CHIRONOMIDS AND OTHER INVERTEBRATES FROM NORTH BOULDER CREEK, COLORADO*

By

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INTRODUCTION

Although many animal surveys of high mountain brooks have been made, the invertebrate fauna in true glacial brooks is not well known except in the Alps. This fauna, consisting mainly of immature midges, seems to be richer in number of species in the Alps and in the present study area in Colorado than in more northern localities, such as the outlet from the Karsajökel glacier in Swedish Lapland (Thienemann 1941, 1954) and the outlet from the Hardangerjökulen glacier in central Norway (Saether, 1968). As mentioned by Thienemann (1954), the main reason for this situation seems to be that during the recent glacial period the typical brook fauna could survive in the vicinity of their original habitats. In the Rocky Mountains the number of species must be expected to be still larger than in the Alps, as this range forms a long continuous north-south bridge across the Nearctic temperate and Arctic zones, allowing interchange between northern and southern animal forms (Elgmork and Saether 1970).

This work constitutes the taxonomic part of a survey of the aquatic fauna above timberline in North Boulder Creek, Boulder County, Colorado (Elgmork and Saether, 1970). It gives an account of invertebrates found except for the water mites and a new species of Encyrtidae, *Copidosoma* (*Litomastix*) *naevia,* which are discussed in separate publications (Saether 1966a, 1966b). The specimens were collected between July 8 and 13, 1960, by Dr. Kåre Elgmork of the Zoological Laboratory, University of Oslo, as part of a larger study financed in part by a National Science Foundation grant NSF G-11667.

A general view of the region in question appears in Fig. 1 of Elgmork and Saether (1970), where the lakes and brooks are numbered. The part of the brook investigated starts at an altitude of about 3,800 meters and extends down to near timberline at about 3,300 meters. The geological background implies a low level of conductivity values. Further notes on the general situation, geology, and climate, and a description of the brook are given in Elgmork and Saether (1970). The Frontispiece of the same publication shows the distribution of the more numerous invertebrates found in relation to the location of the stations, elevations, water temperatures, and distribution of moss and snowbanks. The less common forms are given in Table 4 of Elgmork and Saether. The method used for collecting was to pick up stones and brush the animals off, noting the time spent on each stone (from 7-25 minutes). This method is discussed in Elgmork and Saether.

The nomenclature of the present paper follows Ricker (1959) for stone flies, Ross (1959) for caddis flies, Tuomikoski (1960) for sciarids, Brundin (1949, 1956, 1966) for chironomids, and Stone (1952) for simuliids.

Only the species for which systematic accounts have been made are mentioned in this work. A full list of the species found is contained in Elgmork and Saether.

SPECIES

OLIGOCHAETA

Mesenchytraeus sp.

Specimens (much contracted) measuring from 1.5 to 27 mm in length were found.

The worms have 58 to 66 segments. The color is yellowish-white, opaque. Dorsal bundles in the anteclitellar region contain five to eight (usually seven) setae; in the postclitellar region two to six (usually five) setae; ventral bundles in the anteclitellar region contain six to nine (usually eight) setae; in the postclitellar region two to seven (usually five or six) setae. In most of the anteclitellar bundles one setae is distinctly smaller. The clitellum is slightly elevated and extends over ½ XI-XIII. There seem to be two diverticula.

Keys to species of *Mesenchytraeus* are given by Eisen (1904), Welch (1919), Altman (1936), Bell (1942), and Nielsen and Christensen (1959). References to known species of *Mesenchytraeus* are given by Nielsen and Christensen (1959), and of those mentioned, *M. beumeri* (Mich.) is most nearly related. Among the species mentioned by Welch (1919), *M. hydrius* Welch seems to be closely related. The last-mentioned species is one of the few enchytraeids found in fully aquatic biotopes.

The specimens were not examined in a living condition, and no dissection or sections were made. The specimens examined, however, appear to be an undescribed species.

EPHEMEROPTERA

Baetis sp. cf. *rusticans* McD.

One specimen measuring 5 mm in length was found at Station 14.

The species had its median caudal filament only one-third the length of the lateral filaments, main tracheae of the gills visible, margins of gills darkened and with two to four notches. Coloration and abdominal marks were about as in *B. rusticans* McD. (Ide 1937), to which it may belong.

PLECOPTERA

Isogenus sp. cf. (*Pictetia*) *expansus* Banks.

At Station 11 the specimen found measured 3.5 mm in length; at the other stations the lengths were 6.5 to 8 mm.

According to Ricker (1952, 1959), the present species is closest to *expansus*. The minor spine of the lacinia (Fig. 1), however, is only a little more than one-fourth as long as the major cusp. A stout bristle or thorn beyond the minor cusp and the hairs at the mesal margin are shorter than mentioned by Ricker (1952, 1959). The specimens therefore seem to belong to another species. The subgenus *Chernokrilus* with two rare western species will, according to Ricker (1959), probably key out near the subgenus *Pictetia* with the single species *expansus*. *I. expansus* is known from Montana to Colorado (Ricker 1959).

Nemoura (*Zapada*) *haysi* Ricker.

One nymph reaching only 3 mm in length was found at Station 18.

Although all legs and tail filaments were broken, the specimen must belong to the subgenus *Zapada* of *Nemoura*, according to Ricker (1959). The gills of the specimen are about eight times as long as broad, and are unbranched, cylindrical, slightly constricted at base and close to apex, i.e., as in the imagines of *N. haysi* (Ricker 1959).

The species is known from Alaska to California, Montana to Utah, and Colorado (Jewett 1956, Ricker 1959).

Nemoura sp. (without gills).

One nymph without gills was found at Station 5. The specimen measured 7 mm.

Species of *Nemoura* without gills can-

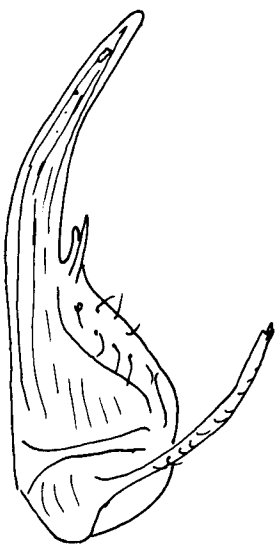

FIGURE 1. Lacinia of *Isogenus* (*Pictetia*) *expansus* type.

not be determined with certainty. Of the species mentioned by Ricker (1952), however, only three species without gills are recorded from Colorado: *N.* (*Podmosta*) *delicatula* Claassen, *N.* (*Podmosta*) *decepta* Frison, and *N.* (*Prostoia*) *besametsa* Ricker (syn. *completa* Rick. nec Walk.). Descriptions of the nymphs of *decepta* and *besametsa* are given by Ricker (1943). The species from Station 5 has the coloration and outline of *besametsa.* The spines on the thorax, legs, and cerci are of the same type, except that there are five to six short spines at each anterolateral angle of prothorax. The tenth tergite is projecting behind, but is not pointed in front. The antennae and one of the cerci are lost and the other cercus broken, but the antennae consist of at least 17 segments, probably more. The posterior margins of abdominal tergites are darkened (not mentioned for *besametsa*).

This species from North Boulder Creek may be identical with *N. delicatula.*

TRICHOPTERA

Rhyacophila sp. (cf. *Rhyacophila* sp. in Dodds and Hisaw 1925a, Figure 10b).

The head and pronotal shield are straw-colored, with scattered brown dots (Figure 2C and D). The body is yellowish with greenish tint. The larval labrum is as in *R. lobifera* Betten (Betten 1934). Ratio of length of head to dorsal width to lateral width of head is 84:52:38.5. The second segment of maxillary palpus is longer than the first (Figure 2A); the ratio of segments to each other is 35:47:25:29. Left and right mandibles are somewhat different (Figure 2G and H). Front and middle legs are as in Figure 2E and F. The strong teeth on the tarsus and on the front tibia distinguish the species from those described by Ross (1944). The second segment of larvapods is without a dorsolateral spur (Figure 2B), but with a strong ventral almost spur-like bristle. The larvae have four pairs of digitiform gills in a transverse row on each abdominal segment, two pairs of gills on metathorax, and one pair on mesothorax.

Döhler (1951) gives a key to the subgenera of *Rhyacophila* larvae. In this key the Colorado specimens fall in the subgenus *Prosrhyacophila* with the species *Rhyacophila laevis* Pict. (Döhler 1951) and *R. retracta* Mart. (Lepneva 1964). *R. laevis,* however, has only one pair of digitiform gills on the abdominal segments. Of the larvae of *Rhyacophila* mentioned by Ross (1944), Lloyd(1921), and Flint (1962), only *R. acropedes* Banks has gills. Betten (1934) mentions that among the larvae of *Rhyacophila* from North America described until then none had gills on the abdomen. In Dodds and Hisaw (1925a), however, a species of *Rhyacophila* is drawn which is exactly the same shape of body and gills as these specimens. Dodds and Hisaw (1925a, b) mention the following species from South Boulder Creek: *acropedes, alberta, anomata, atrata, coloradensis, hyalinata, nevadensis,* and two to four undetermined species. The specimens from North Boulder Creek are in all likelihood identical with one of the above species except *acropedes* and

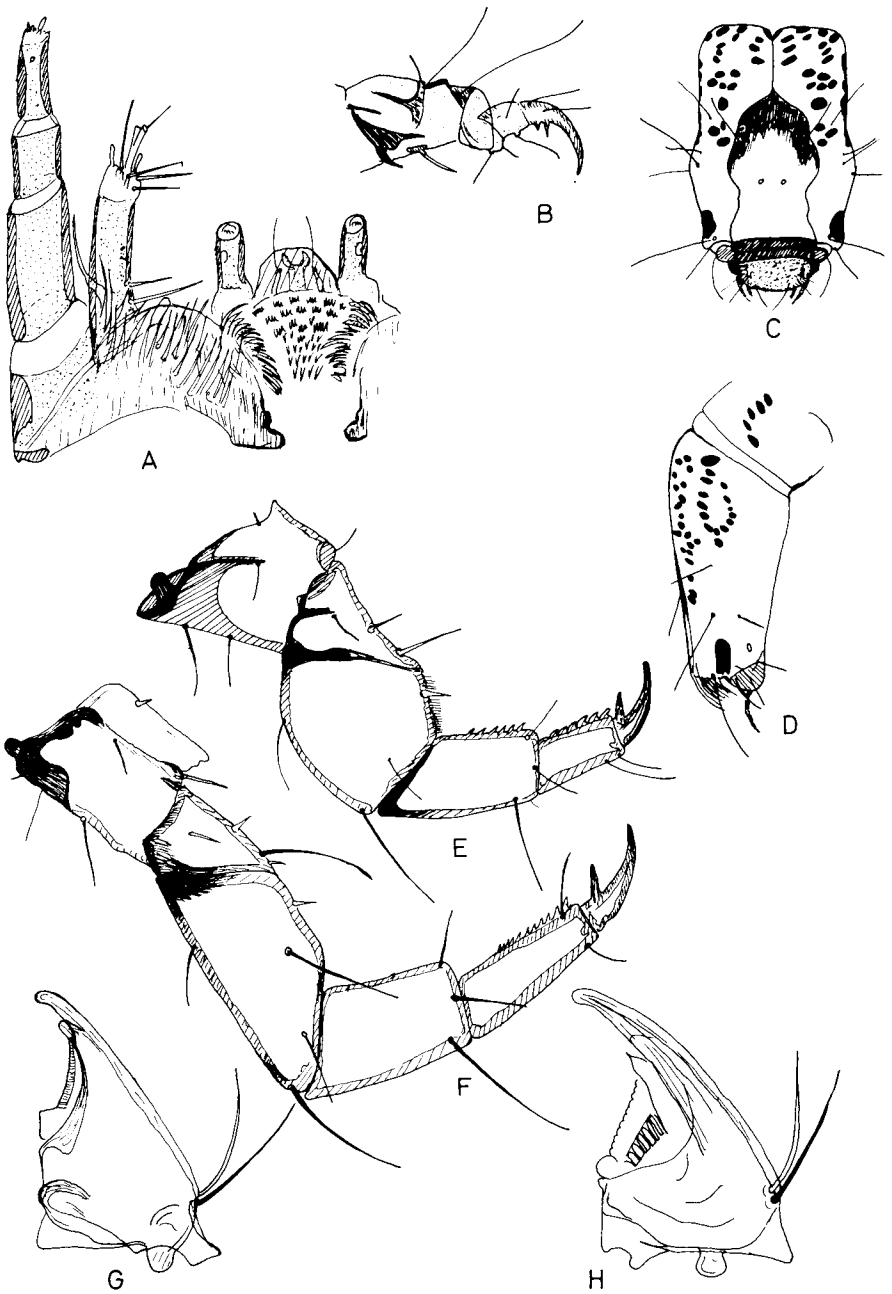

FIGURE 2. Larva of *Rhyacophila* sp. A, maxilla and labium; B, anal leg; C and D, head, dorsal and lateral aspects; E, first leg; F, second leg; G and H, left and right mandibles, inside and outside views.

atrata which are described by Flint (1962).

Brachycentrus sp.

The species makes square cases composed of small bits of woody material as described in Ross (1959). The head is dark brown with a few indistinct darker spots (Figure 3A); the prothorax is dark brown anteriorly, brown with darker spots posteriorly. Lateral separating lines of mesothoracic plates (Figure 3A) more as in *Micrasema* (Ross 1959, figures 39, 14a) than as in *Brachycentrus* (Ross 1959, figures 39, 14b). Middle metathoracic plates seem longer and more narrow than in the larvae described by Lloyd (1921) and Ross (1944). The legs resemble those in Lloyd (1921, figures 134, 146), but the coxal hairs are considerably longer (Figure 3B), more as in *Brachycentrus* sp. (Wiggins 1965). Anal claws (Fig. 3C and D) have two strong, dark, dorsal teeth and three smaller and lighter teeth.

The genus has approximately 10 Nearctic species. Typical localities are cold, fast streams and rivers (Ross 1959, Wiggins 1965). The present species is not one of those whose larvae are described by Ross (1944). Of the remaining species, *B. occidentalis* Banks has a western distribution (Ross 1944), and may be identical with these specimens.

Limnephilid genus *A* in Ross (1959), p. 1044 *Pseudostenophylax edwardsi* Banks (syn. limnephilid in Type 9c L. 243 of Dodds and Hisaw 1925a, p. 127).

This easily recognizable species measured from 2.5 to 6.5 mm in length.

Larval case and general shape as in Dodds and Hisaw (1925a, figure 8) and Wiggins and Anderson (1968, figure 2). The head is as in Ross (1959, figures 39, 15i), Flint (1960, figure 22a), and Wiggins and Anderson (1968, figure 1).

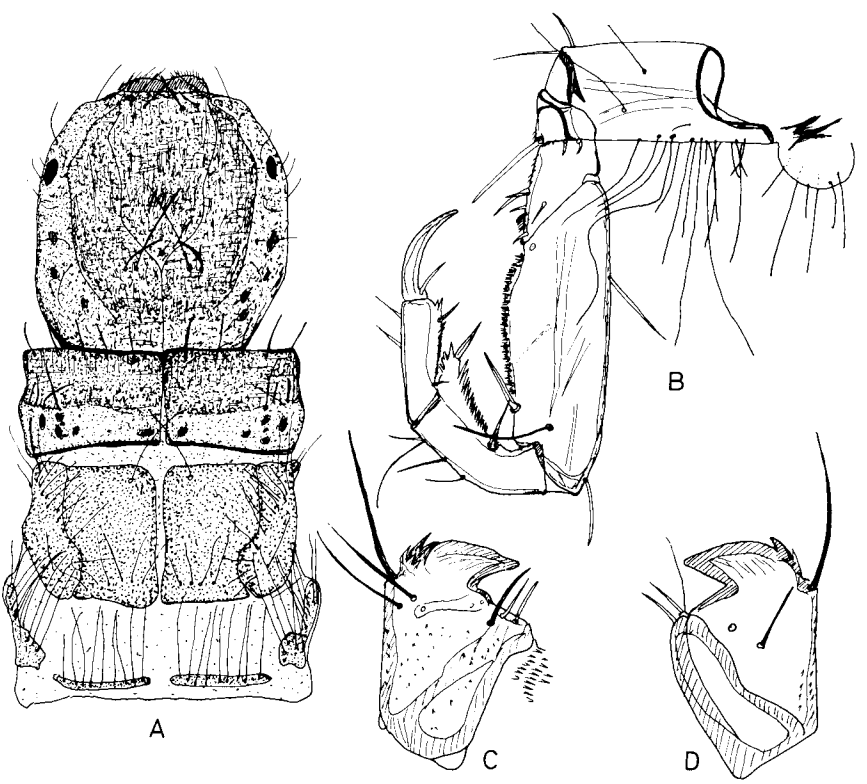

FIGURE 3. Larva of *Brachycentrus* sp. A, head, pronotum, mesonotum, and metanotum; B, hind leg; C and D, anal hook, inner and outer views.

The prothorax, mesothorax, and metathorax are as in Figure 4A). The hind leg is as in Figure 4B, i.e., somewhat different from Flint (1960, fig. 22a), but as the larvae are much smaller they probably belong to an earlier instar. Anal hooks are of normal limnephilid type, about as in *Limnephilus* sp. (Fig. 9C). Larval labrum and mandible are shown in Fig. 4D and C.

Flint (1960) mentions the larvae of Dodds and Hisaw (1925) as synonyms of genus *D* in Ross (1959), but this must be an error.

Hesperophylax oreades sp. n. (cf. syn. *H. designatus* nec Walk. (Dodds and Hisaw 1925a).

LARVA: Mature larva 8-10 mm long. Head, thoracic sclerites, and legs brown with reddish tint; head and pronotum speckled with microscopic brown dots and some large and darker spots (Fig. 5D), i.e., about as in *H. designatus* (Walk) (Vorhies 1909, plate 52 fig. 9; Lloyd 1921, fig. 96, Flint 1960, fig. 34). Fourth instar larva with brownish black head. Pronotum with a transverse crease, darker in anterior parts, i.e., dif-

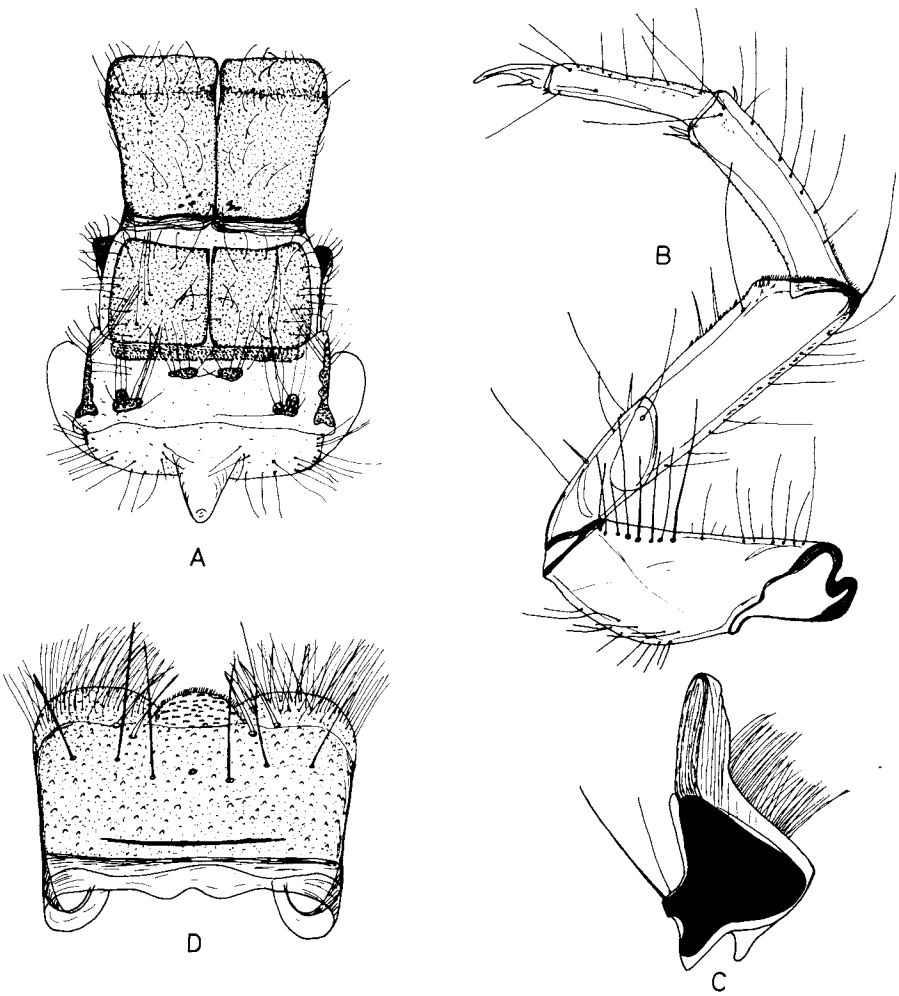

FIGURE 4. *Larva of Pseudostenophylax edwardi* Banks. A pronotum, mesonotum, metanotum, and first abdominal segment, B, hind leg; C, mandible; D, labrum.

