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DESCRIPTIONS OF EASTERN NORTH AMERICAN SPECIES OF
BAETINE MAYFLIES WITH PARTICULAR REFERENCE TO THE
NYMPHAL STAGES.

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During the course of investigation of the mayfly fauna in streams in Ontario and Quebec it became apparent that many of the nymphs of the Baetinae are not known although the adults of most have been named. A few nymphs

are described in scattered papers in the literature and a key has been made for some *Baetis* and *Pseudocloeon* (McDunnough 1932, 1932a) which satisfactorily separates groups within these genera. It would seem that in work on streams in the future these small mayflies would become increasingly important because of their abundance and wide distribution. For this reason descriptions are offered below and drawings of what it is felt are useful characters with a view to aiding in the identification of these forms. The list is by no means complete so that identification should be made with caution. The descriptions are made after the examination, in most cases, of a great many individuals but the description itself and the figure is of a typical individual. There is considerable variation in most species so that the descriptions and figures should not be given too much weight but should be used as an aid in identification where large numbers are available showing some range of variation. The collecting of adults at the same locality and at the same time as full grown nymphs are collected will also aid greatly in making determinations.

The associations of nymphs described in this paper with their adults were made, some by rearing in cages set in the streams, others by long familiarity with both adults and nymphs of various bodies of water, and finding adults at the times when the nymphs were known to be full grown and emerging.

Lengths given in descriptions are the distance from the front of the head to the tip of the abdomen excluding the length of the caudal filaments. In the plates the abdomens of all species are drawn to the same scale. The gills and labial palps are drawn to a larger scale than the abdomens but this scale is the same for all species.

The author wishes to acknowledge his indebtedness to Dr. J. H. McDunnough of the Entomological Branch at Ottawa for allowing him to compare his nymphs with those in the National collection, many of which had been reared to the adult condition, thus definitely associating the two stages.

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Among the nymphs of *Baetis* described below several groups are recognizable which appear to stand fairly well separated at the present state of our knowledge but with more collecting in other localities intermediates will probably turn up. There is the *B. vagans* group including *vagans*, *rusticans* and *pluto*. This group is not very compact and should perhaps be subdivided. *Baetis hudsonicus* described in the present paper should perhaps be included in this group but is probably better left out and considered as a species intermediate between the *vagans* group and *B. brunneicolor*. *Baetis frondalis* is rather distinct from other *Baetis* but shows the same type of labial palp as that found in *B. brunneicolor*. The *cingulatus* group forms a very compact series including *B. phoebus*, *B. cingulatus*, *B. levitans* and *B. flavistriga*. The nymphs of all the species in this group are characterized by banded caudal filaments and similar abdominal maculation. *Baetis intercalaris* would seem to come near this group but to be distinct. The banding of the caudal filaments is of a different type than in the *cingulatus* group there being a dark base to each filament in addition to the dark band and tip. The *pygmaeus* group is represented in this paper by two species, typical *B. pygmaeus* and its northern form and *B. mcdunnoughi* described as new.

Baetis brunneicolor McD. (1925 a)

This is a large species found in the headwaters of streams investigated. It frequents the edge of the stream in the vicinity of rapids where it was obtained by scooping beneath the banks with a dipper.

Nymph Pl. 8., figs. 4, 4a, 4b.

Length:—6.2-7.6 mm. A large dark brown nymph.

Head:—evenly brown with fine median pale line; antennae brownish especially basal segments.

Thorax:—brown with paler brown mid-dorsal line and obscured paler areas near bases of wing pads; legs paler suffused with brown in basal $\frac{3}{4}$ of femur and distally on tarsus; tarsal claws pectinate.

Abdomen:—obscurely brown dorsally with somewhat paler areas down the mid-dorsal line and laterally in each segment; lateral flanges of segments pale; a pair of dark dots submedially placed about the middle of each segment; venter evenly brown, somewhat paler than dorsum and becoming darker posteriorly; faint submedian ganglionic dots; median caudal filament about $\frac{2}{3}$ lateral and all caudal filaments brown in the basal half, pale distally with a dark tip; gills with prominent tracheae and edged medially and laterally with brown.

Pine river, Horning's Mills, Ont., 6-VII-1931. F.P.I.

***Baetis hudsonicus* n. sp.**

Mr. H. E. McClure of the University of Illinois kindly sent the author mayflies collected by him in the vicinity of Churchill, Manitoba. Among others was this large *Baetis* nymph which apparently is undescribed. It is possible that the adult is named but it is doubtful since the adult of this species will be larger than any described North American species. Apparently, judging by the form of the labial palp and other characters, the species comes near *B. brunneicolor*.

