Two New Species of *Protanypus* Kieffer, with Keys to Nearctic and Palaearctic Species of the Genus (Diptera: Chironomidae)

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Two Nearctic species of *Protanypus* are described: *Protanypus ramosus* n.sp. from imagines, pupae, and fourth-, third-, and second-instar larvae; *Protanypus hamiltoni* n.sp. from male imagines, pupae, and fourth-, third-, and second-instar larvae. The larvae of two other species are described. These are the first published descriptions of Nearctic imagines of the genus.

Keys are given for male imagines, pupae, and known larvae of the Nearctic and Palaearctic species of the genus.

Protanypus ramosus occurs in several oligotrophic and oligohumic to weakly polyhumic lakes in northwestern Ontario, in Algonquin Park, and in the Great Lakes. *Protanypus hamiltoni* is found in three deep and large, oligotrophic lakes in British Columbia and in Great Slave Lake. Both species are bivoltine. *Protanypus* sp. A occurs in Marion Lake, British Columbia, a small oligotrophic lake. *Protanypus* sp. B is found in George Lake, La Cloche Mountain Region, Ontario, an acidified oligotrophic lake.

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Nous décrivons deux espèces néarctiques du genre *Protanypus: Protanypus ramosus* n. sp., à partir d'imagos, de pupes et de larves quaternaires, tertiaires et secondaires; *Protanypus hamiltoni* n.sp., à partir d'imagos mâles, de pupes et de larves quaternaires, tertiaires et secondaires. Nous décrivons les larves de deux autres espèces.

Nous donnons des clés d'identification des imagos mâles, des pupes et des larves connues des espèces néarctiques et paléarctiques du genre.

Protanypus ramosus se rencontre dans plusieurs lacs allant d'oligotrophes et oligohumiques à faiblement polyhumiques du nord-ouest de l'Ontario, dans le parc Algonquin et dans les Grands lacs. *Protanypus hamiltoni* se trouve dans trois lacs oligotrophes profonds et étendus de la Colombie-Britannique et dans le Grand lac des Esclaves. Les deux espèces sont bivoltaines. *Protanypus* sp. A se rencontre dans le lac Marion, Colombie-Britannique, petit lac oligotrophe. *Protanypus* sp. B se trouve dans le lac George, lac oligotrophe acidifié de la région des montagnes La Cloche, Ontario.

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As mentioned by Sæther (1973, p. 665) one of the major shortcomings in analysis of Nearctic benthic chironomid samples has been the lack of knowledge of the specific identities of the typologically more important animals. However, the description of several important members of ultra-oligotrophic, moderately oligotrophic, and mesotrophic communities (Sæther 1973, 1975a, b) has made it possible to develop preliminary lists of indicator communities for North America (Sæther 1975c). One of the more important genera is *Protanypus* Kieff. of which two new species and the larva of two others are described in this paper. There are several records of *Protanypus* from North America (Miller 1941, p. 19; Oliver 1963, p. 177; 1964, p. 79; 1968, p. 116; Hamilton 1965, p. 52; 1971, p. 262; Brinkhurst et al. 1968, p. 17; Hiltunen 1969, p. 129; Sæther 1970, p. 6; Sæther and McLean 1972, p. 8). However, only Oliver (1963, p. 177) gives a specific identification, *P. caudatus* Edw., an identification which he regards

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as more doubtful in consequent papers (Oliver 1964, p. 79; 1968, p. 116).

Methods and Morphology

The mounting procedure used is outlined by Sæther (1969, p. 1). The general terminology follows Sæther (1971, 1974) with the following corrections and modifications discussed by Sæther (1975b): Brachiolum is used instead of basal vein (see Hirvenoja 1973), laterosternite IX instead of laterotergite IX, the tarsal "Sinneszapfen" (Sz) of Hirvenoja (1973) is called sensillae chaeticae, and stipes is used instead of cardostipes (see Hansen 1973). Sæther (1971) used the term aedagal lobe for different structures in his fig. 7A and 8B. The term aedagal lobe should be restricted to the lobe more or less distinctly attached to the phallapodeme (Sæther 1971, fig. 7B, D, 8D, G, 9B). Sæther (1971, p. 1249) followed Abul-Nasr (1950), Strenzke (1959), Wensler and Rempel (1962), and van Emden and Hennig (1970) in terming the dorsal or superior volsella the claspette. According to Hirvenoja (1973, p. 27) this volsella is, in chironomids, not homologous with the claspette of the Culicidae and thus should be named differently. In the definition of Smith (1969) the volsellae are the appendages of the gonocoxite and the gonapophysis or both (excluding the gonostylus), whereas the endomeres ("parameres") correspond with parts of gonapophysis IX, sometimes including part of or the whole volsellae. Hirvenoja (1973, p. 24) divides the endomeres ("parameres") into three parts: lateral, intermedian, and median. In *Protanypus*, at least, the intermedian and the lateral endomere clearly seem to correspond with parts of gonapophysis IX and thus fall within the definition given by Smith (1969). The terms intermedian endomere and lateral endomere are thus used here.

Measurements and ratios follow Schlee (1966) with the additions and modifications given by Sæther (1969). In the following descriptions measurements are given as ranges followed by a mean when four or more measurements have been made and again followed by a number in parenthesis giving the number measured (n).

Holotypes, the allotype of *P. ramosus*, and some paratypes have been deposited in the Canadian National Collection (CNC) in Ottawa. Remaining paratypes are deposited at the Illinois Natural History Survey, Urbana, Ill., returned to lender or retained at the collection of the Freshwater Institute, Winnipeg, Man.

The following abbreviations and ratios are used:

Imagines

$$\text{AR (antennal ratio)} = \frac{\text{ultimate flagellomere}}{\text{remaining flagellomeres}}$$

$$\text{BR (bristle ratio)} = \frac{\text{longest seta of } ta_1}{\text{minimum width of } ta_1 \text{ about } \frac{1}{3} \text{ from apex}}$$

$$\text{BV} = \frac{fe + ti + ta_1}{ta_2 \rightarrow ta_5}$$

fe = femur

$$\text{HR (hypopygium ratio)} = \frac{\text{length of gonocoxite}}{\text{length of gonostylus}}$$

$$\text{HV (hypopygium value)} = \frac{\text{length of male}}{\text{length of gonostylus} \times 10}$$

$$\text{LR (leg ratio)} = \frac{ta_1}{ti}$$

MC_u = media to cubitus crossvein

p_{1-3} = legs 1–3

R, R_1, R_{2+3}, R_{4+5} = stem and branches of radius

RM = radius to media crossvein

$$SV = \frac{fe + ti}{ta_1}$$

ta_{1-5} = tarsi 1–5

ti = tibia

$$\text{VR (Venarum ratio)} = \frac{Cu}{M}$$

Pupae

D-setae = dorsal setae (see Pagast 1947)

L-setae = lateral setae (see Pagast 1947)

Larvae

$$\text{AR (antennal ratio)} = \frac{\text{length of basal antennal segment}}{\text{length of remaining segments}}$$

Protanypus ramosus n.sp.

The male imago is characterized by having about 60–64 temporals including 2–3 preoculars, a VR of about 0.76, R with 19–23 setae, R_1 with 9–12 setae, LR_1 of 0.69–0.74, SV_2 of 3.79–3.88, ta_1 of p_1 with 7–8 pseudospurs, lateral endomere with scales, intermedian endomere with a long apical tooth and 1–2 short and simple lateral teeth, gonostylus with microtrichiae in proximal 0.4, and part of gonocoxite posterior to gonostylus about 0.7 times as long as gonostylus.

The female has 49–79 temporals including 8–12 preoculars, R with 27–31 setae, R_1 with 15–22 setae, LR_1 of 0.60–0.65, SV_2 of 4.00–4.13, ta_1 of p_1 with 9–12 pseudospurs, 55–60 sensillae chaeticae on ta_1 of p_2 and 72–108 on ta_1 of p_3, gonocoxite IX with 17–29 weak setae, and tergite IX with 51–64 setae.

The pupa has a 0.5–0.7 mm long thoracic horn with very fine spinules for most of its length, tergite I with very weak analmedian shagreenation, tergites II–IX with median shagreenation, sternite I with thin spinules occupying posterior ⅛–¼, 9–13 dorsal setae on tergites I–VII, and caudal lobe (male) or lobes (female) of segment VIII apically more or less truncated.

The larva has 11–12 labral scales and an AR of about 2.2; apical style of second antennal segment is about twice as long as accessory style and about as long as segment 3 and 4 combined; medioventral appendix of prementum has un-

evenly serrated blades and the widest part is about 2.4–2.5 times as wide as the narrowest part.

MALE IMAGO (N = 2, EXCEPT WHEN STATED OTHERWISE)

Length 6.27–6.78 mm. Wing length 4.06–4.22 mm. Total length/wing length: 1.54–1.61. Wing length/profemur: 2.51–2.59.

Head — AR = 2.52 (1). Temporal setae 60–64. Postorbitals 12–18, divided into two groups each with 6–9 setae; outer verticals 8–9, forming a continuous group with upper group of postorbitals; inner verticals 35–37; preoculars 2–3. Clypeus without setae. Cibarial pump, tentorium, and stipes as in Fig. 1A. Tentorium 310 μ(1) long, maximum width 66 μ(1), width anterior of posterior tentorial pit 21 μ(1), distance from apex to posterior tentorial pit 34 μ(1). Stipes 310 μ long, the two apparently fused medially. Two vestigial ocelli 100 μ(1) apart. Palp lengths in microns: 80, 124–130, 204–232, 220–244, 304–350. Sensilla coeloconicae of third segment large, conspicuous, but without any sensillae chaeticae.

Thorax (Fig. 1B) — Antepronotum with 7–11 median setae and 42–44 lateral setae. Medium anepisternum II with 2–4 setae, posterior anepisternum II with 14–17, epimeron II with 12, preepisternum with 30–35 setae. Dorsocentrals 28; acrostichals 30–35, up to 90 μ long; prealars 19 with a group of 14–15 posterior, 3–4 anterior, and 1 intermediate; supraalars 3, parascutellars 1–2. Scutellum with 40–49 setae.

Wing — VR = 0.76. Extended part of costa 75–80 μ long. MC_u 50–55 μ from RM. Brachiolum with 5–6 setae, R with 19–23, R_1 with 9–12, R_{4+5} with 3 setae. Squama with 72–73 setae. Sensillae campaniformes 17–18 at base of brachiolum, 4–5 below setae of brachiolum, 11–12 at apex of brachiolum, five in basal 260–280 μ of subcosta, one 110–200 μ from base on R_1, and one dorsal and one ventral 60–80 μ and 70–110 μ, respectively, from base on R_{2+3}.