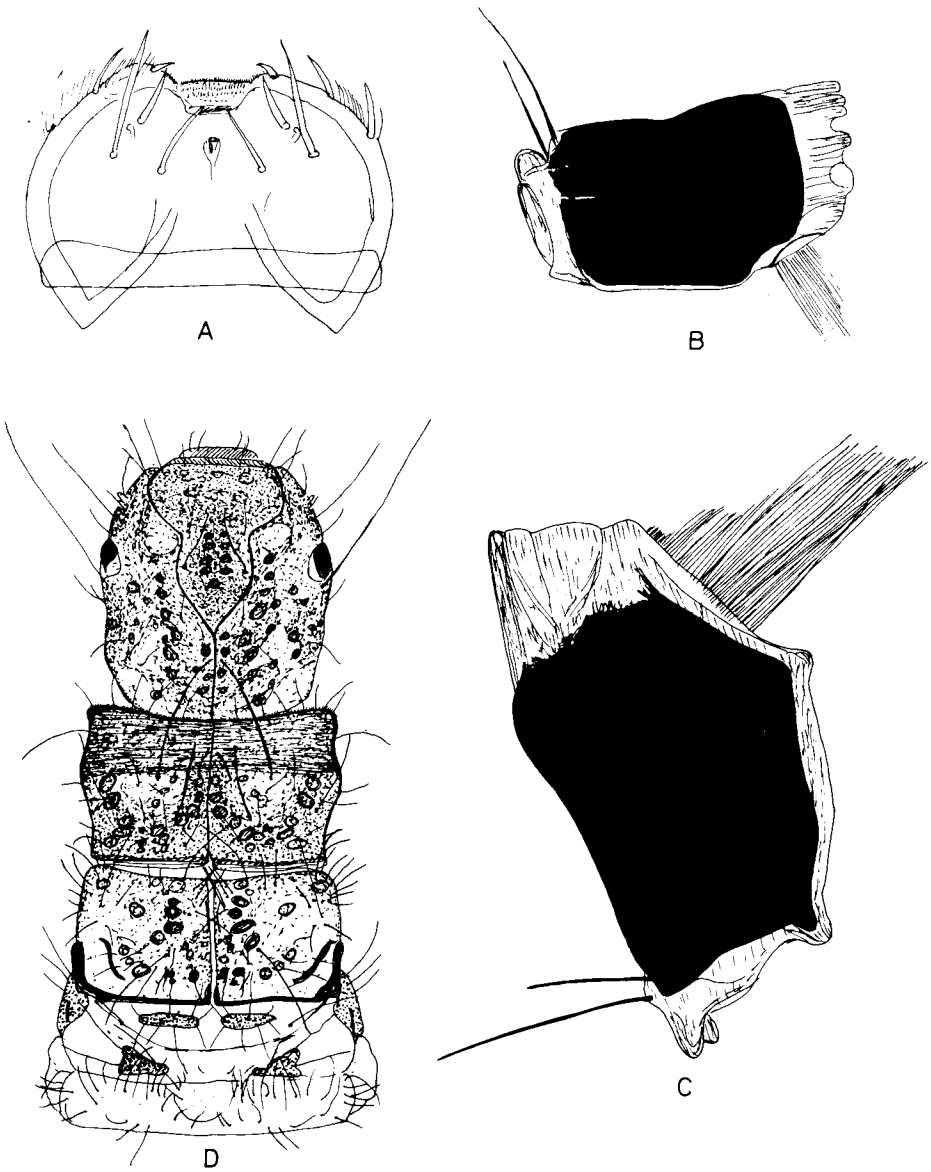

FIGURE 5. Larva of *Hesperophylax*. A, labrum of *H. oreades* sp.n.; B, mandible of *H. oreades* sp.n.; C, mandible of *Hesperophylax* sp. (same scale as A and B); D, head, pronotum, mesonotum, and metanotum of *H. oreades* sp.n.

ferent from *H. designatus*. Abdominal gills single to seven-branched on mature specimens. [In the key of Ross (1959) the smallest specimens, probably belonging to the third instar, key to *Limnephilus*, the fourth instar to *Psychoronia* and *Hesperophylax*, and only in the fifth instar will all larvae key to *Hesperophylax*.] First abdominal sternite has many black conspicious setae, but there were many fewer than 100, as mentioned for *designatus* (Flint 1960).

Labium, mandible, anal hook, and front and hind legs of larva as in Figs. 5A, B, 6E, B, and A. Claws on first legs only half as long as tarsi. [In the following species the claws are 0.9 times the length of the tarsi on the front legs; in *designatus* as long as the tarsi, according to Vorhies (1909, plate 56, fig. 1).] The three rows of teeth on the front tarsi represented only by rudiments. Legs stouter than in the following species.

Leg proportions:

	co	tro	fe	ti	ta	claw
First leg:						
greatest length	186 :	134 :	246 :	160 :	80 :	**53**
greatest width	116 :	63 :	92 :	50 :	33 :	19
length : width	1.60	1.97	2.67	3.20	2.42	**2.79**
Hind leg:						
greatest length	252 :	150 :	270 :	226 :	169 :	**68**
greatest width	97 :	52 :	66 :	48 :	35 :	**18**
length : width	2.60	2.88	4.09	4.71	4.80	**3.78**
(In *H. designatus*, Vorhies 1909):						
First leg:						
length : width	1.9	3.1	2.5	2.7	2.1	**4.0**

Coxa, trochanter and claw more slender in *H. designatus* than in *H. oreades* sp. n.

PUPA: Length of male pupa 7-9 mm; length of female pupa 8.5-12.5 mm. Coloration brown. Antennae much longer than body. On male pupa measuring 7.5 mm in length, antenna length is 11 mm. In *designatus* the antennae extend to seventh segment, or as long as the body (Vorhies 1909).

Labrum, mandible, anal appendages, and hook plates of male and female pupae as in Fig. 7D, G, F, C and B. Labrum and mandibles of same type as in *designatus* (Vorhies 1909, plate 56, fig. 4; Betten 1934, plate 53, figs. 2-3) and as in the following species. Bristles at base of anal appendages reaching only three-fourths the length of appendages, and as long as appendages in the following species. According to Vorhies (1909), the numbers of dorsal hooks are greater than in *designatus* on all plates. Upper line of posterior hook plates on V is straight, but concave in the following species.

IMAGO: (Described from males and females prepared from mature pupae.)

The most mature specimens are brownish. Antennae dark basal and second segment. Head, antennae, pronotum, and mesonotum with the usual warts and hairs, more than one pair of warts present on head, as in *H. minutus* Ling (Ling 1938). Ratio of lengths of segments of maxillary palpi: (male 7.5 mm long, 1st-3rd segm.) 17 : 32 : 43 ; (female 8.5 mm long, 1st-5th segm.) 15 : 16 : 19 : 15 : 20 ; of labial palpi (same ratio, same specimens) male 10 : 11 : 19, female 9 : 10 : 14. In the figures of

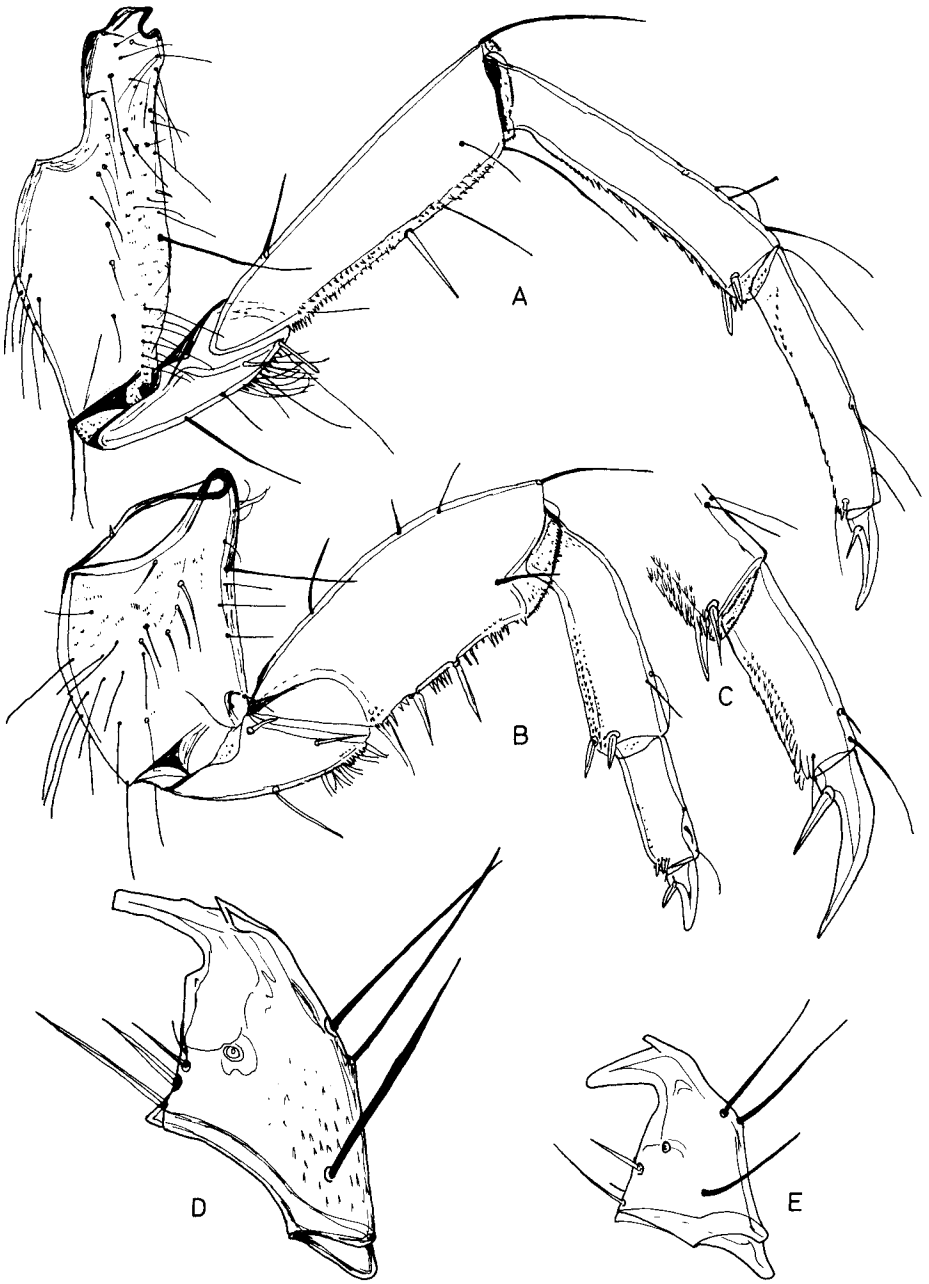

FIGURE 6. Legs of *Hesperophylax* larva. A, hind leg of *H. oreades* sp.n.; B, first leg of *H. oreades* sp.n.; C, claw, tarsus, and tibia of front leg of *Hesperophylax* sp. (same scale as A and B); D, anal hook of *Hesperophylax* sp.; E, anal hook of *H. oreades* sp.n. (same scale as D).

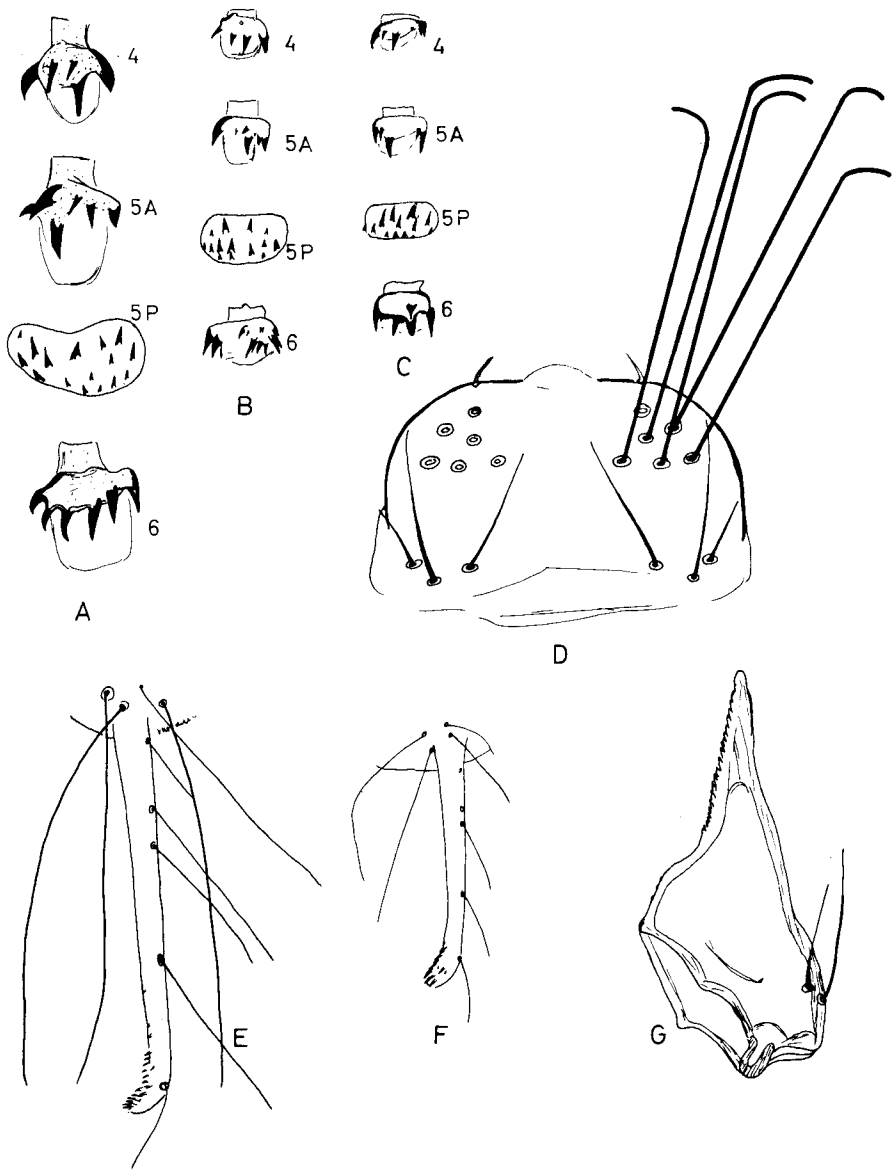

FIGURE 7. Pupa of *Hesperophylax*. A, hook plates of female pupa of *Hesperophylax* sp.; B and C, hook plates of *H. oreades* sp.n., female and male; D, labrum of *H. oreades* sp.n.; E, anal appendage of *Hesperophylax* sp.; F, anal appendage of *H. oreades* sp.n. (same scale as E); G, mandible of *H. oreades* sp.n.

designatus drawn by Betten (1934, plate 52, fig. 13), the ratio of lengths of maxillary palpus in the male are as 9 : 25 : 27.5 ; of labial palpus as 12 : 10.5 : 16, i.e., different from *oreades* sp. n. Spines on legs are black.

Leg proportions (same individuals as above):

Male	co	tro	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	pre-apical spurs	api-cal spurs	LR	BV
p_1	64	19	128	128	58	37	31	24	26		20	0.45	2.66
p_2	73	19	136	134	70	43	32	25	26	17	25	0.52	2.70
p_3	78	20	123	185	85	54	39	26	27	13	20	0.46	2.69

Distance from apical to preapical spurs on middle tibia in same ratio 36. Distance from apical to preapical spurs on hind tibia in same ratio 31.

Female	co	tro	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	pre-apical spurs	api-cal spurs	LR	BV
p_1	59	20	101	88	39	27	21	16	20		15	0.44	2.71
p_2	65	20	120	105	53	33	26	19	23	10	22	0.50	2.75
p_3	73	25	102	143	69	42	32	23	23	19	9	0.48	2.62

Distance from apical to preapical spurs on middle tibia 27; from apical to preapical spurs on hind tibia 26.

$$\left(\text{LR} : \frac{ta_1}{ti} \; ; \quad \text{BV} : \frac{fe + ti + ta_1}{ta_2 + ta_3 + ta_4 + ta_5}\right)$$

Last dorsal segment of male has short black setae as in *designatus* (Vorhies, 1909). Aedeagus as in *designatus* (Vorhies 1909, plate 55, fig. 23). Lateral and dorsal aspect of male genitalia, caudal aspect of tenth tergite of male, and ventral aspect of female genitalia as in Fig. 8D, C, E, and B. Cercus with apico-ventral corner very little produced, thus deviating from *H. magnus* Banks (Ross 1944). Apex of tenth tergite sharp and appearing pointed from both lateral and caudal view (Fig. 8 C-E), i.e., as in *H. consimilis* Banks and *H. magnus* (Ross 1944). Ninth segment with anterior angles pointed, brown, exceeding cerci, and thus deviating from all species described by Ross (1944). Tenth tergite of female genitalia with lateral projections occupying more than two-thirds of ventral aspect, thus deviating from female genitalia of *designatus, occidentalis, incisus,* and *magnus* (Banks 1918, Ross 1944).

All species described by Ross (1944) are larger than this new species. The two species with the most similar male genitalia are *consimilis* and *magnus*. *H. consimilis* measures 18 mm long (Banks 1900) and *H. magnus* 45-50 mm (Banks 1918). *H. minutus* (Ling 1938, Denning 1956), however, has a length of only 10-12 mm, but has only one pair of warts on head, genitalia almost identical with those of *designatus,* and antennae only about as long as the wings.

Dodds and Hisaw (1925a) found *H. designatus* and *H. occidentalis* in South Boulder Creek (*H. occidentalis* only recorded once). *H. designatus* was collect-

ed between 9,000 and 11,000 feet (2750-3350 m) above sea level, but it is unlikely that the species found by Dodds and Hisaw really is *designatus*. *H. designatus* has been recorded only from the northeastern states (Ross 1944). The cases of larvae and pupae drawn by Dodds and Hisaw (1925a, fig. 7) are identical with those of *H. oreades* and the pupal case measures only 10-11 mm in length, i.e., less than in *H. designatus*. The larval case is straighter than in the figure of the case of *designatus* drawn by Lloyd (1921, fig. 101). The larvae mentioned as belonging to *H. designatus* by Dodds and Hisaw thus probably belong to this new species. The larvae from the lakes, however, may be-

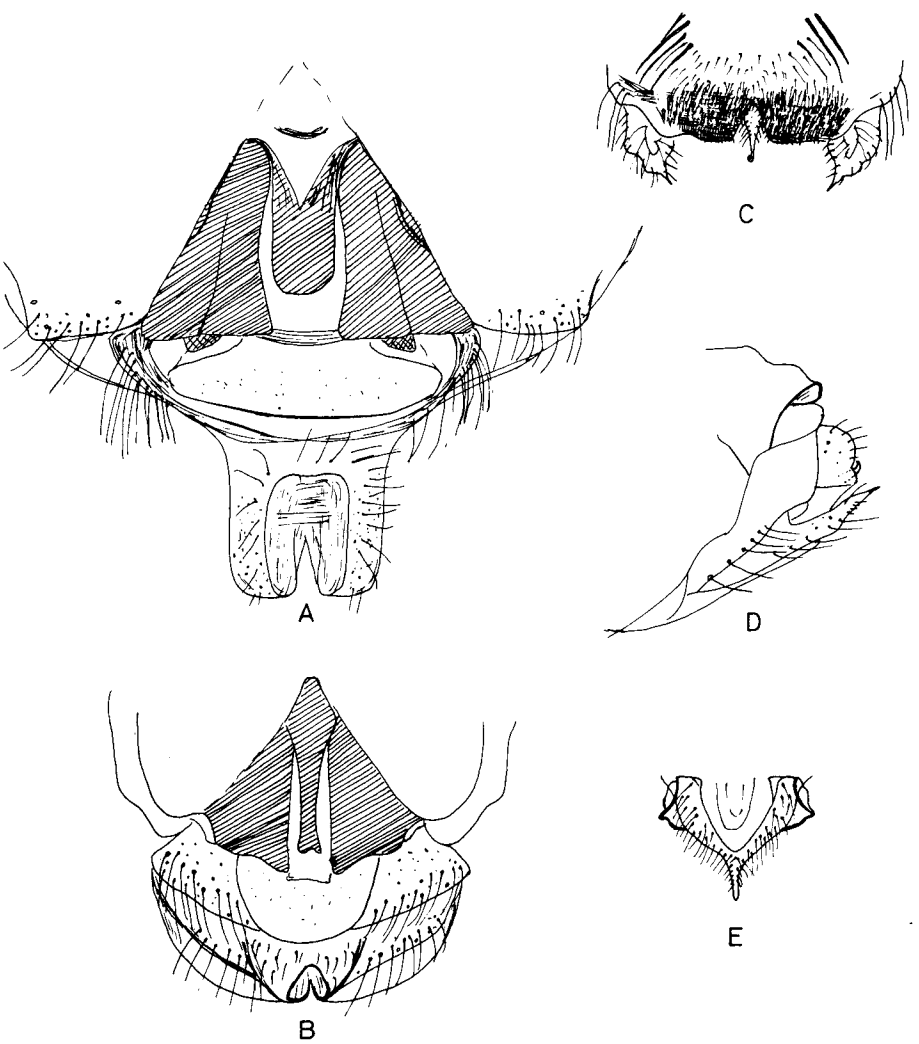

FIGURE 8. Genitalia of *Hesperophylax* imagines. (Same scale in A-D) A, *Hesperophylax* sp., female genitalia, ventral aspects; B, *H. oreades* sp.n., female genitalia, ventral aspect; C-E, *H. oreades* sp.n., male genitalia, dorsal and lateral aspect, and tergite X in caudal aspect.

long to another species, probably the following.

Hesperophylax sp.

LARVA: The larvae measure from 7-17.5 mm in length. (Besides five larvae at Station 6, two were found on the shore of Lake 5, and 11 on the shore of Lake 4.) Head, thoracic sclerites, and coloration about as in *H. oreades*, but head not much darker in the fourth instar, and anterior parts of pronotum not especially darker than posterior parts. Abdominal gills single to eight-branched. Labrum as in *oreades*. Mandible is shown in Fig. 5C. The mandibular hairs finely feathered, visible at an enlargement of 400x. Legs similar to those of *oreades*, but much more slender, with longer claws, and with three distinct rows of teeth on fore-tarsi (Fig. 6C). The anal hook appears in Fig. 6D.

Leg proportions:

	co	tro	fe	ti	ta	claw
Front leg:						
greatest length	322	205	415	250	134	122
greatest width	155	102	132	71	48	30
length : width	2.08	2.00	3.14	3.52	2.82	4.07
Hind leg:						
greatest length	458	255	503	405	302	138
greatest width	143	68	108	72	42	27
length : width	3.20	3.75	4.66	5.63	7.19	5.11

Compared with those of *H. designatus* (see under *H. oreades*), the femur, tibia, and tarsus are more slender in this species. The mandibles are slightly different from those in *oreades* and have feathered bristles (feathering visible at 400x) which seems not to be the case in *H. oreades*). The mature larva of this species has an inconspicuous inner tooth on the anal hooks, not present in *H. oreades*.

PUPA: Two female pupae found at Station 13 measured 17 and 17.5 mm in length. A male pupa from the same station measured 14 mm in length. Antennae extending to segment VII or as long as the body, i.e., as in *designatus* (Vorhies 1909). Labrum and mandible as in *oreades*. Anal appendage and hook plates of female are shown in Fig. 7E and A. Bristles at base of anal appendages as long as the appendages, different from *oreades*. Dorsal hooks more numerous than in *designatus*. Upper line of posterior hook plates on V concave, straight in *oreades*.

IMAGO: As the male pupa was not mature, it was impossible to prepare its genitalia from the pupa, but the genitalia could at least be seen to be characteristic of the genus.

One of the female pupae, however, was fully mature. Coloration of head, thorax, abdomen, legs, hairs on warts, antennae, wings, legs, and spines on legs, and placement of warts exactly as in *designatus* as described by Vorhies (1909), except that the posterior two coxae do not seem darker than the anterior one. Ratio of lengths of maxillary palpus in male about as 28 : 52 : 50, labial palpus as 15 : 16 : 28. Same ratios in female, maxillary palpus (1-5) as 24 : 41 : 42 : 30 : 44; labial palpus as 18 : 19 : 35. The ratio of male maxillary palpus distinguishes this species from *oreades* and *designatus*. As the male pupa was not fully mature, however, the ratios of the male palpi are probably not exact.

Leg proportions in female:

	co	tro	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	pre-apical spurs	api-cal spurs	LR	BV
p_1	113	45	224	180	84	61	46	34	37		32	0.47	2.74
p_2	140	49	268	226	130	79	59	40	38	4	42	0.58	2.89
p_3	168	49	232	363	164	100	70	44	41	19	36	0.45	2.98

Distance from apical to preapical spurs on middle tibia in same ratio 68. Distance from apical to preapical spurs on hind tibia in same ratio 58.

This species differs from the preceding species by the middle and hind ta_4 being longer than the ta_5, the LR, and the BV, and the reduced preapical spurs on the middle tibiae (also distinct in pupae).

