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POPULAR AND PRACTICAL ENTOMOLOGY.

INSECT TROPISMS.*

BY PROFESSOR A. WILLEY, MCGILL UNIVERSITY, MONTREAL.

The behaviour of insects, like that of other animals, is the result of the interaction between the organism and the medium or environment in which it lives. When properly understood it has the value but not always the precision of a chemical reaction, being the summation of a long series of physico-chemical changes.

The fundamental relation between organism and medium is determined by the necessity of the former to extract its nutriment from the latter. The medium not only furnishes food for the organism but also for its enemies and, in addition, it is the source of catastrophic danger. In order to procure its food the insect has to circumvent the enemies which persecute it and evade the dangers which threaten it. There are thousands of ways of avoiding or minimizing risk and thousands of species to adopt one or other of these ways. They all come under the head of "avoiding reactions," whether they operate as visible movements or attitudes, or as structural features; in the former case they may be called "global" reactions, in the latter they are cell or tissue reactions, *i. e.*, reactions of the idioplasm resulting in adaptive growth.

After the emergence from the egg the life-history of the holo-metabolous insects is broken up into two sharply marked periods of active struggle for existence. The larval activities are directed towards solving the problem of food and growth; those of the imago are concerned directly or indirectly with the problem of reproduction to which all the sense-organs are subordinated. A larva has only one question to answer: What can be eaten with impunity? For the imago the burning question of the day is: Where can the eggs be laid with safety? It is one of the tasks of the entomologist to ascertain how these elementary realities are

*Abstract of paper read at 54th Annual Meeting of the Entomological Society of Ontario, Nov. 9th, 1917.

faced, and that is the reason for studying insect behaviour. It is not enough for the imago to deposit its eggs upon the food-plant of its larva. The crisis of pupation has still to be passed. And all this is done, without reflection or premeditation, by hereditary predestination depending ultimately upon the specific physico-chemical properties which make up the "hereditary patrimony" of the organism.

The habits of the insects of to-day afford a picture, more or less altered by repetition and by circumstances, of the habits of their ancestors, so that their observation has an antiquarian or historical interest as well as an economic bearing, and it is not necessary to mix up these two aspects. It is one of the paradoxes of natural history that ancestral types can persist for untold ages alongside the more differentiated types. The tropical genus *Peripatus* is to the insect world what *Amphioxus* is to fishes. The latter has the English name of lancelet, and by a corresponding verbal transposition, *Peripatus* might perhaps become known as the "larvelet" since it has some of the properties and much of the appearance of an insect larva. Its habits are to this extent amphibious that whilst breathing air it requires an excess of moisture; hence, like the alpine salamander amongst batrachians, it is characteristically, though not invariably, viviparous. Whether oviparous or viviparous, there is no free larval period in the life-history of *Peripatus*; its trophic and reproductive phases are not separated.

The multitudinous traits of insects may be grouped under two categories corresponding approximately with their larval and imaginal phases. Idiotropic tendencies comprise the feeding, resting and protective devices of individual life. Phylotropic tendencies comprise habits looking to the preservation of the race, e. g., nest-building, egg-laying and brood-nursing. As an example of a casual observation of an idiotropic performance I may relate a small incident in my own experience. In December, 1905, I was descending the bund or high embankment of one of the ancient irrigation tanks of Ceylon when I noticed a dark brown Mantid ensconced amidst the green foliage of a low shrub. It happened to be a male of *Gongylus gongylodes*, a floreate species with foliaceous expansions on prothorax, legs and abdomen, known to Aldrovandus and figured by him in 1602.

As I approached it, several times in succession, on each occasion the insect squared the elbows of its fore limbs nearly at right angles to the body, the femur bent close against the long coxa, and the tibia pressed against the femur. This alert, defensive attitude had a terrifying aspect which was enhanced by a loud, rasping sound produced by rubbing the borders of the hind femora against the rim of the fore wings. The outer free border of each fore wing is thickened by a chitinous rim which is finely serrate. In the region of the hind femur the border of the wing is slightly emarginate, allowing free play to the thigh under ordinary circumstances. The femur itself is smooth, carrying a few minute hairs, but without any rough edge.

When the insect is alarmed, each hind femur is rubbed deliberately to and fro against the saw-like edge presented to it along the concave border of the wing, and a very effective stridulating sound results from the friction. The same sound can be closely reproduced upon the dead insect by gently passing a porcupine quill backwards and forwards along the wing-border. The serrate border of the wing is also present in the female *Gongylus*, where the emargination is still more pronounced.**

Quite recently I have become acquainted with a paper by J. Wood-Mason: *On the presence of a stridulating apparatus in certain Mantidæ*, (Trans. Ent. Soc. London, 1878, pp. 263-7) in which he, described the toothed edges of the tegmina of *Gongylus*, and supposed erroneously that the sound, which he had never heard, would be produced by the rubbing of the abdomen against the toothed edge. Professor Westwood asked Wood-Mason how it was that nobody had ever heard the Mantidæ stridulate, these insects being common enough where good observers have been. The answer was "that the species in which the stridulating apparatus is present are few in number;" and it may be added that they only perform under the right kind of stimulation applied at the right moment.

The homing instinct which we admire so much in bees and ants and wasps has been shown to depend to a surprising extent upon the chemical or olfactory sensitiveness of these insects, many

***Spolia Zeylanica*, vol. III, p. 226, Colombo, 1906.

of whose actions are reducible to chemotropic responses.*** The most trivial movements may have the deepest significance for the individual, and, when repeated regularly under certain conditions, they have the value of tropistic reactions. It is well not to forget that the record of a vital act is less easy to couch in critical terms than is the description of an inert form. There are several factors which influence behaviour, such as the nature of the species, the susceptibility of the individual, the place and time of observation. If for any reason, known or unknown, the behaviour is indeterminate, we can do nothing with it and the result of observation is negative. Indeed the interaction of tropisms may so confuse the issue as to render observation nugatory. It is only under the fortunate train of circumstances which permits straight and clear-cut reactions, several times repeated, that the study of behaviour becomes available for synthetic treatment.

NOTES ON NOVA SCOTIAN EUPTERYID LEAF-HOPPERS INCLUDING DESCRIPTIONS OF TWO NEW SPECIES.

BY W. L. MCATEE, WASHINGTON, D. C.

Professor W. H. Brittain, Provincial Entomologist of Nova Scotia, sent the writer a small collection of leaf-hoppers of this group, which is herewith reported upon, chiefly for the reason that characterization of two new species is required.

LIST OF SPECIES.

Dikraneura mali Provancher.—Truro, August 26; Digby County.

Empoasca atrolabes Gillette.—Kentville, July 3; Annapolis, July 15.

Empoasca obtusa Walsh.—Kentville, August 14, 16; Annapolis Co., August 8, 11, 28.

Empoasca unicolor Gillette.—Annapolis Co., August 11.

Typhlocyba cymba, new species.—Head and thorax pale yellow flecked with pellucid greenish yellow; elsewhere pale yellowish

***N. E. McIndoo: *Recognition Among Insects*. Smithsonian Misc. Coll., vol. 68, No. 2, Washington, 1917.
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hyaline. Scutellum and a straight-sided band just behind middle of, and confined to, clavi, fuscous. Margin of last ventral segment of female concave on each side before apex. Length 4.5 mm. One specimen, a female, Halifax, N. S., Sept. 1, 1917, in collection of Nova Scotia Department of Agriculture.

Typhlocyba lethierryi Edwards.—Truro, August 17.

Typhlocyba rosæ Linnæus.—Annapolis Co., August 5; Truro, August 26; Halifax, August 5, on elm; September 1, on maple.

Typhlocyba ulmi Linnæus.—Halifax, October 6.

Erythroneura ador, new species.—Venation nearly as in *E. obliqua* Say. Coloration unusual for an *Erythroneura* being pale yellow, except fore wings which vary to golden yellow, pale apically, and tips of tarsi which are dark. Length 4–4.5 mm. Described from four females (one the type) from Halifax, Nova Scotia, August 5, 1917, on elm, and one from same place September 1, 1917. Type and three paratypes in collection of Nova Scotia Department of Agriculture and one paratype in collection of writer.

TWO NEW DIPLOPODS FROM LOUISIANA.

BY RALPH V. CHAMBERLIN, CAMBRIDGE, MASS.

The two new species described below were found represented in a miscellaneous lot of myriapods sent to me for identification by Percy Viosca, Jr., of the Southern Biological Supply Co., of New Orleans. Other diplopods in the lot are *Callipus lactarius* (Say) and *Polydermus serratus* (Say) also from Covington, *Parajulus* sp. and *Spirobolus marginatus* (Say) from New Orleans, and *Julus cerulocinctus* Wood from Rochester, N.Y. The chilopods consist of the following species: *Otocryptops sexspinosus* (Say), *Theatops posticus* (Say), and *Hemiscolopendra punctiventris* (Newport) from Covington, *Arenophilus bipuncticeps* (Wood) from New Orleans, *Neolithobius mordax* (Koch) from Lake Charles, and *Scolopendra viridis* Say from Florida.