Legs — Spur of front tibia (Fig. 2B) 132–142 μ long, spurs of middle tibia (Fig. 2C) 92–116 and 90–107 μ long, of hind tibia (Fig. 2D) 122–165 μ and 74–90 μ. Width at apex of front tibia 92–100 μ, of middle tibia 80–94 μ, of hind tibia 104–110 μ. No true comb present, but heavier spiniform setae in apical of hind tibia grade over in an irregular apical row. Front leg with 7–8 tarsal pseudospurs on ta_1, 2–3 on ta_2, 1–2 on ta_3. Middle leg with 13–16 pseudospurs on ta_1, 5 on ta_2, 2–3 on ta_3. Hind leg with 21–23 pseudospurs on ta_1, 9 on ta_2, 3–4 on ta_3. Pseudospurs 50–60 μ long on ta_1, 40–60 μ on ta_2, and 35–50 μ on ta_3. Lengths (in microns) and proportions of legs:

	fe	ti	ta_1
p_1	1616–1626	1872–2079	1380–1438
p_2	1695–1852	1813–2049	926–1005
p_3	1961–2039	2306–2522	1419–1498
	ta_2	ta_3	ta_4
p_1	662–668	429–442	245–258
p_2	466–478	307–319	202–209
p_3	675–748	393–429	258–276
	ta_5	LR	BV
p_1	159–209	0.69–0.74	3.23–3.29
p_2	165–172	0.49–0.51	3.89–4.16
p_3	221–227	0.59–0.62	3.62–3.66
	SV	BR	
p_1	2.53–2.58	3.25–3.33	
p_2	3.79–3.88	3.05–3.18	
p_3	3.01–3.04	3.04–3.25	

Hypopygium (Fig. 1C) — Ninth tergum with 32–36 setae, laterosternites IX each with 10 setae. Phallapodeme 240–250 μ long. Lateral endomere with scales, 190–206 μ long. Intermedian endomere (Fig. 1D, E) 150–220 μ long, with long apical tooth (60–90 μ long) and 1–2 shorter lateral teeth (16–30 μ). Gonocoxite 440 μ long, with a 190 μ long apical projection. Gonostylus 264–270 μ long, with microtrichiae in proximal 0.41–0.44. HR without projection = 1.63–1.67; HR with projection = 2.33–2.39; HV = 2.32–2.57.

FEMALE IMAGO (N = 5, EXCEPT WHEN STATED OTHERWISE)

Length 6.70–7.39, 6.96 mm. Wing length 4.77–5.12, 4.95 mm(4). Total length/wing length: 1.37–1.44, 1.42(4). Wing length/profemur: 2.85–2.97, 2.93(4).

Head — AR = 0.21–0.26, 0.23(4). Scapus with 12–17,14(4) setae. Flagellomeres 13, 120–164,136 μ (4) long. Temporal setae 49–79,63(4). Postorbitals divided into two groups with 8–10,10(4) setae in lower anterior group and 7–9,8(4) in upper posterior group; outer verticals 6–17,12(4); inner verticals 18–32,24(4); preoculars 8–12,10(4). Clypeus without setae. Coronal suture absent. Tentorium (Fig. 2A), 345–360,351 μ(4) long; maximum width 66–80,75 μ(4); width anterior of posterior tentorial pit 28–40 μ(3), distance from apex to posterior tentorial pit 14–22

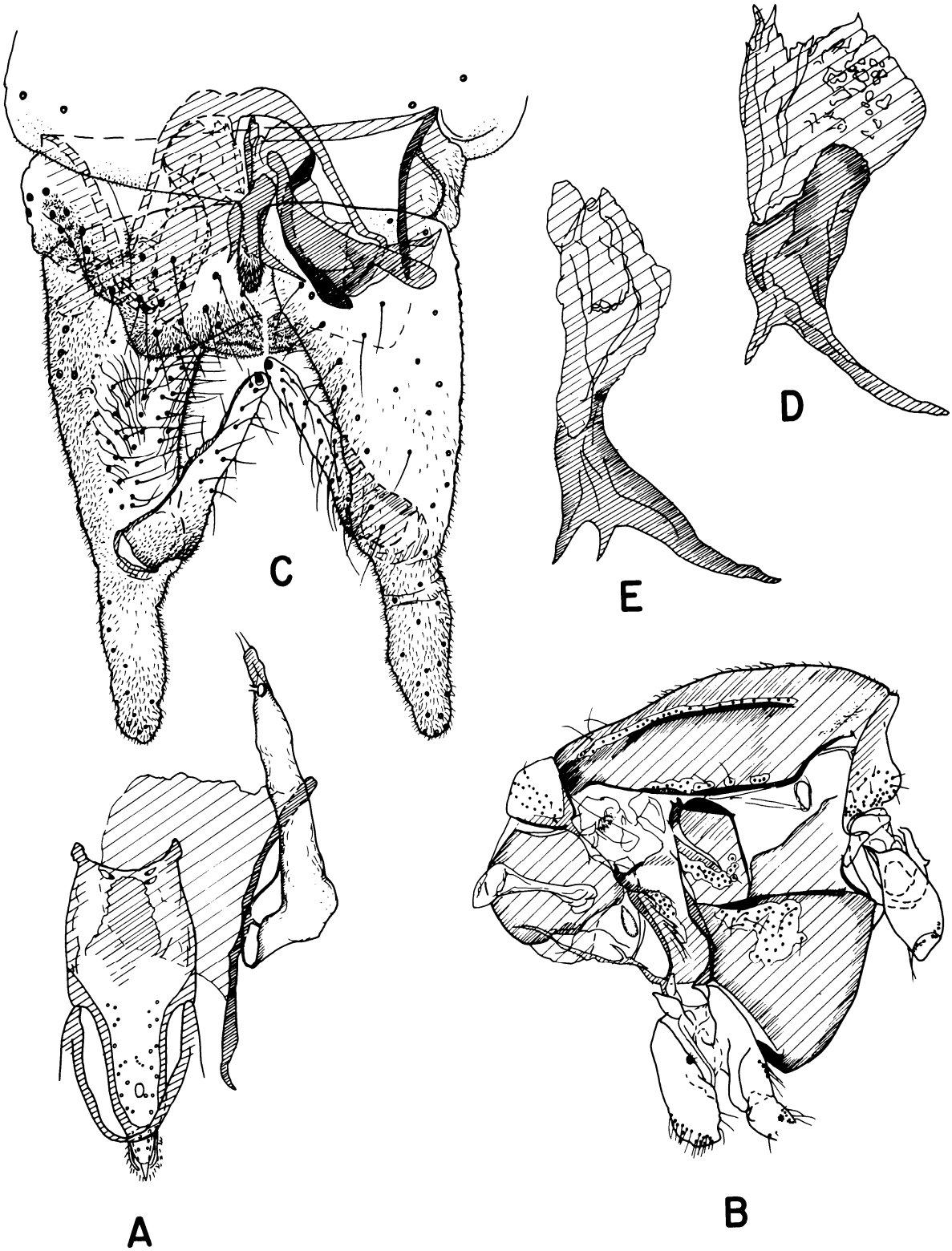

FIG. 1. *Protanypus ramosus* n.sp., male. A, cibarial pump, labial lonchus, tentorium, and stipes; B, thorax; C, hypopygium; D, E, intermedian endomere on holotype from Kenora (D) and paratype from Costello Lake (E).

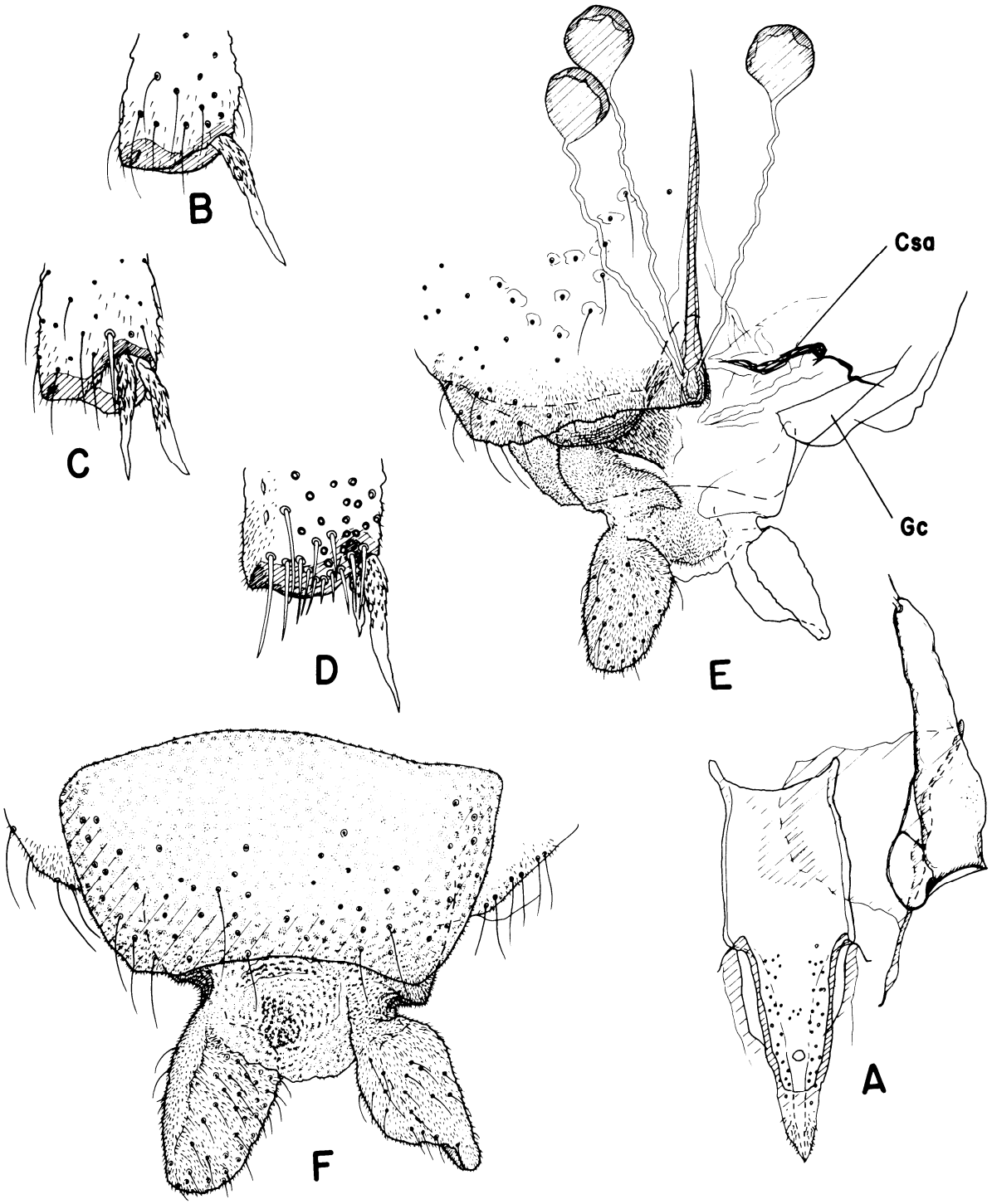

FIG. 2. *Protanypus ramosus* n.sp. A, cibarial pump, labial lonchus, tentorium, and stipes of female; B, C, D, apex of front, median, and hind tibia, respectively, of male; E, F, female genitalia, ventral (E) and dorsal (F) view. (Csa: coxosternapodeme; Gc: gonocoxite (IX).)

μ(3). Palp lengths in microns (n = 4): 88–98,95; 130–142,136; 222–236,231; 210–266,239; 310–362,346.

Thorax — Antepronotum with 64–107,75 setae. Median anepisternum II with 5–8,6 setae; posterior anepisternum II with 13–20,16; epimeron II with 10–20,14; preepisternum with 32–40,35. Dorsocentrals 32–41,37; acrostichals 28–41,33; prealars 33–49,39, with 6–10 anterior ones more or less separate from posterior ones; supraalars 2–4,3; parascutellars 1–4,3. Scutellum with 58–77,68 setae.

