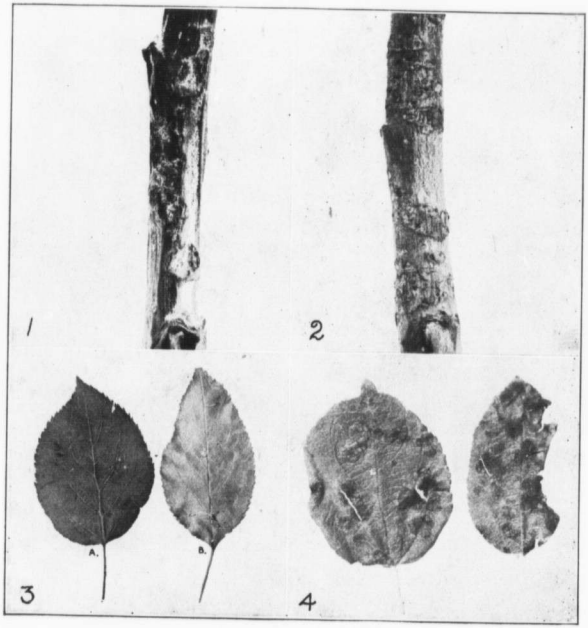


WORK OF APPLE LEAF MITES (P. 189).

The Canadian Entomologist.

VOL. XLIX. LONDON, JUNE, 1917 No. 6

POPULAR AND PRACTICAL ENTOMOLOGY.

TWO APPLE LEAF MITES OF ECONOMIC IMPORTANCE.

BY W. H. BRITTAIN, PROVINCIAL ENTOMOLOGIST FOR NOVA SCOTIA.

THE "SILVER-LEAF" OR "RUSTY-LEAF" MITE.

(*Phyllocoptes schlectendali* NALEPA.)

During the summers of 1912 and 1913, which the writer spent in British Columbia, he had an excellent opportunity for observing the work of the mite *Phyllocoptes schlectendali* Nalepa, this species being extraordinarily abundant in the Okanagan Valley and other parts of the Dry Belt.

It is most commonly found attacking the leaves of the apple, and though it cannot often be considered a serious enemy of the foliage, the result of its work is conspicuous and peculiar. The presence of the mite makes itself apparent by a decided silvery appearance of the leaves, which, in severe cases, is very pronounced and can be detected from a considerable distance. This appearance is due to the formation of an air space between the epiderm and the palisade cells due to the punctures of the mites. A tree so affected bears a striking resemblance to one attacked by the disease Silver-Leaf, said to be caused by a fungus (*Stereum purpureum* Pers.)

This is not the only case in which a silvery appearance is brought about by the work of mites. On plums, bad infestations of Red Spider (*Tetranychus bimaculatus*) produce a somewhat similar appearance, though not so characteristic, and mites feeding upon elm leaves have been observed to produce similar symptoms. It was first thought that all such trees were suffering from Silver-Leaf, which is not surprising, since both these troubles are very abundant in British Columbia and are often present on the same tree. It was only, however, when trees that had been sprayed with nicotine sulphate did not develop the disease that this diag-

nosis was thrown in doubt and the true cause discovered. Though this type of injury is very common in British Columbia and appears to have been noticed quite widely in the United States and Canada, the amount of actual harm which the mites accomplish in this way is questionable, and is probably of little importance in most cases. Parrott (1 and 2) who appears to have been the first to have recorded this species in America, says that this species is very common on apple foliage in the United States, that it is more common in the United States than on the continent, and that it seems to have possibilities of developing to greater economic importance. P. J. O'Gara (3) who records this mite from Southern Oregon, noticed its work on the apple foliage, which, however, he did not regard as serious. He states that the mite is chiefly important as a pest of pears, the foliage, terminals of twigs and even the fruit being injuriously affected. He describes the injured foliage as presenting a peculiar russet appearance on the underside, and as being somewhat curled, as though with drought. The terminal shoots and the fruit is also attacked, being russetted and cracked as a result of the punctures of the mite. With serious attacks, the whole tree is said to have a brownish appearance, giving the trouble the name "Rusty Leaf," by which it is known in the Rogue River Valley, Oregon. We have never noticed such severe attacks to the pear in British Columbia, but it would not be surprising to find that such existed, so prevalent is the mite throughout the fruit-growing sections. It would appear from the foregoing that, though this pest is known to be prevalent throughout the United States and Canada, it has never been regarded as a serious enemy of apple foliage, and only locally as a serious pest of pears.

Through the summer of 1912 numerous specimens of apple twigs were sent to the office of the Provincial Entomologist at Vernon, disfigured in a curious way by brownish incrustations on the bark of one and two-year-old wood. These injured areas were generally more or less circular in form, though sometimes of an irregular shape. A crack usually separated the healthy from the diseased wood, and the epidermis was frequently ruptured. This injury appeared to be most pronounced on wood of the Northern Spy, though other varieties suffered to some extent. A careful

examination of the incrustations revealed nothing of a parasitic nature.

The next year similar injured twigs were submitted for examination in even greater quantity. In particular, a number of nursery firms complained of heavy loss to their Northern Spy stock from being rendered so unsightly as to be quite unmarketable. One firm, situated in the Okanagan, was compelled to destroy a large quantity of Northern Spy stock, as a result of this trouble. It appeared, on further examination of affected twigs, that the year following the appearance of the trouble, the injured areas frequently dropped out, thus rendering the injured tree more unsightly than before. Further examination of the incrustations still revealed nothing, but so serious had the situation become, that it was decided to follow the matter up carefully, in order to determine definitely the cause of the trouble.

The writer left British Columbia in the fall of that year and was unable to prosecute this matter further. However, Mr. J. S. Dash (5), then working under the direction of the Inspector of Fruit Pests, examined a number of injured twigs during the month of October. He found them to contain hundreds of hibernating mites, whose identity could not be ascertained with certainty at the time, since they were immature. At the request of the writer, a number of affected nursery trees were sent to Truro, kept over winter and planted out the following spring. In July the silvery appearance, characteristic of the work of *Phyllocoptes schlectendali*, became apparent on the leaves, which, on examination, were found to be covered with mites belonging to this species.

It would appear from our observations that the mites, which feed on the foliage during the summer months, make their way to the twigs in the autumn where they enter an old egg blister of the Rose Leaf-hopper (*Empoa rosæ*), a common apple pest throughout the province, or of the Apple Leaf-hopper (*Empoasca mali*) or through a lenticel, and there they develop their hibernating incrustations, which render the affected trees so unsightly. As an enemy of nursery trees and particularly of Northern Spys, this mite is, therefore, of considerable importance, since stock so disfigured is unmarketable. The actual harm done to such

stock is slight and, as a pest of older trees, it cannot be considered as being of a very serious nature.

The Apple Leaf Mite (*Eriophyes malifoliæ*).

Regarding this mite Parrott (2) says: "This is a vagabond species and is found in association with *Eriophyes pyri* and *Phyllocoptes schlectendali*, upon the under surface of apple leaves." From this it is apparent that he regards this mite as of secondary and minor importance and not able, by itself, to inflict much injury. While we have never seen any particularly destructive outbreaks, it is possible that this mite may prove to be of greater economic importance than is commonly supposed, at least under conditions that exist in the Okanagan.

In view of the resemblance between the injuries produced by the former species discussed and a fungous disease, it is an interesting fact, that this mite causes symptoms strikingly like another fungous trouble, viz., Apple Scab (*Venturia pomi*). The mites work on the underside of the leaves, concealed by the pubescence, and the first indication of their work is in the form of more or less olive-green, circular spots on the upper surface, which gradually darken until they become dark brown in colour. These spots become slightly raised above the surface of the leaf, forming a saucer-shaped hollow on the underside. These symptoms are so suggestive of apple scab, that it is not surprising that they have been mistaken for this trouble even by those familiar with the disease. Not only were the leaves affected but the tender shoots were also attacked, causing them to wither and become brown and dead. This appearance is suggestive of the damage done to pears by *Phyllocoptes schlectendali*, as described by O'Gara, but was noticed where only *Eriophyes malifoliæ* was present. This type of injury was very prevalent during the summer of 1913.

Unfortunately we were prevented from making observations regarding the hibernating habits of this species, but we feel certain that a careful study of its life history and habits would reward research. It is altogether possible that these two species discussed in this article are responsible for much more damage than is com-

monly attributed to them. In particular it seems well within the range of possibility that they may be responsible for many of the blotched apples and the disfiguration of other species of orchard fruits that is so common throughout the fruit districts, since both species have been found feeding in large numbers on fruit so affected. Which of the species discussed here, if either, is responsible for such injury, can only be determined by experiment.

The problem of control should be a comparatively simple one, since both species are readily destroyed by the summer sprays of lime-sulphur, or by weak solutions of nicotine sulphate.

References.

