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The Ephemeroptera of Covey Hill, Que.

By J. McDUNNOUGH

Presented by ARTHUR GIBSON, F.R.S.C.

(Read May Meeting, 1925)

The village of Covey Hill is situated at an altitude of 560 ft. in the southwest corner of Quebec Province, about one mile north of the International Boundary. Immediately to the west a hill, after which the village is named, rises to a height of 1,100 ft., forming the most northerly outpost of the Adirondack Mountains; beyond this the land slopes rapidly down to the St. Lawrence valley, a flat, sparsely wooded country with sluggish-flowing streams. At the base of the hill several small streams unite to form Allen's Brook, which, at times descending rapidly over limestone ridges, at times flowing slowly between clay banks, runs north to join the English river near St. Chrysostome.

The first collections of Ephemeroptera were made in this region on June 25th, 1923, by Mr. C. H. Curran while staying in Hemmingford in connection with the Dominion Entomological Branch Laboratory for Quebec province; these proved so interesting that arrangements were made in 1924 for my assistant, Mr. G. S. Walley, to spend the latter half of June and early July in this locality. The collecting was practically entirely done along the rapid portion of Allen's Brook, and the results obtained were most satisfactory, showing clearly that the Ephemerid fauna of Covey Hill belongs to that of the Adirondack, or in a broader sense Appalachian, region and contains numerous species entirely distinct from those of the St. Lawrence and Ottawa Valley regions. Besides twelve species new to science, which I have either already described or am describing in the present paper, the material contained seven species hitherto unrecorded from Canada, including two species described by Dr. Banks from specimens collected in the Black Mountains of North Carolina, a typical Appalachian district: these are *Pseudocloeon carolina* Banks and *Ecdyonurus carolina* Banks. The other species new to our fauna were described from either New England or New York material and are as follows: *Ephemerella varia* Eaton, *Leptophlebia johnsoni* McD., *Ephemerella dorothea* Needh., *Iron pleuralis* Banks and *Cinygma bipunctata* McD. The total number of species obtained was 37, and the following list

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will supplement those of Needham (1901, Bull. 47, N.Y. State Mus. 418-427; 1908, 23rd Rep. N.Y. State Ent. 188-194) for the districts of Saranac Inn and Old Forge, N.Y.. These lists only deal with 19 species, several of which, occurring later in the summer, such as *Caenis diminuta* Walk., *Tricorythus allectus* Needh., and *Choroterpes basalis* Banks, will probably be found at Covey Hill if collections are made at the proper time. Many names on these lists are probably misidentifications and will, in the light of our present knowledge, certainly require verification; such are *Hexagenia variabilis* Eaton (probably *limbata* Guer.), *Ephemerella excrucians* Walsh, *Callibaetis (sic) hageni* Eaton, *Baetis posticatus* Say, *Baetis pygmaeus* Hagen, *Cloeon mendax* Wlsh., *Cloeon vicinum* Hag., and *Heptagenia pulchella* Wlsh.; throughout the later literature I find that identifications of the species described by Say, Walsh and Hagen have been very carelessly made and can only be accepted after a careful study of the specimens involved.

It is to be hoped that the present list will stimulate an interest in this much neglected, although economically important, group. North America has a rich Ephemerid fauna, and careful collecting is sure still to bring to light many forms new to science.

EPHEMERIDAE

1. *Ephemera varia* Eaton. The species was rather uncommon late in June and apparently in this locality replaces the common form of the St. Lawrence and Ottawa valleys, *E. simulans* Wlk. This is the first record of the occurrence of the species in Canada. Needham in his paper on "Burrowing Mayflies of our Larger Streams" (1920, Bull. U.S. Bureau Fish. XXXVI, 283), states that *varia* is only doubtfully distinct from *simulans*; he has evidently confused the two species for his figure (Pl. LXXV, Fig. 27) under *varia* represents a male of *simulans*, although that of the genitalia (Pl. LXXXI, Fig. 60) appears to be correct. Typical *varia*, the type of which I have examined at Cambridge, Mass., lacks the outer dark spot at the fork of vein R_s ; it is a paler looking insect, especially in the female, and the underside of the abdomen is light yellow (not brownish as in *simulans*) with narrow, broken, deep-brown lateral lines. It is correctly figured on Pl. II, Figs. 3, 4 of Bull. 47, N.Y. State Mus. To my mind there is no doubt of its specific distinctness.

2. *Ephemera guttulata* Pictet. Only five specimens captured between June 17 and 28. Needham, in the above-mentioned Bulletin (*op. cit.*, p. 283), refers to this species as rare but lacks information

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concerning its habits; it is extremely common, swarming on certain evenings in late June or early July along the Ottawa river, a few miles above the city of Ottawa, and in the day time may be found resting on the foliage in countless numbers; it also occurs in the vicinity of Montreal. Its distribution is evidently widespread, as I have examined specimens taken by C. H. Kennedy in the mountains of Tennessee.

BAETIDAE

3. *Leptophlebia moerens* McD. Two males and three females represent this species captured June 30th and July 4th. I have also specimens from Ithaca, N.Y., collected by Dr. W. Clemens. In the original description (1924, Can. Ent., LVI, 94) I doubtfully associated the female sex; this association has been proved to be correct by the capture of a pair *in coitu* in the Ottawa district, where it was quite plentiful in 1924 during the middle of June and again in August; it is apparently double-brooded.