Nymph Pl. 10., figs. 11, 11a, 11b.

Length:—7.5-8.5 mm.

Head:—dark brown; antennae brown.

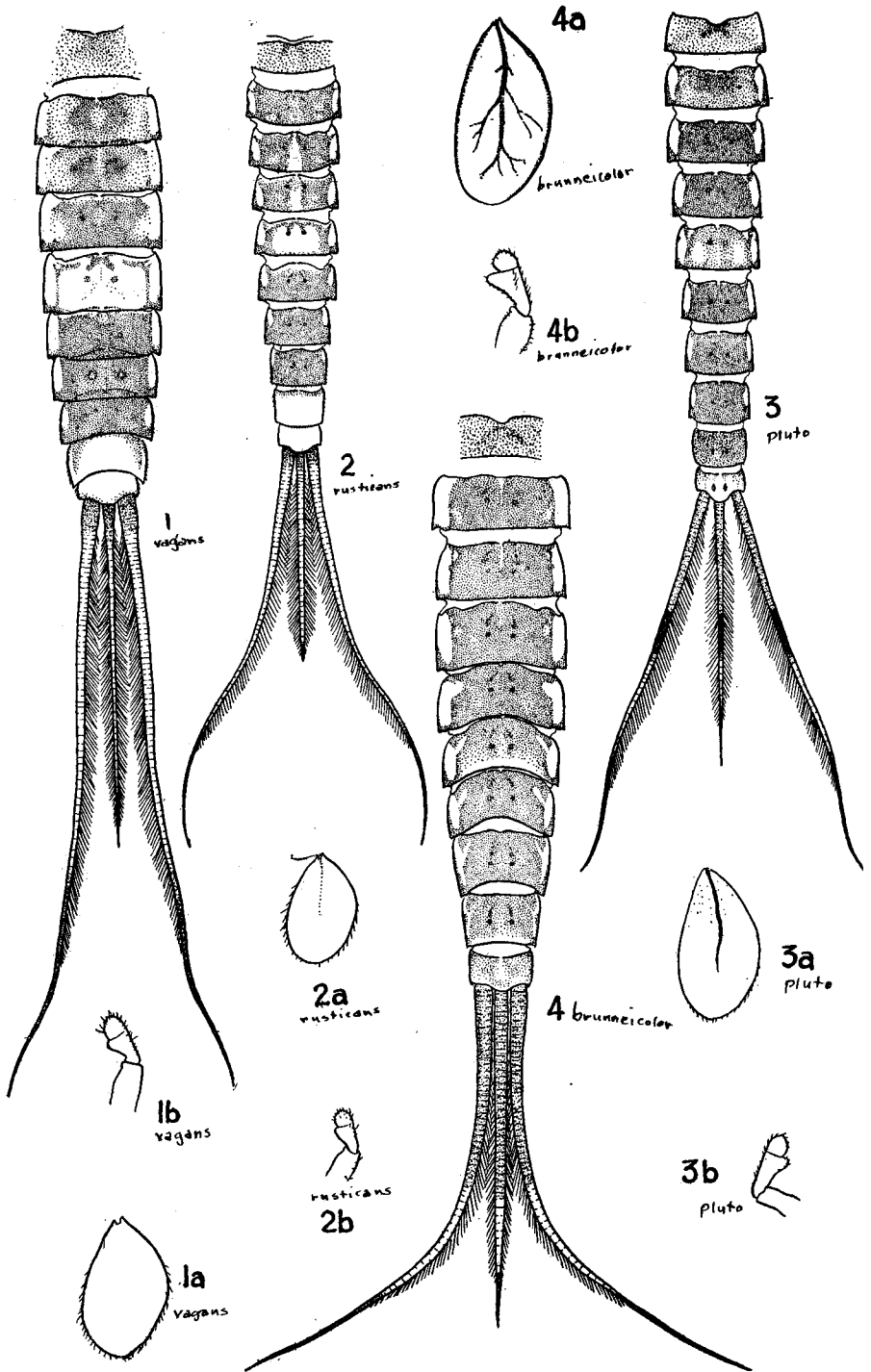
Thorax:—pronotum evenly brown; mesonotum brown with somewhat paler submedian bands and pale areas near bases of wing pads; legs somewhat paler and evenly suffused with brown; tarsal claws pectinate.

Abdomen:—the usual double row of submedian dark dots on a brown background with paler areas suffused with brown; lateral borders of segments pale; venter somewhat paler brown with row of submedian darker dots and anterior border of posterior segments somewhat darker; segment I pale; caudal filaments subequal, median rather longer, lacking bars; gills obovate, long, without conspicuous tracheae.

