

**NORTH AMERICAN SPECIES OF THE GENUS *CHIRONOMUS***  
as recognized by morphology and larval cytology  
(includes *CHAETOLABIS*, *LOBOCHIRONOMUS* and *EINFELDIA* (sens. lat.) and species  
included in *Tendipes* by Townes (1945) but now placed in other genera)

PART 2

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Analysis of the karyotype of the polytene chromosomes in the fourth instar larvae has indicated the presence of a much larger *Chironomus* fauna than indicated in the revision of Townes (1945) or the Nearctic catalog of Oliver, Dillon & Cranston (1990). Some of these species have been described subsequently, but many remain undescribed.

As well, since more information is becoming available, Greenland has been included as it is essentially part of the continent of North America.

This list gives some information on the morphology, karyotype, mt*COI* sequence and distribution of about 118 species that have been recognized, but it should be noted that even this list is not exhaustive as available material includes a number of specimens that do not easily fit this expanded list. The use of DNA sequences, as in the Barcode of Life Database (BOLD) (Ratnasingham & Hebert, 2007), has supported the reality of many of these proposed species.

**In many cases the assigned names result from unpublished studies with the late James E. Sublette, and without the assistance of Jim, and of Wolfgang Wülker, this list would not have reached even the present degree of development. Many other people have assisted with material or in many other ways, and to them I am most grateful.**

Species in other cytocomplexes than the thummi-cytocomplex, in other subgenera of *Chironomus*, or with no cytology or known closely related species. This part finishes with the References and the known geographic distribution of the species.

pseudothummi-cytocomplex

***Chironomus riparius*-group (cont)**

***Chironomus acidophilus* Keyl, 1960** (Species 4f)

This species is in BOLD Bin: [BOLD:AAC0903](#)

**Adult:**

The adults of the original European material were called *C. meigeni* by Thienemann and Strenzke (1951). The cytology of Keyl's original description comes from the same material. Keyl states only that the coloration and hypopygium are similar to *C. pseudothummi* Str. It is not clear why Keyl considered that it was not *C. meigeni*.

Male:

Subsequently the morphology of Palearctic specimens was described by Orel *et al.* (2015).

The following information comes from that work.

Male:

Wing length 2.7-3.0 mm. AR 2.81-3.06. VR 1.05. BR 2.78-3.89.

Antenna dark brown, ground color of thorax and scutellum yellowish; mesonotal stripes and postnotum dark brown, abdomen and legs brown or dark brown.

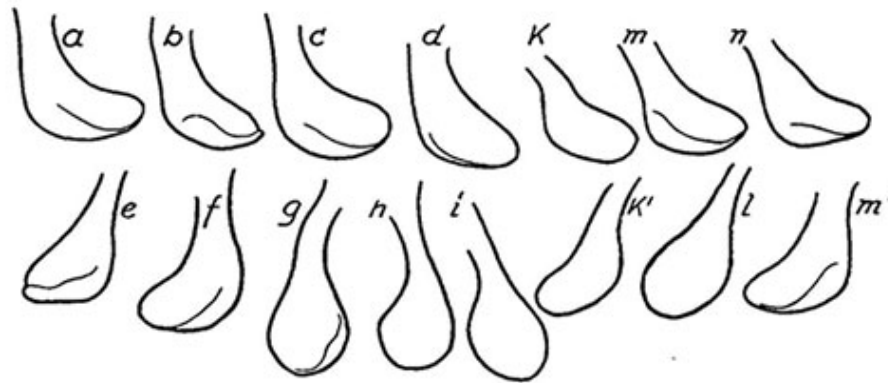
Head with frontal tubercles 24-34  $\mu\text{m}$  long, 10-17  $\mu\text{m}$  wide. 25-28 verticals, 35-38 clypeal setae. Proportions of palp segments 2-5 ( $\mu\text{m}$ ) 64 : 228 : 200 : 280; P5/P4 1.4, P5/P3 1.23.

Thoracic setae: acrostichals 15-21; dorsocentrals 18-29; prealars 4-6; supraalars – 1; scutellars 27-42.

Leg proportions ( $\mu\text{m}$ ):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1240	1124	1628	861	672	504	284	1.33-1.51	1.07-1.14	2.8-3.9
PII	1323	1229	725	430	326	221	158	0.58-0.61	1.06-1.09	
PIII	1500	1522	1075	641	467	305	200	0.70-1.03	0.97-1.00	

Genitalia similar to that of *C. pseudothummi*, SVo of European specimens variable, often due to positioning of hypopygium, but stem narrower than in *C. riparius*; end may appear more rounded (see figure below) i.e. closest to S(b) of Strenzke (1959), but stem narrower .



Variability of the SVo of European *C. acidophilus*  
From Thienemann and Strenzke (1951)

Tergite IX with 9-14 median setae. Anal point expanded in apical 1/3. GS widest at proximal third.

**Pupa:** The Palearctic pupa is included in Langton and Visser (2003):

Exuviae 6.4-6.6 mm long. Golden brown to dark brown, contrast in color between thorax and abdomen not strongly marked; darker specimens have the abdomen infuscated; outer margin of anal lobes colored except at base. Cephalic tubercles 70x67-80x67  $\mu\text{m}$ ; frontal setae 40-53  $\mu\text{m}$  long. Basal ring 155x53-133x55  $\mu\text{m}$ .

Hook row of segment II entire, extending 0.53x the segment width with 68-80 hooks.

Armament of tergites II-VI undivided, not strongly waisted, usually extensive patch of strong

points, increasing in extent from II-V, but more or less reduced on VI. Comb of segment VIII on end of an elongate cuticular mound with 2 stout teeth. Anal lobes nearly parallel-side with 66-84 tainiae.

**Fourth instar larva:** a medium plumosus-type with well-developed lateral and ventral tubules. Gular region and FC pale or slightly darkened. Clypeal aperture about  $83 \times 23 \mu\text{m}$ , about 3.6 times longer than wide.

Center trifold tooth of mentum (b, below) with the c2 teeth well separated (type III), lateral teeth grading evenly to edge of the mentum (type I), although 4th laterals may be slightly reduced in some specimens.

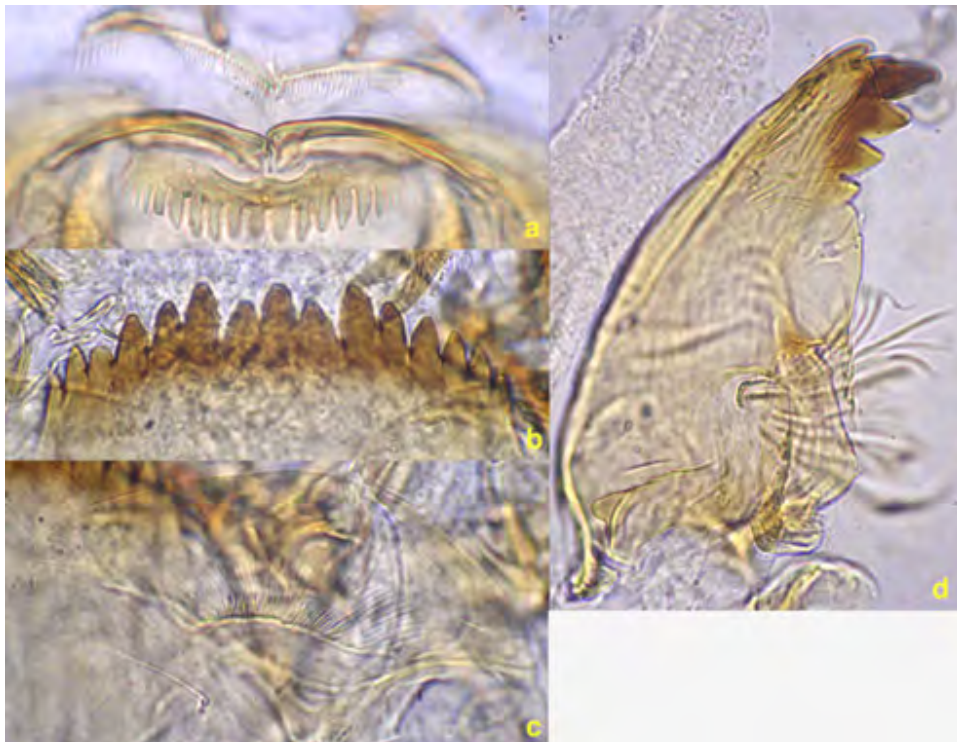
VM (c, below) with smooth anterior edge, about  $215 \mu\text{m}$  wide, 3.4 times wider than deep and 1.08 times wider than the mentum and separated by about 0.3 of its width; and about 45-47 striae (41-48 in Palearctic) extending at least half way to margin (VMR about 0.28). PE (a, below) with about 18 teeth (11-15 in Palearctic) of type B.

Premandible (b, below) about moderately broad teeth, outer tooth slightly longer, inner tooth about 3.5 times wider than the outer.

Mandible (d, below)  $260 \mu\text{m}$  long with third inner tooth moderately to well separated and only slightly darkened (type II or IIIB); 15 furrows on outer margin near base; 11-12 taeniae in PMA.

Distance between the antennal bases greater than that between the S4 setae, which occupy 0.74 of the frontoclypeal width; S5 setae slightly posterior of the RO.

Antenna with basal segment abt 0.43 of ventral head length; 4.3 times longer than wide and over 3.3 times longer than segment 2; RO about 1/3 up from base of segment; AR abt 2.03, ratio of segments ( $\mu\text{m}$ ): 152 : 45.5 : 11 : 11: abt 6.



**Cytology:** 4 polytene chromosomes with the pseudothummi-cytocomplex combination AE, BF, CD, G. Centromeres not heterochromatic.

Arm G with a terminal nucleolus and two BRs towards the other end of the chromosome. No nucleolus in long chromosomes. Polymorphism in arms B, C, E, F and G of Palearctic

material. Arm A differs between European and Siberian material (not a simple inversion), and the Alaskan sequence is the same as that in Siberia (A2). Arm E in Alaska is E1 as in Europe (E2 according to Kiknadze *et al.* 2004), arm G in Alaska is as Palearctic G1.

Sequences, based on Palearctic material:

h'aciA2: 1-2c, 15-13, 10-12, 3-2d, 6c-4, 9-6d, 16-19                      Siberia (Kiknadze *et al.* 1996)

h'aciB1: Puff (gp. 7) near 4 characteristic bands, but dark bands near middle of arm.

h'aciC1: 1a-e, 13e-11d, 21-17b, 7a-d, 16-17a, 15-13f, 5c-6, 11c-8, 1f-5b, 22 (Kiknadze *et al.* 2004)

h'aciD1: 1-2g, 13-15b, 17-15c, 7-2h, 12-8, 18-24                      Siberia (Kiknadze *et al.* 2004)

h'aciE1: 1 - 3e, 10b - 3f, 10c - 13

i.e. as *luridus*, etc., Ya4E2

h'aciF1: 1a-i, 11 - 12, 19 - 16, 2 - 10, 15 - 13, 20 - 23



**Found:** **Alberta** - Wood Bison Trail, Elk Is. Nat. Pk. (53.567°N, 112.851°W) (BOLD BIOUG05915-E07.)

**Saskatchewan** - Yorkton (51.217°N, 102.433°W) (BOLD BIOUG21994-E09).

**Alaska** - Potter Marsh (61.05°N, 149.79°W), Anchorage Co.

Also described from Reinbeck, Germany (**type**); Yakutia, Russia; and Chlepfibeeri Moos, Switzerland.

Supposedly only occurs in acidic waters.

A species with a Holarctic distribution.

There are some differences in the larvae from those described for Germany and Switzerland by Webb and Scholl (1990), notably that Palearctic larvae are thummi-type.

The karyotype, with a heterozygous inversion in arm C, was first figured by Keyl (1960), then the sequences of arms A, E and F for European species given by Keyl (1962), and karyotype of Siberian specimens, as species Ya4, by Kiknadze *et al.* (1996), revised by

Kiknadze *et al.* (2004). Lindeberg and Wiederholm (1979) state that this species is a sibling species to *C. pseudothummi* and *C. uliginosus* (now *C. vallenduuki* Ashe & O'Connor 2015) (incorrectly attributed to Wülker 1973, a paper that does not consider any of these species) and have noted this might still be a junior synonym of *C. meigeni* Kieffer.

The nearest neighbor Bin is [BOLD:ACL4081](#)  
An unidentified species from eastern Canada.

### *C. melanescens*, Keyl 1962 (Species e)

Keyl attributes the species to Strenzke, but Strenzke did not publish any description.

*Chironomus melanescens* Keyl, 1961 – nomen nudum with no description.

The Nearctic specimens are in BOLD BIN: [BOLDAAI4303](#)

The nearest neighbor Bin: [BOLDAAS1281](#) is also identified as *C. melanescens*, but from the Palearctic – Norway, Bulgaria and Russia.

These results suggest that the status of the specimens from the two areas may need to be reconsidered. They represent subspecies at the very least.

### Adult:

Male:

comparison to characters of Palearctic specimens (in brackets) where these are available from Wülker *et al.* (1981).

Wing length 3.74 mm (3.42-4.66), wing width 0.99 mm, VR about 1; AR 3.7 (3.20-4.58); LR 1.52 (1.42-1.58); FeI/Ti 1.05 (1.00-1.11); BR 2.0-2.2 (1.5-3.0).

Additional data from Nearctic male:

Length/width of frontal tubercles 22 x 10 µm; palpal proportions (micron) 53 : 53 : 227 : 255 : 353; P5/P4 1.40. P5/P3 1.49. 43-44 clypeal setae.

Thoracic setae: at least 13 acrostichals; 21-43 dorsocentrals; 5-6 prealars; 1-2 supra-alar; scutellars in approximately three rows, posterior row with 18-19 setae, other two rows less clear and with 25-26 setae between them.

Three SCf on brachiolum of wing, 26-27 setae in squamal fringe.

Leg proportions (micron):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1395	1325	2030	995	825	757	365	1.52-1.54	1.05	2.0-2.5
PII	1455	1395	875	500	360	250	160	0.63-0.64	1.04-1.05	
PIII	1700	1742	1345	740	578	330	195	0.76-0.78	0.97	

Abdominal tergites (below) with brown bands across the anterior part but extending further along the tergite in the more posterior segments. Nine (4-16) setae in center of tergite IX, 1 or 2 to a pale patch (see below).



Hypopygium (below) as that of European specimens of *C. melanescens* in being similar to *C. riparius* Meigen, 1804, with a narrow anal point and an SVo of the S-type of Strenzke (1959). IVo reaching beyond end of anal point to about the midpoint of the gonostylus, with simple setae. GS moderately swollen and 2015tapers relatively gradually from about two thirds along its length.



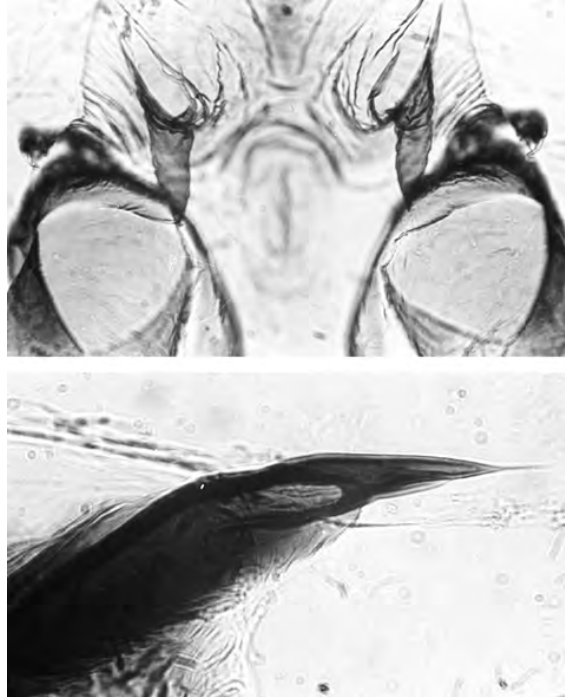
Female – no information available.

**Pupa** typical of the genus, lightish brown in color. Length about 8.2-8.3 mm, posterior margin of wing case 3.4-3.5 mm. Cephalic tubercles (below) abt 46-68  $\mu\text{m}$  in length, slightly longer than their basal diameter. Lacking secondary tubercles and frontal warts.

Respiratory base abt 56 x 48  $\mu\text{m}$ , HR about 1.17-2.61; respiratory fibres very narrowed in the middle.

About 51-73 recurved hooks on posterior margin of segment II, hook row approximately half of width of the segment. Light shagreen pattern particularly near the centerline towards the rear of the segments, small muscle marks on segments I-III; obvious PSB on segment II and large PSA on segment IV (about 164 x 101  $\mu\text{m}$  and about 0.19 of segment length); smaller PSA of spines on segment V (abt 88x50  $\mu\text{m}$ ) and also on segment VI (abt 75x38  $\mu\text{m}$ ).

Posterolateral spurs of segment VIII (below) with 1-2 spines. Anal lobe fringe with about 75-77 filamentous taeniae on each side, initially in a single row, but increasing to a triple row near the posterior end.



Cephalic tubercles (above), and spur of segment 8 (below)

**Fourth instar larva** a medium sized (length, female abt 13.0-16.5 mm, male 10.3 mm) bathophilus-type with VT of equal length (ant. 0.8-2.75 mm; post. 0.8–2.73 mm), anal tubules (g, below) long, about 6 times longer than wide. Gular region pale to slightly dark on posterior third, FC pale to slightly darkened.

Mentum (c, below) with pointed teeth; 4th laterals hardly reduced (type I); c1 tooth long and narrow with c2 teeth well separated (type III).

VM (d, below) with about 37-43 not very obvious striae; VMR about 0.35-0.41 of distance to base of striae. PE (a, below) with about 13-16 sharp teeth (type b), although Clarence Creek specimens had deformed irregular PEs.

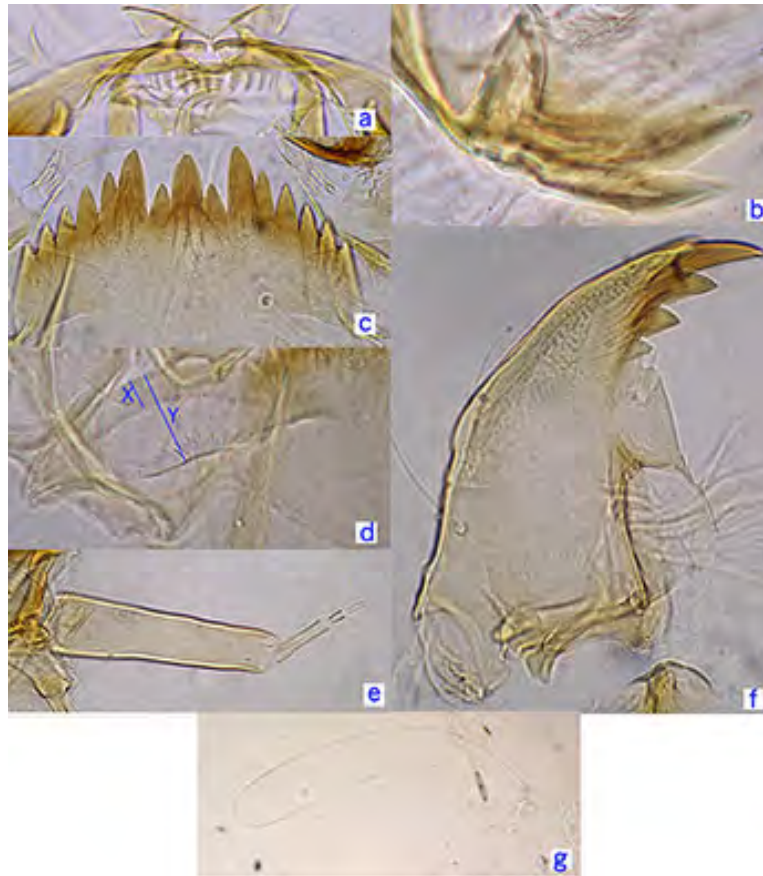
Premandible (b, below) with broad teeth, about equally long unless outer more worn, inner tooth about 2.3-4 times the width of outer tooth.

Antenna (e, below) with relatively long, narrow basal segment, about 0.43-0.45 of VHL, about 4 (3.9-4.4) times as longer than wide; RO between a quarter and half way from base of A1 (0.24-0.32); AR about 1.88-2.3; A1/A2 3.9-4.2 (abt 3.8-4.8); ratio of segments (in microns) about 183 ; 43 : 13 : 15 : 9.

Distance between antennal bases greater than that between the S4 setae.

Mandible (f, below) with 3rd inner tooth only slightly darkened and partly to nearly completely separated (type II-IIIB), and with about 11-14 furrows on the outer surface at the base and 10-13 taeniae in PecM.

Ventral tubules of Wisconsin specimens were much longer than those from Ontario.



**Cytology:** 4 polytene chromosomes with pseudothummi arm combination AE, BF, CD, G. Arm G generally paired unless heterozygous, with a subterminal nucleolus and 2 BRs which vary in position depending on the sequence. No nucleoli in other arms. Polymorphic at least in arms A, C, and G, as in Palearctic populations, but not necessarily the same inversions.

Arm B of North American specimens is inverted compared to the Palearctic sequence.

h'mlsA1: 1 - 2c, 10 - 12, 3i - 2d, 9 - 4, 13 - 19 i.e. as *holomelas* (Holarctic)

mlsA2: 1 - 2c, 10 - 12, 3i - 2d, 16 - 13, 4 - 9, 17 - 19 (Nearctic)

mlsB1: Typical puff (BR?) (gp 7) approximately medial (Palearctic)

mlsB2: Typical puff (group 7) near centromere (Nearctic)

mlsC1: 1-2f, 11c-10, 16-17a, 7d-a, 13-11d, 2g-6, 14-15, 8-9, 17b-22. (Holarctic)

mlsC2: 1-2f, 11c-10, 16-17a, 9-8, 15-14, 6-2g, 11d-13, 7a-d, 17b-22 (Palearctic)

mlsC3: not mapped, but distal break closer to end of arm (Nearctic)

mlsD1: 1a-e, 9-7, 13c-10, 1f-6, 13d-16, 19e-23, 19h-17, 24. (NB. bands 19fg not listed)  
Nearctic sequence not clear but central region may be inverted c/f Palearctic

sequence.

mlsE1: 1a-d, 3f - 11, 1e - 3e, 12 - 13 (Holarctic)

mlsF1: 1 - 4b, 15f - 4c, 15g - 23  
(Holarctic?)

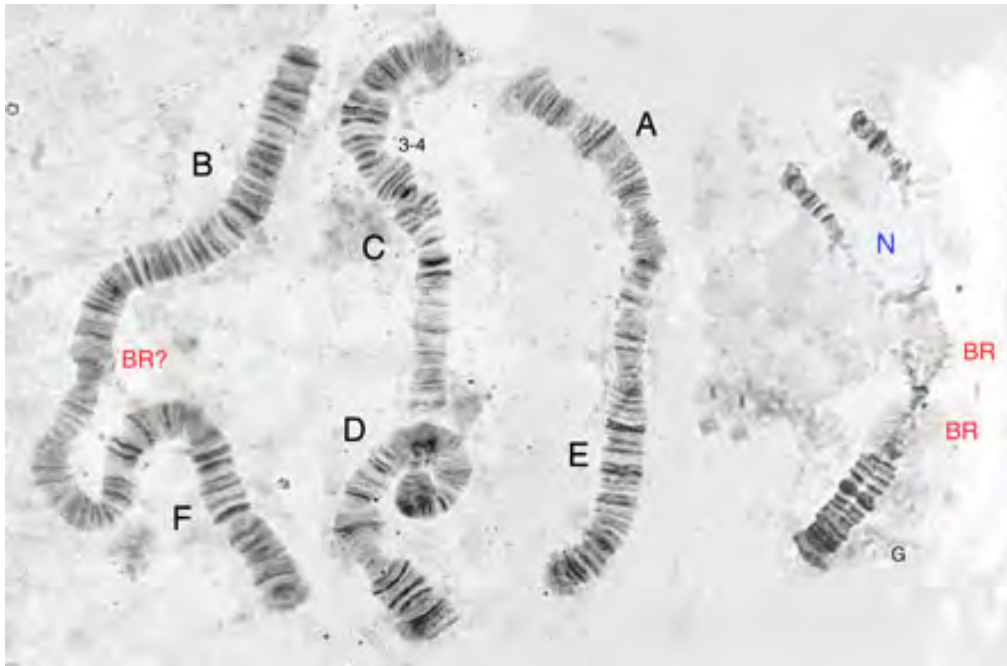
mlsG1: subterminal nucleolus with two nearby BRs. (Holarctic)

mlsG2: simple inversion near distal end of arm, not involving BRs. (Palearctic)

mlsG3: simple inversion of medial section of arm. (Palearctic)



mlsG4: Simple inversion of region between BRa and BRb to near distal end (Nearctic)



**Molecular Data:** Sequence for mitochondrial *COI* and *CytB* of Palearctic material is available in GenBank (accession numbers AF192204, AF192173), *COI* of numerous NA specimens is available in GenBank and BOLD. Barcode sequences of Palearctic specimens differ by 13 bases from those of the Nearctic specimens (below). This suggests they should be considered to be at least subspecies:

base.													
Nearctic													
T	A	G	A	T	A	C	T	T	G	T	C		
Palearctic													
A	T	A	G	C	G	T	C	G	A	A	C	A	T

Palearctic form: *C. muratensis muratensis*

Nearctic form: *C. muratensis canadiensis*

**Found:** **Alberta** – Jasper National Park (53.192°N, 65.22°W) (BOLD)  
**Nova Scotia** – Kejikujik National Park (44.401°N, 65.22°W) (BOLD)  
**Ontario** - Clarence Creek (45.50°N, 75.22°W), Carleton Co.; Dunrobin (45.45°N, 76.00°W), Carleton Co.; Blair Rd Public School, Cambridge (43.3718°N, 80.327°W) (BOLD BIOUG13119-C10); rare Charitable Research Reserve (43.3705°N, 80.3641°W), Cambridge. (Telfer *et al.* 2015); Howick Central Public School, Gorrie (43.884°N, 81.053°W) (BOLD BIOUG13107-G1); Saunders Secondary School, London (42.947°N, 81.289°W) (BOLD BIOUG13007-E01); Notre Dame Catholic School, Orillia (44.61°N, 79.461°W) (BOLD BIOUG13120-A02); Thousand Islands Natl. Park (44.453°N, 75.865°W) (BOLD BIOUG20486-E04); Toronto Zoo, Rouge Natl. Urban Park (43.822°N, 79.19°W), Toronto (BOLD BIOUG20014-G11).

**Prince Edward Island** - Cavendish Grove, Prince Edward Island Natl. Park (46.493°N, 63.394°W) (BOLD BIOUG20330-B12)  
**Saskatchewan** – Grasslands National Park (49.001°N, 106.557°W) (BOLD)  
**Wisconsin** - Arboretum, Madison (43.03°N, 89.42°W), Dane Co.; Trout Lake Limnol. Stn. (41.02°N, 89.67°W), Vilas Co.  
Germany: Clausthal (Zellerfeld) (**locality of type**) and Duemmer Lake;  
Switzerland, Norway and Russia.

Temporary pools, especially snow melt pools.

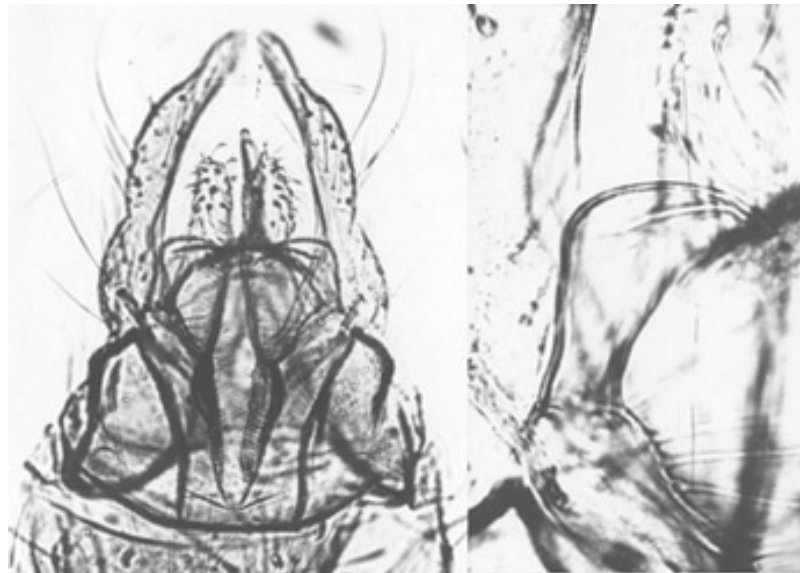
Adults and larvae partly described by Wülker *et al.* (1981), who also described the cytology, and Kiknadze *et al.* (1991) illustrated the larva and redescribed the cytology (with minor errors in arm E); Kiknadze and Broshkov (2009) redescribed the cytology from the Palearctic. Martin (2015) described morphology, karyotype and barcodes of North American material.

### **C. species parariparius** (Species 2c)

#### **Adult:**

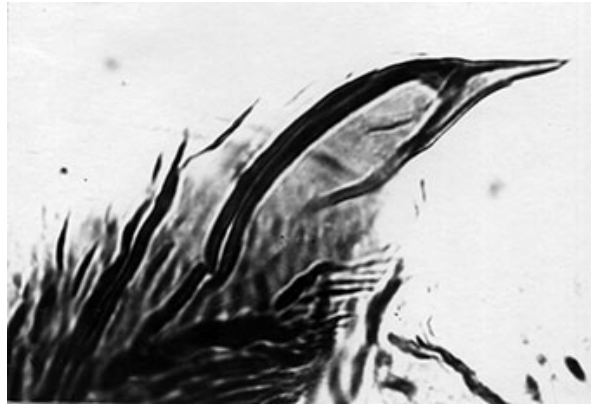
Specimens, including rearings, in the collection of J.E. Sublette, now in the Zoological Museum of the University of Minnesota, St. Paul.

Male: Only available information is the photograph of the terminalia and superior volsella (below)



Setae on TIX in a single pale patch. SVo closest to D(d) of Strenzke (1959); IVo reaching almost to the end of the anal point which narrower at base; gonostylus relatively narrow and narrowing markedly over posterior third.

**Pupa:** Caudolateral spur of segment VIII with about one spine.



**Fourth instar larva** a small to medium thummi-type (Fem. 13.7 (13.1-14.3) mm; Male abt 10.7 mm) with VT relatively short, about equal length or posterior pair longer (ant.1.03 ( 0.7-1.2) mm; post.1.04 (0.8-1.3) mm). Gular region and FC pale or gula occasionally slightly darkened. Anal tubules 326-366  $\mu\text{m}$  long, 130-135  $\mu\text{m}$  wide (2.4-2.8 times longer than wide).

Salivary reservoir about 77 (58-86)  $\mu\text{m}$  long and 3-4.5 times longer than wide.

Mentum (Fig. d, below) with generally sharp teeth; c1 tooth narrow, almost as long as first laterals, c2 teeth well formed and separated (type III); 4<sup>th</sup> laterals not reduced (type I).

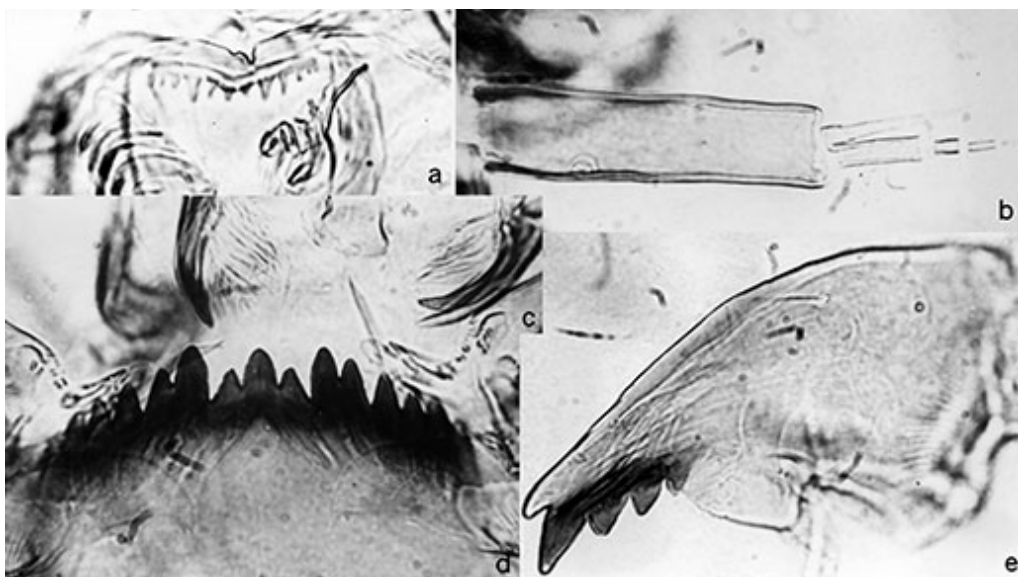
Ventromentum about 190 (172-205)  $\mu\text{m}$  wide and 3.29-3.67 times wider than deep; 1.01-1.13 times wider than the mentum, and separated by 0.29-0.34 of the mentum width; with about 43.5 (38-52) striae; VMR 0.29-0.43).

PE (Fig. a, below) with about 12 somewhat irregular sharp teeth – essentially type B but with occasional small teeth. Premandible (Fig. c, below) with relatively narrow teeth, inner tooth about 2.3-4.0 times wider than the outer teeth and about equal length.