4. *Leptophlebia guttata* McD. The species was described from two males taken by Mr. C. H. Curran at Covey Hill in 1923. Mr. Walley took a series of both sexes in 1924 between June 30 and July 14. The female is deep brown, with a slight wine-red tinge to the abdomen dorsally, paler ventrally; the legs are pale whitish brown tinged more deeply with brown on the femora, especially the fore ones. The excavation of the ventral plate is very deep and narrowly U-shaped, the lobes themselves having the apices rather pointed. The primaries are hyaline with a very faint brown tint apically, the veins are tinted with brown and the cross-veins pale, except on the apical portion of costa, where there are about 14 dark cross-veins, usually not anastomosed. I have specimens also from Ithaca, N.Y.

5. *Leptophlebia mollis* Eaton. Apparently the commonest member of the genus in this region. The dates of capture range from June 19 to June 27. The females are difficult to separate from those of the preceding species; the best points of distinction seem to be the paler legs and the less deep excavation of the ventral plate.

6. *Leptophlebia johnsoni* McD. Two males (June 17) and four females (June 19, 26) were taken. This is the first record of capture for Canada, and the specimens are the only ones I know of other than the type specimens from Jaffrey, N.H.

7. *Leptophlebia praepedita* Eaton. Three males (June 17). The species is widespread, occurring commonly in the Ottawa district and extending westward as far as Manitoba (Gimli, Man., June 17, A. J. Hunter).

8. *Blasturus cupidus* Say. No actual specimens of this species were taken, but Mr. Curran reports seeing it in 1923. It is one of the earliest of our Canadian Mayflies and is one of the few that justifies the common name of the group.

9. *Habrophlebia vibrans* Needh. Very common in late June. There seems little doubt that *jocosa* Banks, described from the Black Mts., N.C., is a synonym; paratypes before me agree perfectly with Needham's description drawn up from specimens from the Adirondack Mts., N.Y.

10. *Habrophlebiodes americana* Banks. Equally as common as the preceding, but occurring a week or so later. As suggested by Ulmer, the species described as *Choroterpes betteni* by Needham is a synonym; the female with its characteristic, produced, sternal plate of the seventh abdominal segment was unknown to Banks at the time of description. The new genus *Habrophlebiodes* for the reception of this species was proposed by Ulmer in 1920 (Archiv f. Naturg., Vol. 85, Abt. A, Heft 11, p. 39).

11. *Ephemerella funeralis* n.sp. (Figs. 3, 4)

Female.—Head deep yellow, shaded considerably with brown, especially next the eyes, leaving a band of the yellow colour crossing the head behind the ocelli; near the posterior edge of this band a fine brown line is frequently visible and behind it the central portion of the head is somewhat depressed, this depression being largely suffused with blackish and crossed by a fine vertical and a similar transverse carina; at the lateral posterior edges of this depression are two distinct tubercles, each situated about equidistant between the vertical carina and the eye. Pronotum with a rather broad O-shaped median depression, the raised edges of which meet anteriorly in a short spine, blackish, with a pale yellow spot on posterior margin laterally and slight yellowish shading anteriorly; mesonotum deep brown, frequently tinged with yellow in the central line anteriorly and with a yellow dash in front of wing base, posteriorly tinged with paler brown and with traces of a geminate mediodorsal line just before the scutellum-like portion. Abdomen deep brown, the last three segments paler; on the first seven segments no dorsal maculation is visible, on segment 8 there are paler, somewhat yellowish dashes on each side of the central line and a better-defined subdorsal, slightly curved dash on the anterior half of the segment, these markings are faintly reproduced on segment 9; ventrally much as in male sex, the subanal plate being well produced, broad and slightly excavated at its apex. Legs yellow with faint brownish patch at apex of femora.

Wings much as in male sex, although there is a tendency for the veins to become tinged with brownish; between veins Cu_2 and 1st anal the intercalary next the anal vein shows a tendency to lengthen. Length of body 7-9 mm.; of forewing 8-10 mm.

Male.—Eyes (dried) dark black-brown. Thorax and abdomen deep blackish brown with a faint greenish tinge, thorax practically unicolorous, abdomen dorsally with traces of a dark median line and subdorsal stripes, bordered faintly with paler brown shading, and with an obscure broken black band above the lateral margin; this dark maculation is best seen on the 8th and 9th segments, which are paler, more brownish in coloration. Ventrally the abdominal segments, except the three terminal ones, are scarcely paler than above, the 8th and 9th are tinged, however, with dull brownish, and the 10th, as well as the forceps and penes, are pale ochreous; segments 4-7 show medioventral dark blotches and there are faint traces of the subventral dots and lateral dashes (as in *temporalis*) as slight depressions of the general surface. Setae whitish with dark joinings. Legs yellow, apical half of fore femora and tip of tibiae tinged with brown, mid- and hind femora with faint brown apical patch; femur and tibia of two posterior pair subequal, on forelegs the tibia about twice the length of femur (femur, 25; tibia, 53; tarsi, 2, 23, 23, 15, 5). Wings hyaline with pale veins and cross-veins; about 12 apical cross-veins, divided, as usual, by a faint line just below costa, a single long intercalary between Cu_2 and 1st anal vein, with a short marginal one on each side. Length of body 6 mm.; of forewing 7 mm.

Holotype.—♀, Covey Hill, Que., June 23 (G. S. Walley); No. 1273 in the Canadian National Collection, Ottawa.

Allotype.—♂, same data.