Female genitalia are shown in Fig. 8A. They resemble those of *designatus* (Ross 1944, fig. 938), but do seem not to be identical. Female genitalia of *magnus, consimilis,* and *minutus* have not been exactly described. *H. minutus,* however, seems too small to be identical with this species, and *H. magnus* is probably too large (Ling 1938, Banks 1918). *H. magnus* is also known only from Arizona, *H. minutus* only from Oregon and California, while *consimilis* is known from several western states (Ross 1944). According to Banks (1900), the coloration of *consimilis* is pale yellow, while this species seems somewhat darker. This may be due to individual variation. *H. consimilis* was first described from South Park, Colorado (Banks 1900).

Limnephilus sp.

Thirteen larvae measuring 9-12 mm in length were collected, together with larvae of *Aedes excrucians,* in a little pond near Lake 4.

Head without distinct pattern, brown with a reddish tinge (Fig. 9A). Pronotum with a transverse crease, but not darker in anterior half. Prothorax, metathorax, and legs are fuscous with yellowish tint. Mesosternum with three to five pairs of small sclerites. First abdominal segment with five to seven setae on each side of dorsal hump, two above, and none to two below lateral hump (Fig. 9A), and venter with 25-36 setae (Fig. 9B). Abdominal hump prominent. Segment VIII with about 20 setae dorsally. Gills in posterior cluster dorsal on segment VII; anterior cluster dorsal on segment VIII; and anterior cluster ventral on segment VIII, reduced to a single filament. Dorsal filament on segment VIII very small in some specimens. Anal hook with one strong dark accessory tooth and three lighter and smaller teeth (Fig. 9C). Case as in *Limnephilus* sp. (Denning 1956, fig. 10:2.g) or about as in *L. submonilifer* Walk (Flint 1960, fig. 57), made of small pieces of grass and leaves.

In the key of known Nearctic larvae of *Limnephilus* (Ross 1944, Flint 1960), *L. submonilifer* seems to be closely related. The present form, however, differs from *submonilifer* by having gills dorsal on segment VIII, and four accessory teeth on anal hooks.

DIPTERA

FAMILY SCIARIDAE

Lycoriella (Hemineurina) sp.

One female imago was found below a waterfall in Brook 3-4.

Female. Length 3.1 mm; length of wings 2.3 mm. Thorax reddish brown and dusty; abdomen more luteous; tergites brownish posteriorly; legs and antennae brown with a yellowish tinge; coxae luteous, but brown at base, joints brown; palpi luteous, first segment brown at base; head almost black; wings and

halteres subfuscous, veins yellowish brown; bristles on notum and abdomen pale, slightly subfuscous.

Eyes densely haired, with three rows of ommatidia in eye-bridge. Face with ten pale bristles, the longest measuring 30μ; clypeus with three bristles. Basal antennal segment longer (74μ) than broad (63μ); first flagellar segment (third antennal segment), including neck, measuring 81μ, 2.71 times as long as broad; fourth flagellar segment reaching 65μ, 1.90 times as long as wide, with neck 6μ long and 22μ wide; last two segments lost. Pale hairs of antennae a little shorter than the width of segments; their apices half the width of antennal segments. Lengths of first three segments of palpi 59μ : 47μ : 55μ. First segment on subapical bristle and indistinct sensory pit, 1.7 times as long as broad; second segment with 11 bristles, 1.7 times as long as broad; third segment with nine bristles, 2.3 times as long as wide.

Notum with short bristles, but longest scutellars reaching 0.16 mm. Upper mesothoracic katepisternite with a distinctly pale margin.

Abdomen with very short bristles. Proximal segment of cercopodium reaching 78μ, distal segment measuring 90μ (Fig. 10C).

Wings (Fig. 10B) without macrotrichiae on cu_1, m, and y, but with four or five macrotrichiae at base of cu_2 and about five on wing-membrane; cuSt = one-third x; mSt : m_1 = 52 : 54; c = 0.39 w.

Ratio of lengths of leg segments (Co to ta_5):

p_1	22	:	6	:	32	:	35	:	14	:	7	:	6	:	4	: 5
p_2	20	:	6	:	38	:	40	:	15	:	7	:	5.5	:	4	: 5
p_3	20	:	6	:	44	:	52	:	21	:	9	:	7.5	:	4.5	: 5

Spurs on hind tibia 92μ long; tibia at apex measuring 76μ in width. Apex of front tibia about as in *Corynoptera sphenoptera* (Tuomikoski 1960, fig. 13c).

In Lengersdorf (1930), Frey (1948), and Tuomikoski (1960) this species keys to *Lycoriella* (*Hemineurina*) *conspicua* (Winn). The macrotrichiae on cu_2 and on the wing-membranes, however, are not mentioned in the descriptions. Nevertheless, this form may be a variety of *conspicua* or a very closely related species.

Sciaridae sp. *B*

One female imago was found at Brook 4-5.

Female. Length of body 2.7 mm; length of wings 2.1 mm. Coloration of thorax black, dorsally indistinctly dusky, almost shining; abdomen black with brownish tint; legs (except coxae), membranous parts of thorax, and cercopods a little more yellowish brown; wings and halteres subfuscous, veins brown, palpi subfuscous, first segment darker; bristles on notum and abdomen pale.

Eyes distinctly haired, with two rows of ommatidia in eye-bridge. Face with 12 pale bristles, the longest measuring 30μ; clypeus with three bristles. Basal antennal segment longer (70μ) than broad (63μ); first flagellar segment, including neck, measuring 63μ, 1.88 times as long as broad; fourth flagellar segment reaching 66μ, 1.83 times as long as broad; flagellar segments 6 to 8 reaching 57μ, 1.71 times as long as broad; 12th and 13th flagellar segments measuring 43μ, and last segment measuring 66μ and being 2.00 times as long as wide. Neck of fourth flagellar segment 10μ long and 20μ wide. Pale hairs of antennae almost as long as width of segments. Lengths of first three segments of palpi : 70μ (1.8 times as long as broad) —56μ (1.8 times as long as broad)— 65μ (2.00 times as long as broad). First segment with one subapical bristle reaching 36μ and without distinct sensory pit; second segment with seven bristles; third

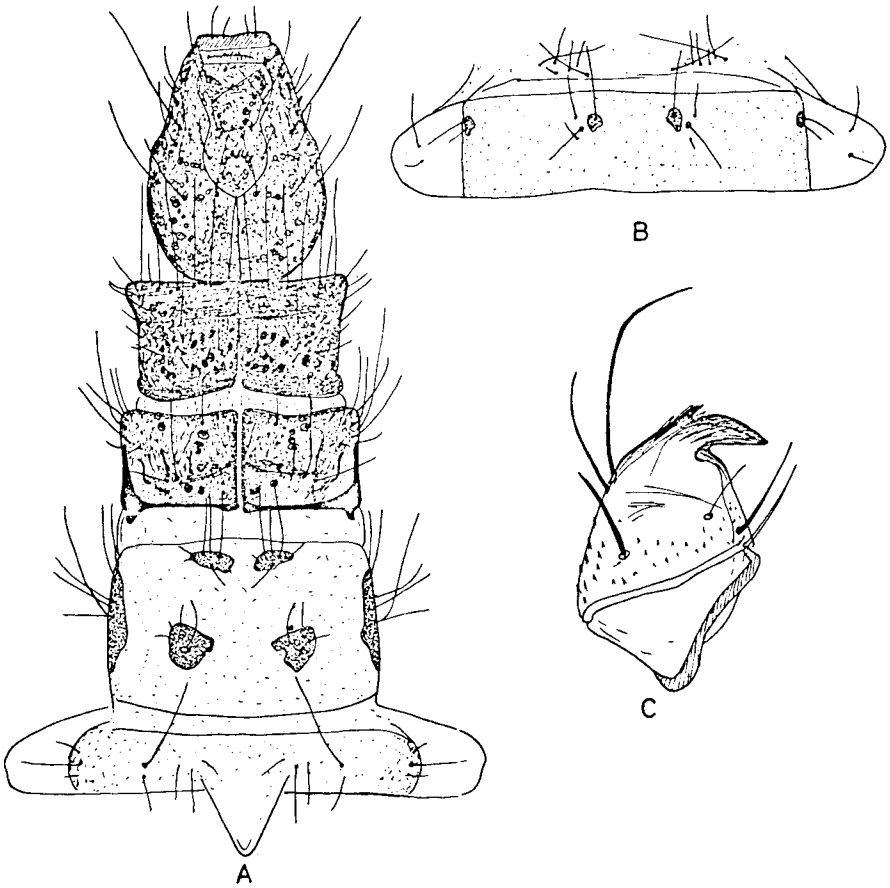

FIGURE 9. Larva of Limnephilus sp. A, head, pronotum, mesonotum, metanotum, and first abdominal segment; B, venter of first abdominal segment; C, anal hook.

with eight bristles (Fig. 10E).

Notum with short, strong bristles, the largest scutellars about 0.10 mm long. Upper hind margin of mesothoracic katepisternite with an indistinct slightly paler border.

Abdomen with short bristles. Proximal segment of cercopodium reaching 70μ; distal segment 95μ (Fig. 10D).

Wings (Fig. 10A); cuSt : x = 7 : 13; y with 3-4 bristles; mSt : m_1 = 55 : 50; two strong dark spines on the wing membrane (Figure. 10A); c = 0.44 w.

Ratio of lengths of leg segments (Co to ta_5):

p_1	21	:	4	:	27	:	33	:	14	:	6	:	5	:	4	:	5
p_2	21	:	4	:	27	:	30	:	11	:	5.5	:	4	:	3.5	:	4
p_3	21	:	4	:	42	:	49	:	19	:	7.5	:	6	:	4.5	:	5

Spurs of hind tibia 90μ long; t_3 at apex 76μ wide. About seven bristles in comb of front tibia. Claws without teeth.

In the key of Tuomikoski (1960) this

species falls in *Bradysia* Winn. It cannot, however, be placed in any of the groups mentioned by Tuomikoski (1960), and seems closely related to *Lycoriella* Frey. The palpi, the antennae, and the short and pale bristles of head, thorax, and abdomen are of the same type as in the preceding species. In the key of Frey (1948), the species comes out to *Bradysia* s. str.

The two female specimens of Sciaridae are interesting in having bristles or spines on the wing membrane and not on cu_1 and m. Such bristles are not mentioned in earlier descriptions. The bristles or spines may, however, have been over-

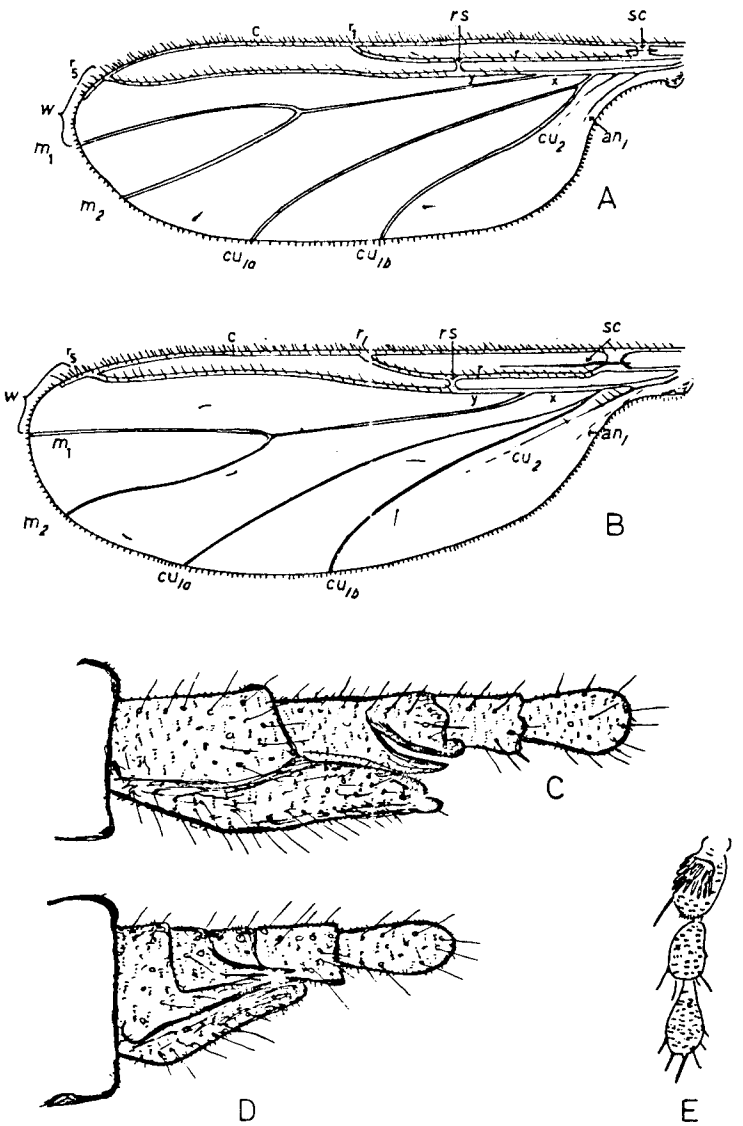

FIGURE 10. A, wing of Sciaridae sp. *B*, female; B, wing of *Lycoriella* (*Hemineurina*) sp, female; C, cercopdium of *Lycoriella* (*Hemineurina*) sp., female; D, cercopodium of Sciaridae sp. *B*, female; E, palp of Sciaridae sp. *B*.

looked as they are few and scattered. Their presence and shape may perhaps be used in future diagnostics.

FAMILY THAUMALEIDAE
Thaumalea sp.

Two larvae and one larval integument were found among vegetation in the steepest, upper part of Brook A-1.

The larvae are very similar to those of *T. testacea* Ruthe (Saunders 1923, Lindner 1930) and *T. veralli* Edw. (Bertrand 1948, Nielsen, Ringdahl, and Tuxen 1954), but differ in some details.

The larvae measure about 6.5 mm (fully grown?). Larvae differ from *T. testacea* in the following particulars: Chaetotaxy (Saunders 1923, fig. 1) (Fig. 11B): all chaetae broader, those not ramified have their greatest width at a point less than half their length (Fig. 11G) (as in *T. veralli*?); those ramified split into a much greater number of hairs than four; chaeta 12 not simple as in *testacea*, but ramified; all chaetae seem longer and stronger, especially 9 and 12; bristles on each side of labium overreaching this (Fig. 11A); antennae less pointed (Fig. 11C); larval prothoracic spiracle as in Fig. 11D; metathoracic macrochaetae as in Fig. 11F. Procerci long, fingerlike, provided with four bristles; posterior proleg with two long unramified bristles on the dorsal anal margin.

The other known larvae of North American species of Thaumaleidae belong to *Thaumalea americana* Bezzi (Johannsen 1934). *T. americana* differs from *T. testacea* and this Colorado species especially by lacking frontal tubercles and by having unbranched setae on the vertex and the upper part of the frons.

Only five species of Thaumaleidae have been described from North America, of which two belong to *Trichothaumalea*, the rest to *Thaumalea* (Vaillant 1959).

FAMILY CHIRONOMIDAE.
Subfamily Chironominae.
Tanytarsariae genuinae.
Eutanytarsus inermipes group. *Micropsectra* type. *Micropsectra* sp.

Several larvae were found in the

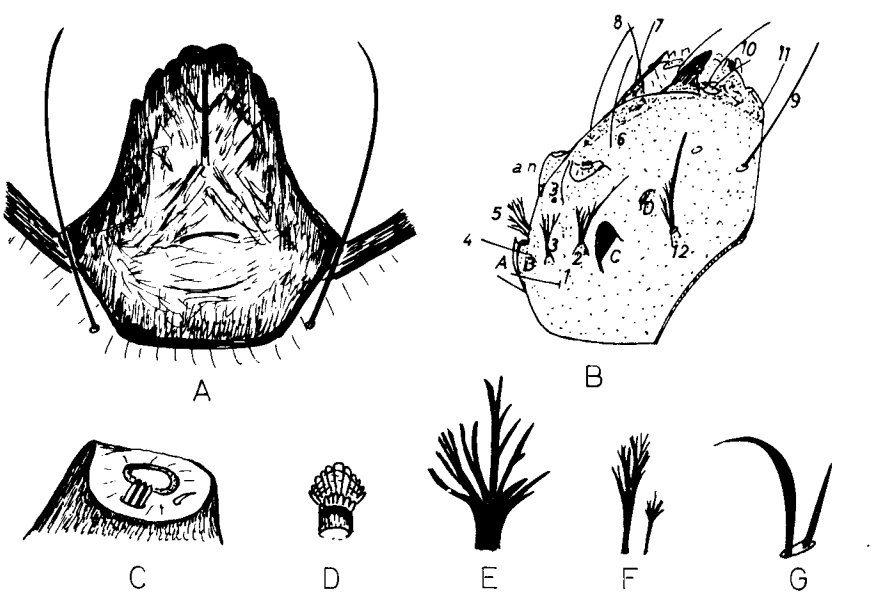

FIGURE 11. Larva of *Thaumalea* sp. A, labium; B, head, numbers, and letters on chaetae and tubercles as in Saunders (1923); C, antennae; D, larval prothoracic spiracle; E, chaeta 12; F, metathoracic macrochaetae; G, chaetae 10.

middle and upper middle part of Brook A-1 at a temperature of 10°C.

One larva was caught just above Lake 3 at Brook 3-4.

LARVA: Length 4 mm. Head yellow; abdominal segments pale grey with a greenish brown tinge; thoracic segments more green.

The larva differs from most *Micropsectra* species by having the basal segment of the antennae only 2.2 times as long as the second segment, as in *Calopsectra* sp. 7 (Roback 1957).

Ratio of length of antennal segments to each other as 46 : 22 : 5 : 3.5 : 2; annular organ directly at base; bristle of basal segment two-thirds from base; spur of antennal tubercle 10-12μ long; blade at apex of second segment almost as long as this; stalks of Lauterborn organs three times the combined length of the three distal segments; Lauterborn organs 5.5μ long and 4.5μ wide; antennae about double the length of the head and more than three times as long as the mandibles; basal segment and whole second segment luteous. Mandible with long, dark, apical tooth, three dark lateral teeth, and two dark dorso-mesal teeth, but without the two teeth on dorsal side of mandible distal to preapical comb present in *Calopsectra* sp. 7. Labial plate with 11 dark teeth, median very slightly trifid, a little lighter at margins and apex.

PUPA: The only pupa found had lost the thoracic segments. Length approximately 3.3 mm. Color about as in abdominal segments of larvae, but a little browner. Chaetotaxy of the tergites as in *Microspectra praecox*, *M.* sp. *H.*, *M. hydra* Kieff., and *M. groenlandica* And. (Kraatz 1911, Goetghebuer 1928, Johannsen 1937b, Andersen 1937), on each latero-posterior angle a comb of fine dark teeth (Fig. 12B); 27 filaments in the fringe of the caudal lobes (as in *M.* sp. *H.*, Johannsen 1937b) and with

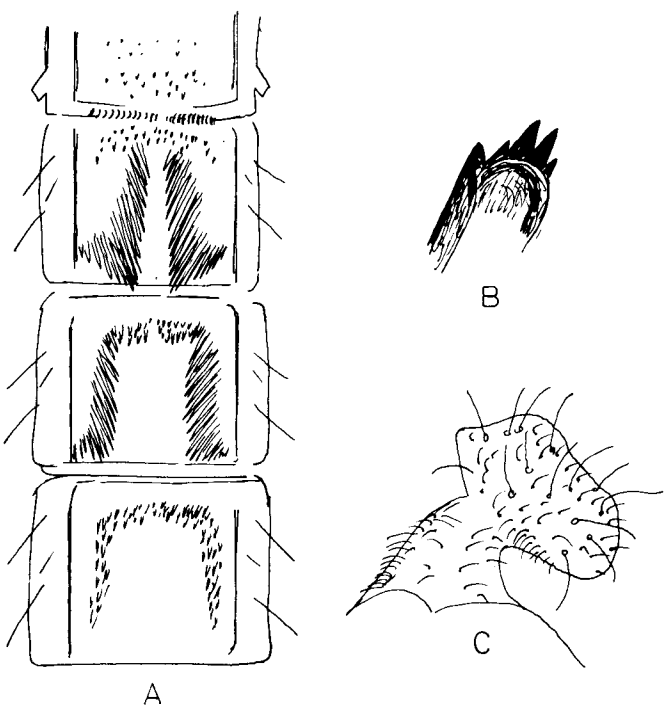

FIGURE 12. Pupa of *Eutanytarsus inermipes* group. *Micropsectra* type. A, tergites III to V; B, comb on laterio-posterior angle of tergite VIII; C. lamelle of ovipositor as seen through exuvia.

a single filament on the disc. Several species of *Microspectra* Kieff. are mentioned by Johannsen (1937b) and Roback (1957b). Lamelles of ovipositors as seen through exuvia are shown in Fig. 12C.

Subfamily Diamesinae.
Tribe Diamesini.
Pseudodiamesa (*Pseudodiamesa*) *pertinax* (Garrett).

Eleven larvae were found in heavy current below Lake Albion at Brook 0 at 10°C. Two larvae were found on a plateau in waterfall in Brook A-2 at 8°C. One small larva measuring 1.5 mm was found in Brook 2-3. One large larva was at the inlet of Lake 2 at Brook 3-4. Large head capsules, but no individuals, were found in Brook 6.

The longest larva measured 12.5 mm, but the head was a little smaller than the head capsules found in Brook 6, which means that fully grown larvae may measure about 15 mm, as found by Johannsen (1937a). The larvae described by Johannsen were whitish, but preserved in alcohol; these formalin specimens are pale olive green with a brownish tint and would in all likelihood have been whitish if preserved in alcohol. The larvae investigated by Johannsen had one reniform eye-spot on each side of the head; young specimens of the present larvae have two eye-spots that are almost connected, the oral one being the smaller (Fig. 13A); in older specimens the eye-spots were contiguous (Fig. 13B). Johannsen mentions that the anterior transverse comb of the labrum is apparently lacking; in these specimens the transverse comb is present, but is often difficult to detect.

Head brown, with darker posterior margin; length of head: width = 35 : 21; labrum and epipharyngeal region (Fig. 13C) about as in *Pseudodiamesa branickii* (Now.) (Thienemann and Mayer 1933, Thienemann 1952b) and *Pseudodiamesa nivosa* group (Goetghebuer 1932, Tshernovskij 1949). Maxillary palp and maxillary lobe as in *P. branickii*. Hypopharynx with two to three rows of small, digitated sclerotized scales at its base in *Prodiamesa praecox* Kieff. (Kraatz 1911, fig. 61). Ratio of segments of antennae to each other as 65 : 21 : 4 : 2 : 4 = 65 : 31; basal segment one-third as broad as long and three times wider than second segment; annular organ in first fifth of basal segment; third segment annulated; styles of first and second segment as mentioned by Johannsen. Mandibles dark brown and black distally; ratio of mandibles to antennae as 2 : 1; mandibles with four lateral teeth and about 12 bristles in the inner brush, the bristles being almost smooth, but with very fine serrations along their inner margin as in *P.* sp. *nivosa* group (Tshernovskij 1949, fig. 83). Premandibles very broad and with eight to nine digits (Fig. 13D), a little shorter than half the length of mandibles; labium strongly arched so that unflattened, it seems to consist of only three teeth (Fig. 13F); after being flattened, the labium looks as described by Johannsen (1937a) (Fig. 13E).