Ethojulus amphelictus, gen. et sp. nov.

This form is separated generically from *Parajulus* because of its different type of structure in the male gonopods. The

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anterior gonopods, which are ectal in position, are deeply bifid; the anterior branch is of ordinary texture, clavate in outline and pilose; the posterior branch is strongly chitinized and smooth, rather slender and blade-like, curving first caudad and then ventrad and mesad, each presenting an acute spur from its mesal edge just distad of the middle of its length. The posterior gonopods are long, slender, chitinous blades curving forward, downward, caudad and then again dorsad, thus forming three-fourths of a circle, with the tip bent slightly to one side; from near the base arises a shorter, distally acute, blade which is weakly sigmoidally bent and which extends ventrad nearly to the lower segment of the principal branch.

Sides and venter light brown. Dorsum of pale ferruginous cast, dusky; a longitudinal mid-dorsal black line; a row of large black spots along each side over the pores; above each black spot a fulvous spot and between this and the mid-dorsal line a narrow, fulvous stripe and a stripe of similar colour also commonly showing across the anterior border of the somite. The sides above, especially in anterior region of body, with a network of black lines over the lighter background. The collum covered with a similar network, a solid dark, transverse band just caudad of the anterior border, this widening toward the middle; a similar but narrower band across the caudal border, this connected with the anterior one along the median line. Vertex of head also with a network of dark lines; a solid black band between edges, this including the usual light spots below. Antennae blackish. Legs fulvous.

In the female the second tergite extends very much below the level of the collum; angularly pointed below. The collum with a longitudinal stria just above the margining sulcus on each side. In the male the collum is more elongate, as usual in *Parajulus*, with the lower margin long and straight. The second tergite does not extend below the level of the collum and its lower edge is straight.

The cardo of the mandibles in the male is strongly produced below; the process narrowed angularly ventrad, its apex narrowly rounded and reaching to the level of the lower edge of the labrum.

Segmental sutures strongly curved at level of pores.

Anal scutum exceeding the valves moderately, the tip straight and acute.

Number of segments, fifty-six and fifty-eight.

Diameter of female 3 mm.; of male 2.5 mm.

Locality.—Louisiana; Covington, Dec. 16, 1917.

Fontaria louisiana, sp. nov.

Type above dull brown; carinae bright yellow.

Vestigial foveolae 2+2.

Characterized by the structure of the gonopods of the male. In these the posterior or principal limb of the telopodite is bifid, the branches long, slender and subequal and cross those of the other gonopod; of the two branches or prongs the mesal one is geniculate near tip with the latter acute, while the ectal one is straight, its tip also acute. The proximal, undivided and less chitinous, stalk is thick, densely hairy, and is prolonged along the mesal side of the mesal prong. The anterior or lesser spine is much shorter than the bifid branch; it is much narrowed distad, is moderately sigmoidally flexed, and crosses that of the other gonopod.

The body is narrowed at both ends between which the sides are subparallel. The caudal plate short, truncate at tip. Processes of penultimate keels distally rounded, the other acute.

Length (male) 50 mm.

Locality.—Louisiana; Covington, Dec. 16, 1917.

A LONG-FASTING LEPIDOPTER.

BY R. R. ROWLEY, LOUISIANA, MO.

On May 15th, 1915, I received from Miss Harriet Boyes, of San Benito, Texas, twenty-four cocoons of *Rothschildia jorulla*, which she informed me were collected during the previous winter and spun by larvæ of the autumn of 1914.

The record for emergence of imagos is as follows: October 14th, 1915, one male moth; October 9th, 1916, one male; October
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10th, 1916, one male; October 16th, 1916, one female; July 19th, 1917, one female; September 20th, 1917, one male; April 25th, 1918, one female; May 2nd, 1918, one male.

Two cocoons gave large wasp-like hymenopters, five contain dead chrysalids, three are doubtful, and six pupæ are still alive and will doubtless give imagos in the autumn, next spring and perhaps later.

Miss Boyes, as well as Miss Pattie Hutchinson, of Beeville, Texas, inform me they have had similar experiences with *zorulla* cocoons.

This coming autumn these cocoons will be four years old. Think of a macro-moth 4 years as a chrysalis!

I have had pupæ of *Automeris io* produce imagos on the second summer, of *Callosamia promethea* to do the same, and occasionally a few to live into the second winter, but have known only one butterfly to live two years as chrysalis, *Anthocharis genutia*.

Little danger of such insects becoming extinct, but four years between meals is a long time to go hungry.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

NOTICE OF POSTPONEMENT OF MEETING.

Owing to the epidemic of influenza it has been thought wise to postpone the annual meeting of the Society, and to hold it on Wednesday and Thursday, the 4th' and 5th of December, instead of the 6th and 7th of November.

The place of meeting will be, as previously announced, the Ontario Agricultural College, Guelph.

It is expected that accommodation for all members can be secured in the residence at the College. Members who propose being present will kindly notify the secretary in advance, and also send as soon as possible the titles of their papers.

The Plant pathologists will meet on the Friday immediately following the Entomological Society meeting.

L. CAESAR, President, O. A. College, Guelph, Ont.

A. W. BAKER, Secretary, O. A. College, Gueph, Ont.

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ON THE AMERICAN REPRESENTATIVES OF SOMATOCHLORA ARCTICA WITH DESCRIPTIONS OF TWO NEW SPECIES. (ODONATA).

BY E. M. WALKER, TORONTO.

Three North American species of *Somatochlora* have been described in which the appendages of the male are of the same general form as in the palæarctic species *S. arctica* Zetterst. These are *S. forcipata* Scudd., *S. semicircularis* Selys, and *S. franklini* Selys. Another species, *S. macrotona*, has been described by Williamson (Ent. News, XX, 1909, pp. 78-79) but, as mentioned below, I find this to be identical with *franklini*. To these three species I have two others to add, so that we have in North America five species of the *arctica* group. I had intended that the descriptions of these new species should first appear in a monograph of the American species of this genus, which is now in course of preparation, but at the request of another writer who wishes to list one of them I decided to publish them in advance.

The five North American species of *Somatochlora* of the *arctica* group may be separated as follows:

- A. Superior appendages of ♂ with a prominent external tubercle beyond the middle, visible from above; vulvar lamina half as long as 9th sternite, bilobed; postclypeus wholly black.....*semicircularis* Selys.
- AA. Distal external tubercle of superior appendages when present not or scarcely visible from above; vulvar lamina little or no shorter than the 9th sternite, entire; postclypeus variable.
- B. Abdominal segments 5 to 7 with yellow latero-basal spots, greatest width of ♂ abdomen distal end of seg. 5, thence narrowing caudad.
- C. Lateral thoracic spots brownish, scarcely paler than the ground colour, the mesepimeral elongate, ill defined; superior appendages of ♂ in profile straight, ventro-lateral tooth not affecting the outline; vulvar lamina extending almost or quite to the hind margin of 10th sternite.....*incurvate* n. sp.

- CC. Lateral thoracic spots pale yellow, subovate, conspicuous; superior appendages of ♂ in profile arcuate, with a very prominent ventrolateral tooth, which affects the outline; vulvar lamina about as long as 9th sternite.....*forcipata* Scudd.
- BB. Abdominal segments 5 to 7 without yellow spots, greatest width of ♂ abdomen at distal end of seg. 6 or beyond.
- D. Frons bounded below by a yellowish margin, separating the metallic portion from postclypeus, the latter with yellowish lateral lobes; hind wing of ♂ but little shorter than abdomen (about 30:33), the anal triangle more or less yellow.....*kennedyi*, n. sp.
- DD. Frons without a yellow inferior margin, the dark coloration continuous with that of postclypeus, which is wholly black; hind wing of ♂ decidedly shorter than abdomen (about 26:38), anal triangle with a brown spot.....*franklini* Selys.

***Somatochlora semicircularis* Selys.**

This species seems to be wholly western, and is apparently the commonest species of the genus from the Rocky Mountains to the Pacific Coast. References to *semicircularis* from eastern localities (Williamson, Ent. News, April, 1906, p. 136, pl. V, figs. 2, 3, 4) apply to *S. kennedyi*.

S. semicircularis is easily recognized by the form of the male abdominal appendages and the vulvar lamina of the female, together with the black lateral lobes of the clypeus. The lateral thoracic spots are conspicuous in young individuals but of a deeper yellow than in *forcipata*, and the metepimeral spot is usually much smaller. Lateral abdominal spots are generally present but are variable and sometimes absent. The extent of these variations are well shown by Kennedy (Proc. U. S. Nat. Mus., 46, 1913, pp. 111-126, figs. 1-57). It is the stoutest of the five species of the group.