Paratypes.—6 ♀, same locality, June 19, 23, July 1.

The females vary considerably in size and are all larger than the single male before me, which I think is correctly associated; as, however, the genitalia of this specimen are practically similar to those of *bicolor* and *temporalis* (*vide* Occ. Pap. Bost. Soc. N.H., V, Pl. VI, Fig. 2), whilst the females show good structural differences, I have made a female the holotype in case the sex association should be incorrect. In size the present species is intermediate between the two above-mentioned species and in coloration much darker, showing practically no light reddish brown shades in the male; the deep ruddy brown colour of the female abdomen is also characteristic, and the head shows better developed posterior tubercles as well as a much darker ground colour with a brown shading lacking in both *temporalis* and *bicolor*; the median O-shaped depression on the female pronotum

seems an excellent specific character; the single long intercalary between Cu_2 and 1st anal vein is useful in separating from *temporalis*, but this feature should be used with caution as it is not quite constant.

12. *Ephemerella temporalis* McD. Two females (June 18, 20) I incline to place under this name although rather darker than typical specimens. The bright coloration (especially when living) and the black spots on the abdomen ventrally, as noted in the original description (1924, Occ. Pap. Bost. Soc. N.H., V, 73), distinguish the species from *lutulenta* Clem.; the two subimagos show also striking differences, that of *temporalis* having the wings uniform smoky, whilst in *lutulenta* they appear checkered with blackish due to the cross-veins being bordered with a darker colour than the wing surface. The abdominal maculation and the male genitalia of *temporalis* are very similar to those of *bicolor* Clem., but this latter species is much smaller and duller in colour and shows between vein Cu_2 and 1st anal only a single intercalary, as in the preceding species, whilst in *temporalis* there are typically two long intercalaries with traces at least (at times well-defined) of three short marginal ones.

13. *Ephemerella atrescens* McD. (Figs. 1, 2). A series of specimens taken in late June seems referable to this species. I can detect no differences in size or maculation between these specimens and my type series, although in the male genitalia the apical region of the penes shows slightly modifications which are probably, however, scarcely of a specific character.

14. *Ephemerella dorothea* Needh. Extremely common in late June and early July. Our specimens are brighter than Needham's types, which are in alcohol and rather teneral. In general the males are light ochreous and the females rather deeper in colour with a distinctly red-brown head. The species has not previously been known from Canada, and is probably typical of the Adirondack region; I have specimens taken by Dr. C. H. Kennedy in the mountains of Tennessee.

15. *Ephemerella invaria* Walk. (Fig. 6). Through the kindness of Mr. K. G. Blair of the British Museum, who has not only sent me a paratype of Walker's species for study but has also made a slide of the genitalia of the type, I have been enabled definitely to tie down this name. The species is of moderate size and largely brown in coloration; the veins of the forewings in fully-developed specimens are distinctly tinted with brown in contradistinction to most of the other species which have entirely pale venation; the second joint of the forceps is noticeably enlarged at the apex and the penes possess small lateral spines, situated well below the terminal area. *Invaria*

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is very closely allied to *vernalis* Banks, described from North Carolina; I have a paratype of this latter species before me and can find nothing very satisfactory, either in pattern or genitalia, whereby the two may be separated; however, until opportunity occurs to examine a topotypical series of both, I hesitate to make *vernalis* an actual synonym. A good series of *invaria* was taken at Covey Hill between June 17 and June 23; a slightly modified form, with much darker venation of primaries, occurs very plentifully in the Ottawa district in early spring.

16. *Ephemerella fratercula* n.sp. (Fig. 5)

Closely allied to *invaria* Walk., having the same type of male forceps but differing in the spining of the penes which show numerous spines ventrally in the terminal area. The underside of the abdomen is pale yellow and shows none of the ruddy brown shades of *invaria*, and the wing venation is entirely hyaline.

Male.—Eyes (dried) red-brown; head light yellow, shaded with brown above the ocelli. Prothorax smoky brown, mesonotum light brown, pleura and sternum deep yellowish shaded with brown at wing bases. Abdomen dorsally deep smoky brown shading into lighter brown on posterior segments, ventrally light yellow, slightly deeper on the opaque posterior segments with base of forceps yellow-brown; a series of medioventral smoky ganglionic patches. Setae pale, ringed narrowly with deep brown. Legs light yellow, the fore-legs, especially the femora, deeper in colour, the relation of the various joints about as in *invaria*. Wings hyaline with entirely pale venation, the cross-veins being indistinct except in the costo-apical region.

Female.—Rather paler than the male with a general ruddy tinge. Head, above the ocelli, almost entirely bright ruddy brown with a few scattered black transverse streaks on the vertex. Distinguished from *invaria* females by the pale ventral surface and the hyaline venation.

Holotype—♂, Covey Hill, Que., June 30 (G. S. Walley); No. 1320 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality and collector, July 3.

Paratypes—11 ♂, 14 ♀, taken by the same collector between June 23 and July 14.