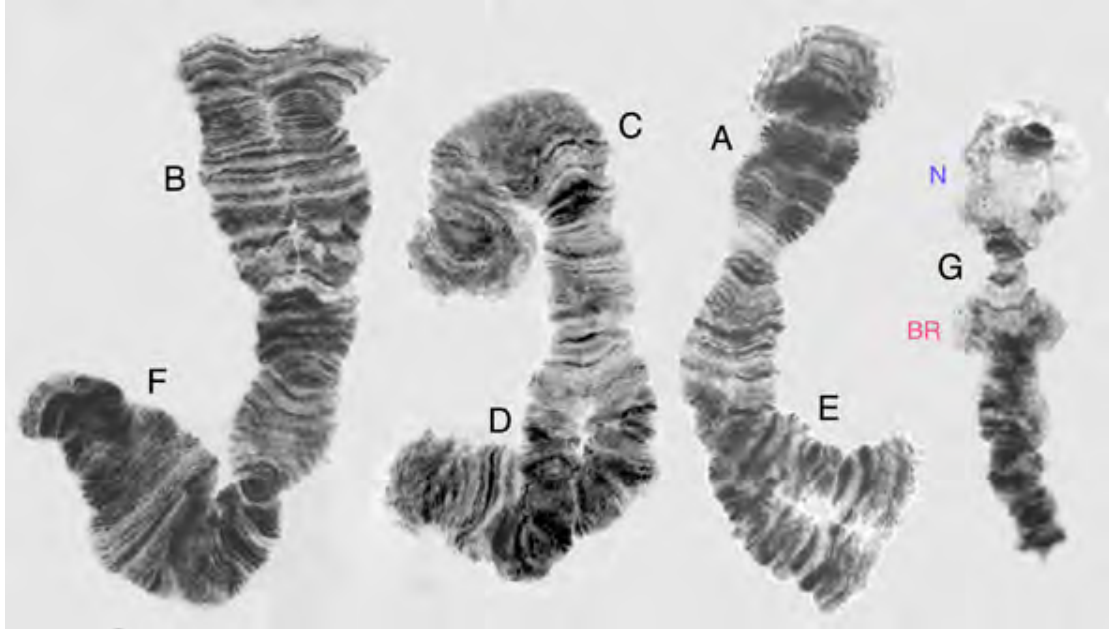
Antenna (Fig. b, below) with basal segment quite long, almost half the VHL and about 5 times longer than wide, RO about 0.4 up from base; AR about 2.43 (2.28-2.68); antennal proportions (micron) 147 : 33 : 10 : 10.5 : 7.5.

Distance between antennal bases greater than that between S4 setae, which occupy about 0.72-0.89 of the width of the frontoclypeus; S5 setae slightly posterior to the adjacent RO.

Mandible (Fig. e, below) with 3<sup>rd</sup> inner tooth separated and darkened (type II-IIIB), about 17.3 (14-19) furrows on outer surface near base and 11 (9-12) taeniae in PecM; Mdt-Mat 15-23, MTR 0.24-0.33.



**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Chromosomes relatively short and often with sections unpaired. Arm G generally unpaired or paired at the subterminal nucleolus and nearly median BR; but occasionally fully paired as in figure. Centromere heterochromatic, arm often constricted between the nucleolus and BR. No nucleoli in the long chromosomes and centromeres not markedly heterochromatic. No polymorphism in specimens examined.



**Found:** Ontario - Glen Tay.

Snow melt pools.

### **C. riparius or C. decorus-group**

#### **Chironomus species 31.      C. decorus- or riparius- group**

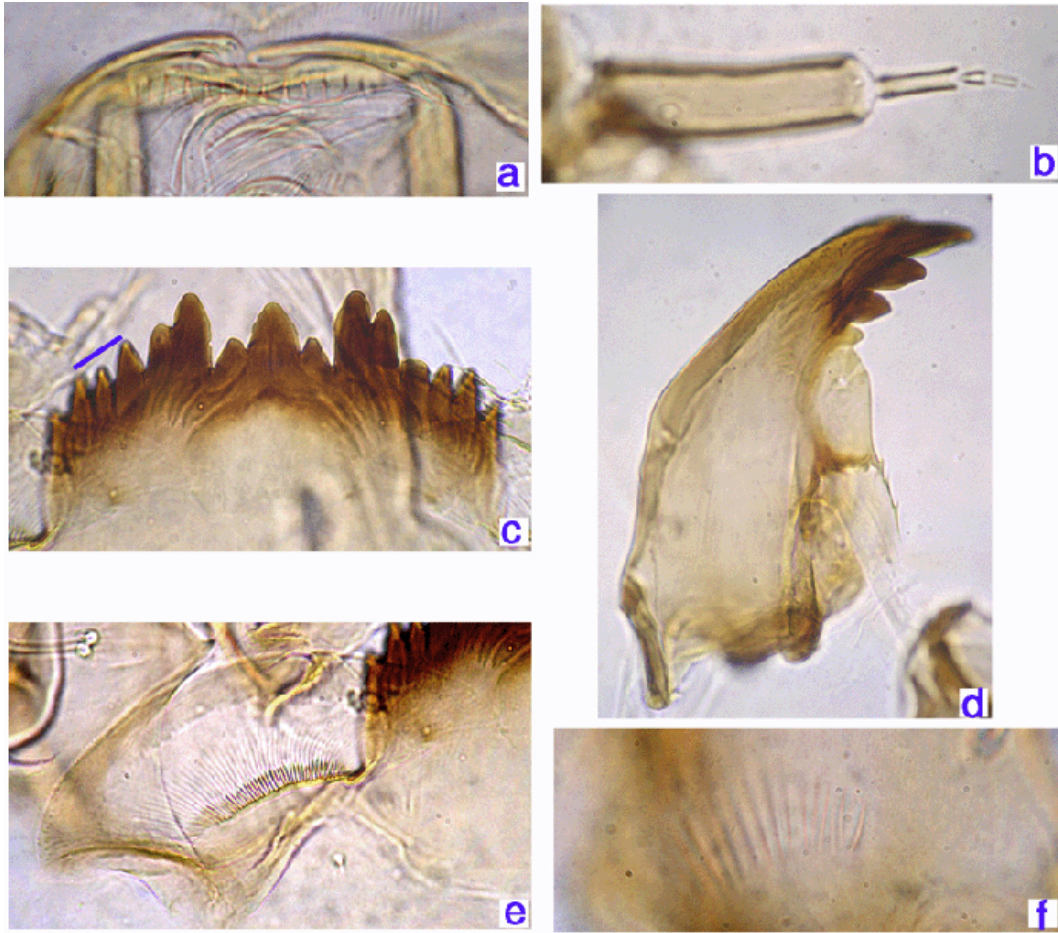
**Fourth instar larva** a medium sized plumosus-type (len. female 13.5-15; VT well developed, posterior pair longer (ant 1.68-1.72 mm; post 2.08-2.16 mm). AT relatively long, with a slight constriction in the middle (372 x 140 µm). Gular region pale or only slightly darkened, FC pale.

Mentum (c, below) of type I, with c2 teeth well separated from the c1 tooth (i.e. type III), the whole central grouping possibly being lower than the arc of the other teeth.

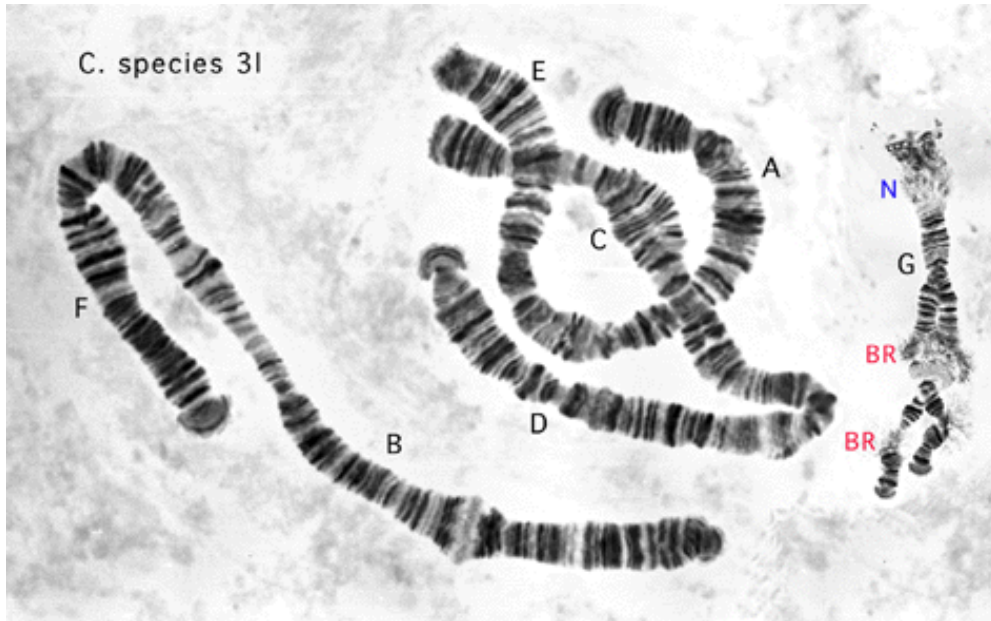
PE (a, below) with about 15 broad teeth. VM (e, below) with about 41-48 striae.

Antenna (b, below) with relatively long and narrow basal segment, about 3.6 times as long as wide; AR about 1.95-2.15; antennal segments 134 : 35 : 10 : 14 : 7 micron.

Mandible (d, below) of type III, with about 15-17 grooves on the outer surface at the base (f, below).



**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. All chromosomes closely paired.  
 Arm G with an almost terminal nucleolus, with 2 BRs approximately equally spaced in the other half of the length of the chromosome. No nucleoli in other chromosomes. Arm B with bulb and some distal dark bands about  $\frac{1}{3}$  from end of arm.  
 Arm A:  
 Arm B: Puff (gp 7) about  $\frac{1}{3}$  from distal end.  
 Arm E: approx. 1-2e, 9d-10b, 3a-e, 8-3f, 10c-13  
 Arm F: i.e. as *anonymus*



**Found:** Kansas - Mill Creek, near Craig, Johnson Co. (38.95°N, 94.80°W) (B.Coler).

This species has not been associated with an adult.

### **Chironomus decorus-group** (cont from Pt 1)

**Chironomus species z.** Possibly *C. decorus* group

**Adult** and **Pupa** not known, but could be those of Species 5u (see Part 1), which were collected at the same place at the same time.

**Fourth instar larva** small to medium melanotus-type (12.6 mm, fem; 12.1 mm, male), VT of moderate length (abt. 1.1-1.2 mm) and about equal length or with anterior longer, TLt about 280-310  $\mu\text{m}$ . AT quite long with a constriction in the middle, dorsal slightly longer (abt 480 cf. 440  $\mu\text{m}$ ) and over 4 times longer than wide (4.0-4.4x).

Gular region usually pale to occasionally slightly darkened on posterior third, FC pale or slightly darkened.

Clypeal aperture about 63 x 15  $\mu\text{m}$ , 4.2 times longer than wide.

Mentum (Fig. c, below) relatively pale with pointed teeth; c1 tooth long, narrow to wider and tapering, c2 teeth very well developed about 2/3 height of c1 tooth (type III, or like IIA if worn), 4<sup>th</sup> laterals not or only slightly reduced (type I).

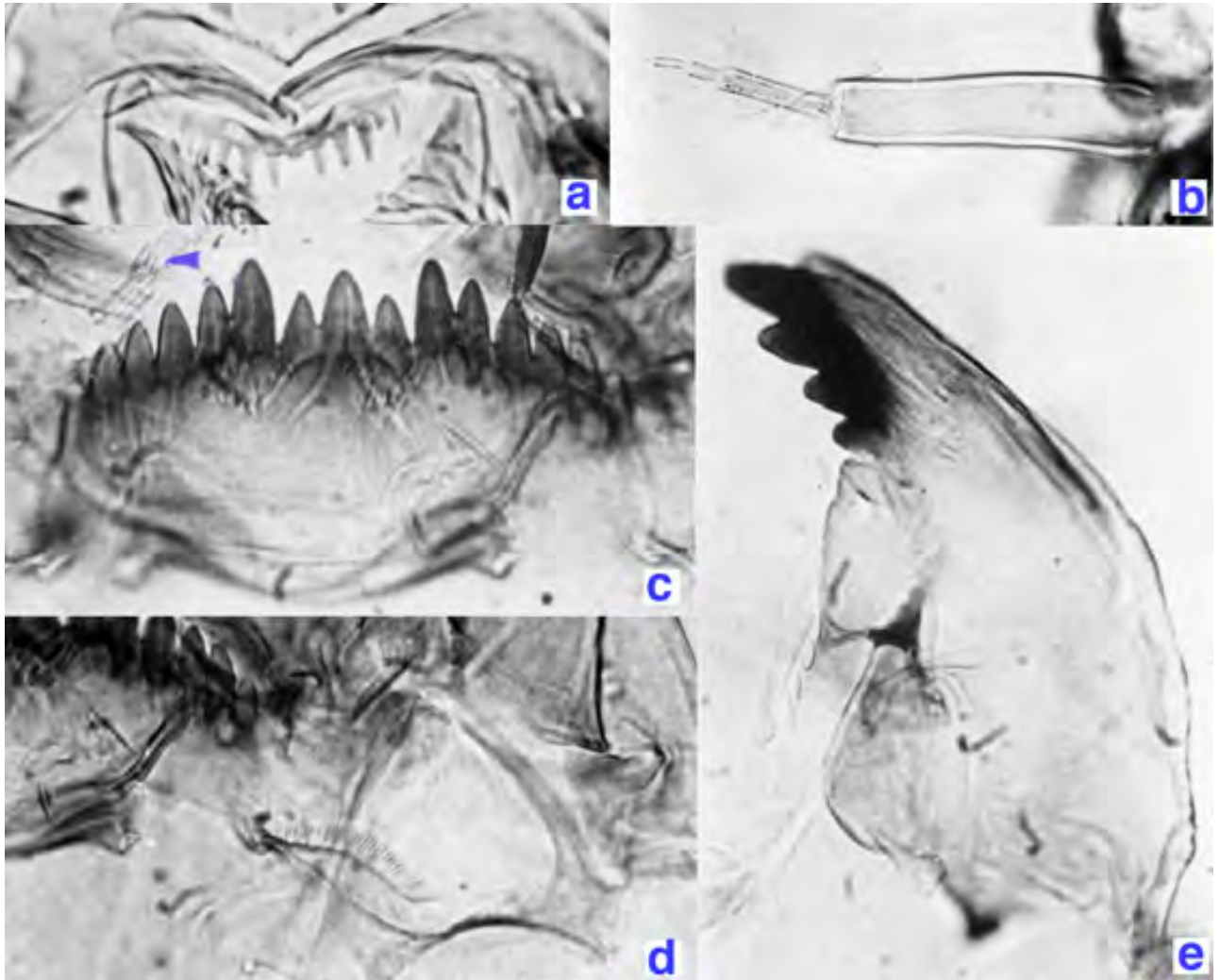
Ventromentum (Fig. d, below) about 173-200  $\mu\text{m}$  wide and 3.04-3.67 times wider than deep; 0.98-1.04 times the width of the mentum; separated by 0.29-0.31 of the mentum width; with 43.6 (38-52) striae; VMR 0.29-.0.34.

PE (Fig. a, below) with about 12-14 teeth, often irregular or short due to wear. Premandible (Fig. c, blue arrow) with relatively narrow teeth; outer tooth about equal length to inner tooth which is about 3.2-3.4 times wider.

Antenna (Fig. b, below) with basal segment about 4.2-4.7 times longer than wide and about 3.5-3.9 times longer than A2 (i.e. A2 about 0.27-0.30 the length of A1); AR about 1.90-2.04; relative lengths of segments (micron): 143 : 41 : 11 : 12.5 : 7.5.

Width between antennal bases (137-152  $\mu\text{m}$ ) greater than that between the S4 setae (104-129  $\mu\text{m}$ ), which are separated by about 0.68-0.74 of the frontoclypeus width. S5 setae posterior to the nearby RO.

Mandible (Fig. e, below) with 3<sup>rd</sup> inner tooth moderately to well developed and darkened (IIB-IIIC); about 11-17 furrows on outer surface near the base; 10-12 taeniae in the pecten mandibularis; Mdt-Mat 23-28  $\mu\text{m}$ ; MTR 0.30-0.37.



**Mouthparts of *C. species z***

- a. Pecten epipharyngis; b. Antenna; c. Mentum - note 4th lateral in line with 3rd and 5th laterals (type I), c2 teeth separate and high (type IV) and premandible (blue arrowhead); d. Ventromentum
- e. Mandible - note for this specimen the 3rd inner tooth is well separated and colored (type IIIC).

**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination. AE, BF, CD, G.

Centromeres obvious

Arm G at least partly paired, nucleolus about the center and generally 2 BRs in the paired section, one immediately adjacent to the nucleolus, other subterminal. No nucleoli in the long chromosomes. Polymorphic in arms B (complex inversion) and D.



- Arm A1: approx. 1 - 2c, 3 - 2d, 15 - 13, 9, 4 - 8, 10 - 19 i.e. Inv8-15 from *holomelas*.
- Arm B1: Puff (group 7) proximal in arm with distal dark bands (group 8), adjacent to characteristic groups 15-19.
- ArmB2: Complex inversion begins in dark bands; puff (group ).
- Arm C1: Typical constriction (groups 3 & 4) just distal of middle of the arm.
- Arm D1: adjacent to bands ,
- ArmD2: Inversion of about 1/3 of arm, distal of the center.
- Arm E1: 1 - 3e, 10b - 3f, 10c - 13 i.e. as *aprilinus*, etc.
- Arm F1: A puff may sometimes be developed about a third from the centromere.
- Arm G1: Nucleolus near center, 2BRs (as above).

**Found:** Ontario - Bear Creek, Carlsbad Springs, Carleton Co. (45.37°N, 75.47°W).

Pools in creek.

### **Chironomus calligraphus-group**

***C. anonymous* Williston, 1896** (Species 2o)

*Tendipes (Tendipes) anonymous* – Townes 1945 as syn. *C. decorus*.



**Adult:**

Partly after Sublette (1966 and 1967 – redesc. of co-types), Wülker *et al.* (1989) and an unpublished manuscript by D. Grimaldi:

Male: Head and thorax with dark brown markings, scutellum pale; all femurs with a narrow apical dark fascia, bases of all tibiae also dark, broadest on foretibia. Abdominal tergites II-IV with saddle shaped marking, becoming a median spot on V-VI.

Wing length 2.73 (2.44-3.06) mm. VR 0.93-0.98; 13.3 (8-17) setae in squamal fringe; almost entirely pale, anterior wing vein slightly darker.

AR about 3.04 (2.84-3.37). Frontal tubercles small, length about 24 (16-30)  $\mu\text{m}$  and 2.75 times longer than wide. Palpal proportions ( $\mu\text{m}$ ) 60 : 49 : 229 : 238 : 352; P5/P4 1.51-1.55; P5/P3 1.48-1.62. Clypeus about 0.6-0.75 times the width of the antennal pedicel, 23 (18-26) setae.

Thorax with a small but distinct median tubercle. Setae: acrostichal – 12-14 in double row; dorsocentral – 13-21; prealar – 5-6; scutellar – 14-34.

LRI about 1.77; LRII about 0.63; LRIII 0.74.

Leg lengths (micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1320	1050	1780	875	770	665	340	1.66-1.82	1.23-1.29	2.47-2.54
PII	1340	1155	745	395	290	195	130	0.61-0.68	1.14-1.18	
PIII	1490	1425	1055	555	445	260	150	0.72-0.76	1.04-1.06	

TIX with about 11 (9-13) setae in individual spots.



Anal point broad and downcurved; SVo curved dorsally, essentially D-type, perhaps between 'e' and 'f' of Strenzke (1959); IVo with 20-27 simple setae. GS relatively narrow, reducing significantly from midpoint.

**Female:**

Antennal flagellomeres darkened; proportions ( $\mu\text{m}$ ) 168 : 117 : 129 : 130 : 191 (Wülker *et al.* list only 4 segments); AR about 0.36; A5/A1 about 1-14-1.25. Frontal tubercles

41  $\mu\text{m}$ .

Palpal proportions (2-5) ( $\mu\text{m}$ ): 61 : 280 : 286 : 474; P5/P4 1.66, P5/P3 1.69. Clypeus with about 44 setae.

Antepnotum slightly broader than in male, mesonotal tubercle conspicuous.

Thoracic setae: acrostichal - 14 in double row; dorsocentral – 45 in up to three rows; prealar 5, supra-alar – 1; scutellar – 20-31.

Wing length 3.64 mm, VR 1.11 (0.89); squamal fringe of 19 setae.

LRI about 1.89; LR II about 0.56; LR III about 0.70.

Leg lengths (micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
PI	1465	1085	1995	1005	890	850	350	1.82-1.89	1.35	0.75
PII	1445	1255	775	410	290	195	155	0.67-0.87	1.15	
PIII	1590	1485	1120	625	465	260	145	0.75	1.07	

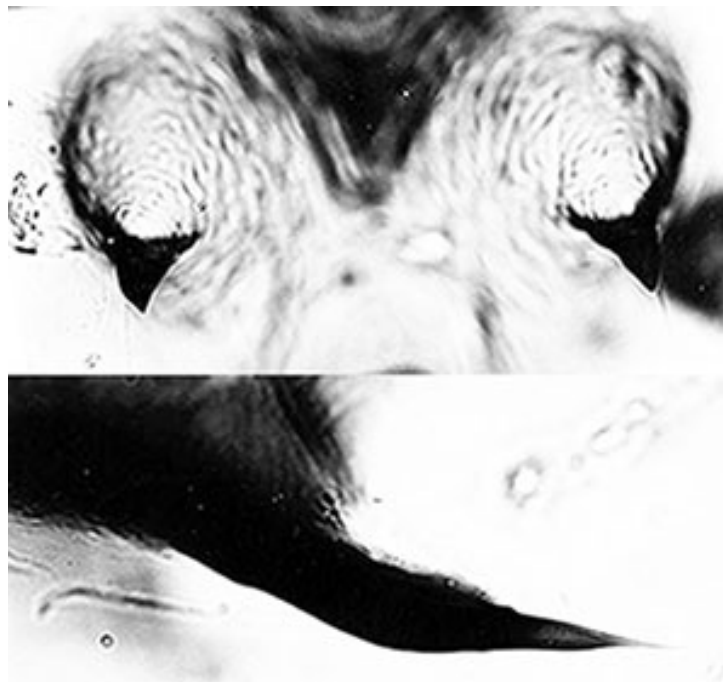
About 4 setae on GcIX; 6 setae on segment X which is long and narrow, about 2.2 times longer than greatest width. Cercus small, essentially quadrate, ventral posterior margin rounded and slightly swollen.

**Pupa:** Total length 5.64-6.22 mm (male); 6.44-6.66 (female); inner margin wing case (male) 1.50 mm. Integument infusate with darker stripe extending to the postero-lateral spur, anal lobe dark. Cephalothorax with coarse tubercles along both sides of the median raphe. Tergum II with 62-84 recurved hooks. Terga II-VI with coarse shagreen over most of the surface; tergum VII with finer shagreen in the basal half; tergum VIII with fine shagreen towards the lateral margin.

CT (male) 63 x 53  $\mu\text{m}$ . Respiratory base about 128 x 67  $\mu\text{m}$ , HR 1.85-1.96.

PSA on segment IV 131.5-146.7  $\mu\text{m}$  long, 88.5  $\mu\text{m}$  wide, 0.19-0.21 of segment length; that of segment V comprised of spines.

Caudolateral spur of segment VIII usually with only 1, but occasionally 2 or 3 weaker spines at the end. Fringe of anal lobe with 68-99 flattened taeniae, in 2-3 rows anteriorly, single row posteriorly.



**Fourth instar larva** a small plumosus type; length about 10.9 (8.0-13.2 mm) (a female 13.2 mm; a male 10.7 mm). Anterior VT (1.12-1.68) shorter than posterior VT 1.26-2.2). AT about 370.5 (304-520)  $\mu\text{m}$  long and 2.4-6 times longer than wide – those from California (abt. 520 x 140  $\mu\text{m}$ ) much longer than those from Mississippi or Texas (321 x 126  $\mu\text{m}$ ). Pale gular and FC. Salivary reservoir about 80 (71-94)  $\mu\text{m}$  long and about 4-6 times longer than deep.

Mentum (Fig. c) with pointed teeth when not worn; c1 tooth moderately broad, c2 teeth well developed and sharp pointed (i.e. type IB-III); 4th laterals at least slightly reduced (type I-II) but occasionally ty. III.

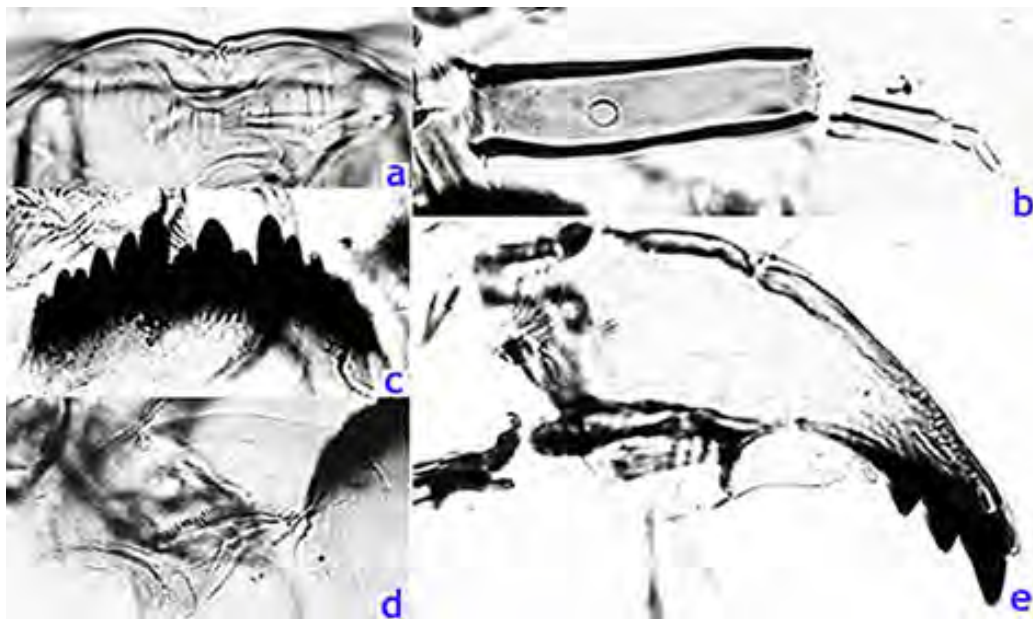
Ventromentum (Fig.d) separated by about 0.25-0.32 of the mentum width; about 194 (182-204)  $\mu\text{m}$  wide and 3.5-3.74 times wider than deep; 1.06 (1-1.12) times the mentum width; with about 42 (40-44) striae; VMR 0.25 (0.23-0.27).

Premandible (see Fig. a) with inner tooth about 4-5 times wider than outer tooth, and coming to a relatively sharp point (Ty. B1). Pecten epipharyngis (Fig. a) with about 12.3 (12-14) teeth of type B.

Antenna (Fig. b) with basal segment quite long, abt 3.7 times longer than wide, abt 4 times the length of A2 and a third to a half the VHL; Ratio of antennal segments 124 : 34 : 9.5 : 12.5 : 7 ; AR about 1.99 (1.83-2.12); A1 about 4 times longer than wide; ring organ toward center of the segment.

Distance between antennal bases (170 (142-205)  $\mu\text{m}$ ) mostly greater than that between the S4 setae (164 (144-190)  $\mu\text{m}$ ), which are separated by about 83% of the FC width at that point.

Mandible (Fig. e) with third inner tooth only partly darkened (generally type IIB); about 15.5 (13-18) furrows on outer surface at the base; 10.6 (8-12) taeniae in P.mand.; Mdt-Mat abt 15-25  $\mu\text{m}$ ; MTR abt 0.25 (0.21-0.32).



Larval mouthparts of *C. anomymus*

- a. Pecten epipharyngis (type B); b. Antenna with long narrow basal segment;  
c. Mentum of Ty.I (note points of premandible visible below); d. Ventromentum;  
e. Mandible of Ty.IIB

**Cytology:** 4 polytene chromosomes with the pseudothLarval mouthparts of *C. anomymus* summi arm combination AE, BF, CD, G.

Arm G paired with a virtually terminal nucleolus at one end and two BRs, separated by dark bands near the other end. The more distal BR is almost terminal in Mississippi populations due to an inversion, apparently as in *C. columbiensis*. No nucleolus in the long chromosomes. Arm B with bulb about  $\frac{1}{3}$  from distal end. Inversion polymorphism occurs in arms D, F and G, although no heterozygotes have been found for the inversions in arms F and G. Two inversions occur in arm D, a short proximal one in California populations, and a distal one in Texas and Mississippi.

anyA1: 1a-e, 12-10, 4-9, 2d-3b, 2c-1f, 3c-i, 13-19

anyB1:

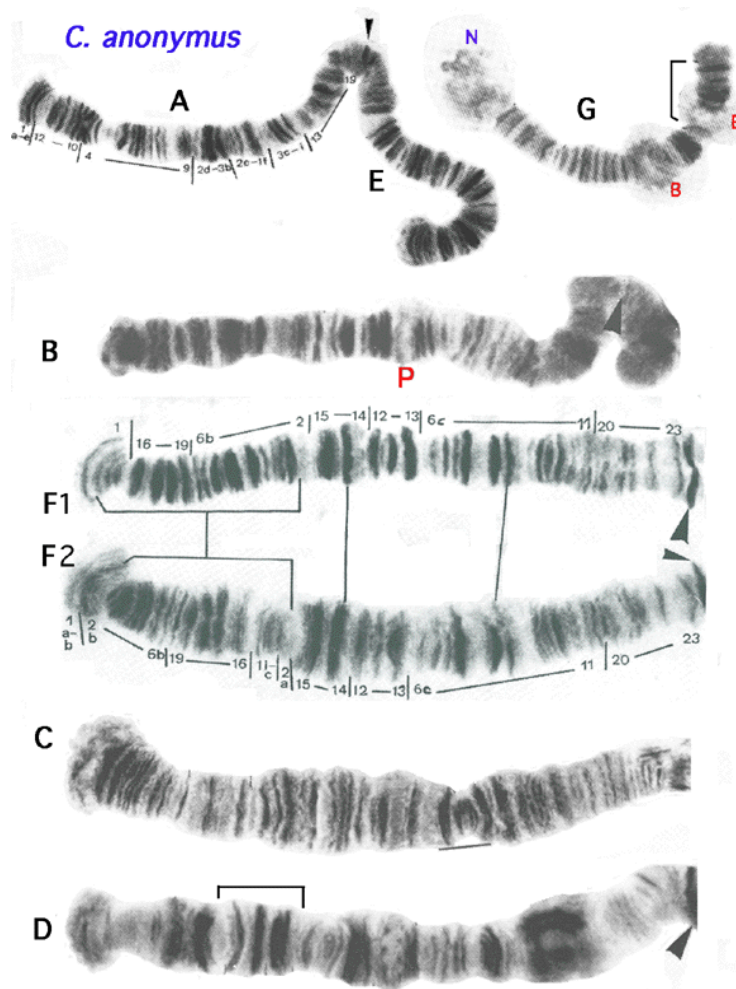
anyC1:

anyD1:

anyE1: 1a-2e, 9a-10b, 3e-a, 8i-3f, 10c-13

anyF1: 1a-i, 16a-19d, 6b-2a, 15i-14a, 12a-13d, 6c-11, 20-23 (Texas, Mississippi), as *columbiensis*.

anyF2: 1a-b, 2b-6b, 19d-16a, 1i-c, 2a, 15i-14a, 12a-13d, 6c-11, 20-23 (California)



**Found:** **California** - Stanford, Santa Clara Co.; Near Palo Alto, Riverside (incl. 'Midgeville', UCR Campus), 3.5 mls. Palm Desert, & Corona, Riverside Co.; Arlington.

**Mississippi** - Jackson, Hinds, Co.(30.50°N; -90.33°W)

**Texas** - Brackenridge Exptl. Stn., Austin, Travis Co.(30.27°N; -97.73°W; Fish hatchery Galveston, Galveston Co., called *C. karensis* (Grimaldi unpubl.)

**Type locality:** 1000ft, St. Vincent Island, West Indies.

Also known as Sp. 51 of Frommer. Egg mass described (as *C. sp. 1*) as arcuate, less than 900 eggs and no enlarged capitulum, by Morrow, Bath & Anderson (1968) and larva by Bath and Anderson (1969). Morphology and cytology described by Wülker, Sublette, Morath & Martin (1989), some details of arms A, E and F given by Wülker & Morath (1989). The sequence differences between western and eastern populations may indicate evolutionary divergence, but this is not certain until it is determined whether polymorphic populations occur between Texas and California.

Biever (1965, 1971) successfully bred this species in the laboratory (under the name *C. sp. 51*), as did Grimaldi in an unpublished manuscript.

The species seems to show differences in size between areas, but this may depend on whether they were wild collected or reared in the laboratory.

Noted as closely related to *C. decorus* among North American species, but males can be distinguished by the abdominal markings and the broad anal point. However, most closely related to *C. columbiensis* (see below).

