



Re-description of the female of *Meropelopia flavifrons* and *Chaetocladius perennis*, and larvae of *Chaetocladius perennis* (Diptera: Chironomidae), with new geographical records from Atlantic Canada

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ABSTRACT

This paper re-describes the female of *Meropelopia flavifrons* (Johannsen), and *Chaetocladius* (*Chaetocladius*) *perennis* (Meigen), and the larva of *Chaetocladius* (*Chaetocladius*) *perennis* (Diptera: Chironomidae) in greater detail than previous taxonomical descriptions. Additionally, new geographical records from Atlantic Canada are provided with descriptions of species in mature and/or immature stages.

RÉSUMÉ

Cet article décrit à nouveau la femelle de *Meropelopia flavifrons* (Johannsen) et de *Chaetocladius* (*Chaetocladius*) *perennis* (Meigen), de même que la larve de *Chaetocladius* (*Chaetocladius*) *perennis* (Diptera : Chironomidae) en plus de détails que les précédentes descriptions taxonomiques. En outre, de nouvelles données de répartition géographique au Canada Atlantique sont présentées, ainsi que la description des espèces dans les stades adultes et/ou immatures.

INTRODUCTION

In Canada, the estimated number of species of Chironomidae is close to 2000 (i.e., described and undescribed) but despite their common occurrence in most freshwater habitats their taxonomy remains, for the most part, poorly described (McAlpine 1979; Oliver and Roussel 1983). Detailed taxonomic descriptions of Chironomidae species with proper illustrations, along with their geographical distribution, are necessary to allow ecologists and taxonomists to identify species, properly construct their phylogenetic relationships, and improve the knowledge of species distributions and life histories (Epler 2001; Andersen 2013). Most chironomid taxonomic literature does not describe the larvae and female in detail. However, the identification of larval stages is required for many ecological investigations, especially those of aquatic ecosystem bio-assessments. Females, though not generally described, are used in phylogenetic reconstruction. Therefore, their descriptions might be considered as necessary as those of males. Along with descriptions of life stages, it is also necessary to report new geographical records or range extensions. Such a more comprehensive approach to species descriptions will not only improve our understanding of Chironomidae biology but will also improve our understanding of the distribution of the Nearctic and the Holarctic taxa in general.

This manuscript is the result of personal collections of Chironomidae larvae and adults from streams and drain-pipe seepages around the cities of Fredericton and Moncton in New Brunswick, and a single visit to New Glasgow, Prince Edward Island. Many adults in this collection were reared from larvae collected at the above locations, including the females of *Chaetocladius* (*Chaetocladius*) *perennis* (Meigen, 1905) and *Meropelopia flavifrons* (Johannsen, 1830). Females of both species have not been described in detail by earlier taxonomists (Walker 1856; Johannsen 1905), creating an opportunity to re-describe these species and their life stages in detail. In addition to these, descriptions of species representing new

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geographical records from Atlantic Canada are provided.

The objective of this study was to improve the knowledge of Chironomidae taxonomy and geographical distribution in Canada. New geographical records are reported for *Meropelopia flavifrons* (Johannsen, 1905), *Pagastia orthogonia* Oliver, 1959, *Prodiamesa olivacea* (Meigen, 1818), *Chaetocladius* (*Chaetocladius*) *perennis* (Meigen, 1830), *Cricotopus* (*Cricotopus*) *bicinctus* (Meigen, 1818), *Metriocnemus* (*Metriocnemus*) *fuscipes* (Meigen, 1818), *Rheocricotopus* (*Psilocricotopus*) *glabricollis* (Meigen, 1830), and *Micropsectra polita* (Malloch, 1919), with additional notes on their ecology.

MATERIAL AND METHODS

Chironomid larvae were collected in the field using a small hand-held net with mesh size of 250 µm, emptied onto a sorting tray, and then hand-picked. Additionally, many larval specimens were collected by scraping and hand-picking boulders and rocks in the aquatic habitats. With the exception of the *Micropsectra polita* males described in this study, all adults were reared from larva individually in a rearing apparatus (Namayandeh and Beresford 2012). Therefore, all stages described in this manuscript are associated with each other. The *Micropsectra polita* adults were obtained in downtown Moncton on white building walls that provided a good contrasting background for capturing specimens.

The total number of specimens measured is indicated as (n) and the measurements presented in this paper represent an average. Geographical records of the species were obtained from Oliver et al. (1990) and Ashe and O'Connor (2009, 2012). Corrections or additional geographical recordings were obtained from previous literature that described the species taxonomy or ecology. *Prodiamesa olivacea* and *Metriocnemus* (*Metriocnemus*) *fuscipes* were originally reported in Canada by Namayandeh et al. (2012). Voucher specimens of species collected were deposited in Canadian National Collection of Insects, Arachnids and Nematodes in Ottawa, ON.

Adults and larvae were cleared and mounted based on methods described by Pinder (1978) and Epler (2001). Images were obtained using a Nikon Digital Sight DS-R11 camera mounted on Leica DM 2500 compound scope and Nikon SMZ 1500 stereoscope.

Initially, descriptions and illustration of these taxa were only made for few morphological characters. Therefore, for consistency and completeness throughout the manuscript, we made detailed comprehensive descriptions of the species. For further detailed diagnosis of species, references

for identification of life stages are given in the discussion section. All taxonomic abbreviations are based on Sæther (1977, 1980).

TAXONOMIC ACCOUNTS

Subfamily Tanypodinae

Meropelopia flavifrons (Johannsen, 1905) (Figures 1 & 2)

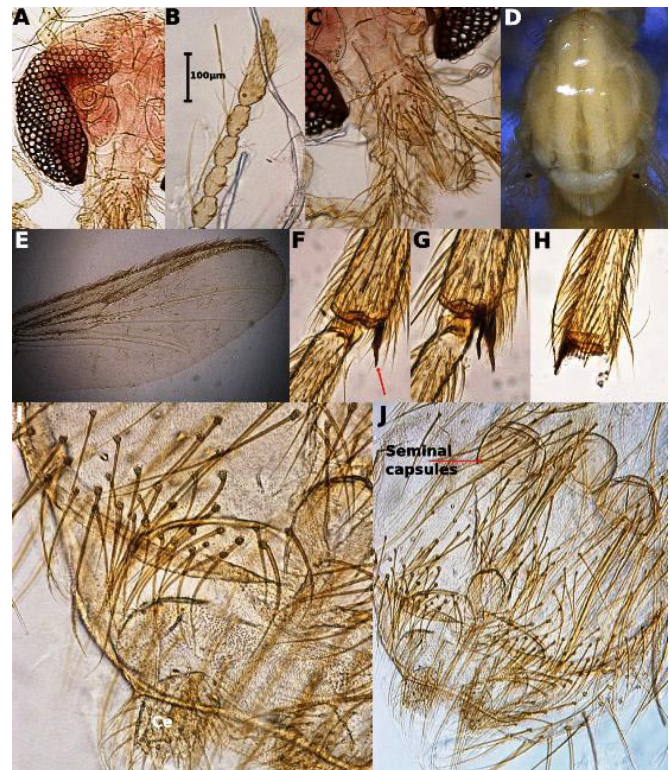


Figure 1. *Meropelopia flavifrons* (Johannsen) female. Eye (A), Last segments of antennae (B), Clypeus and cibarial pump (C), Dorsal view of thorax (D), Wing (E), Fore tibial spurs indicated by arrow (F), Mid tibial spurs (G), Hind tibial spurs and comb (H), Gonocoxapodeme VIII and cercus of female (I), Female genitalia (J).

Material examined

Females reared from larvae collected in an unnamed creek (45°56'56.41"N, 66°38'16.72"W) and a nearby drain-pipe seepage (45°56'48.40"N, 66°38'09.95"W) in Fredericton, New Brunswick, Canada. Pupae are described from the exuviae obtained from the same reared larvae.

Adult Female (re-description) (n = 2)

Preserved female is whitish yellow (TL = 4.8 mm). Eyes bare, with extended dorsomedial extension (Figure 1A). Tentorium L=218.5 µm. Antennae 11 segmented ($L_{1-11} =$



Figure 2: *Meropelopia flavifrons* (Johannsen) pupa. Frontal apotome (A), Thoracic horn (B), Shagreen (C), Abdominal tergites, arrow indicates the median scar (D), Anal lobes of female pupa (E).

