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Excerpt from Canadian Entomologist, August, 1926.

NOTES ON NORTH AMERICAN EPHEMEROPTERA WITH DESCRIPTIONS OF NEW SPECIES.*

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EPHEMERINAE

Ephoron leukon Will.

After a study of the original article (1802, Trans. Am. Phil. Soc., v. 71) I can see no reason why both generic and specific names should not be accepted as valid under the International Rules of Nomenclature. *Ephoron* Will. will supersede *Polymitarcys* Eaton as there seems little doubt, from Williamson's account of the habits of the "White Fly," that he was dealing with a species of this genus; this was already surmised by Hagen (1863, Proc. Ent. Soc. Phil., II, 171) who considered *album* Say as probably synonymous with *leukon* Will. With this latter reference I cannot agree; Say's description of *album* from the "Winnipeek River" Manitoba, calls for a thorax "slightly tinged with pale yellowish brown." Such an insect is before me in numbers from various localities in Manitoba, also from Northern Illinois, Cincinnati, Ohio, and Pullman, Wash. *Leukon* Will. is stated to possess a fuscous thorax and a species agreeing with this description

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

occurs in countless numbers in August on the Gatineau River about 15 miles north of Ottawa; there are also specimens before me from Columbus, Ohio, and Oswego, N.Y. In other respects the two forms are very similar but the thoracic coloration is so constant and distinctive that I am retaining both Williamson's and Say's names. Wih regard to *puella* Pict., described from a female (? subimago) from New Orleans which should be in the National Museum at Paris, I am inclined to think that Eaton's original reference of the species to *Campsurus* (1871, Trans. Ent. Soc. Lond., 58) is more likely to be correct than his later one (1883, Mon. 47), following Hagen (1873, Trans. Ent. Soc. Lond., 391), as a synonym of *album* Say. In Pictet's figure the abdomen shows three setae, it is true, but the fact that it remains uncolored indicates that the original specimen was probably without abdomen; the central projection of the prothorax, as noted both in the figure and the description, certainly points to *Campsurus*, as does also the southern locality. Until such time as it is possible to examine the type (if still extant) or until extensive collections have been made in the vicinity of New Orleans, I shall place *puella* in *Campsurus;* there is a possibility that it may prove identical with *primus* McD.

Pentgenia vittigera Wlk.

I think that Needham is probably correct in making *quadripunctata* Wlsh. a synonym of *vittigera* (1920, Bull. U.S. Bur. Fish., XXXVI, 282); the degree of distinctness of the four black dots on the fore wing seems decidedly variable and the same may be said for the outline of the lateral edge of the dorsal dark stripe, these being the only two characters on which Walsh separated his two species.

There appears, however, to be another species in the Ohio river which I describe herewith.

Pentagenia robusta n. sp.

Differs from *vittigera* as follows; the eyes are slightly larger and the general appearance robuster; the brown of thorax and dorsum of abdomen is deeper and shinier, this color on prothorax being extended so as to leave only a narrow lateral margin of yellow; the pro-, meso-, and metasterna are also largely brown and the pleura are tinged with the same color. Ventrally the abdominal segments show broken, brown, lateral lines, much as in *Ephemera* and the last two segments are considerably shaded with brown. The setae are distinctly brown (not pale yellow) with narrow pale intersegmental rings and the forceps are tinged with the same color. The fore tibiae and tarsi are light brown, darker at the joints. The forewings show no traces of black dots and the veins and crossveins are distinctly pale brown, noticeably darker than in *vittigera*.

Holotype—♂, Cincinnati, Ohio, (A. Braun); No. 1871 in the Canadian National Collection, Ottawa.

Potamanthus verticis Say.

Syn. *flaveola* Walsh, 1862, Proc. Acad. Nat. Sci. Phil., 377.

This species was treated by Eaton (Mon. p. 278) as an *Ecdyonurus*, evidently following an identification by Hagen. A comparison of the description with the original one by Say shows an obvious misidentification on Eaton's part, who probably had before him specimens of a species in the *pulchellus* group. Banks' idea of *verticis* (1910, Can. Ent., XLIII, 201) is just as unsatisfactory

and cannot be made to fit Say's description.

After a careful study of Say's diagnosis I find that the species heretofore listed as *Potamanthus flaveola* Walsh is the only one which satisfactorily complies with the characters given. Say evidently had a female before him and I would call particular attention to the following points: "Body yellowish white; vertex ferruginous; wings with the nervures (? crossveins) black; anterior thighs ferruginous at tip; setae hardly longer than the body." This last statement alone clearly shuts out all reference to the Heptageninae. The synonymy will therefore be as given above.