Prolegs and procerci as mentioned by Johannsen and as in *P.* sp. *nivosa* group (Tshernovskij 1949, fig. 84). Tubuli anales variable; most specimens with tubuli anales as long as posterior prolegs, distally rounded and constricted in the middle; larvulae with pointed, not constricted, tubuli anales; largest specimens with more slender tubuli reaching four-fifths the length of posterior prolegs; two specimens from below Lake Albion with two tubuli as long as posterior prolegs, two half this length, and no tubuli anales constricted. As mentioned by Thienemann (1952b) and Fittkau (1954), it is usual to find different types of tubuli anales within the same species of *Pseudodiamesa*. The larvae had their guts filled with fir pollen.

This species was previously placed in the genus *Syndiamesa*, dissolved by Pagast (1947). The species more commonly placed in *Syndiamesa* are placed in *Pseudodiamesa* or *Diamesa* s. str. Oliver (1959) considers *pertinax* as a member of *Pseudodiamesa*. He distinguishes two subgenera of *Pseudodiamesa*, *Pseudodiamesa* s. str. and *Pachydiamesa* with *Pseudodiamesa arctica* (Mall.). The larvae of the last-mentioned species appears, according to Oliver (1959), to be identi-

cal with larvae of *branicki* and *nivosa*, and thus different from the larvae of *P. pertinax*.

P. pertinax is known from the Rocky Mountains and the Canadian arctic (Oliver 1959).

Pseudodiamesa nivosa Goetgh. and the closely related Russian species *P.* sp. *nivosa* group (Tshernovskij) differ from *P. pertinax* in having a more evenly rounded middle tooth of the labium, greater antennal ratio, and different premandibles and eye spots. *P.* sp. *nivosa* group (Tshernovskij) has its first lateral tooth bifid as in *P. pertinax*.

Diamesa (Meig.) Pag.
Diamesa s. str.
Diamesa sp. *A*.

Larvae were found in moss and blue-green algae in Brook 6. Mostly larvae and some exuviae were found near the steepest ridge (temperature 1-1.5°C). Larvae, some pupae, and a partly dam-

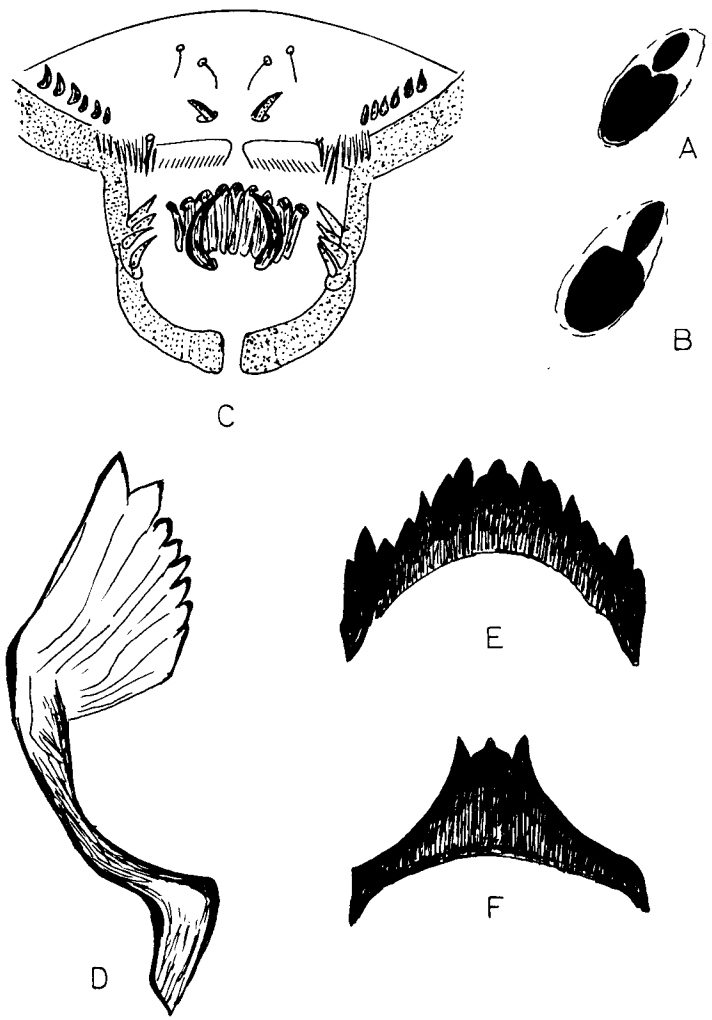

FIGURE 13. Larva of *Pseudodiamesa pertinax* (Garrett). A, eye-spot of young larva; B, eye-spot in older specimen; C, labrum and epipharyngeal area; D., premandible; E, labium flattened; F, labium not flattened.

aged female imago with attached exuvium were found very near the upper snowbank (temperature 0.5-1°C). It is almost certain that larvae, pupae, and imago belong to the same species, though the larvae and pupae were not reared.

LARVA: Length about 6.5 mm. Brown, partly brownish marbled. (The larvae of *D. nivoriunda* Fitch (*D. waltlii* Joh. nec. Meig.) (Johannsen 1903, 1937a) are pale green.) Anterior prolegs with slender curved claws that are not serrated and smaller serrated claws; posterior prolegs with strong darkish brown claws. Procerci lacking, reduced to only one short bristle measuring about 45μ. Abdominal segments with minute lateral bristles. Tubuli anales large and swollen, almost as long as posterior prolegs and distally rounded. Head fuscous with almost black posterior margin; double eyes almost connected. Antennae with five segments; ratio of length of segments to each other as 37 : 9 : 5.25 : 3 : 2.75 = 9 : 5. In *D. nivorunda* (Johannsen 1937) the fifth segment seems to be longer than third and fourth. Annular organ in first sixth of basal segment; style at apex of first segment a little shorter than antennal segments two to five combined (9:10); apical style of second segment almost as long as third segment; basal segment of antennae one third as long as wide (Fig. 14A). Labrum ahead of epipharyngeal area with many slender squamulae (Zavřel), the middle ones with only two or three teeth, the most lateral ones with about five teeth. Anteriolateral to these are some serrated spines (chatae Zavřel); corner of labrum with three to four spinulae (Zavřel), one three-forked, one two-forked, and one or two simple; middle bristles on anterior margin of labrum forked at midlength (Fig. 14B). Hypopharynx, maxillae, and epipharyngeal area as in *Diamesa thienemanni* (Potthast 1915), and *Diamesa* sp. *prolongata* group (Tshernovskij 1949). Premandibles brown, each terminating in seven digits, at the lateral edge with a ramified bristle usually hidden under the premandibles (Fig. 14B). Labial plate with a half-divided middle tooth and nine lateral teeth; three middle teeth at same height, rounded, and a little lighter than the more pointed lateral teeth (Fig. 14C). Mandibles not quite as long as the double length of antennae, with about 20 bristles in inner brush (Fig. 14D).

PUPA: Length 5-6 mm. Dusky brown or almost black (the pupa of *D. nivoriunda* is yellowish to fuscous with greenish tinge); male exuviae grayish luteous. Taps at frons lacking, as in *Diamesa cinerella* Meig. (Pagast 1947); replaced by a long brown bristle (0.27 mm); covering case of scapus with small taps as in *cinerella* and in *Diamesa japonica* Tok. (Tokunaga 1936); thoracic respiratory organs very slender, delicate, and smooth, gradually tapering to apex, with four to five minute teeth at apex, measuring 0.42 mm (about 0.6 mm in *D. nivoriunda*); greatest width 18μ, exactly as in *cinerella;* three bristles ahead of respiratory organ similar to *cinerella;* middle one 0.28 mm (0.33 in *cinerella*), posterior one 0.17 mm (0.19 in *cinerella*) and anterior one 0.10 mm (as in *cinerella*).

Thoracic segments as in *cinerella* (Pagast 1947), but the bristles a little posterior to a line between the respiratory organs, measuring about 220μ (180μ in *cinerella*). Sternites and tergites of abdominal segments shagreened with fine spinules in the same way as in *cinerella;* anterior lines of abdominal segments, pairs of dorsal marks, and lateral edges as in *cinerella.*

Abdominal bristles fuscous, as in *cinerella;* four lateral bristles (L) on segments II-VII and two on segment I; L_4 represented on segment VIII by a small bristle measuring only 9μ (Fig. 14E); according to Pagast (1947, fig. 82) there is one bristle more on tergite VII than on tergite VII of *cinerella;* five dorsal bristles (D) and five ventral bristles (V); D_4 and D_5 placed among the *Diamesa* — thorns; D_4 longest and lateral of D_5; length of bristles on tergite VI : L_1 = 128μ, L_2 = 128μ, L_3 = 156μ, L_4 = 84μ, D_1 = 152μ, D_2 = 84μ, D_3 = 44μ, D_4 = 68μ, D_5 = 21μ; length of D_4 on segment VII 100μ, on segment VIII 152μ.

Diamesa—thorns dorsal on segment II-VIII, ventral on segment III-VIII;

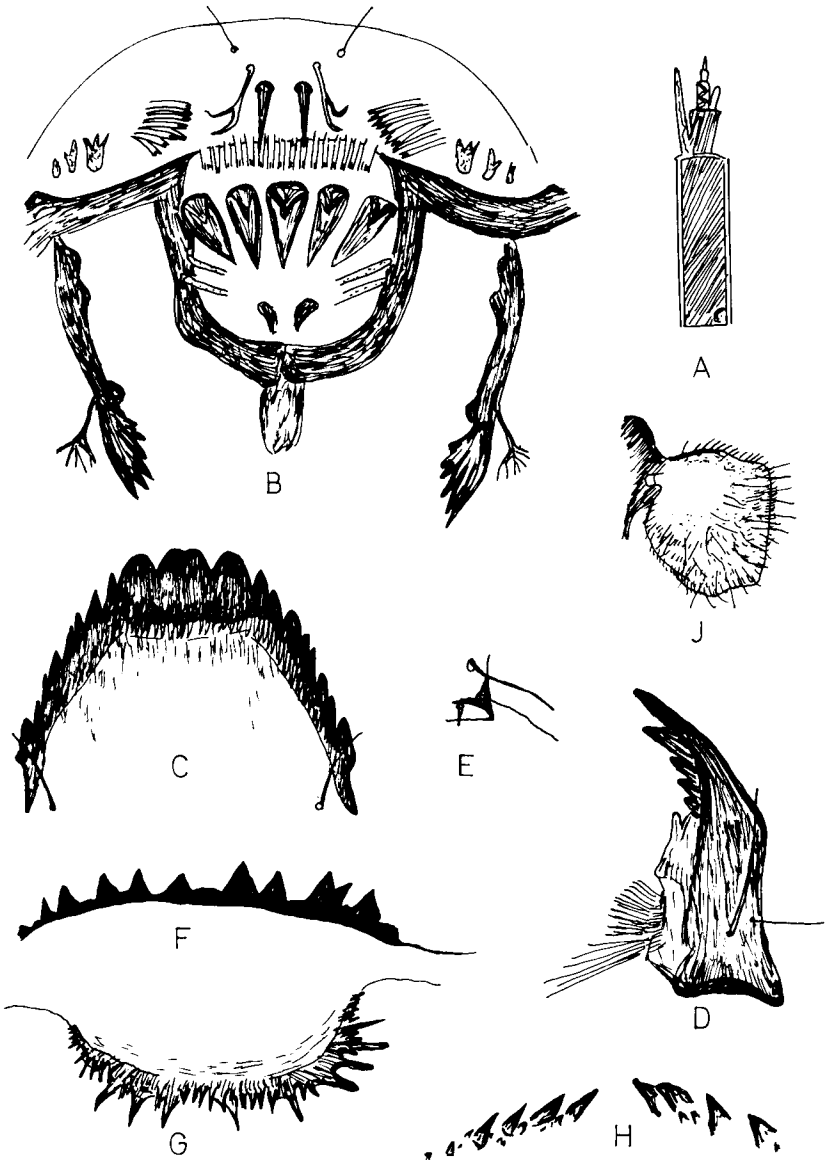

FIGURE 14. *Diamesa* sp. *A*. A-D; larva; E-H: pupa; J: female. A, antenna; B, labrum, epipharyngeal area, and premandibles; C, labium; D, mandible; E, posterior corner of segment VIII; F, dorsal thorns of segment VII; G, ventral thorns of segment VII; H. thorns on sternite IV; J, lamella of the ovipositor.

conic thorns, or, at any rate, some of the thorns of tergite II about the same height as in segment III and not, as in *cinerella,* about half the height; shape of dorsal and ventral thorns are shown in Fig. 14F-H; on sternites VII and VIII the thorns stand on a semicircular chitin formation as in *japonica,* so their apices are directed outward from the median line and slightly forward, i.e., as in *D. nivoriunda;* thorns projecting a little inwards on sternites III-VI.

Lateral borders, anal lateral corners, lobes of segment IX, and genital sac of male as in *cinerella;* curved bristles of segment IX measures about 0.37 mm in length (0.27 mm in *cinerella.*)

Table 1 gives the number of ventral and dorsal thorns on five female exuviae (no whole female exuviae were found). As in *cinerella,* the number, especially ventrally, is difficult to distinguish, as small spines are placed between and a little posterior to the larger ones. Especially dorsally the thorns are thus divided in two size groups. In the Table the "large thorns" are given in ordinary numerals, the "small thorns" in subscripts.

As it will apear from the Table, the number of thorns is much greater than in *cinerella* and *japonica.*

TABLE 1. Number of thorns in five male exuviae of *Diamesa* sp. *A.* (for explanation see text).

	DORSAL					VENTRAL				
II	9_3	7_2	8_5	9_2	9_2					
III	9_5	9_2	9_4	11_2	10_3	5_{10}	7_8	6_9	5_9	7_8
IV	6_7	10_2	9_3	10_2	10_4	6_9	8_{20}	9_{15}	8_{17}	8_{20}
V	8_9	11_1	11_2	11_1	11_2	9_{10}	8_{15}	12_{13}	8_{20}	9_{18}
VI	10_2	11_3	10_7	10_2	11_4	11_{15}	8_{24}	7_{20}	10_{15}	9_{24}
VII	10_4	11_3	10_5	11_4	10_4	10_{23}	10_{26}	15_{24}	12_{20}	9_{23}
VIII	10_2	11_3	9_3	9_2	9_2	7_{27}	9_{33}	8_{23}	10_{20}	10_{19}
Sum	62_{32}	70_{16}	66_{29}	71_{15}	70_{21}	48_{94}	50_{126}	57_{104}	53_{101}	52_{112}

IMAGO: A female imago a little damaged and attached to an exuvium of the above-mentioned type was found in the uppermost sample. The keys of Pagast (1947) and Goetghebuer (1939) lead to *Diamesa* s. str.; the key of Goetghebuer (1939) for females, to *D. cinerella* Meig. (*waltlii* Meig.).

Thorax, metanotum; and scapus brownish black; mesonotum with strong grayish pruinosity and two broad, dark, fuscous, longitudinal bands; legs fuscous; abdomen dusky brown with luteous markings consisting of two anteriolateral irregular stains widest anteriorly, tapering backwards, and merging with a median posterior stain. Abdominal and dorsolateral metanotal bristles forming darker, circular spots; halteres pale, with a greenish yellowish tint, fuscous at base; antennae brown; palpi brown.

Clypeus with about 40 curved bristles, the longest measuring about 55μ. Antennal ratio of female 0.44, i.e., according to Johannsen (1903, plate 47 fig. 7) less than in *D. nivoriunda* Fitch; seg-

ments of antennae well separated; segment 8 of female antennae as long as segments 5-7 combined, i.e., about as in the female of *D. ursus* (Kieff.) mentioned by Oliver (1965), but not as mentioned by Edwards (1922); longest antennal bristle as long as segment 8, i.e., longer than in D. nivoriunda. Second segment of palpi somewhat projecting, fourth segment slightly siuate, apex with an inner indistinct enlargement; ratio of lengths of segments (in μ) as 111 : 148 : 164 : 226; the last segment comparatively longer in *D. nivoriunda* (?) Sublette (1964). Eyes rounded above, hairy. Vertex bristles long and strong, the longest reaching 100μ.

There are 15 completely uniserial dorsolateral metanotal bristles, the longest reaching 128μ. About seven lateral pronotal bristles measure from 45μ to 128μ. No prealar bristles. One very small and indistinct dorso-median bristle. Eight supra-alar bristles, 1, 2, 3, and 5, aligned; 4 and 6 next to 3 and 5; 4, 6, 7, and 8 aligned; longest supra-alar reaching 98μ. No postalar bristles. Scutellum with about 45 scattered bristles, the longest reaching 270μ.

Fore-tarsi not bearded, the bristles about two times as long as width of metatarsus; microtricia on legs measuring one-sixth of width of metatarsus; bristles similar on all segments and legs. Tibial comb of hind leg with 20 spines; ta_4 typically cordiform, not as long as ta_5. Claws smooth apically, with three basal attenuate bristles or spines. Ratio length of claw: length of longest claw bristle: length of ta_5 as 16 : 7.5 : 43.

Leg proportions (fe to ta_5):

														LR
p_1	88	:	100	:	59	:	29	:	18	:	9	:	10	0.59
p_2	98	:	90	:	40	:	23.5	:	15	:	8.5	:	10.5	0.44
p_3	106	:	112	:	69	:	40	:	20	:	9.5	:	11	0.61

BV = 3.74; SV = 3.19.

The leg ratio of *D. nivoriunda* (?) (Sublette) is 0.68; of Oliver's specimen of *D. ursus* 0.67, i.e., clearly different.

Wings somewhat yellowish, with microtrichia; veins yellowish brown, anterior veins a little more brown than the others; r-m deflected towards costa; r_{4+5} surpassed by c; outlet of r-m in m one fourth the length of m-cu distad outlet of m-cu [in *D. nivoriunda* according to Johannsen (1903 plate 47 fig. 9) this ratio is about one half]; m-cu half the length of r-m and stands half its own length from fork of cu. It is as in *D. leona* Rob. (Roback 1957a, 1959) and Oliver's specimen of *D. ursus* (Oliver 1965).

The large lamellae of the ovipositor appear in Fig. 14J.

Length of female 4.9 mm; length of wings 3.9 mm.

Diamesa sp. *A* is not described as a new species because of the absence of male specimens, but it seems closely related to the *cinerella* group. This group has two northern species, *D. ursus* Kieff. and *D. thienemanni* Kieff. (syn. *D. semireducta* Saeth.), and four species known from the Alps, Central Europe, and England, namely *cinerella* Meig., *thienemanni* Kieff., *tonsa* Hal., and *hamaticornis* Kieff. (Saether, 1968) (Pagast 1947). The American species *D. nivoriunda* (Fitch) (*D. waltlii* Joh. nec Meig.) (Johannsen 1903, 1937, Malloch 1915, Sublette 1964) seems also to fall in this group. Its hypopygium (Malloch 1915, plate XXIII fig. 11) closely resembles that of *D. hamaticornis* (Pagast 1947, fig. 49). *D. leona* Rob. (Roback 1957a) also seems closely related to *Diamesa* sp. *A*, but differs in the female genital claspers, palpi, leg ratio, apically toothed claws, and size. [Roback (1959, p. 2) writes: "The antennal segments are in the ratio 8 : 4 : 4 : 3.5 : 12." This would mean that the fe-

male has only five antennal segments. As Roback doesn't mention such a number distinctly, it must be presumed that two or three numbers have been omitted]. *D. nivoriunda* differs in antennal ratio, ratio of segments of palpi, fewer bristles on scutellum, fewer spines in hind tibial comb, different leg ratio, and different wing venation. *D. ursus* may be identical with *Diamesa* sp. *A*, but Edward's specimens differ by antennal characters, Oliver's by leg ratios and perhaps cerci.

In the genus *Diamesa*, deviations from the normal antennae with 14 segments often occur, such as AR about 1.0 and segments 3-13 with two circles of long hairs. As a first deviation the AR may be much less than 1.0, for instance, as in *D. cinerella* and *D. berardensis* Ser.-Tos. (Serra-Tosio 1964), but still with two hair circles. The hair circles, however, may also be reduced to only one per segment, i.e., as in *D. ursus* and *D. tonsa*, and the antennae to only nine segments in the male, and with only one hair circle per segment. The wings may be atrophied or small (Pagast 1947, Saether 1968). As shown by Saether (1968) the immature stages in the same groups also seem to follow a similar trend with reduction of procerci setae and antennal ratio in the larvae. In view of the close relationship to *D. ursus* and the reduction of antennal ratio and procerci setae in the larvae, it seems most likely that the described species has more or less reduced male antennae.

Diamesa sp *B.*

Larvae were found in lower and middle parts of the Brook 6 between small snowbanks, grasses, and white flowers, with a temperature of about 1 °C.

The species seems closely related to *D. aberrata* Lundbl. according to a remnant of male exuvia and a female pupa. *D. aberrata*, according to Wülker (1959 p. 345), forms a species pair with *D. incallida* Walk. [syn. *Diamesa* sp. *VII* of Pagast (1947), p. 515, 521]. Another very closely related species is *D. fonticola* Saeth. (Saether 1969). It is, however, not quite certain that the larva belongs to the same species as the pupa, as the larva seems more closely related to the *latitarsis* group.

LARVA: Length about 6.5 mm. Color an olive, greenish brown; head brown with a dark, almost black posterior margin. Anterior and posterior claws as in *Diamesa* sp. *A*. Procerci lacking; instead of these there is one short bristle as in *Diamesa* sp. *A*. Tubuli anales reach half the length of posterior prolegs, dorsal ones a little shorter and thicker than ventral ones, both pairs distally rounded (Fig. 15C).

Antennae with five segments; ratio of lengths of segments to each other as 21 : 6.5 : 4.5 : 4 : 4 = 21 : 19 = 1.1, [in *D. aberrata* 1.4 (Andersen 1937); in *D. incallida* 2.3 (Wülker 1959)]; annular organ at base of basal segment; blade at apex of first segment: combined segments 2-5 = 11.5 : 19; apical style of second segment a little longer than annulated third segment (i.e., about as in *D. incallida* (Wülker 1959, fig. 2A); basal segment of antennae 2.5 times as long as wide (Fig. 15B). Labrum, hypopharynx, maxillae, and epipharyngeal area similar to *Diamesa* sp. *A*, but the chaetae (Zavřel) broader at their bases; four to five spinules and the two middle bristles on anterior margin seem not to be forked at mid-length (?), thus differing from *D. aberrata* (Fig. 15A) (In *D. incallida*, however, the bristles are not forked). Premandible with seven digits; labial plate (Fig. 15D) a half-divided center tooth and nine pointed, lateral teeth; mandibles very broad, with big teeth, the second and third over-reaching the point, and lighter than it, with about 18 bristles in the inner brush and a notch on the outer margin (Fig. 15E), i.e., about as in *D. lindrothi* Goetgh. and *D. valkanovii* Saeth. (Styczyński and Rakusa - Suszczewski 1963, Saether 1968).