Type:—Churchill, Man., 22-VII-1936. H. E. McClure. In Royal Ontario Museum of Zoology, Toronto.

Baetis vagans McD. (1925)

This species, (which clings to stones,) is common in the rapids of all streams investigated. Typical *vagans* emerges early in the season and is followed later in the season by a smaller form to which the name *B. incertans* McD has been applied. There is evidence to be presented in a later paper dealing with distribution which suggests that *B. incertans* is a generation of small *vagans*. Murphy (1922) has demonstrated three cycles or generations in *B. posticatus*



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which Traver (1935) considers to be synonymous with *B. vagans*. Presumably the name *incertans* has been applied to the small mid-summer generation. The present association is based on rearing of adults from nymphs.

Nymph Pl. 8., figs. 1, 1a, 1b.

Length:—6.8 mm.

Head:—four faint brown submedial stripes between compound eyes; brownish suffusion below ocelli and around bases of antennae.

Thorax:—pronotum brown with paler marks posteriorly in form of two curved bands beginning at the middle line about the middle of the segment and extending laterally along posterior border; mesonotum brown with paler brown areas at bases of wing pads and with the posterior extremity pale; wing pads paler than notum; legs pale with dark areas present as a narrow dark bar basally and an incomplete dark bar about the middle of the femur; the joint between femur and tibia, also that between tibia and tarsus and the distal end of the tarsus dark; tarsal claws pectinate.

Abdomen:—in well marked specimens segments 5, 9 and 10 are pale; a double row of dots placed a little anterior to the middle of the segments and submedial in position, these dots dark in segment 5 and pale in the darker segments; in some segments median pale areas near the anterior border of the segments, laterally large suffused pale areas which are in some segments continuous with the pale lateral border of the segment; venter pale on segments 9 and 10, dark brown on segment 8, and brown becoming less dense on the segments anteriorly; caudal filaments without bars but slightly darkened at the base and tip; the median filament about 5/9 the length of the lateral filaments. Gills on segments 1-7 without visible tracheae.

Credit river, Forks of Credit, Ont., 15-V-1934. F. P. I.

Baetis rusticans McD. (1925)

The association of nymph and adult was not made by rearing in this species so that it is with a certain amount of uncertainty that I describe this nymph under this name. Dr. McDunnough has nymphs tentatively referred to *B. rusticans* which agree well with mine. It is a nymph which might easily be confused with those of the small summer generation of *B. vagans*.

Nymph Pl. 8., figs. 2, 2a, 2b.

Very similar to *Baetis vagans*; its smaller size and the fact that the median caudal filament is relatively shorter, being slightly under $\frac{1}{2}$ the length of the lateral filaments, provides a basis for separation; caudal filaments unbanded but slightly darkened at the base and tip; the gills on segments 1-7 without conspicuous tracheae.

Nottawasaga river, Primrose, Ont., 10-VII-1928. F. P. I.

Baetis pluto McD. (1925)

This species occurred in rapids in tributaries of the Ottawa river. The association was established by rearing.

Nymph Pl. 8., figs. 3, 3a, 3b.

Length:—4.5-5.3 mm.

Head:—a median pale area, broad on vertex and narrowing on frons, between the compound eyes; a brown triangle between ocelli; antennae pale basally, suffused with brown on flagellum.

Thorax:—brownish with narrow pale median stripe margined by broad pale brown submedian stripes; indefinite pale areas laterally, and a well defined pale area at base of each wing pad; the posterior extremity of mesonotum dark brown and in front of this a median cup-shaped pale area; legs pale, a small dark dot basally in the femur and an indefinite dark band about two thirds of the way out on the femur; tibia and tarsus pale, suffused with brown.

Abdomen:—dorsally uniform brown except for pale area on flange of segments 3, 4, 6, 7, 8 & 9; segment 5 mostly pale as in *B. vagans* with two submedian dark dots and anterior transverse brown band extending posteriorly at the sides (in some individuals segments 8 and 9 paler with suffused brown areas and the two dark dots distinct); segment 10 pale with two dark submedian dots; venter, pale on segment 10, dark brown on segments 8 and 9, this dark brown restricted to median region on segment 7 and passing forward as a small triangle on segment 6 leaving anterior segments pale; caudal filaments with a prominent dark band about the middle, a dark tip and the basal part evenly suffused with pale brown; gills on segments 1-7 with distinct main trachea, gill 1 small.