Myops Wlsh., at present listed under Ephemera, also belongs in this genus; I have examined the lectotype at Cambridge, Mass., one of the orginal lot sent by Walsh to Hagen. The species is larger than *verticis* (*flaveola*) with eyes wider apart and in the female sex with no trace of black on the crossveins. The male genitalia of the two species are very similar. Needham (1920, Bull. U. S. Bur. Fish., XXXVI, 287) states that only two species (*flaveola* and *diaphanus*) occur in North America. He has evidently overlooked the fact that he himself (1909, Rep. N.Y. State Ent., XXIV, 74) described another species, *inequalis*, from Schenectady, N.Y., which from the details given must be very close to, if not identical with, *myops* Wlsh.; I have, however, as yet had no opportunity of examining the type specimen. Banks also described a further species, *medius*, from Kansas (1908, Trans. Am. Ent. Soc., XXXIV, 259) which is only known to me from the two female types.

Verticis occurs in southern Ontario (Bothwell, Niagara Falls) and *diaphanus* must also be found in Canada as it was described from material captured at the Niagara River; the species is, however, as yet unknown to me.

BAETINAE

Ephemerella tibialis McD.

I have received what I believe to be the female of this species from Slave Lake, Alberta, (Aug. 17, O. Bryant). Both sexes show a great prolongation of the axillary cords, which project beyond the mesoscutellum fully 1 mm., a fact that was not noted in the original description of the male; the female abdomen is not noticeably pale-banded but the wing venation is dark, as in the male sex; the head shows a slight pale central shading.

Ephemerella coxalis n. sp.

Male. Eyes (dried) ruddy brown; head between eyes yellow; thorax brown, this color becoming brighter on the posterior portion of mesonotum; pleural sutures shaded with yellowish. Abdomen dorsally with the first seven segments pale yellowish heavily mottled with light brown and blackish; on segments 1-4 this mottling is so heavy that only irregular centrodorsal patches of pale color are left and even these are frequently obscured on segments 3 and 4; each pale patch contains a central black dash or spot, the remnant of a mediodorsal stripe, and is bordered by a blackish subdorsal shade; on segments 5-7 the pale dorsal area is considerably extended, the dorsal streaks are lacking, but the subdorsal ones show up plainly on the pale background; the lateral area contains irregular black blotches. All the segments show oblique black spiracular streaks, surrounded by a pale area. Segments 8-10 are light brown with small subdorsal

black spots on anterior margins and lateral dark streaks or spots. Beneath pale whitish ochre, shaded with light brown on segments 1 and 9 and with brown medioventral ganglionic patches; forceps and penes pale, slightly shaded with brown. Setae white. Legs rather bright yellow with two black spots on the coxa and one on each trochanter and femur, situated apically and most evident on the two posterior pairs of legs. Fore tibiae rather more than twice the length of the femur and about equal in length to the first two joints of the tarsi. Wings hyaline with pale venation.

Female. Paler than the male but similarly marked. Head pale yellow marked slightly with black. Length of body 7 mm.; of forewing 7 mm.

Holotype—♂, Dorval, Que., June 20, (F. P. Ide); No. 2070 in the Canadian National Collection, Ottawa.

Allotype—♀, St. Annes, Que., June 24, (F. P. Ide).

Paratypes—1 ♂, 1 ♀, Chateauguay, Que., June 18; 1 ♂, 2 ♀, Beauharnois, Que., June 19; 1 ♂, Dorval, Que., June 20; 2 ♂, 1 ♀, Lachine, Que., June 20, 23; 1 ♂, 3 ♀, St. Annes, Que., June 24; 2 ♂, 1 ♀, Coteau du Lac, Que., June 25.

The species belongs in the *bicolor-lutulenta* group and has very similar male genitalia. It is easily recognized by the black spots on the legs and the peculiar mottled appearance of the abdomen.

Ephemerella inflata n. sp.

Male. Head and thorax shiny blackish, the pleura below wings and the lateral portions of the mesosternum slightly tinged with dull olive-brown; axillary cords not produced beyond scutellum.