118.4, 51.4, 62.0, 60.2, 64.5, 61.6, 62.1, 65.3, 64.2, 184.3 μm), ultimate segment pubescent with long setae, AR = 0.28 (Figure 1B), Clypeus with 26 – 27 long setae, Ls = 124.2 – 174.4 μm (145.4 μm), cornua of cibarial pump rounded at apex (Figure 1C). Palp 5 segmented, (L₁₋₅ = 44.0, 65.2, 90.4, 97.7, 124.1 μm). Thorax with anteprenotal lobes well developed with a small median gap, dorsocentrals present and very long in 2 rows with 44 setae, acrostichals long in 2 rows and with 44 setae, supraalars with 8 setae, prealars with 14 setae and laterals with 14 long setae (Figure 1D). Wings (L = 3.1 mm, W = 0.97 mm), membranes with microtrichia (Figure 1E), Costa ends just adjacent to R₄₊₅ above M₁₊₂, anal lobe very weak, alula bare, squama with 25 setae. Fore tibia with 2 plume-like spines and no comb (L = 60.8 and 83.4 μm ; Figure 1F), mid tibia with 2 plume-like spines and no comb (Ls = 65.3 and 72.1 μm ; Figure 1G), hind tibia with 2 plume-like spines (Ls = 29.5 and 36.0 μm) and well-developed comb (Figure 1H). Abdominal tergites I–VIII with numerous long scattered setae. Gca VIII weakly developed (Figure 1I). Gp VIII small, triangular and rounded at the tip (Figure 1I). GP IX well developed, notum longer than ramus (Figure 1J).

Csa well developed and curved (Figure 1J). Ce diamond shape (L = 74.4 μm , W = 54.0 μm ; Figure 1J). Semicircular seminal capsules (L = 102.2 μm , W = 93.1 μm , Figure 1J). Leg lengths and ratios are shown in Table 1.

Pupa (n = 2)

Pupa is brownish-yellow (L = 6.4 mm). Frontal apotome (Figure 2A). Thoracic horn trumpet shaped (L = 351.2 μm , W_{base} = 48.0 μm , W_{mid} = 98.0 μm , W_{tip} = 142.0 μm) (Figure 2B), respiratory atrium sinuated and expanded apically, plastron plate well developed (L = 153.3 μm , W = 95.3 μm). Elongate median scars on segment I (Figure 2C), shagreen (Figure 2D), 4 LS setae on segments VII and 5 LS setae on VIII (Figure 2E). 2 long anal macrosetae on each anal lobe, macrosetae L = 418 μm . Female genital sacs not reaching the apex of anal lobes, L_{from base} = 152.0 μm (Figure 2E).

Ecology and habitat

Larvae of this species occur in springs, streams, and rivers. Larvae have an optimum pH of 6.05 and temperature of 14.4 °C (Roback 1981).

Nearctic distribution

CANADA: Alberta, Quebec, New Brunswick (first record), Saskatchewan. **USA:** Alaska, California, Connecticut, Florida, Georgia, Idaho, Michigan, New Hampshire, New Jersey, New York, Pennsylvania, South Carolina, and Washington.

Discussion

Johannsen (1905) originally described the female. The adult male is described by Johannsen (1905) as *Ablabesmyia flavifrons*. Only female coloration provided by Johannsen (1905). Roback (1958) described the male and pupa of this species as *Pentaneura alba*. Beck and Beck (1966) described the male and larva of this species as *Arctopelopia fittkaui*. Sublette and Sasa (1994) described the pupa of this species as *Meropelopia* sp. Pupa of this species is described by Roback (1981).

Subfamily Diamesinae

Pagastia orthogonia Oliver, 1959 (Figure 3)

Material examined

Fourth-instar larva (n = 2) is described from the specimens obtained in New Glasgow, Prince Edward Island (46° 21' 28.78"N, 63° 20' 56.40"W). Larvae L = 7.2 mm (Figure 3A). Preserved larval head light yellow, head capsule elongated

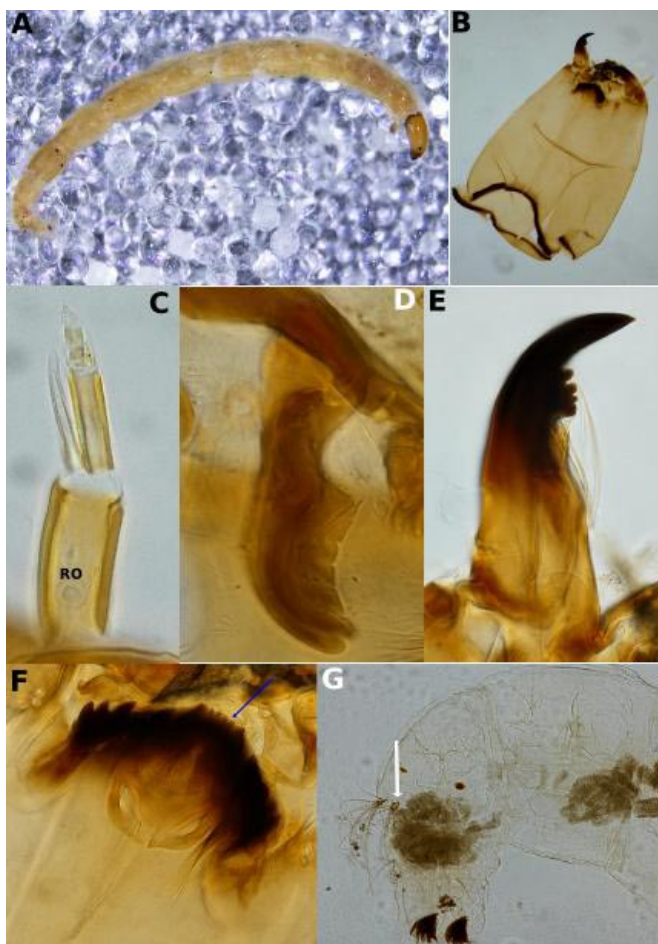


Figure 3: *Pagastia orthogonia* Oliver larva. Larva (A), Head (B), Antennae (C), Premandible (D), Mandible (E), Mentum, arrow indicates the median projections (F), Posterior portion of the body, arrow indicates the procercus (G).

(Figure 3B), HL/HW = 1.85. Antennae 5 segmented, 5th segment longer than 4th, 3rd segment annulated (Figure 3C), blade shorter than flagellum reaching the base of 3rd segment (L = 20.8 µm), B₂ (L = 9.7 µm), RO at the basal 1/3rd of the 1st segment, AR = 1.0; SI–SIII simple. Pecten epipharyngis with 3 narrow scales. Premandible (L = 75.3 µm) with 5 teeth and small spine (Figure 3D). Mandible (L = 168.4 µm) with elongated apical tooth and 4 square-shaped inner teeth (Figure 3E), SSd small, setae interna with 5 simple branches. Mentum (L = 110.5 µm, W = 66.0 µm) with no median teeth but with 4 – 6 projections and 6 – 7 lateral teeth (Figure 3F), VmP is well developed covering the lateral teeth (Figure 3F). Claws of anterior parapods serrated. Body with long scattered setae, setae Ls = 66.7 – 141.3 µm. Procercus (L = 16.4 µm, W = 12.6 µm) is well sclerotized each with

7 – 8 apical setae and 2 subapical setae (Figure 3G), apical setae L = 224.4 µm, sub-apical setae L = 69.0 µm.

Ecology and habitat

Larvae of *Pagastia* species inhabit small streams.

Nearctic distribution

CANADA: First record, Prince Edward Island.
USA: Alaska, Georgia, Michigan, North Carolina, North Dakota, Ohio, and Tennessee.

Discussion

Epler (2001) suggested that *Pagastia orthogonia* is the only known species from the southeastern USA. The teeth of the mentum are often difficult to detect because of the dark and over-bearing VmP. Epler (2001) also indicated that the mandible is similar to that of the western Nearctic species *Pagastia sequax* (Garrett). The lack of markings on the head capsule separates the larvae from those of *Pagastia sequax*. AR is <1.2, which separates this larvae from other known Holarctic species (Makarchenko and Makarchenko 2000). Figures of larvae can be found in Makarchenko and Makarchenko (2000) and Epler (2001).