### ***C. calligraphus* Goeldi, 1905 (Species 2w)**

Synonyms:

*Tendipes aversa* Roback 1962

*Chironomus attenuatus* sensu Sublette & Sublette 1967

*Chironomus* sp. Coyote Creek Wülker, Devaí and Devaí 1989

*Chironomus* sp. 52 (sp. Coyote Creek) Wülker and Morath 1989

There are two BOLD bins that contain specimens labelled as *C. calligraphus*.

Type 1 is in BOLD Bin: [BOLD:ABZ9507](#) [this species](#)

Type 2 is in BOLD Bin: [BOLD:AAP1715](#) see *C. hawaiiensis* (Species 5o)

It is obvious that two species are included in material previously identified as *C. calligraphus* but it is difficult to provide definitive descriptions because most of the published material does not distinguish between them. At present the only distinguishing character suggested is the LR1.

The DNA analysis in Spies *et al.* (2002) suggested the presence of two groups based on a mitochondrial *COII* analysis. However it appears that one of these groups was actually due to contamination (see Martin 2020). *COI* analysis also indicates the presence of two species but has not included any specimens from the type locality in Belém so it is not possible to determine to which form the Fittkau neotypes might belong. Type I is presently designated as *C. calligraphus* Goeldi, while type 2 is conspecific with *C. hawaiiensis* (see Species 5o)..

2) *Chironomus calligraphus* nov. spec. Goeldi (1905).

**Imago** Male: 7.5 mm — 8.5mm

*Palpos* de 4 dos quaes o 2º e o 3º iguaes articulos cyindricos, I curto; II e III compridos, iguaes quasi: IV, o mais comprido.

*Antennas* plumosas equisetaceas de 12 articulos, o 12º muito comprido. Na barba da antenna alternam zonas largas mais escuras e mais claras.

**Imago** Female: 7.5 mm— 8.5 mm·

*Palpos* de 5 articulos cylindricos.

Antennas de 6 articulos, em forma de pote, sendo o 2.<sup>o</sup> (com estreitamento no meio) e o 6.<sup>o</sup> (cilindrico) os mais compridos.

Aspecto geral *brunnaceo*, lembrando quanto ao colorido um tanto as Tipulas. — Cabeça escura no aspecto frontal, devido á grande extensão dos olhos. Palpos e hastes das antenas um pouco mais retintas do que as pernas.

**Thorax:** brunnaceo, com 3 estrias longitudinaes brunoescuras, os interstieios branco amarellaeos. O metathorax fuliginoso-escuro, quasi preto.

**Asas:** hyalinas, iridescentes.

**Abdomen:** Segmentos anteriores meio claros, os dous ou tres posteriores escuros. Margem fortemente encabellada por toda a parte. Em cada segmento uma figura triangular, cuneiforme, brima escura, com base na margem anterior, atravessa o lado dorsal, abarcando ainda parte dos lados e empresta ornamentação característica ao abdómen.

**Pernas:** branco-amarellaceas. **Par I** (comprido): um pouco mais escura (chamuscada) o ultimo sexto distal do fémur, e o primeiro terço medial da tibia. **Par II e III** : Iuliginoso escuro, quasi preto, uma estreita zona terminal em todas as articulações tarsaes, sendo sobretudo distincta a tibio-tarsal.

Numerosos males e females apanhados e criados nos mesmos logares aqui no Pará, e de sociedade com a especie anterior, (fevereiro e março de 1905) e da qual facilmente se distingue pelo seu tamanho mais avantajado e o seu colorido brunnaceo.

O novo nome especifico « *calligraphus* » foi proposto em attenção á notavel belleza da linha que descreve este Chironomus com o seu cordão de ovos.

**Adult:** Male: 7.5-8.5 mm. Palps of 4 cylindrical segments, of which the 2nd and 3rd are equal. I short; II & III long, almost equal, IV the longest.

Antenna plumose, very setaceous, of 12 segments, the 12<sup>th</sup> very long. The antenna beard with the with alternate wider, darker and lighter areas.

Female: 7.5 mm - 8.5 mm. Palps of 5 cylindrical segments. Antenna of 6 segments, in the form of a vase, the 2<sup>nd</sup> (with a constriction in the middle) the 6<sup>th</sup> (cylindrical) the longest.

**Thorax:** brownish, with 3 longitudinal extensions dark brown, with yellowish white in between. The metathorax sooty-dark almost black.

**Wings:** Hyaline, iridescent.

**Abdomen:** Anterior segments partly clear, the posterior two or three dark. Margin strong everywhere. In each segment a triangular figure, cuneiform dark rim, based on the anterior margin, across the dorsal side, still covering part of the sides and lends characteristic ornamentation to the abdomen.

**Legs:** **Pair I** (long), a little darker (singed) on the ultimate sixth distal of the femur and the first third medial of the tibia. **Pair II** and **III** dark almost black, a narrow terminal zone in all tarsal joints, and above all distinguishes the tibial tarsal (junction).

Numerous males and females caught and bred in the same places here in Pará, and in partnership with the previous species (i.e. 1) *Goeldichironomus holoprasinus* Goeldi), (February and March of 1905) and from which is easily separated by its larger size and brown color.

The new specific name <<calligraphus>> is proposed with regards to the remarkable beauty of the line that describes this *Chironomus* with its string of eggs.

The eggs and larva pictured by Goeldi are not *C. calligraphus* (Spies & Reiss 1996).

Goeldi's original syntypes from open water tanks in Belém appear to be lost (but may be in the Museum in Bern, Switzerland where Goeldi lodged much of his collection) and Fittkau (1965) designated a neotype from the material he collected from the original type locality.

#### Adult:

##### Male:

Many measurements vary between regions but greatest variation is in U.S.A. populations for most characters.

Only 1 poor adult specimen from North America, plus some data from Dr. Martin Spies, is known for certain. Therefore the South American data is also provided:

##### South America:

Wing length - 5.5-6.0 mm.

Head: Antennal plume with wide dark band; AR 2.93-3.43; clypeal setae 22-27. Palps (segs 2-5) (micron): 45 : 210 : 210 : 310.

Thoracic setae – Acrostichals at least 15-24; dorsocentrals 14-20; prealars 5; supra alars 1; scutellars 19-29 in total.

Legs: LR1 1.94; F/T1 1.37; Ta5/Ti1 0.37; BR 1.6;

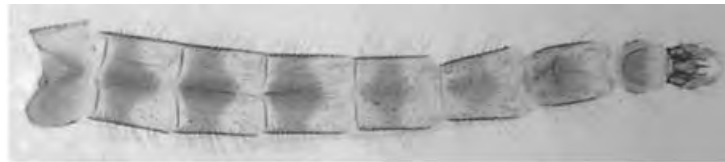
LR2 0.67; F/Ti2 1.16

LR3 0.80; F/Ti2 1.07

Fore leg proportions (relative to length of Ti) (Fittkau 1965):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1.44	1	1.94	0.97	0.83	0.78	0.39	1.94	1.42-1.44	1.6
PII	1.16	1	0.67	0.35	0.26	0.15	0.11	0.67	1.16	2.5
PIII	1.07	1	0.80	0.41	0.31	0.19	0.11	0.80	1.07	4.5

The leg ratio for *C. aversa* Roback of 1.9, noted in Spies *et al.* (2002), suggests that it may be Type 1.



Male abdomen from Belém, Brazil (Spies *et al.* 2002)

Abdomen with a broad lateral band containing a darker longitudinal band, often paler on segments V-VII. 5-19 setae on tergite IX; SVo closest to D(e)-type of Strenzke (1959); anal point narrowed at base; gonostylus narrowing relatively sharply over distal half to third.

Spies *et al.* (2002) compare the measurements to previous descriptions from South America and note that the usual characters of AR, and LR are correlated to wing length.

##### North America (laboratory reared males):

Wing length 2.73-2.80 mm, width 0.75 mm. VR 0.98; SCf 3; Setae on squamal fringe 28-30.

Head: AR abt 2.7-3.1; Frontal tubercles 35 x 12.5 µm (l/w 2.8);

Palps (µm): 46 : 40 : 150 : 170 : shriveled. Clypeus 0.67 of diameter antennal pedicel, with 26 setae.

Thoracic setae: Acrostichal – no count; Dorsocentral – 23, 25; Prealar – 4, 5; Supraalar – 1, 1; Scutellar – 5 anterior, 14 posterior.

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1115	1015	-	-	-	-	-	1.70-1.75	1.10	1.94
PII	1215	1100	690	375	285	175	133	0.62	1.10	
PIII	1240	1215	960	505	405	235	170	0.79	1.02	

Abdomen with anterior triangular brown mark, then most of other tergites brown. Tergite IX with 7 setae in a single patch. SVo closest to E(h) type of Strenzke (1959); Ivo with simple setae and extending to about 1/3 along gonostyle, which is relatively narrow and narrows gently over distal 1/2-2/3.

Female: No significant variation from original descriptions or between individuals from different localities. However, again only a single confirmed North American specimen.

Available values from South America:

Wing length 2.8-3.1 mm.

Head – antennal proportions: 105 : 75 : 72 : 69 : 126. AR 0.39; A5/A1 1.2.

Palps (segs 2-5): 46 : 260 : 280 : 420.

Thoracic setae: Acrostichal 20 (17-28); Dorsocentral 34 (28-34); Prealar 5 (4-6);

Supraalar 1; Scutellar 15 (14-16).

Legs: Proportions (relative to length of Ti):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
PI	1.40	1	2.05	1.03	0.91	0.94	0.43	2.05	1.4	0.94
PII	1.17	1	0.63	0.43	0.24	0.15	0.10	0.63	1.17	
PIII	1.08	1	0.80	0.40	0.32	0.19	0.12	0.80	1.08	

BR 1.6

North American: (Coyote Ck, Cerritos, Los Angeles Co. UCA.16.1 F1-2.

Head – Cephalic tubercles about 40 µm long and 20 µm wide, narrowing towards the tip.

Antennal proportions (micron) (% neck in brackets): 190 (29) ; 110 (31) : 120 (45) : 115 (43%) : 210 ; AR 0.39; A5/A1 1.11. Clypeal width about 1.5 times diameter of antennal pedicel; about 36 clypeal setae. Palp proportions (micron) 80 : 50 : 175 ; 180 : at least 205 (shriveled).

Thoracic setae – acrostichals at least 12 (17-28); humerals – abt 4, 4+1 linear; dorsocentrals – 23; prealars 6; supra alars 1; scutellars with 15 larger setae at rear and 14 in 2 anterior rows.

Leg lengths (micron) and proportions:

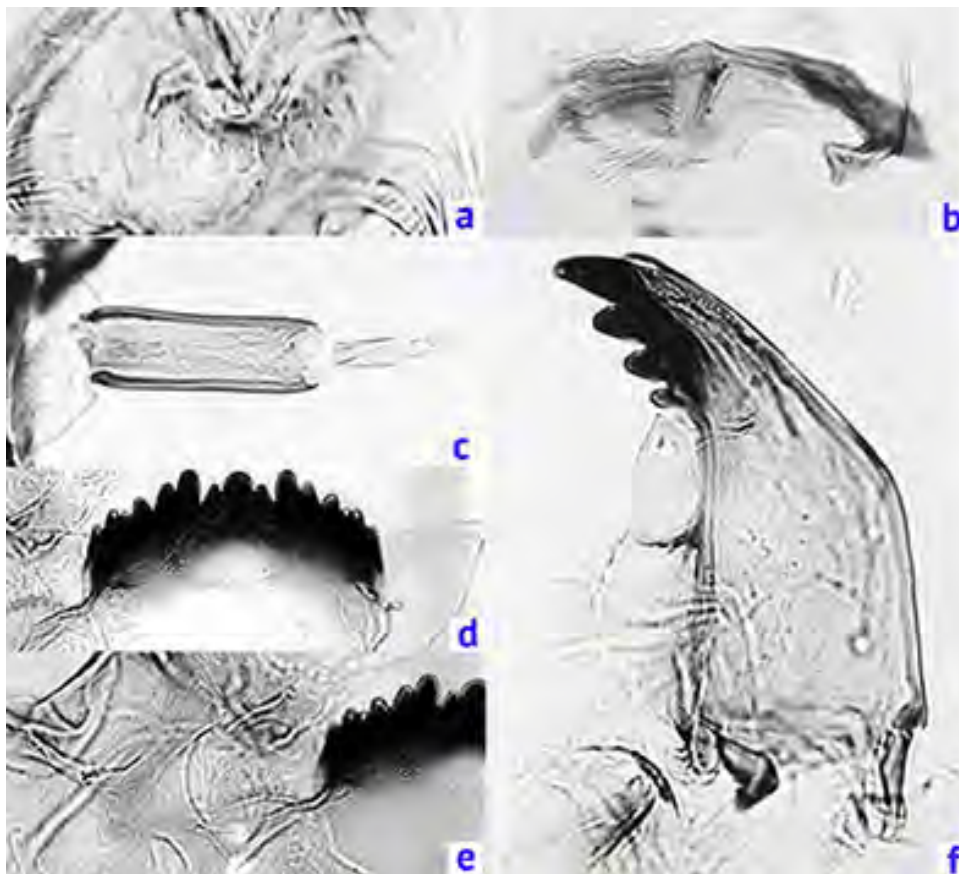
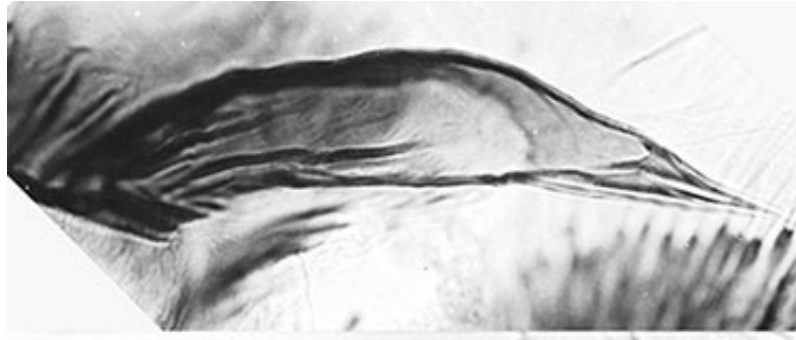
	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T
PI	1390	1115	-	-	-	-	-	-	1.25
PII	1340	1270	735	380	280	150	125	0.58	1.06
PIII	1465	1390	1060	550	430	260	145	0.75	1.05

Abdomen chestnut brown with narrow whitish stripes, last and second last segments wholly dark. Tergite IX with up to 19 setae.

**Pupa:** None confirmed. Fittkau (1965) lists pupal length as 6.8-8 mm. Exuvia hyaline, brownish. Cephalic tubercles well developed and dark.



The shagreen pattern is described as: Abdominal sternites I, II with weak shagreen of variable extent; SI covered at least in posterior 1/4, SII at least in anterior 1/2; parasternite II covered except around Pedes spurii B; SIII shagreen less extensive than on SII, parasternite with only anterior remnants. Paratergites V-VII with a posterolateral field of small points; anal spur with 1-5, usually 2-4 spines. A possible type 1 specimen from Whittier, Los Angeles Co., California (below) has 3 closely applied spines.



**Fourth instar larva:** a small to medium plumosus-type about 10.9 mm (9.3-9.8 in Florida; Kansas female 13.7 mm) in length. Gula darkened on posterior third to half but extending beyond the width of the mentum and with a level anterior margin (see Fig. 4 Spies *et al.* 2002), FC slightly dark to dark. VT about equal length or posterior longer (ant. 2.24 (2.04-2.56) mm.; post. 2.36 (2.04-2.88) mm.) posterior pair coiled, shorter than described by Fittkau for South American specimens. TLt well developed 367 (280-420)  $\mu$ m. Anal tubules relatively short, 180-260  $\mu$ m long, 100-110  $\mu$ m wide (1.8-2.6) times longer than wide).

Clypeal aperture quite wide, abt 65 (63-68) x17 (15-19)  $\mu\text{m}$ ; and 3.6-4.2 x longer than wide in the 2 specimens in which it was able to be seen.

Mentum (Fig. d, above) width about 61 (59-62)% of VHL; c2 teeth well separated, type IIA but may be type III when not worn; 4th laterals reduced to or almost to the level of the 5th laterals (type II or III).

VM (Fig. e, above) plates separated by about a third (0.29-0.33) of the mentum width, about 190 (164-210)  $\mu\text{m}$  long and 3.6 (3.3-3.8) times longer than deep; longer 1.1 (1.0-1.14)x than the width of the mentum; with about 43.6 (40-48) striae.

Premandible (Fig. b, above) with inner tooth coming to a broad point, about 3.3 (3-4) times wider than outer tooth which comes to a fine point (Type D). PE with about 13.5 (9-15) somewhat irregular teeth (type B).

Distance between the antennal bases greater than the distance between the S4 setae, which are separated by about 81 (76-84)% of the FC width at that point.

Antenna (Fig. c, above) with basal segment, about 3.1(3.06-3.11) times longer than wide and about 1/3 the VHL; segment lengths (micron): 99 : 27 : 7 : 10 : 7 (note A3 about same length as A5 - A5/A3 0.86-1.09); AR about 1.96 (1.87-2.05); A2/A1 about 0.28 (0.25-0.29).

Mandible (Fig. f, above) with third inner tooth usually well-developed but only partly colored (mostly type IIIB but occasionally IIB); 14.7 (13-17) furrows on the outer surface near the base; 11 (10-12) taeniae in PMA; MTR 0.32 (0.25-0.38).

**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. This is probably the form used in the cytological studies of arms A, E, and F by Wülker, Dévai and Dévai (1989) and Wülker and Morath (1989).

The chromosomes of a single specimen of type 1, of very poor quality were available. Many sequences could be identical to those of *C. hawaiiensis*; arm C might be sequence C2. Arm G relatively long, closely paired with a nucleolus about 1/4 from end with heterochromatic cap, with a closely applied BR and two BRs near the other end - the most obvious difference being a much more developed nucleolus and BR, although this may just be a characteristic of this specimen. Polymorphism for arms A, B, and C is present in Central or South American samples, but no data for the pattern of arm C or G or of other banding techniques, and there are cases known where homosequential sequences hide a very different pattern of heterochromatin, etc., distribution.

cagA1: 1a-e, 9a-e, 2d-3b, 8g-d, 1k-f, 3c-i, 13a-15e, 4-8c, 2a-c, 10-12, 16-19 as hawA1

cagA3: approx. 1a-e, 9a-e, 2d-3b, 8g-d, 1k-f, 3c-i, 13a-15e, 4a, 6b-4b, 6c-8c, 2a-c, 10-12, 16-19 (Kansas)

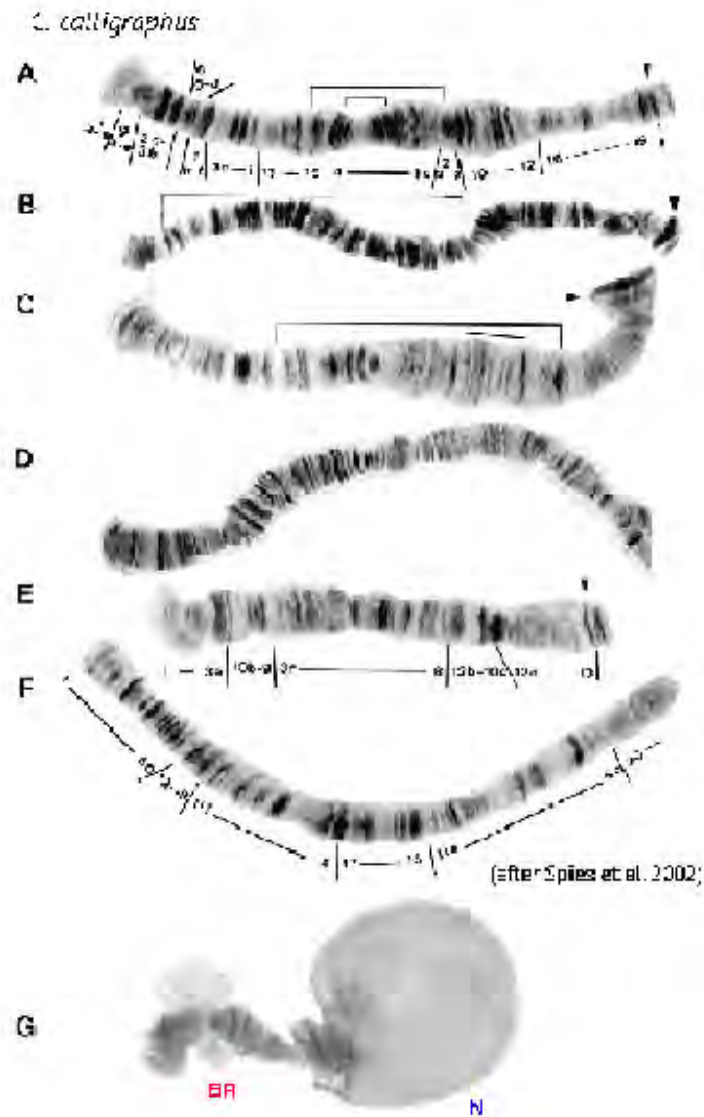
cagB1: bulb (gp 7) about 1/3 from distal end with dark bands (gp 8?) distal to it. as hawB1

cagC1: Typical band group 3-4 about 1/3 from centromere. as hawC1

cagD1: not mapped. as hawD1

cagE1: 1a-3e, 10b-9a, 3f-8, 12b-10c, 12c-13 as hawE1

cagF1: 1a-6b, 19-18, 11f-14, 17-15, 11e-6c, 20-23 as hawF1 & sp. WOC



Chromosomes of *C. calligraphus*. Brackets above segments are inversions that occur in other populations. Line above arm C is characteristic groups 3-4.

**Confirmed localities:**

**California** - confluence N & E forks Coyote Creek, Cerritos (33.88°N, 118.07°W)  
Los Angeles Co.

**Florida** - Gainesville (29.65° N, 82.33°W), Alachua Co.; Winter Haven, Polk Co.

**Kansas** - Mill Creek, nr Craig, Johnson Co. (37.95°N, 94.80°W).

Also Cali, Colombia; Brazil (**Type locality** – **Belém, Pará**)(but which type?).

Specimens identified as *C. calligraphus* are widespread, found in a wide variety of habitats and may become a pest in some habitats (Gray *et al.* 2012). The following is a list of North America localities which are uncertain as to whether *C. calligraphus* or *C. hawaiiensis*, and with a note of other geographic areas, some of which are unconfirmed:

**Found:** **Arkansas** – White River National Wildlife Refuge (Chordas *et al.* 2004)

**California** - South Gate and Long Beach, Los Angeles River; Bellflower, San Gabriel River; N fork Coyote Creek, vicinity of Telegraph Road, Whittier (58.97°N,

118.02°W); all Los Angeles Co.; Good Samaritan retirement home, Corona; Hidden Valley golf course, 2 mi. w. Pedley, all Riverside Co.

**Georgia** - Unidentified pulp plant in coastal Georgia (Gray *et al.* 2012)

Also Panama; Cali, Colombia; Brazil and Peru.

Guatemala: Jacinto Specimens identified as *C. calligraphus* comprised two cytological types: one larva possibly similar to those described here and heterozygous for arm A (but with rather poor chromosomes), while the other larvae had arm A fused to arm G - and presumably arm E as a separate element (perhaps a misidentification?).

Specimens from Argentina identified as "*C. calligraphus*" are a quite different species on the basis of the BARCODE sequence.

These adult male measurements suggest that there may be differences in the relative lengths of segments of at least the fore legs between type 1 and 2.

In the larvae, the VT from California (i.e. *C. hawaiiensis*) are shorter than those from Kansas or Florida (type 1) but both forms have shorter VT than figured by Fittkau from Brazil. The anal tubules of known type 1 specimens are shorter (180-260 µm) than those of type 2 (337-385 µm).

Referred to in some published work as 'Sp. 52' or 'species Coyote Creek (see Spies *et al.* 2002). Wülker & Morath (1989) give the sequence of arms A, E and F; and larva and cytology are described by Spies *et al.* (2002). A form with a different karyotype has been found in Argentina, but this form has not been found in North America.

Shows relationship to *C. anonymus* and species WOC.

The presence of type 2 in Hawaii (and also in Tahiti from BOLD) raises a question as to the correct name for this species. The specimens were originally identified at the Museum in Honolulu as *C. hawaiiensis* but the cytology and BARCODE sequence place them as *C. calligraphus* type 2. Since no difference can be demonstrated between the syntypes of *C. hawaiiensis* and Type 2 of *C. calligaster*, *C. hawaiiensis* becomes the valid name for this type as it has precedence.

### ***C. hawaiiensis* Grimshaw, 1901 (Species 5o)**

Synonym: *C. calligraphus* Type. 2

Possible synonym: *Chironomus* sp. 51 Norland *et al.* 1974 and others

Originally described from the U.S. state of Hawaii, the species is now known to be much more widely distributed, including on the U.S. mainland. Specimens of *C. hawaiiensis* cannot be distinguished morphologically from *C. calligraphus* and the COI barcodes indicated that *C. calligraphus* Ty. 2 is conspecific with *C. hawaiiensis*, which is the valid name (Martin 2020).

In BOLD Bin: [BOLD:AAP1715](#) (as *C. calligraphus*)

Original description of Grimshaw (1901)

Grimshaw, P. H. 1901 Diptera. Fauna Hawaiiensis 3: 4-5.

*Chironomus hawaiiensis*, sp. nov.

Long. corp. male 5, female 5—6 mm. ; al. male 3, female 3—3 1/2 mm.

Male. Head and basal joints of antennae yellow, palpi yellowish-brown, plumes of antennae light yellowish-brown, eyes black. Thorax with the ground-colour whitish, almost silvery, in some specimens with a slight greenish tinge, two anterior approximated dorso-central and two posterior lateral abbreviated stripes reddish-brown, the three lines of ground-colour thus left furnished with rather long very pale hairs; pleurae and scutellum greenish-grey, the latter with long pale yellow hairs, metanotum reddish-brown, halteres pale. Abdomen slender, yellowish-grey, with light yellow hairs, each segment with a triangular basal dark brown spot, the apex of which points backward while the base extends completely across the segment, apical segments almost entirely dark. Legs light yellow, all the femora with a brown ring near the apex, fore legs except the femora, bare, with the tibiae a little more than half the length of the metatarsi, basal third and tip of tibiae brown, tips of all the tarsal joints likewise brown, intermediate and hind legs long-haired, tips and bases of the tibiae and tips of the tarsal joints brown. Wings whitish hyaline, anal angle prominent, transverse vein dark, rest of venation pale.

Martin Spies examined two syntype males from the British Museum of Natural History and provided the following additional information:

One syntype was missing antennae and fore tarsi.

Wing length 2.44 mm and 2.61 mm. AR 3.0. LR 1.70 (Ant Ti 1000  $\mu\text{m}$ ; Ta! 1700  $\mu\text{m}$ ), other Ant Ti 960  $\mu\text{m}$ .

Abdominal marking between that of Figs. 1a and 1c of Spies *et al.* (2002).

Superior volsellae also similar to those seen in specimens of *C. calligraphus*.

Female: Similar to the male, terminal joints of the antennae dark and slender, legs almost bare.

HAB. Oahu, Waialua, Koolau range, three males and three females from the beach and coast, February 1893.



Plate I. figs. 6 and 7, wing and female antenna.

#### Adult:

The previous descriptions, Grimshaw (1901), Williams (1944) and Hardy (1960) are not very prescriptive. They suggest that the major difference from *C. calligraphus* is the narrow anal point of the male.

Williams (1944), while providing good figures, simply states it to be a chiefly dull greenish brown mosquito-size insect. He also quotes Dr. R.C.L. Perkins, in the

Fauna Hawaiiensis 1, Introduction, as stating that its status as a native insect is very doubtful.

Male, from Grimshaw (1901) original description and notes from Hardy (1960):

Length 5 mm. (3.8-4.4 mm), wing length 2.44-3.4 mm)

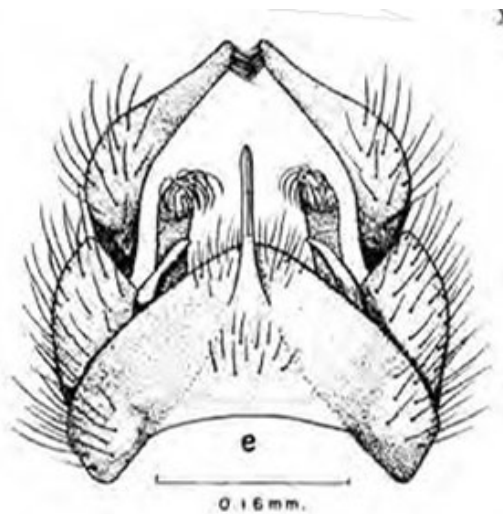
Head yellowish, palps yellowish brown. Thorax whitish almost silvery, sometimes with greenish tint, thoracic vittae and metanotum reddish brown (median vitta with a narrow yellow line along the middle, Hardy); pleurae and scutellum greenish-grey. Abdomen (usually greenish but turns brown after death, Hardy) with a basal triangular dark brown spot with the apex pointing backward (rest of segment yellow to yellow-grey), posterior segments almost entirely dark.

(Gonostylus slightly swollen at the base and rather slender apically. An elongate, slender anal point is present, the SVo slender and pointed, from figure perhaps closest to S(f) of Strenzke – Hardy illustration)

Legs light yellow, all femora with a brown ring near the apex, and darkening of the tips of the tarsal segments. LR under 2 (tibia a little more than half the length of the metatarsus) - a type from the British Museum has LR = 1.7 (see above).

Wings whitish hyaline, cross vein dark. VR perhaps 0.95 (Grimshaw and Hardy illustrations suggest about 1).

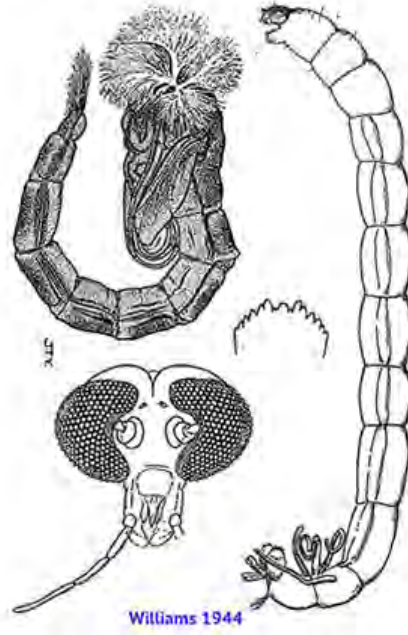
Hardy also illustrates a deformation of the palp in which the fourth segment is swollen and fused with the fifth segment.



Male hypopygium of *C. hawaiiensis* from Hardy 1960

This figure of the male hypopygium is very close to that of males identified by BARCODE as *C. calligraphus* Ty. 2 (i.e. *C. hawaiiensis*) (see photographs below) from Hawaii.

Female similar to male, terminal joints of antennae dark. Grimshaw figure would suggest the antennal proportions could be: 10 : 7 : 8 : 6 : 13. AR about 0.45 and A5/A1 about 1.3 (from Williams 1944, the clypeal width could be about 1.3 times the diameter of the antennal pedicel; and the palp segments 2-5 proportions: 3 : 11 : 11 : 19).



Female head (lower left), Pupa (upper left), 4th instar larva (right) and larval mentum (center) of *C. hawaiiensis* from Williams 1944

**Pupa:** No data – just an illustration in Williams (1944) (above).

**Fourth instar larva:** No data, but an illustration of the whole larva (above) that shows it to be a plumosus type, and a small figure of the mentum (center, above) that suggests the fourth laterals are not reduced (type I) (it is likely this is accurate as his illustration of the mentum of *Chironomus pauciplumatus* (not shown) clearly shows the 4th laterals of that species to be reduced).

These descriptions can now be expanded by the inclusion of more recent specimens from Hawaii and those from mainland U.S.A.:

**Male:**

Wing length - 2.28-3.52 mm., width about 0.7 mm.; 3 SCf on brachiolum, about 22 setae on squamal fringe.

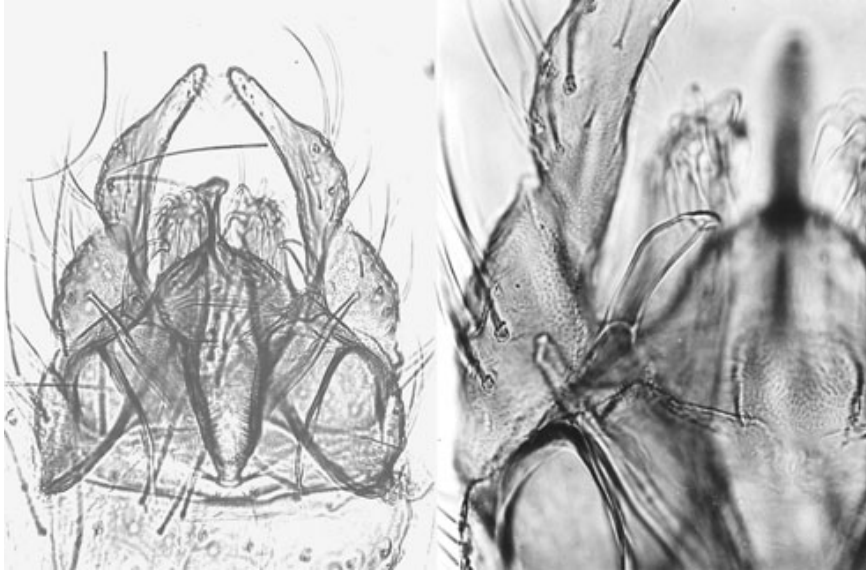
Head: Antennal plume with wide dark band. AR - 2.93-3.52.