Abdomen dorsally almost unicolorous black-brown with traces of a narrow pale medio-dorsal line on anterior segments; ventrally paler, dull olive-brown. Forelegs with femur and tibia deep brown and about equal in length, coxa slightly tinged with olivaceous, tarsi paler, dirty white, the second joint longest, relative lengths of joints, 40; 43; 20, 23, 12, 5; mid and hindlegs pale olive-brown, the femora with an indistinct ruddy centro-dorsal streak; hind femur about equal in length to tibia and tarsi combined (35 : 25 : 10). Setae dirty white. Forceps with second joints inflated at both ends and strongly constricted in the middle, third joint fully three times as long as broad; penes united nearly to their tips, where they expand slightly and show a slight median v-shaped excavation. Wings hyaline with pale veins and crossveins. Length of body 6 mm.; of forewing 6 mm.

Female. Rather paler than the male, with considerable yellow shading laterally on the thoracic segments. Head largely red-brown, paler next the eyes and shaded with black-brown in the region of the ocelli; subanal plate pale, whitish yellow, rather short and broadly truncate apically.

Holotype—♂, Wakefield, Que., July 13, 1925 (F. P. Ide), No. 1951 in the Canadian National Collection.

Allotype—♀, same locality, July 28, 1926 (G. S. Walley).

Paratypes—4 ♀, 11 ♀, same locality, July 28, 1926 (F. P. Ide and G. S. Walley).

The genitalia show great similarity to those of *Drunella grandis* Eaton as figured by Dodd (1923, Trans. Am. Ent. Soc., XLIX, Pl. VIII, fig. 2); the species is, however, much smaller and with the normal venation of *Ephemerella;* it falls into the ***fuscata*** group.

Ephemerella flavilinea n. sp.

Male. Head, thorax and abdomen deep ruddy brown, the ventral surface of abdomen ruddier than the dorsal portion; a pale yellow line along the lateral flange, tending to spread upward along the segmental incisures, especially in the posterior segments. Fore femora and tibiae deep black-brown, the latter about one and one half times the length of former; fore tarsi somewhat longer than the tibia and distinctly paler, being dull dirty white, the first three joints subequal. Mid and hind legs dull yellowish, the femora marked with a ruddy brown apical patch on inner side. Setae blackish at base, paler outwardly. Wings hyaline with pale venation. Length of body 6.5 mm.; of forewings 8 mm.

Holotype—♂, Waterton Lakes, Alta., July 26, (J. McDunnough); No. 1945 in the Canadian National Collection, Ottawa.

The species belongs in the same group as the preceding and the genitalia are very similar to those of *coloradensis* Dodds (1923, Trans, Am. Ent. Soc., XLIX, Pl. VIII, fig. 4); it is however only half the size and is further distinguished by its ruddy venter and pale venation.

Ephemerella rotunda Morg.

Through the kindness of Prof. J. Needham I have been enabled to compare nymphs and female subimagos of this species and of *feminina* Needh. (1924, Psyche, XXXI, 309) and believe them identical, an opinion in which Prof. Needham concurs. The species is only known in the female sex; what appears to be this form is quite common in the Ottawa district and here, too, I have never been able to secure males although diligent search has been made. Judging by the smooth head of the adult and the shape of the subanal plate, the species falls into the *excrucians* group.

Baetis akataleptos n. sp.

Male. Turbinate eyes small, oval, dark red-brown (dried); thorax black-brown, abdomen with segments 2-6 semitranslucent, dull brown, shading into brighter, opaque brown on posterior segments; legs pale smoky, shading into whitish on tarsi; setae whitish. Wings hyaline with pale venation; costo-apical crossveins of primaries few in number and poorly developed, without granulations; no intercalaries in first interspace; secondaries long and narrow with prominent costal projection, and only two veins, vein 3 being absent. Length of body 2.5 mm., of forewing 3 mm.

Holotype—♂, Medicine Hat, Alta., Aug. 14, (F. S. Carr); No. 2215 in the Canadian National Collection, Ottawa.

Paratype—♂, same data.

This tiny species may be separated from the allied *pygmaeus* and *harti* by the dark anterior segments of the abdomen; the ♂ genitalia are similar to those of *pygmaeus* but between the bases of the forceps there is a projecting penis-cover, very finely setose, which is lacking in *pygmaeus*.

Baetis thermophilos n. sp.

Male. Head and thorax shiny blackish; abdomen dorsally dark olive-brown shading into brighter brown on the opaque posterior segments and with narrow pale rings on the posterior margins of the first six segments; ventrally pale ochreous. Legs smoky brown, the tarsi paler; forceps dusky at base with the two apical joints whitish, the last joint being long and narrow and almost

equaling the preceding one in length. Wings hyaline with pale venation; 7-8 well-developed costo-apical crossveins without granulation; secondaries long, narrow, with rather short blunt costal projection and three longitudinal veins, vein 3 being of equal length to the other two and running close to the inner margin for the full length of the wing; a single intercalary between 2 and 3. Length of body, 3.5 mm, of forewing 5 mm.