Subfamily Prodiamesinae

Prodiamesa olivacea (Meigen, 1818) (Figure 4)

Material examined

Fourth-instar larva (n = 2) is described from the specimens collected in unnamed drain pipe seepage in Fredericton, New Brunswick, Canada (45° 56' 48.40"N, 66° 38' 09.95"W). Preserved larva is greyish white, L = 2.6 cm (Figure 4A). Head yellowish brown with postmentum areas dark, HL/HW = 1.1 (Figure 4B). Antennae 4 segmented (Figure 4C), RO at the basal 1/4th of the 1st segment, AR = 2.8. SI pectinate, SII and SIII simple. Premandible bifid (Figure 4D), brush weak, premandible L = 137.2 µm. Mandible with 1 apical tooth and 4 inner teeth (Figure 4E), mandible L = 248.0 µm. Mentum (L = 83.0 µm, W = 210.0 µm with a bifid receded median tooth, and 8 lateral teeth, 1st – 3rd laterals attached and forming a tripartite tooth, 7th lateral longer than 6th (Figure 4B), VmP well developed with numerous setae, VML = 83.4 µm, VMW = 147.0 µm. Procercus (L = 56.4 µm, W = 44.4 µm) well sclerotized, longer than wide each bearing 8 apical setae and 2 subapical setae (Figure 4F). Posterior portion with up to 8 long basal setae (Figure 4F). Posterior parapods (L = 320.5 µm, W = 250.6 µm) longer than wide, bearing simple dark brown claws (Figure 4F).

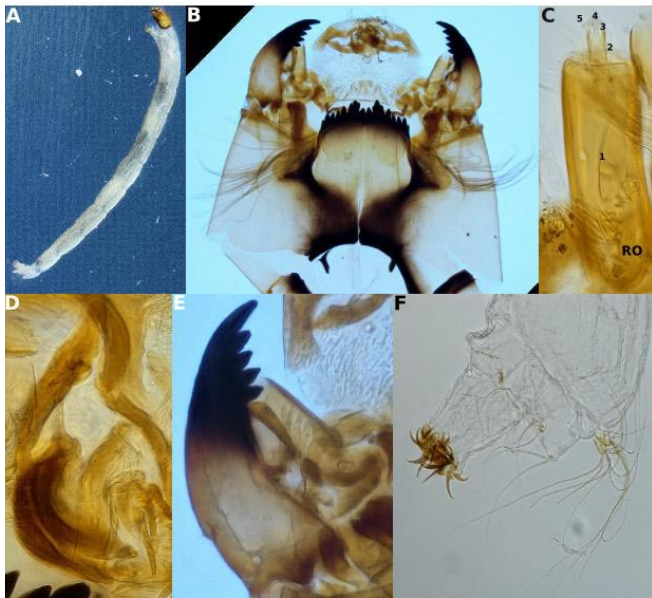


Figure 4: *Prodiamesa olivacea* (Meigen) larva. Larva (A), Head, mentum and postmentum (B), Antennae (C), Premandible (D), Mandibles (E), Posterior portion of the body (F).

Ecology and habitat

An inhabitant of springs, rivers, streams and littoral zone of lakes, this species can tolerate moderate pollution (Epler 2001; Sæther and Andersen 2013). Larvae are reported to be common in sandy or silted sediments of slow flowing streams (Epler 2001; Sæther and Andersen 2013). In this study larvae were found in silted sediments of seepages.

Nearctic distribution

CANADA: Ontario, New Brunswick (first record). **GREENLAND.** **USA:** Colorado, Georgia, Maine, Massachusetts, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, South Carolina, and Tennessee.

Discussion

This species is widespread in USA. It is likely that this species also has a wide distribution in central and eastern Canada. The larva is described by Moller Pillot (1984) and Makarchenko (1985).

Subfamily Orthocladiinae

Chaetocladius (*Chaetocladius*) *perennis* (Meigen, 1830) (Figures 5-8)

Material examined

Adult reared individually from larvae collected in an unnamed creek (45°56'56.41"N, 66°38'16.72"W) and a nearby drain pipe seepage (45°56'48.40"N, 66°38'09.95"W) in Fredericton, New Brunswick, Canada. Pupa is described from exuviae obtained from the same reared larva.

Adult Male (n = 1)

Preserved male head is brown (Figure 5A), thorax with dorsocentral, scutum, postnotum, preepisternum, and anepisternum regions dark brown, rest lighter (yellowish in preserved specimen), wings are grey, tergites greyish green, sternite I white, sternites II – VIII medially greyish green. Male TL = 4.3 mm. Eyes are very faintly pubescent, with extended dorsomedial extension (Figure 5A). Antennae 13 segmented ($L_{1-13} = 60.7, 43.0, 34.5, 28.1, 31.7, 33.8, 36.2, 36.1, 39.7, 34.2, 37.8, 39.7, 575.7 \mu\text{m}$), groove starts on second segment, AR = 1.3 (Figure 5B). Single rows of 12–13 temporal setae on each side of the head. Tentorium L = 131.5 μm (Figure 5C). Clypeus with 10 long setae $L_s = 79.6 - 101.3 \mu\text{m}$ (92.0 μm), cornua of cibarial pump pointed (Figure 5D). Palp 5 segmented (Figure 5B), ($L_{1-5} = 48.7, 58.0, 153.6, 128.1, 239.0 \mu\text{m}$), 7 sensilla clavata are detectable on 3rd segment, L = 18.3 μm (Figure 5E). Anteroproxonum well developed with median gap (Figure 5F), dorsocentrals long in single rows with 12 setae (Figures 5F & 5G), acrostichals very short, scutum with single row of 10 setae (Figure 5F), prealars with row of 5 setae on each side. Wings (L = 2.5 mm, W = 0.62 mm) with microtrichia and fine punctuation, costa extending to R_{4+5} , R_{2+3} runs to midway between R_1 and R_{4+5} , Cu_1 slightly sinuated, R with 18 setae, R_1 with 4 setae, R_{4+5} with 4 setae, squama with 10 setae. Fore tibia with single spur (L = 79.7 μm) and no comb, mid tibia with 2 spurs ($L_s = 35.6 \mu\text{m}$ and 39.0 μm) and no comb, hind tibia with 2 spurs ($L_s = 34.3$ and 71.5 μm) and well-developed comb (Figure 5H), lateral spines on all tibia spurs divergent from the shaft, pseudospurs present on mid and hind legs ta_1 (Figure 5I). Tergites I – VIII and sternites V – VIII with numerous setae (Figures 5J & 5K). Anal point triangular with the tip round, extending just to the inferior volsella, L = 31.2 μm . Inferior volsella well developed, large and lobed (Figure 5L). Gonocoxite L = 230.6 μm , gonostylus L = 102.2 μm , gonostylus racket shaped with anterior portion narrow, gradually expanding in size to mid-point, widest in mid-point and slightly decreasing in size towards the apex (Figure 5L), megasetae L = 12.5 μm ; HR = 2.3, HV = 4.1. Leg length and ratios are shown in Table 1.