Frontal tubercles about 47 x 16 µm; clypeal width about 0.67-0.69 of the diameter of the antennal pedicel, with about 28 setae. Palps (micron): 60 : 45 : 191 : 200 : 308; P5/P4 1.41-1.67.

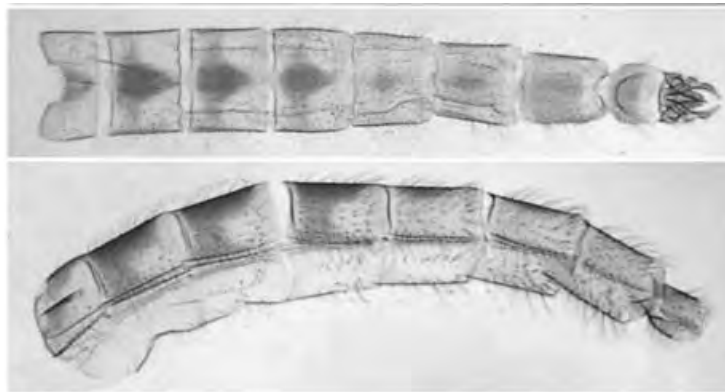
Thoracic setae – Acrostichals at least 11; dorsocentrals 21; prealars 5; supra alars 1; scutellars 8 in anterior row, 10-14 in posterior row.

Leg lengths (micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
<b>PI</b>	1105	955	1555	790	690	635	630	1.59-1.65	1.15-1.17	2-2.07
<b>PII</b>	1168	1050	640	388	280	168	130	0.59-0.63	1.11	
<b>PIII</b>	1315	1215	993	518	405	260	160	0.81-0.82	1.08	



Hypopygium (left) and Svo (right) of males from Hawaii



Male abdomen from Huntington Beach, California (Spies *et al.* 2002)

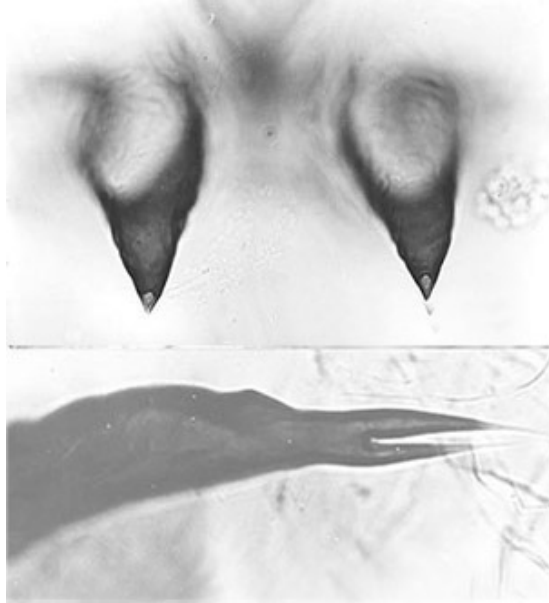
Abdomen with dark, posteriorly pointed, triangular area on midline with generally fairly narrow transverse band at or near anterior margin; 5-7 setae in multiple pale patches on tergite IX. Anal point narrow, IVo with simple setae, reaching about a third along length of gonostylus which is quite expanded at the base and narrows sharply from about midpoint.

**Females:**

No confirmed specimens were available for study. Spies *et al.* (2002) recorded no significant variation between *C. calligraphus* and *C. hawaiiensis* individuals from different localities and also noted that there were no obvious differences from females of related species.

**Pupa:** Length 11.3 (7.8-13.3) mm. Cephalic tubercles well developed (104x63  $\mu$ m) and dark.





Pupal cephalic tubercles (above) and spur (below) of *C. hawaiiensis*

About 101 recurved hooks on segment II, occupying about 77% of segment width; PSA on segment IV about 103x63  $\mu\text{m}$  and about 15% of the segment length, those of V-VII a field of small points.

Abdominal sternite I and II with weak shagreen of variable extent down the center of segs II-VI, on anterior of segment VII and on most of segment VIII.

Postero-lateral spur of segment VIII with 2-3 spines in one case separated like a 2-pronged fork (lower in fig. above). About 87 taeniae on each side of the swim fin.

**Fourth instar larva** a small to medium plumosus-type (11.4 (9.8-13.3 mm) (male 9.8mm; female 10.3-13.3). Gula dark to very dark on posterior third to half extending beyond the width of the mentum and with a level anterior margin, FC also darkened, and sometimes some darkening just outside the FC. Ventral tubules with posterior pair longer (Ant. 1.38 (0.92-1.76) mm; Post. 1.49 (1.08-1.82 mm)), posterior pair coiled, shorter than described by Fittkau for South American specimens. TLt well developed 365 (320-420)  $\mu\text{m}$ . AT relatively short, ventral pair longer (dors. 336.6 (280-360)  $\mu\text{m}$ ; ventral 384.7 (351-450)  $\mu\text{m}$ ), about 2.4-3.7 times longer than wide.

Mentum (c, below) with somewhat rounded teeth; c1 tooth relatively narrow and rounded, c2 teeth moderately well separated (type IIA or III), with reduced 4th lateral (type II).

VM plates (d, below) separated by about 29-30% of the mentum width; about 182.2 (172-195)  $\mu\text{m}$  long and 3.6 (3.4-3.9) times longer than deep; longer 1.08 (1.06-1.13)x than the width of the mentum; with about 40.7 (39-49) striae; VMR 0.25 (0.20-0.33).

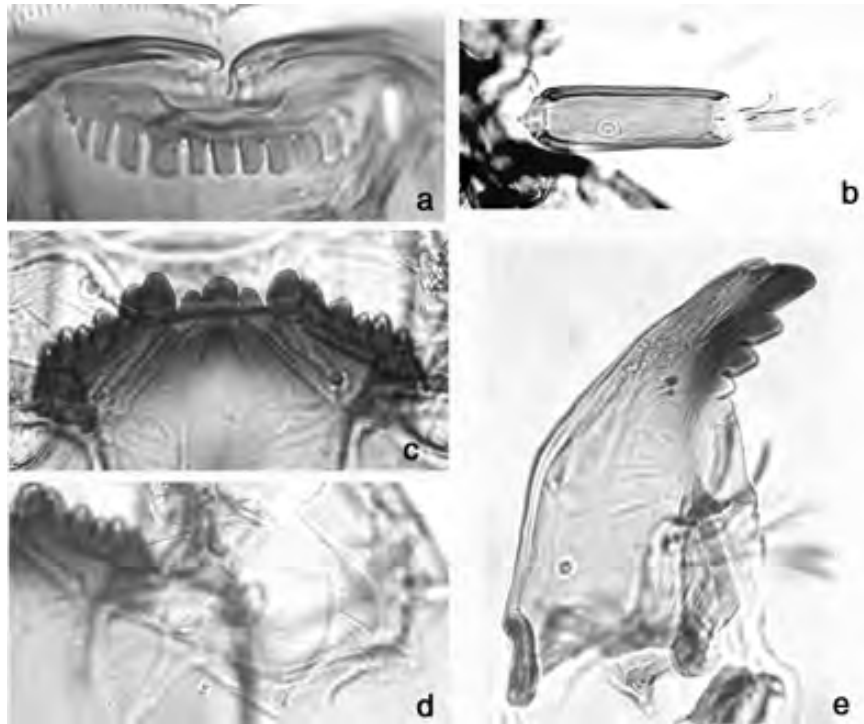
Premandible with teeth about equal length, inner tooth about 3-4.5 times wider than outer tooth.

PE (a, below) with about 12.3 (10-15) somewhat irregular teeth (type B).

Distance between the antennal bases usually greater than the distance between the S4 setae, which are separated by about 81% (76-84%) of the FC width at that point.

Antenna (b, below) with relatively narrow basal segment, about 3.0 (2.64-3.53) times longer than wide; segment lengths (micron): 100 : 26 : 6 : 10.5 : 6 (note A3 about same length as A5 – A5/A3 0.96 (0.75-1.25)); AR about 2.15 (1.73-3.12); A2/A1 about 0.26 (0.23-0.28). Two Hawaiian specimens showed developmental abnormalities of one antenna, in one case with only 4 segments (lacking A3) and the other with only 3 segments (lacking A2 and A3).

Mandible (e, below) with 3rd inner tooth relatively well developed but only partly colored (mostly type IIIB, but occasionally IIB); 13 (10-15) furrows on the outer surface near the base; 11.2 (10-13) taeniae in PMA; MTR 0.10-0.18.



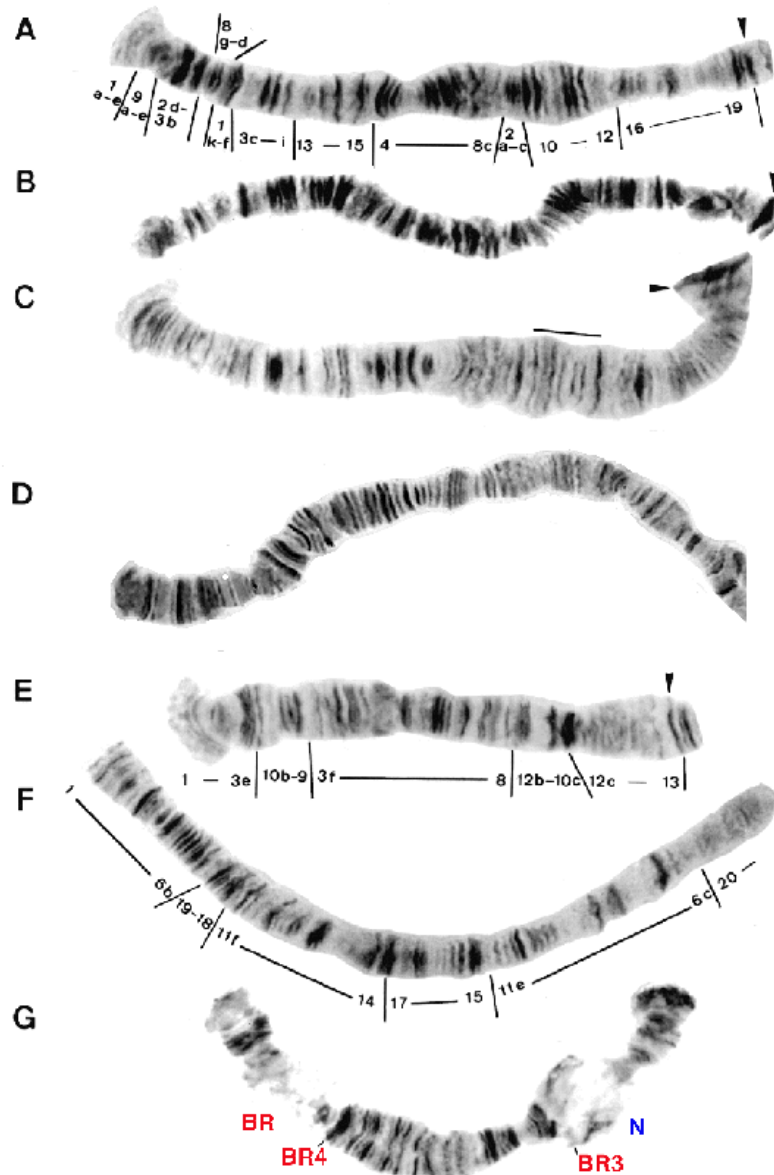
Larval mouthparts of *C. hawaiiensis*

**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G.

Arm G relatively long, closely paired with a nucleolus about  $\frac{1}{4}$  from one end and a BR near the other end. No nucleoli in other chromosomes. Moderate amount of heterochromatin at the centromeres. Arm B with bulb and distal dark bands about  $\frac{1}{3}$  from end of arm.

Polymorphism for arms A, B, and C is present in Central or South American samples and for arm C in Hawaiian samples.

hawA1:	1a-e, 9a-e, 2d-3b, 8g-d, 1k-f, 3c-i, 13a-15e, 4-8c, 2a-c, 10-12, 16-19	as cagA1
hawB1:	bulb (gp 7) about $\frac{1}{3}$ from distal end with dark bands (gp 8?) distal to it.	as cagB1
hawC1:	Typical band group 3-4 about $\frac{1}{3}$ from centromere.	as cagC1
hawD1:	not mapped.	as cagD1
hawE1:	1a-3e, 10b-9a, 3f-8, 12b-10c, 12c-13	as cagE1
hawF1:	1a-6b, 19-18, 11f-14, 17-15, 11e-6c, 20-23	as cagF1 & sp. WOC



(after Spies et al. 2002)

Polytene chromosomes of *C. hawaiiensis*  
Line above arm C is the characteristic groups 3-4.

Identification: This species is essentially only distinguishable from *C. calligraphus* by the *COI* barcode sequence (Martin 2020).

**Confirmed localities:**

**California:** Santa Ana River, Anaheim (33.84°N, 53.89°W) (BOLD), Huntington Beach (33.640°N, 117.971°W), both Orange Co.; Conejo Creek (34.201°N, 119.001°W), Ventura Co.; San Diego Library (32.7088°N, 117,154°W), San Diego Co. (both BOLD); Valley Seminary District (33.71°N, 116.20°W), Riverside Co.  
**Hawaii:** Waialua, Koolau range (**Type locality**), Bishop Museum (19.55°N, 154.77°W), Honolulu ; Enchanted Lake (21.25°N, 158.67°W), Kailua, all Ohau; Kealia Pond (20.78°N, 156.93°W), Kihei, Maui.

also: Brazil – Belém, Pará; and Tahiti (based on barcode data).

**C. species WOC of Wülker & Morath (1989) (Species 3r)**

**Adult and Pupa:** not known, but may be similar to *C. calligraphus*.

**Fourth instar larva:** a medium plumosus-type larva; length (female) about 11.8mm (VHL abt. 320-340  $\mu\text{m}$ ). TLt well developed, about 720  $\mu\text{m}$ . VT long, posterior pair longer and coiled, and may be over 40% of the larval length; AT long, about 3.3-3.6 times longer than wide (dorsal) to 5.7 (ventral).

Clypeal aperture about 4.5 times longer than wide. Gula dark to very dark on posterior third to half, FC slightly to dark, some darkening elsewhere on dorsal head.

Mentum (fig. c, below) with pointed teeth; c1 tooth relatively broad with parallel sides, c2 teeth well developed and separated (type III), 4<sup>th</sup> laterals reduced about to level of 5<sup>th</sup> laterals (type II-III).

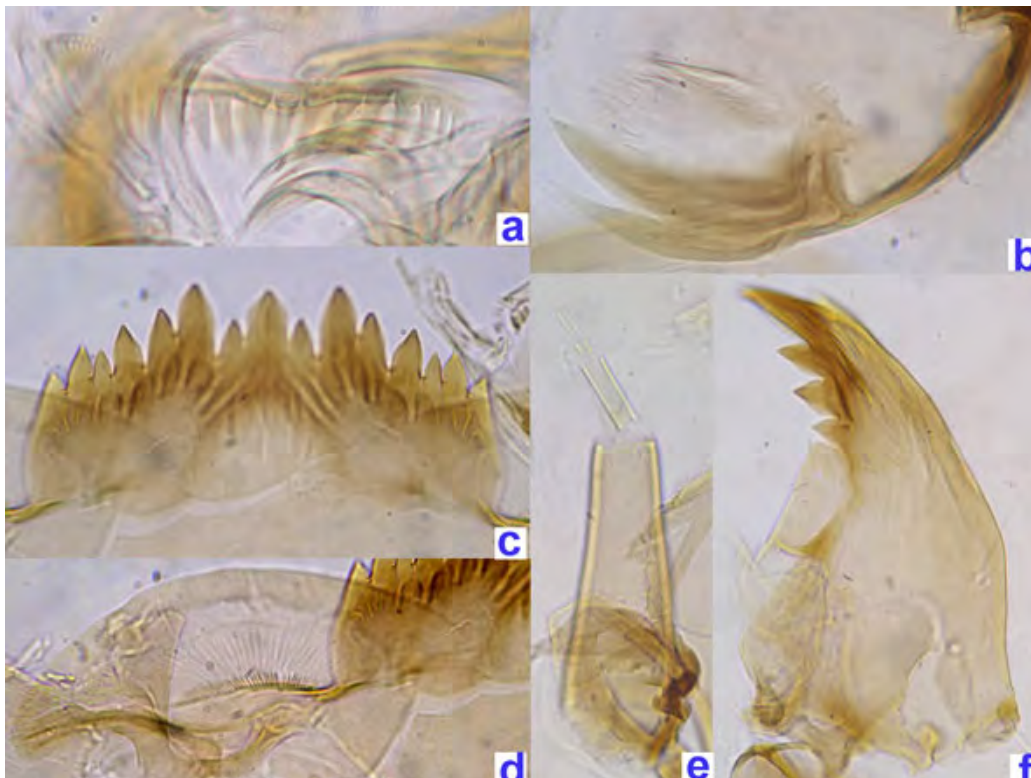
Ventromentum (fig. d, below) with smooth anterior margin; about 38-41 striae; VMR about 0.25; IPD about 28-32% MW. PE (fig. a, below) with about 13-16 sharp teeth (type B).

Premandible (fig. b, below) of type B2 with moderately broad sharp teeth, the inner tooth about 2-3.3 times wider than outer tooth.

Antenna (fig. e, below) with relatively long basal segment, abt. 4.25-4.4 times longer than A2 and abt. 3.4-3.9 times longer than wide; RO abt. a third to half way up from base; AR about 2.06-2.23; A3 shorter than or as long as A5; segment proportions ( $\mu\text{m}$ ): 135 : 31 : 7 : 13 : 8.

Distance between antennal bases slightly larger than that between S4 setae.

Mandible (fig. f, below) with third inner tooth fully developed and separated, and mostly darkened (type IIIB-C); about 13-15 furrows on outer surface at base, PMa with about 10-11 taeniae; Mdt-Mat about 0.12 of mandible length.



Mouthparts of *C. species* WOC.

**Cytology:** 4 moderately long polytene chromosomes with pseudothummi arm combination: AE, BF, CD, G.

Arm G with a terminal nucleolus. No nucleolus in other arms.

Centromeres moderately heterochromatic.

No polymorphism known in the small sample of specimens.

WOC A1: 1a-e, 9a-e, 2d-3b, 7d-4a, 3i, 13a-15e, 3h-c, 1f-k, 8d-g, 8a-c, 2a-c, 10a-12c, 16a-19f

WOC B1:

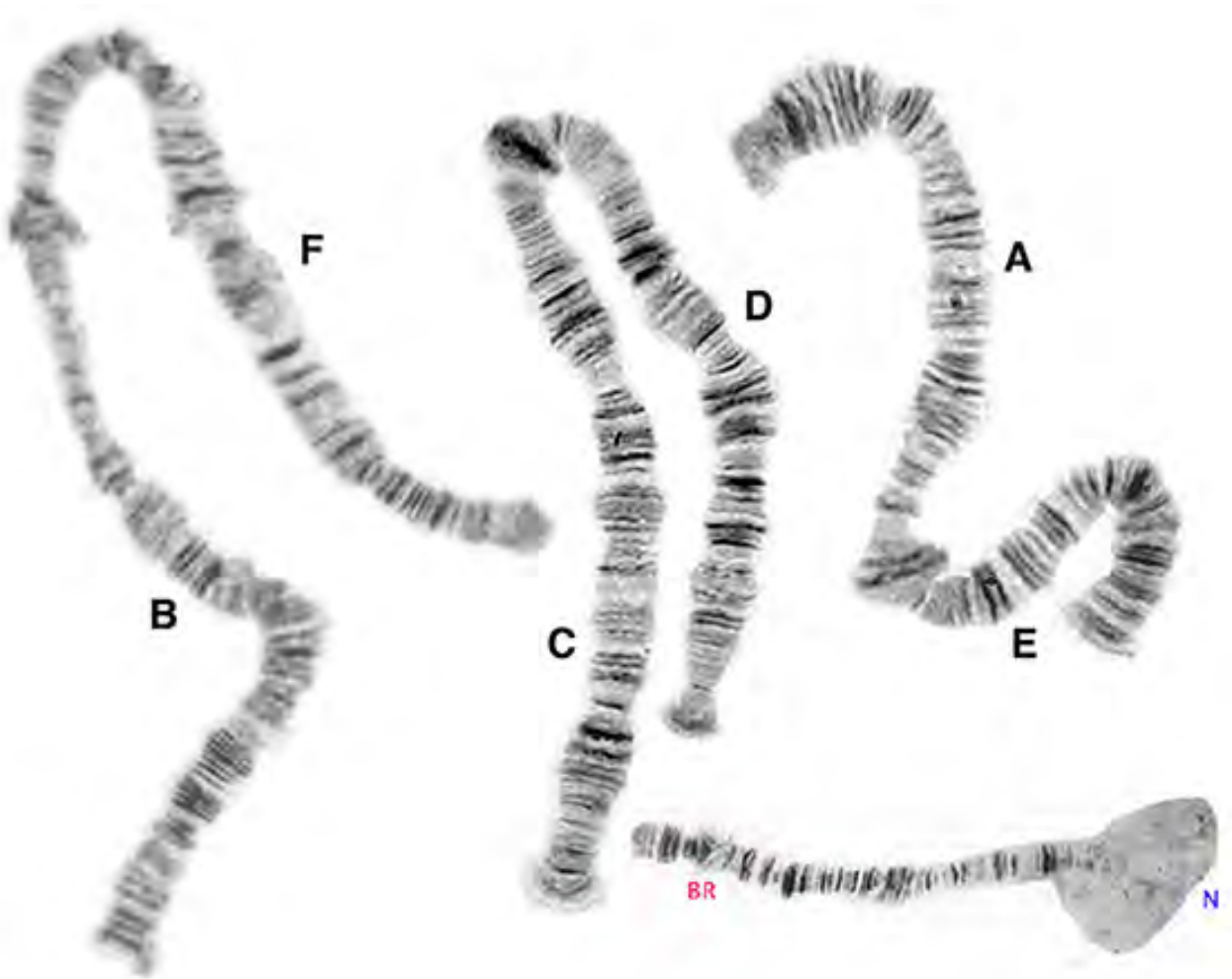
WOC C1: typical bands, groups 3 and 4, about the middle of the arm

WOC D1:

WOC E1: 1 - 10b, 12b - 10c, 12c - 13

WOC F1: 1a - 6b, 19d - 18a, 11f - 14h, 17d - 15a, 11e - 6c, 20a - 23f i.e. as in *calligraphus*

WOC G1: Closely paired with a nucleolus at one end and a BR near the other end



**Found:** Ontario - Aylmer (42.7706°N, 80.992°W) (GenBank & BOLD)

Arkansas - (BOLD)

Florida - Winter Haven;

Georgia - Camden subdivision, n. Athens, Clarke Co. (33.95°N; 83.37°W).

Louisiana - Many, Sabine Parish.

Tennessee - White Oak Creek abt. 38.2°N; 87.5°W) , Knox Co.  
COI sequence in GenBank and BOLD suggests it occurs as far north as Ontario.

Creeks and pools in the southeastern USA and possibly Canada. Does not appear to be common.

Sequences of arms A, E and F given in Wülker & Morath (1989) and photographs of chromosomes in Spies *et al.* (2002).

Shows affinities to *C. anonymus* (species2o), *C. calligraphus* (species 2w) and to a group of South American species.

#### Molecular sequence:

mtCOI: There is sequence of an apparently identical species in the BOLD database, but since it is “Private” the Bin no. cannot be determined, but may be the same specimen as in Genbank.

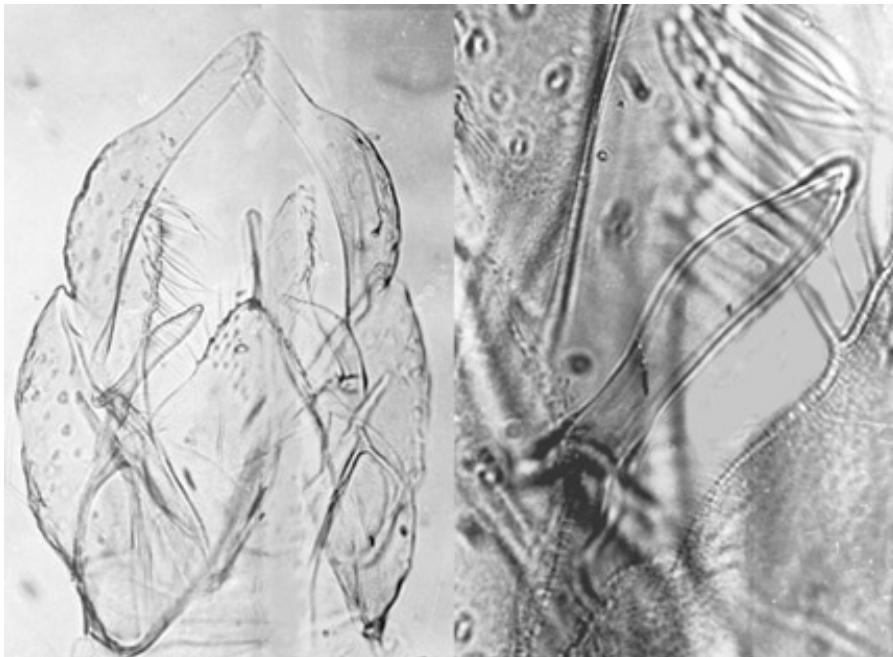
**C. species 2t.** - possibly *C. calligraphus* group – *sp. incert.*

The identity of this species is quite uncertain. No larva is known that fits the few criteria listed by Wülker. It is possible that it is an early designation for the sample from Winter Haven, Florida, since the description and the few images available show a mixture of characters of *C. calligraphus* and *C. species WOC*, both of which were found together at this location (see Spies *et al.* (2002).

#### Adult

The adults of this species are in the Sublette Collection, now in the museum at the University of Minnesota, St. Paul, MN.

Male:



Male terminalia of *C. species 2t* (left), and superior volsella (right).

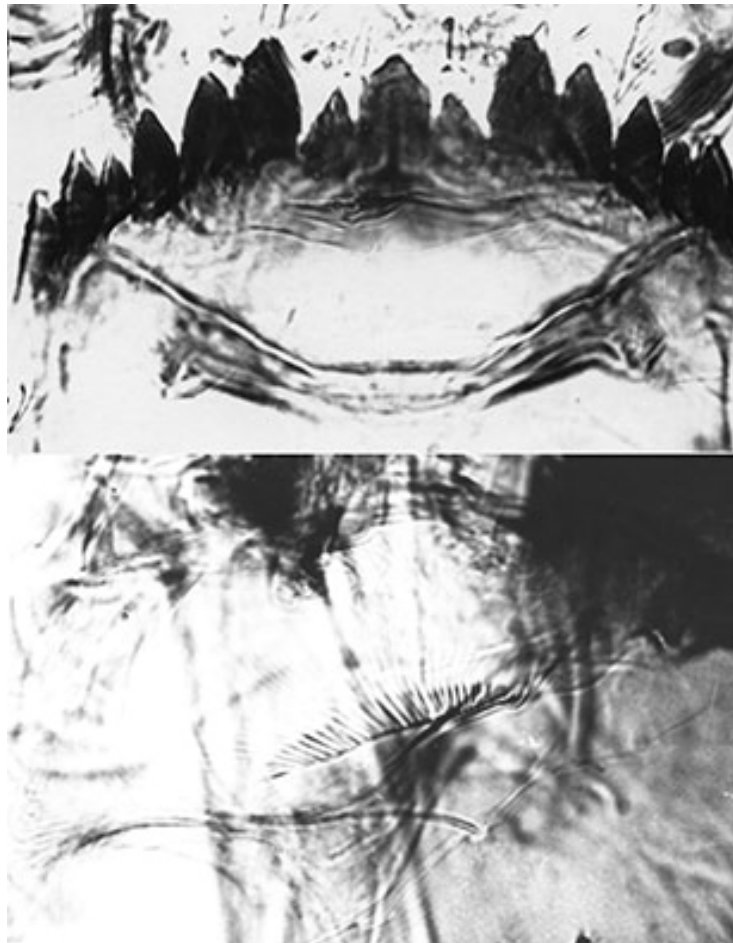
Possibly no setae near middle of tergite IX. Superior appendage most like Strenzke's S(f)-type. Anal point narrow; Ivo reaching beyond end of anal point to about the middle of the gonostylus.

This could be a male of *C. calligraphus*.

**Pupa:** No information.

**Fourth instar larva:** gross morphology not known. Mentum (below) with pointed teeth; c1 tooth relatively broad with parallel sides, c2 teeth well developed and separated (type III), as that of *C. sp.* WOC.

Ventromentum (below) with about 35 striae reaching about halfway to the margin.

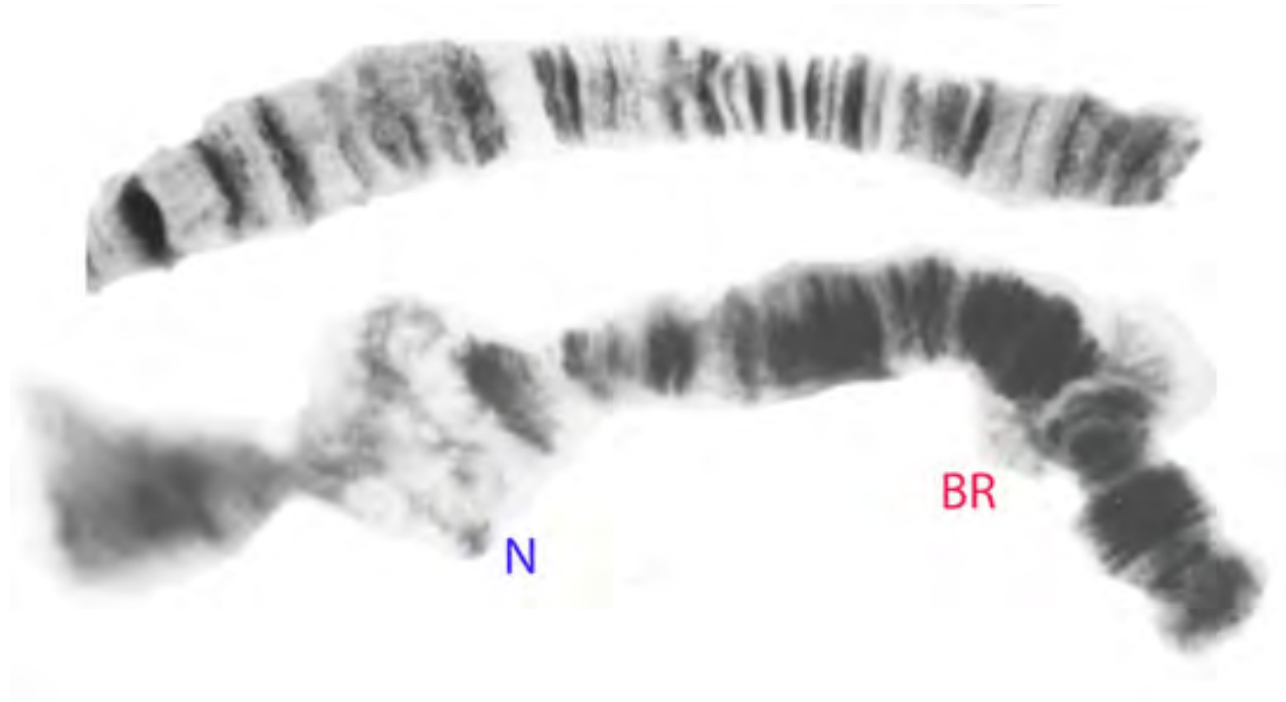


**Cytology:** 4 polytene chromosomes with pseudothummi arm combination AE, BF, CD, G. Arm G (below) paired with nucleolus about a third from one end; two to three BRs, the position of which varies due to inversion polymorphism, very similar to that of *C. calligraphus*. The distal end of arm F (below), is also apparently identical in sequence to that of *C. calligraphus*.

Centromeres of long chromosomes sometimes inflated like a nucleolus.

Arm F1: 1 - 6b, 19 - 18, 11f - 14, 17 - 15, 11e - 6c, 20 - 23 i.e. as *calligraphus* & sp. WOC.

Arm G1: subterminal nucleolus, with an obvious Balbiani ring towards the other end. Similar to that of *C. calligraphus*.



Distal end of arm F (above), and arm G (below) of *C. sp. 2t*  
Both are consistent with *C. calligraphus*

**Found:** Florida - Winter Haven and Lake Cannon, Polk Co.

Corresponds to Species 15 of Wülker. He noted the existence of polymorphism in arm G, but did not indicate the nature or extent of this polymorphism in the Winter Haven material - it may reflect the difference between the G of *C. calligraphus* and *C. sp. WOC*.

### end of calligraphus-group

***Chironomus acerbiphilus* Tokunaga, 1939** (Species 4j)

Synonym: *C. crassimanus* Strenzke 1959.

In BOLD Bin: [BOLD:AAL9507](#)

Nearest neighbour Bin: [BOLD:AAJ4234](#)

This bin contains the Japanese specimens of *C. acerbiphilus*

### Adult:

The adult male is known only from the photograph of an incomplete male from the BOLD database (below).





Wing length about 3.8 mm; wings clear unmarked, anterior veins darker. Coloration generally dark, thorax dark yellow grey; vittae, postnotum and metanotum dark, almost black; scutellum dark yellowish. Abdominal tergites mostly blackish with a thin paler band distal on segments II-VI.

**Pupa:** The pupae of North American populations are not known but the pupa of *C. crassimanus* from Europe has been described by Langton & Visser 2003 and Rodrigues *et al.* 2009.