1. Parrott, P. J. Phyllocoptes schlectendali Nalepa. Science, U. S. 23 : 73 (1906).

2. Parrott, P. J. The Apple and Pear Mites. N. Y. Agr. Expt. Sta., Bul. 283 : 7–32 (1906).

3. O'Gara, P. J. Economic Importance of the Mite Phyllocoptes schlectendali Nalepa. Science, N. S., 36 : 835–836 (1912).

4. Brittain, W. H. The "Rusty Leaf" Mite and the "Apple Scab" Mite. Proc. Ent. Soc. B. C., No. 4, N. S., :18 (1914.)

5. Dash, J. S. Mites. Proc. Ent. Soc. B. C., No. 4, N. S., :37 (1914).

Explanation of Plate X.

Fig. 1. Injury to apple twig by hibernating incrustations of Phyllocoptes schlectendali.

Fig. II. Appearance of injury the next season.

Fig. III. A, Leaf infested with Phyllocoptes; B, Uninjured leaf.

Fig. IV. Leaves injured by Eriophyes malifoliæ (Parrott).

THE OCCURRENCE OF EUMERUS STRIGATUS FLN. IN CANADA.

BY ARTHUR GIBSON, ENTOMOLOGICAL BRANCH, DEPARTMENT OF AGRICULTURE, OTTAWA.

In the Entomological Record for 1915[1] a record of this species is included, namely: "Victoria, B. C., reared from narcissus bulbs, April 7—9, 1910, (E. A. Wallace)." In the Record for 1916[2], the occurrence of the species at Ottawa, Ont. (August, 19, 1904, Fletcher) is mentioned. Recently we received a specimen of *Eumerus strigatus* from Montreal, Que., which was collected in a greenhouse, on Feb. 5, 1917, by Mr. J. I. Beaulne. In October, 1910, Dr. Hewitt, found the larvæ abundant in the greenhouse of Mr. E. A. Wallace, Victoria, B. C.

This European insect which has been recorded as a pest of onions, shallot, roots of Iris and bulbs of narcissus, hyacinth and Amaryllis, has been referred to in economic literature as the Bulb Moon-fly, the Lunate Onion Fly and the Small Narcissus Bulb Fly. Felt[3] first recorded the species from America from specimens reared in New York State from the roots of Iris, and referred to the fact that Dr. F. H. Chittenden had informed him that the fly was reared in the Bureau of Entomology at Washington, in 1906. The taking of a specimen at Ottawa in 1904, however, by the late Dr. Fletcher, is evidently the first record of the occurrence of the species in America.

Emerus strigatus is now widely distributed in North America, having been found in the United States in the States of California, Texas, Connecticut and New York, and in Canada in the provinces of Quebec, Ontario and British Columbia.

Theobald[4] has found as many as 17 larvæ of the species in one bulb and states that "there is no doubt that these small narcissus and other bulb flies are the cause of much loss, but are not, it seems, so widely spread as *Merodon*; still the number one finds

[1] 46th Annual Report of the Entomological Society of Ontario.
[2] 47th Annual Report of the Entomological Society of Ontario.
[3] New York State Museum, 27th Report of the State Entomologist, 1911.
[4] Report on Economic Zoology for year ending Sept. 30, 1911.

in samples of bulbs purchased shows that it has to be dealt with just as much as the larger maggot."

MacDougall[5] describes the larva of *Eumerus strigatus* as measuring "half an inch and over when full grown. It is greyish yellow in colour and has a distinctly wrinkled appearance. The mouth hooks are brown and the respiratory processes at the front end are brownish-red. The rounded hind end is brown at the tip and has a projection on each side with a process which ends in the breathing pores between the projections."

TWO NEW SAWFLIES (HYMEN.).

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

The peculiar Xylids with the remarkably developed third antennal segment, are comparatively rare and unusually interesting. It, therefore, seems desirable to publish the description of a recently discovered species in this group, and also one of a related Pamphilid.

Pleroneura borealis, n. sp. The sawflies described herein were collected at Lake Clear, N. Y., June 7, 1907, and in the key given by Rohwer, would run to *P. fulvicornis* Roh., a larger Californian species exhibiting some differences in colour from this species.

Male.—Length 4 mm. Anterior margin of clypeus broadly rounded; narrow, deep furrows extend from the base of the antennæ and unite above the median ocellus, median foveæ, forked ventrally, extending to the base of the ocellus; terminal anterior segment shorter than the preceding. Head and thorax opaque with close, fine punctures; maxillary palpæ large, probably 7-jointed, the second segment distinctly shorter than the anterior femora, the first joint about one-half as long as the second. Claws with a minute tooth basally. Hypopygium roundly truncate, first recurrent vein free from the first transverse cubital. Head black. Thorax brownish black. Abdomen reddish brown. The antennæ, clypeus, labrum, tegulæ, the dorsum of the abdomen

[5] Journal of the Board of Agriculture, London, October, 1913.

apically, the distal half of the venter of the abdomen and femora rufous; tibiæ and tarsi mostly yellowish; tibiæ and the distal tarsal segments apically reddish brown.

Female.—Length 5.5 mm., to tip of ovipositor 7 mm. Similar to the male and black, except as follows: Antennæ dark brown, the third segment almost blackish; clypeus, labrum, mandibles, tegulæ, the apex of the abdomen dorsally, the posterior margins of the basal segments and the distal third of the abdomen ventrally (except the black ovipositor), femora and tibiæ yellowish or ferruginous; the tarsi reddish brown, the posterior darker.

Described from two males and one female.

Acantholyda ferruginea, n. sp. The sawfly described below differs so greatly from any accessible descriptions, that we have been unable to refer it to known species. It was taken on the summit of Mount Marcy in the Adirondacks, July 31, 1913.

Male.—Length 7 mm. Head brownish black, coarsely and irregularly punctured and with anterior and posterior yellowish, ovate, orbital spots; mandibles fulvous. Antennal segments 21, the first black, with irregular, narrow, yellow annulations basally and apically, the second yellowish brown or dark brown, yellowish apically; third segment shorter than the fourth and fifth combined, the others successively shorter; the third to ninth yellowish brown, the distal segments mostly dark reddish brown. Thorax and abdomen brownish black, the segments of the latter narrowly margined with yellow, the markings on the three posterior segments angulate. Wings suffused with ferruginous, only two submarginal cells, the second cross-vein wanting; venter, coxæ and femora brownish black the tibiæ and tarsi dark fulvous.

ERRATUM—PLATE IX.

We regret that the lettering for Plate IX, in our May issue, illustrating Messrs. Brittain and Saunders' article, "Notes on the Black Apple Leaf-hopper," was omitted. The figures are arranged from top to bottom of page: Figs. 1-4 on left, Figs. 5-7 on right. The magnifications are as follows; Fig. 1 (x 43), Figs. 2-4 (x 29), Fig. 5 (x 23), Fig. 6 (x 19), Fig. 7 (x 17.5).

TWO NEW APHID GENERA AND SOME NEW SPECIES.

BY C. P. GILLETTE, FORT COLLINS, COL.

In Canadian Entomologist, vol. XL, 1908, p. 67; and in Entomological News, vol. XX, 1909, p. 119, the writer described and figured a peculiar aphid from *Carex* under the specific name of *ballii* and placed it in the genus *Brachycolus*, with a remark to the effect that it did not seem to belong to any known genus.

The appearance of Mr. A. C. Baker's paper, "Synopsis of the Genus *Saltusaphis*," in the January (1917) number of the Canadian Entomologist, leads me to publish the characterization of a new genus—*Thripsaphis*—with *ballii* Gill. as the type, as this aphid seems to me generically distinct from *Saltusaphis* Theobald. In giving his characterization of this genus, Theobald says:

*"Head very large. . . Cornicles small, cup-shaped. . . †Cauda in both forms bifid. . . Body hairs fan-shaped or sickle-shaped," and attention is specially called to the single cross-vein in the hind wing and the jumping habit of the type species, *scirpus*. None of these characters apply to *ballii* except the venation of the hind wing, and that does not hold for other very closely allied species.

Thripsaphis, n. gen.

General form very long and slender; eyes without ocular tubercles; antennæ 6-jointed; anterior wings normal in venation, but the first cross-vein in the hind wing weak, or absent in some cases, and easily overlooked when present, if mounted in balsam; cornicles represented by pores only; cauda strongly knobbed; precaudal tergite entire; anal plate strongly bi-lobed; gonapophyses .2; body hairs few and not blunt ended or in form of flabellæ; vertex prominent, and the oviparous females, so far as known, have wax glands on the lateral ventral surfaces of the abdomen, just caudad of the cornicle pores, from which are secreted wax

*African Aphididae—Part II, in Bulletin of Entomological Research, Vol. VI, pt. II, p. 138, 1915.

†I have examples of *Saltusaphis scirpus* from Theobald. It is evident that he mistook the extended and strongly bi-lobed precaudal tergite for a bi-lobed cauda. The cauda has a large and typical knob with a narrowly constricted neck which was mistaken by Theobald for the anal plate. The anal plate is bi-lobed also, as in the Colorado species, *flabellus* Gill.

threads that are used by them with which to cover their eggs. Males, so far as known, apterous and very small.