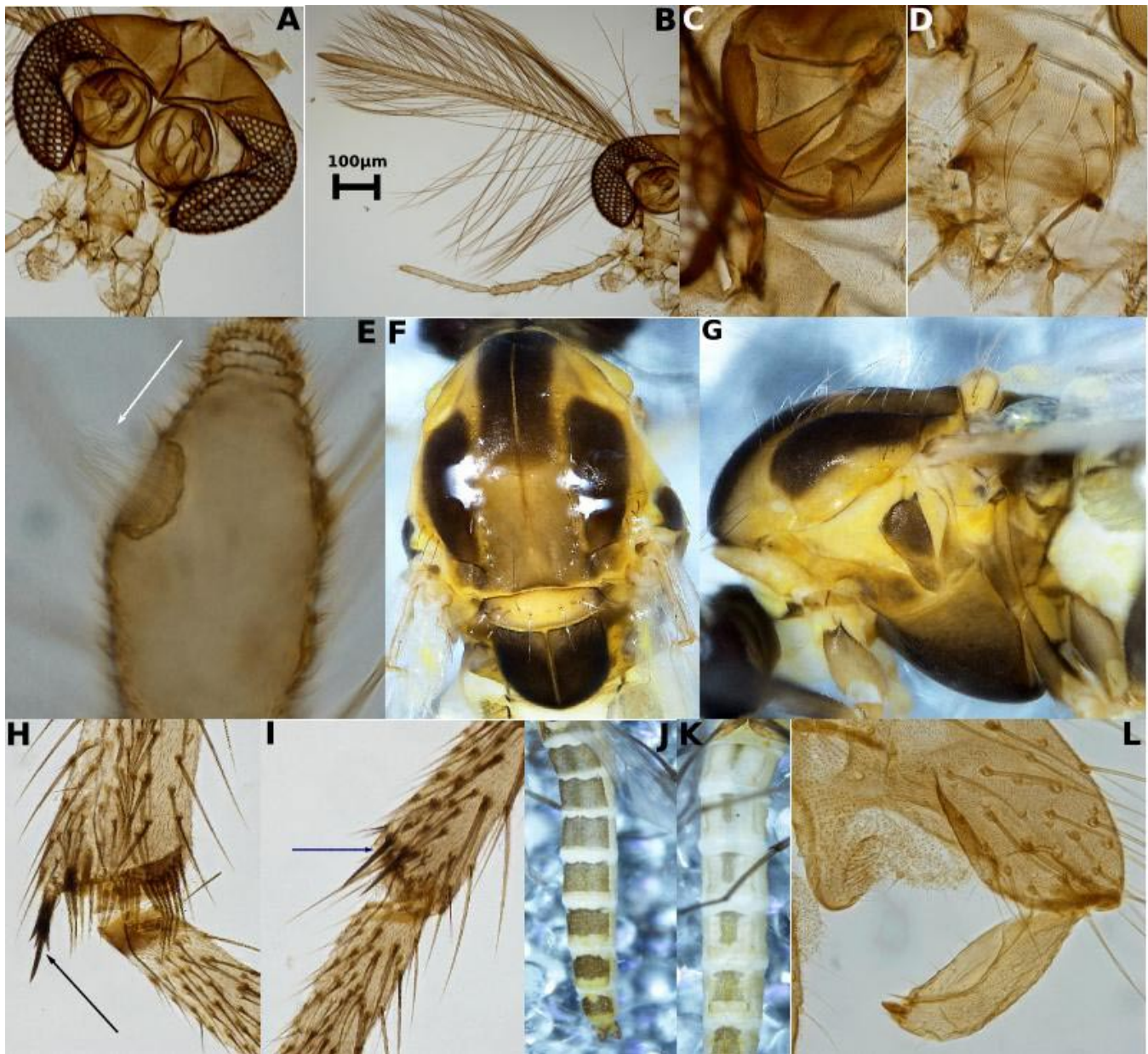


Figure 5: *Chaetocladius (Chaetocladius) perennis* (Meigen) male. Head and eyes (A), Antennae and palp (B), Tentorium (C), Clypeus and cibarial pump (D), Sensilla clavata on 3rd palp segment (E), Dorsal view of thorax (F), Lateral view of thorax (G), Hind tibial spurs (arrow) and comb (H), Psuedospurs (arrow) of legs ta (I), Abdominal tergites (J), Abdominal sternites (K), Male genitalia, inferior volsella, gonocoxite and gonostylus (L).

Adult Female (re-description) (n = 2)

Thorax light in preserved specimen with dorsocentral, postnotum, preepisternum, and anepisternum regions dark brown, scutum white, wings grey, tergites I – VIII yellowish-white with patches of grey antrolaterally, sternites I – VIII white medially and yellow laterally. Female TL = 4.7 mm. Single rows of 12 – 13 temporal setae on each

side of the head. Eyes bare, with very weak dorsomedial extension (Figure 6A). Antenna 5 segmented ($L_{1-5} = 72.0, 42.0, 43.9, 48.5, 159.8 \mu\text{m}$), ultimate segment with 10 – 12 setae, AR = 0.78 (Figure 6B). Tentorium L = 168.6 μm (Figure 6C). Clypeus with 10 long setae $L_s = 65.3 - 87.4 \mu\text{m}$ (75.6 μm), cornua of cibarial pump pointed (Figure 6D). Palp 5 segmented ($L_{1-5} = 46.9, 65.6, 128.2, 128.3 \mu, 152.0$

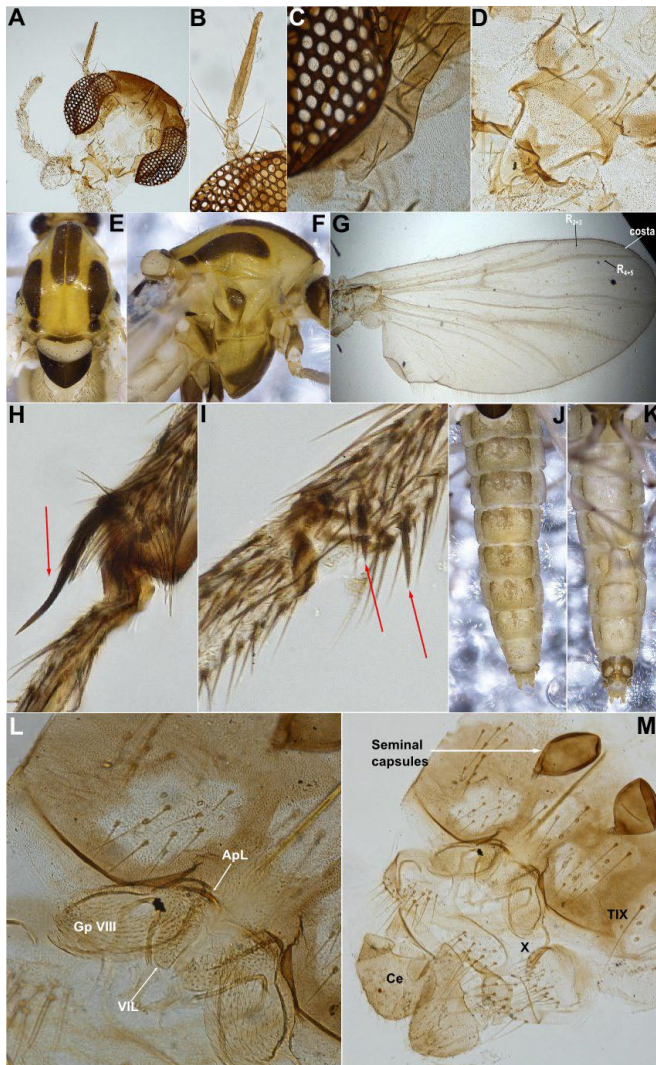


Figure 6: *Chaetocladius (Chaetocladius) perennis* (Meigen) female. Head, eyes and palp (A), Last antennal segments (B), Tentorium (C), Clypeus and cibarial pump (D), Dorsal view of thorax (E), Lateral view of the thorax (F), Wing (G), Hind tibial spurs (arrow) and comb (H), Pseudospurs (arrows) of legs ta_1 (I), Abdominal tergites (J), Abdominal sternites (K), Lobes of gonopophysis VIII (L), Ventral view of female genitalia (M).

μm) (Figure 6A). Anteropronotum well developed with median gap (Figure 6F), dorsocentrals present in single rows of 12 – 13 long setae (Figure 6E), acrostichals present and short, scutum with an uneven row of 18 setae (Figure 6E). Wings ($L = 2.6 \text{ mm}$, $W = 0.78 \text{ mm}$) with microtrichia and fine punctuation (Figure 6G), costa extending to R_{4+5} , R_{2+3} runs to midway between R_1 and R_{4+5} , Cu_1 sinuated, R with 12 setae, R_1 with 10 setae, R_{4+5} with 7 setae, squama

with 14 setae. Fore tibia with single spur ($L = 63.5 \mu\text{m}$) and no comb, mid tibia with 2 spurs ($Ls = 36.1$ and $42.0 \mu\text{m}$) and no comb, hind tibia with 2 spurs ($Ls = 39.0$ and $95.1 \mu\text{m}$) and well-developed comb (Figure 6H), lateral spines on all tibia spurs diverged from the shaft, pseudospurs present on mid and hind ta_1 (Figure 6I). Tergites I – VIII with scattered long setae, few long setae on sternites III – VIII (Figures 6 J-K). GP VIII divided into ventrolateral lobe and small dorsomesal lobe, ApL and VIL as in (Figure 6L). Gc IX well developed with 22 long setae, $Ls = 23.5 \mu\text{m} - 106.2 \mu\text{m}$ ($60.5 \mu\text{m}$). T IX undivided except at caudal cavity, T IX with 3 white patches bearing long setae (Figure 6M). Segment X with 2 white patches each bearing 12-13 long setae. Ce pediform (Figure 6M), $L = 188.2 \mu\text{m}$, $W = 101.2 \mu\text{m}$. Seminal capsules semi-circular with no neck (Figure 6M), $L = 101.1 \mu\text{m}$, $W = 80.1 \mu\text{m}$. Leg length and ratios are shown in Table 1.