Length of exuvia: 6.7-10.0 mm.

Coloration golden brown to brown, contrast between thorax and abdomen not clearly marked. Cephalic tubercles conical, 70-120  $\mu\text{m}$  x 55-67  $\mu\text{m}$ ; frontal setae 38-40  $\mu\text{m}$  long. Basal ring of thoracic horn 140-180  $\mu\text{m}$  long by 60-90  $\mu\text{m}$  wide (HR 2.0-2.4). Anterior thorax more sparsely granulate; granulation grading into reticulation sooner: above the oblique hinge line towards scutal hump evanescent and below, reticulate.

Hook row entire (except in some Polish specimens) occupying 0.41 of segment width; 42-66 hooks. Pedes spurii B well developed on segment II. Pedes spurii A of segment IV not considered by either author.

Armament of tergites II-VI in the form of an undivided patch of strong points, not strongly waisted and e.g. on tergite III extending laterally at most only as far as the inner edge of the lateral of the anterior adhesion marks and setae D4. The posterior transverse band not successively increasing in extent to tergite VI; usually reduced on VI, the most posterior points of tergites IV and V short.

Conjunctives IV/V and V/VI less strongly armed, rarely the points spinulate.

Postero-lateral spur of segment VIII with 1-4 long-acuminate spines.

Anal lobes weakly rounded; fringe with 67-116 taeniae.

**Fourth instar larva:** A small-medium plumosus-type larva. TLt turn ventrally as described by Sasa (1978) for Japanese specimens. VT well developed. Head capsule generally brownish; gula very dark over posterior half to two thirds and wider than width of mentum, FC darkened, as well as some darkening along the outside edges of the apotome. Salivary opening abt. 76  $\mu\text{m}$  long and 5 times longer than wide.

Mentum width about 157  $\mu\text{m}$ , c1 tooth of mentum (c, below) relatively broad, with c2 teeth well separated and sharp, worn ty. IIA or possibly ty. III, about 68% of distance between 1st laterals, which slope outwards at the top; lateral teeth sharp, 4th laterals hardly reduced (type I), but 5th laterals slightly above the graduated level of the other lateral teeth. Sasa (1978) shows small notches near the tip of the center tooth, but these will only be seen if the mentum is not worn.

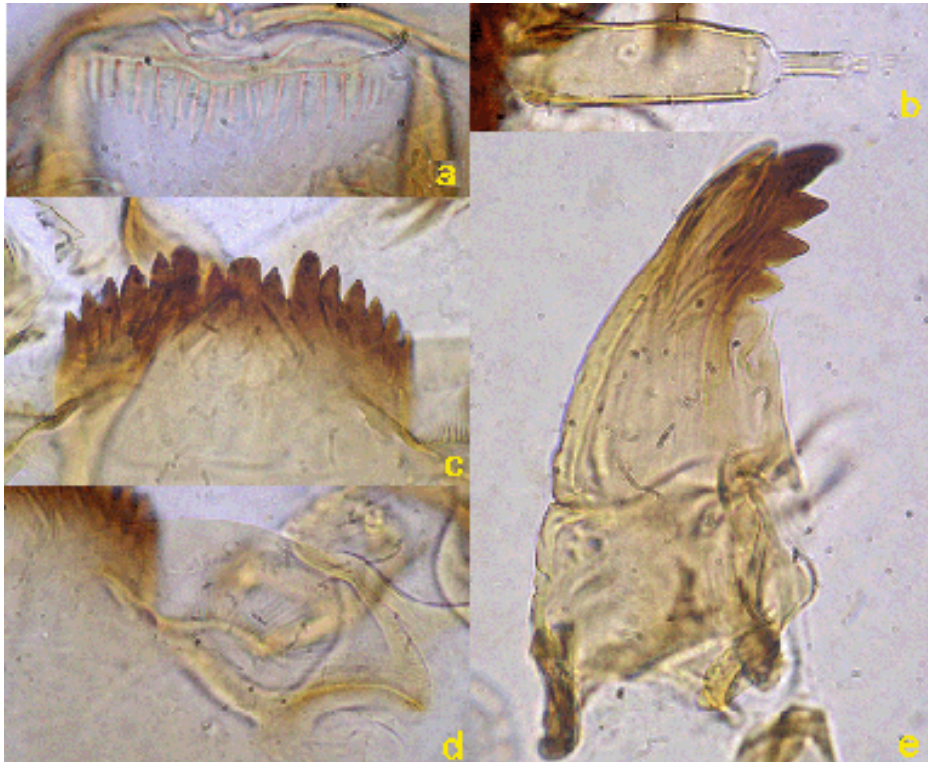
Ventromental plates (d, below) abt 3.7-4.0 times wider than deep and 1.16-1.2 times the mentum width, IPD 34-40%; with about 38-40 striae; VMR about 0.31. PE (a, below) with about 16-19 sharp graded teeth. (type B)

Antenna (b, below) with basal segment relatively short only about 0.3 of VHL, about 2.5–3 times longer than wide; RO about middle of segment; AR about 2.17; segment 3 quite short, shorter than segment 5; relative length of segments ( $\mu\text{m}$ ) 110 : 28 : 7 : 10 : 8.

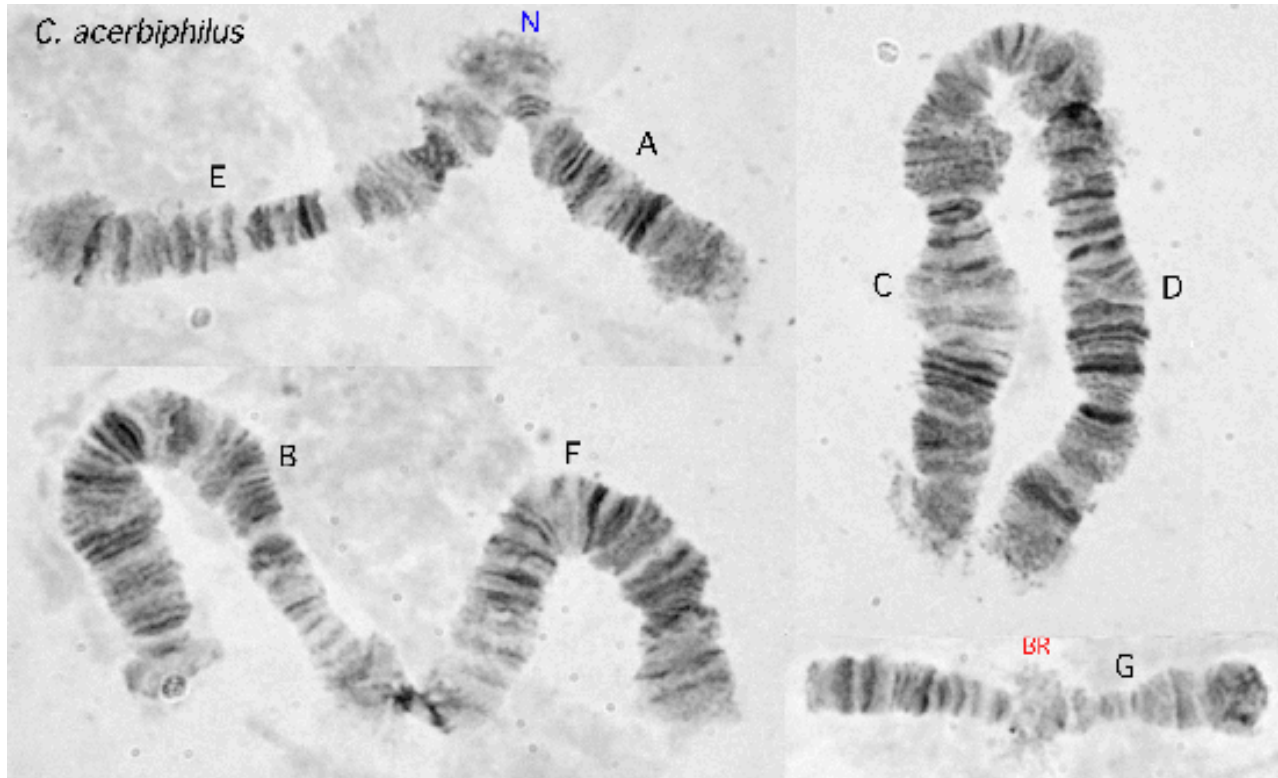
Distance between antennal bases about the same or slightly wider than the distance between the S4 setae, which occupy about 0.78 of the FC width at that point.

Premandibles of type A, with narrow teeth, outer tooth slightly longer (when not worn); inner tooth about 4–4.5 times wider than outer tooth.

Mandible (e, below) with 3rd inner tooth defined and darkened (type IIIC), at least 12 furrows on outer surface near the base; about 11–12 taeniae in PecM; Mdt-Mat about 23  $\mu\text{m}$ , MTR 0.32–0.4.



**Cytology:** 4 polytene chromosomes with the pseudothummi-cytocomplex combination, AE, BF, CD, G. Centromeres strongly heterochromatic and constricted. Pairing may occur between the centromeres of different chromosomes. Arm G mostly paired, with BR near middle of arm and no nucleolus. Nucleolus developed in arm A. A fixed asymmetrical pericentric inversion occurs on chromosome CD, transferring the proximal bands of arm D into arm C, or alternatively it may be related to the duplication of the CD centromere region reported in other pseudothummi-cytocomplex species such as *C. alpestris* (Wülker, pers. comm.; Kiknadze *et al.* 2008, as *C. dorsalis*). No polymorphism in studied North American, European, or Japanese populations.



- aceA1: 1a-i, 7 - 9, 2d - 3, 12 - 10, 2c - 1k, 6 - 4, 13 - 19 - with large nucleolus in segment 15
  - aceB1: banding not clear, but probably 22-28 near centromere.
  - aceC1: 1 - 2, 10 - 3, 11 - 16, 22, 24 - 21, D(see below) (Jablonska-Barna *et al.* 2010)
  - aceD1: 1 - 3, 6 - 4, 7 - 9, 18f-a, 13 - 10, 17 - 14, 18g - 20 (Jablonska-Barna *et al.* 2010)
  - aceE1: 1 - 3e, 10b - 3f, 10c - 13 i.e. as *aprilinus*, etc.
- Jablonska-Barna *et al.* also consider the arm as identical to the *aprilinus* sequence but list a proximal inversion 13-11.
- aceF1: 1-7, 17-16, 11-14a, 15-14b, 4-6, 9-8, 1-3, 10, 18-20 (clarified from Jablonska-Barna *et al.* 2010)
  - aceG1: BR near middle of arm.



## Nymph Creek YNP, Wyoming. (Photo courtesy Kathy Sheehan)

In acidic waters (pH3), and also elevated temperatures (35C, but some up to 45C) in North America.

**DNA sequence:** MtCOI sequence is in the BOLD database. Sequence of Japanese specimens are also in GenBank and/or BOLD database. BOLD places them in a separate Bin (BOLD:AAJ4234). This could simply be due to geographic isolation, but the differences in color and the fact that the Japanese specimens have a different nearest-neighbor Bin, suggest that they may be different species. A comparison of the base sequences shows that they differ at 35 bases in the Barcode region (below):

	Base differences																																		
USA	A	A	T	G	G	T	T	T	A	A	T	T	C	T	A	T	T	A	C	A	C	G	G	T	A	C	T	T	G	G	A	T	G	T	A
Japan	G	G	A	A	A	C	C	C	G	G	C	C	T	C	G	C	C	G	T	T	T	A	A	A	G	T	C	A	A	A	T	C	A	C	G

The critical information is missing to determine the specific status of these forms. The adults and pupae of North American specimens are not known, and the Barcode sequence of the European synonym *C. crassimanus* is unknown, data which are required before a proper decision can be made as to whether they are separate species or only sub-species. Jablonska-Barna *et al.* (2012) note that the morphology, even within Europe is variable, but the cytology is consistent.

**Found:** **California** – may be specimens mentioned below.

**Wyoming** - Nymph Creek, Yellowstone National Park (44.67°176;N, 110.67°W).

possibly also in Japan - Lake Katanuma, Honshu (**Type locality**).

and in Europe - Reinbeck, Germany (**Type locality** of *C. crassimanus* (Keyl 1962))

The adult, pupa and larva of Japanese specimens were described and figured by Sasa (1978) and much more fully by Yamamoto (1986), and European specimens by Jablonska-Barna *et al.* (2012). Cytology of the European specimens was illustrated by Keyl & Keyl (1959), and banding pattern of arms A and E by Keyl (1962), as *C. crassimanus*, and subsequently the whole karyotype by Jablonska-Barna *et al.* (2010) as *C. acerbiphilus*.

Yamamoto (1990) notes that *C. acerbiphilus* appears very similar to the Japanese species *C. fuscipes*, mainly noting that the SVo of *C. fuscipes* is more robust than that of *C. acerbiphilus*. There is no evidence that *C. fuscipes* occurs in North America.

Another nearest neighbour Bin is [BOLD:ACP9581](#)

This is classed as the nearest neighbour of the Japanese specimens and is an unidentified species from California. However it differs from the *C. acerbiphilus* sequence by some 60 bases, about twice as many as the difference between the Japanese and U.S.A. populations of *C. acerbiphilus*. It is possible it was listed as nearest neighbour Bin before the sequence of U.S.A. populations became available.

The only available information is from the photograph of an incomplete male from the BOLD database:



Wing length about 3.8 mm; wings clear unmarked, anterior veins darker. Coloration generally dark, thorax dark yellow grey; vittae, postnotum and metanotum dark, almost black; scutellum dark yellowish. Abdominal tergites mostly black with a thin paler band distal on segments II-VI.

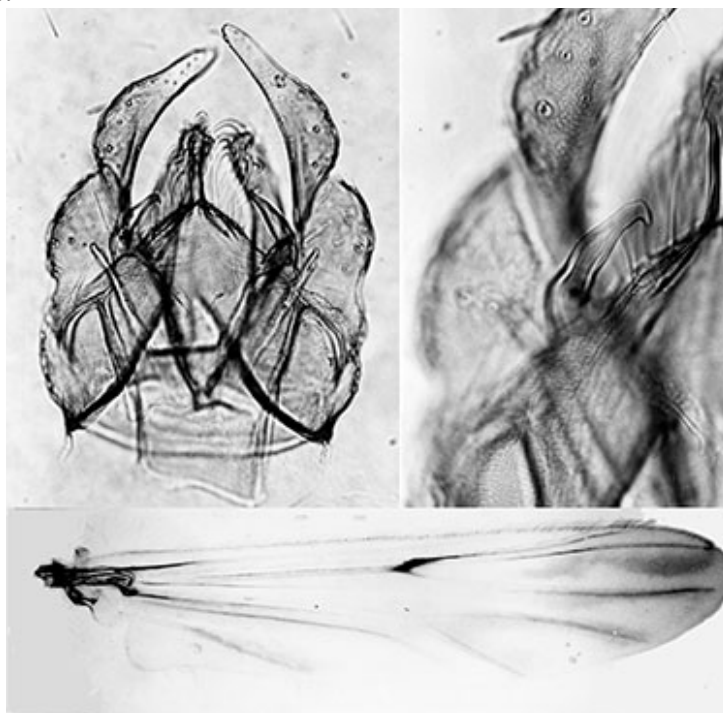
***C. striatipennis* Kieffer, 1910 (Species 4b)**

In BOLD Bin: [BOLD:ABZ2474](#)

Originally identified as *C. strenzkei* Fittkau, 1968, but morphological, cytological and DNA analysis revealed that *C. strenzkei* was a junior synonym of *C. striatipennis* (Martin 2017).

**Adult:**

Material from California was described by Sublette and Mulla (2000). Information below is for the California material but supplemented by data from other populations of this widely distributed species.



Male hypopygium, SVO and wing of Brazilian *C. striatipennis*.

**Male:**

Head – Frontal tubules long, about 65 x 18  $\mu\text{m}$  (3.7x longer than wide); about 16 clypeal setae; palp proportions ( $\mu\text{m}$ ) 60 : 35 : 145 : 160 : 225.

Wing length 2.04-2.18 mm; VR about 1.04-1.08; AR 2.71-2.95; LR 1.69-1.78.

Thoracic setae: Acrostichal abt 9-15; Dorsocentral 12-17; Prealar 4-5; Scutellar 2-4 in anterior row, 8-14 in posterior row.

Wings (see above) with a pattern of dark markings

Leg lengths and ratios ( $\mu\text{m}$ ):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
<b>PI</b>	1130	930	1610	880	615	470	265	1.69-1.78	1.18-1.21	4.5-5.0
<b>PII</b>	1180	1090	670	400	275	195	145	0.62-0.63	1.04-1.12	
<b>PIII</b>	1260	1350	990	595	445	266	170	0.72-0.74	0.93-1.01	

Abdominal setae: TIX 2-9; SVo 12-15; IVo 22-24, simple.

Anal point narrow; SVo closest to type E(h) of Strenzke (1959); IVo bending towards centerline and reaching about to the end of the anal point. Gonostyle narrowing fairly sharply about 1/3 from distal end.

**Pupa:** (based on specimens from other populations)

Length 5.5–9.8 mm. Exuvia dark brown, shagreen darker on posterior of tergites IV-VI.

Cephalic tubercles about 80  $\mu\text{m}$  long and 65  $\mu\text{m}$  in diameter at the base.

Prealar tubercle present, not simple, but small, about 25  $\mu\text{m}$  long and 6  $\mu\text{m}$  wide. Basal ring of respiratory horn with edge thicker at the anterior end, and pinched at the center, about 119-126  $\mu\text{m}$  long and 60-63  $\mu\text{m}$  wide (HR 1.98-2.0). There are about 3 rough short spines immediately anterior to the basal ring, and a large, possible muscle scar, just posterior to it.

Abdomen: About 62-72 recurved hooks on posterior margin of segment II, the hook row covering about 55% of the width of the segment. Pedes spurii B on segment II, and pedes spurii A on segment IV, while those of segment V and VI are small and mainly identifiable by the spinules.

Caudolateral spur of segment VIII with usually 1 main spine, but also one or two small lateral spines. Anal lobe with about 53-72 taeniae on each side, mostly in a single row.



Cephalic tubercles, spur and abdominal tergites of *C. striatipennis*.

**Fourth instar larva** (based largely on South American specimens) a small plumosus-type, length about 9.3-11.3 mm, TLt about 280-360  $\mu\text{m}$ , VT long, coiled, posterior pair usually longer (Ant. 1.40-1.68; post. 1.44-1.84 mm). Anal tubules relatively short (160 x 60  $\mu\text{m}$ ), about 2.5 times longer than wide.

Head capsule with pale to slightly dark gula, frontoclypeus pale to slightly dark.

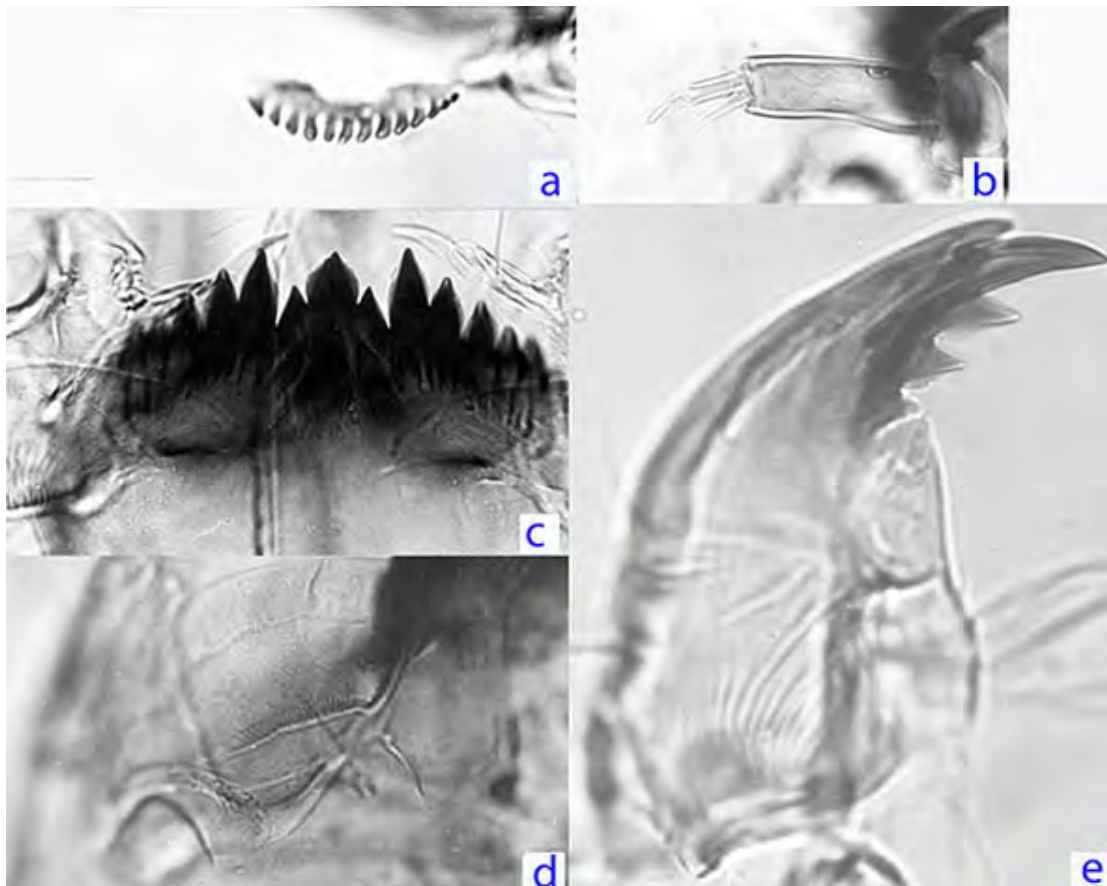
Teeth of mentum (c, below) with flanges, c2 teeth of the central trifold group moderately well separated (type IB or III), 4th laterals slightly reduced (type I+).

Ventromentum (d, below) with about 34-35 striae, VMR about 0.32-0.36. PE (a, below) with about 11-13 even sharp teeth.

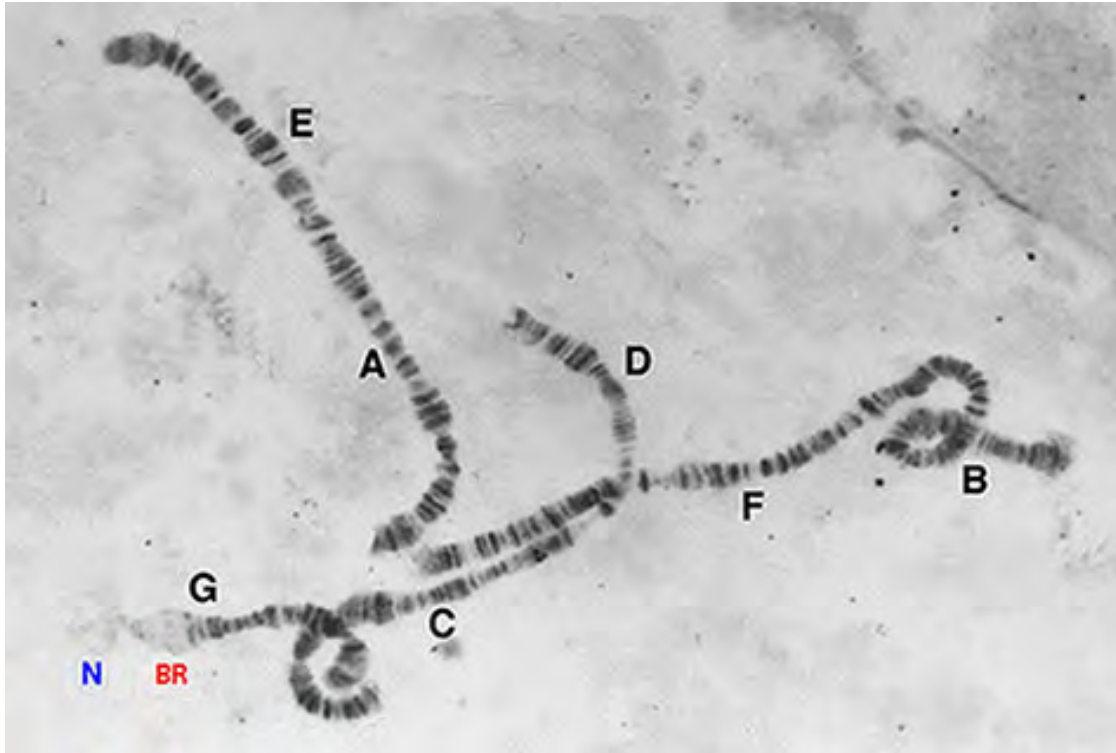
Antenna (b, below) with basal segment about 3-3.1 times longer than wide, RO about middle of the segment, AR about 1.62-1.77; relative lengths of segments 92 : 28 : 8 : 12 : 8.

Premandible with relatively narrow sharp teeth, outer longer, inner tooth about 1.8x width of outer tooth and with an obvious narrow outer edge.

Mandible (e, below) also with flared teeth and with a characteristic, relatively long, sharp dorsal tooth; 3<sup>rd</sup> inner tooth partially separated and colored (type IIB); about 13-14 grooves near base, PM with about 8-13 filaments; MTR about 0.34.



Larval mouthparts of *C. striatipennis*



Polytene chromosomes of *C. striatipennis*

**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination: AE, BF, CD, G (Wülker & Morath 1989).

Arm G closely paired with a subterminal nucleolus, which may have a very close BR. No nucleoli in the long chromosomes. In Asia, the species is highly polymorphic.

stpA1:	1 - 2c, 11 - 7, 4 - 6, 2d - 3, 12 - 19	
stpB1:	Bulb of group 7 not obvious, does not appear to be one of the Indian sequences.	
stpC1:	no sequence available.	
stpD1:	no sequence available.	
stpE1:	1a - 13g	i.e. Standard
stpF1:	1 - 2a, 15e - 11f, 2b - 15f-a, 11a-e, 16 - 23	
stpG1:	subterminal nucleolus	

**Found:** - **Type localities:** India - Bhim tal and Kumaon, Uttar Pradesh  
 California - El Segundo, Los Angeles Co. (Sublette & Mulla 2000)  
 Brazil - Manaus; Belém. (Fittkau 1968)  
 Peru - Pucallpa. (Fittkau 1968)  
 also Japan, Singapore, Thailand and other south-east Asian countries.

Shallow pools with high nutrient content (e.g. algae-rich puddles in the bottom of dugout canoes). Larval habitat in California was not determined, but adults were collected in the vicinity of a wastewater treatment plant.

Adult redescribed and immatures described by [Chaudhuri, Das & Sublette \(1992\)](#) for Indian material, while [Sasa \(1978\)](#) and [Sasa & Hasegawa \(1983\)](#) redescribed Japanese material as *C. kiiensis*. Morphology described as *C. strenzkei* by Fittkau (1968), while Sublette & Mulla (2000) have identified the species in southern California, suggesting it was a recent hitchhiker from South America as it had not been found in earlier surveys – since it is not native to South America, it is just as likely that it is a separate introduction from the area of



Japan. They also state that the cytology had been studied by Wülker and Morath (1989), but that paper only notes that it has the pseudothummi-complex arm combination and the banding pattern is not related to other South American species they studied.

### **Chironomus lugubris-group**

**Chironomus sp. 1TE**, from BOLD Database (Species 5c)

Also referred to in BOLD database as *C. cf. saxatilis*.

In BOLD Bin: [BOLD:AAC0592](#)

It is possible that this is the species recorded as *C. riparius* in Greenland.

Nearest neighbour Bin is: [BOLD:AAI4306](#)

Identified as *C. sollicitus*.

**Adult:**

Male



Dark species, thorax, postnotum and abdomen and legs blackish brown.

Wing length about 3 mm, width about 0.8 mm, VR about 0.94; AR perhaps 3-3.5; Ant LR about 1.4-1.5; Mid LR abt 0.5; Hind LR abt 0.75-0.77.

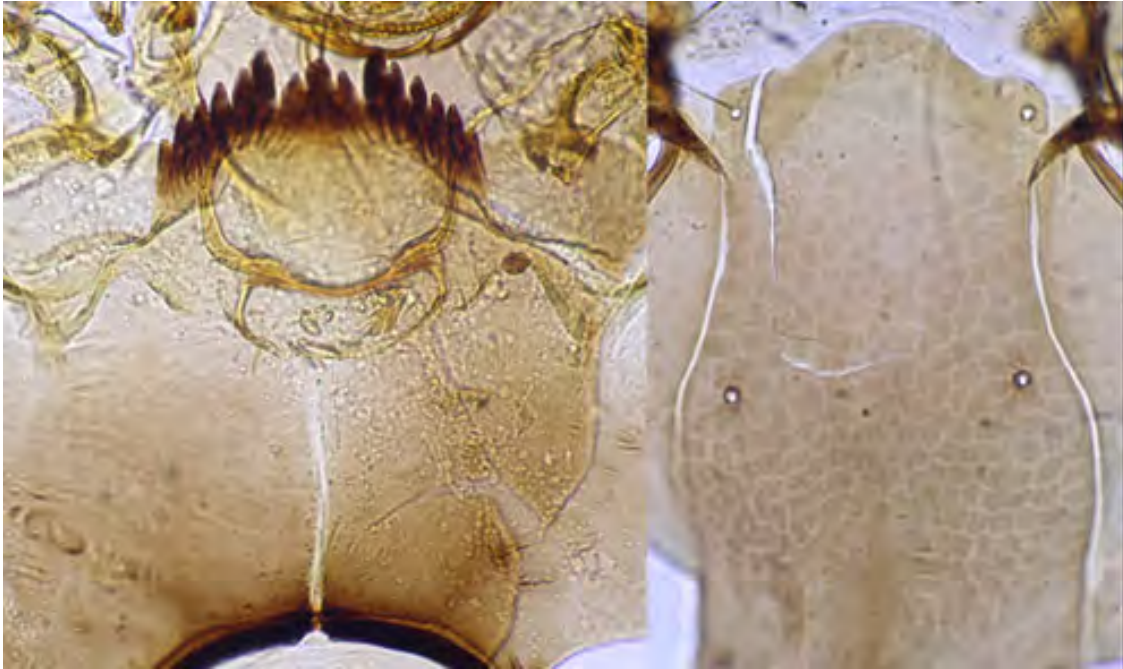
About 6-9 setae on tergite IX, each in a separate patch. Anal point narrow, SVo similar to *C. holomelas*, *C. saxatilis* closest to Keyl's S(c)-type; style moderately swollen, narrowing moderately rapidly over posterior third.

**Pupa:** Not known

**Fourth instar larva:** (based on Greenland specimens): A small-moderate halophilus-type 11.7-12.5 (males 11.7-12.2 mm.), VT short, posterior pair usually longer (0.24-0.40; 0.28-

0.40 mm), AT long with constriction in middle, dorsal abt. 380-825  $\mu\text{m}$ ; abt 2-4 times longer than wide; ventral abt. 400-700  $\mu\text{m}$ , abt 2-4 times longer than wide).

Darkening of head capsule variable: gula pale to dark, extending wider than the mentum and higher at the edges; frontoclypeus dark, sometimes with darkening outside the FC, particularly near the posterior margin, but capsule generally yellowish brown. Oesophageal aperture 55-71  $\mu\text{m}$  long and 2.75-4.0 times longer than wide.



Mentum with 4th laterals reduced about halfway to height of 5th laterals (type I-II), central trident tooth probably type III, but wear may make it appear as type IB or type IV.

Ventromental plates separated by at least a third to half the mentum width, with about 35-48 striae, VMR 0.22-0.34. PE with about 11-15 relatively broad teeth (type C).

Premandible with teeth about equal in length or outer slightly longer, inner tooth about 2.5-3 times wider than outer tooth.

Distance between antennal bases slightly longer than that between the S4 setae, which are separated by about 3/4 of the width of the FC.

Antenna with A1 about 0.4-0.45 of the VHL and 3.5-4 times longer than wide, RO variable - from 0.15 to 0.36 up from base of segment; AR abt 1.75-2.51. Antennal proportions ( $\mu\text{m}$ ) 125-150 : 32-40 : 9-11 : 13-15 ; 6-10.

Mandible with 3rd inner tooth partly to fully separated and partially darkened (type II-IIIb), with about 12-13 furrows on the outer surface near the base, and 11-13 taeniae in the P.Man.

Larval characters, particularly of the antenna, are quite variable. While nothing is known of the larval habitats, it is possible that this is due to ecological difference which may influence the length of the life cycle, which is known to extend up to 7 years in some high northern species (Butler 1982a & b), i.e. there may be members of different cohorts.

**Cytology:** 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G.

Arm G with a terminal nucleolus and no clear BRs. No nucleoli in other chromosomes.

Inversion in arm A.

Arm A1: Inverted towards distal end cf. *holomelas* sequence.

- Arm A2: simple inversion of about 1/3 of arm distal to middle of arm – possibly as *holomelas*.
- Arm B1: Puff (group 7) near distal end, with dark bands (group 8?) on proximal side.
- Arm C1: 1, 6 – 2, 7 – 10?, etc. Possibly as *holomelas*, *saxatilis*.
- Arm D1: proximally possibly 16-24. Inverted cf. *saxatilis*
- Arm E1: probably 1 - 3e, 10b – 3f, 10c-g, 11 – 13 i.e. as *luridus*, *halophilus*, etc.
- Arm F1: ?? – 21-23
- Arm G1: Terminal nucleolus. Probable BR about middle of the chromosome. May be closely paired or paired only at nucleolus.