The squamulae also seem similar to those in *D. lindrothi* and *valkanovii* and in *D.* sp. *B*, but the present species differs distinctly in other particulars, especially in the lack of anterior setae with about eight dichotomously spread branches, as in *D. lindrothi* and *valkanovii*.

PUPA: The female pupa and the male exuvia key to near *D. aberrata* but show several dissimilarities.

Length of female pupa 4.5 mm.

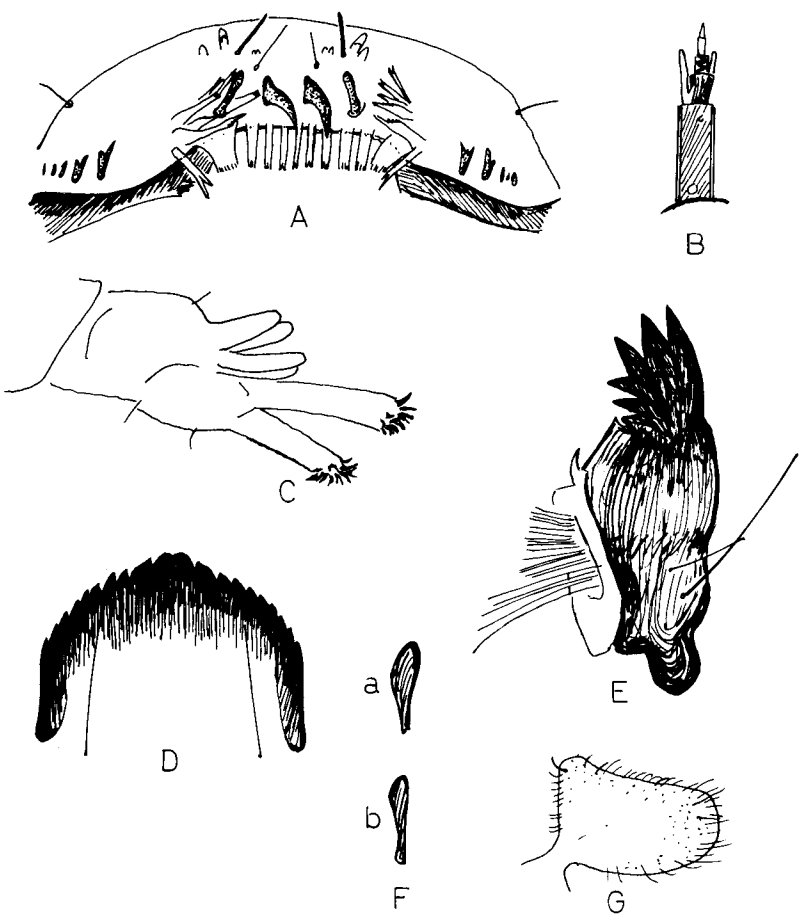

FIGURE 15. *Diamesa* sp. *B.* A, labrum of larva; B, antenna of larva; *C,* posterior segments of larva; D, larval labial plate; E, mandible of larva; F, spermathecae of female as seen through pupal exuvia, a, front view, b, lateral view; G, lamella of ovipositor as seen through pupal exuvia.

Coloration fuscous, almost black; male exuvia yellowish brown.

Covering case of scapus naked. Thoracic respiratory organs slender and smooth, gradually tapering towards apex and a little to its base, measuring 0.35 mm in length and having a dark brown color. Bristles anterior to respiratory organs and lobes of segment IX lost; bristles a little posterior to a line between respiratory organs measure about 170μ.

Lateral edges of last abdominal segments notched. *Diamesa*-thorns, shagreen of abdominal segments, and genital sac of male as in *aberrata,* (Pagast 1947), but color of thorns and bristles not fuscous but yellowish brown.

L_2-bristles on male exuvia on every segment about midway between L_1 and L_3; on female pupa L_2 is placed nearer L_1, except middle of L_1-L_3 on segment IV. D_4 and D_5 on a line just anterior to abdominal thorns; there are 0-2 thorns outside D_4. Length of bristles on segment VII of male exuvia (in μ) : $L_1 = 220$; $L_2 = 204$; $L_3 = 200$; $L_4 = 80$ (very fine); $D_1 = 76$; $D_2 = 36$; $D_3 = 24$; $D_4 = 128$; $D_5 = 24$; lateral bristles on segment VIII : $L_1 = 160$; $L_2 = 32$; $L_3 = 200$; $L_4 = 12$.

Number of thorns (for explanation see *Diamesa* sp. *A*):

II-VIII
dorsal:

male: $10_1, 9_2, 5_5, 8_5, 9_4\ 10_1, 8_3$.

female: $10_2, 8_3, 7_1, 7_3, 8_4, 9_3, 5_4$.

III-VIII
ventral:

male: $9_5, 9_{10}, 9_7, 14_3, 12_{11}, 11_{12}$.

female: $8_4, 9_{11}, 8_9, 11_{15}, 10_{10}, 0$.

IMAGO: Female pupa shows that female imago has a fuscous coloration; dorsolateral bristles uniserial and, as abdominal bristles, placed in white, rounded spots. Antennae with eight segments, segment 8 being as long as combined length of segments 5-7. Lamellae of ovipositor and spermathecae as in Fig. 15 F-G.

Diamesa sp. *C.* (cfr. Saether 1969)

Specimens were found in lower and middle parts of brook A-1, temperature 10°C; in upper plateau in waterfall of Brook A-2, temperature 8°C; and in Brook 2-3, temperature 10°C.

LARVA: Length of largest larvae 7 mm. Color brownish marbled with blackish brown head. Claws of anterior and posterior prolegs appear as in preceding species. Procerci lacking; replaced by four short bristles of which two are a little longer than the others; anterior to these is one finer bristle measuring half their length, as in *Diamesa lindrothi* Goetgh., *D. latitarsis* Goetgh., and *D. valkanovii* Saeth. (Thienemann 1936, Wülker 1959, Saether 1968). Tubuli anales short, distally rounded, reaching about one-fourth the length of posterior prolegs (Fig. 16B).

Ratio of antennal segments to each other as 23 : 8 : 5 : 3 : 3 = 23 : 19, but length of basal segment seems to vary; annular organ at base of basal segment; ratio of blade at apex of first segment to combined segments 2-5 as 15 : 19, i.e., as in *D. latitarsis*—Gr. (Wülker 1959, fig. 2b); apical style of second segment as long as annulated third segment; ratio of antennae to mandibles to premandibles as 42 : 78 : 43; mandibles with one large lateral tooth over-reaching the point and three smaller lateral teeth; there are about twenty bristles in the inner brush (Fig. 16D). Premandibles with seven digits. Hypopharynx and maxillae as in *Diamesa* sp. *A;* labrum and epipharyngeal area as shown in Fig. 16A; labrum with broad squamulae (fewer than in the preceding species), as in *D. latitarsis* Gr. (Wülker 1959 fig. 3b), and also with strong chaetulae laterales. Labium with ten lateral teeth and one bifid middle tooth; first lateral teeth as high as middle toth (Fig. 16C), i.e., as in *Diamesa* ex. gr. *latitarsis* Goetgh. (from Tatra mountains) (Styczynski and Rakusa-Suszczewski 1963); labium seems to vary much perhaps owing to different wear as shown in *D. valkanovii* Saeth. (Saether 1968).

PUPA: One male pupa probably belonging to this species was found in the steepest part of Brook A-1.

Length about 5 mm. Coloration brownish marbled; exuvia yellow.

Covering case of scapus with many long and dense taps (Fig. 16E); thoracic respiratory organs lost; replaced by two equal bristles anterior to respiratory organs, measuring about 85μ. Thoracic segments covered with dense, scale-like eminences (Fig. 16F) and with cross-stripes as in *D. latitarsis*-group (Pagast 1947). Tergites and sternites with a polygonic design on the whole surface except where the somewhat darker dorsal marks are seen; spinules almost always in corners of polygons and always on lines forming polygons (Fig. 16G); spinule shagreen only posterior on segment I; on other segments a strong shagreen, but always with a broad band anterior to *Diamesa*-thorns without spinules. Lateral edges of segments indented. Shagreen seems to be similar to that of the *latitarsis*-group.

Diamesa-thorns very faintly indicated on tergite I, with about six thorns as in *D. tyrolensis* Goetgh. (Pagast 1947). Thorns on tergite II reach only about half the length of thorns on posterior segments. Ventral thorns higher and more slender than dorsal ones. One to three rows of scale-like points posterior to ventral thorns (as in *latitarsis*-group),

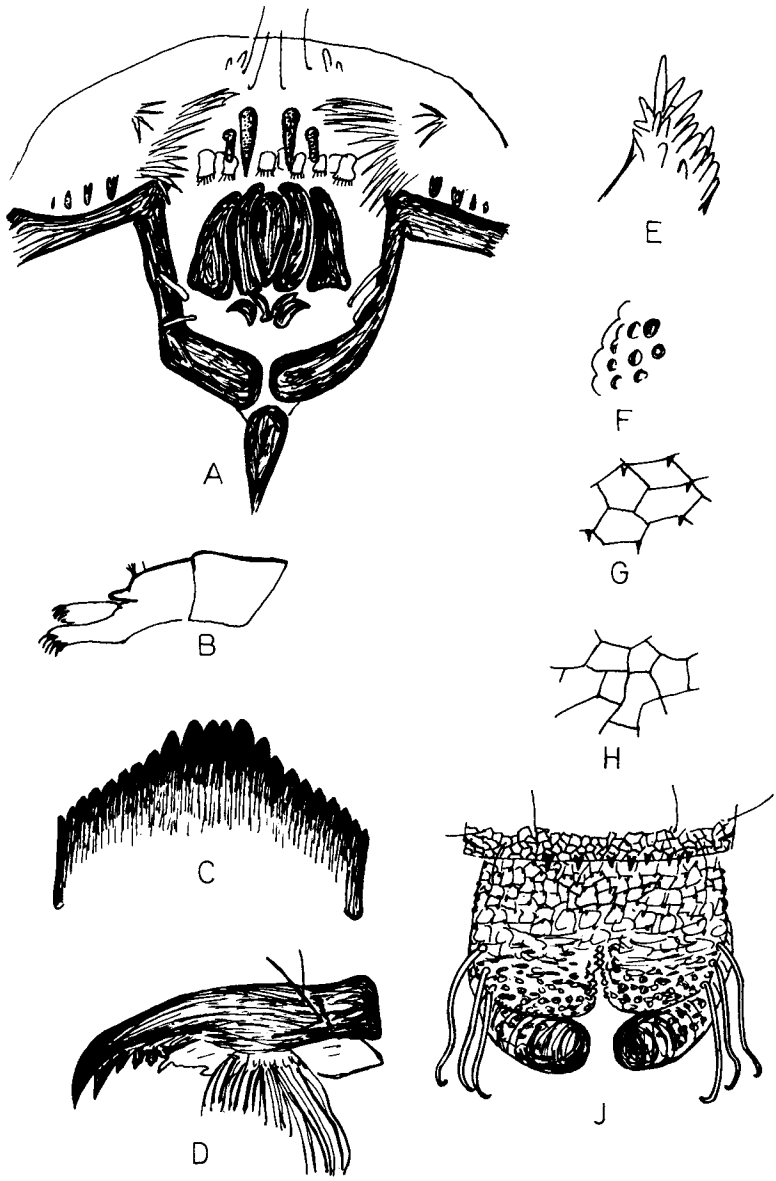

FIGURE 16. *Diamesa* sp. *C*. A-D : larva; E-J : pupa. A, labrum and epipharyngeal area; B, posterior segments; C, labium; D, mandible; E, covering case of scapus; F, structure of prothoarcic surface; G, structure of surfaces of segments II to VIII; H, structure of surface of segment I; J, segment IX.

and posterior to these there is a very fine shagreen (as in all intersegmental conjunctivae).

Number of thorns (for explanation see *Diamesa* sp. *A*): Tergites I-VIII: 6_0, 23_5, 18_9, 14_8, 18_6, 15_3, 15_2, 10_4. Sternites III-VIII: O_5, 12_{15}, 12_{37}, 9_{30}, 10_{31}, 9_{10}. (Subscripts indicate number of scale-like points posterior to ventral *Diamesa*-thorns).

D_4 equal to D_5, close together, and one or two thorns from margin; L_1 and L_2 also close together. All L-bristles short and grayish; L_4 a little longer than the other ones, but much finer. Length of bristles on tergite VI: $L_1 = L_2 = L_3 = 40\mu$; $L_4 = 44\mu$; $D_1 = D_2 = 28\mu$; $D_3 = 44\mu$; $D_4 = D_5 = 20\mu$.

Curved bristles of segment IX about 0.26 mm long. Genital sac much longer than lobes of segment IX, thick, brownish colored at their end, distally rounded and bent upwards (Fig. 16J), i.e., of *cinerella*-type and not as in the *latitarsis*-group.

This species seems most closely related to the *latitarsis*-group. In several particulars, however, such as the posterior bristle, instead of procerci and the genital sac of the male pupa, it is more like *Diamesa* sp. *A* and the *cinerella*-group.

Diamesa sp. *D*.

One larva was found in Brook A-2; water temperature 8°C. Larvae were found in upper middle parts of Brook A-1; water temperature 10°C. Larvae were found below Lake Albion in Brook 0; temperature 10°C.

The species is similar to preceding species in length, coloration, preanal bristles, prolegs and claws of prolegs, mandibles, premandibles, hypopharynx, and epipharyngeal area. Tubuli anales reaching half the length of posterior prolegs. Ratio of antennal segments to each other as 23 : 5 : 3 : 2 : 2 = 23 : 12; blades and styles of antennae as in sp. *B.*; ratio of antennae to mandibles to premandibles as 24 : 40 : 25. Labium with a median bifid tooth and nine lateral teeth; third and fourth teeth bifid (Fig. 17A). Labrum about as in *Diamesa* sp. *C*, but the two middle bristles on anterior margin of labrum seem to be forked at mid-length.

Diamesa sp. *E*.

Larvae were found in lower stretches in vegetation of Brook 4-5; temperature 3.5°C., and in lower stretches of Brook 6; temperature 1°C.

The species differs from *Diamesa* sp. *C* in having a somewhat different labium with a bifid median tooth and eleven lateral teeth, the median tooth and the first lateral teeth being a little lighter than the others (Fig. 17B); ratio of antennal segments to each other as 28.5 : 8 : 5 : 3.5 = 28.5 : 19.5; similar to sp. *C* in all other characters.

It is possible that specimens here called sp. *C*, *D*, and *E* all belong to a single, greatly variable species.

Diamesa sp. *F*.

Larvae were found below waterfall and in heavy current in temperature 5°C.

Length 6.5 mm. Coloration brown with brownish-black head. Prolegs as in sp. *C;* tubuli anales reaching half the length of posterior prolegs; instead of procerci, there are four equal bristles, and, anterior to these, one finer bristle reaching half their length.

Ratio of antennal segments to each other as 27 : 7 : 6 : 2 : 2 = 27 : 17; annular organ in first sixth of basal segment; style at apex of first segment a little shorter than segments 2-5 combined. Hypopharynx, maxillae, epipharyngeal area, and premandibles about as in sp. *C;* labrum about as in sp. *C*, but with only three spinules. Mandibles as shown in Fig. 17C with about 25 feather-like bristles; labium with one simple median tooth and nine lateral teeth, first lateral teeth being equal to median tooth (Fig. 17E).

Diamesa sp. *G*.

One single larva was found in Brook 2-3; temperature 10°C. Twelve juvenile larvae were found in Brook 3-4; temperature 5°C.

Length 4.5 mm. Coloration brownish, marbled with brownish-black head. Tubuli anales and prolegs about as in sp. *D*.

Ratio of antennal segments to each other as 23 : 9 : 4 : 3.5 : 3 =23 : 19.5; first blade at apex of basal segment reaching the middle of third annulated segment; second blade almost same

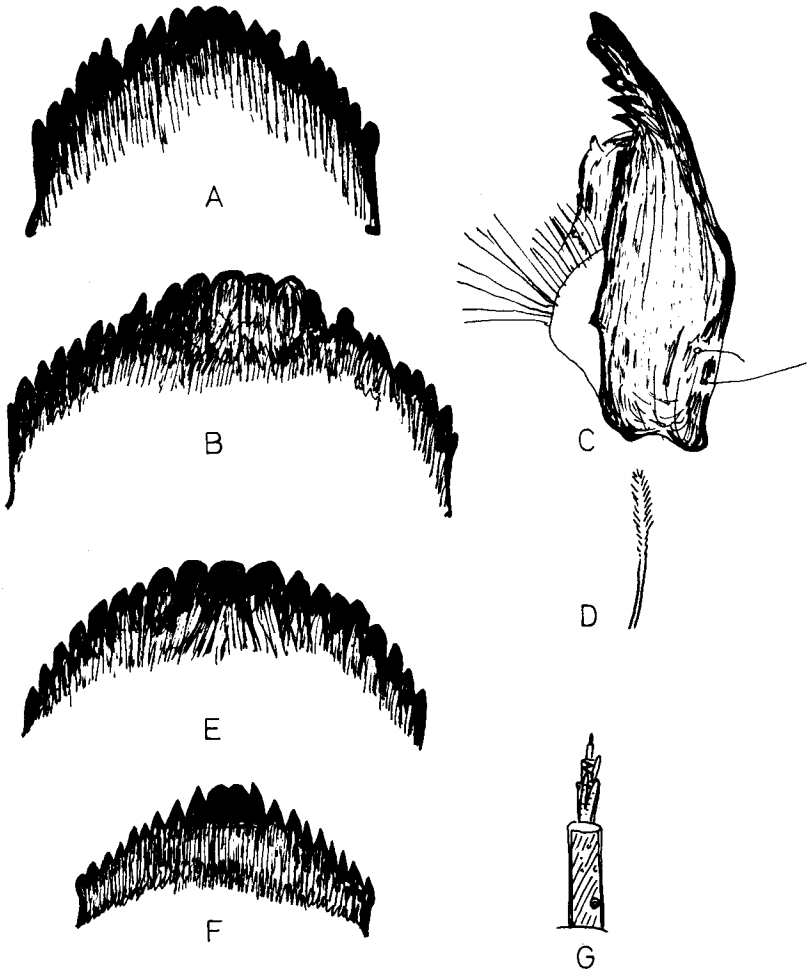

FIGURE 17. Larvae of *Diamesa*. A, *Diamesa* sp. *D*, labium. B, *Diamesa* sp. *E*, labium. C-E. *Diamesa* sp. *F*. C, mandible; D, one of the bristles in inner brush of mandible; E, labium. F-G *Diamesa* sp. *G*. F, labium; G, antenna.

length (Fig. 17G). Labrum, hypopharynx, maxillae, premandibles as in sp. *C;* labium (Fig. 17F) about as in sp. *B;* mandibles as in sp. *C.;* ratio of mandibles to antennae as 90 : 42.5.

The larvae of *Diamesa* s. str. may belong to seven different species or may simply be variants, stunted forms, or different stages of three or more species. At least three species are present: *Diamesa* sp. *A., Diamesa* sp. *B,* and *Diamesa* sp. *C,* including one or more of the other species. The species *D-G* will all probably belong in the *Diamesa latitarsis*-group (Pagast 1947, Thienemann 1952b, Wülker 1959, Serra-Tosio 1964, Saether 1968).

Subgenus *Pseudokiefferiella* Zavřel (syn. *Diplomesa* Pagast)

Thienemann (1952a, 1952b) states that according to the collection of Vaillant, *Diplomesa lapponica Pagast* (= *Pseudokiefferiella* Zavřel) is identical with *Diamesa parva* Edw.

Diamesa (*Pseudokiefferiella*) sp. *H.*

Specimens were found together with *Diamesa* sp. *A* in moss and blue-green algae in Brook 6.

LARVA: Length 10.5 mm (6-7 mm in *parva* (Zavřel 1941a). Coloration uniformly brown (fulvous in *parva*); head brown with darker posterior margin; the two eye-spots merged into a single eye-spot situated in a pale area on each side; length of head to width of head as 35 to 22. Abdominal segments with strong dark hairs of *Eukiefferiella bavarica* type; thoracic segments slender; posterior prolegs with brown claws; tubuli anales slender, distally rounded, reaching a little more than half the length of posterior prolegs (Fig. 18C); procerci dark brown, strong, broader than high, with a basal spur and a very strong basal bristle, and one finer lateral bristle and six strong bristles at apex (seven in *parva*) (Fig. 18D).

Ratio of antennal segments to each other as 44 : 10 : 7 : 3 : 4 = 44 : 24; length of basal segment to width of basal segment as 44 : 17; blade at basal segment a little longer than segments 2-5; annular organ in first fifth of basal segment; sensory bristle of basal segment at three-sevenths the height of the segment; style at apex of second segment reaching midway up annulated third segment. Labrum with squamulae (Zavřel), five single-pointed spinules, and ramified chaetae (Fig. 18A) (in *parva* the chaetae are single-pointed). Epipharyngeal region, maxillae, and hypopharynx as in *parva* (Zavřel 1941a). Premandibles with six or seven blunt digits; mandibles as in *parva;* ratio of mandibles to antennae as 101 : 68; labium with one median tooth and six lateral teeth (Fig. 18B).

PUPA: Length 6 mm. Coloration uniform brown; male exuviae subfuscous. Thoracic respiratory organs slender, as in *Diamesa* s. str., with a peculiar grayish-brown color as in *parva* (Pagast 1947), and measuring 350μ (360μ in *parva*). Covering case of scapus naked; attachment points of wings dusky. Thoracic bristles thin, the longest, middle one measuring 120μ (as in *parva*).

Tergite I is most very finely shagreened and without spinules on intersegmental conjunctiva I/II (in contrast to *parva*). As in *parva,* segments II-IX uniformly covered with fine spinules, but these continue beyond lateral fields not only on segment II but also on segments III-IX. Marks on abdomen slightly darker than their surroundings and with no spinules. A two to four double anal row of points are sharply conspicuous dorsally; the band anterior to these has very few spinules. Points consisting of enlarged spinules are in same position and have the same coloration as in *parva,* but with about 100 points on segment VI and other segments (only about 35 in *parva*). Points less dense on tergites II and III than on other segments; they are especially dense on segment VIII, but here a little smaller than on preceding tergites. In connection with spurs at anal corners, segments IV-VII have points of the same shape, but these measure only three times the length of ordinary spinules. Spinules present in intersegmental conjunctivae II/III to VIII/IX. A brown band present anteriorly on segments II-VIII, but spinules here are not substituted by shagreen. Sternites also covered with fine spinules, but spinules finer and anal points lacking; only spinules in their place. Anal corners of sternites II-VIII drawn out into a spur as in *parva;* a similar spur at lobes of segment IX. Lobes of segment IX and genital sac of male as in *parva;* bristles of lobes measuring about 130μ. D-bristles fine and short; D_1 measures about 75μ; D_2 and D_3 70μ, D_4 100μ, and D_5 about 40μ; D_1 and D_4 slightly brown at base; D_1, D_3, and D_4 form a row; D_4 and D_5 among anal row of points. L-bristles placed as in *parva;* length of L_1 and L_2 about 185μ (290μ in *parva*); L_3 measures 170μ and L_4 75μ.