When the alate form of *ballii* was described, the writer had but a single example in balsam, which did not show the first cross-vein of the hind wing and it was so described and figured, and is probably one of the reasons why Mr. Baker includes this species in *Saltusaphis*. Many alate examples of closely allied species have since been taken which plainly show the first cross-vein, even after being put in balsam, so I do not think the presence or absence of this vein should be given generic importance in the group to which *ballii* belongs.

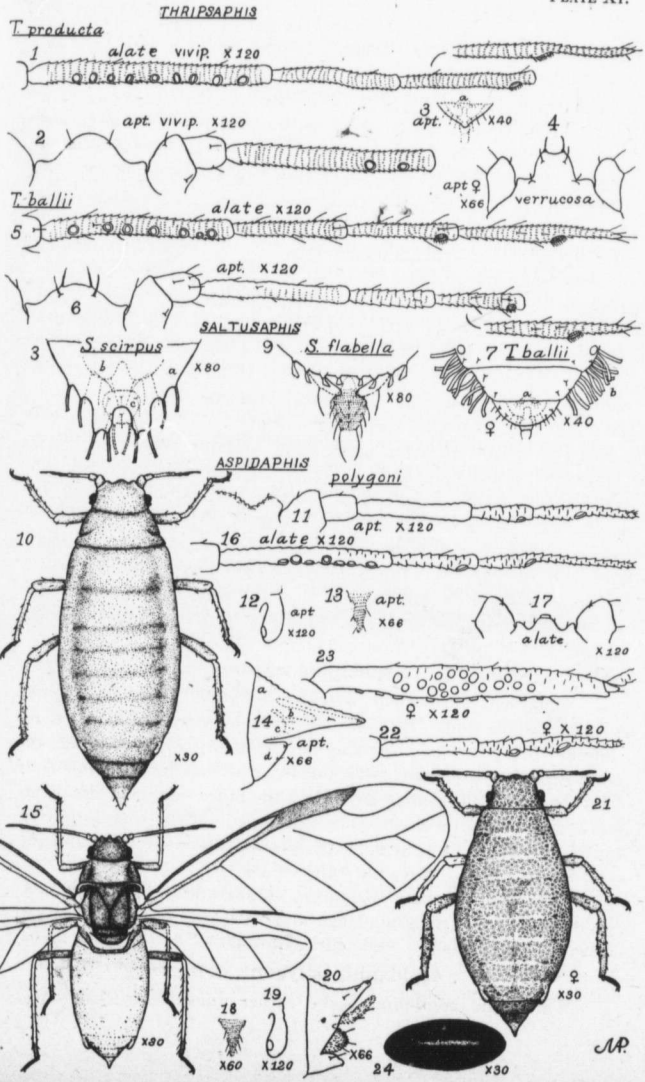
While *Callipterus flabellus* Sanb. does not have the bifid precaudal tergite that is so strong a character in the type of the genus *Saltusaphis*, I believe Mr. Baker is right in placing it with that genus, for it qualifies in all other important respects and does have a large eighth tergite bearing tuberculate hairs as in *scirpus* Theobald.

Thripsaphis ballii Gill.

This species is separated rather easily separated from, at least, three other Colorado forms that are congeneric with it, by the short antenna, which, in the alate form, has about 7 small circular sensoria on the third joint, and in the apterous form none, the absence of the first transverse vein in the hind wing of the alate louse, the moderately produced vertex, the short and broadly rounded eighth tergite and the stout femora of the apterous viviparous form. See Plate XI, figures 5, 6, 7.

Thripsaphis verrucosa, n. sp.

In the original description of *ballii* the writer mistook for it the egg-layer of what now proves to be a distinct but closely allied form. See Canadian Entomologist, vol. XL, p. 67 (apterous viviparous female), and plate III, figures 12 and 14. This form must be segregated from *ballii*, and for it I suggest the specific name *verrucosa*, because of the prominent projection on the vertex. See also Plate XI, figure 4, accompanying this paper. The other forms for the year have not been thoroughly worked out, so are held for later descriptions.


THRIPSAPHIS
T. producta
1
alate vivip. x120
2
apt. vivip. x120
3
apt. x40
4
apt ♀ x66
verrucosa
T. ballii
5
alate x120
6
apt. x120
SALTUSAPHIS
3
S. scirpus
x80
9
S. flabella
x80
7 T. ballii
♀ x40
ASPIDAPHIS
polygoni
10
x30
11
apt. x120
16 alate x120
12
apt x120
13
apt. x66
17
alate x120
23
♀ x120
14
apt. x66
22
♀ x120
15
x30
21
♀ x30
18
x60
19
x120
20
x66
24
x30

Thripsaphis producta, n. sp.

Our collections indicate this as the most abundant species in Colorado occurring upon *Carex*. With the generic characters given above, only a brief characterization of this species seems necessary.

Alate Viviparous Female.—General colour blackish, legs and antennæ black; length 2.00; wing 2.50 x .70; hind tibia, .60; antenna, 1.15; segments of antenna in following proportions: III, 15; IV, 9; V, 8; VI, 7; spur, 4; sensoria on joint III, 9 to 11, rather large and slightly transverse; venation of fore wing normal and veins rather heavy; hind wing with first cross-vein weak or lacking, usually quite plainly seen before clearing in balsam. See figures 1, 2, 3.

Apterous Viviparous Female.—Colour (in balsam) dark yellowish brown, darkest on lateral margins and back of cornicles; legs black; antennæ black to near base; vertex convex, being rather strongly produced at the middle; length of body 2.10; width .70; antenna .95; third segment with 2-3 small circular sensoria near distal end; segments III, .30; IV, .18; V, .15; VI, 13; spur .08; hind tibia .48; beak very short, but little surpassing the first pair of coxæ; femora not specially thickened for jumping; hairs few, short, and simple; anal plate bi-lobed; 8th tergite produced and rather sharply rounded posteriorly. Figures 2, 3.

Aspidaphis, n. gen.

Wing venation normal; antennæ 5-jointed, less than one-half as long as the body; antenna and body very free from hairs, no lateral tubercules on prothorax or abdomen; cornicles weak, recumbent, shorter than hind tarsus, without flange, somewhat clavate, and with opening lateral, on the inner side, near the distal end; eighth tergite of abdomen developed into a very large triangular shield, which, in the type species, extends well beyond the end of the cauda. Eyes not tuberculate.

The three specially diagnostic characters are: Antenna, 5-jointed; cornicles without flange and with side opening, and the large precaudal shield. See figures 10 to 23.

Aspidaphis polygoni, n. sp.

This aphid, combining some rather unusual structures, was

first taken by Mr. L. C. Bragg upon knot-grass or door-weed, *Polygonum* sp., at Ft. Collins, Colo., in July, 1907, and we have had it under observation each year since and throughout the growing season.

Apparently, the different species of *Polygonum* are the sole food plants of this species. It imitates the colour of the under-side of the leaves and the stems of the plants upon which it feeds so perfectly that it is seen with some difficulty, and it is sporadic in its habits. The lice also have the habit of working beneath the bracts at the bases of the leaves where they are out of sight. The different stages may be described as follows:

Apterous Viviparous Female.—Colour green, with tips of the antennæ, the tarsi, distal ends of tibiæ, and extreme tip of cornicles, dusky to blackish; form of body long and tapering posteriorly to the point of the pre-caudal shield; body, legs and antennæ very free from hairs; antennæ upon slight tubercles, 5-jointed; joints 4 and 5 and spur sub-equal; joint 3 as long as 4 and 5 together, total length about .40; legs short and stout; cornicles a little more than one-half as long as the hind tarsi, placed at extreme lateral margins of abdomen, weak, recumbent upon the abdomen, clavate, rounded and without flange at the distal end, the opening being on the inner side near the end; cauda long, slender and entirely hidden from above by a triangular shield-like projection of the pre-caudal tergite which extends beyond the end of the cauda; lateral margins of prothorax and abdomen without spines. See plate XI, figures 10 to 14.

Winged Viviparous Female.—General colour, pale yellowish or greenish yellow, eyes blackish, head, mesothorax above and below, metathorax above, antennæ and tarsi dusky brown; wing veins heavy and dusky brown to blackish; length 1.40; antenna .40 to .50; wing 1.80; head rather broad and flat, the antenna being widely separated and not upon distinct tubercles, 5-jointed; medium ocellus prominent on the vertex; joints of the antenna: III, .18; IV, .08, V, .07; spur, .08. Joint 3 has about 6 to 8 sensoria; joint IV, 1 near the distal end; joint VI, 1 large and 4 or 5 small ones; antennal segments free from hairs; prothorax rather large and without lateral tubercles; cornicles, concolorous with the abdomen, situated on extreme margins, weak and lying against

the side of the abdomen and about one-half as long as the hind tarsus; terminal segment of the abdomen, above, in the form of a long, triangular plate with an acute upturned apex, beneath which is the cauda, which is rather narrow and directed downward; beak not attaining the second pair of coxæ. See figures 15 to 20.