Holotype— ♂, Old Faithful Geyser, Yellowstone National Park, Wyo., Sept. 3, (N. Criddle); No. 2216 in the Canadian National Collection, Ottawa.

The peculiarly long third vein of secondaries distinguishes the species at once from all other North American species.

Centroptilum semirufa n. sp.

Male. Head below the antennae pale yellowish, vertex brown, tinged with ruddy around the ocelli. Eyes (dried) red brown, appearing as flat disks, and not shrivelled longitudinally as is usually the case with species of the genera *Centroptilum* and *Cloeon*. Thorax olivaceous brown, mesonotum paler along lateral edges anterior to wing bases, the posterior portion (scutellum) is white with slight ruddy tinges anteriorly; metanotum with pale anterior edge which is tinged strongly with ruddy in central area. Mesosternum pale yellowish, the lateral flanges and most of the pleura brown, with small pale areas at the bases of the legs. Abdomen with segments 2-6 dorsally shaded strongly on the posterior half to three quarters with ruddy-brown, leaving on segments 2 and 3, more or less, the entire anterior half of segment pale hyaline, whilst on 4-6 this area is narrower and divided by a fine oblique shade of brown color into a large, pale, dorsal patch and a similar-colored one on latero-anterior margin; segments 7-10 dorsally entirely opaque ruddy-brown. Ventrally segments 2-6 entirely hyaline, segments 7-9 opaque whitish, with slight ruddy tinges laterally. A faint broken black stigmatal line. Forceps and setae white. Legs whitish yellow, with faint ruddy streak along dorsal edge of femora in median area. Wings hyaline with pale venation; costo-apical crossveins of primaries 3-4 in number, first crossvein of radial sector situated slightly proximad of second crossvein; hindwings narrow with the usual two longitudinal veins and a strong costal projection near base. Length of body 4 mm.; of forewing 4 mm.

Holotype— ♂, Kearney, Ont., Aug. 6, (F. P. Ide); No. 1789 in the Canadian National Collection, Ottawa.

Paratype—1 ♂, same data.

The species is a rather fragile one and should be readily recognized by the white scutellum and the broad ruddy abdominal shade-bands.

Centroptilum album n. sp.

Male. Head black-brown with whitish ochreous tinges medially behind the ocelli; eyes dull orange-brown (dried). Pronotum blackish with paler lateral patches; mesonotum pale ochreous shaded with brown, the scutellum and posterior portion being almost entirely white with faint pink shades; metanotum deep brown, the anterior margin white, shaded with pinkish and with a median dark dot; sternum and pleura largely deep brown with slight white shading on the sutures. Abdomen with segments 1-6 entirely hyaline, segments 7-10 opaque whitish. Setae and legs white. Wings hyaline with pale venation; secondaries

very narrow, as in *fragile* McD., but hardly as long, with prominent costal projection.

Female. Head olive-ochre with a red-brown V-shaped mark medially behind the ocelli. Mesonotum light olive-ochre, paler posteriorly, as in the male; mesosternum and pleura similarly colored with considerable purple-brown suffusion on pleura. Abdominal segments 2-6 dorsally light yellowish with small purple-brown spots medially; laterally almost the entire area is covered with large purple-brown blotches, except on the fourth segment where the blotches are reduced to triangular patches on anterior margin and the yellow ground color is more evident; segments 7-10 pale ochreous with broken purplish median line and small latero-anterior blotches; ventrally all segments are pale ochreous with a row of brown dashes along each lateral edge and slight traces of ruddy on posterior margin of each segment. Legs and setae whitish, wings hyaline with pale venation. Length of body 4 mm., of forewing 4 mm.

Holotype—♂, Silver Creek, Orillia, Ont., June 13, (C. H. Curran); No. 1790 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, June 11, (J. McDunnough).

Paratypes—9♂, 14♀, same locality, June 11-13, (J. McDunnough and C. H. Curran).

A single female is before me from St. Annes, Que., (at the mouth of the Ottawa river), June 24, F. P. Ide, which appears to belong to this species.

Cloeon minor n. sp.