GENUS *Baetis* LEACH

The species belonging to this genus proved to be quite numerous and almost without exception distinct specifically from those common to the Ottawa region; most of them are undescribed. In a difficult

group like the present one it is almost impossible to give any single character whereby closely allied species can be definitely separated. I have devoted considerable attention to examining the various characters used by European and American writers, such as coloration, shape of hind wing, position of vein 3 in same and presence or absence of intercalaries, size of turbinate eyes, male genitalia, etc., and find that, while each is useful, none of them can be used without a certain amount of caution; the correct association of the two sexes is also a matter of doubt until such time as extensive breeding can be done. For the sake of completeness I have prepared the following key to the males of all of our known Eastern Canadian species; this key may be subject to alteration as our knowledge of the numerous forms advances, but embodies for the moment the chief characters which I use in separating the species. With regard to the terms "large," "moderate," or "small" as used in connection with the turbinate eyes, I refer to my figures (1923, Can. Ent. LV, 40) of the eyes of *intercalaris*, *propinquus* and *flavistriga*, which may be considered as illustrative of the three sizes.

KEY TO MALES OF EASTERN CANADIAN SPECIES

1. Second longitudinal vein of hind wing bifurcate. *parvus* Dodds
 Second longitudinal vein of hind wing single. 2
2. Vein 3 of secondaries lacking; a single long intercalary below
 vein 2; costal projection short, blunt and sometimes obso-
 lescent; 4th joint of forceps fully twice as long as broad
 *pygmaeus* Hagen
 Vein 3 of secondaries present; costal projection prominent,
 pointed; 4th joint of forceps about as long as broad. 3
3. Male forceps with second joint cylindrical, the inner edge dis-
 tinctly convex; first joint without inner apical tubercle. 4
 Male forceps with second joint conical, the inner edge straight or
 concave; first joint generally with well-developed inner apical
 tubercle. 5
4. Turbinate eyes large; size large (6 mm.); abdomen dorsally with
 the anterior margin of segments 2-6 pale hyaline. *vagans* n.sp.
 Turbinate eyes moderate; size smaller (4-5 mm.); abdomen
 dorsally with segments 2-6 evenly brown. *incertans* n.sp.
5. Turbinate eyes large. 6
 Turbinate eyes moderate or small. 7
6. Abdomen with segments 2-6 unicolorous pale hyaline; first pair
 of intercalaries on forewing very strongly developed.
 *intercalaris* McD.

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- Abdomen with segments 2-6 pale, ringed posteriorly with brown;
first pair of intercalaries shorter *cingulatus* n.sp.
- 7. Turbinate eyes small 8
Turbinate eyes moderate 9
- 8. Turbinate eyes in living specimen pale yellow-brown; thorax pale
yellowish *nanus* McD.
Turbinate eyes in living specimens light ruddy-brown; thorax
olivaceous brown *flavistriga* McD.
- 9. Abdomen with segments 2-6 almost unicolorous pale whitish or
yellowish *phoebus* McD.
Abdomen with segments 2-6 considerably marked with brown 10
- 10. Thorax deep blackish; abdomen with segments 2-6 maroon brown
except along anterior and lateral margins; first joint of forceps
without inner apical tubercle *pluto* n.sp.
Thorax olive-brown; abdomen otherwise; first joint of forceps
with tubercle more or less developed 11
- 11. Abdomen with segments 2-6 dorsally unicolorous olive-brown;
first joint of forceps with a decided inner apical tubercle
. *rusticans* n.sp.
Abdomen with segments 2-6 dorsally largely yellowish white,
slightly tinged with brown and ringed faintly posteriorly with
same colour; first joint of forceps with apical tubercle much
reduced *laevitans* n.sp.

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17. *Baetis flavistriga* McD. A series of very small males was captured by C. H. Curran on June 30th along the English River, a sluggish stream flowing through open country about 3 miles east of Covey Hill. In size they are much smaller than the typical spring generation from Ottawa but agree closely in maculation. At Covey Hill itself the species was not found.

18. *Baetis parvus* Dodds. A series of females taken late in June shows the characteristic forking of the second vein of hind wings typical of this species (1923, Trans. Am. Ent. Soc., Pl. 9, Fig. 41). I have also before me numerous females of the same species from the Ottawa region, but so far no males have been captured. *Parvus* was described from Colorado, and there is a long series of both sexes from Waterton Lakes, Alta., under this name in the Canadian National Collection. As our eastern females are very closely allied to the western ones, I am placing them under the above name until such time as the male sex is available for study.

19. *Baetis cingulatus* n.sp. (Figs. 7, 8)

Male.—Turbinate eyes large (size of *intercalaris*) deep brown (dried); face and antennae black-brown; thorax deep olive brown, the lateral edge of mesonotum anterior to wing bases generally paler, frequently yellowish, posterior portion (scutellum) whitish, frequently preceded by ruddy tinges; pleura tinged with ruddy and with paler sutures; anterior edge of metanotum whitish, especially the median projecting portion. Abdomen dorsally with segments 1-6 pale yellowish white, semitranslucent, with the posterior borders narrowly ringed with ruddy brown, this colour at times extending forward over half the segment laterally, segments 7-10 opaque, light ruddy brown; ventrally pale whitish, the three posterior segments opaque and more or less brown-tinged; forceps and setae white; the tracheae in the spiracular area are blackish forming a more or less continuous waved line. Legs pale yellowish, most of the anterior femur and the tips of the posterior ones pale brownish. Wings hyaline, venation pale, on primaries first pair of intercalaries below costa well-developed but shorter than in *intercalaris*, second pair shorter than either the first or third pair; secondaries slightly more than twice as long as broad with 3rd vein to middle of inner margin but either entirely without or with only traces of intercalaries. Length of body 5 mm.; of forewing 5.5 mm.

Holotype.—♂, Covey Hill, Que., June 20 (G. S. Walley); No. 1257 in the Canadian National Collection, Ottawa.