Oviparous Female.—The oviparous female differs from the viviparous form in being more robust, a little shorter and brownish or slightly rusty in colour. The antennal joints and other characters are substantially as in the viviparous form. The hind tibiæ are moderately swollen and have 20 or more circular sensoria on their middle one-half. Figures 21–23.

The eggs are bright green in colour when deposited upon the stems of the host plant, but soon turn shining black on exposure. See figure 24.

While we have never found this louse abundant, we have seldom had trouble to find examples when looked for at any time during the growing season.

Explanation of Plate XI.

Thripsaphis producta. 1, antenna of alate viviparous female; 2, vertex and first three joints of antenna of same; 3, eighth tergite of abdomen with cauda and anal plate beneath showing gonapophyses (a).

T. verrucosa. 4, vertex showing tubercle.

T. ballii. 5, antenna of alate female; 6, vertes and antenna of apterous female; 7, terminal segments of oviparous female showing gonapophyses (a), and wax threads (b).

Saltusaphiis scirpus. 8, showing terminal segments of abdomen of apterous female—(a) large bi-lobed 8th tergite, (b) bi-lobed anal plate, (c) knobbed cauda.

S. flabella. 9, eighth tergite, bi-lobed anal plate (dotted), and cauda of apterous viviparous female.

Aspidaphis polygoni. 10, apterous viviparous female (stem mother?); 11, vertex and antenna of same; 12, cornicle of same; 13, cauda of same; 14, lateral view of 8th and 9th segments, (a) 8th tergite, (b) cauda, (c) anal plate, (d) genital plate of No. 10; 15, alate viviparous female; 16, antenna of same; 17, vertex of

same; 18, cauda of same; 19, cornicle of same; 20, lateral view of 8th and 9th segments of same; 21, oviparous female; 22, antenna; 23, hind tibia and, 24, egg of No. 21. The enlargement is indicated with each figure. Original, Miriam A. Palmer, Illustrator.

NEW NEARCTIC CRANE-FLIES (TIPULIDÆ, DIPTERA) PART III.

BY CHARLES P. ALEXANDER, CORNELL UNIVERSITY, ITHACA, N. Y.

This paper is a continuation of the preceding articles under the same title (Can. Ent., vol. 48, p. 42–53, 1916; vol. 49, p. 22–31, 1917). The species here considered include a small number of subapterous forms, these belonging to the genera *Chionea*, *Limnophila*, and *Tricyphona*.

I am indebted to Mr. W. L. McAtee, Mr. R. C. Shannon, Mr. C. W .Johnson and other gentlemen mentioned in the paper. I am especially indebted to Mr. L. O. Jackson for specimens herein described. Unless stated otherwise, the types are in the collection of the author.

Subfamily *Limnobiinæ*.
Tribe *Limnobiini*.
Genus *Limnobia* Meigen.

Limnobia indigena jacksoni, subsp. n.

Male.—Length 7.4 mm.; wing 8.8 mm.

Female.—Length 7.1 mm.; wing 7.6–8 mm.

Similar to typical *indigena* O. S. (Northeastern America), differing as follows:

The medial præscutal stripes are continuous and well-defined behind, the interspaces obscure, not bright yellow; pleura largely dark brown, this including also the outer faces of the coxæ. Wings similar, the ground-colour more grayish, the brown clouds less distinct and more extensive, pale grayish brown; these markings include a broad, continuous seam along and slightly before the cord and the apex of the wing; basal deflection of vein *Cu*1 close to the fork of *M*. Abdominal tergites with the cross-bands poorly defined, the sternites suffused with brownish.

Holotype, ♂, Geneva Park, Grant, Colorado, altitude 10,000 feet, July 16, 1916 (L. O. Jackson).

Allotopotype, ♀, July 21, 1916.

Paratopotype, ♀, altitude 9,500 feet, July 22, 1916.

This fly will probably be found to be a valid species. It differs from *indigena* in the dusky brown body coloration, the gray wings with a more extensive brown seam, the position of the basal deflection of Cu_1, etc.

Tribe *Eriopterini*.

Genus *Erioptera* Meigen.

Erioptera (Empeda) cinereipleura, sp. n.

Male.—Length 4 mm.; wing 4.5 mm.

Similar to *E. stigmatica* O. S. (Northeastern America) but the body-coloration clearer gray throughout. Antennæ darker, brown, the male with very long verticils.

Mesonotal præscutum gray, the pseudosutural foveæ and the tuberculate pits large and conspicuous, black, the latter closely approximated, separated by a distance less than the diameter of one. Pleura clear light gray, not reddish gray as in *stigmatica*. Legs with the femora yellowish basally, soon passing into brown. Wings grayish subhyaline, the stigma clear but distinct (fig. 6).

Abdominal tergites dark brown, contrasting with the yellow hypopygium.

Holotype, ♂, Hall Valley, Colorado, August 11, 1915 (E. J. Oslar).

Erioptera (Empeda) noctivagans, sp. n.

Wings pale dusky with an indistinct brown seam along the cord.

Male.—Length 3.2 mm.; wing 4.7 mm.

Female.—Length 3.8–4.1 mm.; wing 5.6–5.8 mm.

Male.—Rostrum and palpi black. Antennæ black, the second and third antennal segments enlarged, the flagellum without exceedingly elongated verticils as in *stigmatica*, *cinereipleura*, etc. Head dark gray.

Thorax grayish brown, the humeral portions bright yellow; præscutum before the pseudosutural foveæ slightly brightened. Pleura and sternum dark coloured with a sparse, gray pruinosity;

pleural membranes yellowish brown. Halteres yellow. Legs with the coxæ and trochanters yellowish, remainder of the legs brown. Wings dusky gray, the stigma distinct; an indistinct, brown seam along the cord; veins dark brown. Venation as in fig. 5.

Abdomen light brown with a broad, blackish, sublateral stripe on either side of the tergites; hypopygium small, brownish yellow; sternites brown.

Female.—Slightly larger than the male, the basal segments of the antennæ not so enlarged; flagellar segments oval, those toward the tip more attenuated; humeral portions of the thorax whitish yellow; abdominal tergites with the sublateral stripes somewhat narrower; tergal valves of the ovipositor pointed at their apices.

Holotype, ♂, Maywood, Alexandria Co., Virginia, October 19, 1915, (W. L. McAtee); at light.

Allotopotypes, ♀, October 15, 1915.

Paratopotypes, 2 ♀s, October 16–19, 1915.

Type in the collection of the United States Biological Survey.

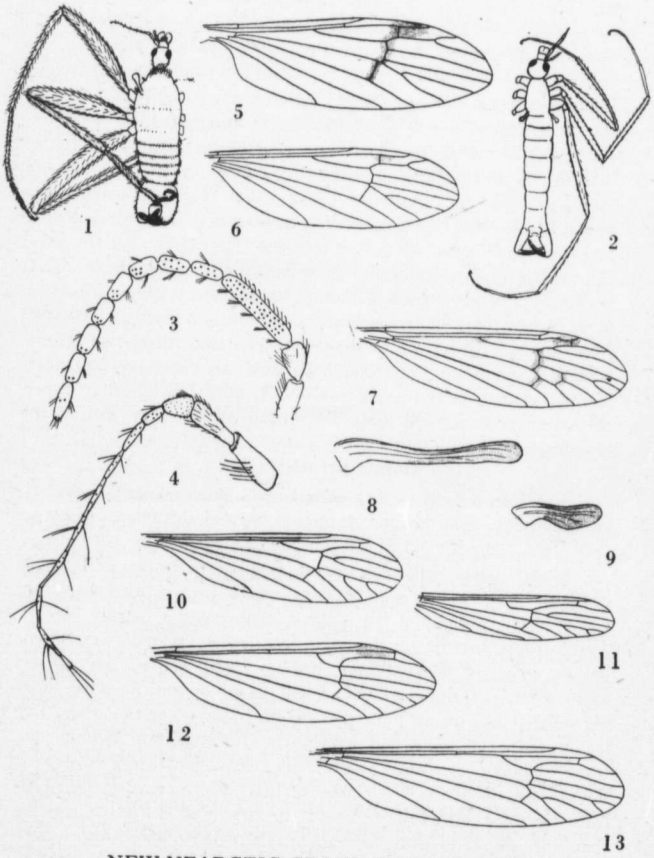
A key to the nearctic species of the genus Erioptera (Empeda).