Wing (n = 4) — VR = 0.83–0.84, 0.83. Extended part of costa 40–60, 51 μ. Brachiolum with 7–9,8 setae; R with 27–31,29; R_1 with 15–22,19; R_{2+3} with 1 seta in two of four specimens; R_{4+5} with 8–20, 15 setae. Squama with 96–117,105 setae. Sensillae campaniformes 18–23,21 at base of brachiolum; 4 below setae of brachiolum; 8–9,9 at apex of brachiolum; 4 in basal 210–300,255 μ of subcosta; one 200–280,245 μ from base on R_1; 1–2,1.5 dorsal and ventral 32–140,97 μ from base on R_{2+3}.

Legs — Spur of front tibia 119–128, 124 μ long; spurs of middle tibia 89–100,95 μ and 86–100,94 μ; of hind tibia 126–140,131 μ and 98–106,101 μ. Width at apex of front tibia 96–102,100 μ; of middle tibia 104–110,108 μ; of hind tibia 110–126,119 μ. Front leg with 9–12,10 tarsal pseudospurs on ta_1; 2 on ta_2; 0–2 on ta_3. Middle leg with 14–19,16 pseudospurs on ta_1; 5–6 on ta_2; 2 on ta_3. Hind leg with 23–26,24 pseudospurs on ta_1; 7–10,8 on ta_2; 2–3 on ta_3. Pseudospurs 45–60 μ long on ta_1, 40–50 μ on ta_2, 35–50 on ta_3. Sensillae chaeticae 55–60,58(4) in basal ⅕ to ¼ on p_2; 72–108,88(4) in basal ⅕ to ¼ on p_3. Lengths (in microns) and proportions of legs:

	fe	ti	ta_1
p_1	1596–1754, 1673	2040–2237, 2109	1252–1380, 1311
p_2	1813–1971, 1892	1941–2128, 2028	926–1005, 963
p_3	2030–2188, 2125	2523–2720, 2627	1390–1518, 1467
	ta_2	ta_3	ta_4
p_1	352–626, 594	393–442, 417	258–294, 277
p_2	423–466, 445	331–356, 343	227–239, 233
p_3	699–761, 720	443–466, 445	282–313, 296
	ta_5	LR	BV
p_1	215–245, 231	0.60–0.65, 0.62	3.19–3.50, 3.35
p_2	202–227, 217	0.47–0.49, 0.48	3.83–4.02, 3.94
p_3	233–258, 247	0.55–0.57, 0.56	3.56–3.77, 3.64
	SV	BR	
p_1	2.76–2.98, 2.88	2.03–2.22, 2.12	
p_2	4.00–4.13, 4.07	1.67–2.10, 1.91	
p_3	3.15–3.31, 3.24	2.00–2.33, 2.16	

Genitalia (Fig. 2E, F) — Gonocoxite with 17–19,22 weak setae. Tergite IX undivided, with 51–64,57(4) setae. Cercus 200–210,205 μ long. Three ovoid seminal capsules each 110–134,119 μ long and 93–108,103 μ wide.

PUPA (N = 4, EXCEPT WHEN STATED OTHERWISE)

Length 8.02–10.80,9.38 mm. Length of thoracic horn/length of anal macrosetae: 1.37–1.44(2).

Cephalothorax — Thoracic horn (Fig. 3A) 546–687 μ(3) long, 56–80 μ(3) wide, covered with faint spinules for most of its length, mostly with a proximal swelling. Frontal tubercle (Fig. 3B, C) 100 μ(1) high with the wider base an additional 100 μ(1) high, tubercle 70–80 μ(2) wide, base 140–150 μ(2) wide; apical setae 527–552 μ(3) long. Anterior thoracic tubercle (Fig. 3B, C) 70–90 μ(2) high, 66–70 μ(2) wide, with a 331–491, 428 μ(4) long apical seta.

Abdomen — Tergite I with weak and sparse median spinules in posterior corners of polygons of reticulation, remaining tergites fully shagreenated except on lateral margins. Sternite I (Fig. 3D) with shagreenation in posterior ⅕ to ⅓ consisting of thin 5–6 μ long spinules, sternite II with up to 10 μ long spinules, remaining sternites with spinules of same length as on tergites (up to 7 μ), sternites II–V fully shagreenated except laterally, sternite VI–VIII with sparse median shagreenation. Tergites I–VII with 9–13 pairs of dorsal setae (D-setae), tergite VIII with 6–7 setae. Segments I–VIII with 3 L-setae, none filamentous on I, 2 filamentous on II–IV, all 3 filamentous on V–VIII. Caudal lobe of segment VIII in male (Fig. 3F) 399–515 μ(3) long, usually apically truncate, 0.53–0.67(3) times as long as anal lobe. Caudal lobes of segment VIII in female (Fig. 3E) 711 μ(1) long, ending 552 μ(1) posterior of tergite VIII. Anal lobe 662–853, 761 μ(4) long; with 7–13,10(4) setae; 4–5 of them on strong tubercles; 0–3,1 on weaker tubercles; setae of tubercles 343–417 μ(3) long, shortest setae 221–307 μ(3) long.

FOURTH-INSTAR LARVA (N = 2, EXCEPT WHEN STATED OTHERWISE)

Length 7.84–10.45 mm. Head capsule length 0.77–0.82 mm.

Head — Antenna as in Fig. 4A. Lengths of antennal segments in microns: 80–98, 25–28, 4,

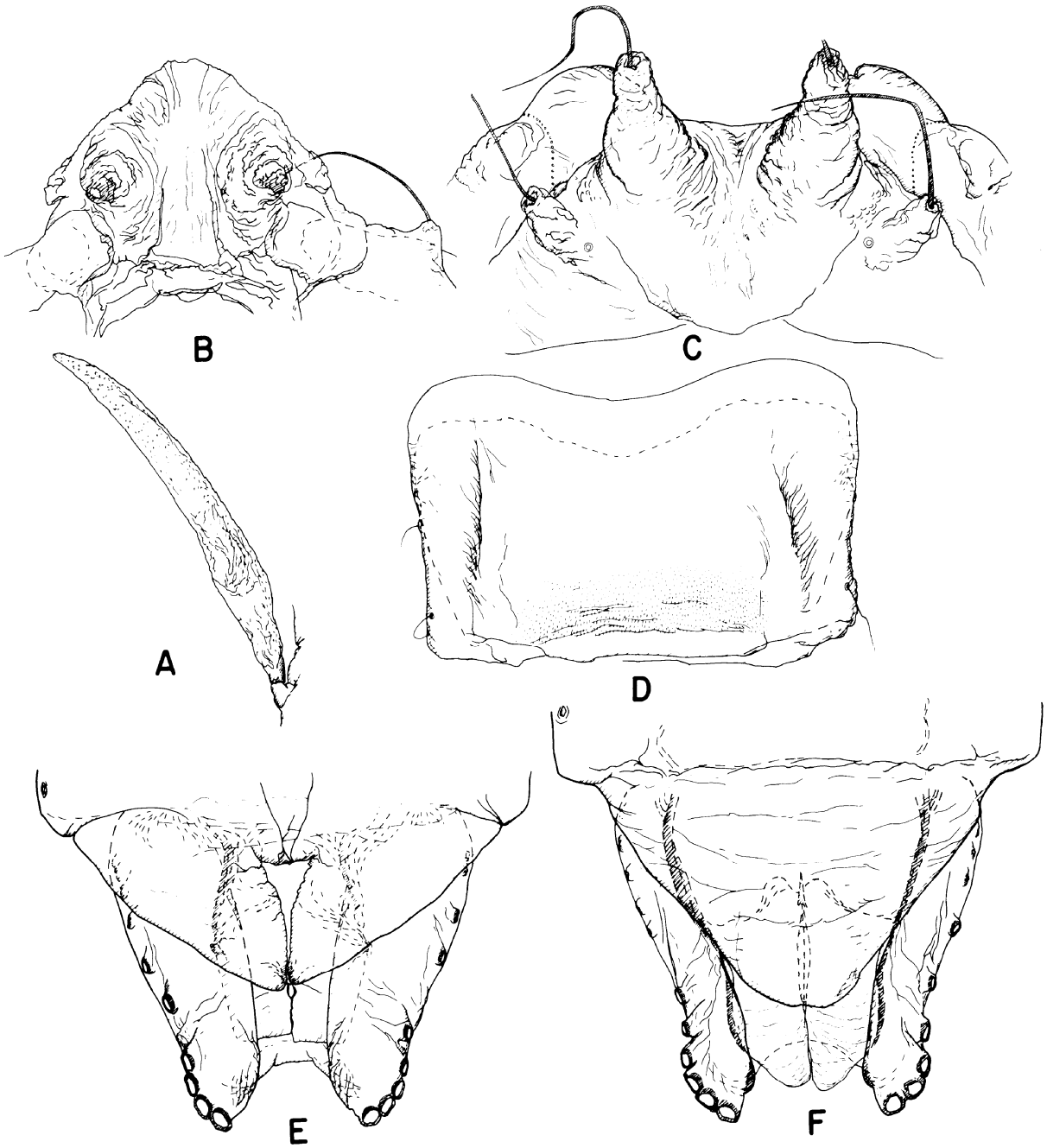

FIG. 3. *Protanypus ramosus* n.sp., pupa. A, thoracic horn; B, C, frontal plate and anterior thoracic tubercle, different views; D, sternite I; E, F, caudal lobes of segment VIII and anal lobe of female (E) and male (F).

8–9. AR = 2.22. Basal antennal segment 28–30 μ wide, 2.86–3.27 as long as wide, distance from base to annular organ 12–15 μ, to basal seta 22 μ(1), blade at apex 30–33 μ long, accessory blade 30–33 μ long. Apical style of second segment 12–13 μ long, accessory style 6 μ. Labrum and palatum as in Fig. 4B, labrum with 11–12 scales. Premandible 98 μ(1) long. Maxilla as in Fig. 4C, D. Medioventral appendix of prementum (Fig. 4E) 122–140 μ long, 76–92 μ wide, minimum width at base 31–37 μ, maximum width/basal minimum width: 2.45–2.47. Supporting endoskeleton of appendix 132–152 μ wide, 1.65–1.69 times as wide as the 80–90 μ median tooth