Male. Head and thorax deep black-brown, anterior edge of metathorax tinged with purplish; pleura and sternum mostly dark with slight ruddy tinges anterior to the wing bases. Abdomen with segments 2-6 dorsally hyaline, with geminate purplish brown dorsal dashes on each segment and large similarly colored lateral blotches which on segments 3 and 6 coalesce dorsally, leaving only traces of hyaline on anterior portion of segments; segments 7-10 opaque, deep brown with slight purplish tinges. Ventrally segments 2-6 hyaline with row of brown patches along lateral edge and the posterior edge of each segment marked with two transverse blackish dashes, one on each side of the median line; segments 7-9 opaque, light creamy brown with purplish shading on the posterior margin of the ninth segment. Forceps and setae pale. Legs whitish with traces of a ruddy spot on the middle of the femora. Wings hyaline with pale veins and crossveins; first crossvein of radial sector considerably nearer base of wing than the following crossvein. Length of body 3 mm.; of forewing 3 mm.

Holotype—♂, Joe Lake, Algonquin Park, Ont., Aug. 7, (F. P. Ide); No. 1791 in the Canadian National Collection, Ottawa.

Paratypes—6♂, same data.

The small size and the brown blotches on the abdomen distinguish the species at once from other described North American species.

Siphlonurus luridipennis Burm.

At my request Dr. G. Ulmer of Hamburg instituted a search for the type of this species which has always perplexed workers in the group and has heretofore been referred to the genus *Heptagenia*. Dr. Ulmer has recently informed me that he has located the type in the Zoological Institute of the University of

Halle; it is a female belonging to the genus *Siphlonurus* and was collected by Zimmermann in Carolina. I have been unable to match the excellent description drawn up and forwarded to me by Dr. Ulmer with any of our other *Siphlonurus* species, and the matter of identity must remain in abeyance until it is possible to study a good collection of material from the type region.

HEPTAGENIINAE

Ecdyonurus mediopunctatus n. sp.

Male. Close to *pulchellus* Walsh; head, anterior to ocelli, pale, whitish; vertex of head sepia-brown tinged with ruddy next the eyes. Thorax, both dorsally and ventrally, deep black brown with the exception of a whitish patch on the pleura anterior to the base of primaries and some slight pale shading below wing-bases; the mesonotum shows faint paler shading on the posterior portion of the scutellum and anterior to this a small whitish median dot and two small white lateral streaks. Abdomen with segments 2-7 white, hyaline, with scarcely a trace of dark posterior borders but with a small dark transverse dash in the median line in the hind margin of each segment and black stigmatal dots on segments 4-7 (sometimes obsolete); segments 8-10 opaque, whitish with light sepia brown shades dorsally on posterior half of 8 and on 9. Setae pure white (not banded as in *pulchellus*); forceps and legs whitish, the femora banded in the middle with purplish and tipped with the same color; apex of fore-tarsus black-tipped; first fore tarsal joint more than half as long as the second. Wings hyaline, with fine black veins and crossveins, the latter slightly thickened in the costo-apical area. Length of body 9 mm.; of forewing 10 mm.

Holotype—♂, Walsh, Ont., July 10, (G. S. Walley); No. 2228 in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, same data: 2 ♂, Victoria Harbor, Ont., June 14, (C. H. Curran).

The Victoria Harbor specimens were reared from subimagos which were quite pale whitish in coloration.

The species belongs in the *pulchellus* group but can be distinguished by the very dark thorax in the male which lacks the prominently white scutellum of *pulchellus* and also by the single small dark streak on the mediodorsal line of the abdomen. The crossveins of the primaries are much finer than in *pulchellus*.

Ecdyonurus bipunctatus n. sp.

Male. Closely allied to *pulchellus* Wlsh. Head, anterior to ocelli, pale, whitish; vertex of head olive-brown to ruddy brown. Thorax dorsally dark sepia-brown, most noticeably on posterior portion and on lateral flanges at base of mid-legs. Abdomen with segments 2-7 hyaline white with a double row of small black transverse dashes dorsally on the posterior margin of each segment, mostly clearly defined on segments 4-7; segments 8-10 opaque, whitish, with the posterior half of 8 and most of 9 and 10 shaded with bright brown dorsally. Setae, forceps and legs pale, whitish, the forelegs somewhat tinged with smoky, the fore and mid femora with a faint ruddy median band which is generally lacking or extremely faint on the hind pair; all femora with ruddy apical spot; tip of fore tarsus blackish; first fore tarsal joint almost two-thirds the length of second. Wings hyaline without apical shading and with fine black

veins and crossveins, the latter slightly thickened in costo-apical region. Length of body 7 mm., of forewing 8 mm.