1. Cell *1st* M_2 closed; body-coloration yellow.....2.
   Cell *1st* M_2 open; body-coloration gray or brown.....3.
2. Basal deflection of Cu_1 beneath the middle of cell *1st* M_2; vein R_2 oblique, diverging strongly from vein R_3 (Eastern United States).....*nyctops* Alex.
   Basal deflection of Cu_1 before the fork of M; vein R_2 not oblique, running parallel with vein R_3 (Western United States).....*alicia* Alex.
3. Wings gray with an indistinct, brown seam along the cord; verticils of the male antennæ not greatly elongated (Eastern United States).....*noctivagans*, sp. n.
   Wings subhyaline without a brown seam along the cord, only the stigmal region slightly darkened, verticils of the male antennæ greatly elongated.....4.
4. Body-coloration clear gray, including the thoracic pleura (Rocky Mt. Region).....*cinereipleura*, sp. n.
   Body-coloration reddish brown, the pleura reddish gray (Northeastern United States).....*stigmatica*, O. S.

Chionea Dalman.

These interesting subapterous crane-flies have been the subject of much discussion during the past hundred years. They were long supposed to be wingless but this is incorrect, the wings being present although greatly reduced (see fig. 1, *w*). The legs of the males of many species are strongly incrassated and hairy. The evolution of the group from full-winged ancestors has been indicated by the author in another paper (Proceedings Academy Natural Sciences of Philadelphia, p. 529, 530; 1916). The closest known relative of *Chionea* I believe to be the full-winged *Pterochionea bradleyi* Alexander (British Columbia), a fly that is interesting and suggestive in many ways. Its structure may be compared with that of *C. primitiva*, sp. n., when the relationships existing will be better understood.

The antennæ of *Pterochionea*, unlike the normal eriopterine crane-flies, have undergone a reduction in the number of the antennal segments, this reduction being brought about by a curious fusion of the five basal segments of the flagellum (fig. 3), that has been termed the fusion-segment. In *Pterochionea* this fusion-segment is elongated and the five sets of verticils are well-preserved. In *Chionea*, and, to a lesser extent,in *Crypteria* Bergroth, the fusion-segment has shortened up into a conical structure that is scarcely longer than the succeeding flagellar segment, and the five sets of verticils are either lost or very reduced. Beyond the fusion-segment in *Pterochionea*, *Crypteria* and *C. primitiva*, there are nine flagellar segments, thus accounting for the sixteen segments of the normal eriopterine organ. In order to determine, if possible, how the further reduction in segments in *C. valga*, *C. nivicola* and the other species had been brought about, Mr. C. W. Johnson has very kindly examined the types and fresh metatypical specimens of *C. valga* Harris in the collection of the Boston Society of Natural History. Under the date of March 11, 1917, he writes in part: "Under the binocular and with a fresh specimen I seem to see traces of segmentation in the three conspicuous joints of the flagellum, with 12 verticils and bristles, showing, as you say, nine. In the old specimens, including the type, I cannot make out clearly the weaker segmentation, but the verticils seem to be the same: all of the specimens have the three long bristles on the



NEW NEARCTIC CRANE-FLIES (P. 211).

terminal segment, one a little below the apex." The sketch supplied by Mr. Johnson indicates that the first of the flagellar segments has two of these weak segments, the next two have three each while the short terminal segment is not further divided, these totalling up to the nine distinct segments in *C. primitiva*. It will be seen from the figures (fig. 3) that the flagellar segments in *Pterochionea* are all short-cylindrical; in *C. primitiva* (fig. 4) the basal segments are short with short verticils, these segments gradually becoming more attenuated and provided with longer bristles, the last segment shorter with three terminal bristles.

The male hypopygia of *Chionea* and *Pterochionea* show a peculiar, powerful type of genitalia, consisting of a massive pleurite and a single elongate pleural appendage (figs. 1, 2). In *Crypteria* the appendages are small, two in number and quite normal. Thus in the structure of the antennæ, *Chionea* comes closest to *Crypteria*, but in the hypopygium the condition is remarkably close to *Pterochionea*. There can be little doubt but that these two genera, with perhaps others yet to be discovered, are the direct ancestors of our familiar snow-flies, *Chionea*. As stated in another paper, this interpretation will place the group at the very end of the eriopterine series.

Chionea primitiva, sp. n.

Size large; form stout; entire body hairy; head elongated; antennæ with nine flagellar segments beyond the fusion segment.

Male.—Length 5.8 mm.; diameter across thorax, 1.5 mm.

Mouth parts yellowish brown; palpi dark brown. Antennæ elongate, the scapal segments yellowish brown, the flagellum darker; first segment of the scape a little broader basally, with a group of long bristles on the outer face; second segment narrowed, basally enlarged, darkened and provided with bristles beyond the basal portion; fusion-segment of the flagellum conical, with short verticils; it is shorter than the second segment of the scape but longer than the following segment of the flagellum; beyond the fusion-segment are nine distinct segments, increasing in length toward the tip of the organ, the verticils also increasing in length from the base outward, those of the first four segments shorter than the segments that bear them, the others very long, longer than the segments that bear them; the terminal segment is smaller,

enlarged apically and bearing at its tip three very long bristles. The frontal prolongation of the head bears a group of about eight stout bristles. The head behind the eye is large, elongated and prominent, bearing many strong verticils. Head yellowish.

Thorax reddish yellow, the region of the mesonotal scutum and scutellum with abundant strong black bristles. Halteres prominent, light yellow. Legs with all the femora enlarged, yellowish; tibiæ yellow; tarsi black. Wings very small but evident (fig. 1, *w*) about as long as the third flagellar segment of the antennæ.

Abdomen stout, the tergites with their caudal portions provided with abundant long, black bristles; sternites with similar but shorter hairs. Male hypopygium powerful, the pleurites stout, the appendage enlarged basally and provided with an inner basal tooth, in the angle of which is a tuft of stout, black hairs; the appendage is shorter than the pleurite.

Holotype, ♂, Cascade, Owasco Lake, Cayuga Co., New York, November 15, 1915 (Bishop and Crosby).

Chionea noveboracensis, sp. n.

Body-coloration dark brownish gray; ovipositor of the female very elongated.

Female, somewhat shrunken, length about 3.5 mm.

Mouth parts and palpi brownish black. Antennæ black, the fusion-segment of the flagellum short; remainder of the flagellum broken. Head very dark brown with a gray pruinosity and numerous dark bristles.

Thorax brownish gray. Halteres elongate, brownish yellow. Wings very small but evident, dusky gray. Legs with the coxæ prominent, dark brown; femora and tibiæ brown, the tarsi dark brown; femora not incrassated.

Abdomen very dark brown with a gray bloom, the tergites with long, golden hairs on the caudal portion. Female ovipositor exceedingly long and slender, the tergal valves much longer than the sternal pair, slightly upcurved, narrowed and obtuse at their tips. The tergal valves of the ovipositor are about as long as the thorax.

Holotype, ♀, Coy Glen, Tompkins Co., New York, altitude 800 feet, Feb. 25, 1917 (R. C. Shannon).

The type is in the collection of the collector.

Chionea gracilis, sp. n.

Size small; form very long and slender; head round; femora not swollen.

Male.—Length 3.9 mm.; diameter across the thorax, .6 mm. Mouth parts and palpi yellowish. Antennæ yellow, the scapal segments long and slender, the flagellar fusion-segment long and slender, conical. Head rounded, yellowish.

Thorax brownish yellow. Halteres yellow. Legs yellow, the tarsi scarcely darkened.

Abdomen long and slender, about twice the length of the combined head and thorax. Male hypopygium not conspicuously enlarged, the pleurites slender, the appendage very long and slender, curved, narrowed at the tip and nearly as long as the pleurite.

The body and legs are provided with a sparse covering of short, pale hairs.

Holotype, ♂, Ithaca, Tompkins Co., New York, December 21, 1914.

The description of *C. scita* Walker indicates a form that is longer than *C. valga* Harris (*aspera* Walker) and having black antennæ. It seems probable that *C. scita* is the female of *C. valga*, the females of *Chionea* having the legs more slender than those of the male, and with the body more elongate and slender (see Emerton's figures, in Johnson's paper, "The Snow-fly, *Chionea valga* Harris," Psyche, vol. 14, p. 43; 1907).

A key to the Eastern American species of the genus Chionea.

1. Body-coloration gray.....*noveboracensis*, sp. n.
   Body-coloration reddish or yellowish.....2.
2. Form long and slender; (length of the male less than 4 mm.; diameter across the thorax about .6 mm.); all the legs elongate, slender, not at all thickened.....*gracilis*, sp. n.
   Form stouter; (length of the male over 4 mm.; diameter across the thorax 1 mm. or over); at least the posterior legs of the male incrassated.....3.

3. Antennæ with 12 segments; all the femora of the male incrassated; size larger, (length of the male about 6 mm.; diameter across the thorax 1.5 mm.).....*primitiva*, sp. n.
Antennæ with 7 segments; the hind femora of the male conspicuously incrassated; size smaller (length of the male about 5 mm.; diameter across the thorax about 1 mm.).....*valga* Harris

Tribe *Limnophilini*.
Genus *Limnophila* Macquart.