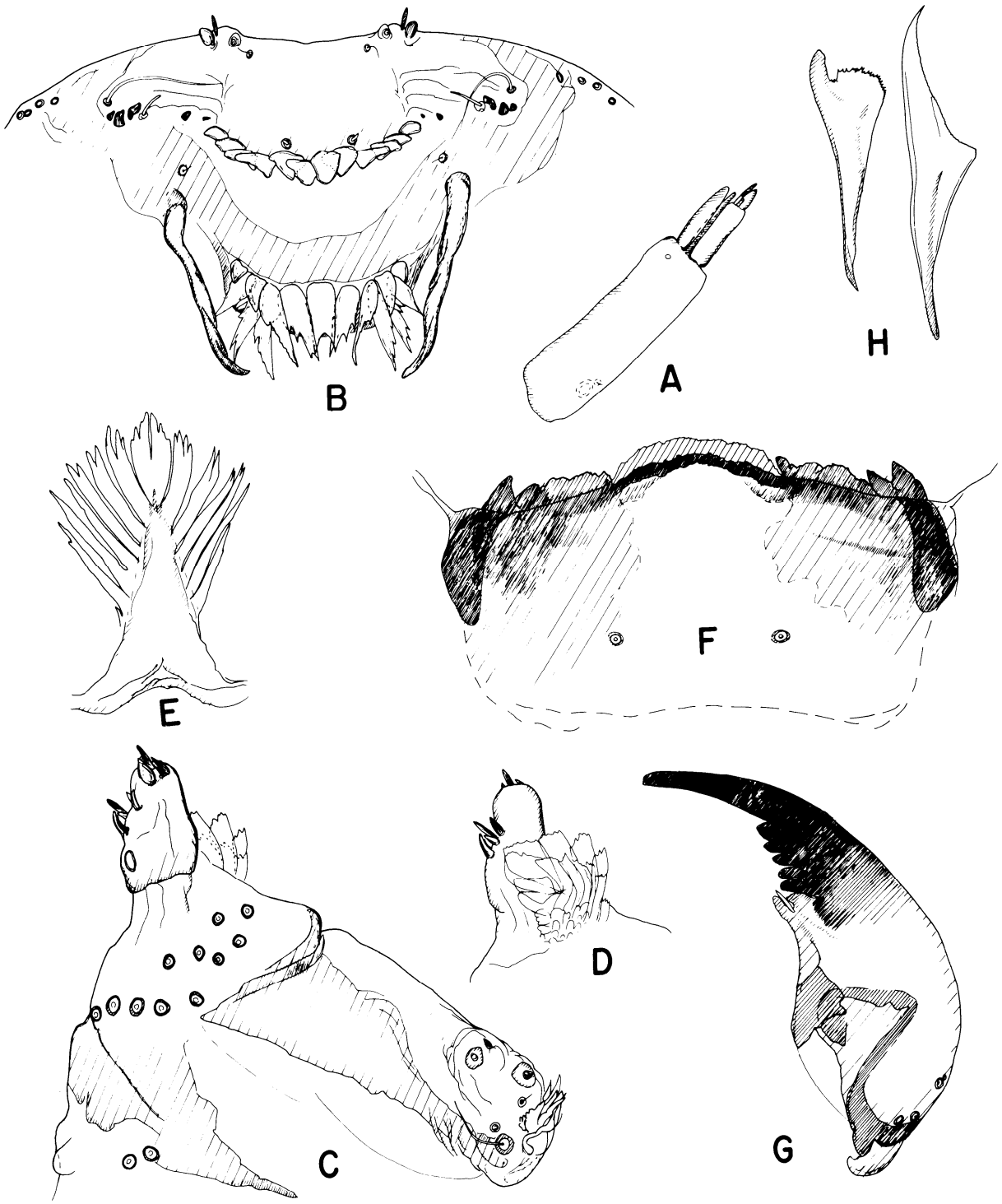

FIG. 4. *Protanypus ramosus* n.sp., larva. A, antenna; B, labrum and palatum; C, D, maxilla and maxillary palp, ventral (C) and dorsal view (D); E, medioventral appendix of prementum; F, mentum; G, mandible; H, claws of posterior parapods.

of mentum (Fig. 4F). Mandible (Fig. 4G) 312 μ(1) long, apical tooth 79–92 μ long. Postmentum (mentum plus submentum) 302–348 μ long.

Abdomen — Procercus 114–134 μ high, 36–42 μ wide, with 6 apical anal setae and 2 weak lateral setae. Posterior parapods 613 μ(1) long with two kinds of apical claws (Fig. 4H).

THIRD-INSTAR LARVA (N = 6, EXCEPT WHEN STATED OTHERWISE)

Length 4.40–7.19, 5.98 mm. Head capsule length 0.45–0.50, 0.48 mm.

Head — Lengths of antennal segments in microns: 49–52,50; 20–27,23; 4; 6–8,7. AR = 1.23–1.58, 1.46. Basal antennal segment 19–20,20 μ wide; 2.45–2.63,2.58 times as long as wide; distance from base to annular organ 6–14,10 μ(5); to basal seta 13–18 μ(2); blade at apex 25–30,28 μ long; accessory blade 25–30, 28 μ. Apical style of second segment 9–11, 10 μ long; accessory style 4–6,5 μ long. Labrum with 8–10,9(5) scales. Premandible 74–81,78 μ(4) long. Medioventral appendix of prementum 78–87,81 μ long; 45–54,49 μ wide; minimum width 19–21,20 μ; maximum width/minimum width: 2.36–2.70,2.45. Supporting endoskeleton of appendix 90–93, 92 μ(5) wide; 1.48–1.80,1.65(4) times as wide as the 50–63,56 μ(4) wide median tooth of mentum. Mandible 200–228,211 μ(4) long; apical tooth 50–56,53 μ(4) long. Postmentum 216–242,233 μ long.

Abdomen — Procercus 72–80, 75 μ high; 25–44,33 μ wide. Anal tubules 116–180 μ(3) long, 38–60 μ(3) wide at base. Posterior parapods 319–393, 358 μ(5) long.

SECOND-INSTAR LARVA (N = 1)

Head capsule length 0.29 mm.

Head — Lengths of antennal segments in microns: 20,18,3,5. AR = 0.80. Basal antennal segment 11 μ wide, 1.82 times as long as wide, blade at apex 22 μ long, accessory blade 22 μ long. Apical style of second segment 6 μ long, accessory style 3 μ long. Labrum with 2 scales. Premandible 44 μ long. Mandible 122 μ long. Postmentum 142 μ long.

Material Examined

HOLOTYPE: male with exuvia, emergence trap, Lake 122, Freshwater Institute Experimental Lakes Area (ELA), Kenora, Ont., 1/10/68, S. S. *Chang* (CNC No. 13403). ALLOTYPE: female, Costello Lake, Algonquin Park, Ont. 17/5/65, D. W. Webb. PARATYPES: 1 male, 4 females, same data as allotype; 2 exuviae, Lake 122, ELA, Kenora, Ont., 7/5 and 14/5/68, S. S. *Chang*. OTHER MATERIAL: pupa with larval exuvia, depth 43 m, Georgian Bay, Lake Huron, 23/8/64, Great Lakes Institute, University of Toronto; 1 fourth-instar larva, depth 26 m, Lake 305, ELA, Kenora, Ont. 2/5/69, A. L. Hamilton and G. P. McRae; 2 third- and 1 second-instar larvae, depth 9–12 m, Lake 239, ELA, Kenora, Ont., 1/5/69, A. L. Hamilton and G. P. McRae; 2 third-instar larvae, depth 1.8 m, Lake Mad Dog, ELA, Kenora, Ont., 6/5/69, A. L. Hamilton and G. P. McRae; 1 third-instar larva, depth 46 m, Hillock Lake, ELA, Kenora, Ont. 6/5/69, A. L. Hamilton and G. P. McRae; 2 third-instar larvae, depth 4 m, South Indian Lake, Man. 12/7/72, A. L. Hamilton.

Remarks

The species most closely resembling *P. ramosus* n.sp is *P. hamiltoni* n.sp. (see p. 368).

Protanypus hamiltoni n.sp.

Protanypus sp. A pro parte, Hamilton 1965 part II; 52 (male, pupa, larva)
Protanypus near *morio* Sæther 1971; fig. 3E, 4D, 8B, 10D (male, larva).

The male imago is characterized by having about 31–40 temporals; lacking preoculars; a VR of 0.82–0.88; R with 29–35 setae; R_1 with 20–26 setae; LR_1 of 0.66–0.70; SV_2 of 4.00–4.06; ta_1 of p_1 with only 2 apical pseudospurs; lateral endomere with scales; intermedian endomere with a short apical tooth and 1–2 short and 1 long, simple to four-pronged lateral teeth; gonostylus with microtrichiae in apical 0.8; and part of gonocoxite posterior to gonostylus about 0.8 times as long as gonostylus.

The pupa has a 0.5–0.7 mm long thoracic horn without spinules; tergite I with weak analmedian shagreenation; tergites II–IX with median shagreenation; sternite I with long, thin spinules occupying posterior ½–⅔; 9–13 dorsal setae on tergites I–VII; and caudal lobe (male) or lobes (female) of segment VIII apically rounded.

The larva has 10–12 labral scales and AR of

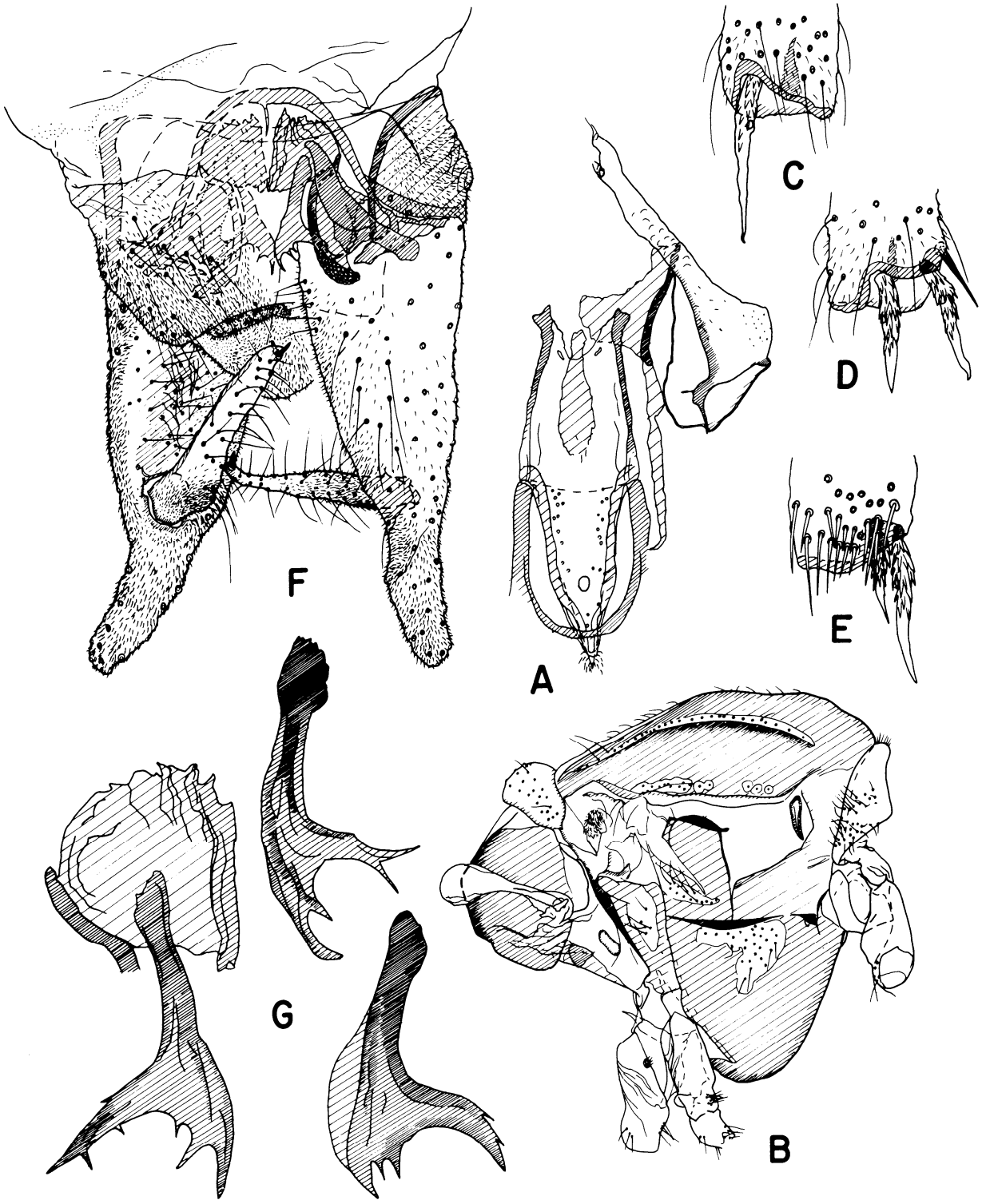

FIG. 5. *Protanypus hamiltoni* n.sp., male. A, cibarial pump, labial lonchus, tentorium, and stipes; B, thorax; C, D, E, apex of front, median, and hind tibia, respectively; F, hypopygium; G variations of intermedian endomere.