Pupa (n = 2)

Pupa $L = 5.0 \text{ mm}$. Frontal apotome (Figure 7A), frontal setae $L = 83.3 \mu\text{m}$. Thoracic horn elongated 7 X as long as wide ($L = 226.0 \mu\text{m}$; Figure 7B), spinules running from stem to tip of the horn, $Pc_{1-3} L = 74.0, 116.7, 110.5 \mu\text{m}$. Segment I bare, with no shagreen, segments II – VIII with shagreen (Figure 7C), segment I with 3 L setae and 5D setae, segments II – VII with 4 L setae and with every two of these setae spine like and on tubercles (Figure 7C), segment II – VIII with single row of recurved spines posteriorly (Figure 7C). Anal lobes with 2 spine-like macrosetae $L = 126.7 \mu\text{m}$, genital sacs longer than anal lobes in male (Figure 7D).

Fourth-instar larva (n = 5)

Larvae $L = 6.5 \text{ mm}$ (Figure 8A). Head capsule yellow with occipital margins dark brown, $HW/HL = 0.91$. Antennae 5 segmented, 4th segment longer than 3rd segment, RO on basal 1/4th of 1st segment (Figure 8B), blade reaching the tip of 4th segment ($L = 20.0 \mu\text{m}$), $B_2 (L = 6.8 \mu\text{m})$, $AR = 2.0$. SI plumose (Figure 8C), SII – SIII simple, SIII lamellated. Labral lamellae present, rounded on outer margin with pectinate tips (Figure 8D). Premandible ($L = 75.0 \mu\text{m}$) bifid with accessory tooth (Figure 8E). Mandible ($L = 114.1 \mu\text{m}$) with 1 apical and 4 inner teeth (Figure 8F), SSd pincer-like, setae interna with 6 serrated branches, $A_1/M = 0.4$. Mentum ($L = 67.0 \mu\text{m}$, $W = 142.0 \mu\text{m}$) with a wide bifid median teeth that could also be notched or simple (i.e., if worn) and 5 pairs of lateral teeth (Figures 8G & 8H), median teeth sits lower than 1st laterals and slightly lighter, VmP large and prominent not extending beyond mentum's margins (Figure 8H), VmP ($L = 48.3 \mu\text{m}$, $W = 9.1 \mu\text{m}$), SSm sits just

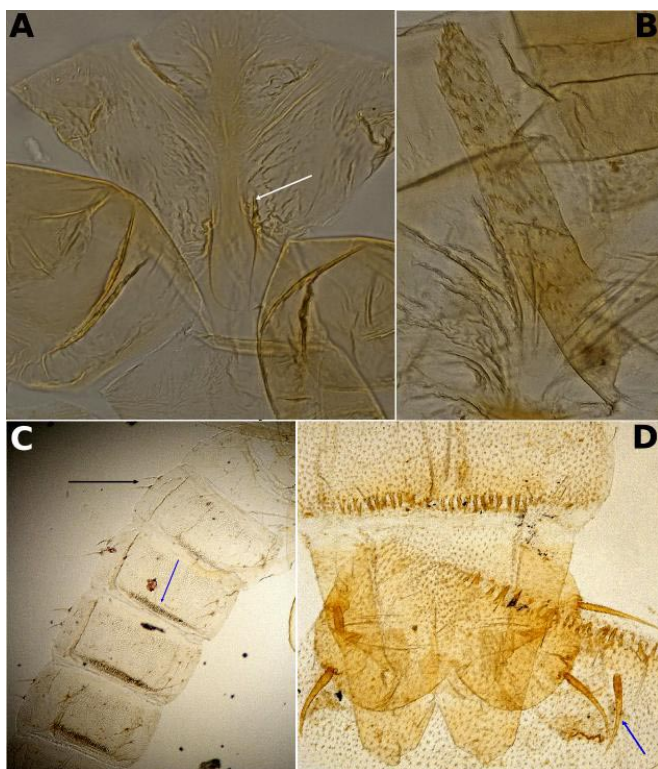


Figure 7: *Chaetocladius (Chaetocladius) perennis* (Meigen) pupa. Fron, arrow indicates the frontal setae (A), Thoracic horn (B), Abdominal tergites I-V, black arrow indicates the 2 spine like L setae with tubercles and blue arrow indicates the recurving spines (C), Anal lobes and genital sacs, arrow indicates the macrosetae torn from left anal lobe (D).

below the mentum. Procercus (L = 25.0 µm, W = 15.3 µm) well sclerotized and longer than wide bearing 6 apical setae (Figure 8I), anal setae L = 233.0 µm. Posterior parapods (L = 174.0 µm, W = 90.0 µm) longer than wide, bearing group of simple light brown claws (Figure 8I); 2 dorsal anal tubules longer than the 2 ventral anal tubules (Figure 8I), dorsal tubules L = 82.1 µm, ventral tubules L = 48.3 µm.

Ecology and habitat

Orendt (1990) reported the larvae of this species to be tolerant of extreme acidity in waters. In this study larvae were collected on masses of algae attached to rocks in streams.

Nearctic distribution

CANADA: New Brunswick (first record), Northwest Territories; **USA:** Alaska.

Discussion

Walker (1856) originally described the female. The male

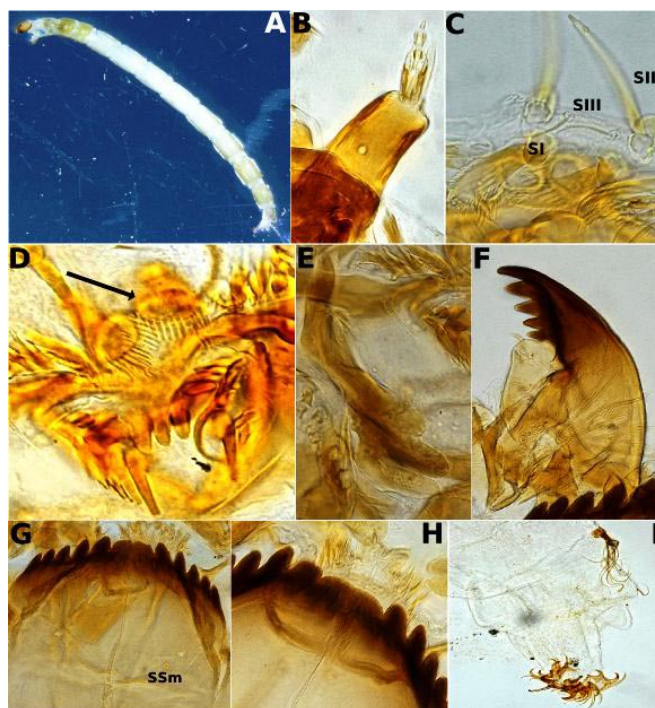


Figure 8: *Chaetocladius (Chaetocladius) perennis* (Meigen) larva. Larva (A), Antennae (B), Labrum (C), Labral lamellae, arrow (D), Premandible (E), Mandible (F), Mentum (G), Mentum variations, worn with notch (H), Posterior portion of the larva (I).

genitalia were described by Brundin (1956) and Pinder (1978). A detailed male description was given by Sæther (2004) based on Chironomidae described by Lundström (1915). The single male specimen reared in this study is larger than the male described by Sæther (2004) and therefore, the HV is higher than male described by Sæther (2004). Sæther (2004) indicated that type specimens of *Chaetocladius (Chaetocladius) perennis* have not been examined in detail; therefore, large variation may exist with respect to leg ratios and other morphological features of the adult. At least 7 sensilla clavata were detectable on the 3rd palpal segment (Figure 5E) compared to the 3 detected by Sæther (2004).