Masham Mills, P.Q., 29-VI-1935. F. P. I.

The following four species together with others comprise a closely related group of mayflies which are difficult to distinguish from one another especially in the nymphal stage. The adult characters, too, although very definite in typical specimens, tend to break down making identification difficult. *B. phoebus* and *B. cingulatus* are large species, *B. levitans* somewhat smaller and *B. flavistriga* smaller still. There seems to be a real problem in systematic treatment arising in this group. *Baetis cingulatus* appears to have a wide distribution being found in streams of different character e.g. those of limestone and granite country. It appears in most localities early in the season and is followed by another member of the group. In my experience this other member has been a form of *levitans* in limestone streams and *flavistriga* in igneous rock streams.

This suggests that in these species we are perhaps dealing with subspecies or with a single species which varies considerably with the character of the water or possibly with species which have evolved independently from *B. cingulatus* in these different waters. All members of the group have banded caudal filaments.

Baetis phoebus McD. (1923)

The nymph figured and described here was taken from the wave-washed shores of a lake and the adult reared. The species also occurs in large rivers such as the Ottawa. This nymph is, I believe, the one which Clemens (1915) described under the name *B. propinquus* as his description fits these individuals well and his specimens were collected in a similar habitat.

Nymph Pl. 9., figs., 5, 5a, 5b.

Length:—5.7 mm.

Head:—pale with light brown submedian line; antennae pale.

Thorax:—notum pale with darker maculation, consisting of submedian stripes and irregular pale areas; legs pale with dark band about the middle of the femur, basally in the tibia and distally in the tarsus, tarsal claws pectinate.

Abdomen:—the dorsal maculation very similar to that of *Baetis vagans*, with segments 5 and 9 mostly pale; a double row of dark submedian dots and posterolat-

eral to the dark dot a small pale area; caudal filaments pale with a conspicuous dark band about halfway back on each filament and a dark tip; middle filament about $\frac{7}{9}$ length of a lateral filament; gills on segments 1-7 without conspicuous tracheae.

Frank's bay, lake Nipissing, Ont., 5-VII-1929. F. P. I.

Baetis cingulatus McD. (1925)

Nymph Pl. 9., figs. 6, 6a, 6b.

Length:—5.3 mm.

Head:—pale with narrow submedian brown line over vertex breaking up into irregular brown blotches on frons; laterad a broader brown submedian band; distance between turbinate eyes of male about equal to width of one turbinate eye.

Thorax:—notum pale with light brown markings similar to those of following species but somewhat paler; legs pale with dark triangular mark at base of femur, another about the middle of the femur and a small one at the apex; tibia dark apically and with faint dark mark basally; tarsal claws pectinate.

Abdomen:—very similar dorsal maculation to that of *B. phoebus* the main difference being the greater extent of the submedian pale areas, giving the nymph a generally paler appearance, but the pale areas are not as extensive as in the next species; two pale dots near middle of segments and anterior to these convergent pale dashes in some individuals, in others these latter obsolescent; segment 10 entirely pale; the caudal filaments with a distinct black bar about the middle and a dark tip; gills without visible tracheae, in some individuals these are present but indistinct.

Credit river, Erindale, Ont., 21-V-1934. F. P. I.

Baetis levitans McD. (1925)