2.3–2.7; apical style of second antennal segment is about twice as long as accessory style and about as long as segment 3 and 4 combined; medioventral appendix of prementum has unevenly serrated blades and is 1.9–2.2 times as wide at the widest as at the most narrow point.

MALE IMAGO (N = 6, EXCEPT WHEN STATED OTHERWISE)

Length 6.62–7.19 mm (3). Wing length 3.75–4.53, 4.22 mm (7). Total length/wing length: 1.58–1.67(3). Wing length/profemur: 2.59–2.68, 2.66(4).

Head — AR = 2.30–2.72,2.58(8). Temporal setae 31–40,37. Postorbitals divided into two groups with 6–11,8 setae in lower anterior group and 8–14,11 in upper posterior group, outer verticals 6–9,8; inner verticals 8–12,10. Clypeus without setae. Cibarial pump, tentorium, and stipes as in Fig. 5A. Tentorium 330–380,354 μ(5) long; maximum width 66–78,70 μ(5); width anterior of posterior tentorial pit 18–21,20 μ(5); distance from apex to posterior tentorial pit 23–40,32 μ (5). Palp lengths in microns (n = 7): 68–85, 79; 120–148,136; 210–240,223; 214–272,255; 275–374,335. Sensillae coeloconicae of third segment large, conspicuous, but without any sensillae chaeticae.

Thorax (Fig. 5B) — Antepronotum with 8–12, 10 median setae and 30–49,38 lateral setae. Median anepisternum II with 1–2,1.5 setae; posterior anepisternum II with 13–17,15 setae; epimeron II with 4–9,6(5) setae; preepisternum with 15–30,25 setae. Dorsocentrals 20–26,22(5); acrostichals 22–31,26(5), up to 90 μ long; prealars 14–22,19(5) with a group of 12–19 posterior and 2–4 anterior; supraalars 4–8(3); parascutellars 3–5,4(5). Scutellum with 38–50,43 setae.

Wing — VR = 0.82–0.88,0.85. Extended part of costa 88–120,103 μ long. MC_{II} 50–60,56 μ(5) from RM. Brachiolum with 5–8,6 setae; R with 29–35,32(7); R_1 with 20–26,23(7); R_{4+5} with 3–8,6(7) setae. Squama with 71–88,77(7) setae. Sensillae campaniformes 19–24,22 at base of brachiolum; 4–5,5 below setae of brachiolum; 10–11,11 at apex of brachiolum; 4–5,4 in basal 240–400,253 μ of subcosta; one 200–450,292 μ from base on R_1; one dorsal and one ventral 95–140,118 μ and 125–170,155 μ from base on R_{2+3}.

Legs (n = 4) — Spur of front tibia (Fig. 5C) 130–142,135 μ long; spurs of middle tibia (Fig. 5D) 101–113,105 μ and 86–102,94 μ; of hind tibia (Fig. 5E) 134–136,135 μ and 84–88,86 μ. No true comb present, but heavier spiniform setae in apical $\frac{1}{10}$ of hind tibia grade over in an irregular apical row. Front leg with 2 tarsal pseudospurs on ta_1; 1–2,1.8 on ta_2; 0–2,1 on ta_3. Middle leg with 12–16,14 pseudospurs on ta_1; 4–8,5 on ta_2; 1–2,1.8 on ta_3. Hind leg with 16–20,19 pseudospurs on ta_1; 5–10,8 on ta_2; 1–2,1.5 on ta_3. Pseudospurs 40–60 μ long on ta_1, 35–55 μ on ta_2, and 35–47 μ on ta_3. Lengths (in microns) and proportions of legs:

	fe	ti	ta_1
p_1	1557–1695, 1611	1912–2148, 2015	1311–1429, 1355
p_2	1734–1911, 1793	1863–2174, 1985	887–1005, 936
p_3	1872–1991, 1929	2384–2503, 2444	1399–1439, 1419
	ta_2	ta_3	ta_4
p_1	662–687, 675	429–466, 454	251–276, 261
p_2	478–527, 506	319–368, 347	196–215, 207
p_3	711–779, 744	380–405, 390	245–258, 253
	ta_5	LR	BV
p_1	202–215, 209	0.66–0.70, 0.68	2.99–3.29, 3.11
p_2	190–196, 193	0.46–0.48, 0.47	3.59–3.95, 3.77
p_3	221–233, 227	0.57–0.59, 0.58	3.57–3.60, 3.59
	SV	BR (n = 3)	
p_1	2.59–2.74, 2.68	2.80–3.26	
p_2	4.00–4.06, 4.04	2.60–2.95	
p_3	3.02–3.17, 3.08	2.90–3.04	

Hypopygium (Fig. 5F) — Ninth tergum with 28–32,30(5) setae; laterosternites IX each with 12–15,13(5) setae. Phallapodeme 180–190,187 μ(7) long. Lateral endomere with scales, 152–180,165 μ(7) long. Intermedian endomere (Fig. 5G) 150–170,163 μ(7) long with short apical tooth, 1–2 short lateral teeth and 1 long, single to 4-pronged lateral tooth. Gonocoxite 440–474,455 μ long; with a 200–214,205 μ long apical projection. Gonostylus 254–266,260 μ long; with microtrichiae in proximal 0.81–0.92,0.84. HR without projection = 1.67–1.81,1.75; HR with projection = 2.44–2.62,2.54; HV = 2.51–2.72(3)

PUPA (N = 10, EXCEPT WHEN STATED OTHERWISE)

Length 9.26–10.54,9.85 mm. Length of thoracic horn/length of anal macrosetae: 1.33–1.97,1.56.

Cephalothorax — Thoracic horn (Fig. 6A) 491–675,565 μ long; 62–98,75 μ wide; void of spinules. Frontal tubercle (Fig. 6 B, C), 100–140,116 μ(5) high with an additional 175–240, 199 μ(5) high base; tubercle 66–98,78 μ(9) wide; base 140–230,170 μ(5) wide; apical setae 319–480,412 μ(7) long. Anterior thoracic tubercle (Fig. 6 B, C) 56–86,61 μ(9) high; 56–80,68 μ(9) wide; apical seta 245–440,341 μ(8) long.

Abdomen — Tergite I with weak and sparse median spinules in posterior corners of polygons of reticulation, remaining tergites fully shagreenated except on lateral margins. Sternite I (Fig. 6D) with shagreenation in posterior ½–⅔ consisting of thin spinules up to 12 μ long, sternite II with similar long spinules, remaining sternites with spinules of approximately same length as on tergites (up to 7 μ), sternites II–V fully shagreenated except laterally, sternites VI–VIII with sparse median shagreenation. Tergites I–VII with 9–13 D-setae, tergite VIII with 6–7 D-setae. Segments I–VIII with 3 L-setae, none filamentous on I, 2 filamentous on II–IV, all 3 filamentous on V–VIII. Caudal lobe of segment VIII in male (Fig. 6F) 478–540,502 μ(6) long, apically rounded, 0.68–0.74,0.70(6) times as long as anal lobe. Caudal lobes of segment VIII in female (Fig. 6E) 589–613,607 μ(4) long, ending 368–411,391 μ(4) posterior of tergite VIII. Anal lobe 687–797,730 μ long; with 7–9,8 setae; 4–6 of them on strong tubercles, 0–2 on weaker tubercles; setae on tubercles 319–399,365 μ long, shortest setae 172–282,247 μ long.

FOURTH-INSTAR LARVA (N = 5 EXCEPT WHEN STATED OTHERWISE)

Length 6.70–12.22,10.35 mm. Head capsule length 0.74–0.79,0.78 mm.

Head — Antenna as in Fig. 7A. Lengths of antennal segments in microns: 88–104,97; 23–27, 25; 3–5,4; 6–9,8. AR = 2.32–2.65,2.46. Basal antennal segment 30–31,30 μ wide; 2.93–3.47, 3.23 times as long as wide; distance from base to annular organ 16–20,18 μ(4); to basal setae 21–24 μ(3); to mark of distal setae 72–92 μ(3); blade at apex 30–34,32 μ long; accessory blade 31–34,32 μ long. Apical style of second segment 11–14,12 μ long; accessory style 5–8,7 μ long. Labrum and palatum as in Fig. 7B, labrum with 10–12,11 scales. Premandible 120–144,128 μ long. Maxilla as in Fig. 7 C, D. Medioventral appendix of prementum (Fig. 7E) 128–144,135 μ long; 76–90,82 μ wide, minimum width at base 37–42,40 μ; maximum width/basal minimum width: 1.90–2.18,2.05. Supporting endoskeleton of appendix 140–152,136 μ wide; 1.33–1.60,1.50 times as wide as the 93–110,98 μ wide median tooth of mentum (Fig. 7F). Mandible (Fig. 7G) 300–344,318 μ long; apical tooth 86–92,87 μ long. Postmentum 354–400,374 μ long.

Abdomen — Procercus 114–136,124 μ high; 38–46,41 μ wide: with 6 apical anal setae 368–466,414 μ(4) long and 2 weak lateral setae. Supraanal setae 80 μ(1) long. Anal tubules triangular; 190–220,202 μ long; 70–104,82 μ wide at base. Posterior parapods 540–638,589 μ(4) long with two kinds of apical claws (Fig. 7H).

THIRD-INSTAR LARVA (N = 1)

Head capsule length 0.47 mm.

Head — Lengths of antennal segments in microns: 42,21,3,7. AR = 1.27. Basal antennal segment 19 μ wide, 2.21 times as long as wide; distance from base to annular organ 2 μ, to basal seta 6 μ, to distal mark of seta 32 μ; blade and accessory blade at apex both 27 μ long. Apical style of second segment 10 μ long, accessory style 5 μ long. Labrum with 8 scales. Premandible 75 μ long. Medioventral appendix of prementum 79 μ long, 50 μ wide; minimum width at base 26 μ, maximum width/minimum width: 1.92. Supporting endoskeleton of appendix 86 μ wide, 1.51 times as wide as the 57 μ wide median tooth of mentum. Mandible 232 μ long, apical tooth 47 μ long. Postmentum 225 μ long.

SECOND-INSTAR LARVA (N = 1)

Length 3.65 mm. Head capsule length 0.25 mm.