Diamesa (*Pseudokiefferiella*) sp. *J.*

A single larva was found in the lower part in vegetation at Brook 4-5; temperature 3.5°C. One larval exuvia was found in the open space between two snow banks in Brook 6.

Length 4 mm. In appearance very similar to larvae of *Eukiefferiella bavarica*-group. Larva with brown, high procerci (height: width = 2 : 1); procerci with basal and subterminal spurs, seven bristles at apex, and long orally-directed bristle, on the whole as in the second

species of *Pseudokiefferiella* mentioned by Zavřel (1941a) (Fig. 18J). Coloration olive greenish; head brown with darker posterior margin; eye-spots in a lighter field, not contiguous as in *parva* (Fig. 18F); claws of posterior prolegs luteous; tubuli anales reaching two-thirds the length of posterior prolegs (Fig. 18H).

Ratio of antennal segments to each other as 43 : 11 : 6.5 : 3.5 : 2 = 43 : 23 (much like the preceding species); basal segment four times longer than wide, with annular organ at base; blade at apex of basal segment extending beyond segment 3; style at apex of second segment a little shorter than annulated third segment. Mandibles with about 21 bristles in inner brush (as in *parva*); bristles feathery; entire mandibles fuscous with blackish point; ratio of mandibles to antennae as 43:26. Labium with single median tooth and six lateral teeth; the five median teeth a little lighter than the others (Fig. 18G). Epipharyngeal area, maxillae, hypopharynx, and

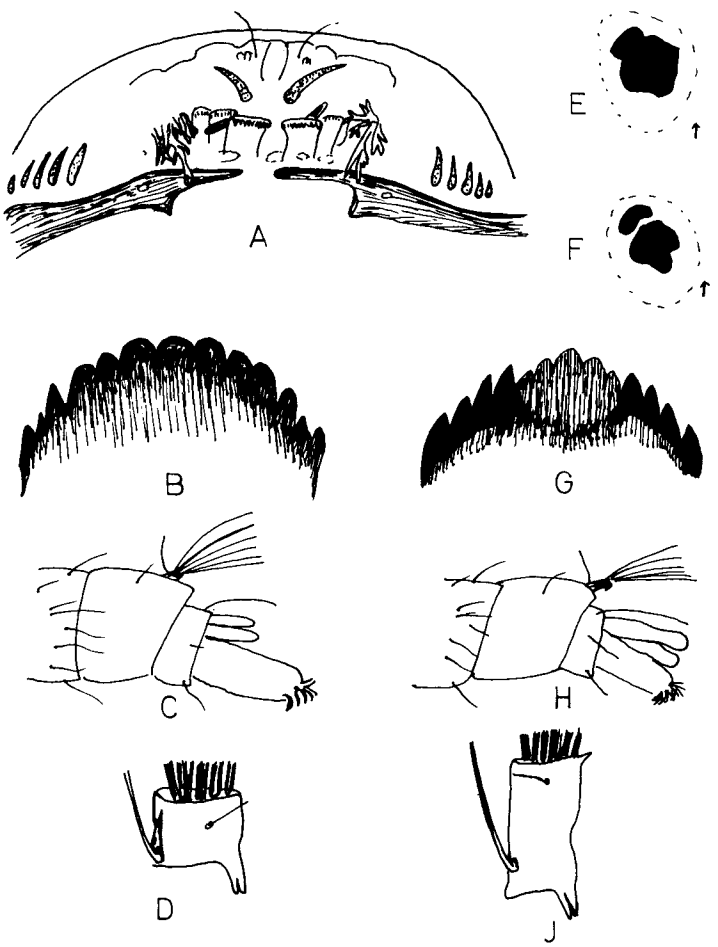

FIGURE 18. Larvae of *Diamesa* subgen. *Pseudokiefferiella*. A-E. *Diamesa* (*Pseudokiefferiella*) sp. *H*. A, labrum; B, labium; C, posterior segments; D, procerci; E, eye-spot (arrow pointing anteriorly); F-J. *Diamesa* (*Pseudokiefferiella*) sp. *J.*; F, eye-spot (arrow pointing anteriorly); G, labium; H, posterior segments; J, procerci.

premandibles seem to be of same type as in preceding species. Labrum damaged, but bristles on anterior margin of labrum all short and simple with squamulae present. In all likelihood, labrum is of same type as in preceding species.

Other immature stages of *Diamesa* (Meig.) Pag. known from North America are those of *D. nivoriunda* (Fitch.) *D. mendota* Mutt. *D. fonticola* Saeth. and *D. spinacies* Saeth. The pupa of *D. fulva* Joh. belongs, according to Pagast (1947), to *Sympotthastia* and is possibly synonymous with *S. zavřeli* Pag. The larva, however, seems almost identical with *Potthastia gaedei* Meig. (Thienemann 1952b). The larva mentioned as *D.* nr. *fulva Joh.* by Roback (1957b) may also belong to *Sympotthastia* or *Potthastia.* The larva of *Potthastia longimanus?* Kieff. has been reported from the Savannah River (Roback 1953b).

Tribe Boreoheptagyini (sensu Brundin 1966)

Boreoheptagyia sp.

A single larva in this genus was found near the inlet of Brook A-1 into Lake Albion. It is distinct from *Boreoheptagyia lurida* Phil., the only described North American species.

Length 6 mm. Coloration fuscous with greenish tint; head brownish black; intersegmental conjunctivae and sternites lighter than tergites, but not white; claws of anterior prolegs yellow. Posterior and anterior prolegs and claws, procerci, bristles on the feeble procerci, and tubuli anales about as in *lurida* (Saunders 1928) (Fig. 21D).

With two similar pairs of strong tubercles on dorsal side of head; directed cephalad and upward and with a short stout apical bristle, like the second pair of tubercles in *lurida* (Fig. 19A). Antennae originating on a broad, circular tubercle with a flat top (Fig. 19C); ratio of lengths of antennal segments to each other as 18 : 4 : 6 : 1; second antennal segment with two styles (one in *lurida,* three in European species) (Saunders 1928, 1930); third antennal segment annulated; basal segment with three sensory pits; blade of basal segment twice as long as basal segment. It is

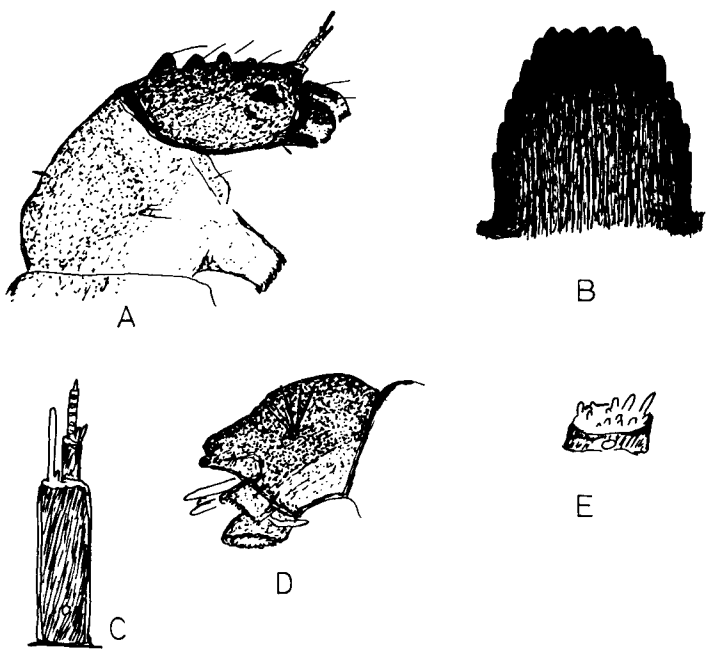

FIGURE 19. Larva of *Boreoheptagyia* sp. A, head and prothorax; B, labium; C, antenna; D, posterior segment; E, palpus maxillaris.

difficult to determine whether there are four or more segments, but as in the species described by Mayer (1935) and in *H. brevitarsis* Tok. (Tokunaga 1939), it is likely that only four antennal segments are present (Fig. 19C). Eyes with three lenses. Mandibles with six teeth; proximal teeth very small and distally lighter than the other fuscous ones; about 15 inner bristles (11 in *lurida*); dorsal bristles strong; mandibles slightly longer than antennae. Labium with six rounded teeth in a median straight line and six lateral teeth on each side, thus making 18 teeth (Fig. 19B). Premandibles with six teeth. Maxillary palps with colored parts 5.5 times as broad as high, bearing 12 papillae (Fig. 19E). Maxillary lobes, hypopharynx, and epipharyngeal area as in *lurida*. Labrum as in *Heptagyia* sp. (Mayer 1935) and in *H. brevitarsis*.

Very short, minute papillae are found on dorsum of larvae; metathorax and all abdominal segments bearing two pairs; oral pair on metathorax shorter than the other; with two especially strong bristles between the metathoracic pairs. Vestiture of body as in *lurida*.

Subfamily Orthocladiinae
Tribe Orthocladiini.
Cardiocladius sp.

One larva was found in steepest part of Brook A-1; temperature 10°C. One of the predominant chironomid larvae of North Boulder Creek (temperature 3.5° C.); 98 specimens in one sample were found in the middle of Brook 4-5. The larvae were most abundant in the same places as were the Simuliidae.

LARVA: Length about 6 mm. Young larvae blackish violet with olive greenish tint; fully grown ones more dark olive-green with a violet tinge and more greenish thoracic segments; head blackish brown (a specimen preserved in alcohol shows a bright violet colour on abdomen and a yellowish brown head). *C. capucinus* Zett. (Tokunaga 1939) has a similar coloration. The two eyespots in pale area are nearly fused, the oral one being the smaller. Posterior prolegs extremely long and with brown claws. Tubuli anales short, rounded at apex, and reaching one seventh of posterior prolegs (Fig. 20A). Procerci with two longer bristles measuring about 75μ, four shorter ones measuring 30-55μ; (i.e., as in *C. obscurus* Joh. (Johannsen 1937a); in *C. fuscus* Kieff. (Thienemann 1933) there are two shorter and two longer bristles, and in *C. capucinus* two long and three shorter setae), and with one strong bristle anterior to procerci measuring about 35μ and one finer one measuring 24μ (Fig. 20B).

Ratio of antennal segments to each other as 30 : 8 : 4 : 4 : 3 = 30 : 19; blade of basal segment over-reaching segment 5, i.e., longer than in related species; ratio of mandibles to premandibles to antennae as 28 : 18 : 18. Labium with a broad median tooth and five lateral teeth about as in *C. obscurus* (Fig. 20C). Premandible as in Fig. 20D. Other characteristics as in *C. obscurus* or *C. fuscus*.

The most closely related species seems to be *C. obscurus*. *C.* sp. differs from *C. capucinus* and *C. fuscus* especially in the form of the labium and in the number of bristles on the procerci.

Johannsen (1951a) found *C. obscurus* in Fall Creek at Ithaca, New York.

Eukiefferiella Thien.
Type: *discoloripes*.
Subtype: *discoloripes* s. str.
Eukiefferiella sp. *A*.

Three juvenile larvae were found in the steepest part of Brook A-1. There seem to be no differences between these larvae and those of *E. discoloripes* Goetgh. (Zavřel 1939 pp. 3-4), but as the larvae are small, identification is not certain.

Subtype: *bavarica*.
Eukiefferiella sp. *B*.

Three larvae were found in steepest part of Brook A-1. One larva was found in upper plateau in waterfall in Brook A-2. Larvae were found in all parts of Brook 4-5. Larvae were found in all parts of Brook 6. The only *Eukiefferiella* were on upper shelf.

Length of largest larvae 4.5 mm. Coloration pale green with brownish violet tint; head and claws of posterior prolegs luteous. Tubuli anales almost as

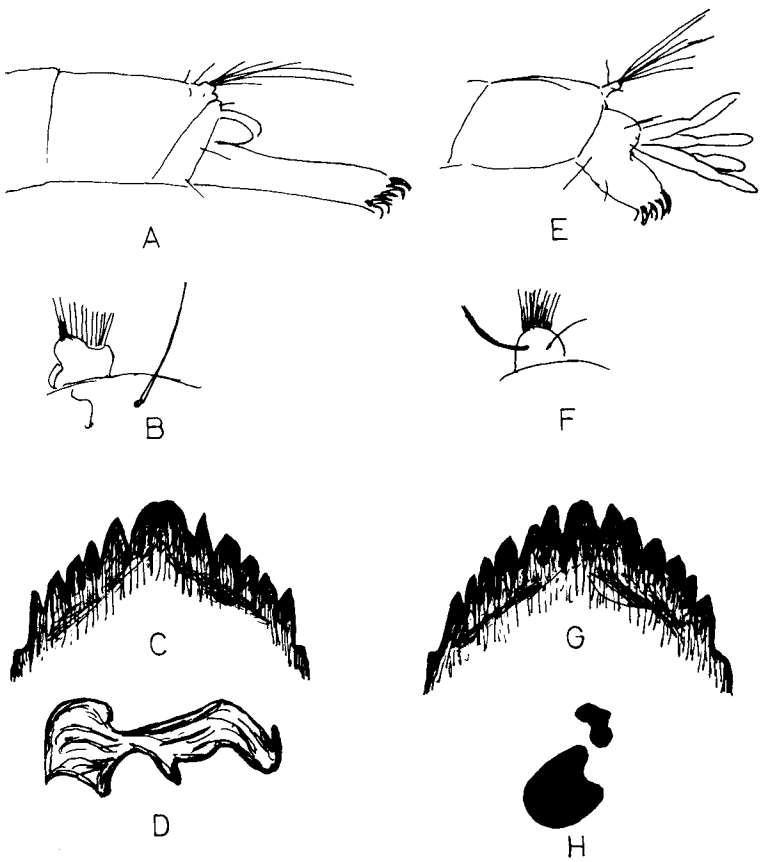

FIGURE 20. A-D. Larva of *Cardiocladius* sp. A, posterior segments; B, procerci; C, labium; D, premandible. E-H. Larva of *Orthocladius* subgen. *Euorthocladius* sp. *E*, posterior segments; F, procerci; G, labium; H, eye-spots.

long as posterior prolegs. Ratio of antennal segments to each other as 38 : 12.5 : 3 : 4 : 3. Other characteristics as in *bavarica* Goetgh. (Zavřel 1939 pp. 4-5).

Eukiefferiella sp. *C*.

Larvae were found among vegetation in the steepest part of Brook A-1; temperature 10°C.

Length 3 mm. Coloration dark brownish violet with a blackish brown head and greenish tubuli anales. Eyespots and procerci of *bavarica* type. Ratio of antennal segments to each other as 46 : 12 : 3 : 4 : 3 = 46 : 22. Labium of *alpestris* type. Tubuli anales about half as long as posterior prolegs. Posterior prolegs with brownish black claws.

This species differs from other members of the *discoloripes* type by having a darker coloration, but according to length of bristles, eye-spots, and procerci, it must belong to the *bavarica* subtype.

Eukiefferiella sp. *D*.

Larvae were found among vegetation in steepest part of Brook A-1; temperature 10°C.

One single larva measures 3.5 mm. It is similar to the preceding species except that tubuli anales reach five-sevenths the length of posterior prolegs, and the two middle teeth of labium are very broad (Fig. 21A).

Larvae and pupae belonging to the

subtype *bavarica* have been reported from the Philadelphia area (Roback 1957b). The species mentioned as *E.* sp. *2* seems to be closely related to Zavřel's cfr. *bavarica* juv. *1* (*tatrica*) (Zavřel 1939).

Saether (1969) describes two new species of the *bavarica* type from Canada.

Type: *longicalcar*.
Subtype: *longicalcar* s. str.
Eukiefferiella sp. *E*.

Larvae were found in all parts of Brook A-1; temperature 10°C., and below Lake Albion in Brook 0; temperature 10°C.

Length 5 mm. Coloration blackish violet with pale whitish intersegmental conjunctivae; head and claws of posterior prolegs brownish black. Tubuli anales half as long as posterior prolegs, distally rounded. Ratio of antennal segments to each other as 32 : 8 : 5 : 4 : 3. Other characteristics as in *longicalcar* Kieff. (Zavřel 1939).

Eukiefferiella sp. *F*.

One larva was found in upper part among vegetation in Brook A-1.

It is similar to the preceding species except in following characteristics: Tubuli anales three-fourths as long as posterior prolegs, slightly constricted in the middle; middle tooth of labium slightly lighter than the lateral teeth.

Subtype: *minor*.
Eukiefferiella sp. *G*.

Larvae were found in: Brook 3-4, temperature 5°C; Brook 4-5, temperature 3.5°C; Brook 6, temperature about 1°C. These larvae were the predominant chironomids; 1,361 were collected in one sample in Brook 3-4.

Length up to 6 mm. Coloration yellowish olive green with yellow thoracic

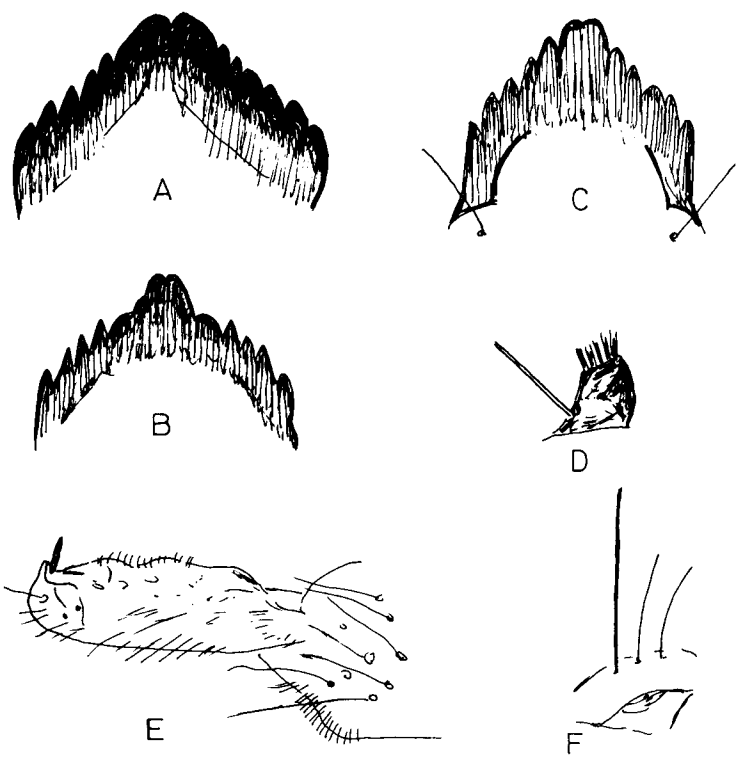

FIGURE 21. A, labium of larva of *Eukiefferiella* sp. *D;* B, labium of larva of *Eukiefferiella* sp. *H;* C-D, larva of *Eukiefferiella* sp. *G*. C, labium; D, procerci. E-F, *Eukiefferiella* sp. *J*. E, apex of hypopygium as seen inside exuvia; F, prostigmal area of pupa.

segments [i.e., as in *E. flavipes* Goetgh. (Goetghebuer, Humphries, and Fitzgerald 1949)]. Tubuli anales about two-fifths as long as posterior prolegs. Ratio of antennal segments to each other as 20 : 7.5 : 3 : 3.5 : 2.5. Labium luteous, with a small notch in median tooth (Fig. 21C). Procerci as in Fig. 21D. Eyespots as in *minor* Edw. (Zavřel 1939). The species may be identical with the above-mentioned *E. flavipes.*

Eukiefferiella sp. *H.*

A single larva was found in Brook 4-5.

Length 1.5 mm. Coloration pale greenish yellow. Tubuli anales three-fourths as long as posterior prolegs. Ratio of antennal segments to each other as 34 : 9 : 3.5 : 4 : 3.5. First lateral teeth of labium reduced (Fig. 21D). Procerci and eyespots as in *minor.*

Subtype: *similis.*

Eukiefferiella sp. *I* of Roback (1957b) keys out to here.

Type: *brevicalcar.*

No specimens of this type were found. *Eukiefferiella brevinervis* (Mall.) (Roback 1957b, p. 93) will, according to the key of Zavřel, belong here.

Type: *rectangularis* (syn. *Akiefferiella* Type *abisko* Thienemann 1941, 1944).

Eukiefferiella sp. *J.*

One pupa was found in the lower part, one in the middle part of Brook A-1; temperature 10°C. Two hundred eighteen larvae were found in one sample below waterfall in Brook 3-4; temperature 5°C. Others were found in the lower part where the current is strong; temperature 3.5°C.

LARVA: Length 4 mm. Coloration yellowish green with yellowish brown head; brown procerci, and brownish yellow claws on posterior prolegs. Eye-spots of *coerulescens* type (Zavřel 1939). Tubuli anales reaching three-fourths the length of posterior prolegs, tapering and distally rounded in some larvae; in other larvae the dorsal pairs of tubuli anales measure only half the length of posterior prolegs and of ventral pairs of tubuli anales.

Ratio of antennal segments to each other as 29 : 11 : 2.5 : 2 : 1.5 = 29 : 17; style at apex of first segment exceeding second segment. Mandibles about as long as antennae. Labium similar to that of *alpestris* Goetgh. (Zavřel 1939). Procerci of *coerulescens* type (Zavřel 1939).

PUPA: Length 3 mm. Coloration dark olive green. Characters as in *rectangularis* type (Thienemann 1941, 1944). Prostigmal-area with one strong bristle measuring 96μ and two finer bristles measuring 72μ (Fig. 21F). Shagreen strongest on tergites II-V. Apex of hypopygium as seen inside exuvia as in Fig. 21E.

The pupae seem to belong to same species as the larvae, and some of them still had the eyespots of the larvae.

Type: *coerulescens* [syn. VII Type: *Akiefferiella* (Zavřel)].

Eukiefferiella (?) *sordens* (Joh.), described by Johannsen (1937a) and Roback (1957b), has been placed in this group by Johannsen. The species obviously belongs to a unique type within the genus or, very possibly, not to *Eukiefferiella* at all.

Orthocladius (v. d. Wulp) Brundin

Subgenus *Eudactylocladius* Thien.

Orthocladius (*Eudactylocladius*) sp. *A.*

Larvae found among vegetation in steepest part of Brook A-1 and below waterfall in Brook 3-4.

Length 5.5 mm. Coloration dark greenish with brownish head; claws of posterior prolegs brownish. Tubuli anales almost reaching half the length of posterior prolegs. Other characteristics as in *E. olivaceus* Kieff. (Potthast 1915).

Orthocladius (*Eudactylocladius*) sp. *B.*

Three juvenile larvae were found below Lake Albion in Brook 0. A few juvenile larvae were found in Brook A-2, 2-3, 3-4, and 4-5. Some of the Brook 4-5 larvae were mature.

Description from specimens collected in Brook 4-5.

Length 5 mm. Coloration dark olive green with brownish head; claws of posterior prolegs fuscous. Tubuli anales almost as long as posterior prolegs; dorsal pair thicker and slightly shorter than ventral pair (Fig. 24b), [i.e., as in *Orthocladius (Pogonocladius) consobrinus* (Holmgr.) Edw. (*crassicornis* Goetgh.) (Goetghebuer, Humphries, and Fitzgerald 1949).] Ratio of antennal segments to each as 35.5 : 12 : 6 : 5.5 : 4.5 = 35.5 : 28.