Female. Scarcely separable from *terminatus;* whitish with the head behind the ocelli largely orange-red shading into yellowish at bases of ocelli; antennae ringed at bases with ruddy-brown; the abdomen appears yellow due to the underlying egg-masses and the black subdorsal dashes are more pronounced than in the males.

Holotype—♂, Queenston, Ont., July 28, (G. S. Walley); No. 2229 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—2♂, same data; 2♂, 1♀, Niagara Glen, July 27; 6♂, Niagara Falls, July 29, 30, all collected by G. S. Walley.

The species was taken along with typical *pulchellus* from which it may be distinguished by the presence of the two dark, subdorsal dashes on abdomen, the lack of stigmatal black dots, the much finer crossveins on primaries, which lack all trace of apical shading, and the slightly longer first joint of the male foretarsus. It is very close to *terminatus* Walsh which is a ruddier species with a much shorter first foretarsal joint and a continuous brownish band on the posterior margins of abdominal segments with only traces of the dark transverse dashes. Walsh possibly had both forms included in his series of *terminatus* as they both occur in Illinois.

Ecdyonurus ruber n. sp.

Male. Head in front of antennae pale whitish with slight ruddy marks on vertical carina; vertex of head deep ruddy-brown. Thorax dorsally deep brown with slight ruddy tinge; pleura whitish with strong ruddy tinges anterior to the wing-bases, extending down to the bases of the midlegs, and with fainter pinkish shades below wing-bases; sternum pale ochreous slightly tinged with yellowish; the scutellum of the mesonotum is tipped with whitish and the lateral areas beneath the scutellum, as well as the anterior projection of the metanotum, are also pale. Abdomen with segments 1-7 pale hyaline with a slight smoky tinge and with narrow black bands dorsally on posterior margin of each segment; a row of blackish stigmatal dots on each side of segments 3-7; segments 8-10 dorsally deep ruddy-brown, ventrally opaque, whitish; setae pale, narrowly ringed with purple-brown; forceps pale, slightly infuscated apically. Forelegs dull amber-colored, hinder pairs pale yellowish-white, each femur with a median purplish band and tipped with the same color, apex of tibia and apices of tarsal joints faintly, blackish; foreleg with coxa largely ruddy, two hind pairs of legs with small reddish spot on coxae; first joint of foretarsus rather more than half the length of second joint. Wings hyaline with faint ruddy tinge before apex of primaries; veins and crossveins all dark, the latter slightly thicker than the longitudinal veins. Length of body 7 mm.; of forewing 8 mm.

Female. Pale whitish-ochreous with only slight ruddy tinges on thorax and abdomen but with the dark markings as in the male sex. Head white with rusty brown shading at base of antennae, behind each ocellus and broadly on the vertex; a slight dark mark on the vertical carina. The abdomen generally appears bright yellow, due to the underlying egg-masses. Legs all pale with maculation as in male sex.

Holotype—♂, Ottawa Golf Club, Que., July 31, (G. S. Walley); No. 2230 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality and collector, July 21.

Paratypes—20 ♂, 7 ♀, taken in the same general locality by various members of the Entomological Branch Staff during July and August.

The species is close to *pulchellus* but is distinguished in the male sex by its ruddier color, especially on the anterior portion of the pleura; the white on the scutellum is restricted to the posterior margin and the abdominal segments 1-7 are not as pure white as in *pulchellus* but are faintly tinged with smoky. From *terminatus* Walsh it is separable by the presence of stigmatal dots on the abdomen, the much longer first joint of the male fore-tarsus, the banding of the hind femur, and apparently by the color of the eyes in the living males which, according to my notes, are pale slaty-blue or pearly-gray, whilst in *terminata* they are light yellow-green. The species is common in the Ottawa region; I have taken it on the Rideau river in June but in the Ottawa Valley it has not appeared until July and August. It also occurs on the St. Lawrence, specimens being before me from Lachine and Laprairie. It is probably this species which was misidentified by Banks as *terminatus* Walsh (1910, Can. Ent., XLII. 200) and by Clemens as *luridipennis* Burm. (1915, Cont. Can. Biology, 139).