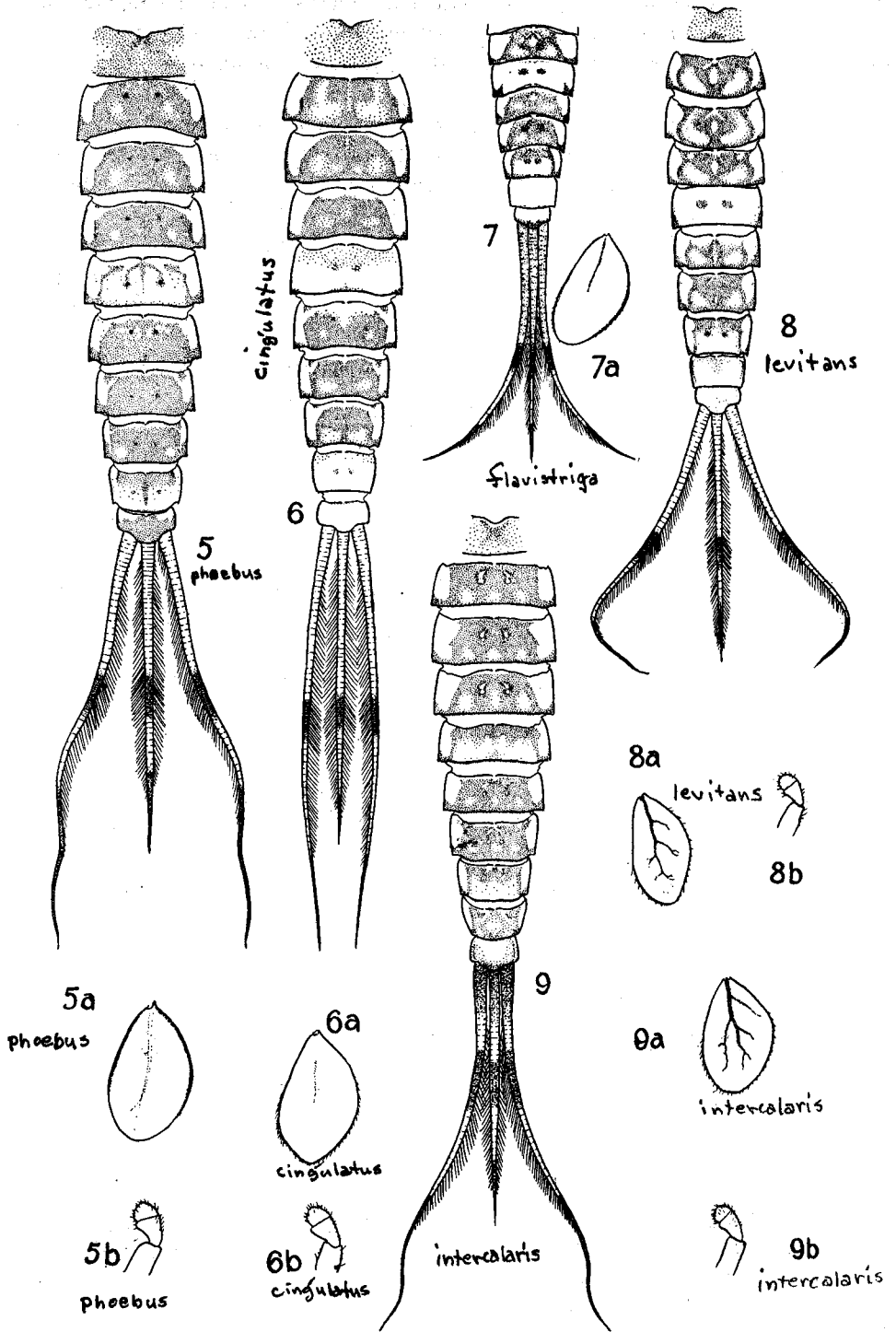
The nymph described here is the form which occurs in the Credit river, Ontario. Typical *levitans* is slightly larger than this form and differs somewhat in the extent of brownish flush on the abdominal segments of the male imago. The brownish flush consists of a posterior transverse band in each of segments two to six extended anteriorly above the pleural region in typical *levitans* but in the Credit river form the brownish flush along the posterior border of the segments and anteriorly above the lateral fold is very indistinct or absent from all but segment five.

In both the Ottawa and Credit rivers there occurs a member of this group which in size agrees with typical *levitans* but lacks almost all traces of brownish markings on the anterior abdominal segments of the male. What is believed to be the nymph of this species is not described in this paper; it is almost identical with that of *B. cingulatus* but somewhat smaller with turbinate eyes of the male about equal in width to the distance between them. The tracheae of the gills are quite distinct in some individuals and inconspicuous in others.

Nymph Pl. 9., figs. 8, 8a, 8b.

Length:—4.1 mm.

Head:—brownish between developing eyes of male with pale irregular patches in a row on either side of mid-line; distance between turbinate eyes of male slightly less than the width of one turbinate eye; antennae slightly darkened at base of flagellum.



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Thorax:—notum pale with brown markings consisting of broad stripes and irregular areas; wing pads paler; legs pale with dark marks, a small triangular patch at base of femur, an incomplete band about middle of femur and patch at apex; slight darkening at base of tibia, distal ends of tibia and tarsus dark; tarsal claws pectinate.

Abdomen:—maculation very similar to that of *Baetis cingulatus* but with the pale areas more clean cut and more extensive than in that species (in some individuals these may be somewhat suffused); segment 5 pale with two dark submedial spots, segments 9 and 10 entirely pale; converging on the anterior border of the segment at the middle line two small pale dashes; caudal filaments pale with a dark bar half way out and a dark tip; gills present on segment 1-7 with conspicuous tracheae which may be somewhat more developed in some individuals than in others.

Frequently the pale markings of the abdomen are varied, a triangle standing on the anterior border of the segment replacing the two convergent dashes and central median pale spot of the individual figured.