Material studied.—68 ♂'s, 21 ♀'s; Banff, Alta., June 29-31, 1913, 5 ♂'s 2 ♀'s, (Walker and Kurata); Nordegg, Alta., 6,500 ft., July 16, 1917, 1 ♂, (F. C. Whitehouse); Mt. Benson, Vancouver Is., B.C., July 21, 1909, 4 ♂'s 1 ♀; id., July 23, 1909, 1 ♀, (A. G. Huntsman); Departure Bay, Vanc. Is., July 13, 1908,

4 ♂'s 2 ♀'s, (Huntsman); near Lonely Lake, Vanc. Is., July 19, 1913, 6 ♂'s 2 ♀'s, (Walker and Kurata); Ainsworth, B.C., July 11, 1903, 1 ♂, (R. P. Currie, U.S.N.M.); Bumping Lake, Wash., July 10-11, 1911, 37 ♂'s 12 ♀'s, incl. 7 prs. in cop. (C. H. Kennedy, U.S.N.M.); Big Meadows, Or., July 7-8, 1913, 6 ♂'s, (Kennedy); Snake River, Yellowstone National Park, Aug. 14, 1896, 1 ♂, (Currie, U.S.N.M.); "Mountains, S. W. Colorado," Aug. 15-Sept. 6, 3 ♂'s 1 ♀ (Lieut. Carpenter, coll. Calvert, 1 ♂ coll. Walker).

***Somatochlora incurvata*, n. sp.**

Male.—Occiput, frontal vesicle and upper part of frons metallic blue-black; sides of frons and lower margin ochreous to brownish yellow; postclypeus black in middle, lateral lobes castaneous; labrum black; anteclypeus and labium pale yellow; pile moderately dense, blackish on metallic areas, elsewhere pale brownish.

Prothorax dark greyish-brown, anterior lobe broadly edged with whitish, posterior lobe brownish ochreous. Meso- and metathorax metallic blue to violet, sometimes with greenish reflexions, with the following parts reddish brown; antealar sinus, inferior half of mesepisternum, an area along bases of wings extending as a stripe down the mesepimerum, an obscure, ill-defined area enclosing the metastigma and a large spot on the metepisternum, which is angular above when well defined. The mesepimeral and metepimeral spots are generally lighter than the other brown areas. Fore coxæ black in front, reddish brown behind, this colour extending over most of the outer surface of the fore femora. Pile of thorax rather thin, especially on the sides, pale brown.

Wings hyaline, the faint yellow tinge deepening in the anal triangles; pterostigmata castaneous, not very dark; costal veins dark brown, edged with dull ochreous toward the base; membranule dull dark brown, paler in basal third.

Abdomen slender, elongate, expanding from the constriction at seg. 3 to the distal end of seg. 5, narrowing gradually on 6, more rapidly on 7 and 8. Pile pale brownish, scanty. Genital lobes rather small, rounded angulate, incurved.

Colour greenish black, moderately shining. Segments 1, 2 and base of 3 castaneous, somewhat lighter on the sides and dorsal

surface of 2, but not forming distinct spots in the specimens studied. Base of 3 with lateral yellowish patch extending from dorsal to ventral surface. Segs. 4 to 8, each with a roundish, baso-lateral spot becoming small on 8.

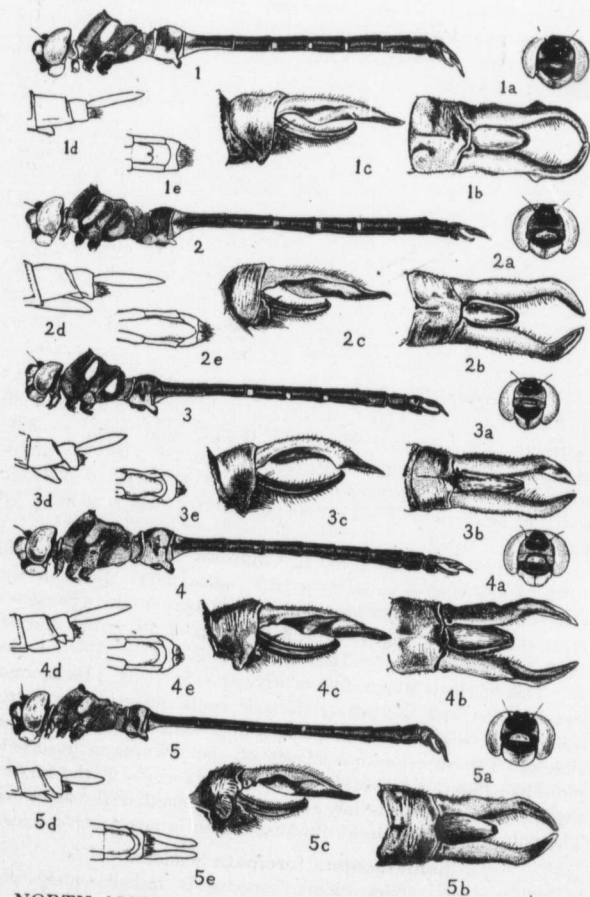
Appendages.—The form of these is shown on pl. X, figs. 2b, 2c. In dorsal view the superior appendages appear widest at the base, where they are close together, subparallel in proximal half, the apical inward curve nearly as in *semicircularis* but not quite so regularly arcuate. In profile they are straight, lateral carinae percurrent, inferior carinae gently arcuate towards base, slightly bent outward, but not visible from above; ventro-lateral prominence well marked, barely seen from above (probably not in all cases); apices acute, slightly carinate above, the extreme tips somewhat decurved (perhaps in drying). Inferior appendage about half as long as superiors, triangular, apex bluntly pointed, with a well-marked recurved spine.

Female.—Similar in coloration to male. Seg. 2 is entirely castaneous, except a very small lateral spot and an apical ring, which are pale brownish grey or drab. The underside of 3 is also of about the same colour. The yellow spots on the other abdominal segments are usually larger than in the ♂, and often diffusely prolonged caudad.

The wings as usual show considerable variation in colour but are typically hyaline, each with two basal, amber, yellow streaks, and a yellowish cloud occupying the distal half, or less, of the wing and deepest about the pterostigma. In some individuals the entire wing is flavescent, but even in these the basal streaks appear deeper than the rest of the wing.

In most of the specimens the abdomen is broadest at base and tapers fairly regularly to near the caudal extremity, but, as in other species, its form varies with age, younger individuals being more depressed and regularly tapering, older ones more cylindrical and laterally constricted at seg. 3.

The vulvar lamina is elongate, extending in all the specimens well beyond the distal margin of the 9th sternite, as far as that of 10 or even a little farther. It is horizontal, trough-shaped, the sides slightly convergent, apex broadly rounded, upper edges before the apical curve slightly arcuate. Inferior surface in profile



NORTH AMERICAN SPECIES OF SOMATOCHLORA
OF THE ARCTICA GROUP.

feebly convex. Colour yellowish, darkened in the middle. Appendages about as long as vulvar lamina or as segs. 9 and 10 together.

VENATIONAL DETAILS. (2 ♂'s 10 ♀'s.)

	No. of veins	No. of wings, ♂	No. of wings, ♀		No. of veins	No. of wings ♂	No. of wings ♀
Antecubitals fore wings	7		3=15%	2nd postc. before pter., fore wings	3	4	17=85%
	8	2	16=80%		4	4	3=15%
	9	2	1=5%				
Antecubitals hind wings	5	2	18=90%	2nd postc. before pter., hind wings	3		4=20%
	6	2	2=10%		4	4	14=70%
					5		2=10%
Postcubitals fore wings	5		6=30%	Veins in triangle, fore wings	0		2=10%
	6	4	10=50%		1	4	18=90%
	7		4=20%				
Postcubitals hind wings	6		2=10%	Veins in triangle, hind wings	0		2=10%
	7	1	12=60%		1	4	18=90%
	8	3	5=25%				
	10		1=5%				

*Measurements**.—(2 ♂'s, 10 ♀'s)—Length (without apps.) ♂ 52.0–54.5, ♀ 47.5–56.5; thorax, ♂ 8–9, ♀ 7.5–8.5; abdomen (without apps.), ♂ 38.0–39.5, ♀ 35.0–43.0; hind wing, ♂ 33.0–34.0, ♀ 32.0–36.5; sup. apps. ♂ 4; apps. ♀ 3.0–3.75; pterostigma of hind wing (costal margin), ♂ 2.75–3.0, ♀ 2.8–3.5; width of hind wing, ♂ 9.25–10.0, ♀ 9.0–10.3; width of head, ♂ 7.6–8.0, ♀ 7.0–8.0.