Paratypes.—8 ♂, same locality, June 17, 18, 23, 25, July 4 (C. H. Curran, G. S. Walley).

The male genitalia are essentially the same as those of *phoebus* McD., but the species can readily be distinguished by its brown-banded abdomen; the large turbinate eyes seem also characteristic, although the size in the dried specimens before me is somewhat variable, certain specimens (not paratypes) from the same locality having eyes only slightly larger than in *phoebus*. Several females before me, which may belong to this species, are very similar to those of *phoebus*, being olive-brown in coloration with dark veins and cross-veins on primaries.

20. *Baetis levitans* n.sp. (Figs. 13, 14)

Male.—Turbinate eyes moderate (size of *propinquus*), deep ruddy-brown; face and antennae black-brown, the bases of latter shaded with olivaceous; thorax deep olive brown with lateral edge of mesonotum, anterior to wings, paler, often yellowish; posterior portion of mesonotum with a central and two lateral small yellowish

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patches, the scutellum itself, however, being dark; metanotum with
 anterior projection whitish; pleura shaded with ruddy and with
 sutures partially yellowish. Abdomen with segments 2-6 pale whitish-
 yellow, semitranslucent, with faint brown shadings dorsally along
 posterior margin and laterally above spiracular area; segments 7-10
 dorsally light brown russet (Ridgeway, Pl. XV, k), ventrally opaque
 creamy with slight brown tinges; forceps and setae whitish; tracheae
 in spiracular area strongly black, forming a geminate lateral line with
 irregular branchings dorsally and ventrally. Legs pale yellow, the
 femora more or less brown-shaded; this shading on the fore femora
 being over the entire length, in the mid-femora consisting of a small
 median and a similar terminal spot and on hind femora of simply a
 terminal spot. Wings hyaline with pale venation, first and second
 pairs of intercalaries on primaries rather short and frequently broken,
 third and fourth pairs longer; secondaries over two and one-half
 times longer than broad, and more or less of even width throughout
 (narrower than in *cingulatus*), third vein present and running close
 to inner margin of wing for about half its length, intercalaries obso-
 lescent. Length of body 4 mm.; of forewing 4.5 mm.

Female.—Face yellowish, shaded with ruddy at base of antennae
 and between ocelli, head deep brown centrally, broadly pale yellowish
 along inner margin of eyes; thorax dorsally much as in male, paler
 ventrally, abdomen entirely brown, paler ventrally; wings hyaline
 with dark veins and cross-veins.

Holotype.—♂, Covey Hill, Que., June 25 (C. H. Curran); No.
 1260 in the Canadian National Collection, Ottawa.

Allotype.—♀, same data.

Paratypes.—3 ♂, 1 ♀, same data; 2 ♂, 3 ♀, Covey Hill, Que.,
 June 24, 30, July 2, 10 (G. S. Walley).

The species may be distinguished in the ♂ sex from *cingulatus*
 by its smaller eyes, darker scutellum, less distinctly banded abdomen,
 narrower hind wing and by the genitalia in which the interior apical
 tubercle of the first joint of the forceps is scarcely, if at all, developed.
 The maculation of the abdomen is much as in *flavistriga*, but the eyes
 are considerably larger.

21. *Baetis rusticans* n.sp. (Figs. 9, 10)

Male.—Turbinate eyes moderate (size of *propinquus*) red-brown;
 head and thorax deep olive brown, the latero-anterior edges of meso-
 notum paler and at times terminating in a small yellowish spot on
 each side of the anterior tubercle, posterior portion slightly tinged
 laterally and centrally with ruddy-brown, with scutellum at times

of *propinquus*), deep
 brown, the bases of latter
 brown with lateral edge of
 yellowish; posterior
 lateral small yellowish

somewhat paler; pleura marked with ochreous; metanotum with anterior projection whitish. Abdomen with segments 2-6 dorsally olive-brown, semitranslucent, with posterior margins ringed with deeper, ruddier brown, segments 7-10 opaque, russet brown, tracheae of the stigmatal area clearly defined in black as in *levitans*; ventrally segments 2-6 are smoky hyaline, 7-9 whitish, tinged with brown and with posterior margins edged with ruddy brown; forceps and setae whitish. Legs pale yellowish brown, femora tinged with deeper brown, especially apically. Wings hyaline, cross-veins slightly tinted with brownish, first radial cross-vein close and only slightly proximal to second cross-vein, costal cross-veins 4-6 with slight granulation between; first pair of intercalaries short or obsolescent, second pair shorter than third ones; hind wing much as in *levitans*, two and a half times longer than wide, third vein weak to middle of inner margin, strongly bent toward vein 2 at base, no intercalaries. Length of body 3.5 mm.; of forewing 4 mm.

Female.—What I presume to be the female has the head and abdomen very deep brown with a distinct wine-color tinge; ventrally the abdomen is paler. The venation agrees with that of the male, but the cross-veins are thicker and decidedly brown.

Holotype.—♂, Covey Hill, Que., June 24 (G. S. Walley); No. 1261 in the Canadian National Collection, Ottawa.

Allotype.—♀, same locality, June 25 (C. H. Curran).

Paratypes.—3 ♂, 3 ♀, same locality and collectors, June 24, 25, 27, 28, July 4.

Differs from the male of the preceding species in its unicolorous brown abdomen; the genitalia possess a decided tubercle on the inner distal end of the first joint as in *cingulatus*. Possibly close to *unicolor* Hag., described from a female from Washington, D.C. Until, however, the fauna of this district is better known and the correct males associated, it is impossible to identify this species with any certitude.