Limnophila subaptera, sp. n.

Subapterous; wing of the male longer than the halter.

Male.—Length about 12 mm.; wing 2.5 mm.

Rostrum and palpi dark brown. Antennæ dark brown, apparently with only 15 segments; segments of the flagellum short-oval with stout, black bristles and a sparse, white pubescence. Head grayish with scattered yellowish bristles.

Thoracic dorsum grayish with three indistinct grayish brown stripes, the lateral pair running back on to the scutum; sides of the scutellum yellowish. Pleura gray, the dorso-pleural membranes brownish yellow. Halteres brown, paler basally. Legs long and slender; outer faces of the coxæ grayish except the fore coxæ which are pale yellow; femora pale at the extreme base, the remainder dark brown; tibiæ brownish yellow, the apices darker brown; tarsi brown. Wings subatrophied, long and narow, longer than the halteres (fig. 8), pale basally, darker brown apically.

Abdomen long and slender, brownish gray, the segments narrowly and indistinctly margined with paler; hypopygium with golden-yellow hairs.

Holotype, ♂, South Fork of the Kaweah R., California, below 5,000 feet, July 25, 1915, (J. Chester Bradley).

Type in the collection of Cornell University.

Similar to *L. aspidoptera* Coquillett (New Mexico) and like this species having apparently but 15 antennal segments, the reduction being brought about by the fusion or very close approximation of the last two segments; the three basal antennal segments in *aspidoptera* are the more brightly coloured. The most obvious difference is in the elongate wings of the present species, these

being about one and one-half times the length of the halteres; in *aspidoptera* (fig. 9) the wings are short and broad, and extend to about two-thirds the length of the halteres.

Limnophila (Prionolabis) cressoni, sp. n.

Dark brown with the thoracic stripes indistinct; wings with narrow, grayish brown seams to the cross-veins and deflections of veins.

Male.—Length 8 mm.; wing 10.6 mm.

Female.—Length 10 mm.; wing 10.8 mm.

Rostrum short, dark brown; palpi dark brown. Antennæ short, dark brown; the flagellar segments very short, almost rounded, with an abundant white pubescence. Head gray.

Thoracic dorsum dark brown with a sparse, yellowish gray bloom, the præscutal stripes poorly defined. Pleura clearer gray, the dorsal-pleural membranes brownish. Halteres dull yellow, the knobs a little darker. Legs with the coxæ and trochanters dull brownish yellow, darkened toward their apices, this dark tip broadest on the fore and middle femora, narrowest on the hind femora; tibiæ brown, the tips narrowly dark brown; tarsi brown. Wings with a pale, brown suffusion; stigma dark brown; broad, grayish brown seams along the cord, the outer end of cell *1st* M_2 and at the origin of the sector. Venation (fig. 7) R_{2+3} about as long as the basal deflection of Cu_1.

Abdomen brown, the terminal segments darker. Hypopygium of the male with the ninth tergite having a broad, V-shaped median notch that is bordered with pale reddish brown; ventral pleural appendage with a few scattered teeth that are not prominent.

Female quite similar to the male, the ovipositor with elongate, acute, nearly straight tergal valves; sternal valves elongate, only a little shorter than the tergal pair.

Holotype, ♂, Lagunitas Canyon, Marin Co., California, March 29, 1908, (E. T. Cresson, Jr.).

Allotopotype, ♀.

The types are in the collection of the American Entomological Society, Philadelphia.

This fly differs from the only described regional member of

the subgenus (*L. barberi* Alex.) in its larger size and different coloration.

Tribe *Pediciini.*

Genus *Tricyphona* Zetterstedt.

Tricyphona degenerata, sp. n.

Cell *1st* M_2 of the wings open by the atrophy of the outer deflection of vein M_3; wings small, somewhat degenerate, in the male less than 5 mm. in length.

Male.—Length about 4.8 mm.; wing 3.8 mm.

Head lacking in the type.

Pronotum light yellow. Mesonotum yellowish, the præscutum with a broad, dark brown, median stripe and shorter lateral stripes that continue back on to the anterior half of the scutal lobes; scutellum and the remainder of the scutum yellow; postnotum with a very sparse, grayish pruinosity. Halteres pale, the knobs a little darkened. Legs with the coxæ elongated, dull yellowish; trochanters yellow, the margin at the junction with the femora darkened; femora and tibiæ brownish yellow, the tips of the latter narrowly darkened; last two tarsal segments and the claws dark. Wings long and slender, small, degenerate, although with a complete venation; pale yellowish subhyaline, the veins yellowish brown; stigma indistinct. Venation (fig. 11) *Rs* angulated at its origin; cross-vein *r* about two-thirds the length of that portion of R_1 beyond it; petiole of cell R_4 longer than the *r-m* cross-vein; forks of *M* subacute; cell *1st* M_2 open by the atrophy of the outer deflection of M_3.

Abdomen dark brown, the hypopygium more reddish brown.

Holotype, ♂, Geneva Park, Grant, Colorado, altitude 9,500–10,000 feet, July 22, 1916, (E. C. Jackson).

The only other *Tricyphona* in the Nearctic fauna with the cell *1st* M_2 open by the atrophy of the outer deflection of vein M_3, is *T. aperta* Coq. (fig. 10), a full-winged fly that is much larger than our present species. A comparison of figures 10 and 11 will show the chief differences between the species. The condition in the present species is one of degeneration, the wing measuring but 3.8 mm.; the even more degenerate *T. hannai* Alex. (Pribilof Islands) represents the culmination of this tendency in the known species of the genus.

Genus *Rhaphidolabis* O. S.

Rhaphidolabis (Rhaphidolabis) sessilis, sp. n.

Size large (wing of the female over 8.5 mm.); body-coloration gray, the mesonotal præscutum with three dark brown stripes; wings with the cross-vein *r* at the tip of R_1; cell R_2 sessile or subsessile.

Female.—Length 6.8 mm.; wing 8.8 mm.

Rostrum and palpi dark brown. Antennæ brownish, the scape with a gray bloom; flagellar segments oval, dark brown. Head gray.

Mesonotum light gray, the præscutum with three dark brown stripes of which the median one is slightly darker and broader, becoming obsolete just before the transverse suture; lobes of the scutum brownish. Pleura gray, the dorsol-pleural membranes more brownish. Halteres pale, the knobs brown. Legs with the coxæ duli yellow, the outer faces with a gray bloom that is heaviest on the hind coxæ; remainder of the legs dark brown, the femora brightened basally. Wings with a pale gray suffusion, highly iridescent; stigma light brown; veins brown. Venation (fig. 12) *Rs* short, strongly arcuated; cross-vein *r* at the very tip of R_1; cell R_2 sessile or very short-petiolate.

Abdomen dark brown; valves of the ovipositor strongly reddish yellow.

Holotype, ♀, Hall Valley, Colorado, August 11, 1915, (E. J. Oslar).

This fly is readily separated from all the described species (see the author's key to the Nearctic species of the genus, Proceedings Academy Natural Sciences Philadelphia, p. 541, 542, 1916), in its large size and the position of the radial cross-vein.

Rhaphidolabis (Rhaphidolabis) major, sp. n.

Size large (wing of the female over 9 mm.); body-coloration pale brown, the præscutum with a broad, dark brown median stripe.

Female.—Length 7.8 mm.; wing 9.4 mm.

Rostrum yellowish brown, the palpi dark brown. Antennæ dark brown. Head brownish gray.

Pronotum light brown, darker brownish medially. Mesonotal

præscutum light fawn-brown with a very dark brown median stripe and much paler lateral vittæ; the conspicuous median stripe is broadest in front, gradually narrowed behind, ending before the transverse suture and narrowly bisected behind; lateral præscutal stripes and the lobes of the scutum paler brown; remainder of the scutum, the scutellum and postnotum reddish yellow, the latter browner on the caudal half. Pleura pale reddish brown, very sparsely dusted with whitish. Halteres yellow, the knobs brown. Legs with the coxæ dull yellow; trochanters similar, their margins blackened; femora dull yellow, the tips narrowly brown; tarsi dark brown. Wings yellowish gray subhyaline, strongly iridescent; stigma very pale; veins dark brown. Venation (fig. 13) *Rs* long, almost straight; cross-vein *r* removed from the tip of vein R_1 to a distance about equal to its own length; R_{2+3} shorter than the radial cross-vein.

Abdomen grayish brown with a reddish cast that is best defined on the caudal margins of the terminal sternites; ovipositor reddish yellow.

Holotype, ♀, Horseman Creek, Geneva Park, Grant, Colorado, altitude 10,200 feet, July 19, 1916, (L. O. Jackson).

This is the largest species of the genus.

Explanation of Plate XII.