Credit river, Erindale, Ont., 15-VI-1934. F. P. I.

Baetis flavistriga McD. (1921, 1923)

Nymph Pl. 9., fig. 7, 7a.

Length:—3.6-3.9 mm.

Head:—distance between turbinate eyes of male about one and one third the width of one turbinate eye; area between eyes pale with submedial vermiculation; labial palp as in *B. levitans*.

Thorax:—brown above with paler areas; legs pale with dark mark at base of femur, a broad nearly complete dark band about the middle of the femur, dark tip; tibia with proximal and distal ends dark and tip of tarsus dark.

Abdomen:—maculation very similar to that of *B. phoebus*, the pale areas suffused with brown so that they are not so extensive as in *B. cingulatus*, or they may be completely obscured in some segments; segment 9 pale and the extremity of segment 10 conspicuously darkened; the pale basal part of the caudal filaments is slightly darkened, the pale distal band seeming by contrast quite white; gills usually with single (sometimes branched) trachea showing, sometimes invisible; medial edge of gills dark.

This nymph is about the same size as that of *B. levitans* as described above but can be separated by the darker base of the caudal filaments, the generally more suffused character of the maculation including the darker extremity to segment ten and the wider separation of the turbinate eyes of the male.

Ottawa river, Ottawa, Ont., 20-VII-1935.

Peche river, Wakefield, P. Q., 18-VI-1935.

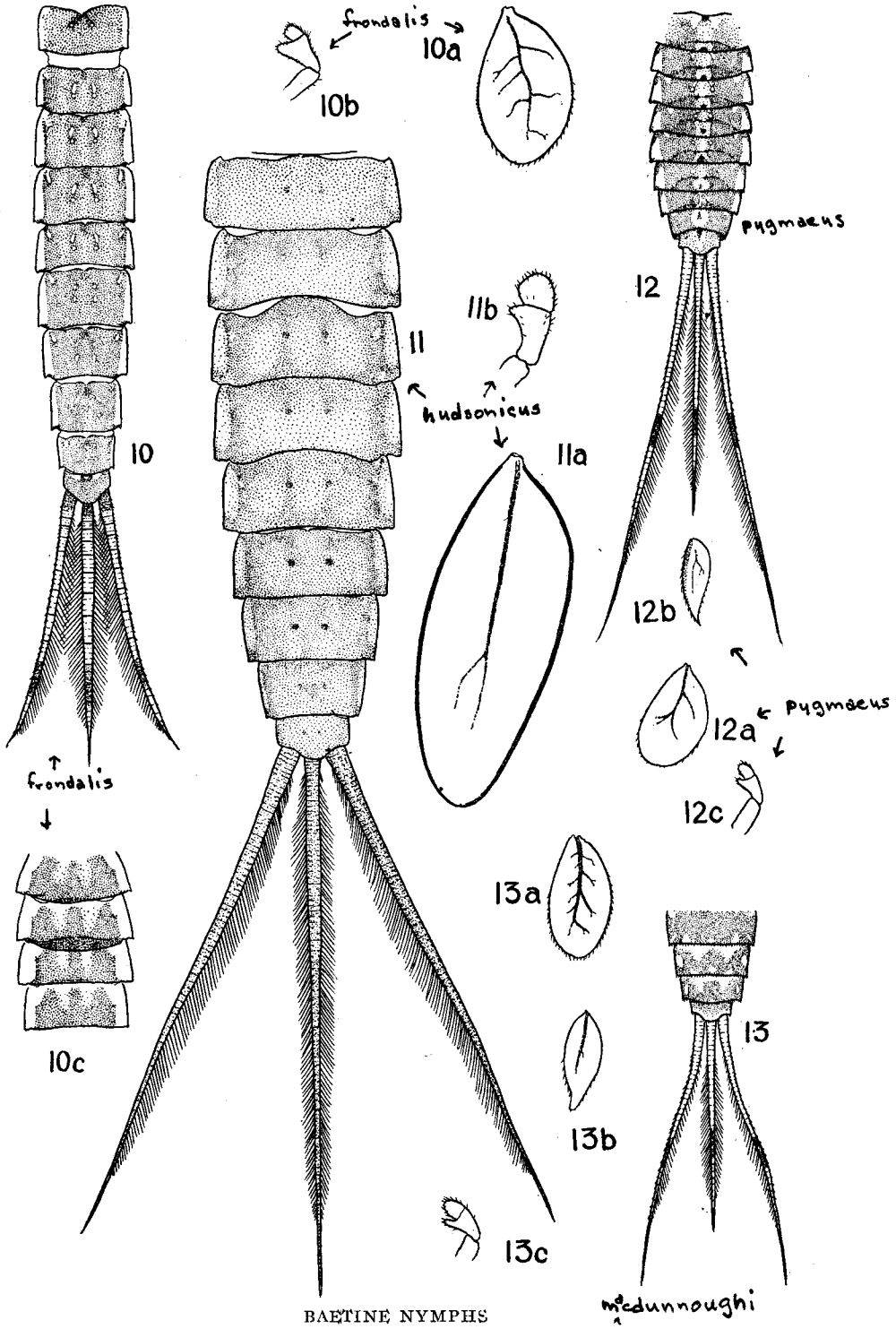
Baetis intercalaris McD. (1921, 1923)