22. *Baetis pluto* n.sp. (Figs. 11, 12)

Male.—Turbinate eyes moderate (slightly larger than in *propinquus*), deep black-brown; head and thorax shiny blackish; lateral edge of mesonotum, anterior to wing base, brown, pleura shaded in the sutures with brown, mesonotum with a light brown spot on the anterior lateral corner. Abdomen with segments 2-6 dorsally semitranslucent, most of each segment deeply tinged with maroon brown, leaving a pale hyaline portion along anterior and lateral margins; segments 7-10 dorsally opaque, maroon brown, ventrally, segments

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2-6 pale hyaline, 7-10 opaque, whitish tinged with brown; tracheae in spiracular area well-defined in black; forceps tinted with brown, setae white. Legs dull ochreous, tibiae and tarsi paler than femora. Wings hyaline with pale venation, apical costal cross-veins heavily granulated and anastomosing, first radial cross-vein widely removed from second, being nearer base of wing by a space greater than (in paratype, less than) its length, first pair of intercalaries obsolescent, second pair short (in paratype better developed), third pair long and well-developed; hind wing long, almost three times as long as broad, third vein to well beyond middle of inner margin with one long intercalary and an obsolescent second one between it and second vein. Length of body 4.5 mm.; of forewing 4.5 mm.

Holotype.—♂, Covey Hill, Que., June 27 (G. S. Walley); No. 1264 in the Canadian National Collection, Ottawa.

Paratype.—♂, Broadview (near Hull), Que., June 21 (R. Ozburn).

Closest to *rusticans* but differing in the much blacker thorax, the less evenly shaded brown abdomen and the distinctly wine or maroon-coloured nature of the shading. The male forceps show no tubercle on the inner apical portion of the first joint, in this respect being closer to *levitans* than to *rusticans*, from which, however, it is easily separated by the darker abdominal shading. The fact that the species occurs in the Ottawa region would indicate a widespread distribution.

23. *Baetis vagans* n.sp. (Figs. 15, 16)

Male.—Turbinate eyes very large (larger than in *intercalaris*), deep red-brown; head and thorax deep pitch brown, the pleural sutures shaded with paler brown; mesonotum generally with a pale yellowish spot on each side of the anterior tuberculate portion and with the postero-lateral margins shaded with light ruddy brown, a spot of this colour being also present before the scutellum, which is pale brown; anterior edge of metanotum, especially the median projection, prominently whitish. Abdomen dorsally with segments 2-6 dull olive-brown, the anterior edges of each segment being paler, semihyaline and the posterior edges defined by a dark ruddy brown line, not reaching across the lateral area, segments 7-10 opaque, ruddy brown or chocolate brown, tracheae of spiracular area more or less marked with black; ventrally segments 2-6 pale smoky, semi-translucent, segments 7-10 pale whitish-brown; setae white. Legs dull whitish ochreous, the fore femora decidedly tinged with brown and the fore tibiae with a small dark apical patch. Wings hyaline with pale venation, costal cross-veins strongly anastomosed, forming

an irregular net-work, first radial cross-vein generally widely separated from second, being closer to base of wing by a distance about equal to its own length, first pair of intercalaries generally poorly developed, being frequently broken, second and third pairs subequal and moderately long; hind wing twice as long as broad with third vein strong and reaching to middle of anal margin, one or two intercalaries between it and second vein and frequently traces of an intercalary between second and first veins. Length of body 6 mm.; of forewing 6 mm.

Female.—I have before me several females which agree with the males in size and venation and which I presume belong to this species. As usual they show a unicolorous dark brown abdomen slightly paler on terminal segments, the legs are light brown and the cross-veins of primaries brown; the head is deep chocolate brown with light brown along the margin of the eyes.

Holotype.—♂, Covey Hill, Que., June 17 (C. H. Curran); No. 1262 in the Canadian National Collection, Ottawa.

Allotype.—♀, same locality, June 19 (G. S. Walley).

Paratypes.—17 ♂, 2 ♀, same locality and collectors, June 17, 26.

Distinguished from the preceding by its large size and different type of male genitalia; these belong in the *moffatti* group, in which there is no internal tubercle on the first joint of the forceps and the second joint is cylindrical, not conical, with the inner edge distinctly convex. The species also occurs in the Ottawa region quite commonly.

24. *Baetis incertans* n.sp. (Figs. 17, 18)

Male.—Turbinate eyes moderate (somewhat larger than in *propinquus*), red-brown, head and thorax deep olive-brown, posterior edges of mesonotum and the scutellum only slightly paler; anterior projection of metanotum whitish; pleura tinged with ruddy brown. Abdomen dorsally olive-brown, segments 2-6 semitranslucent with posterior margins narrowly deeper ruddy brown, ventrally pale yellowish-white, segments 7-10 opaque; forceps and setae white. Legs with the femora pale yellowish, the tibiae and tarsi dirty whitish, the fore tibiae with smoky apical spot. Wings hyaline with pale venation, costal cross-veins about 6, with only slight granulations between them; first pair of intercalaries obsolescent, second and third pair subequal and rather short; first radial cross-vein closely approached to second; hindwing broad, rather more than twice as long as wide, third vein rather weak, close to inner margin with two strong intercalaries between it and second vein. Length of body 4.5 mm.; of forewing 5 mm.