Walker (1856) described the female coloration with no detailed taxonomic description and no illustrations. Kieffer and Thienemann (1908) described the female as *Dactylocladius setiger* with no illustration. Kieffer in Thienemann and Kieffer (1944) described the female as *Dactylocladius trinotatus* with no illustration. The pupa was described by Thienemann (1944) as *Dyscamptocladius perennis* and by Pankratova (1970). Larvae SI and labral lamellae were described by Anderson et al. (2013). Thienemann (1936) originally put the larvae in *vitellinus*

group. Plumose labral lamella or labral lamella with apical setae separates *vitellinus* group from other groups in this genus. The mentum of this species is similar to *Chaetocladius* (*Chaetocladius*) *piger* (Goetghebuer, 1913); however, 2 median teeth sit slightly lower than the first lateral teeth in *Chaetocladius* (*Chaetocladius*) *perennis* compared to that of *Chaetocladius* (*Chaetocladius*) *piger*. Labral lamella is simple and SI is serrated in *Chaetocladius* (*Chaetocladius*) *piger* whereas *Chaetocladius* (*Chaetocladius*) *perennis* has a pectinate labral lamella with plumose SI.

***Cricotopus* (*Cricotopus*) *bicinctus* (Meigen, 1818)**
(Figure 9)

Material examined

Fourth-instar larva (n = 2) is described from specimens obtained in New Glasgow, Prince Edward Island (46° 21' 28.78"N, 63° 20' 56.40"W). Larvae L = 6.0 mm (Figure 9A). Larvae head capsule yellowish brown with occipital margins dark brown (Figure 9B), HL/HW = 0.9. Antennae 5 segmented, segments sequentially decrease in size (Figure 9C), LO prominent covering most of 3rd segment, blade shorter than flagellum L = 25.1 µm, B₂ (L = 9.2 µm), RO at the basal 1/8th of the 1st segment, AR = 1.8. SI bifid, SII – SIII simple. Pecten epipharyngis with 3 almost equal sized scales (Figure 9D). Premandible simple (Figure 9D), premandible L = 94.3 µm. Mandible with 1 apical and 3 inner teeth, outer ridge roguers and inner ridge with spines (Figure 9E), SSd prominent, setae interna with 6 branches, 3 branches serrated and 3 simple, mandible L = 153.0 µm, A₁/M = 0.40. Mentum with 1 wide median tooth and 6 pairs of lateral teeth (Figure 9F), median and the 1st two lateral teeth slightly lighter in color than other lateral teeth, VmP narrow, SSm posteriad to mentum (L = 78.2 µm, W = 161.2 µm), median tooth L = 29.0 µm. Procercus (L = 31.3 µm, W = 23.1 µm) well-sclerotized, longer than wide and bearing 6 apical setae, apical setae L = 475.3 µm (Figure 9G). Posterior parapods (L = 189.1 µm, W = 114.3 µm) longer than wide bearing group of simple light brown claws. 2 dorsal anal tubules longer than the 2 ventral tubules and posterior parapods (Figure 9G).

Ecology and habitats

Larvae are tolerant of high chromium, cyanide, copper, and zinc toxicity and also of low oxygen concentrations (Surber 1959; Winner et al. 1990). Additionally, the larvae were reported to be abundant in areas with crude oil contamination (Rosenberg et al. 1977a). Larvae of this species occur in almost all aquatic habitats including rice



Figure 9: *Cricotopus* (*Cricotopus*) *bicinctus* (Meigen) larva. Larva (A), Head (B), Antennae (C), Labrum, pecten epipharyngis (arrow) and premandible (D), Mandible, arrows indicate the inner serration (E), Mentum (F), Posterior portion of the larva (G), Larval tubes (arrows) on conditioned leaf of *Solanum dulcamara* (Linnaeus) (H).

fields and are usually associated with masses of *Spirogyra* algae, which form their diet along with desmids and diatoms (Darby 1962). The species is multivoltine with peak emergences in June, July and August (Rosenberg et al. 1977b). In this study, larvae of *Cricotopus* (*Cricotopus*) *bicinctus* were observed tube-making on the conditioned submerged leaves of *Solanum dulcamara* (Linnaeus) (Figure 9H).

Nearctic distribution

CANADA: Alberta, Manitoba, New Brunswick, Newfoundland and Labrador, Northwest Territories, Nunavut, Ontario, Prince Edward Island (first record), Saskatchewan, and Yukon Territory. **USA:** Alabama, Alaska, Arkansas, California, Florida, Georgia, Louisiana,

Maine, Michigan, Minnesota, New Mexico, New York, North Carolina, Ohio, Pennsylvania, South Carolina, South Dakota, and Tennessee. **MEXICO:** Mexico State.

Discussion

Larva of this species was described by Hirvenoja (1973) and by Oliver (1977). This species is widespread in the Holarctic; however, it has never been reported from Prince Edward Island.

***Metriocnemus (Metriocnemus) fuscipes* (Meigen, 1818)** (Figure 10)

Material examined

Fourth-instar larva described from a single specimen obtained in drain pipe seepage in Fredericton, New Brunswick, Canada (45° 56' 48.40"N, 66° 38' 09.95"W). Larvae L = 3.9 mm (Figure 10A). Head brown (Figure 10A), HL/HW = 0.76. Antennae 4 segmented and reduced, first-antennal segment as long as wide, blade longer than flagellum, AR = 0.96; SI, SII and SIII are simple. Premandible bifid (Figure 10B), premandible L = 43.6 µm. Mandible with 1 apical tooth and 4 inner teeth (Figure 10C), SSd small, setae interna with 6 serrated branches, mandible L = 84.8 µm. Mentum (L = 67.1 µm, W = 70.0 µm) with 2 median teeth well receded and 6 pairs of lateral teeth (Figure 10D), mentum appears oriented inward, the 6th lateral teeth sit well below the 5th (Figure 10D), VmP indistinct, SSm well posterior to mentum (Figure 10D). Body yellowish grey with bands of blue stripes (Figure 10A). Procercus (L = 48.0 µm, W = 23.8 µm) short and as long as wide each bearing 6 short apical setae (Figure 10E), apical setae L = 77.0 µm. Posterior parapods (L = 138.0 µm, W = 103.8 µm) well-reduced, each bearing group of claws, (Figure 10E). Anal tubules small and conical (Figure 10E).

Ecology and habitat

The larva inhabits pitcher plants, slow reaches of streams, and also occurs among wet moss in streams and on the rocks adjacent to streams. In this study, the larva was found in moss attached to rocks in seepage.

Nearctic distribution

CANADA: Ontario, New Brunswick (first record). **GREENLAND.** **USA:** Georgia, New York, North Carolina, South Carolina, South Dakota, and Tennessee.

Discussion

Larva is illustrated by Moller Pillot (1984),

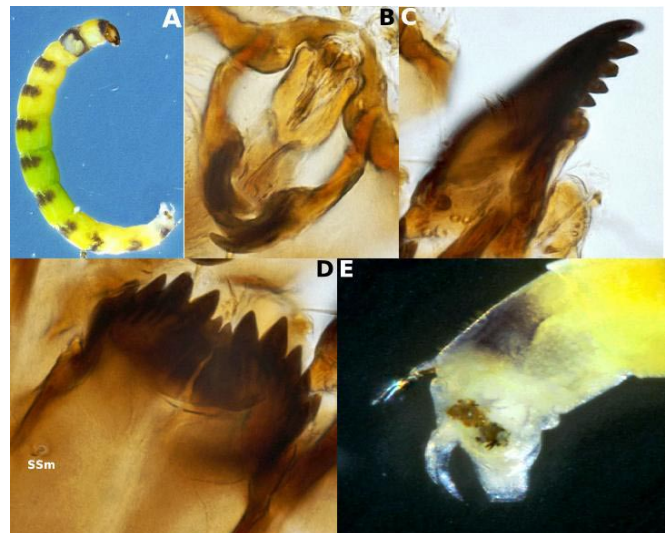


Figure 10: *Metriocnemus (Metriocnemus) fuscipes* (Meigen) larva. Larva (A), Premandible (B), Mandible (C), Mentum (D), Posterior portion of the larva (E).

Pankratova (1970) and Epler (2001). Namayandeh et al. 2012 described the larva from Ontario, Canada.

***Rheocricotopus (Psilocricotopus) glabricollis* (Meigen, 1830)** (Figure 11)

Material examined

Female reared from a larva collected in an unnamed creek (45°56'56.41"N, 66°38'16.72"W) and a nearby seepage (45°56'48.40"N, 66°38'09.95"W) in Fredericton, New Brunswick, Canada. The larval description is from specimens obtained in the same locality.