Fig. 1. *Chionea primitiva*, sp. n.; ♂, legs of the right side not figured; *w* = wing.
Fig. 2. *C. gracilis*, sp. n.; ♂, dorsal aspect, legs of the left side not figured.
Fig. 3. Antenna of *Pterochionea bradleyi* Alexander; ♂.
" 4. The same, *Chionea primitiva;* ♂.
" 5. Wing of *Erioptera noctivagans*, sp. n.; ♂.
" 6. " *E. cinereipleura*, sp. n.; ♂.
" 7. " *Limnophila cressoni*, sp. n.; ♀.
" 8. " *L. subaptera*, sp. n.; ♂.
" 9. " *L. aspidoptera* Coquillett; ♂.
" 10. " *Tricyphona aperta* Coquillett; ♂.
" 11. " *T. degenerata*, sp. n.; ♂.
" 12. " *Rhaphidolabis sessilis*, sp. n.; ♀.
" 13. " *R. major*, sp. n.; ♀.

SUNFLOWER INSECTS IN VIRGINIA AND CONNECTICUT

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

Last August I visited Mr. S. A. Rohwer, at Falls Church, Va., and with his assistance obtained a series of insects from the sunflowers (*Helianthus annuus* var. *zonatus*) growing in his garden. The list is as follows:

(A) Visiting the Flowers.

Lepidoptera: *Anosia plexippus* L., sucking.

Hymenoptera: *Melissodes dentiventris* Smith, both sexes; *Melissodes caliginose* Cress., ♀; *Apis mellifera* L., worker; *Bombus consimilis* Cress., worker; *B. americanorum* Fb., worker; *Halictus capitosus* Sm., ♀s.

(B) On Foliage.

Hymenoptera: (Determined by Dr. W. M. Wheeler, who was present at the time). *Formica pallidefulva* Latr. and var. *nitidiventris* Emery.

Hemiptera: (Determined by Mr. O. Heidemann). *Entylia concisa* Walk., breeding on leaves; *Ilnacora stalii* Reuter, breeding on leaves.

In addition, a species of aphid (*Macrosiphum*) was found, of which we can only say now that it differs from any recorded from *Helianthus*.

On Sept. 11, Dr. W. M. Wheeler very kindly collected insects on sunflowers (*Helianthus annuus* var. *macrocarpus*) at Colebrook, Conn., (alt.1200 ft.), and sent me the specimens. The list is as follows:

Hymenoptera: *Myrmica scabrinodis* subsp. *schenki* var. *emeryana* Forel (Oct., Wheeler); *Bombus consimilis* Cress., six workers having the yellow pubescence brighter than in examples from Garrison, N.Y.; *B. fervidus* Fb., one male and six workers; *Melissodes dentiventris* Sm., ♀; *Megachile latimanus* Say, ♀.

Hemiptera: *Lygus pratensis* L., and a species not recognized.

Diptera: *Eristalis, Syrphus and Sphærophoria.*

At Boulder, Colorado, in September, 1916, I observed numerous moths one evening visiting the red sunflowers. On collecting a number, I found they were nearly all *Feltia subgothica* Haw.

A COMPARISON OF THE ANTENNÆ OF THE GRYLLOBLATTIDÆ AND EMBIIDÆ TO DEMONSTRATE THE RELATIONSHIP OF THESE TWO GROUPS OF INSECTS.

BY G. C. CRAMPTON, PH. D.*, AMHERST, MASS.

It has been maintained that the Grylloblattidæ are descended from Blattid-like forms, by some investigators (Walker, 1914, and others), while the writer (Crampton, 1915–1916) would derive them from Plecoptera-like forebears, through Embiid-like ancestors. It is of the utmost importance to determine the exact affiinities of the Grylloblattids, if we wish to trace the genealogy of the Orthopteroid groups (i. e., the Tettigonids, Gryllids, Locustids, etc.) since the Grylloblattids have departed the least of any living insects from the ancestral condition of the Orthoptera and their immediate relatives, and, therefore, furnish us with the most reliable evidence available for determining the affinities of Orthopteroid insects. On this account, I would present the evidence to be gained from comparative anatomy, in a series of papers in which the various external structures of the Embiids and Grylloblattids are compared part for part, in an endeavor to demonstrate that the Grylloblattids are more closely related to the Embiids than to any other group of lower Pterygotan insects, and that the Grylloblattids are consequently to be derived from Plecoptera-like ancestors through more immediate ancestors which closely resembled living Embiids.

In the present paper, which is the first of the series, I would present the evidence of close relationship between the two groups, to be gained from a comparison of their antennæ. Unfortunately, the accompanying rough sketches were made from loaned material, at a time when I did not realize the importance of making a more detailed study of the antennæ, since the specimens were borrowed primarily for the purpose of examining the thoracic sclerites—which furnish one of the most reliable sources of determining the relationships of insects, from the standpoint of comparative anatomy. The drawings, however, will be found sufficiently accurate for all practical purposes.

* Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass.
June, 1917.

The close correspondence in the number of antennal segments occurring in a female *Grylloblatta* and a female *Embia* is most striking. In the female *Embia* which I was able to examine, through the generosity of Major Imms, twenty-seven antennal segments

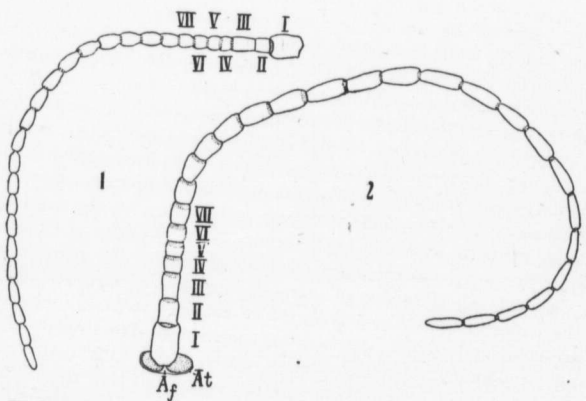


Fig. 9.—Lateral views of left antenna of (1) *Embia major* Imms, (2) *Grylloblatta campodeiformis* Walker.

occur (Fig. 9, 1), and in the female *Grylloblatta*, kindly loaned me by Dr. Walker, twenty-eight antennal segments occur (Fig. 9, 2). Imms, 1913, records a maximum of *twenty-nine* antennal segments for females of *Embia major* Imms; while Walker, 1914, records exactly the same number of segments (namely *twenty-nine*) as the maximum for females of *Grylloblatta campodeiformis*, Walk., thus showing an astonishingly close agreement in the number of antennal segments occurring in the two groups of insects. Indeed, there is a greater variation in the number of antennal segments among insects belonging to the same order, or even family, elsewhere in the lower Pterygota, and, coupled with other anatomical features no less striking, this clearly points to a remarkably close relationship between the Embiids and Grylloblattids.

In comparing the antennæ of the Grylloblattids with those of the typical Blattids (e. g., the antennæ of *Periplaneta americana* Linn) we find no such close correspondence in the number of segments, since the typical Blattid antenna is composed of considerably over a hundred more segments than are present in the antenna of *Grylloblatta*. Furthermore, the segments of a Blattid's antenna are of a very different type from those of a Grylloblattid's antenna, the smaller proximal antennal segments being more annular in outline in the Blattids. In the antennæ of the Embiids and Grylloblattids, on the other hand, there is not only a remarkable correspondence in the number of segments composing the antennæ, but the similarity extends even to the relative size and the outline of the antennal segments themselves.

In both *Embia* (Fig. 9, 1) and *Grylloblatta* (Fig. 9, 2)the scape (Seg. I) is much larger than the pedicel (Seg. II). Furthermore, the pedicel (Seg. II) is of about the same width as the postpedicel (Seg. III), but is shorter than the postpedicel (Seg. III) in both *Embia* (1) and *Grylloblatta* (2). In both insects, the postpedicel (Seg. III) is longer than the succeeding two segments. (Segs. IV and V) which are somewhat annular, or broader than long, in outline. The sixth segment (Seg. VI) is slightly longer than the two preceding it, in both *Embia* and *Grylloblatta*, while here is a slight increase in length in the seventh segment in both insects. The segments from this point on, gradually become longer, slenderer, and more clyindrical in both insects, and the correspondence, even to the minutest details, is so striking, that even the veriest tyro could not fail to perceive the remarkable similarity in the antennæ of these two insects. On the other hand, one has but to glance at the antennæ of a typical Blattid, to convince himself that the segments of its "whip-lash" antenna are of a very different type from those of *Grylloblatta;* and if any conclusions are to be drawn from a comparative study of the antennæ, they would clearly point to a remarkably close relationship between the Grylloblattids and Embiids. and a much more distant relationship to the Blattids.