Considerable confusion has existed in the literature regarding the identity of *pulchellus* Walsh and *terminatus* Walsh. Walsh's collection is destroyed but in the Museum of Comparative Zoology at Cambridge there still exist male specimens of the original series of both species sent by Walsh to Hagen: as these agree excellently with Walsh's descriptions I propose to regard them as types. From a study of these I am led to the conclusion that Banks in his article on the Eastern species of *Heptagenia* (1910, Can. Ent., XLII, 200) has misidentified both species; his *pulchellus* is probably *integer* McD. whilst his *terminatus* is closer to the true *pulchellus,* but probably *ruber* McD. The true *terminatus* is a rather ruddy appearing species with no stigmatal dots nor banding on the mid and hind femora (occasional traces on midfemora) and with a distinctly shorter first joint of the male foretarsus as compared with *pulchellus;* this joint is considerably less than one half (generally about one third) of the second joint. *Pulchellus* has a blacker thorax, due to the lack of ruddy shades, but the scutellum is broadly white, not merely white-tipped; the dark stigmatal dots are present, the hind femora are banded and the first joint of the foretarsus is fully one half of the second one (rather over than under). Our only Canadian records are from the Niagara River. *Placita* Banks, described from a unique male from Sacandaga River, N. Y., now in alcohol in the Museum of Comparative Zoology, can scarcely be separated from *terminatus;* it probably represents a slightly darker Eastern race. It is common in the Ottawa and St. Lawrence Valleys.

Heptagenia walshi n. sp.

Male. Head deep brownish with a pale yellow transverse band in the antennal region; thorax dorsally deep black-brown with slight paler shades in the region of the scutellum; pleura largely dark; sternum light yellowish. Abdomen with segments 1-6 pale hyaline with a slight smoky tinge and with narrow dark brown transverse bands on posterior margin of segmens 1-6 dorsally; segments 7-10 opaque, dorsally deep brown, ventrally light ochreous; setae and

forceps pale. Legs light yellow, all femora with a fine dark apical streak; fore tibia tipped with brown; fore tarsi slightly smoky; first joint about one fourth the length of second. Wings hyaline with a faint milky tinge on basal half and along costa of primaries; veins and crossveins blackish; costal crossveins before the bulla and those below the bulla broadly margined with black; there is also a slight black margining on some of the crossveins near apex of wing and a slight tinge at the fork of the median vein. Length of body 6 mm.; of forewing 6 mm.

Holotype—♂, Walsh, Ont., July 10, (G. S. Walley); No. 2231 in the Canadian National Collection, Ottawa, Ont.

The species belongs in the *maculipennis* group and is close to *juno* McD. from which it can be distinguished by its dark thorax and slight smoky tinge to the anterior abdominal segments; the entire foreleg (as far as can be judged) is much shorter than that of *juno*.

I name the species in honor of B. D. Walsh who did so much pioneer work in this order in Illinois.

Heptagenia minerva McD.

A study of long series of specimens from the Ottawa region convinces me that two species have been mixed under this name; in the type series the holotype and allotype belong to the same species but some of the paratype material belongs to a species which I characterize below. Typical *minerva* has no ruddy shading on the vertex of the head in either sex; the thorax is pale with the exception of a geminate brown medio-dorsal line on anterior portion of mesonotum and two small black dots laterally at the base of the scutellum (this rather characteristic feature was omitted in the original description); the fore femora, at least, show a fine ruddy streak in the median area as well as the apical streak, and the abdominal maculation is reduced to a series of dark lateral dashes or small triangular patches.

Heptagenia aphrodite n. sp.

Very similar to *minerva* McD. but with darker thorax, no spots at base of scutellum and more extended dark abdominal markings; the median ruddy streak of the femora is lacking and the head (especially in ♀) shows ruddy shading on vertex and between the lateral ocelli and the eyes.

Male. Head pale yellow, tinged with black on anterior and posterior areas and with orange or ruddy shading at base of ocelli and between these and the eyes. Pronotum pale yellow, tinged with black laterally; mesonotum pale smoky-brown, the lateral area anterior to the wings more or less light ochreous giving the impression of a broad dark mediodorsal stripe which contains a faint pale central line; scutellum pale whitish, the area before it, however, being noticeably smoky brown; pleura and sternum light yellowish with a broad blackish stripe across the former as in *minerva*. Abdomen with segment 1 deep brown except the anterior margin which is pale ochreous, segments 2 and 3 with broad dark brown lateral semi-rhomboidal patches with concave lateral edges; these patches do not quite attain the anterior margin of segments but are joined by a narrow dark band on the posterior margin of each segment leaving a more or less hemispherical, pale ochreous dorsal patch, larger on 3 than on 2, and lateral

areas of the same pale color; on segments 3-6 the dark lateral patches are reduced in size and semi-triangular in shape, the pale areas being correspondingly larger, segments 7-10 dorsally deep black-brown. Ventrally the entire abdomen is pale yellowish; setae and forceps pale. Legs pale yellowish, the fore tibiae and tarsi tinged with smoky; the femora show a faint dark apical streak only (generally confined to the fore femora). Wings as in *minerva*.