Holotype.—♂ Whitefish Pt., Chippewa Co., Mich., July 29, 1916 (A. F. Combs). *Allotype*.—♀, same data. Both in the University of Michigan Museum, Ann Arbor, Mich. *Paratopotypes*.—1 ♂ 2 ♀'s Aug. 7, 1916; 6 ♀'s July 29, 1916; 1 ♀ Aug. 4, 1916, 1 ♀ without date. Total 2 ♂'s 11 ♀'s.

This species is a very close relative of *S. forcipata*. Its average size is larger and the lateral thoracic spots differ in shape and colour, otherwise the colour pattern approaches that of *forcipata* closely. The superior appendages of the ♂ appear in profile more like those of *kennedyi* than *forcipata* and, as in the former the inferior appendage is only about half the length of the superiors. The vulvar lamina is decidedly longer than in any other species.

***Somatochlora forcipata* Scudder.**

This slender, dark-coloured species is rather widely distributed but seems to be everywhere rare. It ranges from New-

*All measurements are in millimetres.

foundland and Labrador to Great Slave Lake and southward to Nova Scotia, northern New England, Quebec, Ontario and northern Michigan. I have seen but nine specimens from the following localities:

Hopedale, Labrador, Aug., 1917, 1 ♂, (W. W. Perrett) Ashwanipi River, Northern Quebec, July 25, 1917, 1 ♀, (Carnegie Museum Coll.); Isle d'Orleans, Que., Aug. 27, 1904, 1 ♂, (Walker); Algonquin Park, Ont., July 15, 1900, 1 ♂, (J. Macoun); De Grassi Pt., Ont., June 26, 1918, 1 ♂, (Walker); Profile Lake, N. H., July 20, 1918, 1 ♂, (R. H. Howe); Manistiqua River, Schoolcraft Co., Mich., 2 ♂'s, (A. F. Combs); Marquette, Mich., 1 ♀, (Coll. Hubbard & Schwarz, U. S. N. M.).

***Somatochlora kennedyi*, n. sp.**

Male.—Occiput, frontal vesicle and upper part of frons metallic blue-black or green-black; sides of frons and a moderately broad, lower margin yellowish brown; postclypeus dark brown or black in centre, lateral lobes yellow; labrum black or deep brown, anteclypeus and labium pale yellow. Pile somewhat dense, blackish on top of head, pale yellowish on face. Rear of head black with whitish pile.

Prothorax greyish brown, anterior lobe edged with whitish, posterior lobe testaceous. Meso- and metathorax metallic gold-green with blue reflexions, the actual brilliancy of the colour much obscured by dense, light brownish pile; the following parts ochreous but not forming well-defined nor conspicuous spots:—the antealar sinus, the ventral edges of the mesepisternum, a narrow area below bases of wings, an oblong or ovate spot on the mesepimerum connected with the above area, an ill-defined blotch enclosing the metastigma, and the posterior half or more of the metepimerum. Fore coxæ black in front, dull yellowish above and behind, this colour extending over trochanters to outer surface of fore femora in their basal half.

Wings hyaline or tinged with yellow, especially along costa, sometimes entirely suffused with amber yellow; costa yellowish proximally, darkening beyond nodus; pterostigmata dark yellowish brown; hind wings with a yellow basal spot of variable size and

depth of colour, but not extending much beyond the anal triangle; membranule dark smoky brown, the basal third or fourth paler.

Abdomen greatly constricted at seg. 3, slender and scarcely expanding on 4, thence gradually widening to the distal end of 6 or even that of 7, beyond which it is considerably narrowed again. Pile pale brownish, long and thick on segs. 1 and 2, elsewhere very short. Genital lobes large, subangulate below, moderately incurved, with dense pile.

Colour greenish black, but little shining, marked with dull yellow as follows: Seg. 1, a large lateral spot. Seg. 2, a large antero-ventral and usually a postero-ventral spot on each side, narrowly separate or connected, the latter extending upon bases of auricles; a pair of large, rounded postero-dorsal spots, which may be narrowly connected with the postero-ventral spot, and a pale, apical annulus. Seg. 3, a pair of small, antero-dorsal spots and larger paler antero-ventral spots, continued caudad as narrow marginal streaks. The remaining segments have no pale markings except the brownish streaks along the tergal margins on the ventral surface.

The abdominal appendages (pl. X, figs. 4b, 4c) differ from those *forcipata* as follows: The superior appendages are less arched in profile with a less prominent distal ventro-lateral prominence; the lateral carina extends farther distad and gives a broken appearance to the outer margin in dorsal view, the apices are more acute. The inferior appendage is a little shorter. The broken outer margin and acute apices also distinguish the appendages from those of *incurvata* and *semicircularis*, the latter differing also in other points already noted.

Female.—Similar to male in coloration with the following slight differences: Abdominal segment 2 with a single large pair of ventro-lateral spots and a pair of postero-dorsals, or these may fuse to form one large lateral blotch. Seg. 3 with antero-dorsal spots much larger and broadly connected with the antero-ventral spots. The basal yellow spot of the hind wings may be very small or indistinct.

The shape of the abdomen varies much according to age, and is similar to that of *incurvata*. Vulvar lamina about four-fifths as long as 9th sternite, not elevated, spoon-shaped, broadest at

base, but little narrowed distad, the free margin entire, broadly rounded, colour yellowish.

VENATIONAL DETAILS. (10 ♂'s 10 ♀'s.)

	No. of veins	No. of wings, ♂	No. of wings, ♀		No. of veins	No. of wings, ♂	No. of wings, ♀
Antecubitals, fore wings.	7 8 9	11 = 55% 9 = 45%	11 = 55% 8 = 40% 1 = 5%	Antecubitals hind wings.	4 5 6 7 8	1 = 5% 17 = 85% 1 = 5% 1 = 5%	19 = 96% 1 = 5%
Postcubitals, fore wings.	5 6 7 8	12 = 60% 4 = 20% 4 = 20%	6 = 30% 6 = 30% 8 = 40%	Postcubitals, hind wings.	5 6 7 8 9 10	1 = 5% 1 = 5% 8 = 40% 7 = 35% 2 = 10% 1 = 5%	2 = 10% 2 = 10% 12 = 60% 3 = 15% 1 = 5%
Triangles fore wings	0 1 2	20 = 100%	20 = 100%	Triangle hind wings	0 1 2	7 = 35% 13 = 65%	4 = 20% 15 = 75% 1 = 5%

Measurements.—10 ♂'s 10 ♀'s. Length (without apps.) ♂ 46.5–51.0, ♀ 46.0–52.0; thorax, ♂ 8.5–9.0, ♀ 7.0–8.0; abdomen (without apps.), ♂ 33–36, ♀ 34–38.5; hind wing, ♂ 30–31.5, ♀ 30–32.5; sup. apps. ♂ 3.6–4; apps. ♀ 3.4–4.3; pterostigma of hind wing, ♂ 2.5–3, ♀ 2.5–3; width of hind wing, ♂ 8.5–9, ♀ 9–10; width of head, ♂ 7–7.5, ♀ 7.25–7.6.

Holotype.—♂, Orono, Me., F. L. Harvey, collection of Dr. P. P. Calvert. *Allotype.*—♀, Orono, Me., F. L. Harvey, collection of Dr. P. P. Calvert; taken in cop. with holotype. *Paratopotype.*—♂, June 15, 1891, Harvey, collection of Dr. Calvert.

I have also examined the following specimens: Orono, Me., June 18, 1898, Bartle Harvey, 1 ♀, (U. S. Nat. Mus.); Manchester, Me., Miss M. Wadsworth, June 20, 1904, 1 ♀, (coll. Calvert); Concord, Mass., R. H. Howe, June 18, 1917, 1 ♀, (teneral); id., June 24, 1917, 2 ♂'s 1 ♀; id., June 4, 1917, 1 ♀; id., June 4, 1918, 1 ♂ 1 ♀; id., June 6, 1918, 1 ♂ 1 ♀; id., June 9, 1918, 1 ♂; Manistiqua River, Schoolcraft Co., Mich., 2 ♂'s, (A. F. Combs); Godbout River, Quebec, July 29, 1918, 1 ♂ 1 ♀, (Walker); Mer Bleue, near Ottawa, Ont., June 9, 1903, 2 ♂'s 2 ♀'s, (A. Gibson); De Grassi Pt., Lake Simcoe, Ont., June 19, 1917, 1 ♂, (Walker). Total 13 ♂'s, 11 ♀'s.

This species has been confused with both *forcipata* and *semicircularis*. Eastern records of this latter species all belong to

kennedyi. The untangling of the synonymy, however, can be omitted here, as it will be considered in my revision of the genus, now in preparation.

I take pleasure in naming this species after Mr. Clarence Hamilton Kennedy in recognition of his valuable contributions to North American Odonatology. Mr. Kennedy recognized this species as distinct independently of the writer and at about the same time, so that it is particularly fitting that it should bear his name.

***Somatochlora franklini* Selys.**

This species is remarkable for the great length and slenderness of the abdomen and shortness of the wings in the male, and to a less extent in the female. There is much variation in these characters, and also in size, coloration of wings and length of appendages of the ♀.