**Molecular sequence:**

mtCOI: Sequence for this species is in the BOLD database where it is placed in BOLD BIN AAC0592. However, the sequence for one larva shows only about 94% similarity, and is described below as a potential closely related species, *C. sp. 5h*, for which there is no sequence in GenBank or the BOLD database.

**Found:** [Alberta](#) - Banff National Park (from BOLD database)  
[Manitoba](#) - Churchill (from BOLD database)  
[Northwest Territories](#) - Aulavik National Park (73.71°N;, 119.92°W), Banks Island.

**Nunavut** - Auyuittuq National Park (67.88°N, 65.02°W) and Sirmilik National Park (72.99°N, 81.14°W), Baffin Island; Quttinirpaaq National Park (82.22°N, 72.22°W), Ellesmere Island.

**Yukon Territory** - Ivvavik National Park (69.162°N, 140.155°W); Kluane National Park and Reserve.

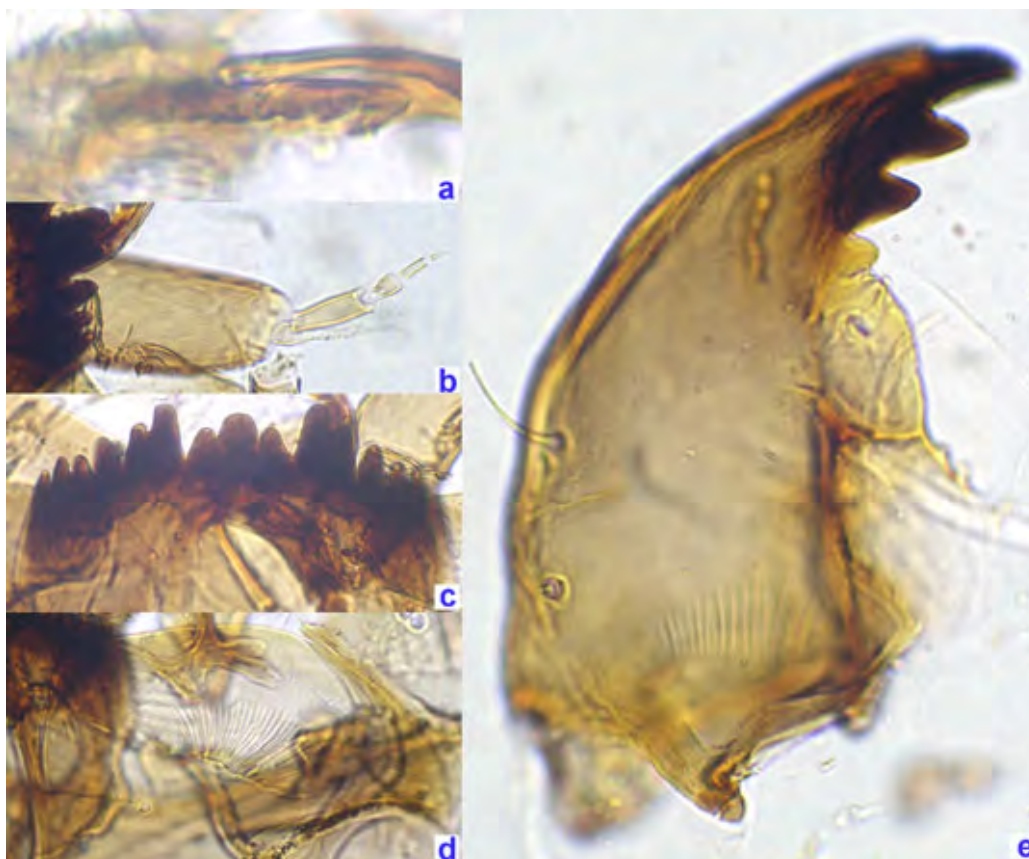
**Greenland** - Nedre Midsommer Sø, Peary Land, sample GP8 (82.63°N, 32.50°W); Northeast Greenland NP (from BOLD database).

Norway – Svalbard (Stur & Ekrem 2)

Sweden – Borgholm, Barnaesuddern, Oeland (BOLD)

*C. saxatilis* was described by Wülker *et al.* (1981) with the type specimen a polytene chromosome squash. It has been suggested that it is a synonym of *C. lugubris* (Lindeberg, unpubl.), although this is not supported by *COI* sequence data. It is very similar in morphology to *C. holomelas*, such that Wülker *et al.* did not see the necessity of illustrating the male terminalia. The polytene chromosomes of a specimen, not yet confirmed from the Barcode, suggest that the present species cannot be *C. saxatilis*, but is closely related and does not match any cytologically studied species from the Holarctic.

Another larva from Peary Land has a *COI* sequence most closely related to Sp. 1TE (0.96 homology), and there are some differences in the larvae – however, the larva shows a number of malformations so is not certain just how real some of these differences are.



**Fourth instar larva GP8.1.1 12F:** A halophilus-type larva, very similar to those of Sp. 1TE. Length about 10.8 mm, ventral tubules shorter than those of other available specimens: anterior 0.18 mm. posterior 0.24 mm; anal tubules much shorter 300-400  $\mu$ m (ventral pair

longer) and about 1.9-1.8 times longer than wide. Head capsule generally dark, gula darkened over posterior 2/3. Salivary reservoir abt 71 x 33  $\mu\text{m}$  (2.2 times longer than wide). Distance between the S4 setae (147  $\mu\text{m}$ ) less than that between the antennal bases (179.5  $\mu\text{m}$ ), with the setae separated by about 0.73 of the width of frontoclypeus at that point). S5 setae slightly posterior to the nearby RO.

Mentum with 4th laterals reduced about to level of 5th laterals (type II) and central tooth probably type IIA.

Ventromentum abt 215  $\mu\text{m}$  wide and 2.93 times wider than deep, 1.06 times the mentum width; abt 42 striae and VMR abt 0.28.

PE as in other larvae above, with about 13 teeth (type C); Premandible not clear.

Antennal measures within the ranges of the Sp.1TE larvae, lengths 140 ; 34 ; 10 ; 12.5 ; 9.

AR 2.13; RO about 1/3 up from base of A1; A2 abt 1/4 of length of A1 which is 0.45 of the VHL and 3 times longer than wide; A5 abt 0.88 the length of A5.

Distance between the antennal bases greater than that between the S4 setae, which occupy abt 0.73 of the width of the FC at that point; S5 setae slightly posterior to the nearby RO.

Mandible of type II-IIIB, about 260  $\mu\text{m}$  long; 16-17 furrows on the outer surface near the base; 13 taeniae in PecM; Mdt-Mat 28  $\mu\text{m}$ , MTR 0.37.

**Found:** [Greenland](#) - Nedre Midsommer Sö, Peary Land, sample GP8 (82.63°N, 32.50°W).

#### **Species 5n.** *C. lugubris* (?as Zetterstedt 1851)

The presence of this species in North America is known only from some BARCODE sequence in the BOLD database that has been attributed to this species. At least one specimen in this BOLD Bin was identified as *C. sp.* TE11, for which the other specimens are in species 4y. It has been suggested that *C. lugubris* is a senior synonym of *C. saxatilis* Wülker *et al.* (1981), the name that has been suggested for species 5c. However as Wülker *et al.* (1981) point out, there is some dispute as to the actual identity of *C. lugubris*, Zetterstedt 1851, hence this material is not identified as the Zetterstedt species. The COI sequences, however, indicate that this material is not synonymous with species 5c.

This constitutes the first record of *C. lugubris* in North American and hence indicates that this species has a Holarctic distribution.

In BOLD Bin: [BOLD:AAB4581](#)

\_\_\_\_\_  
Nearest neighbour Bin is [BOLD:ADL5630](#) – species TE11

#### **Adult:**

Where possible the description is based on, or supported by, photographs associated with the BOLD Bin. Those photographs and the keys in Pinder (1978) show that this is a largely blackish brown species.



Photograph by Elisabeth Stur.

Male: Wing length about 4.1-5.3 mm, VR less than 1. AR about 3.05. LR about 1.3; anterior tarsi without a long beard (Pinder 1958). Abdomen with a thin pale band at the posterior margin of each segment. About 11 setae on tergite IX, some in individual pale areas and others in a larger area. Hypopygium quite similar to that of *C. riparius* except that the gonostylus narrows more gently over the posterior third. SVo of Strenke's (1959) S-type but more pointed than that shown in Fig. 55F of Pinder (1958) (so, is this the same species as Pinder's *C. lugubris*?).



Photograph by Elisabeth Stur

Female: Mostly blackish brown, but thorax and anterior parts of the femurs a lighter brown. Halteres pale.

Wing length about 3.5 mm, width about 1.6 mm; VR about 0.84.

**Pupa:** No definite data. Langton & Visser (2003) describe a pupa, but there is uncertainty as to whether it refers to the species considered here.

**Larva:** According to Wülker *et al.* the larva should be a thummi-type.

**Cytology:** According to Wülker *et al.* the polytene chromosomes should have the pseudothummi arm combination AE, BF, CD, G, although the basis for this information is not given.

However the close relationship with Sp. TE11 raises queries as to whether the identification as *C. lugubris* sensu Wülker is correct, as Sp. TE11 belongs to the thummi-cytogroup.

**Molecular sequence:**

mtCOI: As noted above there is sequence in the BOLD Database.

**Found:**

**Yukon Territory** - Ivvavik National Park (69.162°N, 140.155°W) (BOLD BIOUG17183-B09).

**Norway** - Spits-Bergen and Jan-Mayen, Svalbard (Stur & Ekrem 2020)

### end of lugubris-group

#### C. species v.

**Adult and Pupa** – not known, unless some adults are in the Canadian National Insect Collection.

**Fourth instar larva** a large (abt. 13-13.5 mm) halophilus-type. Dark posterior half of gular region, extending beyond edges of mentum & higher at edges; dark FC. VT 0.58-0.73 µm (ant.) and 0.83 µm (post). Anal tubules about 420-480 µm (dors.), 435-455 µm (vent.) long and 2.1-2.4 (dors.), 1.93-2.0 (vent.) times longer than wide.

Mentum (see d, below) with rounded teeth; c1 tooth with short outward sloping sides, c2 teeth well separated, type IIA; fourth laterals slightly reduced (type I-ii).

Ventromentum (see e, below) abt. 253-280 µm wide and 3.4-3.6 times wider than deep; with about 45-53 striae, IPD abt. 0.3; VMR about 0.28-0.30.

PE (see a, below) with about 8 irregular, broad and rounded, teeth; this broad tooth development is also seen in *C. hyperboreus* which is sometimes found in the same pools.

Premandible (see b, below) with relatively short broad teeth; outer tooth shorter (wear?) and about a third the width of the inner tooth.

Antenna (see c, below) with relatively long basal segment (about 3.2-3.8 times longer than wide and abt. 0.4 of the VHL) ; RO about a third up from base of segment; AR about 2.08-2.16; segment proportions (micron) 160 : 37 : 14 : 16 : 9.

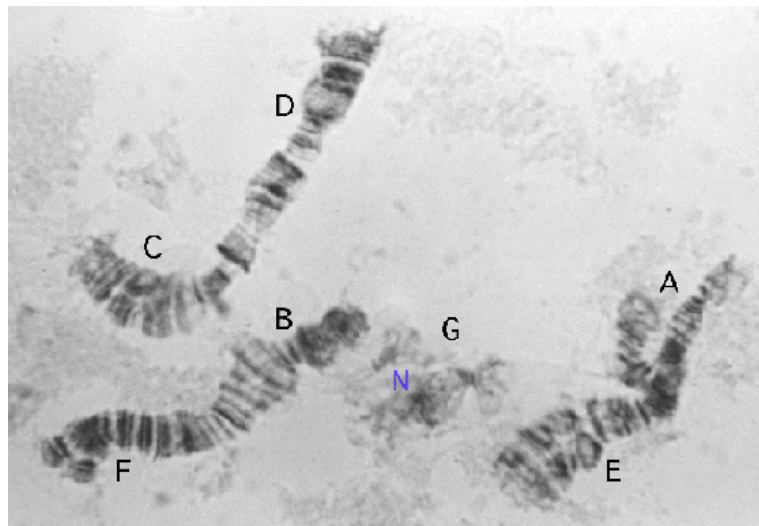
Distance between the antennal bases and that between the S4 setae about equal; S4 setae occupy about 0.8 of FC width. S5 setae posterior of nearby RO.

Mandible (see f, below) about 295-300µm long, with 15-18 furrows on outer surface near base, 3rd inner tooth only slightly developed (type IIB)(broken in fig. below); about 15-18 taeniae in PMa: MTR about 0.26.



Mouthparts of *C. species v.*

**Cytology:** 4 polytene relatively short chromosomes, with the pseudothummi arm combination, AE, BF, CD, G, but Keyl pattern hard to recognize. Arm G rather indistinct, usually unpaired, with a terminal nucleolus. Arm A sometimes unpaired. According to Wülker (pers. comm.), arm A has the *holomelas* banding sequence.



- Arm A: 1 - 2c, 10 - 12, 3 - 2d, 9 - 4, 13 - 19 i.e. as *holomelas*
- Arm B: Puff near middle of the arm with dark bands on proximal side.
- Arm C: Constriction about 1/4 from distal end.

**Found:** Nunavut (formerly Northwest Territories) - Hazen Camp Pond, Ellesmere Island (Pond 1 of Oliver & Corbet, 1966); Isachsen, Ellef Ringnes Island (78.8°N, 103.5°W).



**C. species 4m.**

This species is in BOLD Bin: [BOLD:AAW3991](#)

Adult and Pupa not known.

**Fourth instar larva:** A medium sized plumosus-type species. Gula slightly darkened, FC also slightly darkened. Mentum (Fig. a, below) with 4<sup>th</sup> laterals reduced virtually to level of the 5<sup>th</sup> laterals (i.e. type II), and center trifid tooth with c1 broad and the c2 teeth relatively well separated (i.e. type IIA). VM (Fig. c, below) with about 40–41 striae, plates separated from each other by about 0.3 of the width of the mentum. PE with about 19 teeth.

Antenna (Fig. b, below) with basal segment about 4.2 times as long as wide; AR about 1.80; ratio of segments (micron) 144 : 38 : 12 : 15 : 8.

Mandible (Fig. d, below) about 255 micron long, with third inner tooth well developed (Type III), and about 12–13 striae on inner margin near the base.

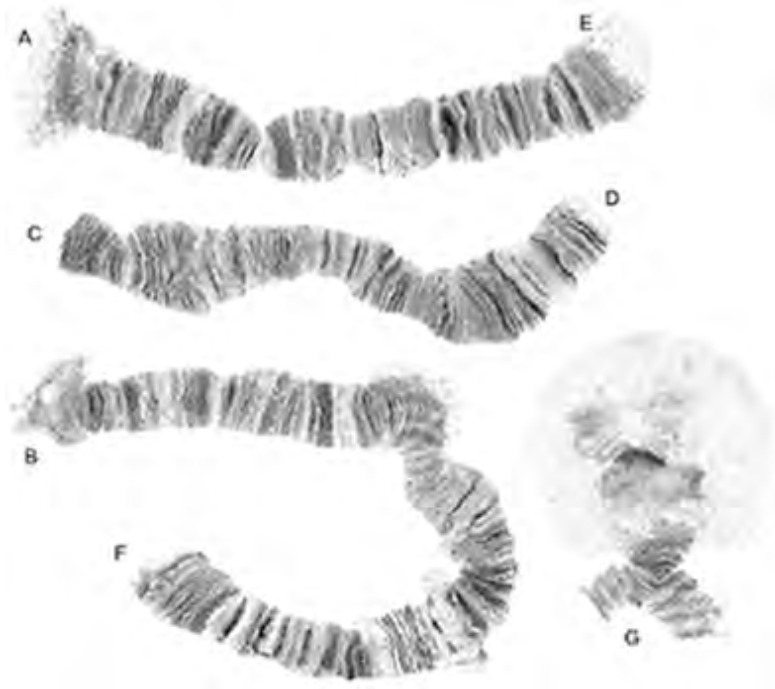


**Cytology:** Not known for certain, but most likely candidate at the only known locality is a pseudothummi-cyto-complex species, i.e. 4 polytene chromosomes with arm combination AE, BF, CD, G.

Arm G paired at the median nucleolus; no nucleolus in long chromosomes. Puff not formed in arm B; characteristic band group (25-27) in normal position close to centromere.

Arm E1: 1a - 3e, 10b - 3f, 10c - 13

i.e. as in *aprilinus*



Karyotype figure courtesy of I. I. Kiknadze.

**Found:** Alaska - Potter Marsh (61.054°N, 149.792°W), Anchorage Co.

Fourth instar larva collected by Dave Wartenbee; thorax taken by Iya Kiknadze; head and rest of larval body by Jon Martin. Unfortunately the original coordinated labelling became lost, but this combination of cytology and morphology is the only one not accounted for.

Mitochondrial *COI* sequence indicates that this is a species that has not been barcoded previously, with relationships to pseudothummi-cytocomplex species.

### maturus-cytocomplex

***C. maturus* Johannsen, 1908** (Species d)  
(i.e. *C. decorus* group)

In BOLD Bin: [BOLD:AAB4657](https://www.boldsystems.org/index.php/AAB4657)

**Adult:**



Male: (from Sublette & Sublette 1974).

A darker species, thoracic markings dark brown.

Wing length about 2.49-3.95 mm; width about 0.83-0.89 mm; VR 1.06 (0.94), anterior veins darkened.

Foretarsus bearded, BR about 3-5.

AR about 2.64-3.64. Frontal tubercles present, about 25  $\mu$ m long. Clypeus about 0.6 of the width of the antennal pedicel, with at least 14 setae.

Mesonotum with a slight hump but no discernable median tubercle.

Thoracic setae – Acrostichals in 2 staggered rows; scutellum with an anterior row of about 6 scattered setae; main row of about 12 long setae.

Legs with tibiae infusate yellow, middle and hind tarsi becoming darkened apically; foretarsus bearded. Leg lengths (units) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	75	76	100	55	41	16	-	1.32-1.66	0.99	3.0-5.0
PII	85	78	48	28	20	14	9	0.56-0.65	1.09	
PIII	98	102	75	45	32	20	10	0.70-0.79	0.96	

Abdomen with a dark band across the base of each segment I-V, with apical area paler infusate yellow, similar to *C. bifurcatus*. About 10-14 setae in a single essentially triangular clear patch on tergite IX.



Photo courtesy P.L. Hudson

Anal point broad, essentially same width along length; the SVo is darker and heavier than in *C. bifurcatus* or *C. decorus*, closest to E(g)-type of Strenzke (1959). IVo with simple setae, as long as or slightly longer than the anal point and to about midpoint of the gonostyle, which is moderately swollen and reduces more gradually over about posterior third, about 5+1 setae at tip.

Female: The female does not appear to have been described previously. The following description is based on a single specimen from Torbolton, Ontario (CO.59.3 Female 1): Background coloration dark, as in male.

Wing length 5.05 mm, width 1.55 mm, VR 0.91; 3-4 SCf on brachiolum.

Head: Frontal tubercles 39 mm. Antennal proportions (micron) with proportion of neck in brackets: 250 (0.32) : 145 (0.32) : 160 (0.38) : 132 (0.43) : 250. AR – 0.37; A5/A1 – 1.0. Palps (micron): 58 : 73 : 80 : 245 : 240 : at least 360 (shriveled). Clypeal width about 240  $\mu$ m, about 1.8 times diameter of antennal pedicel; 44 clypeal setae.

Thoracic setae: acrostichals – at least 17; humerals abt. 2-3 in linear arrangement but beginning about half way back to the suture; dorsocentrals – 21-24 (i.e. 24-26 including humerals); prealars – 7; supraalars – 1; scutellar – about 15 in posterior row and 6 in anterior row (total 21).

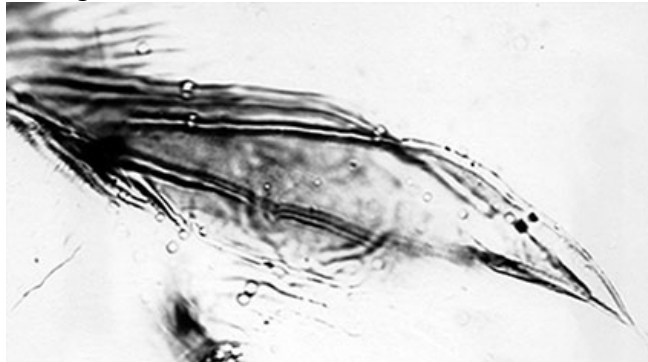
Leg coloration essentially as in male; lengths (micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti	BR
PI	1570	1425	2050	1070	805	620	325	1.44	1.10	0.44	1.52
PII	1745	1645	1005	540	410	265	215	0.61	1.06		
PIII	1985	2025	1375	875	645	365	225	0.68	0.98		

Hind sens. chaet.: at least 62.

4 setae on GcIX; 9 setae on segment X which is long and narrow, about 4.14 times longer than greatest width. Cercus with essentially straight posterior margin and ventral margin shorter than the dorsal.

**Pupa:** General color dark with lateral abdominal markings blackish. Length about 6.13-8.88 mm. Respiratory base abt. 200x76 (HR 2.6); 65-74 hooks in row at apex of tergite II. Usually with about 2 appressed spines on the caudolateral spurs of segment VIII, but may vary from 1-6, with some small. Fringe of anal lobe with about 57-96 broad taeniae.

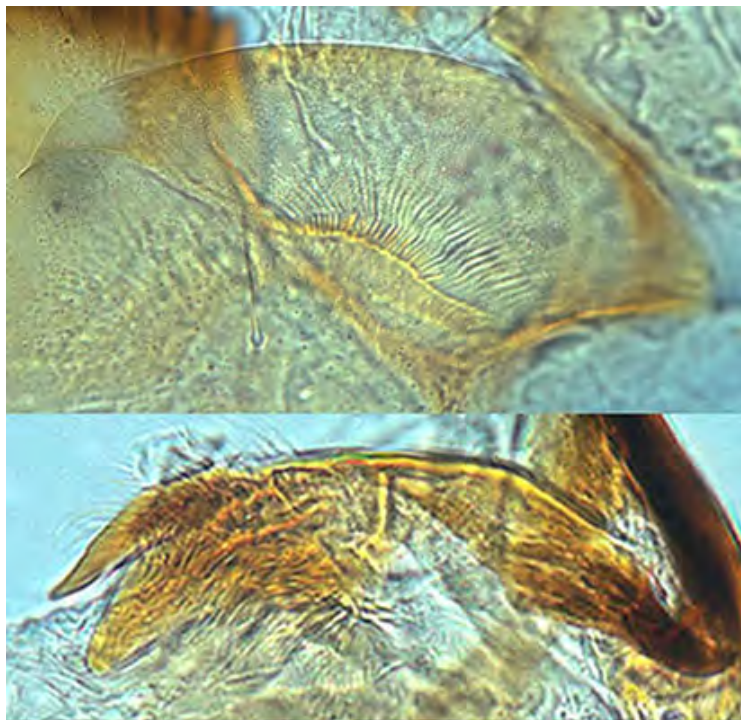
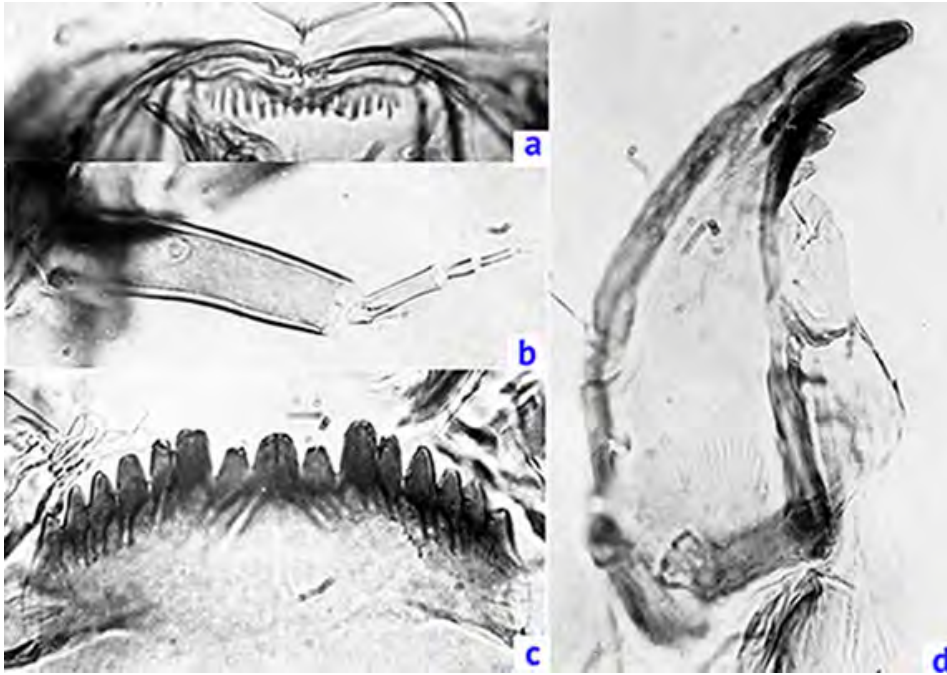


**Fourth instar larva** a moderate size (female: 12.9 (11.7-14.8) mm; male: 12.2 (10.5-13.5) mm. plumosus-type, with long VT, posterior pair longer on average (ant. 0.9-3.4 mm, post. 0.9-3.7 mm) and longer in females. AT with dorsal pair longer and wider (346-480 x 100-140  $\mu$ m) than the ventral pair (340-430 x 100-120  $\mu$ m) about 2.5-5 times longer than wide. VHL about 273-304  $\mu$ m. Gular region mostly only slightly darkened, FC generally darker. Salivary reservoir about 73.8 (60-101)  $\mu$ m long and 3.4 (2.50-5.00) times longer than wide. Mentum (Fig. c) with rather rounded teeth, c1 tooth long and narrow with c2 teeth well separated (type IB-III), 4th laterals barely reduced (type I). Ventromentum (Fig. below) about 205-230  $\mu$ m wide and 3.3-3.6 times wider than deep; about 1.08 times the mentum width; with about 41-52 striae

PE (Fig. a) usually with fairly uniform teeth of type B, occasionally with an interspersed smaller tooth, about 17.5 (10-20) teeth. Premandible (Fig. below) with broad teeth, inner tooth about 3-5 times the width of the outer tooth, both coming to relatively broad points (type D).

Antenna (Fig. b) with basal segment relatively long, about 0.4 of VHL and about 3.3 (2.60-4.0) times longer than wide; RO about 0.3 to 0.4 up from base of segment, AR about 1.88 (1.7-2.0); segment lengths (micron) 127 : 36 : 12 : 12.5 : 6; i.e. A3 much longer than A5, and only slightly shorter than A4.

Mandible (Fig. d) with third internal tooth well developed but only partially darkened (type IIIA-IIIB); about 16 (11-20) furrows on outer surface near the base; about 12.5 (11-14) taeniae in PMa; Mdt-Mat about 20-25; MTR about 0.22-0.31.



*C. matorus ventromentum* (above) and premandible (below)  
(courtesy I. Proulx)

**Cytology:** 4 polytene chromosomes with matorus arm combination AF, BE, CD, G.  
Arm G often partly unpaired, with a subterminal nucleolus and 2 BRs whose position varies depending on the sequence. Nucleolus also in arm F in some specimens.

Polymorphic in all arms except E.

mat A1: 1-2c, 10-12, 3-2d, 9-4, 15-13, 16-19

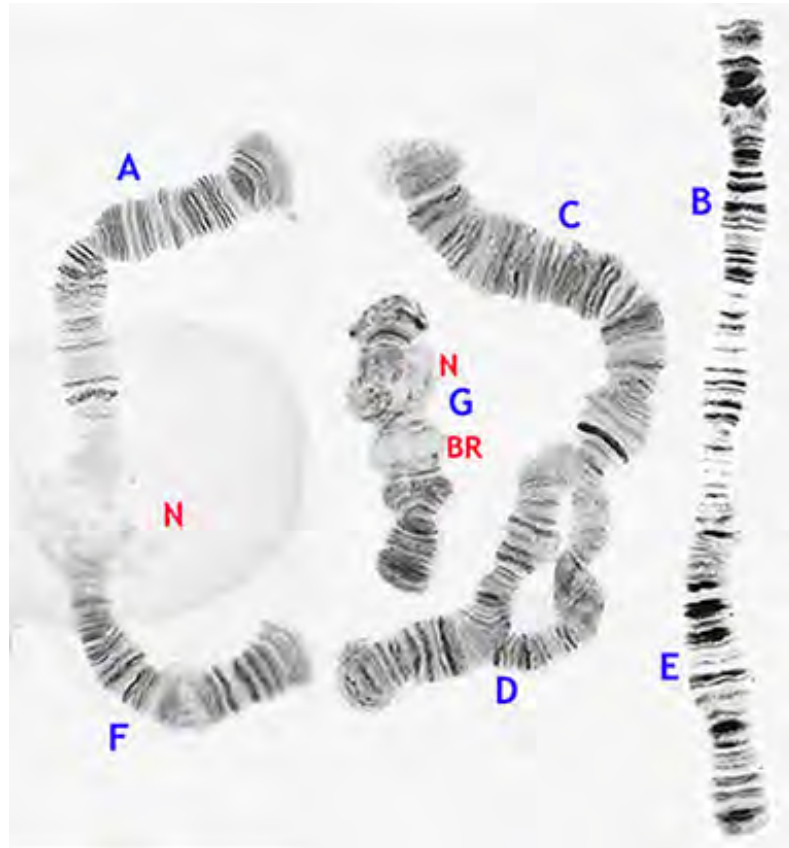
mat A2: 1a-e, 2d-3, 12-10, 2c-1f, 9-4, 15-13, 16-19

mat A3: 1a-e, 2d-3, 12-10, 16, 13-15, 4-9, 1f-2c, 17-19

mat B1: Bulb with distal dark bands nearer the end of the arm than in *whitseli*.

mat C1: 1a-i, 10-11c, 2-6b, 9f-a, 6hg, 11d-15, 8a-g, 17-16a, 7d-6c, 17b-22

- mat D1: 1a-i, 15e-11, 3-2, 16-18f, 7d-4, 10-7e, 18g-24  
 mat E1: 1-3e, 8-5, 9-10b, 4-3f, 10c-13 i.e. as *stigmaterus*.  
 mat F1: 1-2, 15e-3, 15f-23  
 mat F2: 1, 13b-15e, 2, 13a-3, 15f-23  
 mat G1: Large BR near center of arm with darker bands towards the nucleolus  
 mat G2: A large inversion from just distal of nucleolus, to just proximal of subterminal BR  
 BR  
 mat G3: A small inversion at the distal end of the arm, which takes small BR terminal (not proven)  
 mat G4: Derived from G2 by a similar small inversion to that hypothesized for G3



**Found:** **Manitoba** - Southern Indian Lake (Rosenberg *et al.* 1984)  
**Ontario** - Copanspin Farm (45.75°N, -75.87°W), Central Experimental Farm Ottawa (45.38°N, -75.70°W), Hogs Back (45.37°N, -75.70°W), Torbolton (45.47°N, -76.05°W), Rideau R., nr Ottawa (45.37°N, -75.70°W), all Carleton Co.; Mile 14.3, Highway 60 (45.58°N, -75.70°W), Algonquin Provincial Park, Nipissing Co.  
**Quebec** - Lake Bédard (47.27°N, -71.12°W).  
**Yukon** - Kluane National Park and Reserve (60.714°N, -137.432°W).  
**Alaska** - Potter Marsh (61.054°N, 149.792°W), Anchorage Co.  
**California** - Berkeley, Hayward, Oakland and Strawberry Canyon, Berkeley Hills, Alameda Co.; El Cerrito, West Pittsburg, Trout Farm, Concord, Wildcat Creek, nr. El Cerroti, Jewell Lake, Tilden Park and Antioch, Contra Costa Co.; State line, Eldorado Co.; Mad River Beach, Humboldt Co.; Lakeport and Clear Lake Park, Lake Co.; Susanville, Lassen Co.; Rio Hondo, Montebello, and Pasadena, Los Angeles Co.; Lily Lake, Marin Co.; 15 ml nw. Canby, Modoc Co.; 3 ml sw. & 1 ml. sw. Napa (38.28°N, -122.28°W), Napa Co.; Huntington Beach (33.640°N, -

117.971°W), Orange Co.; Lake Almanor & Lake Davis (39.91°N, -120.50°W), Plumas Co.; Bergh Ranch, Coachella Valley, Arlington, Good Samaritan Retirement Home, Corona, 448 Orange St., and UCR Experimental Ponds, Riverside, Palm Springs, Hidden Lake, 3 ml. n. Arlington & Priester Ranch, Norco, Riverside Co.; Ontario & Spring Valley Lake nr Hesperia, Apple Valley, San Bernardino Co.; San Luis Obispo & Black Lake Canyon, San Luis Obispo Co.; Redwood City, Laurel Creek, marshland pond Millbrae, 19th & Bayshore & 16th Ave., Hayward Park, San Mateo, & Atherton, San Mateo Co.; Stanford Uni. (37.43°N, -122.17°W), Palo Alto & Mountain View, Santa Clara Co.; Hat Creek, Fall River Mills, Shasta Co.; Vallejo, Dixon, & Rio Vista, Solano Co.; Cotati, Sonoma Co.