This is one of the commonest species in all the streams investigated where it occurs in company with *B. vagans* and members of the *B. cingulatus* group.

Nymph Pl. 9., figs. 9, 9a, 9b.

Length:—5.0 mm.

Head:—brown vermiculate marks in band to each side of middle line on frons and over vertex.



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medunnoughi

Thorax:—dorsum of pronotum with median dark band divided medially by a fine pale line; laterally a pale area, continuous posteriorly with another pale area nearer lateral border; mesonotum with narrow median pale line and two pale lines edged with brown, widely divergent at anterior border and converging on median line about middle of segment; irregular pale and brown areas laterad; in posterior portion a pale mark consisting of a transverse wide band between bases of wing pads with anterior median quadrate projection; legs pale with a dark triangular patch about the middle of the femur, a smaller dark patch basally, and distally in femur and basally and apically in tibia dark shading; tarsal claws pectinate.

Abdomen:—on segments 2, 3, 4, 6, and 7 the pattern is much the same consisting of pale dots and areas on a dark background; near the posterior border are 3 subequal pale areas, one median and 2 submedian; about the middle of each a pair of submedian pale dots and in front of each another pale dot extended anteriorly as a pale stroke converging on the median line (in some specimens and especially in nymphs which are not fully grown the above mentioned dots coalesce, and reach the anterior border of the segment, forming, thus, two anterior pale submedian areas). This arrangement, two anterior pale areas and three posterior pale areas is very characteristic of the species. Segments 5, 8 and 10 mostly pale; caudal filaments with a conspicuous dark band before the middle, and an extensive dark tip; in addition the base is suffused with dark; in well-marked specimens the caudal filaments are usually suffused with dark between the dark base and the dark middle band; gills on segments 1-7 with conspicuous tracheae.

The type of banding in the caudal filament and the three posterior pale areas in the segments separate this nymph readily from nymphs of the *cingulatus* group.

Credit river, Erindale, Ont., 5-VI-1934. F. P. I.

Baetis frondalis McD. (1925 a)

This slender nymph has been found frequenting aquatic vegetation in moderate current in streams. The nymphs were reared to make the association. This species is apparently allied to *B. atrebatinus* of England which occurs in the same type of habitat.

Nymph Pl. 10., figs. 10, 10a, 10b, 10c.

Length:—6.2-7.1 mm. A slender pale brownish nymph.

Head:—a median pale line over head; bases of antennae brown, flagellum paler.

Thorax:—brown with median pale band and small pale areas laterally particularly at the base of wing pads which are themselves somewhat paler in colour than thorax generally; legs pale with incomplete brown bands just beyond middle in femur and basally and distally in tibia.

Abdomen:—in general dorsum rather pale brownish with paler indefinite median line, not always apparent; lateral to this four distinct pale dots, the posterior pair rounded, the anterior pair frequently more elongate and curved or convergent; in the antero-lateral angles and obliquely placed elongate dots, these becoming more extensive anteriorly; venter with posterior 2/3 of segments suffused with brown except for pale lateral flange and 4 pale ganglionic dots in most segments; caudal filaments subequal and stout, the laterals spinulose along lateral border, dark at base and a dark band in the distal third; gills simple lamellae with prominent tracheae.

In some specimens from a different locality the markings are less defined, the pale spots coalescing to form a submedial pale area as shown in pl. 10, fig. ioc.

Male river, McIntyre, Ont., 6-VIII-1930. F. P. I.