A study of this species in considerable series shows that *S. macrotona* Wmsn. (Ent. News, Feb., '09, pp. 78-79) is not distinct from *franklini*, the characters employed to separate the two forms being very variable, especially in the female. The principal character upon which the specific diagnosis of *macrotona* was based is the presence of small genital lobes in the ♀, these being absent in *franklini*. I find these lobes are sometimes present as an individual variation, but are independent of the other characters given for *macrotona*. They show various degrees of development, being sometimes barely indicated.

There is some doubt as to whether the present species is the true *franklini* of Selys. In case it proves to be a distinct species, the name *macrotona* will still be valid.

S. franklini is the most widely distributed species of this group, and is characteristic of the Hudsonian and Canadian zones from Labrador, Newfoundland and Maine to the Rocky Mountains, probably ranging to the Pacific Coast.

I have examined the following material: Hopedale, Labrador, Aug., 1917, 1 ♀, (W. W. Perrett); East Main, Hudson Bay, Que., July 8, 1914, 2 ♀'s, (W. Todd); Sherbrooke, Que., 1 ♀, (Abbé Begin); Mer Bleue, near Ottawa, Ont., June 9, 1908, 1 ♂, (A. Gibson); Western Ont., Hudson Bay drainage, July 21, 1917, (Mrs. G. K. Jennings), 1 ♀; Winnipeg, Man., June 16, 1910,

1 ♂ 1 ♀, (J. B. Wallis); Winnipeg Beach, Man., June 19, 1909, 1 ♀, (Wallis); Husavick, Man., Aug. 17, 1910, 1 ♀, (Wallis); Le Pas, Man., July 1, 1917, 1 ♂ 2 ♀'s, (Wallis); Hudson Bay Railway, various points from M214 to M332, July 7-19, 1917, 4 ♂'s 7 ♀'s, (Wallis); Nordegg, Alta., July 11-17, 1917, 5 ♂'s 17 ♀'s, (F. C. Whitehouse); Chemo Stream, Bradley, Me., July 27, 1891, 1 ♂, (F. L. Harvey); Whitefish Point, Chippewa Co., Mich., Aug. 4, 1916, 1 ♂; id., no date, 2 ♂'s, (A. F. Combs). Total 16 ♂'s, 34 ♀'s.

EXPLANATION OF PLATE X.

Fig. 1—*Somatochlora semicircularis* Selys, ♂ (legs and wings omitted); 1a, front view of head; 2b, abdominal appendages of ♂, dorsal view; 1c, same, lateral view; 1d, end segments of ♀, lateral view; 1e, same, ventral view (appendages omitted).

Figs. 2—2e, *Somatochlora incurvata*, n. sp., same parts in fig. 1-1e.

Figs. 3—3e, *Somatochlora forcipata* Scudd., same parts as in figs. 1-1e.

Figs. 4—4e, *Somatochlora kennedyi*, n. sp., same parts as in figs. 1-1e.

Figs. 5—5e, *Somatochlora franklini* Selys, same parts as in figs. 1-1e.

ZOROTYPUS HUBBARDI, A NEW SPECIES OF THE ORDER ZORAPTERA FROM THE UNITED STATES.

BY A. N. CAUDELL, BUREAU OF ENTOMOLOGY, U. S. DEPT. OF AGRICULTURE, WASHINGTON, D.C.

For over two decades a very unusual termitophilous inquiline has remained unstudied in the National Collection in spite of its having been several times brought to the attention of men better fitted to publish upon it than myself. It seems wrong to neglect longer the recording of this interesting addition to our fauna, and especially the interesting notes made by Mr. H. G. Hubbard, the original discoverer of the species, and I have, therefore, decided to assume the responsibility for the new name here erected. In

my studies I have benefited greatly from advice and assistance from various of my office associates. At an opportune moment, just as I was studying the Hubbard material, there came to hand an additional lot of six specimens taken but a month previous by Mr. Snyder. This accession of fresh material proved of great value.

It was in 1895 that this insect was first discovered, Mr. Hubbard collecting material at Haw Creek, Florida, in March of that year. Specimens were taken in termite galleries in a decayed log, and field notes were made on their appearance and habits. Except for an extract published by T. E. Snyder, Bull. Bur. Ent., U. S. Dept. Agric., No. 94, part II, p. 71 (1915), these notes are still in manuscript. Deeming them well worth printing I here quote them in full:

"Termitophilous insects Haw Creek, Fla., March 4, 1895, (*Trichopsenus?* and a Thysanuran near *Campodea* imitating a young termite) found in galleries of *Termes flavipes*, small var., living in large, red rotten log in palmetto hammock. The *Campodea* lives in galleries not among the termites but in their immediate vicinity. It can only be distinguished from the immature termite by its longer legs and greater activity. It is very difficult to capture. I saw several, got only one in small vial of alcohol.

"March 26 from same log I took numerous specimens of the Thysanuron, but lost one vial and saved only a few specimens, one of which is mounted on a point, the rest in alcohol tube.

"May 16. I mounted in balsam on a slide two specimens, one on its back and one on its belly. The balsam clouded considerably."

The *Trichopsenus?* mentioned in the above quoted notes is a Staphylinid beetle.

Some time later, the exact date not known and of little importance, the above notes were rewritten by Mr. Hubbard in a more permanent form and show a change of opinion as to the probable identity of the species concerned. This recasted note is here copied in full:

"247 Termitophilous Psocid found with termites in large log in pine swampy hammock of Prairie Farm, Haw Creek, Fla.,

March 26, 1895. Several specimens in alcohol together with worker of the termite collected at the above date, also one specimen dry on triangle point, collected March 4, '95, from the same log. The resemblance to a young termite is perfect, especially in mature specimens like that mounted dry. The psocid is, however, much more active than the termite and very difficult to capture. Immature specimens were not rare, and I took a large number but lost most of them with the vial that contained them. The immature specimens inhabit the galleries of the termites, but are not so apt to be found among the termites themselves as in their immediate vicinity. No. 244 *Microcorytus testaceus* was taken from this log at the same time.

⁴Balsam slide with two specimens of the Psocid.

"In the spring of 1896 I visited this log and found the vial with specimens lost the previous year. These are in separate vial (alc) numbered 247^a. The termites from this same collecting vial are in a separate vial and numbered 707."

The lost vial mentioned in this note has again been lost track of and its whereabouts is at the present time unknown.

The recently acquired material was taken in Florida by Mr. T. E. Snyder, who has kindly furnished the following field note regarding them:

"15290^a. Miami Beach, Fla., April 10, 1918. Inquilines? With termite in decayed red mangrove log; with termite and in adjacent wood. Very much more active than the termite."

The above material, ten specimens in all, four from Hubbard and six from Snyder, forms the basis for the following description:

Zorotypus hubbardi, new species.

General habitus very like that of a termite. Entire insect beset with stout, inclined bristle-like hairs, those on the dorsal surface of the abdomen directed backwards and mostly arranged in two transverse rows on each segment, one post-mesial and one at the posterior margin. A few of these bristles towards the end of the abdomen are sometimes quite long, almost as long as the basal segment of the antenna, but for the most part they are less than one-half that long and those of the sides and especially on the venter of the abdomen are very small and short. These

bristly hairs are scattered over the entire insect, body and appendages, including even the palpi, those on the legs and other appendages smaller and shorter, some on the antennæ being somewhat longer and a few on the coxæ as long as or even longer than the average ones on the dorsum of the abdomen, but less stout.

Head from above about as long as broad, without a prominent nasus as common in wingless psocids. Antennæ thick and consisting of nine segments; basal segment large, the apical fourths swollen, the entire segment almost three times as long as the greatest width; second and third segments approximately a third narrower than the first and subequal in length, their combined length scarcely as much as that of the basal segment; fourth to ninth segments about the same thickness and length as the basal one, the fourth slightly shorter, and the ninth somewhat more pointed apically than the others. Mandibles subquadrate and heavily chitinized, with two major teeth and some smaller notches and with a few fine hairs on the outer side; between the mandibles and the antennæ is the clypeus, which is small and narrow, making the antennæ but little separated from the base of the mandibles; maxillæ large and well developed, from a side view forming no inconspicuous feature of the head in fresh material or specimens preserved in spirits, the tip pointed and chitinized and with several moderately long teeth and some short brush-like bristles; maxillary palpi consisting of five segments; basal segment short and generally inconspicuous, little longer than broad; second segment of about the same thickness as the basal one, thickening somewhat in about the apical two-thirds and about four times as long as the greatest width; third segment about as long as the second but a little thicker; fourth segment but little longer than the apical width, apically about as thick as the preceding segment but basally much narrowed, the tip concave; fifth and last segment noticeably longer than any of the preceding ones, nearly as long as third and fourth together, and somewhat thicker than any of the preceding ones, the margins very slightly rounded and the tip broadly rounded; labial palpi three-segmented, the basal two short and generally obscure and the apical one large and thick, being nearly as thick as the terminal segment of the maxillary palpi, and but a little shorter, the whole segment about three

times as long as the greatest width. Eyes wanting, two specimens on a slide in balsam showing pigmented lateral spots which may represent eye facets. Ocelli wanting.