**Indiana** - Ridinger Lake, Kosciusko Co.

**Louisiana** - Fish Hatchery and Chaplain's Lake, Natchitoches, Natchitoches Ph.

**New York** - Ithaca, Tompkins Co. (**Type locality**)

**New Mexico** - Bonito Dam (33.45°N, -105.72°W), Lincoln Co.

**South Dakota** - 3 ml. w. Yankton, and Yankton (42.93°N, -97.33°W), Yankton Co.

**Wisconsin** - Trout Lake Limnological Station (41.02°N, -89.67°W), Vilas Co.

Many localities from Sublette & Sublette (1974).

Shallow pools, often temporary and often polluted.

Morphology of larva, pupa and male adult described at least briefly by Sublette & Sublette (1974). Cytology described by Wülker and Martin (1974) with arm C1 and D1 in Kiknadze *et al.* (2004).

Differs from *C. decorus* in the possession of a tarsal beard, a character shared with *C. bifurcatus* and *C. 'butleri'* (species 2g). Sublette & Sublette note that the adult male is most similar to *C. whitseli*.

Pupae and larvae very similar, but the larva of *C. maturus* is a plumosus-type with some darkening of the gula and frontoclypeus, while *C. whitseli* has a thummi-type larva, although with some development of lateral tubules in some locations, but with pale gula and frontoclypeus. The Barcode sequences are in separate BOLD-bins.

Barcode: *COI* sequence in GeneBank, Accession no. DQ648204; and in BOLD database.

### ***C. whitseli* Subl. & Subl., 1974 (Species 2f)**

This species is in BOLD Bin: [BOLD:AAJ4143](#)

#### **Adult**

Male:

Wing length 2.62-3.77 mm; width about 0.89 mm; VR about 1.05 (or 0.95); anterior veins darkened.

AR 2.75-3.41; frontal tubercles present about 23 µm.

Clypeal setae - 18-38.

Palpal proportions (segs. 2-5): 5 : 30 : 32 : 43; P5/P4 1.34, P5/P3 1.43.

Thorax dark brown – Mesonotum with a low median tubercle. Acrostichals in a single staggered row; Dorsocentrals in a partial double row; Prealar – 5-7; Scutellar anteriorly with about 8 smaller setae in a strewn pattern, posterior transverse row of about 16 setae.

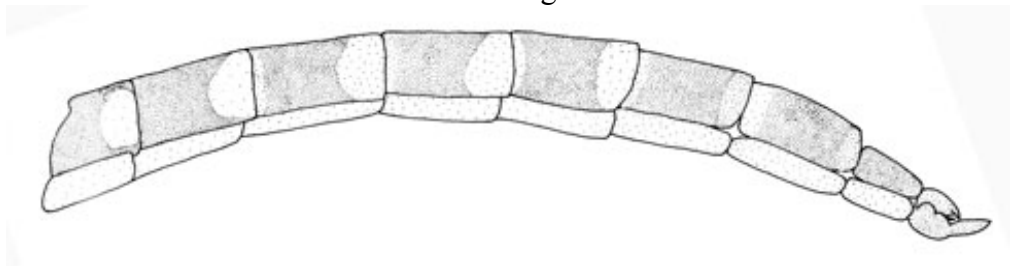


LRI 1.42-1.67; LR II 0.58-0.62; LR III 0.70-0.76.

Legs pale with apex of femora, base of tibiae and tarsomeres darkened; proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	890	830	1190	650	480	390	170	1.42-1.67	1.07	0.24
PII	950	870	550	320	250	180	100	0.58-0.62	1.09	
PIII	1070	1130	820	400	350	210	120	0.70-0.76	0.95	

Abdominal segments with broad basal fasciae which extend all the way to the base of most terga.



From Sublette & Sublette 1974

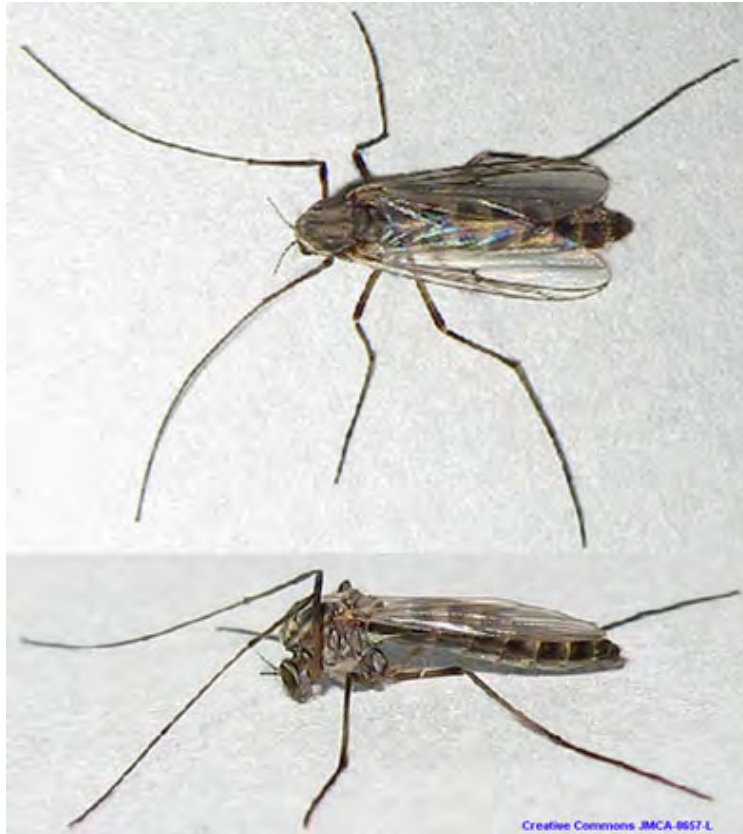
Tergite IX with 4-11 setae in individual spaces.



Hypopygium of paratype male  
(Sublette & Sublette 1974)

Anal point only slightly narrowed at base. SVo closest to E(g)-type of Strenzke (1959); IVo not reaching the end of the anal point, but to about midpoint of gonostyle, which is moderately swollen and narrows only slightly over posterior third to quarter, with 5+1 setae at tip. Setae of the IVo with small branches.

Female:



Wing length 3.77 mm; VR – 1.06. LR – 1.53-1.67.

Head – frontal tubercles about 410  $\mu$ m.

Antennal proportions: 13 : 15 : 13 : 22. Palpal proportions (segs 2-5): 7 : 25 : 33 : 49.

Clypeus with 30 setae.

Thorax - Mesonotum with conspicuous median tubercle. Setae: Acrostichals in staggered row; Dorsocentrals – 33; Prealar – 6, Supra-alar - 1; Scutellar anteriorly with 14 smaller setae in random pattern, posterior transverse row of about 16 setae.

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
PI	900	780	1300	620	500	420	200	1.53-1.67	1.5	0.53
PII	930	850	530	300	200	150	100	0.62	1.09	0.18
PIII	1000	1070	800	470	330	200	120	0.75	0.93	0.19

**Pupa:** Cephalothorax blackish; abdomen infuscate with marginal markings and anal lobe blackish. Total length 6.13-8.44 mm (males) (1 female - 8.70 mm), inner margin of wing case 1.92 mm. Respiratory base abt 139 x 80  $\mu$ m and only slightly constricted in middle (HR 1.74), although actual fiber base slightly constricted, patch with 3 vacuoles and 2 setae just anterior, also an area of scalloping slightly ventral; 55-74 recurved hooks at posterior margin of TII. Pedes spurii B visible on Seg. II, pedes spurii A on seg IV about 202-233  $\mu$ m long and 233  $\mu$ m wide (l/w 1.90) and about 0.27 of segment length; PSA on segs V and VI just patches of spines. Spurs highly variable with from 1-6 spines, usually more than two, on a fairly broad base (except when only 1 spine). Fringe of anal lobe with 57-85 flattened taeniae.

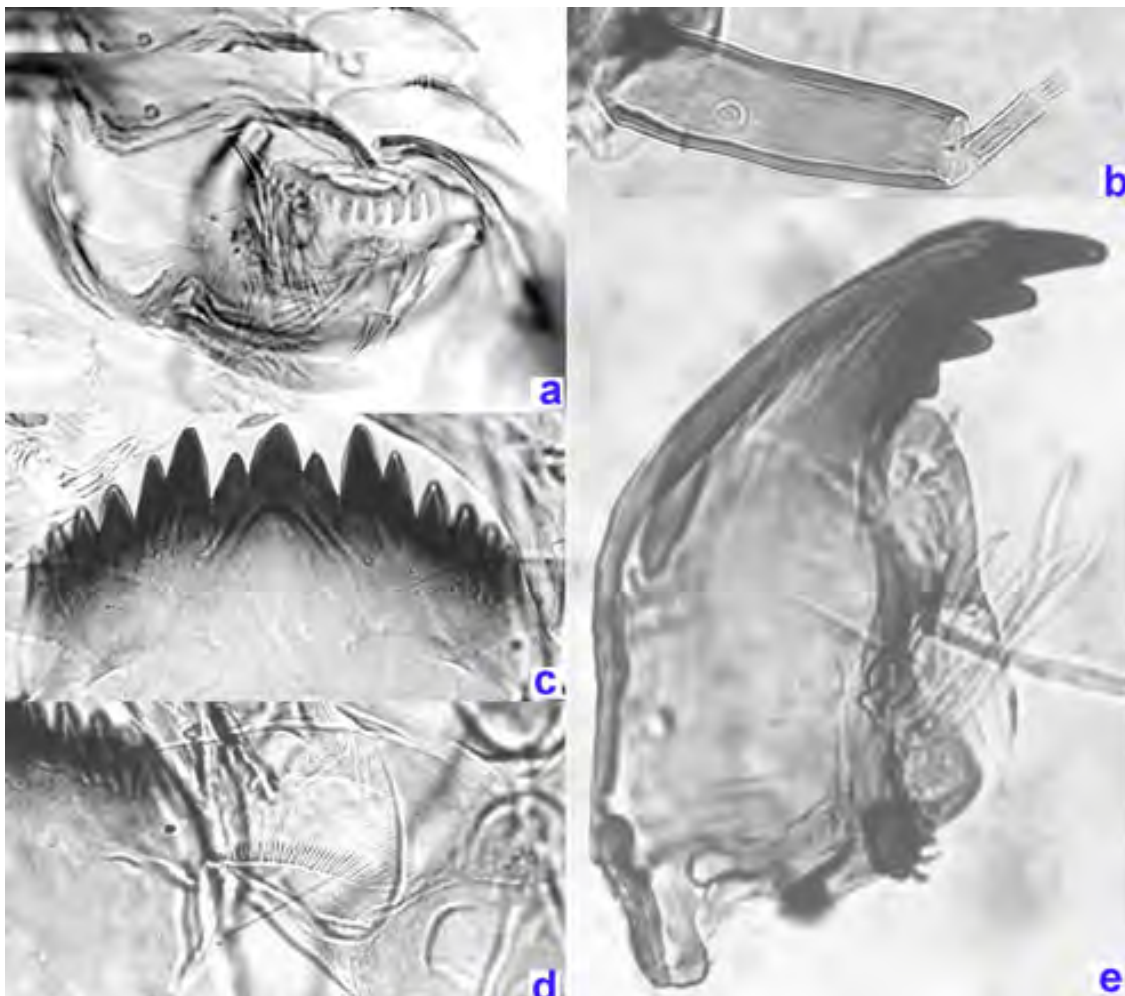
**Fourth instar larva** a small to medium (female 12.8 (10.5-14.2) mm; male 10.2 (1) mm.) thummi or plumosus-type (i.e. some from Truckee River with TLt up to about 60  $\mu\text{m}$  long); posterior pair of VT usually longer - ant. 1.45 (0.92-2.08) mm; post. 1.60 (0.92-2.32) mm. Gular region and FC pale. Anal tubules without a constriction, dorsal pair shorter and wider (347.2 (250-391)  $\mu\text{m}$  x 127. 0 (95-160)  $\mu\text{m}$ ) than the ventral pair (393.0 (340-406)  $\mu\text{m}$  x 111.25 (100-120)  $\mu\text{m}$ ). Salivary reservoir 61.8 (50.5-76.0)  $\mu\text{m}$  long, 18.6 (15.0-20.0)  $\mu\text{m}$  wide (2.9-5.0 times longer than wide).

Mentum (Fig. c, below) with pointed teeth; c1 tooth tall and relatively narrow, c2 teeth well separated (usually type IB, occasionally type III) ; 4th laterals usually slightly reduced (type i-II).

VM (Fig. d, below) with smooth outer margin; about 43.6 (39-46) striae; about 185-215  $\mu\text{m}$  wide, 3.3-3.6 times wider than deep; about 1.02-1.09 times wider than the mentum, VMR about 0.27-0.38. PE (Fig. a, below) with 13.9 (11-17) relatively broad, sharp teeth (type C). Premandible with relatively broad teeth, inner tooth about 4-6 times the outer tooth, inner coming to a broad point, the outer to a relatively narrow point (Fig. a, below).

Antenna (Fig. b, below) with basal segment about 0.37 (0.34-0.39) of the ventral head length and about 3.2 (3.0-3.5) times longer than wide; Ring organ about 1/3 to 1/2 way up from base (although 3/4 in one antenna of one larva); AR about 1.92 (1.7-2.2); antennal proportions (micron) 118 ; 30.5 : 10 : 13 : 7.

Mandible (Fig. e, below) with 3rd inner tooth well developed and darkened (type IIIC); about 15.1 (13-18) furrows on outer surface near the base; about 12.3 (9-14) taeniae in PecM; Mdt-Mat about 20-33, MTR about 0.26-0.43.



**Cytology:** 4 polytene chromosomes with the matusus arm combination AF, BE, CD, G. Arm G normally paired except in the area of the virtually terminal nucleolus; two BRs whose position varies due to inversion polymorphism. No nucleoli in the long chromosomes.

Inversion polymorphism in arms B, C, D and G.

whiA1: 1a-e, 2d-3, 12-10, 2c-1f, 9-4, 15-13, 16-19 i.e. as *maturus* A2

whiB1: Puff with distal dark bands near the end of arm, but further from end than in *maturus*

whiC1: 1-6b, 11c-8, 15-11d, 17a-16, 7-6c, 17b-22 i.e. as *aberratus*, *pilicornis*, *tenuistylus*, etc.

whiC2: 1-2b, 11bc, 6b-2c, 11a-8, 15-11d, 17a-16, 7-6c, 17b-22

whiD1: 1-3g, 11-18d, 7-4, 10-8, 18g-24

whiE1: 1 - 3e, 10b - 3f, 10c - 13 i.e. as *frommeri*, *aprilinus*, etc.

whiF1: 1 - 2, 15e - 12d, 8 - 3, 9 - 12c, 15f - 23

**Found:** **British Columbia** - Abbotsford; Burnaby; Gulf Islands National Park Reserve; 10 Km w. Kamloops (all from BOLD).  
**California** - **horse trough, Santa Clara Co.** (**Type locality**); Berkeley, Alameda Co.; 2 ml n. Lafayette, Kennsington (37.906°N, 122.274°W), 1 ml s. Martinez and Wildcat Creek, El Cerrito, Contra Costa Co.; Pico Rivera, Los Angeles Co., 12 ml ne. El Portal, Mariposa Co.; 6274 Western, Arlington, Experimental Ponds UCR and 448 N. Orange St., both Riverside, all Riverside Co.; Truckee River nr. Tahoe City (39.172°N, 120.138°W), Placer Co.; 5 ml n. Vacaville (38.71°N, 121.98°W) Solano Co.; Clear Lake Park, Lake Co.; Wildcat Creek

Pools and shallow flowing parts of creeks and rivers. The sample from near Vacaville was in sulphurous water.

Morphology described by Sublette and Sublette (1974), cytology by Wülker and Martin (1974), pattern of arm C1 in Wülker (1991) and of arm D1 in Kiknadze *et al.* (2004). Pupae and larvae very similar, but the larva of *C. matusus* is a plumosus-type with some darkening of the gula and frontoclypeus, while *C. whitseli* has a thummi-type larva, although with some development of lateral tubules in some locations, but with pale gula and frontoclypeus. The Barcode sequences are in separate BOLD-bins.

### end of matusus-complex

### columbiensis-cytocomplex

***C. columbiensis* Wülker, Sublette, Morath & Martin, 1989** (Species 4a)

#### Adult:

This species is in BOLD Bin: [BOLD:AAJ0163](https://www.boldsystems.org/index.php/AJAJ0163)

Male based on South American specimens)

Wing length 2.59 (2.47-2.70) mm; venarum ratio 1.03

Antennal ratio 2.2 (2.1-2.4).

Leg ratios: Ant. - 1.76 (1.73-1.80); Mid - 0.64 (0.61-0.67); Hind- 0.76 (0.75-0.77);

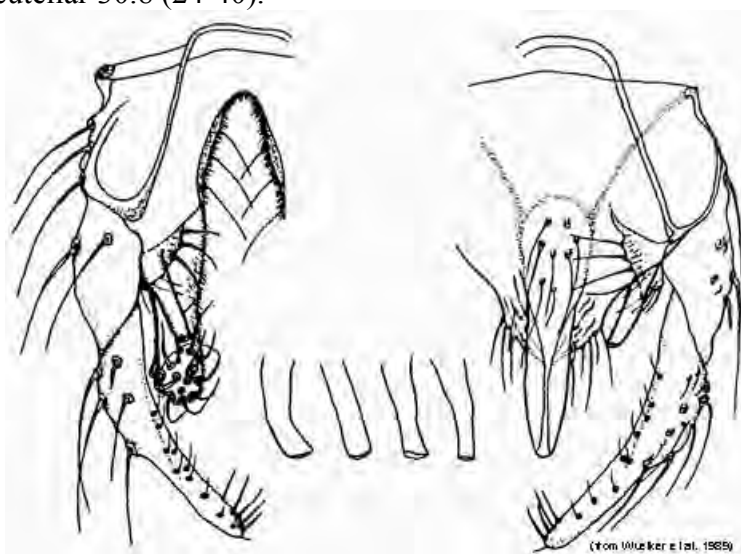
Beard ratio: 2.08 (2.0-2.2).

Whole body yellow-brownish with darker markings, middle and lateral mesonotal vittae separate, scutellum pale All femora with a narrow apical dark fascia, the basal third of fore tibiae dark, in middle and hind tibiae bases only slightly infuscate; tarsomeres 1-4 with an apical dark fascia.

Abdominal segment I with broad median fascia, II-IV with saddle-shaped fasciae, V and VI with longitudinal oval dark spot, VII darker than the light segment VIII.

Head: Palpal proportions (segs 2-5,  $\mu\text{m}$ ) 58 : 225 : 228 : 297 Clypeus with 29 (26-33) setae; frontal tubercles 30  $\mu\text{m}$  long, 9.2  $\mu\text{m}$  wide.

Thoracic setae dorsocentral 28.8 (24-35), acrostichal 12.8 (10-19) in double row, prealar 5, scutellar 30.8 (24-40).



Male terminalia of *C. columbiensis*, with superior volsella variants (center)

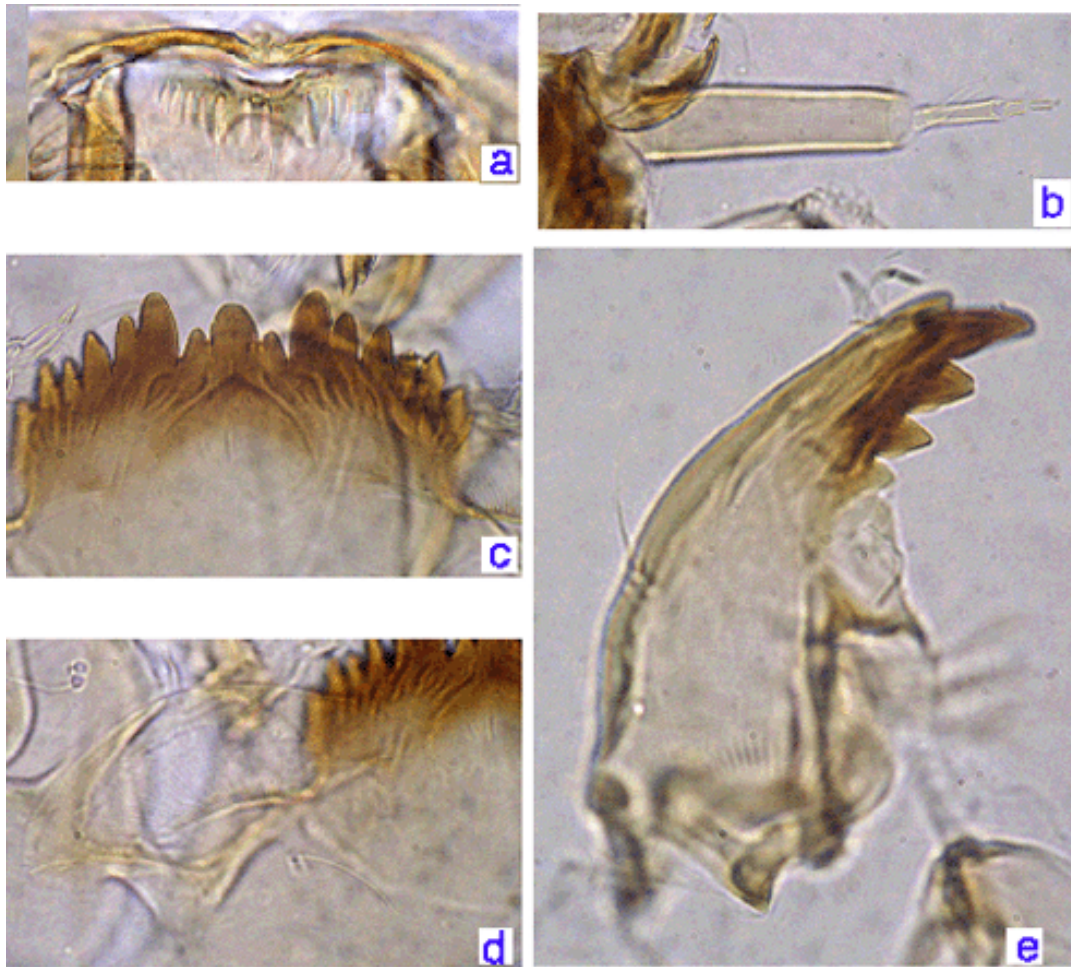
Genitalia: Anal point parallel sided, in its middle slightly widened, terminally rounded; SVo comparatively long, straight, but dorsally curved, blunt-tipped, basal lobe with remarkably strong setae; IVo parallel sided, reaching to the middle of gonostyle. Setae of anal tergite 10.4 (8-13), gonostyle inner setae 4.5 (4-5).

Similar to that of *C. anonymous* Williston. Best distinguished by the lower AR (2.1-2.4 in South America)

**Pupa:** not described.

**Fourth instar larva:** a medium-sized (abt 9 mm) plumosus-type with well-developed lateral (0.4 - 0.5 mm) and VT, posterior pair of VTs slightly longer (ant 1.9 - 2.3 mm; post 2.5 - 2.65 mm). Dorsal pair of AT constricted in the middle (abt 1 mm). Gular region slightly darkened on the posterior edge; dorsal head sometimes with slight darkening paralleling the frontoclypeus near its posterior end. Mentum (c, below) with 4th laterals reduced to level of 5th laterals, c1 tooth moderately broad with c2 teeth well developed (type II). VM (d, below) with about 40 - 42 striae. PE (a, below) with about 14 teeth. Antenna (b, below) with

relatively long narrow basal segment, almost 4.5 times as long as wide; AR about 1.8; ratio of segments (microns) 110 ; 31 ; 7 ; 11 ; 6. Mandible with third inner tooth only partially separated (type IIB).



**Cytology:** Four polytene chromosomes with the columbiensis-cytocomplex combination: AG, BF, CD, E. Nucleolus on arm G near the centromere. Arm G also with two BRs, one near the middle of the arm and the other near the distal end. No polymorphism yet found in North American populations, but heterozygosity of arms A and B was found in a Guatemalan population (Wülker *et al.* 1989).

colA1: 1a-e, 6c - 4, 10 - 12, 6d - 9, 2d - 3b, 2c - 1f, 3c-i, 13 - 19

colB1: Large puff (group 7) near center of arm with distal dark bands (group 8)

colC1: The typical dumb-bell (group 4 plus parts of 3 and 5) is about one third from centromere

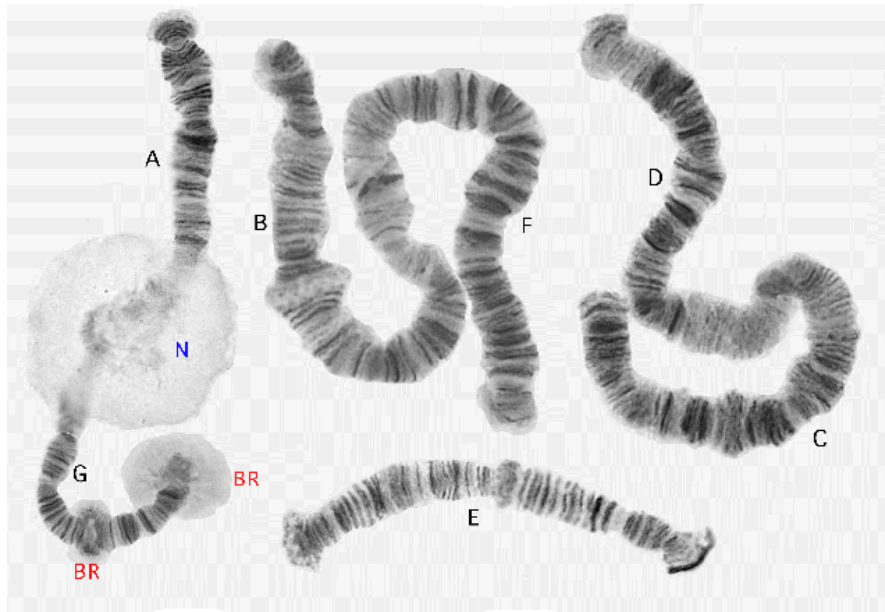
colD1:

colE1: 1 - 2, 9 - 10b, 3e-a, 8 - 3f, 10c - 13

as *anonymus* E1

colF1: 1, 16 - 19, 6b - 2, 15 - 14, 12 - 13, 6c - 11, 20 - 23

as *anonymus* F1



**Found:** Florida - Grassy Key, Munroe Co. (Hribar *et al.* 2008)  
 Virgin Islands (USA) - Lameshur Bay, St. John Island  
 This species has also been found at Cali, Colombia (Type locality) and Jocotan, Chiquimula, Guatemala.

So far found in man-made habitats, in Colombia associated with algae.

The banding sequences of arms A, E and F were described by Wülker & Morath (1989) as *C. spec. Cali*. The species was described for all stages and the polytene chromosomes pictured by Wülker, Morath, Sublette and Martin (1989).

This species is related to species in the calligraphus complex

### End of columbiensis complex

### camptochironomus-cytocomplex

### **Chironomus tentans-group**

***C. dilutus* Shobanov *et al.*, 1999** (Species t) Previously placed in the subgenus *Camptochironomus*

Synonym: *Chironomus pallidivittatus* Malloch 1915 (not sensu Beermann 1955 - see species 21) This is actually the senior synonym, but confusion arises because of the widespread use of the name in the Beermann sense.

In BOLD Bin: [BOLD:AAB4658](https://www.boldsystems.org/index.php/AAB4658)

**Adult:**

The cytology shows that there are two races of this species – the Eastern Race and the Western Race. However the original description does not distinguish between them and there is not enough data to detect whether there are any morphological differences. It is noticeable that most of the data in Shobanov *et al.* (1999) comes from the Western Race and specimen size is smaller than that in the Eastern race, and indicates that the supposed size difference from *C. tentans* in mature larvae is not supported.

Male: Shobanov *et al.* (1999) describe the adult of *C. dilutus* as paler than the Palearctic *C. tentans* (hence Malloch's description of it as 'pallidivittatus'), with a pale green thorax with orange-grey mesonotal bands; abdomen grey green, tergites uniformly colored or with a dark spot in the center. Legs green brown, with nearly 80 sensilla chaetica on IITa<sub>1</sub>; LR<sub>1</sub> 2.04 (1.79-2.27), BR<sub>1</sub> 1.30-1.46. AR 3.36 (2.96-3.64).

Leg lengths and proportions (micron) (from Shobanov *et al.* 1999):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
<b>PI</b>	1920	1910	2340	1200	910	760	380	1.79-2.27*	1.02-1.03	1.30-1.46
<b>PII</b>	2030	2030	880	540	430	330	250	0.44-0.45	0.98-1.01	-
<b>PIII</b>	2300	2350	1010	700	590	380	280	0.43-0.51	0.97-0.99	-

\*these figures do not seem to be compatible with their data in Table 4

Very similar to *C. pallidivittatus*, but males can be differentiated by characters of the hypopygium, viz. Dististyle and inferior appendage longer and more tapered, superior appendage longer, anal point broader, and indentation in tergite IX is more a U-shape.

Additional data including further specimens:

Wing length abt 4.55-5.40 mm, width 1.14-1.32; VR 0.95; 4 Scf on brachiolum; 25-41 setae on squamal fringe.

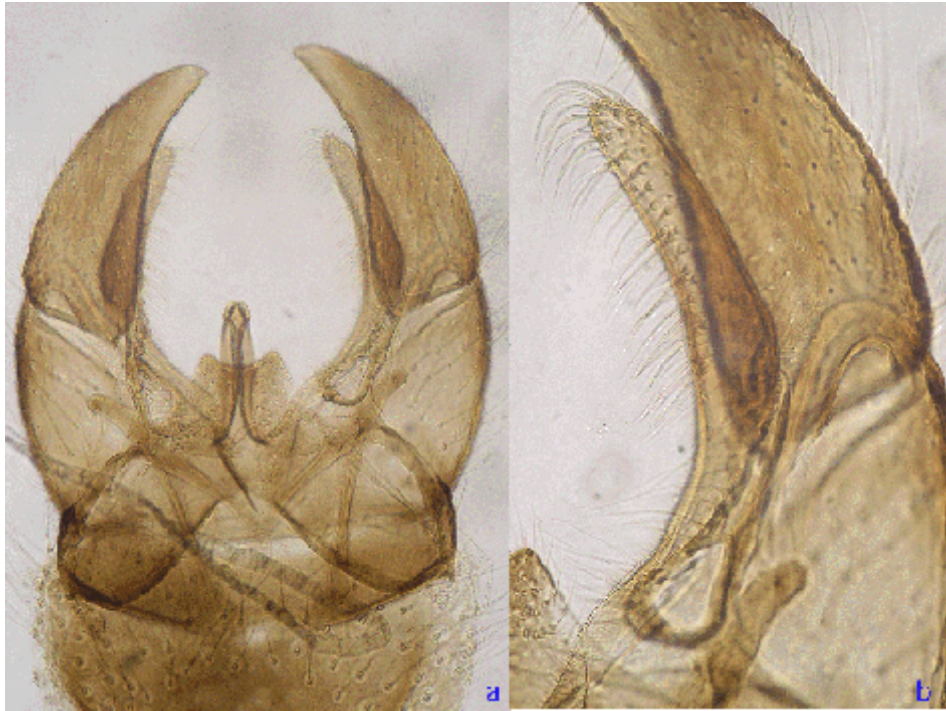
Head: AR 3.34 (2.72-3.65); CT 29.7 (21-35) µm long and 1.90-2.0 longer than wide; 61-65 setae on clypeus, which is about 0.85-0.94 of the diameter of the antennal pedicel; palp proportions (µm) 82 : 75 : 278 : 273 : 328 ; P5/P4 1.15-1.33, P5/P3 1.23-1.56.

Thoracic setae: Acrostichal – abt 12-16; Dorsocentrals 32-36; Prealars – 1; Supraalars 6-9; Scutellar 8-20 in anterior rows, 11-22 in posterior row (total 22-42).

Leg lengths (micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
<b>PI</b>	2104	2074	2418	1259	994	828	420	1.14-1.32	1.01-1.02	1.10-1.48
<b>PII</b>	2410	2142	995	752	460	357	272	0.44-0.47	0.98-1.01	-
<b>PIII</b>	2400	2483	1242	757	626	424	303	0.43-0.56	0.94-0.99	-





One specimen had 3 setae in a small clear area right at the base of the anal point. IVO reaching to about 2/3 the length of the gonostylus, with simple setae along the distal 2/3. Gonostylus narrows gently along its length usually to more of a point than figured by Shobanov *et al.* (1999).

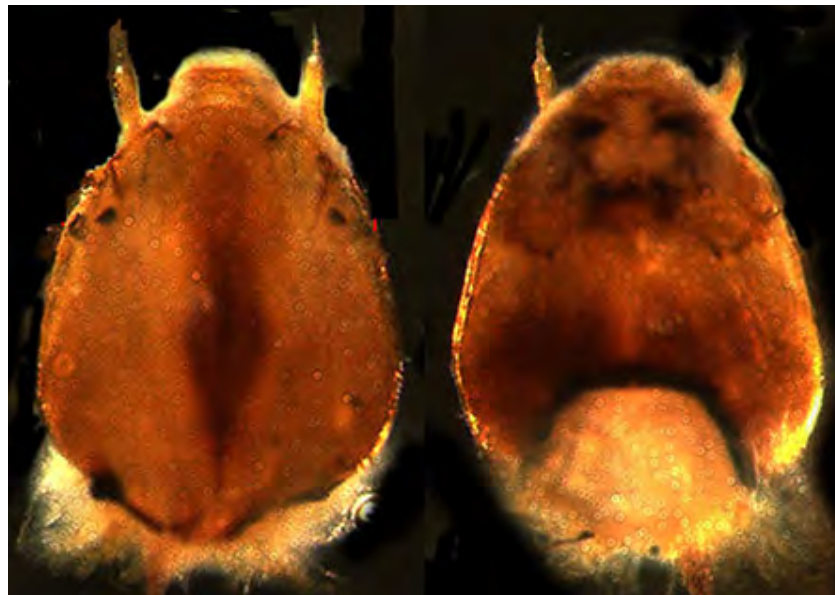
Female: The female has not been described, but it is likely that the genital regions will be quite similar to those of *C. tentans* as described by Shilova (1978).