The species differs from the usual type of *Eudactylocladius* Thien. in having a very narrow labium with three equal median teeth (Fig. 24A). *Hydrobaenus* sp. *3, eudactylocladius* group (Roback 1957b, figs. 188 and 190) has a similar labium. Other details as in the typical *Eudactylocladius*.

Roback (1957b, figs. 195-199) describes another species of this subgenus, namely *O. (E.) dubitatus* Joh. Johannsen (1937a) describes larva and pupa of *O. (E.) sordidella* (Joh. nec. Zett.).

Goetghebuer, Humphries, and Fitzgerald (1949) mention that the basal segment of the antenna in *Eudactylocladius* is only half as long as the sum of the end segments. This must be an error; according to Potthast (1915), Johannsen (1937a), and Thienemann (1935), the basal segment is one and one half times as long as segments 2-5 combined.

Subgenus *Euorthocladius* Thien.

Orthocladius (Euorthocladius) sp.

Larvae were found below waterfall in Brook 3-4, in the middle stretches of Brook 4-5 in heavy current, in the lower and upper stretches of Brook 6, and in Rainbow Lake Brook.

Length 6 mm. Coloration is olive green with brown head. Eyespots as in Fig. 20H. Posterior prolegs with 16 simple, strong, fuscous claws as in *O. (E.) saxosa* Tok. (Tokunaga 1939). Anterior prolegs with golden yellow claws arranged in about 15 transverse lines and serrated in the same manner as in *O. (E.) saxosa*. Tubuli anales very long; one and one-half times as long as posterior prolegs in the specimens from Brook 6, in the other a little shorter; they are also slender and have two or three constrictions, dorsal ones perhaps a little thicker at base than ventral ones (Fig. 20E). Procerci bearing two long and two shorter bristles at apex and two fine lateral bristles (Fig. 20F).

Ratio of antennal segments to each other as 31 : 9 : 3 : 3 : 2 = 31 : 17 or 1.8 : 1, i.e., about as in *thienemanni* Kieff. (Thienemann 1935, 1944); blade of basal antennal segment as long as segments 2-5 combined. Mandibles measuring about two times the length of antennae. Labium with a broad median tooth and five lateral teeth, of which the first are bifid (Fig. 20G). Labrum, epipharyngeal area, premandible, maxillae, and hypopharynx as in *saxosa* except that a common plate of setae anteriores seems to be lacking. Thienemann (1944) mentions that *saxosa* does not have a common plate, but this is an error according to fig. 117 in Tokunaga (1939).

Roback (1957b) mentions *O. (E.) rivulorum?* Kieff. from the Philadelphia area. The determination, however, is doubtful; since in the specimen of *rivulorum* described by Potthast (1915), the basal segment of the antenna is 2.36 times as long as segments 2-5 combined, while in the Philadelphia specimen this ratio is 3.50. Furthermore, the Japanese species *O. (E.) suspensa* Tok. (Tokunaga 1939) cannot be distinguished from *rivulorum*.

Subgenus *Orthocladius* (v. d. Wulp) Brundin (syn. *Rheorthocladius* Thien.: *rhyacobius*—group, *lignicola*—group).

cf. *Orthocladius (Orthocladius)* sp.

One damaged male imago was found in the lower part of Brook 6.

The specimen could not be identified with certainty, but seems to belong to *Orthocladius* s. str. in the sense of Brundin (1956a).

Roback (1957b) and Saether (1969) mention several American species of this subgenus.

Rheocricotopus Thien. et Harn.

Rheocricotopus sp. *effusus* (Walk.) Edw. (*fuscipes* Kieff.) type.

Larvae were found below Lake Albion in a strong current in Brook 0; temperature 10°C. Only three larvae were found

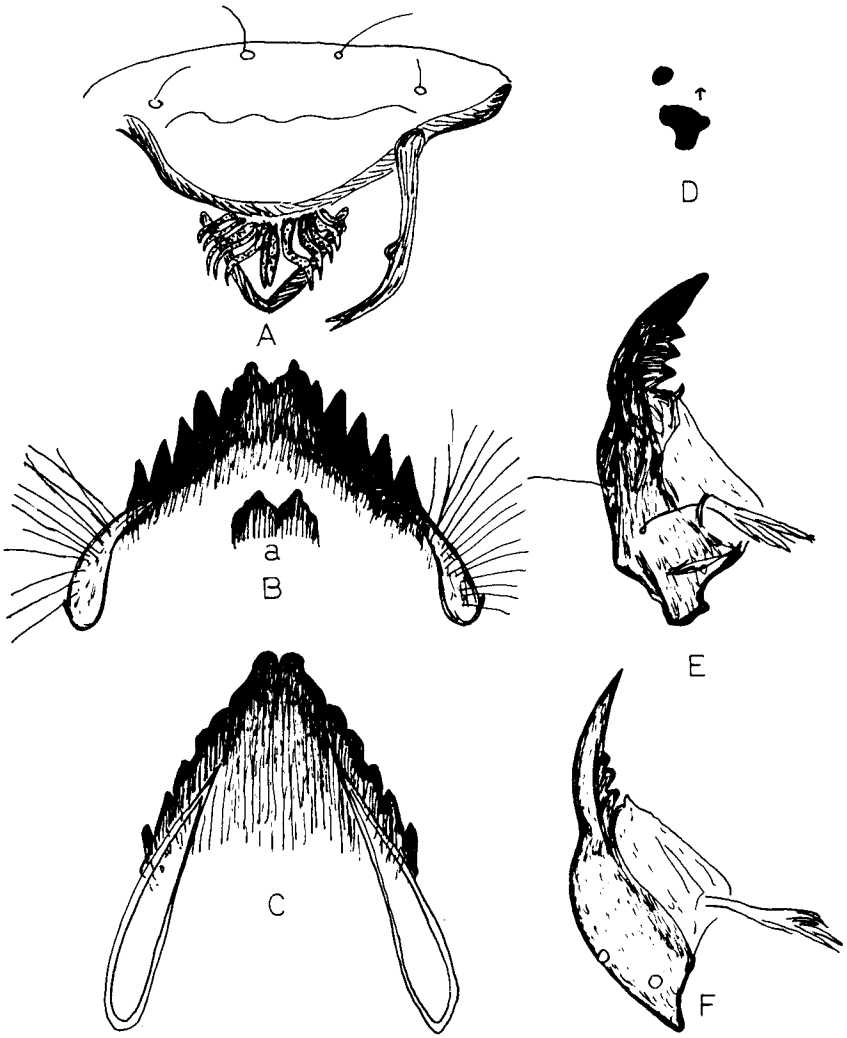

FIGURE 22. A, labrum and epipharyngeal area of larva of *Microcricotopus* sp. *parvulus* type. (The white area below the undulating line and above the epipharyngeal region was damaged in the specimens examined); B, labium of larva of *Rheocricotopus* sp. *effusus* type; a, the middle teeth of the specimen from Brook 0; C, labium of larva of *M.* sp. *parvulus* type; D, eyespot of larva of *R.* sp. *effusus* type; E, mandible of larva of *R.* sp. *effusus* type; F, mandible of larva of *M.* sp. *parvulus* type.

in the plateau in waterfall of Brook A-2; temperature 8°C.

Length 5 mm. Coloration greenish brown with a dark posterior margin on head. Eyespots as in Fig. 22D. Length of head: width of head = 21 : 14. Procerci with median spur and five apical bristles; length to width of procerci as 7 : 4. Tubuli anales blunt, reaching almost half the length of posterior prolegs.

Ratio of antennal segments to each other as 17 : 5 : 3 : 2 : 1.8 = 17 : 11.8; Lauterborn organs distinct; annular organ at base of basal segment; blade of first segment exceeding second segment. Mandibles with three lateral teeth

(Fig. 22E). Ratio of mandibles to antennae as 35 to 29. Labium with two large, laterally notched median teeth and five lateral teeth (Fig. 22B). The specimen from Brook 0 has middle teeth of a different shape (Fig. 22Ba) (another species ?).

Rheocricotopus sp. *atripes* Kieff. type. Two larvae were found in Brook 0 in the same place as above-mentioned species.

Length 2 mm. Coloration whitish with the characteristic chaetotaxy of this group; no spur at procerci; labium with double median tooth. Other characteristics indistinct as the larvae were damaged.

Roback (1957b) describes five species of *Trichocladius* (Kieff.) Edw., which includes the genera *Acricotopus* (Kieff.) Thien., *Rheocricotopus* Thien. et Harn., *Microcricotopus* Thien. et Harn., and *Paracricotopus* Thien. et Harn. Three of these species, *T. extatus* Roback, *T.* sp. *1*, and *T.* sp. *2*, he considers to belong to the genus *Rheocricotopus*. None of these larvae can belong to *Rheocricotopus* as their labrums all have palmate bristles. On the bases of all characters, especially the palmate bristles, antennal ratio, and procerci with sclerotized, warty area, the larvae of *T. extatus* are typical of the *Psectrocladius psilopterus* group. The pupae of *T. extatus* seems to be closely related to *Psectrocladius* spec. *"connectens"* (Thienemann 1944). It differs from the *Rheocricotopus atripes* group, the most nearly related group of *Rheocricotopus*, especially by having a fine shagreen on the discs of all tergites. The adults of *Psectrocladius* and *Rheocricotopus* are closely related, but the eyes of *Psectrocladius* are naked and the eyes of *Rheocricotopus* are hairy. Eye characters are not given by Roback. Nevertheless, this species must be named *Psectrocladius extatus* (Roback) n. comb.

Trichocladius sp. *1* (Roback 1957b) has no paralabial hairs. The characters given are in full accordance with those of the genus *Heterotrissocladius* Spärck except that this larva has only five antennal segments.

Trichocladius sp. *2* (Roback 1957b) falls in *Psectrocladius* in the key of Thienemann (1944), but does not correspond exactly to this genus. With the exception of the palmate bristles on the labrum, it fits better in the genus *Rheocricotopus*.

Trichocladius sp. *3* (Roback 1957b) will fall in *Rheocricotopus*. The labium is, except for the paralabial hairs, very similar to the following species of *Microcricotopus*.

Psectrocladius sp. *1* and sp. *2* (Roback 1957b) will fall in *Rheocricotopus* or *Acricotopus* (see below).

Psectrocladius sp. *4* (Roback 1957b) keys out to *Rheocricotopus* (see below).

Saether (1969) describes three new species of *Rheocricotopus* from Canada including the immatures of one of them, *R. pauciseta* Saeth.

Microcricotopus sp. *parvulus* Kieff. type. One pupa with attached larval integument and two larvae were found in heavy current in Brook 0. One larva was found in the plateau in waterfall between Lake Albion and Lake 2 in Brook A-2.

LARVA: Length 3 mm. Coloration olive green; head yellow; claws of anterior prolegs yellowish brown and comb-shaped dentate; claws of posterior prolegs yellow, smooth, and strongly curved. Tubuli anales as long as posterior prolegs but a little constricted in the middle. Length to width of procerci as 4 to 3. Procerci with anal-basal spur; spur and inner margin chitinized; apex with three long and two slightly shorter bristles; two fine bristles at side of procerci. Large anterior eyespot having a small eyespot close behind. Length to width of head as 65 to 43.

Antennae on a low tubercle; ratio of antennal segments to each other as 12 : 4.8 : 3 : 1.2 = 12 : 9, (i.e., between *bicolor* Kieff. and *albicornis* Goetgh. (Thienemann 1944); length to width of basal segment as 12 to 3, [i.e., between *bicolor* and *parvulus* var. Albrecht (Thienemann 1944)]; annular organ one third from base of basal segment; blade at apex of basal segment reaching middle of last segment; length of antennae: length of mandibles = 20 : 26. Mandibles with long, slim terminating

point and three darker lateral teeth (Fig. 22F). Premandibles as long as antennae, slender, with two teeth (Fig. 22A). Epipharyngeal area with two dorsal-median lancet-like points, and on each side five almost sickle-shaped points (Fig. 22A). Labium with prominent, double, median tooth and five lateral teeth and with very long paralabials (Fig. 22C).

PUPA: No dissimilarities from *M. curtistylus* (Goetgh.), *rectinervis* Kieff., or *parvulus* Kieff. (Thienemann 1944) observed.

The species seems not to be *parvulus* as indicated by larval characters. The larvae of *rectinervis* and *curtistylus* are not known.

The only known North American species in this genus is *Microcricotopus alternantherae* Dend. et Subl. (Dendy and Sublette 1959, Sublette 1964a). The characteristic paralabials of the larval labial plate, however, have not been illustrated, but as the larva is described from larval integuments only, the paralabials may have been damaged. The species mentioned as *Psectrocladius* sp. *3* by Roback (1957b) must, according to all given characters and figures, fall here.

Psectrocladius (*Psectrocladius*) *octomaculatus* Wülk. (syn. pupae of *P. calcaratus* Thienemann 1944, p. 593 fig. 64).

One single exuvia was found below Lake Albion in Brook 0.

Length of exuvia 4.5 mm. Exuvia hyaline with very slight yellowish tinge and 30 bristles on each lobe. Similar to *P. octomaculatus* Wülk. (Thienemann 1934, 1937, 1944), except that bristles of front plate of exuvia are placed more

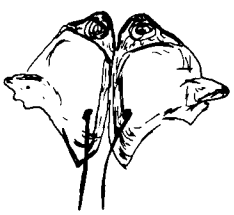

FIGURE 23. Pupa of *Psectrocladius octomaculatus Wülk.* Frontal plate of exuvia.

anteriorly than in this species (Fig. 23). Nevertheless, the specimen seems to belong to *P. octomaculatus*. A species previously known only from Europe and having a boreo-alpine distribution (Wülker 1956).

Johannsen (1937a) mentions two species belonging to the *P. psilopterus* group, both known from New York: *P. simulans* Joh. and *P.* sp. *A*. Only the larva is known for sp. *A*.

Psectrocladius sp. *1* (Roback 1957b) fits well in *Acricotopus*. If a mandibular brush was present, it would fall in *Rheocricotopus*, although not in all given characters.

Psectrocladius sp. *2* (Roback 1957b) cannot, because of the bifid labral bristle, belong to *Psectrocladius*. If a mandibular brush were present, the species would fall in *Rheocricotopus;* if not present, in *Acricotopus*, although not fitting well in either of these genera.

Psectrocladius sp. 3 (Roback 1957b) keys out to *Microcricotopus* (see above).

Psectrocladius sp. *4* (Roback 1957b) keys to *Rheocricotopus* (see above).

Roback (1953b) mentions four larval types of *Psectrocladius* from the Savannah River.

FIGURE 24. Larva of *Orthocladius* subgen. *Eudactylocladius* sp. *B*. A, labium; B, posterior segments.

Tribe Metriocnemini.
Metriocnemus group.
Thienemannia cf. *gracilis* Kieff. (*clavaticornis* Kieff.).

One larval skin of this type was found between two small snow banks in the lower reaches of Brook 6; temperature 1°C.

Only middle claws of anterior prolegs distally serrated. Procerci barely longer than broad, with a spur and six bristles at apex, bristles being as long as tubuli anales. Tubuli anales distally rounded, almost as long as the short posterior prolegs; claws of posterior prolegs brown; of anterior prolegs, luteous. Antennae reaching half the length of mandibles; basal segment twice as long as wide; ratio of antennal segments to each other as 30 : 8.5 : 3 : 3 : 2; of blade at apex of basal segment to segments 2-5 combined as 21 to 16.5. Labium with two small, median teeth and five lateral teeth, the first exceeding the middle teeth (Fig. 25B). Inner brush of mandibles appear in Fig. 25A. Premandibles four with digits and a little longer than antennae (Fig. 25F). Labrum as in *Metriocnemus ursinus Holmg.* (Thienemann 1944) or *Metriocnemus inopinatus* Strenzke

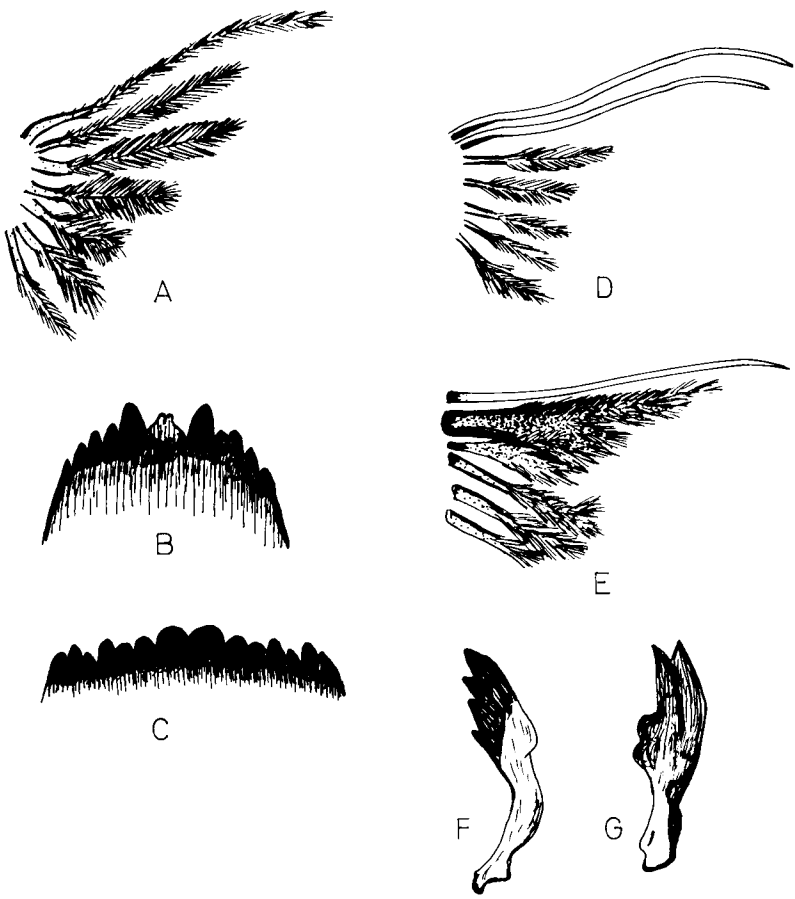

FIGURE 25. Larvae of the *Metriocnemus* group. A, inner brush of mandible of *Thienemannia* cf. *gracilis;* B, labium of same; C, labium of *Metriocnemus* sp. *A;* D, inner brush of mandible of same; E, inner brush of mandible of *Metriocnemus* sp. *B.* F, premandible of *T.* cf. *gracilis;* G, premandible of *Metriocnemus* sp. *A.*

(Strenzke 1951 fig. 26).

The species seems closely related to *T. gracilis* (*clavaticornis*) and may belong to this species. Metamorphosis is mentioned in Potthast (1915). Distribution : Europe; no species of this genus have been reported from North America.

Metriocnemus sp. *A*.

One larva belonging to the genus *Metriocnemus* (v.d. Wülp) Thien. was found between two snow banks in the middle stretch of Brook 6.

Length 7.5 mm. Slender, and with a shape similar to the Ceratopogonidae, as in the larvae possibly belonging to *M. ampullaceus* mentioned by Spärck (1922-1923). Thoracic and abdominal segments yellowish white; head somewhat rectangular, luteous with brown posterior margin; length : width of head as 26 : 16; head with double eyespot, the anterior one being the smaller. Procerci yellowish brown, two times longer than broad, with a distal anal spur. Distally rounded tubuli anales reaching half the length of posterior prolegs. Claws of posterior prolegs rusty brown; of anterior prolegs, yellow; anterior prolegs on common base, but with separated groups of distal serrated claws.

Ratio of antennal segments to each other as 38 : 13 : 2 : 5 : 3; blade of basal segment reaching tip of segment 5; basal segment three times as long as broad; antennae: mandibles = 61 : 115. Premandibles with four digits, two large, two small (Fig. 25G). Basal two bristles of inner brush of mandibles smooth; brush also with five feathery ramified bristles, basal bristles about twice as long as distal ones (Fig. 25D). Labium with two large, rounded median teeth and six lateral ones (Fig. 25 C). Also in *Metriocnemus inopinatus* Strenzke (Strenzke 1951) and the specimentioned by Roback (1957b), the medians are longer than first laterals. Hypopharynx and labrum seem to be similar to *M. fuscipes* (Meig.) (Potthast 1915, Thienemann 1944), but with spinules very long and slender. Epipharyngeal area about as in *M. hirticollis* var. *dipsaci* Zav. (Zavřel 1941b), but chatulae laterals not serrated, and lateral blades anterior to epipharyngeal region broader and longer than median ones.

Metriocnemus sp. *B*.

Two larvae in upper part of Brook 6; temperature 1-1.5°C.

Length 7.5 and 8 mm. Coloration brownish olive green with brown head and procerci and with brownish black claws of posterior prolegs. Eyes as in *hygropetricus* group (Zavřel 1941b). Procerci with distal spur; length : width = 15.5 : 10.5. Tubuli anales more pointed than in the preceding species, about as long as posterior prolegs.

Labrum, epipharyngeal area, hypopharynx, premandibles, shape of labium, and length of mandibles as in *Thienemannia* cf. *gracilis*. Ratio of antennal segments to each other as 33 : 8 : 2.5 : 2 : 1; blade of basal segment as long as segments 2-5 combined; basal segment twice as long as wide; ratio of antennae to mandibles as 46.5 to 95. Inner brush of mandibles with one smooth bristle and five feathery ramified ones; second bristle very broad and brownish (Fig. 25E).

The species seems to be closely related to *Metriocnemus* sp. *4* (Styczyński and Rakusa-Suszczewski 1963), but differs in some particulars.

North American species of *Metriocnemus* are *M. fuscipes* (Meig.), *M. knabi* Coq., *M. edwardsi* Jones, *M. obscuripes* Holmgr., and *M.* sp. (Roback 1957b) (Johannsen 1937a, Roback 1957b, Oliver 1963).

Paraphaenocladius sp.

One larva was found below Lake Albion in Brook 0, and one larva was found above Lake 4 in Brook 4-5.

The larvae seem to be of the type *P. impensus* Wülk., but with posterior end more as in *P. pseudirritus* Strenzke (Thienemann and Strenzke 1941, Thienemann 1944, Strenzke 1951). The larvae measure less than 2 mm. Possibly they were washed out of the vegetation along the sides of the stream.

Smittia group.

Smittia sp.

One female imago was found in the

lower part among vegetation in Brook 4-5.

This specimen lacks all tarsal segments and antennae, but very probably belongs to *Smittia* Holmgr. It is similar in coloration and wing venation to *flavibasis* Mall., but measures 1.75 mm instead of 1.25 mm, as stated by Malloch (1915). *Smittia flavibasis* also has squamal setae, in contrast to this species, and is regarded by Sublette (1970) as species *inserta sedis*.

Parakiefferiella group (*sensu* Brundin 1956).

cf. *Epoicocladius* sp.

Three juvenile larvae (<1 mm) were found on the plateau in the waterfall in Brook A-2. Three head capsules were found on upper shelf nearest steep ridge in Brook 6.