Adult Female (n = 1)

Head dark brown (Figure 11A). Thorax dark brown. Female TL = 2.8 mm. Antennae 5 segmented (L₁₋₅ = 108.6, 72.7, 72.1, 61.8, 101.5 µm) (Figure 11A), ultimate flagellomere with 8 – 10 long setae, AR = 0.3. Eyes hairy, no drosomedial extension (Figure 11A), and cluster of 9 temporal setae. Tentorium L = 187.0 µm (Figure 11B). Clypeus with 20 long setae Ls = 68.7 – 105.7 µm (86.0 µm), cornua of cibarial pump slightly rounded at the tip (Figure 11C). Palp 5 segmented (Figure 11A) (L₁₋₅ = 44.2, 65.2, 101.7, 160.0, 242.9 µm), 5 sensilla clavata ventrally and 2 medially on 3rd palpal segment (Figure 11D), ventrals Ls = 15.2 – 21.5 µm (17.4 µm), medial L = 15.0 µm. Antropronotum with setae and median gap (Figures 11E & 11F), dorsocentrals present in 4 uneven rows of 8 – 9 setae, acrostichals present and

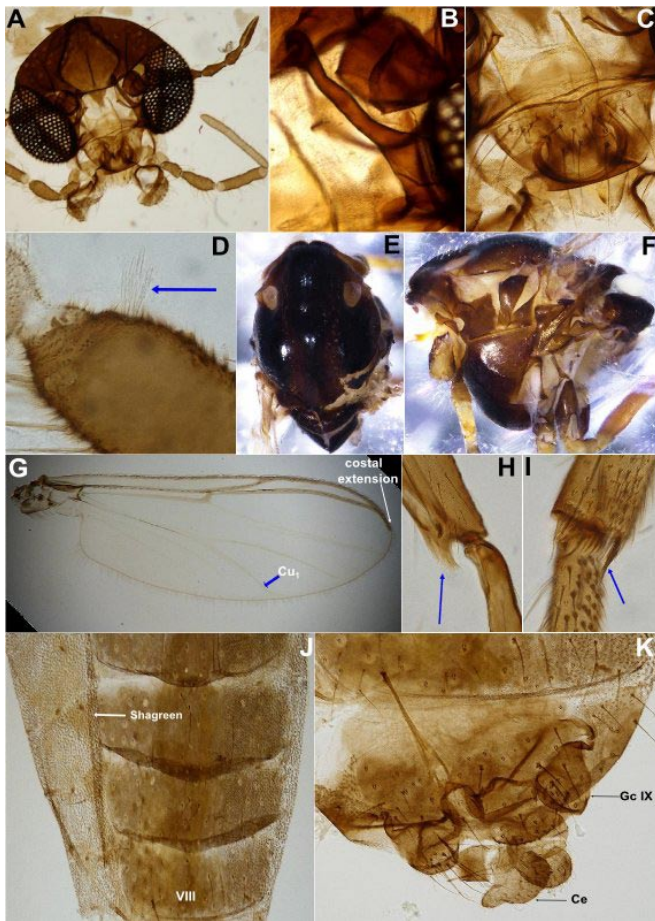


Figure 11: *Rheocricotopus (Psilocricotopus) glabricollis* (Meigen) female. Head, eyes, antennae and palp (A), Tentorium (B), Clypeus and cibarial pump (C), Sensilla clavata on 3rd palp segment indicated by arrow (D), Dorsal view of thorax (E), Lateral view of thorax (F), Wing (G) Hind femur, arrow indicates the keel (H) Hind tibial spurs (arrow) and comb (I), Abdominal tergites and shagreen (J), Female genitalia (K).

short. Wings bare (Figure 11G) with fine punctations (also visible at 100X), wing (L = 2.4 mm, W = 0.78 mm), costa extends beyond R_{4+5} (extension L = 128.6 μm), Cu_1 sinuate, brachiolum with 1 long setae, R with 18 setae, R_1 with 6 setae, R_{4+5} with 18 setae squama with 18 setae. Hind femora with keel (Figure 11H), fore tibia with single spur (L = 34.8 μm) and no comb, mid tibia with 2 spurs (Ls = 19.0 μm , 18.8 μm) and no comb, hind tibia with 2 spurs (Ls = 20.0 μm , 64.0 μm) and well-developed comb (Figure 11I). Shagreen on tergites and sternites I – VIII (Figure 11J), tergites I – VIII with long scattered setae, tergite IX undivided (Figure 11K). GP VIII divided in two lobes (Figure 11K).

Gc IX with 14 – 15 long setae. Ramus shorter than notum. Ce is lobed (Figure 11K), Ce L = 91.7 μm , Ce W = 113.7 μm . Seminal capsules ovoid shape, L = 75.0 μm , W = 41.4 μm . Leg length and ratios are shown in Table 1.

Fourth-instar larva (n = 2)

Larva L = 5.0 mm. Head yellowish brown with submentum area darker and occipital margin dark brown (Figure 12A), HL/HW = 1.2. Antennae 5 segmented, 5th segment longer than 4th (Figure 12B), RO at the very base of 1st antennal segment, blade shorter than flagellum L = 28.2 μm , B2 (L = 9.8 μm), AR = 2.0; SI serrated at the tip (Figure 12C), SII – SIII simple. Pecten epipharyngis with 3 equal scales (Figure 12C). Premandible simple with accessory tooth (Figure 12D), L = 96.0 μm . Mandible wide at the base with 1 apical and 3 inner teeth (Figure 12E), SSd prominent and pincer like, setae interna with 5 serrated branches, mandible L = 168.2 μm . Mentum (L = 97.4 μm , W = 138.3 μm) with 2 median teeth and 5 pairs of lateral teeth (Figure 12F), VmP (L = 99.2 μm , W = 15.0 μm) prominent with cardinal beard each bearing 18 – 19 long hairs (Figure 12G). Body with scattered long hair, Ls = 102.1 – 127.0 μm . Procerus (L = 34.5 μm , W = 24.1 μm) well sclerotized bearing 5 apical setae and 2 subapical setae (Figure 12H), apical setae L = 558.0 μm , sub-anal setae L = 34.1 μm . Posterior parapods (L = 389.5 μm , W = 236.0 μm) longer than wide bearing group of simple light brown claws (Figure 12H); 2 dorsal anal tubules (L = 224.0 μm) slightly longer than the 2 ventral tubules (Ls = 200.0 μm ; Figure 12H).

Ecology and habitat

Larvae occur in lotic environments and have been reported in mountain and piedmont plateau streams (Hudson et al. 1990).

Nearctic distribution

CANADA: Manitoba, New Brunswick (first record). **USA:** Georgia, North Carolina, Ohio, Pennsylvania, South Carolina, and Tennessee.

Discussion

The female and larva were described by Sæther (1985).

Subfamily Chironominae

Micropsectra polita (Malloch, 1919) (Figure 13)

Material examined

The male is described from specimens collected on outer walls of St. Georges Anglican Church, Moncton,

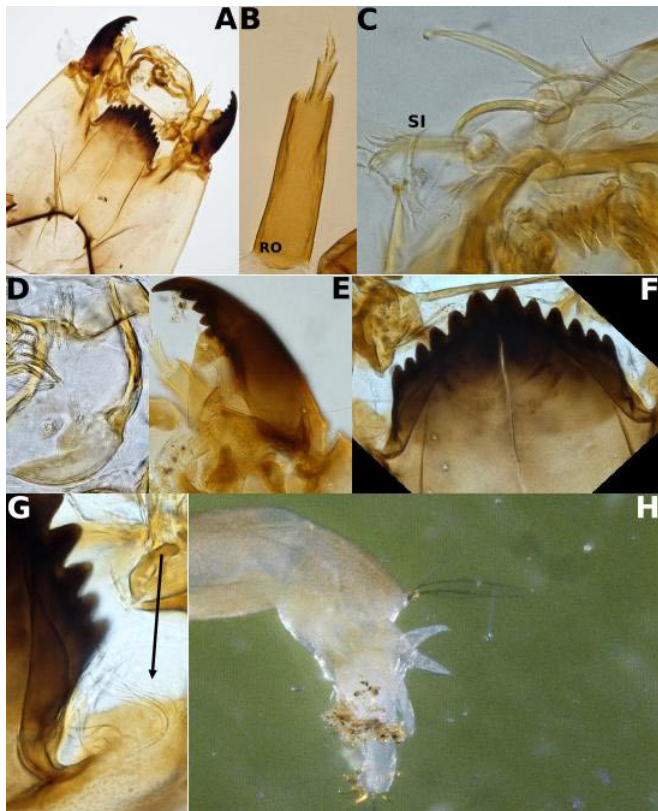


Figure 12: *Rheocricotopus (Psilocricotopus) glabricollis* (Meigen) larva. Head (A), Antennae (B), Labrum, SI-SIII and pecten epipharyngis (C), Premandible (D), Mandible (E), Mentum (F) VmP, arrow indicates the cardinal beard (G), Posterior portion of the larva (H).