Head — Lengths of antennal segments in microns: 12, 17, 2, 5. AR = 0.46. Basal antennal segment 12 μ wide, as long as wide; blade and accessory blade at apex both 21 μ long. Apical style of second segment 6 μ long, accessory style 2 μ long. Mandible 106 μ long, apical tooth 30 μ long. Postmentum 150 μ long.

Abdomen — Procercus 48 μ high, 24 μ wide. Anal tubercles 80 μ long, 40 μ wide at base.

Material Examined

HOLOTYPE: male, Babine Lake, B.C., 18/5/65, A. L. Hamilton (CNC No. 13402). PARATYPES: 6 males, 1 mature pupa, 13 pupal exuviae, 2 larvae (depth 3.5 m), same data as holotype; 1 male, Hay River, N.W.T., 10/9/32, O. Bryant; 2 pupal exuviae, Westbank, Okanagan Lake, B.C., 9/9/69, J. F. Flannagan and O. A. Sæther; 14 larvae depths 13–117 m, Okanagan Lake, B.C., 8-10/9/69, J. F. Flannagan and O. A. Sæther; 4 larvae, depths 37–100 m, Kalamalka Lake, B.C., 11/6/71, J. F. Flannagan and O. A. Sæther.

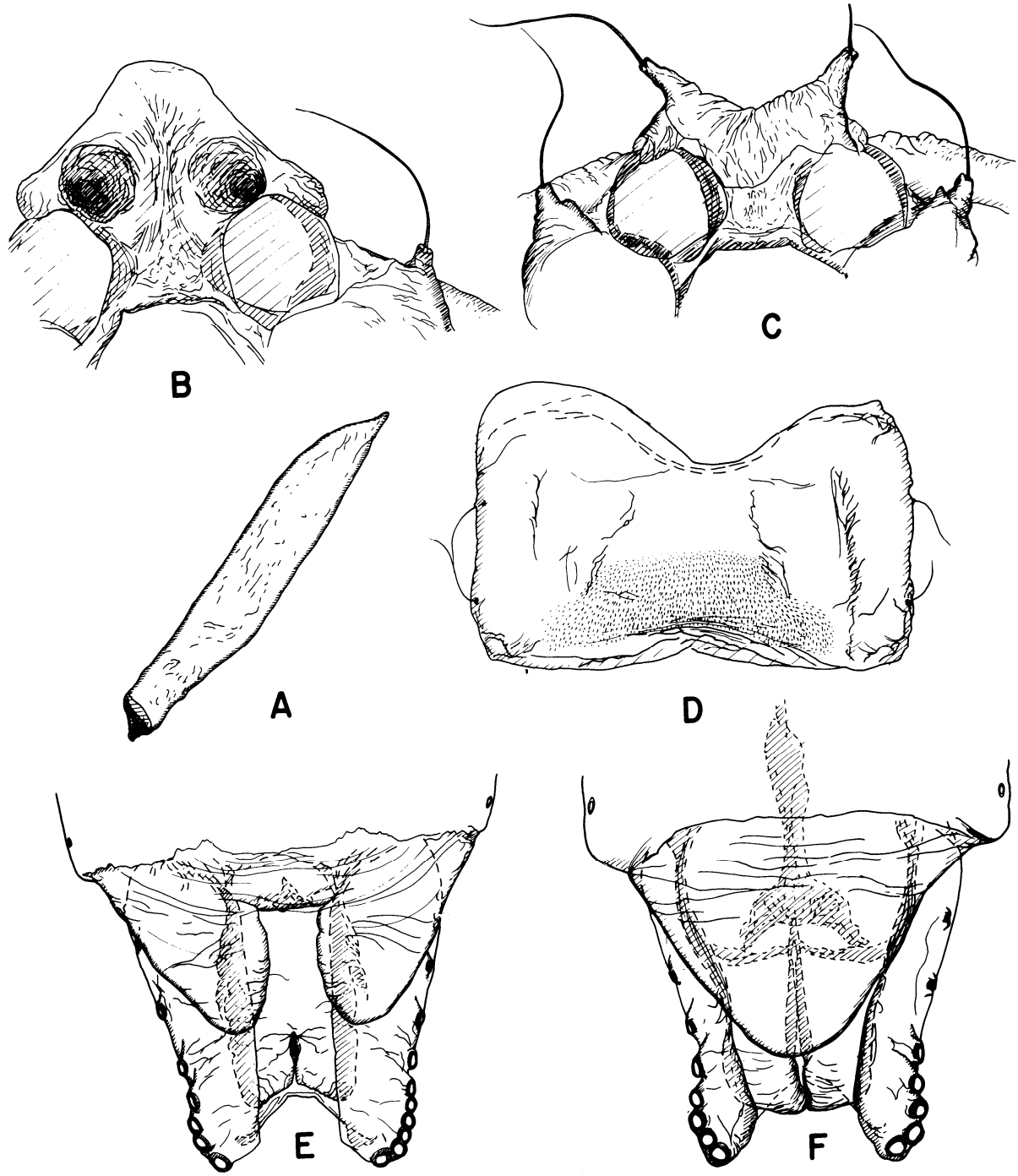

FIG. 6. *Protanypus hamiltoni* n.sp., pupa. A, thoracic horn; B, C, frontal plate, anterior plate, and anterior thoracic tubercle, different views; D, sternite I; E, F, caudal lobes of segment VIII and anal lobe of female (E) and male (F).

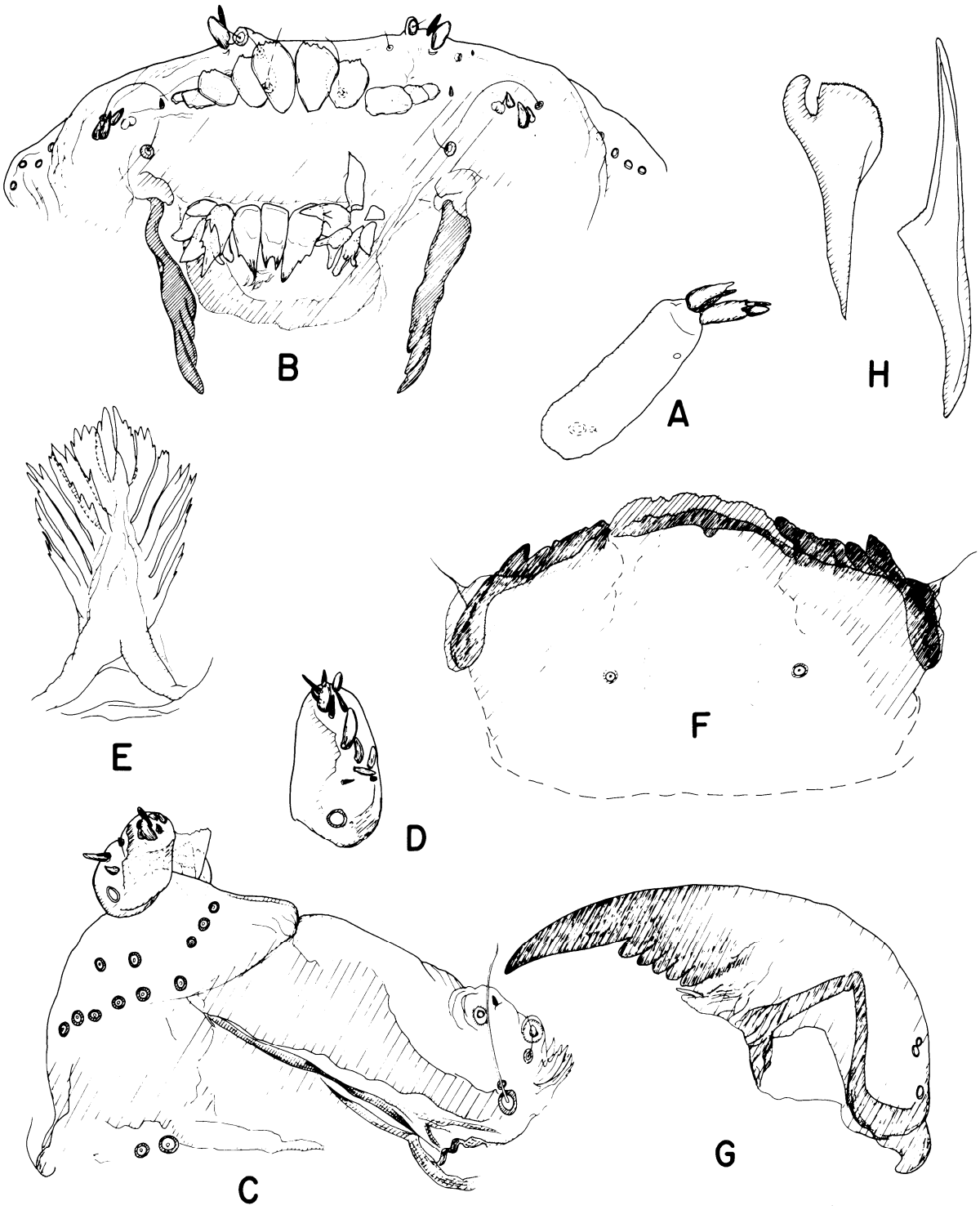

FIG. 7. *Protanypus hamiltoni* n.sp., larva. A, antenna; B, labrum and palatum; C, D, maxilla and maxillary palp, ventral (C) and dorsal view (D); E, medioventral appendix of prementum; F, mentum; G, mandible; H, claws of posterior parapods.

Remarks

The imago of this species as well as that of the preceding species closely resemble *P. forcipatus* (Egg.) from the Alps. *P. forcipatus*, however, according to Brundin (1952, p. 42, fig. 8), does not have microtrichiae on outer surface of the gonostylus, whereas both these species do (in proximal 0.4 in *P. ramosus* n.sp. and in proximal 0.8 in *P. hamiltoni* n.sp.) The leg ratio of the front leg is also mentioned to be only 0.63 in *P. forcipatus* (Brundin 1952, p. 43) while these species have leg ratios of 0.66–0.74. *Protanypus ramosus* n.sp. differs from *P. hamiltoni* n.sp. in the extent of microtrichiae of the gonostylus mentioned above, by having fewer setae on R and R_1, more numerous temporals (60–64 compared to 31–40), presence of distinct group of preoculars, metatarsus of front leg with 7–8 pseudospurs compared to only 2, lower BR_2, and intermedian endomere with a long apical tooth and 1–2 shorter lateral teeth compared to a short apical tooth and 1–2 short and 1 long simple to four-pronged lateral teeth in *P. hamiltoni*.

The pupae of both new species differ from those of *P. caudatus* Edw. and *P. forcipatus* (Brundin 1952, pp. 39, 43) by having the thoracic tubercles about half as large as the frontal tubercles, i.e. intermediate between *P. morio* Zett. and *P. forcipatus* plus *P. caudatus* (Brundin 1952, fig. 10–11), extensive shagreenation also on tergite II, and caudal lobe or lobes of segment VIII not sharply pointed. *Protanypus ramosus* differs from *P. hamiltoni* by having fine spinules on the thoracic horn and by having the posterior band of spinules on sternite I occupying only the posterior ⅕–⅓, while it occupies the posterior ½–⅔ in *P. hamiltoni*.