Female. Largely pale ochreous; the head shows ruddy shading in the vicinity of the ocelli as in the ♂; the thorax is pale with the exception of a geminate dark brown streak on the anterior portion of mesonotum; the dark lateral abdominal markings are somewhat reduced but sharply defined. Length of body 6 mm.; of forewing 7 mm.

Holotype—♂, Ottawa Golf Club, July 30, (J. McDunnough); No. 2233 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality and collector, but captured Aug. 6.

Paratypes—26 ♂, 17 ♀, from same general locality taken on various dates during late July and August by Messrs. Ide, Walley and McDunnough.

The species is intermediate in some respects between *minerva* and *hebe*, the latter species having a still darker thorax and in the male more limited pale markings on the abdomen. The male genitalia show a more prominent apical projection in the penes than is found in *minerva* and the apical spines are stronger but not as strong as in *hebe*, (vide Can. Ent., LVI, 122, Plate III, fig. 6); the female is very close to that of *hebe* but in this latter species the ruddy shades on head are generally confined to the corner of the eye, the thoracic geminate streak is either entirely lacking or represented by a diffuse shade and the abdominal markings are less black and rather diffuse and poorly defined.

In this whole group I have noticed that specimens left too long in the killing-bottle or subjected to moisture after death are liable to turn purple-black and confusion of species is the result with such specimens, unless carefully examined.

Genus **Rhithrogena** Eaton.

After an examination of specimens of the type of this genus, *semicolorata* Curt., I am following Eaton in placing our North American species of the *brunnea* group in *Rhithrogena*. Our species are all more or less unicolorous dark brown as in the genotype and show the same dark streaks on the femora; the male genitalia are of essentially the same rod-like type without the centrally placed stimuli of *Heptagenia* and the only difference I can point to is the tendency to anastomosis of the costo-apical veins in our American species, these being typically simple in European species; I can hardly regard this, however, as of generic value. The following species fall into this genus: *flavianula* McD., *brunnea* Hag. (*hageni* Eat.), *morrisoni* Banks, *impersonata* McD., *undulatus* Banks and *jejuna* Eaton (*fusca* Wlk.); *robusta* Dodds may also be included, but the species is at present unknown to me. Of the above mentioned forms the first three show a lateral spine at the base of each penis which is wanting in the latter three species

The species recorded and figured by Dodds (1923, Trans. Am. Ent. Soc., XLIX, 104, fig. 13) as *hageni* Eaton is not the true species; an examination of the type at Cambridge, Mass., showed me that Eaton's figure of the ♂ genitalia

was good and that the penes are strongly bent outward apically; *morrisoni* Banks is much closer to *brunnea* than is Dodds' Colorado species. I have a good series of Dodds' form from southern Alberta and Colorado and as it is apparently without a name I describe it as follows.

Rhithrogena doddsi n. sp.

Male. Head deep brown with a paler band in the antennal region; thorax brown, the scutellum slightly paler; the pleura largely light ochreous. Abdomen brown dorsally with lighter intersegmental rings, dull ochreous brown ventrally, forceps and setae smoky-brown. Legs dark amber-brown, the fore tibiae and tarsi smoky-brown; all femora show a dark streak in the basal half. Wings hyaline with fine dark brown venation, the costal cross-veins being obsolescent in the basal half of wing. Male genitalia as figured by Dodds (*op. cit.* fig. 13). Length of body 10 mm.; of forewing 11 mm.

Female. Essentially as in ♂, but head shaded with ruddy and mesonotum rather paler.

Holotype—♂, Waterton Lakes, Alta., July 6, (J. McDunnough); No. 2234 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality and collector, July 8.

Paratypes—8 ♂, same locality and collector, July 6, 8, 9, 11, 13.

Close to *morrisoni* Banks but this shows the outcurved apex of penis, as does *brunnea,* and has, further, the large basal cross-vein on forewing deep black. Coloradan specimens are rather larger than my Alberta type-series and show a dark costo-apical shade but I can detect no further differences.