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Holotype.—♂, Covey Hill, Que., July 2 (G. S. Walley); No. 1263 in the Canadian National Collection, Ottawa.

Agrees with the preceding and differs from the other described species in type of male forceps; may be separated from *vagans* by its smaller size, smaller turbinate eyes and more evenly brown abdomen; in the venation the costal cross-veins of primaries do not form a network, and vein 3 of secondaries is closer to inner margin and weaker. The position of the radial cross-veins is probably variable and should be used with caution to separate species.

25. *Pseudocloeon carolina* Banks. One male (June 20) and a long series of females taken both in 1923 and 1924 (June 17-30). The female, which was not described by Banks, is unicolorous brown, of a rather ruddy hue, the ventral surface of the abdomen and the legs being paler.

The species is allied to the western *turbidum* McD., but is much darker in colour in both sexes.

26. *Centroptilum simile* McD. The species was described from a single pair taken in 1923 by C. H. Curran. Three more males (June 30, July 2, 4) and two females (July 2, 4) were secured by G. S. Walley in 1924. These are the only specimens of the species known to me.

27. *Siphonurus berenice* McD. A long series was taken on June 17, showing considerable variation in size and depth of colour. It is apparently the dominant form in the New England and northern Atlantic States, being replaced largely in the Ottawa region by *triangularis* Clem. In a previous paper I have referred *novangliae* McD. as a synonym.

HEPTAGENIIDAE

28. *Iron pleuralis* Banks. Three females which appear to belong to this species were captured June 18 and 24, this being the first record of the occurrence of the species in Eastern Canada. It is very close to *longimanus* Eaton from Colorado, but compared with a series of this latter species before me from Waterton Lake, Alta., shows a distinctly deeper coloration. In view of the widely divergent type localities I hesitate to make the two names synonymous without examination of more eastern material than is available at the present moment.

29. *Iron humeralis* Morgan. Common all through the latter half of June and in early July. The species is also an inhabitant of the St. Lawrence and Ottawa valleys, but is rather rare in the Ottawa district.

30. *Cinygma bipunctata* McD. A single male of this recently described species (1924, Occ. Pap. Bost. Soc. N.H., V, 76) was taken on June 19. This is not only a Canadian record, but the only known specimen outside of the types.

31. *Ecdyonurus carolina* Banks. This handsome species was quite common in the latter part of June and early July, and a fine series of both sexes was captured; there is very little variation in the specimens and they agree excellently with paratypes in the Canadian National Collection received from Dr. Banks. I have seen specimens taken in the mountains of Tennessee by Dr. Kennedy, and imagine the species is restricted to the Appalachian region, as it does not occur either in the St. Lawrence or Ottawa valleys.

32. *Ecdyonurus canadensis* Walker. Common in late June and early July; the species is one of the commonest eastern Canadian Heptagenias and in the Ottawa valley is, at least partially, double-brooded. It is quite possible that it is merely a dark form of *interpunctata* Say as Clemens suggests (Can. Ent. 1924, LVI, 17), but the group is a difficult one and needs further study before a definite decision can be made.

33. *Ecdyonurus fusca* Clem. A long series of what I believe to be this species was taken in late June and early July. Clemens' male type, which is before me, is a very poor specimen in alcohol, with only the wings on the left side present; in the venation and also in the male genitalia (of which a slide has been made) the Covey Hill series agrees, so that the determination seems reasonably sure.

34. *Ecdyonurus vicarius* Walk. This species has been very generally misidentified and the conception of the species given by Banks (1910, Can. Ent., XLII, 201) is erroneous. Through the kindness of Mr. K. G. Blair I possess specimens which have been compared and found to agree with Walker's type in the British Museum. The species is close to *fusca* Clem., but is more robust with more heavily-marked cross-veins and a decidedly ruddier tinge on the costo-apical portion of primaries; in the region of the bulla the cross-veins in the costal and two following interspaces are grouped closer together; the setae are also darker than in *fusca*, at times quite blackish, and show only very indistinct annulation. The species seems rarer than *fusca* as only a few specimens were taken between June 17 and 23; stray specimens have also been captured around Ottawa during the past two years.

35. *Heptagenia pullus* Clem. One male (June 23) and three females (June 23, 28, July 4). The species may possibly have blown over from the St. Lawrence valley, as it is supposed to occur only in

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this handsome species was taken in late June and early July, and a fine specimen with very little variation in the venation. Paratypes in the Canadian Museum of Natural History. I have seen specimens from the St. Lawrence region, and imagine the distribution, as it does not occur elsewhere.

Common in late June and the commonest eastern Canadian form, at least partially, double-headed, a dark form of *intermedia* (Proc. Ent. 1924, LVI, 17), but the latter requires further study before a definite

series of what I believe to be a new form in late June and early July. Clemens' description of a poor specimen in alcohol, and the differences in the venation and also (where they have been made) the Covey Hill form seems reasonably sure.

This species has been very different from the species given by Clemens, and is erroneous. Through the examination of specimens which have been taken in the British Columbia type in the British Columbia form, but is more robust and has a decidedly ruddier tinge in the region of the bulla the venation interspaces are grouped differently than in *fusca*, at times quite different annulation. The specimens were taken between late June and early July, and also been captured around

single male (June 23) and three females may possibly have blown from the west, as supposed to occur only in

larger bodies of water, the type specimens having been captured on the rocky shores of small islands four or five miles from shore in the Georgian Bay. In the National Collection is a single specimen from Kingston, Ont., and several specimens from Montreal, Que., taken a day or two previously to the Covey Hill capture; this would indicate a distribution throughout the Great Lakes and St. Lawrence region. In the Ottawa Valley *pullus* is represented by a smaller form, apparently distinct but not yet named.