Thorax well developed; pronotum from dorsal view about as long as broad, about as long as the meso- and metathorax combined, and very broadly rounded anteriorly and truncate posteriorly the sides very gently rounded and gradually convergent posteriorly where it is nearly a fourth narrower than anteriorly, the length about equal to the anterior width; mesonotum from above half as long as the pronotum and posteriorly broadly rounded, the sides straight and gradually divergent posteriorly, where the width is slightly greater than that of the posterior part of the pronotum; metanotum similar to the mesonotum in length and shape but a little broader.

Legs stout, coxæ very large and broad, being fully as broad as the femora; trochanters well developed, being of about the thickness of the apical tarsal segment and a little longer than broad; femora stout and decidedly swollen, about four times as long as broad and beset with small bristles except on the inner surface, which is naked, otherwise unarmed except the posterior ones, on the inferior caudal margin of which there are two black chitinized teeth, one at the basal and apical thirds; the hind femora are somewhat larger than the others and have eight or nine bristles on the lower margin in addition to the two larger chitinized teeth; tibiæ less than one-half as thick as their respective femora and of about the same length except the posterior ones, which are somewhat longer than the corresponding femora; the tibiæ are beset on every side by short bristles but are otherwise unarmed; the anterior ones on the anterior inferior margin with a series of a score or more bristles; tarsi consisting of two segments, the basal one triangular and very minute, the second one large, somewhat less thick than the tibiæ, about five or six times as long as broad and beset all over with short bristles which, like those on the tibiæ and femora, are not erect but considerably inclined. Claws two in number on each foot, slender, as long as the thickness of the terminal tarsal segment and abruptly curved at a right angle at about the basal fourth.

Abdomen but little flattened, from a dorsal view decidedly

broader mesially and apparently consists of seven dorsal segments in the female and eight in the male; apically there is a pair of short, thick, fleshy, unsegmented cerci, as thick as the basal segment of the antenna, a little longer than broad, apically moderately narrowly rounded and, like the rest of the insect, bearing bristly hairs, four or five at the tip being unusually long, the apical one being sometimes even as much as twice as long as the cercus itself; genitalia usually concealed, in alcoholic material some males have a somewhat chitinized compressed organ more or less exerted. A detailed study of the genital characters was scarcely possible with the material at hand.

Entire length from front of head to tip of abdomen two mm., of pronotum three-eighths mm.; of hind femora seven-twelfths mm.; antennæ one and one-third mm.

Described from a total of ten specimens; one male on card point, one female in alcohol and two specimens, probably male nymphs, in balsam on a slide, taken by H. G. Hubbard in galleries of *Leucotermes flavipes* Kol. at Haw Creek, Fla., on March 26, 1895; four males, one female and one mutilated specimen of doubtful sex, all in spirits, taken by T. E. Snyder, at Miami Beach, Fla., April 10, 1918, in galleries of a termite of a different genus and species than the above.

Type, male; allotype, female, from material taken by Snyder. These two specimens are preserved in a hermetically sealed tube of spirits.

Type U. S. N. M. Cat. No. 21835.

The above described species is related to *Zorotypus neotropicus* Silvestri from Costa Rica, but seems a little larger, and the proportionate length of the basal segment of the antenna is different and the number of setæ on the lower margin of the anterior tibia appear to be greater. The description of *neotropicus* makes no mention of the two chitinized teeth on the inferior caudal margin of the posterior femora, a character present in *hubbardi* and one scarcely likely to have been overlooked by Silvestri, and thus presumably not present in the Costa Rican species.

The Order Zoraptera was established by Silvestri* for the

*Bollet. Lab. Zool. Gen. Agr. Portici, vol. VII, p. 193-209, figs. I-XIII (1913.)

single genus *Zorotypus* containing three species, *guineensis* from Africa, *ceylonicus* from Ceylon and *javanicus* from Java. Excellent figures showing the general appearance and details of these interesting insects are given by the describer. Later* the same writer described a new species from the New World, *Z. neotropicus* from Costa Rica. Melander and Brues, Key to the Families of North American Insects, Plate 2, Fig. 26, copy one of Silvestri's figures showing the general appearance of *Zorotypus*.

Silvestri compares the Zoraptera with the Isoptera and with the Blattidæ and mentions the Dermaptera in this relation, but did not seem to consider any possible relationship with the Psocidæ. Thus it seems somewhat odd that they should have been considered psocids by Mr. Hubbard and others. The rapidity of movement was probably responsible, as structurally little similarity to Corrodentia seems to exist. The presence of cerci, the situation of the antennæ near the base of the mandibles and especially the general appearance show a wide divergence from the psocid type but a near relationship to termites.

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

BY CHARLES P. ALEXANDER, LAWRENCE, KANS.

Dicranomyia rhipidioides, new species.

Antennæ black, moniliform; general coloration brownish yellow, the præscutum with three dark brown stripes; wings grayish with sparse brown spots and subhyaline drops; *Sc* short, cell *1st M*² closed, elongate.

Male.—Length about 5.2 mm.; wing 6.9 mm.

Rostrum and palpi dark brown. Antennæ black, the flagellar segments moniliform, subglobular. Head dark.

Thorax pale brownish yellow, the præscutum with three dark brown stripes, of which the median stripe is very broad, the lateral stripes narrow, continued backward so as to suffuse the scutal lobes; postnotum darker. Pleura light yellowish brown. Halteres

*Id, vol. X, p. 120 (1916.)
November, 1918

short, pale. Legs with the coxæ pale yellowish brown; trochanters and femora dull yellow, the tips of the latter narrowly dark brown; tibiae yellowish brown, passing into dark brown at about mid-length; tarsi brown. Wings strongly tinged with gray, sparsely marked with brown and subhyaline; small brown spots and seams at the arculus, origin of the sector, along the cord, and the outer end of cell *1st M*²; stigma pale, rectangular; subhyaline drops as follows: before and beyond the stigma; end of cell *R*⁵; cell *1st M*²; a few small droplets in cells *M*, *Cu*, and *1st A*. Venation: *Sc* short, ending opposite the origin of the sector; *Sc*¹ slightly retracted from the tip of *Sc*¹; *Rs* long, strongly arcuated at origin, about twice the length of the deflection of *R*⁴⁺⁵; *r* at the tip of *R*¹; cell *1st M*² very long, closed; outer deflection of *M*³ about twice the length of *m*; *M*³ beyond *m* but little longer than that portion of the vein before *m*; basal deflection of *Cu*¹ just beyond the fork of *M*.

Abdominal tergites dark brown, the caudal margins of the segments pale; sternites pale brown. Hypopygium with the pleurites long and slender, about twice the length of the appendages; ventral pleural appendage terminating in a slightly curved cylindrical point.

Habitat.—California.

Holotype.—♂, Alameda, Cal., May 26, 1915, (M. C. Van Duzee).

This fly bears a superficial resemblance to *Rhipidia fidelis* O. S., but may readily be distinguished by the structural details.

Erioptera (Erioptera) pilipennis, new species.

Related to *E. laticeps* Alex.; wings with a sparse pubescence in the apical cells.

Female.—Length 3.2 mm.; wing 5 mm.

Rostrum, palpi and antennæ black. Head dark gray.

Thorax dark gray, the pleura a little brighter. Halteres pale. Legs with the coxæ and trochanters brownish yellow; femora dark brown, more yellowish basally; tibiae and tarsi dark. Wings grayish; veins dark brown; a distinct though sparse pubescence in the centres of the apical cells from *R*² to *Cu*¹, inclusive. Venation: almost as in *E. laticeps* but *Rs* longer; *R*²⁺³ longer; *r*,

inserted farther out on R^2 and closer to the tip of R^1 ; Cu^1 at the fork of M .

Abdomen dark gray; ovipositor horn-coloured.

Habitat.—Oregon.

Holotype.—♀, Hood River, Oregon, June 2, 1917, (F. R. Cole).

In our fauna this species resembles *E. laticeps*, from which it is readily separated by the sparsely pubescent wings, the venation and the coloration of the abdomen.

Erioptera (Mesocyphona) needhami, new species.

Related to *E. dulcis* O. S.; coloration pale grayish yellow, the mesonotum with four separated brownish stripes; legs white with a brown ring before the tips of the femora; tip of the tibiae not darkened.

Length 4–4.2 mm.; wing 3.8–4 mm.

Rostrum and palpi dark brown. Antennae yellow, the terminal segments of the flagellum a little darker. Head pale.

