in a streak following the former, are broad black scales; the third is between fold and dorsal margin in middle of wing; it is also followed by a patch of broad black scales from its upper end. There is a smaller but similar tuft at outer fourth of wing, on lower margin, and a small tuft above the third large one on upper half of middle of wing. Below costa, at inner third, is a small tuft of black scales.

Hind wing dark gray, cilia ochreous, the same shade as cilia of fore wing. Under side both wings smoky black, with a whitish streak through middle of hind wing, and the apex of both wings whitish.

Three specimens, Rounthwaite, Manitoba, July 11 and 12, collected by Claud Marmont, whose name I am glad to give to this very beautiful species.

Co-type in U. S. Nat. Mus., Cat. No. 9871.

Mailed June 4th, 1907.