Three members of the *B. pygmaeus* group occur in the streams studied. Typical *pygmaeus* nymphs have a pale median dorsal stripe which is apparent also in the imago female. Needham (1909) has described this nymph but a brief description is given below together with a figure. In 1930 the author described another nymph as that of *B. pygmaeus* which is referable to a northern form which for the present it seems advisable to leave with that status. Both these nymphs are characterized by an acutely pointed seventh gill. A third species occurs in the headwaters of various streams in which the seventh gill, although reduced in size and somewhat lanceolate is not acutely pointed. This species appears to be new and a description of the female imago and nymph is given below under the name *Baetis macdunnoughi* n. sp. The members of this group are associated with aquatic vegetation in moderate to slow current although the last mentioned was taken on stones in the rapids also.

Baetis pygmaeus Hagen.

Nymph Pl. 10., figs. 12, 12a, 12b, 12c.

Length:—4.3 mm.

Head:—rather evenly brown; antennae pale.

Thorax:—evenly brown; paler beneath; legs pale with faint darker banding; tarsal claws pectinate.

Abdomen:—reddish brown dorsally with a pale interrupted median stripe; on the middle segments the pale stripe is formed by a number of pale dots, a pair of submedial pale dots posteriorly in the segment and a pair of pale dashes anteriorly converging on a median pale area on the anterior border of the segment; a median dark spot in the angle formed by the converging pale dashes; on the anterior border of the segment near the lateral border a somewhat triangular pale area and the lateral border of the segment itself pale posteriorly; venter pale; caudal filaments long, the median about $\frac{4}{5}$ the laterals; a dark bar about half way out on the laterals and a corresponding dark bar on the median; another dark bar about $\frac{3}{4}$ out on the laterals; gills on segments 1-6 with rounded apices, those on segment 7 with curved and acutely pointed apices, all gills with conspicuous tracheae.

Mad river, Singhampton, Ont., August, 1930. F. P. I.

***Baetis macdunnoughi* n. sp.**

Length:—3.5 mm., wings 3.8 mm.

Female imago

Head:—brown, reddish between ocelli, somewhat paler immediately above and darker between compound eyes; antennae quite dark smoky.

Thorax:—brown, somewhat paler buff on scutellum and anteriorly on mesonotum; pleura paler; venter dark brown; legs smoky amber; mesothoracic wings with no intercalaries between subcosta and succeeding longitudinal vein; metathoracic wings much as in *B. pygmaeus* but with more prominent costal projection.

Abdomen:—dorsum brown, somewhat paler in indistinct median band and on posterior segments; venter pale smoky with small indistinct purplish triangles in antero-lateral corners below pleural fold; caudal filaments smoky.

Nymph Pl. 10, figs. 13, 13a, 13b, 13c.

Length:—4.45 mm.

Head:—brown with narrow pale median line and submedian pale vermiculate spots. *Thorax*:—dorsally brown, with halberd-shaped pale area anteriorly in mesonotum, other obscurer pale areas laterally; longitudinal veins of wings traced in brown and between these pale lines towards the periphery of the wing; ventrally, pale; legs pale with incomplete dark bands proximally in femur, beyond the middle in femur, about the middle of the tibia and basally in the tarsus; joint between femur and tibia dark; tarsal claws pectinate.

Abdomen:—dorsum brown, segments 8-10 paler with maculation as shown in fig. 13; segments 1-7 with less pale marking; all segments with a trace of submedian spots and dashes similar to those of *B. pygmaeus*; in addition 3 pale areas along posterior border of segments (sometimes obsolescent) and flanges pale in antero-lateral and postero-lateral angles; venter paler than dorsum but with diffuse darker areas medially in the anterior half of the anterior segments and dark longitudinal strokes near the lateral border setting off the paler flanges; gills on segments 1-6 with rounded apices, those on segment 7 with a bluntly pointed extremity readily distinguishing this nymph from that of *B. pygmaeus*; all gills with conspicuous tracheae.

Holotype—Imago female—Masham Mills, P. Q., 24-VI-1935. F. P. I. in Royal Ontario Museum.

Paratypes—Eight females, same locality, 24-VI-1935—18-VII-1935. F. P. I. in Royal Ontario Museum and National Collection at Ottawa.

Female imagos of typical *B. pygmaeus* have a more prominent mid-dorsal pale stripe and rarely show any purplish shading below the pleural fold on the venter; the venter is in addition paler whitish. Females of the northern form of *B. pygmaeus* lack the mid-dorsal pale stripe but frequently segment 5 is pale above. The purplish shading is present on the venter below the pleural fold and is more intense and contrasts more with the paler venter than in the new species. The two can be most readily distinguished by the fact that the new species is somewhat larger and also by the better development of the metathoracic wing and its costal projection. In females of the northern form of *B. pygmaeus* the hind wing is usually small, varying considerably in different specimens, and shows very little of the costal projection.

(To be continued)