Thorax pale grayish yellow, the præscutum with four narrow, dark brown stripes, the median pair widely separated from one another, lying outside the tuberculate pits; lateral stripes on the margin of the sclerite. Pleura with two narrow, dark brown stripes enclosing a broad, silvery stripe; sternites silvery. Halteres pale, knobs brown. Legs with a broad, dark brown ring before the tips of the femora; remainder of the legs white excepting the slightly darkened last two tarsal segments. Wings grayish brown, dark brown on the anterior half, fading into grayish on the posterior half; a few large, whitish spots on the surface including the arculus, origin of Rs , Sc^2 , Sc^1 , R^1 , R^2 , along the cord and smaller spots near the tips of the other longitudinal veins.

Abdomen yellow, the segments marked with brown; hypopygium yellow; sternites with an interrupted dark brown lateral stripe and a less distinct but broader, pale brown median stripe.

Habitat.—Eastern United States.

Holotype.—♂, Sacandaga Park, Fulton Co., N.Y., June 17; 1910.

Allotype.—♀, with the type.

Paratopotypes.—Abundant specimens of both sexes.

This species is related to *E. dulcis* O. S. (Western United States) but is much paler, the legs white and completely lacking the dark tibial tips of *dulcis*. The fly is very common throughout the Eastern States. My distribution sheets indicate a wide distribution (Maine, Vermont, Connecticut, New York, Pennsylvania, New Jersey, Maryland, Virginia and North Carolina). The fly has hitherto been determined as *dulcis* by Mr. Johnson and the writer, but comparison with authentic specimens of *dulcis* show that it requires a new name, and I take great pleasure in dedicating the form to Dr. James G. Needham.

Gonomyia (Gonomyia) spinifer, new species.

Related to *G. cognatella*, O.S.; thoracic pleura with a broad, dark brown stripe; abdominal tergites dark brown, tipped with yellowish; sternites yellow; male hypopygium with the ventral pleural lobes elongate, on the dorsal face before the tip with a sharp spine.

Male.—Length 3.8–4 mm.; wing 4.9–5 mm.

Female.—Length 3.8 mm.; wing 4.8 mm.

Rostrum and palpi dark brown. Antennæ with the scape light yellow, the flagellum dark brown. Head yellow.

Thorax yellow, the præscutum with three broad, brown stripes that are confluent behind. Pleura yellow with a rather broad, dark brown stripe extending from the cervical sclerites to the base of the abdomen and including the halteres; sternites dusky. Halteres pale. Legs dull yellow, the tips of the femora and tibiae and the terminal tarsal segments a little darker. Wings pale gray; stigma indistinct, pale brown; veins dark brown. Venation: *Sc* short ending far before the origin of *Rs*, this distance a little longer than *r-m*; *R*²⁺³ arcuated, a little longer than the sector; veins *R*² and *R*³ divergent at the wing-tip; cell 1st *M*² open by the atrophy of *M*²; basal deflection of *Cu1* before, at or just beyond the fork of *M*.

Abdominal tergites dark brown, the caudal-lateral angles of the segments yellowish; hypopygium yellowish; sternites light

yellow. Male hypopygium with the ventral pleural lobe elongate, fleshy, projecting far beyond the other appendages, on its dorsal face before the tip with a sharp, dark-coloured spine. Penis-guard narrow subtended on either side by a sharp, curved chitinized hook whose points are directed ventrad; these hooks are unequal in size, one being much smaller and feebler than the other; at its apex the guard ends in a slender dorsally curved hook. Female ovipositor with the valves long and straight.

Habitat.—California.

Holotype.—♂, Los Cerritos, Cal., March 19, 1915, (M. C. Van Duzee).

Allotype.—♀, with the type, March 14.

Paratopotypes.—2 ♂'s.

***Tipula entomophthoræ*, new species.**

Mesonotal præscutum gray with three brown stripes; wings gray with a broad cross-band of white beyond the cord; vein R^2 persistent for its entire length; male hypopygium having the ninth tergite deeply notched medially, the lateral angles obliquely truncated.

Male.—Length about 18 mm.; wing 15.8 mm.

Frontal prolongation of the head elongate, yellow above, dark brown beneath and on the sides. Antennæ with the three basal segments brownish yellow, the remainder of the flagellum dark brown. Head gray with an indistinct, median brown line.

Thoracic pronotum gray, narrowly brown medially. Mesonotal præscutum light gray with three dark brown stripes that are centred with gray, the median stripe narrowed behind. Pseudosutural foveæ prominent. Scutum with two brown marks on each lobe; median lobe of the scutum and scutellum with a very narrow, brown line; postnotum yellowish brown. Pleura clear gray. Legs with the femora dull yellow, the bases brighter, the tips more infuscated; tibiæ and tarsi dark brown. Halteres broken. Wings brown, gray and whitish, cross-banded. A dark area at the arculus and cross-vein h , another at the origin of the sector, a large area at the stigma continued down to cell $1st M^2$;

apex of the wing brown including the apical half of cells R^2 and R^3 , the apical two-thirds of cell R^5 and all of cells M^2 and $2nd\ M^2$; remainder of the wing grayish brown with a large, white cross-band beyond the stigma extending clear across the wing except the apex of cell M^3 ; a broad cross-band before the stigma and beyond the origin of the sector extending into cell M ; a large white blotch in the base of M and the basal half of cells Cu and $1st\ A$. Venation: R^2 persistent for its entire length; petiole of cell M^1 short, a little longer than m ; $m-cu$ short but evident.

Abdomen dull yellow, the tergites and sternites with a broad, median brown line. Pleural region and sides of the sternites brownish. ♀ Hypopygium brown. Male hypopygium with the ninth tergite large, sub-quadrate, the caudal margin with a deep U-shaped notch, this latter medially with a still smaller but similar notch; lateral angles obliquely truncated. Ninth pleurite complete, large, the ventral portion with dense long setae; outer pleural appendage narrow at base, expanded into a flatted blade which is covered with numerous long stiff setae; inner pleural appendage terminating behind in a scoop-like lobe that is two-toothed, the inner tooth longest and acutely chitinized, the convex lower surface with long, pale hairs; anteriorly the blade is white, very flattened, the outer edge heavily chitinized, jet-black, the tips expanded, in a position of rest lying beneath the ninth tergite. Ninth sternite with a deep, median notch behind which is a membranaceous area; margin of the sternite adjoining the pleurite setigerous, the posterior portions smooth.

Habitat.—North Carolina.

Holotype.—♂, Cranberry, N. Car. (Roland Thaxter.)

Paratopotype.—♂, in the author's collection.

This species is related to *T. angulata* Lw, *T. penobscot* Alex., *T. subfasciata* Lw., etc., but is separated from all by the structure of the male hypopygium and from the last two species by the complete vein R^2 . The material was heavily infested with the type-material of *Entomophthora caroliniana* Thaxter. The type and two additional specimens have been placed in the M.C.Z. collection by Dr. Thaxter.

(To be continued)

THE OTTAWA NATURALIST.

To the officers of the Ottawa Field-Naturalists' Club we extend our hearty congratulations on the great improvement in the appearance of the new volume of its organ, *THE OTTAWA NATURALIST*. The size is considerably larger, the number of pages increased, while the quality of the paper is vastly superior, being adequate to the needs of the best half-tone illustrations, as shown by the excellent plate of photographs of mushrooms, accompanying Mr. F. W. Waugh's article on "Wild Plants as Food." The magazine also gains in appearance by the attractive design on the cover.

THE OTTAWA NATURALIST, which was established in 1887, is one of the oldest natural history periodicals in North America. It is the only Canadian magazine whose scope extends to all branches of the subject, and it should, therefore, receive the hearty support of nature lovers, teachers and educational institutions throughout the country; as without an adequate subscription list it cannot be expected to maintain the high standard it has now reached. The subscription price, one dollar per year, remains unchanged, and for this small sum a volume consisting of nine numbers is offered.

In the wider sphere of usefulness upon which it is entering we wish *THE OTTAWA NATURALIST* a long and successful career.

BOOK NOTICE.

Report of the Proceedings of the Second Entomological Meeting, held at Pusa on the 5th to 12th February, 1917. Edited by T. Bainbrigge Fletcher, F.L.S., F.E.S., F.Z.S., Imperial Entomologist, Calcutta, 1917. Rs. 3 or 4s. 6d.

This volume does not consist of a series of separate contributions from different writers but is virtually a summary or abstract of the current knowledge of the insects injurious to Indian crops of all kinds, based upon notes prepared before the Meeting by the Imperial Entomologist and the discussions of these which took place at the Meeting.