36. *Heptagenia junio* McD. The species was described from two males and a female taken at Covey Hill in 1923 by C. H. Curran. In 1924 a long series of specimens was secured in early July. I have no other records of capture but it is probable the species is Appalachian in its distribution.

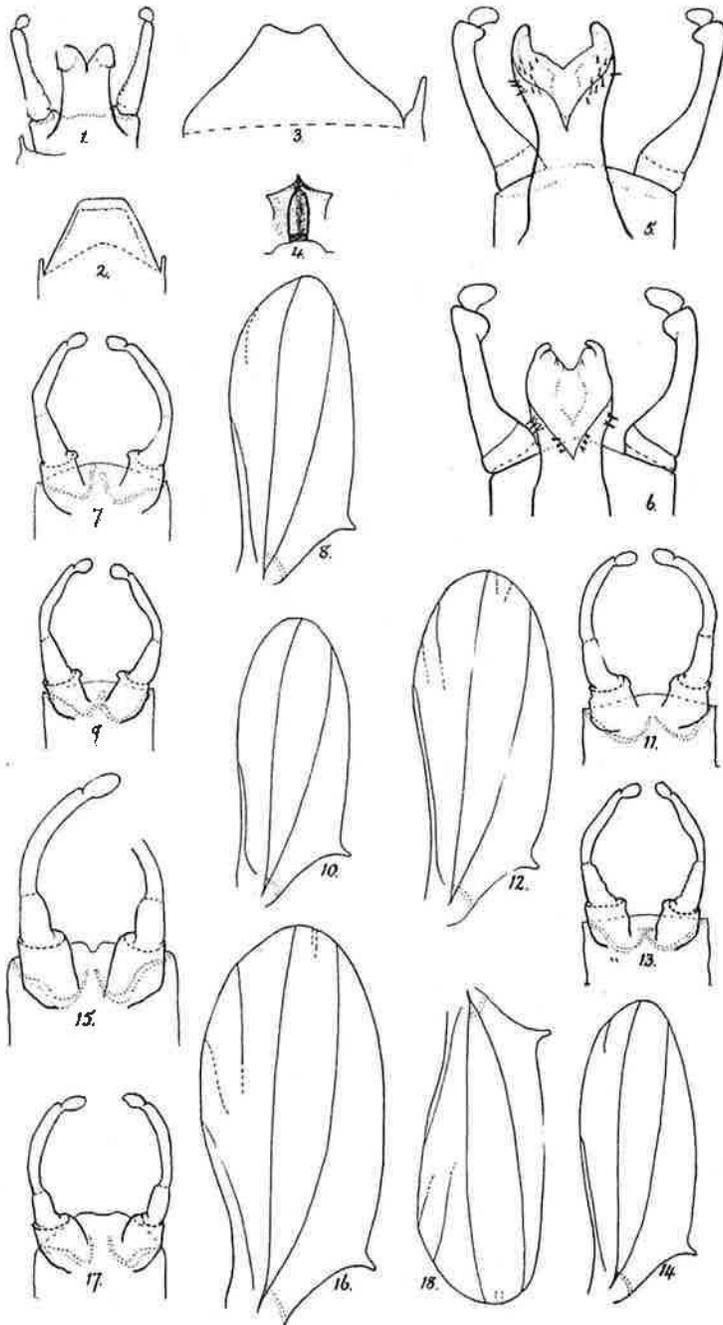
37. *Heptagenia hebe* McD. Fairly common in late June and early July, but not as plentiful as the preceding. This species is the commonest one of the group in the St. Lawrence and Ottawa valleys, and extends westward into Manitoba.

Entomological Branch,
Department of Agriculture,
Ottawa.

EXPLANATION OF PLATE

- Fig. 1.—Male genitalia of *Ephemerella atrescens* McD.
Fig. 2.—Female subanal plate of *Ephemerella atrescens*.
Fig. 3.—Female subanal plate of *Ephemerella funeralis* n.sp.
Fig. 4.—Female prothoracic depression of *Ephemerella funeralis* n.sp.
Fig. 5.—Male genitalia of *Ephemerella fratercula* n.sp.
Fig. 6.—Male genitalia of *Ephemerella invaria* Wlk.
Fig. 7.—Male genitalia of *Baetis cingulatus* n.sp.
Fig. 8.—Hindwing of *Baetis cingulatus* n.sp.
Fig. 9.—Male genitalia of *Baetis rusticans* n.sp.
Fig. 10.—Hindwing of *Baetis rusticans* n.sp.
Fig. 11.—Male genitalia of *Baetis pluto* n.sp.
Fig. 12.—Hindwing of *Baetis pluto* n.sp.
Fig. 13.—Male genitalia of *Baetis levitans* n.sp.
Fig. 14.—Hindwing of *Baetis levitans* n.sp.
Fig. 15.—Male genitalia of *Baetis vagans* n.sp.
Fig. 16.—Hindwing of *Baetis vagans* n.sp.
Fig. 17.—Male genitalia of *Baetis incertans* n.sp.
Fig. 18.—Hindwing of *Baetis incertans* n.sp.

PLATE I



EPHEMEROPTERA OF COVEY HILL

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