The only visible feature both in the very small larvae and in the head capsules was the labium. The labium was of the type described by Johannsen (1937a, fig. 263). According to Šulc (1944), the labium of larvae of *Epoicocladius ephemerae* Kieff., has six equal teeth, of which only the lateral ones are brown, the others yellow. In the author's collections, however, there are specimens of *Epoicocladius* (from River Kögeå in Zealand, Denmark, from Lake Borrevann on the western side of the Oslo-fjord, and from Lake Rundvann in the county of Troms in Northern Norway) that have a labium looking exactly like that on Šulc and Zavřel's specimens when not flattened out, but with five lateral teeth on each side when flattened out, and thus with a total number of 16 teeth (Saether, 1967). The same arrangement of teeth is mentioned by Henson (1957). Roback (1953a) has drawn a similar labial plate of a specimen probably belonging to *E. ephemerae*. The mandibles of the above-mentioned specimens from Denmark and Norway (as well as Henson's specimens) have three teeth as in sp. *E* of Johannsen, and not only one as in the specimens described by Šulc and Zavřel; two of the three teeth, however, are formed only by incisions, and might easily be overlooked (Saether 1967).

The European specimens of *Epoicocladius* have been found living on *Ephemera vulgata* and *E. danica*. The specimens of *E. ephemerae* mentioned by Roback (1953a) are assumed to be epizoic on *Ephemera guttulata* Pict. The larvae of the North American sp. *E.* were found clinging to the legs and gills of *Hexagenia recurvata*. No ephemerid specimens were found in Brook 6. In Brook A-2 several specimens of *Ephemerella coloradensis*, one very small specimen of *Cinygmula mimus*, and one very small indeterminable ephemerid nymph were found.

The larvae and head capsules found do not necessarily belong to *Epoicocladius*, but possibly to an undescribed genus.

Parakiefferiella sp.

One larva was found at the lower end of the creek near Lake Albion in Brook A-1. Two larvae were found near the upper end of the dam. The specimens were found in level stretches of the brook.

Length about 3 mm. Coloration olive green with a violet tint dorsally; head yellowish-brown with dark posterior margin. Eyespot (Fig. 26B) about as in *P. bathophila* Kieff. (Potthast 1915, Thienemann and Harnisch 1933, Thienemann 1944). Ratio of antennal segments to each other as 3.5 : 3 : 1 : 2 : 1 = 1 : 2; blade at apex of basal segment exceeding segment 3; small Lauterborn organs. Mandibles with four lateral teeth (Fig. 26C); premandibles with three digits. Labium with a large, single median tooth and six lateral teeth (Fig. 26A). Ratio of mandibles to antennae as 18 to 10.5. Tubuli anales pointed, about half as long as posterior prolegs. About six bristles on procerci. Labrum, maxillae, hypopharynx, and epipharyngeal area about as in *P. bathophila* (Potthast 1915).

Corynoneura group.

Corynoneura sp.

One larva was found on plateau in waterfall in Brook A-2, and three larvae were caught below waterfall just above Lake 2 in Brook 3-4.

The larvae belong to the group consist-

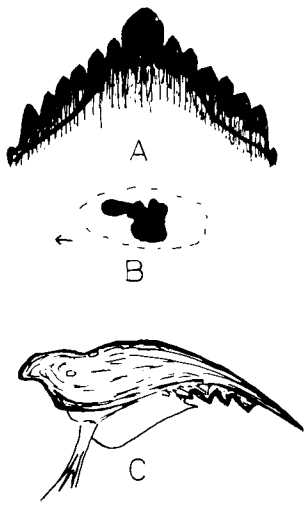

FIGURE 26. Larva of *Parakiefferiella* sp. A, labium; B, eyespot (arrow pointing anteriorly); C, mandible.

ing of *C. validicornis* Kieff., *minuta* Winn., and *celtica* Edw., but differ from these and other known Corynoneurinae in having three eyespots on each side of the head (Fig. 27) (Lenz 1939).

Length 2.5 mm. Coloration yellowish green with brown head having a darker posterior margin. Length of head to width of head to length of antennae as 66 : 26 : 75. Ratio of antennal segments to each other as 39 : 17 : 19 : 1; style at apex of first segment to first segment as 12.5 to 39; annular organ in middle of basal segment; sensory bristle midway between annular organ and apex. Other characters as in *C. validicornis* (Lenz 1939).

Johannsen (1937a) and Hennig (1950) mention that the observed larvae and pupae from the United States belong to the species *C. celeripes* Winn. and *C. scutellata* Winn. The species named Genus incertus *C* by Malloch (1915), found in the Illinois River, belongs to *Corynoneura* and not to any of the other known American species. Roback (1953b) mentions three larval types of *Corynoneura*. Roback (1957b) describes all stages of *C. taris* Roback.

FAMILY SIMULIIDAE

Prosimulium Roubaud

All specimens of larvae and imagines observed appear to belong to this genus. Remains of one type of exuviae always lacked the posterior parts and may belong to another genus.

As *P. esselbaughi* and *P. travisi* are especially difficult to distinguish, the specimens were usually determined only to genus. Individuals were present in all brooks, but in Brook A-2 (plateau in waterfall) there were only two specimens. The maximal number was found in Brook 3-4 (1,456 individuals in one sample).

Prosimulium esselbaughi Sommerman

Larvae, pupae, exuviae, and imagines were found. This species is the predominant black-fly of North Boulder Creek. The species has a western Nearctic distribution (Peterson 1970).

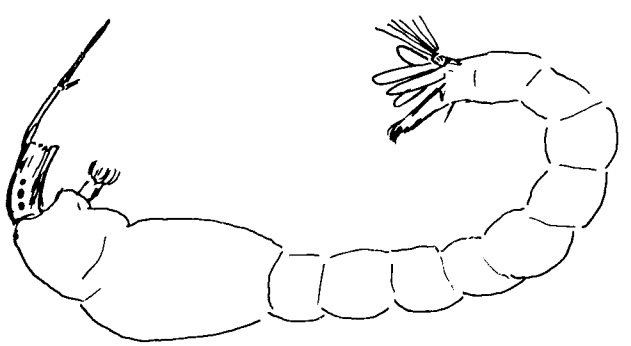

FIGURE 27. Larva of *Corynoneura* sp.

Prosimulium travisi Stone

This species is difficult to distinguish from *hirtipes* as a larva. However, head pattern and mentum of some larvae, especially from the upper part of the creek, must belong to the *travisi* type. The species is previously known from Alaska and Loveland Pass, Colorado (Stone 1952).

Prosimulium ursinum (Edw.)

Head capsules and a few larvae were found, especially in lower parts of Brook 6. *P. ursinum* has a Holarctic distribution (Carlsson 1962).

Prosimulium juv. *esselbaughi* or *travisi*

Some young larvae had a poorly developed mentum, but probably belong to one of these two species (Fig. 28B).

Simuliidae sp.

Remains of exuviae lacking posterior parts and with pupal filaments as shown in Fig. 28A were found in all parts of the creek. Respiratory organs with about 40 filaments. The exuviae probably belong to *Cnephia* End. or *Prosimulium* (Sommerman 1953, Stone 1952) and most likely to *Cnephia saileri* Stone (Stone 1952).

FAMILY EMPIDIDAE

Atalanta Meig. (syn. *Clinocera* Meig.)

Atalanta sp.

Two small larvae were found below the waterfall in Brook 3-4. One small larva was found near Lake 5 and eleven larvae a little higher up in an open space between two snow banks in Brook 6. A larva of the same species was found on 14 June in Rainbow Lake Brook.

The specimens found measured 2.0 mm to 8.0 mm in length. Whitish larvae with a finely rugulose, striated skin (Fig. 29D), some specimens with an olive greenish tinge in posterior abdominal segments; chitinous parts of head brown. Shape cylindrical, tapering anteriorly on thorax and head. Head minute and retractile. There are eight pairs of abdominal prolegs, last pair the longest. Ratio of lengths of prolegs to each other as 8 : 9 : 10 : 10.5 : 11 : 12 : 33. Last pair of prolegs bearing several rows of claws of which a few rows are especially stronger than the others and composed of anteriorly directed, pale brownish-grey, flat, smooth claws strongly curved at apex; posterior claws the longest, measuring about 175μ; other prolegs also with several rows of claws of which three rows are especially distinct (Fig. 29C), having smooth posteriorly directed claws with anterior claws the longest and reaching about 100μ; about 9-13 claws in each row of more distinct claws. On prothoracic segments there are, instead of prolegs, pairs of bristle-bundles with four equal bristles in each bundle, with bristles measuring about 125μ. Bristle-bundles are called "pattes vestigiales" by Vaillant (1951b), or vestigial pseudopods. Apex of abdomen with two pairs of setigerous processes (Fig. 29A, B). Upper setigerous processes as long as third pair of pro-

FIGURE 28. A, respiratory organs of remains of exuvia probably belonging to *Cnephia* or *Prosimulium;* B, partly developed mentum of *Prosimulium esselbaughi* or *travisi* with beginnings of next mentum.

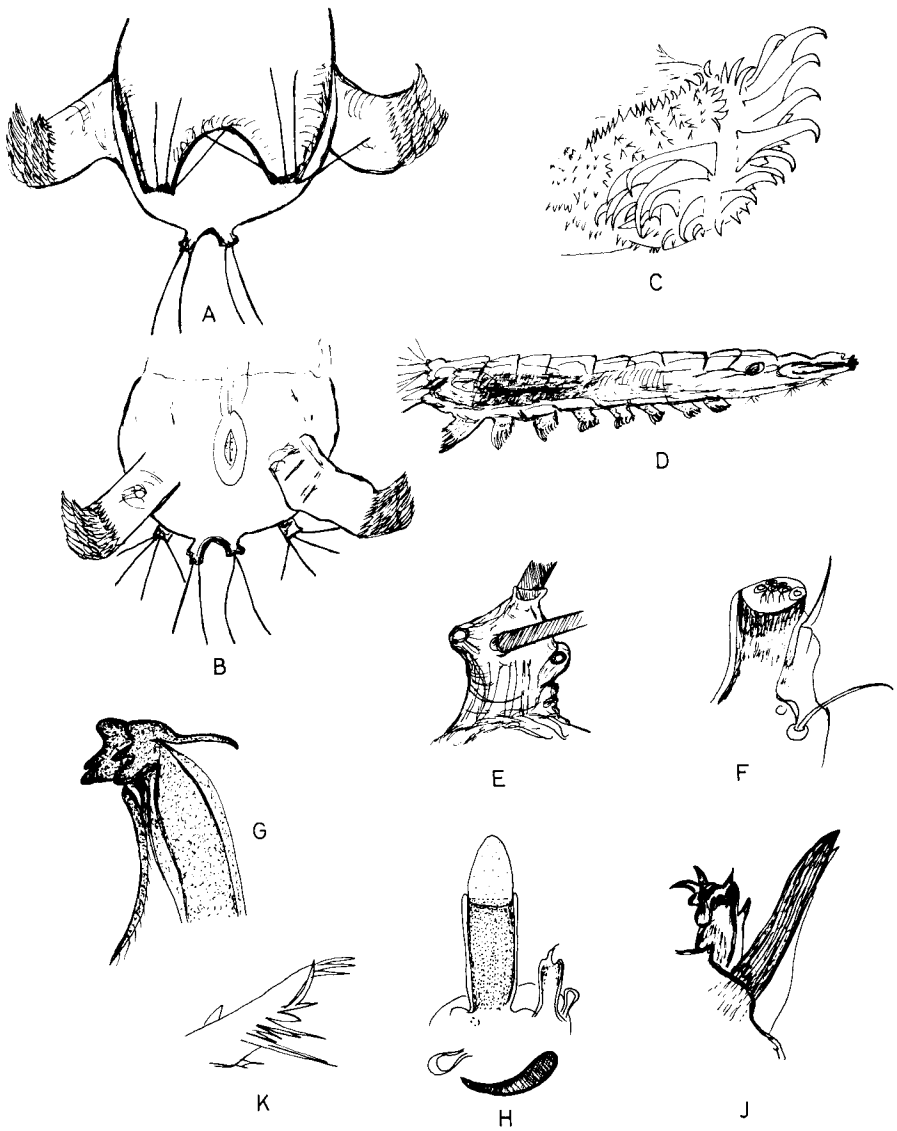

FIGURE 29. Larva of *Atalanta* sp. A, posterior segments, dorsal view; B, same, ventral view ; C, claws of left proleg of abdominal segment VII, ventral view; D, larva; E, lower setigerous process; F, maxillary palpus; G, labium and hypopharynx; H, antenna; J, tip of labrum and anterior projection of the cephalic capsule; K, maxillary pallet.

legs and with four strong, simple, brownish bristles; longest bristles in 8 mm specimens reaching 450μ. Lower setigerous processes half as long as upper and are approximately on apex of abdomen; each bears two finer setae measuring about 340μ and two prominences a little below apex (stigmata?) (Fig. 29E). Anterior projection of the cephalic capsule (Vaillant 1951a) seems to have six more prominent projections and some smaller projections (Fig. 29J); other projection of cephalic capsule as in *Kowarzia bipunctata* Haliday (Vaillant 1951b). Labrum not quite as pointed as in other known larvae of Atalantinae and with a projection at the tip (Fig. 29J). Hypopharynx as in related species. Labium with the usual three pairs of teeth, but besides the ventral projections there also seem to be dorsal projections (Fig. 29G). Rotula, cardo, U-shaped piece ["pièce en U" of Vaillant (1951a)], blade-shaped piece ("pièce en lame" of Vaillant), ventral hook of mandible, and articulated piece about as in related specimens [perhaps most nearly as in *Hydrodromia stagnalis* Haliday var. *vorsi* Vaillant (Vaillant 1951b, fig. 6)]. Dorsal hook of mandible not quite as pointed and bent as in related species. Maxillary palp as in Fig. 29F. Maxillary pallet ("palette de la maxille" of Vaillant) distinct from that of *Kowarzia barbatula* Mik., *Dolichocephala ocellata* Costa var. *barbarica* Vaillant, and *Roederella oedorum* Vaillant (Vaillant 1952, figs. 1, 14) and is shown in Fig. 29K. In contrast to other known Atalantinae larvae, the antennae have two papillae both measuring 7.5μ in length; median rod measuring 12μ in length, 6μ in breadth, and terminating in a spine (Fig. 29H); ventral rod ("baguette ventrale") biarticulated, measuring 39μ in length, 12μ in breadth, last hyaline joint measuring 16μ. Metacephalic and tentorial rods as in related species.

Vaillant (1952) distinguishes three groups of Atalantinae larvae: the rheophilous larvae, the less rheophilous larvae, and the almost limnophilous larvae. The larvae of the first group have elongated pseudopods and setigerous processes; in the second group pseudopods and processes are much smaller; and in the last group they are much reduced. The claws of the pseudopods are also mentioned as being greater in the first group than in the second and reduced in third group. This species seems to belong to the second group, but the claws are most similar to those of the first group consisting of *Roederella ouedorum* (Vaillant 1951a, figs. 13-16), and the setigerous processes are more reduced than in *Atalanta nigra* (Vaillant 1951b, fig. 2), probably the most closely related species. Of the species mentioned by Vaillant (1951a,b, 1952), *Atalanta nigra* Meig. has the most similar antennae, but the second hyaline segment of the ventral rod is shorter compared with the Colorado species, and there is only one papilla. (One of the papillae in the Colorado species is usually hidden behind the median rod, and it might have been overlooked in descriptions of other species.)

Other larvae of Atalantinae are: *Atalanta* sp. (Hennig 1952), *Hydrodromia stagnalis* Haliday (Nielsen, Ringdahl, and Tuxen 1954), and *Roederiodes juncta* Coq. (Needham and Betten 1901, Engel 1918, Johannsen 1935, Engel and Frey 1956). The larvae of *Hydrodromia stagnalis* have four bristles on upper setigerous processes, and lower processes seem to be without setae and as long as upper processes. Thus the species differs distinctly from the Colorado species as well as from *Hydrodromia stagnalis* var. *vorsi*. *Roederiodes juncta,* the only known American Atalantinae larva, is lacking the vestigial pseudopods, the upper setigerous processes have only three setae, and the abdominal prolegs have only two terminal rows of curved claws; below and lateral to the apical abdominal processes there is a pair of low bare prominences.

FAMILY EPHYDRIDAE
Subfamily Notiphilinae
Tribe Philygriini
Cressoniella montana gen. n., sp. n.

One imago was found below the waterfall and two imagines above waterfall in Brook 3-4. One imago was found in the lower stretches of Brook 4-5.

The species seems most closely related

to *Philygria* Stenk and *Nostima* Coq. (*Philygriola* Hend.). It differs from *Philygria* in having finely-haired arista and several hairs at lower apex of second segment of antennae, and from *Nostima* by having the antesutural dorsocentral bristle (Becker 1926, Cresson 1944, Sturtevant and Wheeler 1953).

Length of male and female is 2.2 mm; length of wings 2.3 mm; breadth of wings 0.8 mm. Coloration black macroscopically; antennae fuscous, third antennal joint tawny; palpi yellow; coxa, trochanter, femur, tibia (except in the middle), ta_5, tip of ta_4, and sometimes whole t_4, tawny; other tarsal segments and middle of tibia more yellowish; halteres pale, yellowish grey; abdomen with reddish tinge, fifth segment black; wings hyaline, veins tawny. Shiny to polished, but following surfaces rather densely granulose: clypeus, occiput, mesonotum, pleurae, metanotum, scutellum, and more or less all of the femora. Frons dusty; head subhemispherical; occiput concave (Fig. 30B, C). Eyes obliquely rounded and distinctly haired. Frons convex in profile; post-orbits visible in profile; parafacialia dilating below into the medium broad cheeks. Ocelli close, not

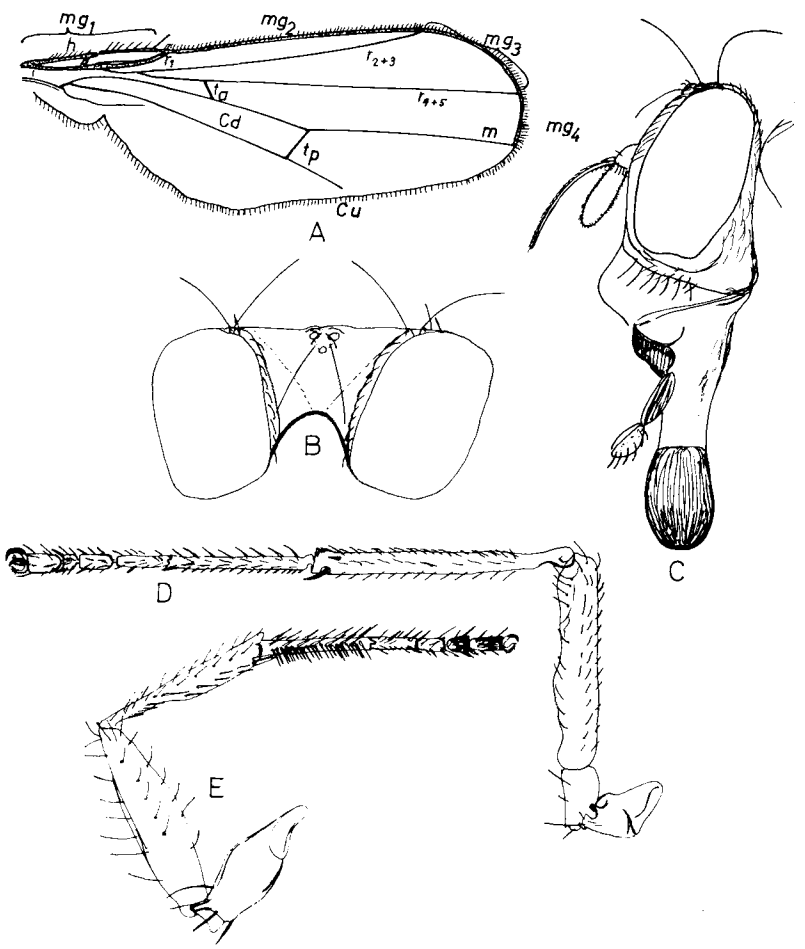

FIGURE 30. Imago of *Cressoniella montana* gen.n., sp.n. A, wing; B, head, front view; C, head, lateral view; D, middle leg; E, front leg.

tuberculate. True post-verticals absent; orbitals proclinate and weak, about as in *Mosillus* Latr.; true front - orbitals missing. Cheeks with moderately developed post-buccal area and with weak bristles. Clypeus moderately developed and a little projecting. Antennae short; the second segment seems to be without apical spine, but with many apical bristles, of which the lower ones are the strongest; arista microscopically haired above.

The three specimens found are more or less damaged, so the thoracic segments are indistinct and the number and position of bristles are difficult to determine. There seem, however, to be four pairs of dorsocentrals (two strong bristles and two weak ones), about six weak acrostichals in only one row, at least one pair of posthumerals, at least one pair of presuturals, one pair of intra-alars, one pair of prescutellars, and four bristles on scutellum. Further, these seem to be two notopleural bristles, of which the posterior is displaced dorsad from ventral margin as is characteristic of the tribe Philygriini.

Wings microscopically haired, hyaline, but blackened at crossveins (Fig. 30A). Costa reaching m ; ratio of mg_1 : mg_2 : mg_3 : mg_4 as 44 : 74 : 36 : 15.5 ; ta : tp = 7.5 : 9.5; cu not fully reaching the wing-margin; discal cell elongate; distance between crossveins 0.42 times the length of ultimate section of m.

Front and middle legs as in Fig. 30D and E. Ratio of maximum lengths of leg segments (Co to ta_5):

p_1	19	7	32	27	17	7	5	3.5	5
p_2	11	7	36	38	21	8	5	3.5	5
p_3	11	6	36	36	18	7.5	5	3.5	5

Spur of middle tibia measuring 66μ; distal height of middle tibia 59μ.

As the specimens are somewhat damaged, especially in the thoracic segments, the above description is not quite complete. These shore-flies, however, seem to belong to a new genus of the tribe Philygriini for which the name *Cressoniella* is proposed, after the late American specialist on these flies, Dr. Ezra T. Cresson, Jr.

SUMMARY

This paper presents the taxonomic results of a survey of invertebrates in North Boulder Creek in Colorado, from its source in a snow bank at about 3800 meters above sea level to near the timber line at about 3300 meters. [Notes on distribution, ecology, and population dynamics as well as a more detailed description of the brook will be found in Elgmork and Saether (1970), and an account of the watermites and a new species of chalcid-fly are given by Saether (1966a,b).]

A new species of Trichoptera, *Hesperophylax oreades* sp. n., and a new genus and species of Ephydridae, *Cressoniella montana* gen. n., sp. n., are described. In addition, new descriptions and redescriptions are given for one oligochaete; one nymph of Ephemeroptera; three nymphs of Plecoptera; one female imago, two pupae, and six larvae of Trichoptera; two female imagines of Sciaridae; one larva of Thaumaleidae; three female imagines, eight pupae, and 34 larvae of Chironomidae; and one larva of Empididae. One genus, three species, and a number of forms are new to North America.

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