New Brunswick, 46°05'24.76"N, 64°46'43.04"W.

Adult Male (n = 2)

Thorax dark brown in anterior and dorsolateral parts of scutum, scutellar region, preepisternum, and anepisternum regions, scutellum light brown and remainder light yellow, dorsocentrals present in single rows of 10 long erect setae; wings pale, sternites and tergites brown. Male TL = 3.4 mm. Antennae 13 segmented (L_{1-13} = 48.9, 27.8, 32.5, 35.9, 40.9, 41.7, 42.5, 43.8, 43.3, 41.8, 47.0, 46.3, 526.6 μ m), AR = 1.1 (Figure 13A). Eyes bare, with dorsomedial extension. Clypeus with 29 – 30 setae, Ls = 80.2 – 119.0 μ m (96.0 μ m), conua of cibarial pump slightly turned (Figure 13B). Palp 5 segmented (Figure 13C) (L_{1-5} = 38.0, 44.6, 179.0, 146.5, 214.0 μ m), at least 1 sensilla clavata dorsally and 7 ventrally on the 3rd palpomere (Figure 13D) Ls = 17.0 – 21.1 μ m (18.8 μ m). Acrostichals in single uneven row of 13 setae, 3 – 4 erect supraalars (Figures 13E & 13F), scutellum with 10 long erect setae (Figure 13e). Wings with

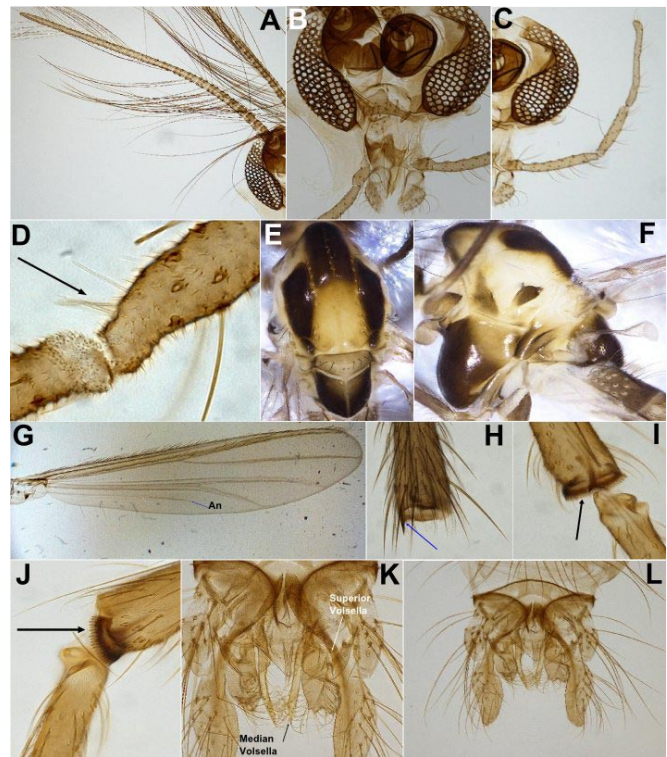


Figure 13: *Micropsectra polita* (Malloch) male. Antennae (A), Head, eyes, clypeus and cibarial pump (B), Palp (C), Sensilla clavata (arrow) on 3rd palp segment (D), Dorsal view of thorax (E), Lateral view of thorax (F), Wing (H), Fore tibial spur, blue arrow (G), Mid tibial combs, arrow (H), Hind tibial combs (I), Superior, median and inferior volsella, and the anal point (J), Male genitalia (K).

fine punctation and covered with fine setae (Figure 13G), wing (L = 2.3 mm, W = 0.48 mm), costa extends to tip of R_{4+5} , R_2 inconspicuous merged with R, anal vein extends to the fork of Cu (Figure 13G), brachiolum with 3 long setae, squama bare. Fore tibia with single spur (L = 44.0 μ m; Figure 13H), mid and hind tibia with adjoining combs (Figures 13 I & 13J). Tergites with rows of long setae dorsally and dorso-centrally evenly distributed; Anal point short and triangular with tip rounded (Figure 13K), L = 25.1 μ m. Superior volsella rounded with ventral projection narrow (Figure 13K), median volsella evenly tube shaped with 20 – 23 spoon-shaped distal setae (Figure 13K), inferior volsella square shaped with small posterior projection and bearing multiple long setae (Figure 13K). Gonocoxite L = 144.0 μ m and gonostylus L = 134.3 μ m (Figure 13L). Leg length and ratios are shown in Table 1.

Ecology and habitat

Larvae of this species prefer low order streams or slow-flowing runs in seepage areas (Webb 1981).

Nearctic distribution

CANADA: Alberta, Saskatchewan, Ontario, Québec, New Brunswick (first record). **USA** Pennsylvania, Maryland, South Dakota, Illinois south to Arizona.

Discussion

The adult male described by Oliver and Dillon (1994) and Webb (1981).

Table 1. Leg lengths (µm) and ratios from adults of four species of chironomids collected in New Brunswick and Prince Edward Island. BV = Beinverhältnisse (combined lengths of femur, tibia and t1/length of t2-5); BR = Bristle ratio (longest bristle on t1/minimum width of t1 (1/3rd from the apex); F = female; fem = femur; LR = Leg Ratio (length of ta1/length of ti); M = Male; P1-3 = front, mid and hind legs; ta1-5 = tarsus 1 through 5; ti = tibia; SV = Schenkli-Schiene Verhältnis (combined lengths of femur and tibia/length of ta1).

Species	Sex	P	fem	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR	BV	SV	BR
<i>Meropelopia flavifrons</i>	F	1	1153.8	1518.6	1061.1	603.1	408.8	271.7	158.8	0.7	2.6	2.5	4.1
		2	1359.1	1461.8	816.6	423.6	310.7	212.6	144.2	0.6	3.3	3.5	3.5
		3	1178.2	1846.3	1120.2	584.2	411.6	280.3	166.2	0.6	2.9	2.7	2.9
<i>Chaetocladius perennis</i>	M	1	941.2	1079.3	739.5	407.5	296.6	181.1	116.8	0.7	2.8	2.7	4.1
		2	951.6	928.5	476.4	262.5	207.4	125.2	121.0	0.5	3.3	3.9	3.5
		3	1048.2	1104.2	623.0	343.7	253.1	163.3	131.6	0.6	3.1	3.5	2.9
	F	1	759.3	1026.0	666.6	443.2	275.9	178.7	141.8	0.7	2.4	2.7	2.4
		2	811.3	886.3	453.2	266.4	189.0	102.5	136.2	0.5	3.1	3.7	2.6
		3	835.9	1068.0	598.1	349.0	251.6	117.7	150.5	0.6	2.9	3.2	5.2
<i>Rheocricotopus glabricollis</i>	F	1	863.9	934.3	673.3	335.4	261.5	172.8	105.7	0.7	2.8	2.7	1.7
		2	802.4	779.7	428.9	196.6	145.0	77.5	94.2	0.6	3.9	3.0	2.0
		3	811.2	947.6	577.9	281.1	238.2	120.5	105.9	0.6	3.1	3.0	2.0
<i>Micropsectra polita</i>	M	1	989.1	779.7	1115.7	586.1	433.0	315.4	168.1	1.4	1.9	1.6	3.8
		2	950.6	841.2	450.7	294.1	230.8	163.3	113.8	0.5	2.8	4.0	4.0
		3	1121.7	1071.4	726.4	452.0	350.7	223.5	132.9	0.7	2.5	3.0	4.2

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