November, 1918

To the general reader and those unfamiliar with the peculiar problems that confront the economic entomologist in India, the introductory remarks by Mr. Fletcher will be found interesting. He gives much sound advice on the need of exactness in the making of observations and recording of data. The life-histories of most Indian insects are as yet very imperfectly known, and there are gaps in our knowledge of the life cycles of some of the commonest species, such as, e. g., *Agrotis ypsilon* and *Pieris brassicae*, both of which, during certain months, disappear completely from the affected regions, the adults suddenly reappearing after a long absence to deposit their eggs. Their disappearance is probably due to migration, but nothing is definitely known as to their movements. Such information is necessary in order to determine the most effective methods for their control.

In the body of the report the various crops are taken up in order, the pests enumerated in each case, and each species is then discussed in its turn. On account of the enormous field covered the specific accounts of the numerous pests are necessarily very brief; the object of the meeting having been to bring up for discussion any questions or recent observations by the members, on matters of importance in their work. It should be remembered, in this connection, that in India there is but one entomological staff, the work of the provinces being under the advice and direction of the Imperial Entomologist.

In order to give the reader some idea of the variety of crops and other plants grown for useful purposes in India, the following classification employed in the report may be quoted from the table of contents. The figures refer to the number of different crops listed under each heading: Hill crops, 6; leguminous field crops, 24; oil seeds, 7; Malvaceae, 10; non-malvaceous fibre crops, 3; sugar cane, paddy (rice) and other cereals, grasses and fodder crops, 23; fruit-trees, 38; palms, 4; garden plants, 15; drugs and dyes, 5; cruciferous crops, 10; other vegetables and condiments, 31. There is also a section on stored products, 3.

The various insect pests discussed and the crops they infest are so numerous and so unfamiliar to most of our readers that it would be useless to give them more than a passing notice. A few

of the destructive species are also well known in America, such as *Heliothis obsoleta*, *Cirphis unipuncta*, *Agrotis ypsilon* and *Aphis brassicae*, and many others belong to familiar genera, e. g., *Diacrisia obliqua*, a woolly-bear, which attacks a great many plants and sometimes occurs in very destructive numbers. Among the more important crops cotton suffers from a very long list of pests, including several species of boll-worms (*Earias fabia*, *E. insulana*, *Gelechia gossypiella*). The American boll-worm, *Heliothis obsoleta*, also occurs on cotton but is not destructive, preferring other plants, particularly certain of the leguminous field crops. Rice or "Paddy," the most important of all Indian crops, also suffers from a great variety of pests, of which the most important of all is *Schænobius bipunctifer*, a moth whose larva does enormous damage by boring in the stalks. It is estimated that the injuries caused by this one insect in Southern India alone amount to one hundred millions of Rupees annually. *Pachydiplosis oryzae*, a gall midge, is another very destructive enemy of rice. Two of the other pests of rice are not insects but crustaceans, a land crab, *Paratelphusa hydrodromus*, and a Phyllopod, *Apus cancriformis*. Wheat and oats are both attacked by the common Army-worm (*Cirphis unipuncta*) and other species of *Cirphis*, but the most important pest of wheat seems to be a termite (*Microtermes anandi*), which destroys seedlings and sometimes also plants that are coming into ear.

Of the numerous fruit-trees, mangos are among the most widely grown and the most extensively attacked by insects. No less than 57 species attack the various parts of this tree. The principal enemies of the fruits are weevils of the genus *Cryptorhynchus* and three species of fruit-flies, *Chaetodacus* spp., this genus being the one to which most of the fruit-flies of the region belong. The general question of the control of fruit-flies is taken up at some length under the discussion of insects affecting the peach.

On account of the fact that agriculture in India is practised chiefly by the natives whose superstitious beliefs and utter ignorance of the life-histories of insects are deep-rooted and difficult to overcome, the methods of controlling insect pests must needs be of the simplest character. Hence we find that the use of in-

secticides is rarely possible on an effective scale, and it is necessary in most cases to resort to such simple expedients as hand-picking, destruction of affected parts, the use of bait and light traps, bag-nets, etc. Considerable experimental work is being done, however, in the use of insecticides and the introduction and dissemination of parasitic and predaceous insects is also receiving much attention.

The report is beautifully illustrated by 35 coloured plates of very fine quality, each showing the life-history of a single species of insect.

RECENT CANADIAN PUBLICATIONS.

(Continued from page 356.)

THE ORTHOPTERA ((COCKROACHES, LOCUSTS, GRASSHOPPERS, CRICKETS) OF NOVA SCOTIA; WITH DESCRIPTIONS OF THE SPECIES AND NOTES ON THEIR OCCURRENCE AND HABITS.— By Harry Piers, Curator of the Provincial Museum of N. S. From *Trans. N. S. Inst. Sc.*; vol. XIV, pp. 201-356, with 4 plates. Halifax, N. S., 1918.

It is gratifying to note the growing interest in systematic entomology in Nova Scotia. Through the combined efforts of Messrs. Piers and C. B. Gooderham considerable information has been gathered on the distribution and habits of the native species of Orthoptera, a group of which until recently little has been known in the Maritime Provinces.

The fauna is very sparse, only 26 species having been recorded, although two others are included as being practically certain to occur in the Province. This is somewhat surprising in view of the fact that the Transition Zone is said to be represented in the Province, and many other species range throughout this zone in eastern North America. Possibly intensive collecting in a larger number of localities will reveal a fair number of additional forms, though the author believes the total number will never exceed about 35.

In Part I, which contains general matter introductory to the study of the Orthoptera, there is also a valuable historical account of our knowledge of the Nova Scotia species, in which the author

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has been able to establish the identity of the species recorded by Francis Walker (Cat. Derm. Salt. Brit. Mus., 1869-71). This part also contains an account of the life zones of Nova Scotia with the distribution of the Orthoptera within these, useful information on climatic conditions of the Province in relation to the time of hatching and other phenomena of seasonal distribution, and some interesting comparisons between the faunas of Nova Scotia and other regions in Eastern North America, more particularly New England.

Part II contains keys to the families, genera and species, with descriptions of each form and full notes on distribution, both general and local. There are also many interesting notes on habits haunts, stridulation, etc. A very full account is given of the variations in Nova Scotian specimens of the common field cricket, *Gryllus pennsylvanicus* (*G. assimilis*).

The following minor errors may be noted here:

P. 256. *Nomolettix cristatus* has been reported from Go Home Bay, Georgian Bay, Ont., in addition to the Toronto record (39th Ann. Rep. Ent. Soc. Ont., 1909, p. 113.)

P. 297. The macropterous form of *Melanoplus fasciatus*, stated to be known only from Michigan, has been reported also from Lake Simcoe (Can. Ent., XXXI, p. 32), Fort William and the Temagami District Ont. (l. c., XLI, pp. 142, 207).

P. 325. The genus *Ceuthophilus* is now referred to the sub-family Rhabdiphorinæ, not the Stenopelmatinæ.

P. 336. Concerning *Nemobius carolinus* it is stated that the present author "does not report it from Ontario (1904), although his common *N. angusticollis* seems to be a somewhat related form." The latter name has been placed in the synonymy of *N. carolinus* (Walker, Can. Ent., XLI, p. 211).

The paper is illustrated by four plates and several text figures, characters of all the species being shown.

DRAGONFLIES (ODONATA) OF ALBERTA.—By F. C. Whitehouse.

Published by the Alberta Natural History Society, Red Deer, March, 1918. 16 pp. 44 figs.

We welcome this first entomological contribution from the Alberta Natural History Society, and hope that many more will

be forthcoming. So little is known of the insects of Alberta that Mr. Whitehouse's work makes a valuable addition to our knowledge of the fauna of this Province.

The author has aimed to make the paper useful to the beginner and he has, therefore, avoided all but the most necessary technical terms, and has made the descriptive notes as brief and simple as possible. They are not intended to enable the student to determine all his captures with certainty, but with the help of the figures, which in most cases illustrate the male appendages, (these being usually among the most useful characters), the identification of the males, at least, of most of the species, should not be a difficult matter, especially as the Alberta fauna is not a very large one. There are 43 species actually recorded from the Province and 12 others are included as probably occurring there.

The omission of exact localities and dates of capture, though regrettable from the specialist's standpoint, is, no doubt, due to the author's object of merely providing a simple guide for the use of the beginner, this information having been already published for most of the species in Mr. Whitehouse's papers on the Odonata of the Red Deer District (Can. Ent., XLIX, pp. 96-103; L, pp. 95-100). As a substitute, a key is given to the seasonal distribution, with remarks on the range within the Province and the relative frequency of occurrence of each species. The data for the seasonal distribution is, however, in most cases insufficient and must vary considerably according to altitude and other factors. It is, in some cases, based on a single record, which has no value for such a purpose, and in other cases the records are from localities outside of Alberta, which are equally valueless. To this extent, therefore, the key is misleading.

Unfortunately, through no fault of the author, the numbering of the pages has been omitted.

We hope that this useful little guide will stimulate others to take up the study of dragonflies in this interesting region where mountain and prairie faunas meet.

(To be continued.)

Mailed November 13, 1918.