The larvae of the two new species are nearly identical to one another. They both differ from *Protanypus* sp. A and *Protanypus* sp. B described below by having 11–12 labral scales in fourth-instar larvae (17–22 in the other two species), and by having style of second antennal segment twice as long as the accessory style, while these are equal in *Protanypus* sp. A and the style only slightly longer in *Protanypus* sp. B. *Protanypus ramosus* differs from *P. hamiltoni* by having a lower AR (about 2.2 compared with 2.3–2.7), and by having the medioventral appendix of prementum about 2.4–2.5 times as wide at the widest as at the narrowest part (1.9–2.2 in *P. hamiltoni*). There probably are further differences in the maxillae, labrum, hypopharynx, and epipharyngeal area, but more material needs to be examined.

Protanypus ramosus and *P. hamiltoni* form a species pair possibly geographically separated from one another and forming a sister group of *P. forcipatus* and possibly *P. caudatus*.

Protanypus sp. A

Protanypus sp. A pro parte, Hamilton 1965; 52 (larva, in part).

This larva differs from that of the other three described species by having about 22 labral scales, an AR of only about 2.0 and style of second antennal segment as long as accessory style and only slightly longer than segment 3.

FOURTH-INSTAR LARVA (N = 1)

Length 12.02 mm. Head capsule length 0.92 mm.

Head — Antenna as in Fig. 8A. Lengths of antennal segments in microns: 84, 28, 4, 8. AR = 2.04. Basal antennal segment 28 μ wide, 3.00 times as long as wide, distance from base to annular organ 16 μ, to basal seta 24 μ, blade at apex 29 μ long, accessory blade 26 μ long. Apical style of second segment and accessory style both 5 μ long. Labrum and palatum as in Fig. 8B, labrum with 22 scales. Premandible 124 μ long. Maxilla as in Fig. 8C. Medioventral appendix of prementum (Fig. 8D) 128 μ long, 100 μ wide, minimum width at base 40 μ, maximum width/basal minimum width: 2.50. Supporting endoskeleton of appendix 140 μ wide. Mandible (Fig. 8F) 336 μ long, apical tooth 76 μ long. Postmentum 420 μ long.

Abdomen — Procercus 142 μ high, 44 μ wide, with 6 apical anal setae and 2 weak lateral setae. Anal tubules triangular, 300 μ long, 100 μ wide at base. Posterior parapods 638 μ long with two kinds of apical claws (Fig. 8G).

Material Examined

Two larvae, depths 1–4.5 m, Marion Lake, B.C. 1/4 and 24/6/64, A. L. Hamilton.

Remarks

This larva appears to be closely related to *P. morio* Zett. (Lenz 1925, p. 86, Thienemann 1944, p. 634, Greze 1953, p. 78, Pankratova 1970, p. 60). [The larva described by Zavrel (1926, p. 208) and referred to by Thienemann (1944) as *P. morio* more likely belong to *P. caudatus* [com-

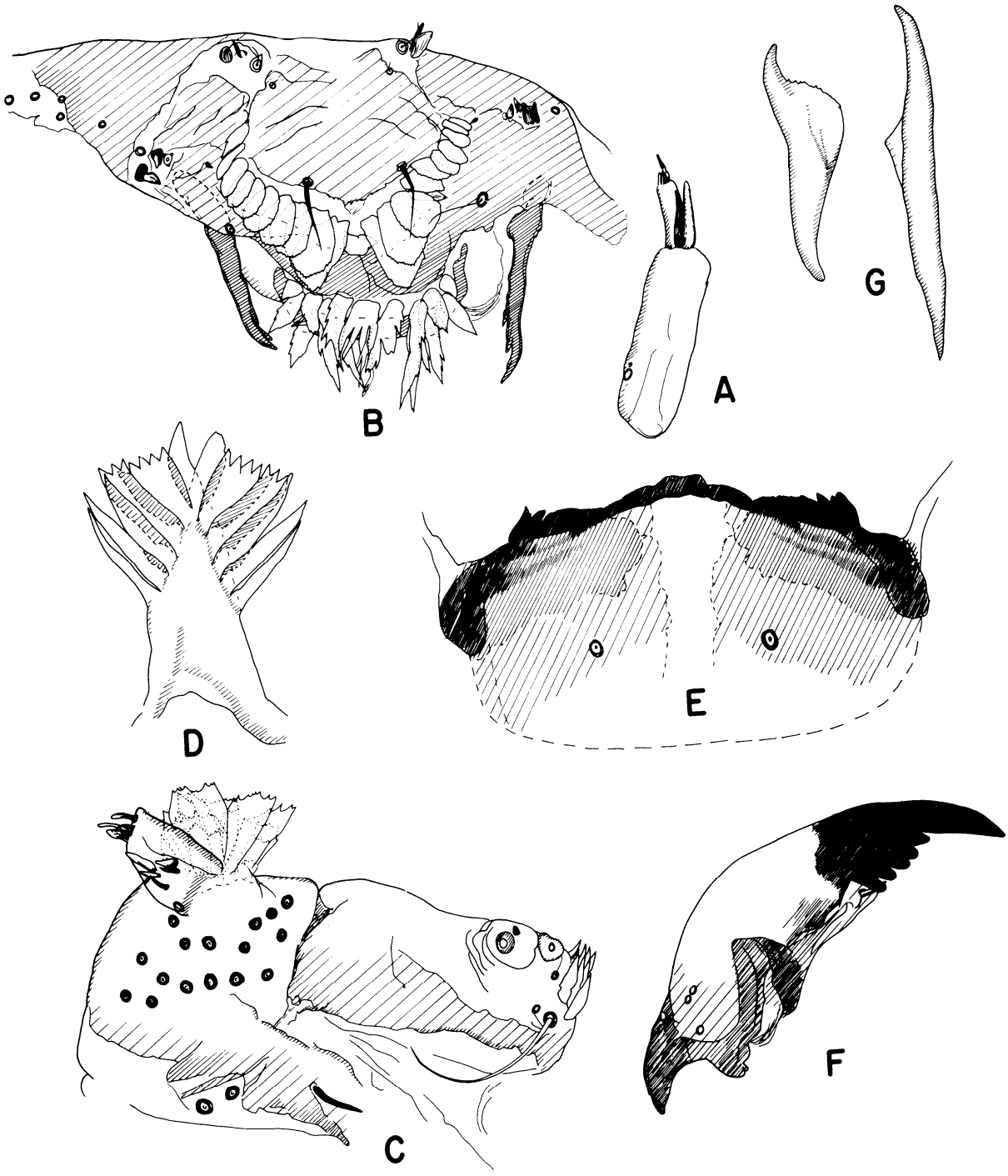

FIG. 8. *Protanypus* sp. A, larva. A, antenna; B, labrum and palatum; C, maxilla ventral view; D, medioventral appendix of prementum; E, mentum; F, mandible; G, claws of posterior parapods.

pare Zavřel (1926, fig. 3B) and Hirvenoja (1973, fig. 24,3).] However, *P. morio* is said to have only about 16–18 labral scales, an AR of about 3, antennal blade as long as the three last segments combined, and, if the tentative identification by Hirvenoja (1973, fig. 24, p. 43) is correct, slightly different medioventral appendix of prementum.

Protanypus sp. B

This larva differs from that of the other three described species by having 17 labral scales, an AR of about 2.9, and style of second antennal segment about 0.8 times as long as segments 3–4 combined and about 1.3 times as long as the accessory style.

FOURTH-INSTAR LARVA (N = 1)

Head capsule length 0.90 mm.

Head — Antenna as in Fig. 9A. Lengths of antennal segments in microns: 100, 25, 5, 7. AR = 2.86. Basal antennal segment 31 μ wide, 3.23 times as long as wide, distance from base to annular organ 8 μ, to basal seta 16 μ, to apical mark of seta 86 μ, blade at apex and accessory blade both 28 μ long. Apical style of second segment 10 μ long, accessory style 8 μ long. Labrum and palatum as in Fig. 9B, labrum with 17 scales. Premandible 110 μ long. Maxilla as in Fig. 9C. Medioventral appendix of prementum (Fig. 9D) 134 μ long, 84 μ wide, minimum width at base 42 μ, maximum width/basal minimum width: 2.00. Supporting endoskeleton of appendix 160 μ wide, and 2.29 times as wide as median tooth of mentum (Fig. 9E). Mandible (Fig. 9F) 286 μ long, apical tooth 86 μ long. Postmentum 384 μ long.

Abdomen – lost.

Material Examined

One larva, depth 17 m, George Lake, La Cloche Mountain Region, Ont., 23–30/9/68, R. J. Beamish.

Remarks

This larva appears to be closely related to *P. morio* Zett. and *Protanypus* sp. A (see p. 381). It differs from *P. morio* in having the antennal blade only slightly longer than second antennal segment and by having serrated median lamellae of medioventral appendix of prementum. *Protanypus* sp. A differs from this species in having 22 labral scales, an AR of about 2.04, apical style and accessory style of second antennal segment equal in length, and smooth median lamellae of medioventral appendix of prementum.

Key to Males of Nearctic and Palaearctic Species of *Protanypus*

1 Part of gonocoxite posterior to gonostylus about 0.5 times as long as gonostylus; gonostylus with microtrichiae on whole outer posterior surface, lateral endomeres smooth, without scales..... ..... *P. morio* Zett. (Palaearctic)

Part of gonocoxite posterior to gonostylus 0.6 times as long to longer than gonostylus; gonostylus void of microtrichiae or with microtrichiae at proximal 0.4 or 0.8–0.9; lateral endomere with scales (not examined in *P. forcipatus*)..... 2

2 Part of gonocoxite posterior to gonostylus longer than gonostylus; outer surface of gonostylus without microtrichiae; LR = 0.76–0.81..... ..... *P. caudatus* Edw. (Holarctic)[1]

Part of gonocoxite posterior to gonostylus about 0.6–0.8 times as long as gonostylus; outer surface with or without microtrichiae; LR = 0.61–0.74..... 3

[1]The males of the Nearctic species called *P. caudatus* by Oliver (1963, p. 177) have not been examined by the author. The females examined, however, have only about 7–10 sensillae chaeticae on the midleg and about 15–20 on the hind leg and the species thus is at least different from *P. ramosus* n.sp. There still is, however, some doubt whether the Nearctic imagines belong to *P. caudatus* or to a new undescribed Nearctic species.