It might be mentioned in passing, that the antennæ are situated nearer to the base of the mandibles, and below the eyes, in Embiids and Grylloblattids; while in the typical Blattids, the

antennæ are located higher up in the frontal region, between the eyes. The eyes of Embiids and Grylloblattids are similar in outline, and do not extend upward on the sides of the head; while in the typical Blattids, the eyes are more "reniform," and extend for a considerable distance upward along the sides of the head. The head is typically opisthognathous (i. e., mouthparts directed backward) in Blattids, while in both Embiids and Grylloblattids it is more prognathous (i. e., mouthparts directed forward). The cervical sclerites are astonishingly similar in Embiids and Grylloblattids (as will be brought out in a paper now ready for publication) while these neck plates in both groups differ markedly from those of the Blattids, and the same is true of the thoracic sclerites in general. The bodies of the Embiids and Grylloblattids are slender, while those of typical Blattids are broader and more flattened. It would be possible to cite many more instances of striking structural similarity between the Grylloblattids and Embiids, (in points wherein both differ markedly from the Blattids) but it is preferable to take up these structures point by point in a series of papers in which they can be discussed more in detail, and in which the points brought out can be illustrated by numerous figures—which after all are more convincing than bare statements of facts, since they enable one to form an opinion for one's self concerning the features in question.

The Grylloblattids are undoubtedly also very closely related to the Phasmids such as *Timema*, and in all probability both Phasmids and Grylloblattids were derived from forms quite similar to the Embiids. The Phasmodidæ (*Phasmodes ranatriformis*, Westw.) are insects very closely related to the Tettigonids ("Locustidæ") which have retained many features suggestive of Phasmid affinities, and beyond a doubt, a comparative study of *Phasmodes*, *Grylloblatta* and *Timema*, would be extremely instructive from the genealogical standpoint. It might also be mentioned that the Phylliidæ are too closely related to the Phasmids to be considered as a distinct order (the "Phyllioptera") as I formerly believed, since such Phasmids as *Ectatosoma* are quite closely related to the Phylliids (as can be seen by comparing the males of Phyllium with these Phasmids), so that I would now regard the Phylliids as a sub-order of the Phasmid group, rather than as a distinct order.

The insects most closely related to the Embiids are the Plecoptera, which are probably the nearest living representatives of the ancestral Pterygota, so that the Embiids were doubtless descended from Plecoptera-like ancestors. From these "Plecopteroid" ancestors the Forficulid line of development branched off in one direction, while that of the Embiids branched off in the other direction, and somewhere between the two (though doubtless nearer to the Embiid than to the Forficulid line) arose the Grylloblattid and Phasmid line of development. Somewhere between these in turn arose the Phasmodid, Tettigonid and Gryllid lines of development, while the Phylliids branched off from the Phasmid line of development. From this, it may be seen that the Blattids are not near the direct line of descent of the Grylloblattids, Phasmids, etc.; but this point will be more fully discussed elsewhere.

Bibliography.

1915. Brues & Melander. Key to the Families of North American Insects; Boston, 1915.

1915. Crampton. The Thoracic Sclerites and the Systematic Position of Grylloblatta campodeiformis, etc.; Ent. News, 26, p. 337.

1916. Crampton. The Lines of Descent of the Lower Pterygotan Insects, etc.; Ent. News, 27, p. 244.

1914. Walker. A New Species of Orthoptera, Forming a New Genus and Family; Canadian Entomologist, 46, p. 93.

Dr. Walker will shortly publish an article dealing with both sexes of Grylloblatta.

Abbreviations.

Af. Antennifer, or process bearing the antenna.

At. Antennale, or ring at base of antenna.

I. First antennal segment, or scape.

II. Second antennal segment, or pedicel.

III. Third antennal segment, or postpedicel.

IV. Fourth segment of antenna, etc.

TWO NEW SPECIES OF DICYPHUS FROM PORTO RICO, (MIRIDÆ, HETEROPTERA).

BY EDMUND H. GIBSON, U. S. BUREAU OF ENTOMOLOGY, WASHINGTON, D.C.

Specimens of the following new species have been received from Mr. R. T. Cotton, stationed at Rio Piedras, Porto Rico, where he finds them injurious to tobacco plants.

Dicyphus prasinus, n. sp.

Resembling *D. minimus* Uhl., but much larger and with greater width at the base of the head.

Head distinctly narrowed anteriorly, widest behind the eyes, with short, inconspicuous hairs. Eyes large. Front very convex and prominent. Clypeus prominent. First joint of antennæ stout and distinctly longer than the distance between the eyes, second joint as long as the head and pronotum together, third joint about equal to the second, and fourth joint equal to or slightly longer than the first. Rostrum extending to or beyond the hind coxæ. Pronotum wider than long, posterior lateral angles acute, posterior margin deeply emarginate, hairs or bristles on pronotum more prominent than those on head. Callosities of pronotum transverse, their posterior margin at the middle of the pronotum, median line impressed. Pronotum deeply concave or grooved at base of callosities. Colour: head, pronotum and scutellum pale yellow to yellowish green; eyes dark; clypeus and first antennal joint black; remainder of antennæ pale yellow to testaceous; a broad, dark lateral stripe on head behind eyes. Elytra subhyaline with small, fuscous spots, especially on the inner half. A large, irregular fuscous spot near costal margin of each wing-cover and midway between base and apex. Membrane more or less clouded and veins fuscous. Abdomen pale green, legs yellowish. Length to tip of hemelytra, ♀ 3¼–3½ mm., ♂ 3–3¼ mm. Width of pronotum ¾ mm.

Described from three females and ten males, all of which are in the collection of the U. S. National Museum.

Dicyphus luridus, n. sp.

This species may readily be distinguished from others of the genus by its short head and lack of colour markings.

Head short, space between the eyes and the pronotal collar short, about equal to the width of the collar. Eyes large. Front very convex, clypeus prominent. Rostrum extending to hind coxæ. Basal joint of antennæ stout, short, slightly less than the width between the eyes, with few stout bristles, second joint only slightly longer than length of pronotum, third about as long as the second, fourth longer than the first. Collar of pronotum wide, callosities transverse with posterior margin at middle of pronotum. Posterior margin of pronotum nearly truncate, posterior angles rounded. Scutellum large. Elytra evenly clothed with fine, short hairs. Length to tip of elytra 3.5–4 mm. Width of pronotum 1 mm. General colour pale yellowish green, but varying from yellow to green, normally nearly unicolorous. Basal joint of antennæ yellow or testaceous at base and apex, making a dark band in the middle, apex of other segments pale, otherwise dark. Elytra subhyaline without distinct spots or colour markings, more or less smoky. Veins of membrane fuscous. Abdomen green, legs more or less spotted with fuscous.

Described from two females and seven males all of which are in the collection of the U. S. National Museum.

It is gratifying to learn that the Dominion Government has recently appointed Dr. C. Gordon Hewitt to be Consulting Zoologist, in addition to his duties as Chief of the Entomological Branch of the Department of Agriculture. The object of this new appointment is to enable him to advise the Government in all matters relating to the protection of birds and mammals, and dealing with any injurious kinds. It is not intended that this should in any way interfere with the performance of his valuable duties as Dominion Entomologist.

BOOK NOTICE.

Check List of the Lepidoptera of Boreal America, by Wm. Barnes, S. B., M. D. and J. McDunnough Ph. D., Decatur, Ill., 1917.

The publication of a new faunal check-list may well be likened to adding another milestone along the roadside of science, and

Lepidopterists looking over this latest list and then glancing backward at its excellent predecessor, Dr. J. B. Smith's List of 1903, may well be satisfied with the progress made.

In the matter of species, over 8,500 are now included against about 6,800 in Smith's List, an increase of 1,700 species or 25%, which in itself indicates much activity. But more important still has been the work of specialists in working out revisions of the various groups from a world-wide standpoint, which, while necessitating many changes, is bound to result in a more stable classification. Among the works referred to are those of Rothschild & Jordan on the Sphingidæ; Sir Geo. Hampson on the Arctiidæ and Noctuidæ; and of Mr. L. B. Prout on the Geometridæ, in addition to the revisions in the partially completed "Genera Insectorum" and "Macro-Lepidoptera of the World."

Embodied in the new list are not only the conclusions of these eminent authorities, but also the results of several years' study of the Barnes' collection and existing types in other North American collections, and finally changes had to be made to accord with the rules of nomenclature adopted by the International Congress.

The changes in many instances have been very drastic, but with the excellent index, which occupies almost as many pages as the list proper, little trouble will be experienced in finding the species looked for. As a compensation for having to forget a lot of names and learn new ones, it will give the older collectors a feeling of pleasure to find the "swallow-tails" are all Papilios again, the "whites" are Pieris, instead of Pontia, and our friend the milk-weed butterfly is archippus again and its genus is Danaus, which sounds familiar even if the spelling be not.

The check-list is valuable to everyone interested in North American Lepidoptera, and the few lines headed "Exchange" on the fly-leaf at the back convey the good news that the same authors purpose publishing a full catalogue of North American Lepidoptera. It is hoped that the request for information will meet with a general and cheerful response.

The price of the Check-List is $2.00, and copies are obtainable from Dr. Wm. Barnes, Decatur, Ill. A. F. W.

Mailed June 2nd, 1917.