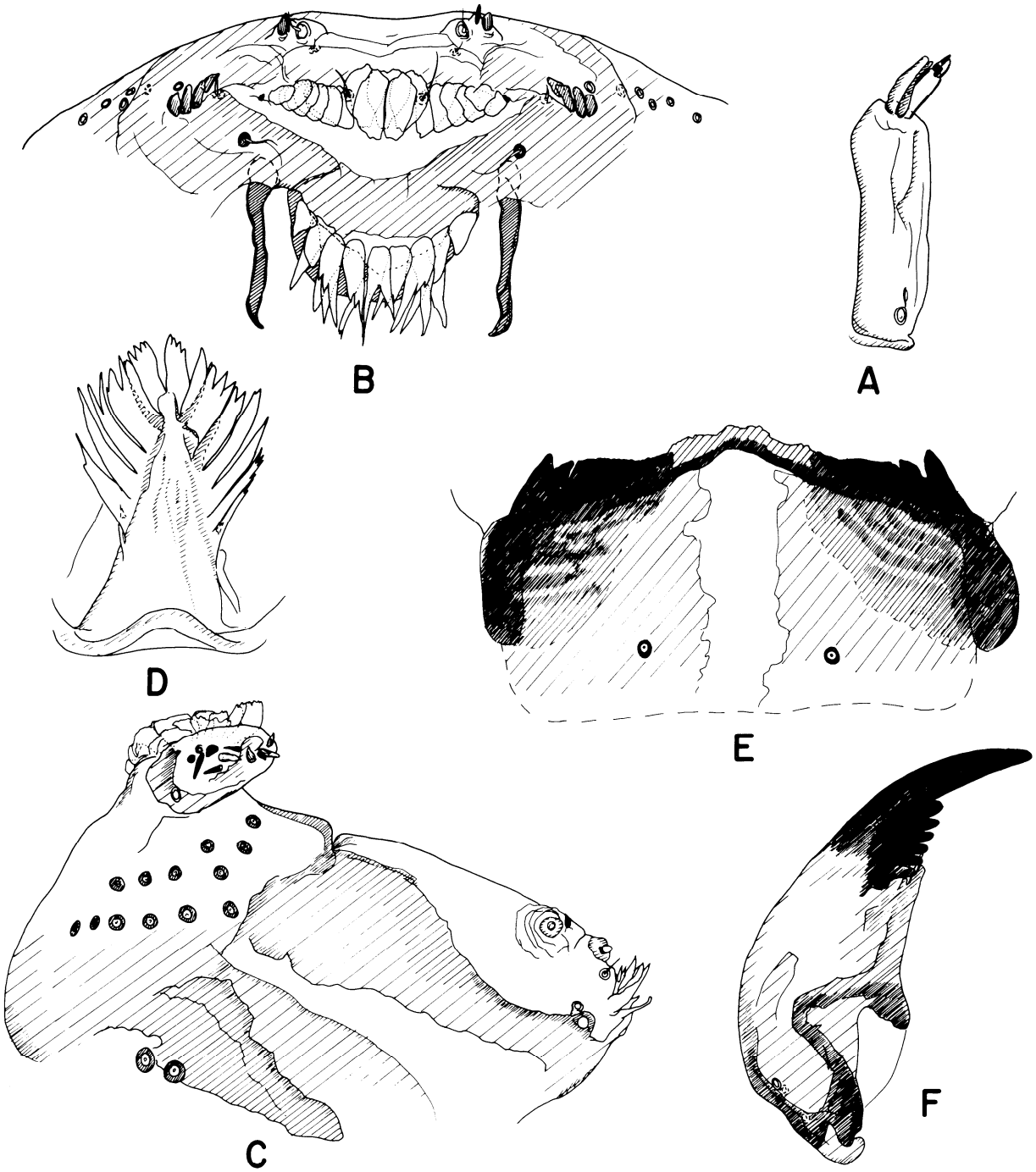

FIG. 9. *Protanypus* sp. B, larva. A, antenna; B, labrum and palatum; C, maxilla, ventral view; D, medioventral appendix of prementum; E, mentum; F, mandible.

3 Gonostylus void of microtrichiae on outer surface..... ..... *P. forcipatus* Egg. (Palaearctic)

Gonostylus with microtrichiae in basal 0.4 or basal 0.8–0.9..... 4

4 Front leg with 7–8 pseudospurs on ta_1, about 60–64 temporals including 2–3 preoculars, R_1 with about 9–12 setae, intermedian endomere with long apical tooth and 1–2 short and simple lateral teeth, gonostylus with microtrichiae in proximal 0.4..... ..... *P. ramosus* n.sp. (Nearctic)

Front leg with 2 apical pseudospurs on ta_1, about 31–40 temporals, preoculars absent, R_1 with 20–26 setae, intermedian endomere with short apical tooth and 1–2 short and 1 long simple to 4-pronged lateral teeth, gonostylus with microtrichiae in proximal 0.8–0.9..... ..... *P. hamiltoni* n.sp. (Nearctic)

Key to Pupae of Nearctic and Palaearctic Species of *Protanypus*

1 Anterior thoracic tubercle about as high and strong as frontal tubercle; shagreenation of tergites strong and extensive; thoracic horn 0.60–0.80 mm long, void of spinules; caudal lobe(s) of segment VIII broad and apically rounded..... *P. morio* Zett. (Palaearctic)

Anterior thoracic tubercle about 0.3–0.5 times as high as frontal tubercle; shagreenation of tergites weaker and less extensive; thoracic horn 0.30–0.70 mm long, with or without spinules; caudal lobe(s) of segment VIII more narrow, apically pointed, rounded or truncate.....2

2 Caudal lobes of segment VIII apically pointed, tergite II practically without shagreenation, tergite III with extensive shagreenation.....3

Caudal lobes of segment VIII apically truncate to rounded, tergite II with shagreenation nearly as extensive as on tergite III.....4

3 Thoracic horn short, at most 0.30 mm long, occasionally with a few distal spinules, but usually void of spinules..... ..... *P. forcipatus* (Egg.) (Palaearctic)

Thoracic horn 0.45–0.60 mm long, with distal spinules..... ..... *P. caudatus* Edw. (Holarctic)[2]

4 Sternite I with thin spinules up to 6 μ long, occupying posterior $\frac{1}{5}$–$\frac{1}{3}$; thoracic horn with weak, scattered spinules; caudal lobe of segment VIII usually apically truncate..... ..... *P. ramosus* n.sp. (Nearctic)

Sternite I with spinules up to 12 μ long, occupying posterior $\frac{1}{2}$–$\frac{2}{3}$; thoracic horn without spinules; caudal lobe of segment VIII apically rounded..... *P. hamiltoni* n.sp. (Nearctic)

Key to Known Larvae of Nearctic and Palaearctic Species of *Protanypus*

1 16–22 labral scales, median lamellae of medioventral appendix of prementum smooth or serrated.. 2

10–12 labral scales, median lamellae of medioventral appendix of prementum serrated.....4

[2]See Footnote 1.

2 About 22 labral scales, AR about 2.2, blade at apex of basal antennal segment only slightly longer than second segment, style and accessory style of second antennal segment both only slightly longer than third segment, median lamellae of medioventral appendix of prementum smooth..... .....*Protanypus* sp. A (Nearctic)

About 16–18 labral scales, AR about 2.9–3.0.....3

3 Blade at apex of basal antennal segment about as long as segments 2–4 combined, median lamellae of medioventral appendix of prementum smooth.....*P. morio* Zett. (Palaearctic)

Blade at apex of basal antennal segment only slightly longer than second segment, style of second antennal segment about 1.3 as long as accessory style and about 0.8 times as long as segments 3–4 combined, median lamellae of medioventral appendix of prementum serrated..... .....*Protanypus* sp. B (Nearctic)

4 AR about 2.0, Holarctic species[3]..... .....*Protanypus* sp.prob. *caudatus* Edw. (Zavřel 1926, p. 208 as *Didiamesa* sp.).

AR about 2.2–2.7, style of second antennal segment about twice as long as accessory style and about as long as segments 3–4 combined, Nearctic species.....5

5 Medioventral appendix of prementum 2.4–2.5 times as wide as the minimum width at base, supporting endoskeleton of appendix 1.6–1.7 times as wide as median tooth of mentum, AR about 2.2 .....*P. ramosus* n.sp. (Nearctic)

Medioventral appendix of prementum 1.9–2.2 times as wide as the minimum width at base, supporting endoskeleton of appendix 1.3–1.6 times as wide as median tooth of mentum, AR = 2.3–2.7 .....*P. hamiltoni* n.sp. (Nearctic)

Distribution and Ecology

While Lenz (1925, p. 94) regarded the Boreoalpine *P. morio* as characteristic for mesotrophic lakes, Brundin (1949, p. 719; 1956, p. 203) showed that the species is most common in oligotrophic lakes. However, weak populations of *P. morio* may occur even in moderately eutrophic lakes, showing that the environment is not too extreme. *Protanypus morio* is bivoltine in Fennoscandia, but is a univoltine spring species in Lake Bodensee, the only certain record from the Alps (Reiss 1968, p. 228).

Protanypus caudatus is so far recorded only from strongly oligotrophic Fennoscandian lakes. However, of the several records of *Protanypus* larvae (see Pagast 1947, p. 561), the specimens from Lake Wigry and Lake Hańcza in northeastern Poland (Zavřel 1926, p. 208) appear to belong to *P. caudatus* according to the description (and not to *P. morio* as suggested by Brundin 1952, p. 43). The main basin of Lake Wigry is moderately oligotrophic, while Lake Hańcza is the most oligotrophic lake in the area. *Protanypus caudatus* is a bivoltine species (Brundin 1949 table 106, 1952 p. 41).

Protanypus forcipatus forms the Alpine sister species of the Boreal *P. caudatus* (Brundin 1952, p. 43). The species has been recorded only from oligotrophic lakes.

The two new Nearctic species are closely related to the species pair *caudatus–forcipatus*, and their ecology may be expected to be similar.

Protanypus ramosus was found at depths of 9–26 m in some of the most oligotrophic and unproductive lakes in the Experimental Lakes Area in Kenora, Ont. (*Protanypus* sp. in Hamilton 1971, p. 262). It is also present in Costello Lake, Algonquin Park, Ont. (*Protanypus* sp. in Miller 1941, p. 39), in South Indian Lake, Man. at 4 m depth, and at a depth of 43 m in Georgian Bay, Lake Huron (Brinkhurst et al. 1968, p. 19 as *Protanypus* cf. *forcipatus*). The larvae of *Protanypus* mentioned by Hiltunen (1969, p. 128) from Lake Superior probably also belong to *P. ramosus*. All these lakes are strongly oligotrophic and range from oligohumic to moderately polyhumic. The species is bivoltine with a strong

[3]See Footnote 1.

spring emergence in the first half of May and an apparently weaker fall emergence from the end of August to the beginning of October.

Protanypus hamiltoni is found in three deep and large oligotrophic lakes in British Columbia, namely Babine, Okanagan, and Kalamalka lakes, and at the shore of Great Slave Lake in the Northwest Territories. In Babine Lake the species was present in the littoral zone from where the only samples taken at the time were collected (Hamilton 1965, p. 55). In Okanagan Lake the species was found at depths of 13–117 m, in Kalamalka Lake at depths of 37–100 m (Sæther 1970, table 6 as *P.* cf. *morio*, Sæther and McLean 1972, table 3 as *P.* cf. *morio*). There may be several reasons why *P. hamiltoni* does not appear in the littoral zones of Okanagan and Kalamalka lakes, whereas it is present in the littoral zone of Babine Lake. One of these may be climatic, Babine Lake being considerably farther north; another may be the presence of pollution in the two other lakes which has affected the littoral zones to a considerable extent while the profundal zone is virtually unchanged. This species is also bivoltine with emergence in May and in September.

Protanypus sp. A. has so far been found only in Marion Lake, B.C. (Hamilton 1965, p. 52), a small and relatively shallow oligotrophic lake. Here it was collected at depths of 1 and 4.5 m.

Protanypus sp. B. has been found only in George Lake, Ont., an oligotrophic lake acidified by sulfur dioxide emitted by the smelters of Sudbury, Ont. (Beamish and Harvey 1972).

The four described species of *Protanypus* thus seem to have the same ecology as their European counterparts and can be regarded as important members of ultra-oligotrophic and moderately oligotrophic benthic communities in North America.

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