**Pupa:** (from Shobanov *et al.* 1999) Exuvia pale-brown; thorax may be darker. Shagreen: trapezoidal spine patches, wider towards posterior margin in TII & III, becoming narrower in posterior 1/4 of TIV-V, and a pale line on the mid line of TV-VII; groups of small spines on TVII & VIII. Antennal sheath 1.89 (1.74-2.04), wing sheath 2.80 (2.53-3.16), abdomen length 9.51 (8.2-10.7), no. of hooklets on tergite II, 92 (67-113); anal spur dark or black-brown with about 4-5 appressed spines at tip and a smaller spine on one side near the base. To this can be added: Total length 12-12.8 mm (male); CT 80-120  $\mu\text{m}$  high, 65-74.5  $\mu\text{m}$  wide at base; hooklet row of segment II covers about a third to a half of the segment width. Respiratory base abt 268 x 112), HR 2.1-2.6. The L-setae at the TIII/IV conjunctive are about 125  $\mu\text{m}$  long, those at the TIV/V conjunctive at least 100 $\mu\text{m}$  long. Pedes spurii B are present on segments II and III, and a large Pedes spurii A, about 315-340  $\mu\text{m}$  long and 1.5-2.3 times longer than wide, which cover about a quarter of the length of segment IV; the PSA of segments V and VI are patches of spines, about 150-250  $\mu\text{m}$  long on segment V and 115-125  $\mu\text{m}$  long on segment VI. The number of appressed spines on the spur of segment VIII is 5.5 (3+1-7), with the higher numbers from pupae of the Eastern race (below). The number of flattened taeniae on each side of the anal lobe is about 152-165 in up to 3 rows, particularly towards the distal end.



Spur of pupa of the Eastern race

**Fourth instar larva:** A large plumosus-type. As indicated above, larvae of the Eastern race (fem. 23.22 mm; 14.8-28.9; male 19.96 mm; 16.9-24.2) are larger than those of the Western Race (fem. 21.6 mm; 19.8-25.9; male 17.96 mm; 15.3-21.5). TLt long (longer in the Western Race), up to 1/3 of segment length (617.5  $\mu$ m; 310-1070); VT longer than posterior parapods, posterior pair generally longer (ant. 2.20 mm; 0.80-3.84; post. 2.35 mm; 1.29-3.94). AT well developed, dorsal 425-730  $\mu$ m, ventral 506-650  $\mu$ m and about 2-3 times longer than wide. Gular region pale or slightly darkened on posterior third to half and wider than the mentum, with FC darkened particularly in the center, posteriorly. Salivary reservoir about 2.9-3.4 times longer than wide.



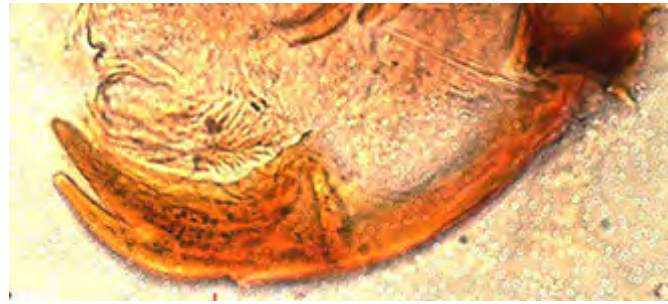
Frontoclypeus (left) and gula (right) of *C. dilutus*. Photo courtesy of I. Proulx.

Mentum with rounded teeth; c1 tooth broad with short parallel sides, c2 teeth quite well separated (Type II); 4th laterals only slightly reduced (type I). Ventromental plates separated by about 35% of the mentum width, each with about 5 -66 striae.

PE with about 10-18 broadly rounded or flat teeth (Hilsenhoff & Narf 1968, Shobanov *et al.* 1999). Premandible (below) with moderately broad teeth, inner tooth about 3-5 times wider than outer tooth, coming to a broad point (Type C).

Basal segment of antenna about 3.7 times longer than wide; AR 2.1 (1.79-2.29). Mandible of type II, variation of 3rd inner tooth shown in Figs 4L and M of S of Shobanov *et al.* (1999),

about 19-25 grooves on outer surface near the base. Note that female larvae can be larger than the 25 mm limit indicated by Shobanov *et al.* (1999).



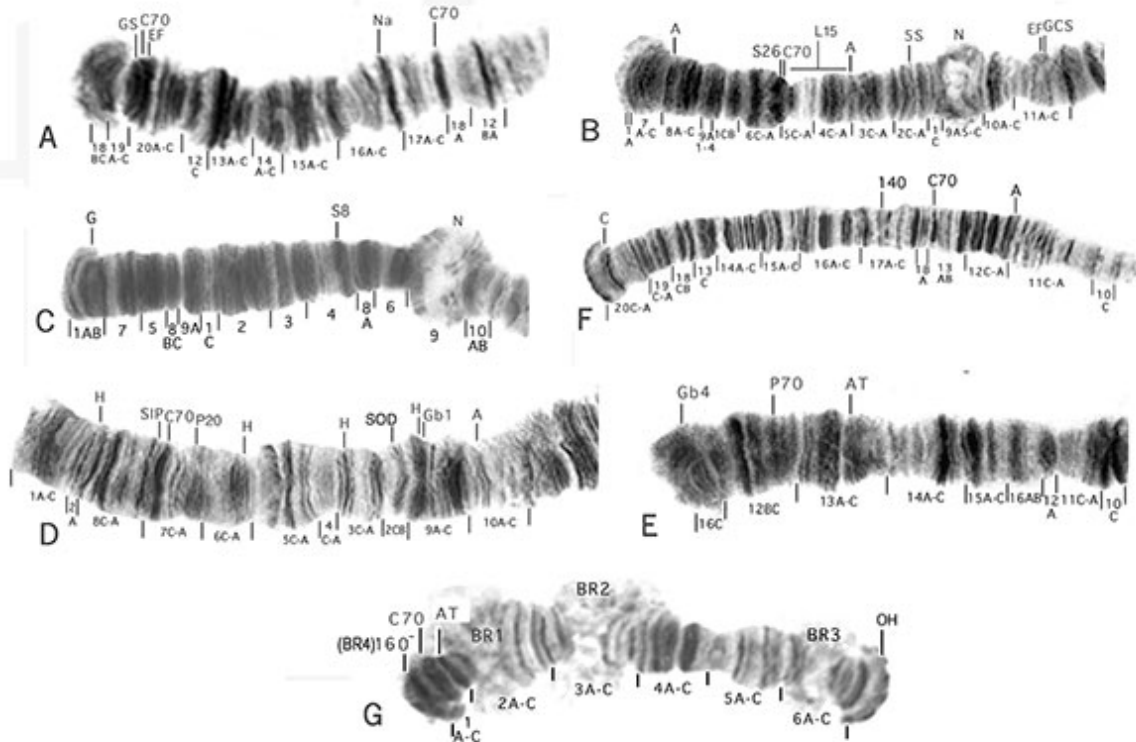
**Cytology:** 4 polytene chromosomes with the camptochironomus arm combination AB, DE, CF, G.

Arm G with 3 BRs but no nucleolus. Position of BRs variable due to the polymorphisms; arms B and C with a nucleolus near the centromere, nucleolus also in arm D with an extra band. Chromosome polymorphism in all arms, with 23 sequences known. The male sex determiner is on arm C near the centromere, but the female sex determiner reported by Thompson (1971) does not actually exist (Martin and Lee 1984).

dilA1:	1a-b, 8c-7b, 3i-7a, 1g-c, 8de, 17-13, 1h-2c, 9c-8f, 10-9d, 11-12, 3h-2d, 17g-19
dilA2:	
dilB1:	
dilB2:	
dilB3:	
dilC1:	1-2d, 4g-6b, 9-11c, 3c-2e, 11d-14c, 19-16, 7d-a, 6h-c, 8, 15-14d, 4a-f, 20-22
dilC2:	
dilD1:	1-2b, 15-14, 10, 4-7, 2c-3, 13, 22-18e, 8-9, 17-18d, 12-11, 16e-a, 23-24 as tenh'D1, except for nucleolus and extra band in 10B.
dilD2:	as tenp'D2?, except for nucleolus and extra band in 10B
dilD3:	
dilE1:	1 - 2b, 7h - 8, 9 - 10b, 3e - 2c, 7g - 3f, 10c - 13 as tenp'E1
dilE2:	as tenp'E2
dilE3:	1 - 2b, 10a-c, 3f - 7g, 2c - 3e, 10b - 7h, 11 - 13
dilF1:	1 - 2, 7 - 9, 16, 6 - 3, 15 - 10, 17 - 23 as tenp'F3
dilF2:	
dilF3:	1a-d, <u>9b-12, 3b-2, 13a-d, 1i-e, 3c-5c, 16-14d, 7-9a, 6-5d, 14c-a, 2a-e</u> , 17-23
dilF4:	
dilG1:	BR1 and BR2 separated by about 1/3 of length, towards the centromeric end as tenh'G1
dilG2:	Inversion of virtually the whole arm, so the close BRs are now at the distal end as tenh'G2
dilG3:	Inversion including BR2, so that BR1 and BR2 are separated by over half the chromosome length.
dilG4:	Reported by Acton (1962) as rare, but limits not defined.



Chromosome complement of a member of the Western race  
(Modified from Martin (1979))



A more detailed map showing the position of some genes  
(Modified from Martin *et al.* (2010))

**Found:** Numerous localities across the northern U.S. and Canada.-

Alberta (WR) - Elkwater; Edmonton; Lacombe.  
 British Columbia (WR) - Chilcotin area; Williams Lake, Kamloops; Sawmill Lake, Sorenson, Westwick Lake (52.00°N; 122.17°W) (A.B. Acton).  
 Manitoba (WR) - Churchill; Erickson; Winnipeg; St Alphonse.  
 Ontario (ER) - Hogs Back (45.35°N, 75.68°W), Ottawa; Cranberry Creek, Kars (45.13°N, 75.63°W); Mud Lake, South March (45.40°N, 75.87°W), all Carleton Co.; Kelly Lake, Sudbury (46.45°N, 81.07°W)  
 Saskatchewan (WR) - Big Quill Lake; 6ml. n. & e. Colgate; Lake Waskesiu, Prince Albert Park; 6ml. s. & w. Stoughton; 5ml. w. Theodore.  
 Colorado – Walden Pond, Boulder.  
 Iowa - Lake Okoboji & Jemerson Slough, Dickinson Co.; Little Wall Lake, Hamilton Co.; Cerro Gordo Co.  
 Massachusetts (ER) - Longmeadow.  
 Michigan (ER)  
 Minnesota (WR) - Badger Lake, Erskine, Polk Co.(47.67°N, 96.00°W) Lake Christina (46.08°N, 95.75°W), Douglas Co.  
 New York (ER) - Ithaca.  
 North Dakota (WR) - Warsing Dam, Eddy Co.(47.83°N, 99.12°W); Braddock Dam, Emmons Co.; Fullers Slough; Hankinson.  
 South Dakota (WR) - Lake Francis Case, Gregory Co. (43.27°N, 99.00°W); Gavins Point National Fish Hatchery, Yankton Co. (42.87°N, 97.47°W); Su-Falls; Missouri R., Running Water.  
 Utah (WR) - Logan.  
 Wisconsin (ER) - Stevens Pond & U.W. Arboretum, Madison, Dane Co. (43.03°N, 89.42°W).  
 Wyoming (WR) - 6ml s Lander.

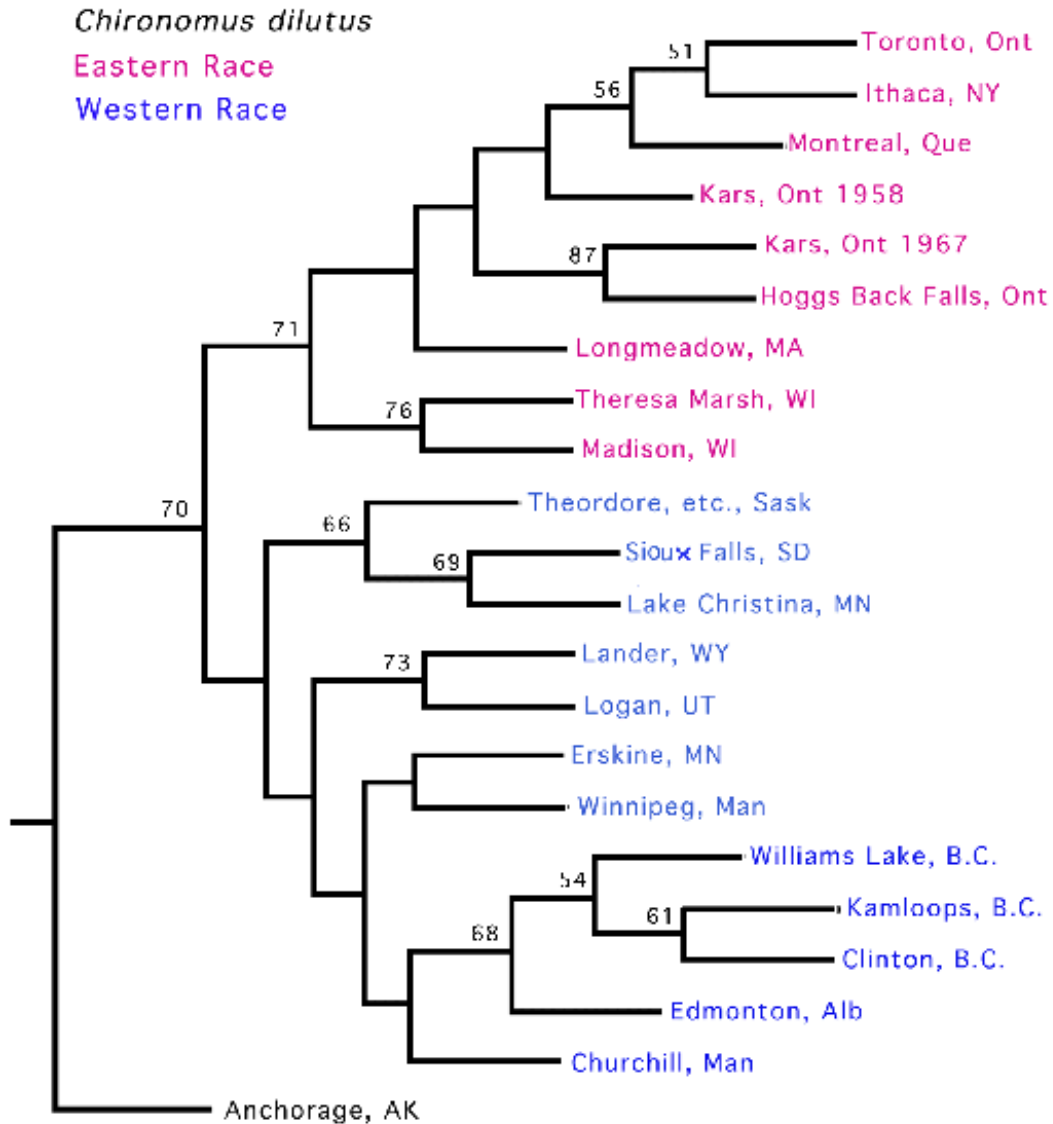
In prairie sloughs, shallow eutrophic lakes and ponds, sewage oxidation lagoons.

Fourth instar larva described by Johannsen (1937). Chromosomes have been shown in a number of papers, e.g. Thompson (1971), Firling and Kobilka (1979) Martin (1979); full karyotype, using Beermann maps, published by Kiknadze *et al.* (1996). Keyl (1962) gives the sequence of arm F on his scheme, including IR-2 = p<sup>3</sup>F3 = n<sup>3</sup>F1 (Kiknadze *et al.* 1996), other sequences from Kiknadze *et al.* (2004).

Martin *et al.* (2010) provided a physical map for the position of some genes on the polytene chromosomes.

Acton and Scudder (1971) consider North American populations to comprise three races - Alaskan, west Canadian, east Canadian. Alaskan is considered here to be still probably *C. tentans* (see Sp3y).

The other two races are distinct in the West and East respectively, but tend to merge in the central area where the biogeographic barriers currently exist, although Gunderina *et al.* (1996) showed that samples from Minnesota and Saskatchewan were distinct from the eastern populations. However, this could just reflect an east-west cline. Therefore, inversion frequency data from all available populations were incorporated in a UPGMA analysis (see below), which still supported two groupings, with a break somewhere around the western borders of Wisconsin in the U.S.A., and Ontario in Canada.



UPGMA tree showing the distribution of the two races of *C. dilutus*

The morphological data shows that the Eastern race tends to be larger than the Western race:

**Eastern Race:** Larval length - female 24.5 mm (21.5-28.9)(7); male 20.0 mm (16.9-24.2)(9). Cytologically, this race is characterized by more frequent n'D2, h'E2, and n'F4, but lower frequencies of n'F3 and n'G3; with no n'G4 recorded.

**Western Race:** Larval length - female 21.6 mm (19.8-27.0)(13); male 19.1 mm (15.3-22.5)(14). Cytologically, this race is characterized by more frequent n'F3, n'G3 and rarely n'G4 (known only from British Columbia), while frequencies of n'D2 and h'E2 are lower; n'F4 has not been recorded in this form.

Formerly considered a synonym of *C. tentans* Fabricius, the North American material clearly differs genetically from the Palearctic species and was renamed by Shobanov *et al.* (1999).

*C. dilutus* and *C. pallidivittatus* cannot be separated on the basis of the DNA “barcode” sequence of *COI* and *CytB* (Guryev *et al.* 2001) but can be separated by the sequence of the globin gene *gb2β* (Martin *et al.* 2002).

#### Molecular sequences:

mt *COI* sequences in GenBank, Accession nos. AF110160 – AF110162.

mt *cytB* sequences in Genbank, Accession nos. AF109700 - AF109709.

*gb2β* sequences in Genbank, Accession nos. AF110173 - AF110174.

#### *C. pallidivittatus sensu Beermann (1955)* (Species 21)

Placed in the subgenus *Camptochironomus* but this is no longer recognised as a subgenus. Usually stated to be “sensu Edwards 1929”, but Beermann did not confirm the identity of his material with that of Edwards, and until the identity is confirmed, this synonymy cannot be made with certainty.

#### Adult:

Male: similar to that of *C. dilutus* but paler and usually slightly smaller.

Wing length 2-4.58 mm, width 1-2.42 mm; VR 0.93-0.94; 2-4 setae on SCf.

AR 2.3-2.62. Cephalic tubercle about 28-30 μm. 42-66 clypeal setae.

Palpal proportion (segs 2-5): 80 : 205 : 205 : P5/P4 1.14-1.6; P5/P3 1.1-1.9.

Thoracic setae: Acrostichal - abt 15; Dorsocentrals 21-33; Prealars not seen;

Supraalars 1; Scutellars with 3-4 in anterior row, 5-9 in posterior row, total 9-12.

Leg lengths and proportions (micron):

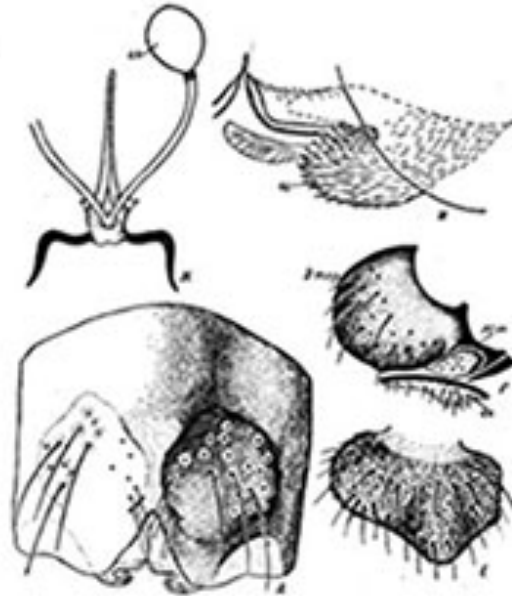
	<b>Fe</b>	<b>Ti</b>	<b>Ta1</b>	<b>Ta2</b>	<b>Ta3</b>	<b>Ta4</b>	<b>Ta5</b>	<b>LR</b>	<b>F/T</b>	<b>BR</b>
<b>PI</b>	1860	1750	2340	1190	910	760	380	1.18-1.32	1.06	0.71-1.08
<b>PII</b>	1865	1900	920	560	430	320	250	0.47-0.50	0.98	-
<b>PIII</b>	2140	2270	1270	760	620	400	270	0.55-0.57	0.94	-

Apparently no setae at center of TIX.



Males can be differentiated from *C. dilutus* by characters of the hypopygium, viz. shorter and less tapered dististyle and SVo, the shorter SVo, narrower anal point, and the deep W-shaped indentation in tergite IX. The Hind LR is also higher in *C. pallidivittatus*.

Female: Some characters of European specimens have been described in Russian by Shilova (1978), as illustrated below:



**Pupa:** Length (male) about 16.5 mm; inner margin of wing case about 1.64 mm. Cephalic tubercles about 76 x 78  $\mu\text{m}$  (l/w 0.97), seta at least 50  $\mu\text{m}$ . Frontal warts and secondary cephalic tubercles absent.

Basal ring about 177 x 89  $\mu\text{m}$ , with core waisted in the middle, HR 1.98.

Hook row of abdominal segment II with about 65 recurved hooks. Hook row about 0.4 mm wide, segment width 1.14 mm, so hook row occupies about 35% of segment width. Large Pedes spurii B on segment III, small one on segment II; large Pedes spurii A on segment IV, small ones on segment V and VI.

Postero-lateral spur of eighth segment relatively fine, with one or two spines.

Fringe of anal lobe with about 81 taeniae on each side.

**Fourth instar larva:** a medium to large plumosus-type (fem. 18.0-19.7 mm; male 14.3-17.2 mm); TLt developed (340-680  $\mu\text{m}$ ); VT about equal length (ant.: fem 1.40-2.60; male 1.24-2.06 mm; post.: fem. 1.64-3.08; male 1.28-2.36 mm).

Gular region pale or darkened, FC darkened posteriorly.

Mentum of type IIA, with relatively pointed teeth; c1 tooth moderately broad with parallel sides, c2 teeth well developed and sharp pointed (type II).

VM with deep clefts on inner edge of the marginal region; abt 52-55 striae reaching about  $\frac{1}{2}$  way to anterior margin; VMR abt 0.32-0.35.

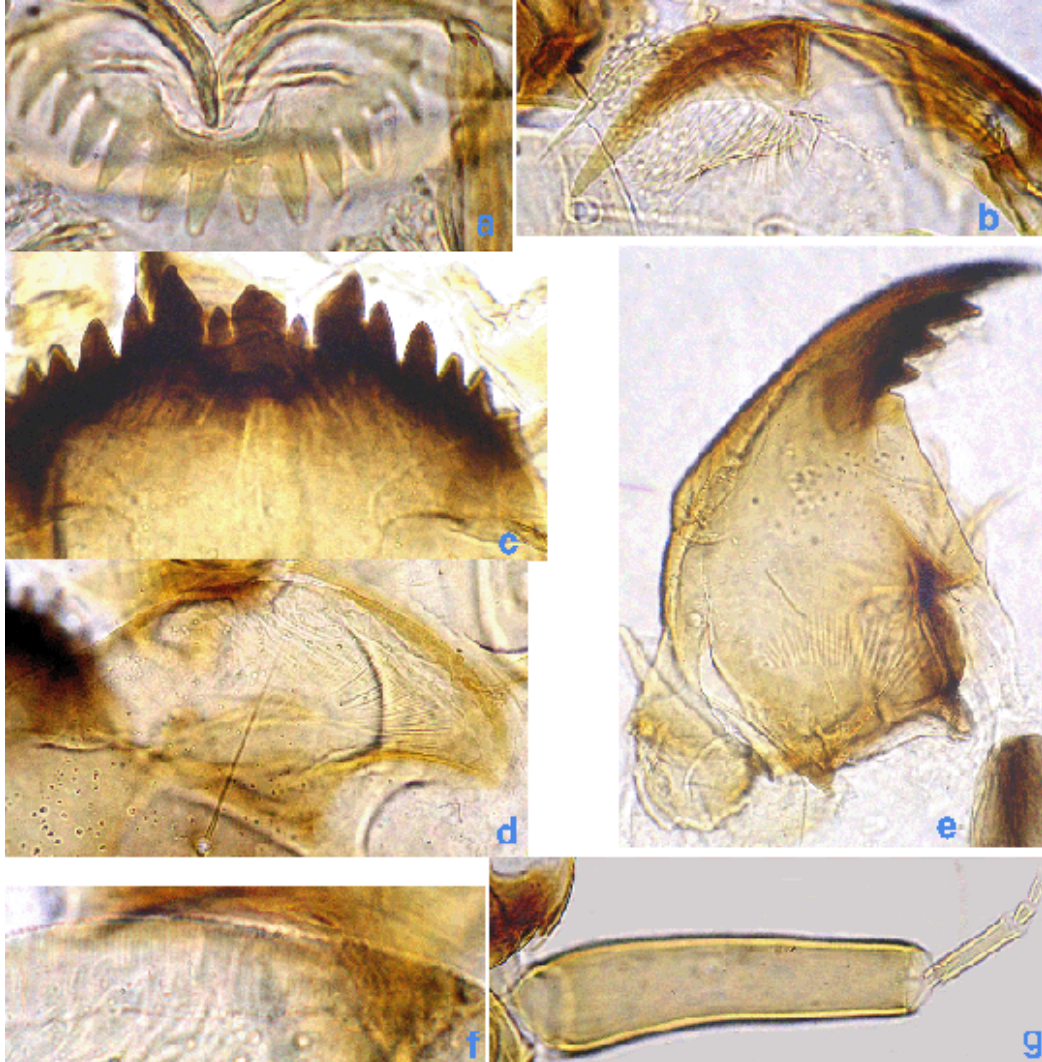
Premandible with relatively narrow teeth, inner tooth about 1.75-2 times the width of the outer; approximately equal in length unless outer worn.

PE with about 13-14 even sharp teeth.



Antenna with RO about a third up from the base, A1 about 4 times longer than wide and abt 4.7 time longer than A2, AR abt 2.15, A3 about same length as A4 and longer than A5; segment proportions ( $\mu\text{m}$ ): 167 : 35 : 13 : 13 : 8.

Mandible with third inner tooth generally dark and well separated (type IIB-IIIC), about 24-25 grooves on outer surface at base.



**Cytology:** 4 polytene chromosomes with the camptochironomus arm combination AB, DE, CF, G. Arm G closely paired with three BRs, 2 close together near one end with a constriction between most distal and the end, and the other towards the other end. Nucleolus in arm B, virtually at centromere, but other smaller ones may be developed distal to this in sequence n'B9, known only as a heterozygote, and hence may be associated with the MD as in Palearctic populations.

pal h'A1: 1ab, 7d-7b, 3i, 2c-1h, 9c-8f, 10-9d, 11-12, 3h-2d, 8e-a, 1c-g, 7a-4, 13-19

pal n'B8:

pal n'B9:

pal h'C2: 1a-e, 15-14d, 4-6b, 8g-a, 2e-3c, 11c-9, 1f-2d, 11d-14c, 19-16, 7-6c, 20-22

pal h'D2: 1a-2b, 15-14, 22-18e, 8-9, 17-18d, 16a-e, 11-13, 3g-2c, 7-4, 10e-a, 23-24

pal n'D3:

pal h'E1: 1-2g, 4b-f, 12f-10c, 3f, 8g-10b, 3a-e, 8f-4c, 12g-13

pal h'F1: 1a-d, 9b-12, 3b-2f, 13-14c, 5d-6, 9a-7a, 14d-16, 5c-3c, 1e-2e, 17-23 i.e.  
as h'F1 of *tentans*

pal n'G4:

pal n'G5:

**Found:** **Manitoba** - Lake Winnipeg (Sæther 2012)  
**Saskatchewan** - 5ml nw Theodore.  
**North Dakota** - Cleveland  
**South Dakota** - Vermillion, Clay Co.; Sioux Falls, Minnehaha Co.; Lake Francis Case, Gregory Co. (43.27°N, 99.00°W);

Generally at low frequency in prairie sloughs containing *C. dilutus*.

Hein and Schmulbach (1971) first described this species in North America, noting that it was not the same as *C. pallidivittatus* Johannsen. The cytology of North American populations in comparison to that of European populations was described by Kiknadze *et al.* (1998a). Kiknadze *et al.* (1991) noted that larvae of the European populations of *C. pallidivittatus* could be distinguished from the related *C. tentans* by the smaller size as reflected in the head width and the length of antennal segment 1. It is not clear whether this could be applied to separating the North American specimens from those of *C. dilutus*, particularly in view of the occurrence of hybridization and the existence of different races of the latter species. *C. pallidivittatus* and *C. dilutus* cannot be separated on the basis of the DNA “barcode” sequence of *COI*, but can be separated by the sequence of the globin gene *gb2β* (Martin *et al.* 2002).

Barcode: *COI* sequence in GenBank, Accession number AF110165.

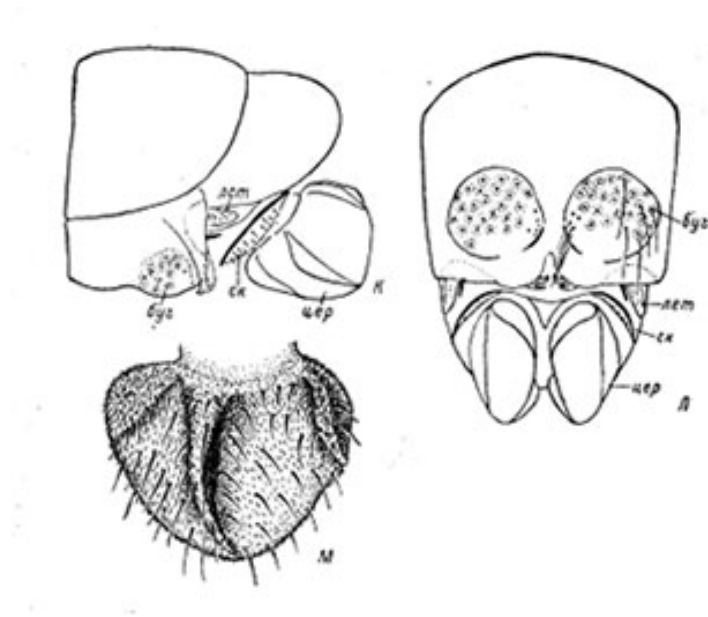
### ***C. tentans* Fabricius, 1805 (Species 3y)**

Previously placed in the subgenus *Camptochironomus*.

#### **Adult and Pupa**

The adults and pupae of the Alaskan population have not been described.

On the assumption that it is possibly *C. tentans*, the illustrations of the genital region of the female by Rodova (1978) is shown below.



**Fourth instar larva** a large plumosus-type. Gular region slightly darkened with FC darkened particularly in the center.

**Cytology:** 4 polytene chromosomes with the camptochironomus arm combination AB, DE, CF, G.

Arm G with 3 BRs. Nucleoli in arms B and D, as in Palearctic populations. Polymorphism in arms A, B, C, D, and F; males particularly are heterozygous for arm F.

ten h'A1: 1a-g, 7a-3i, 7b-8e, 17f-13, 1h-2c, 9c-8f, 10-9d, 11-12c, 3h-2d, 17g-19

ten h'A2:

ten h'B1:

ten n'B2:

ten h'C1: 1-2d, 11d-14c, 19f-16, 7-6c, 8a-g, 6b-4, 14d-15, 9-11c, 3-2e, 20-22

ten n'C2: 1-2d, 4g-6b, 9-11c, 3-2e, 11d-14c, 19f-16, 7d-6c, 8a-g, 15-14d, 4a-f, 20-22

ten n'C3(1Lz):

ten n'D1:

ten n'D2:

ten h'E1: 1-2b, 7h-10b, 3e-2c, 07g-3f, 10c-13

ten h'F1: 1a-d, 9b-12, 3b-2f, 13-14c, 5d-6, 9a-7a, 14d-16, 5c-3c, 1e-2e, 17-23

ten n'F2: 1a-d, 9b-12, 3b-2, 13a-d, 1i-e, 3c-5c, 16-14d, 7-9a, 6-5d, 14c-a, 2a-e, 17-23

ten n'F3(1Rjk):

ten h'G1:

**Found:** **Alaska** - Potter Marsh, Anchorage (61.054°N; -149.792°W).

There is some doubt that this species actually occurs in North America. However the data of Acton (1962) suggests that Alaskan populations should still be considered to be this species.

***C. vockerothi* Rasmussen, 1984.** (Species 3w)

Was placed in the subgenus *Camptochironomus*.

It has been suggested that this is a hybrid between *C. dilutus* and another species.

**Adult:**

Description largely based on that of Rasmaussen (1984).

**Male:**

Wing length 3.1-3.8 mm, wing width abt 0.96 mm, VR 0.95-1.0. AR 1.89-2.35. Fore LR 0.95-1.09; no tarsal beard.

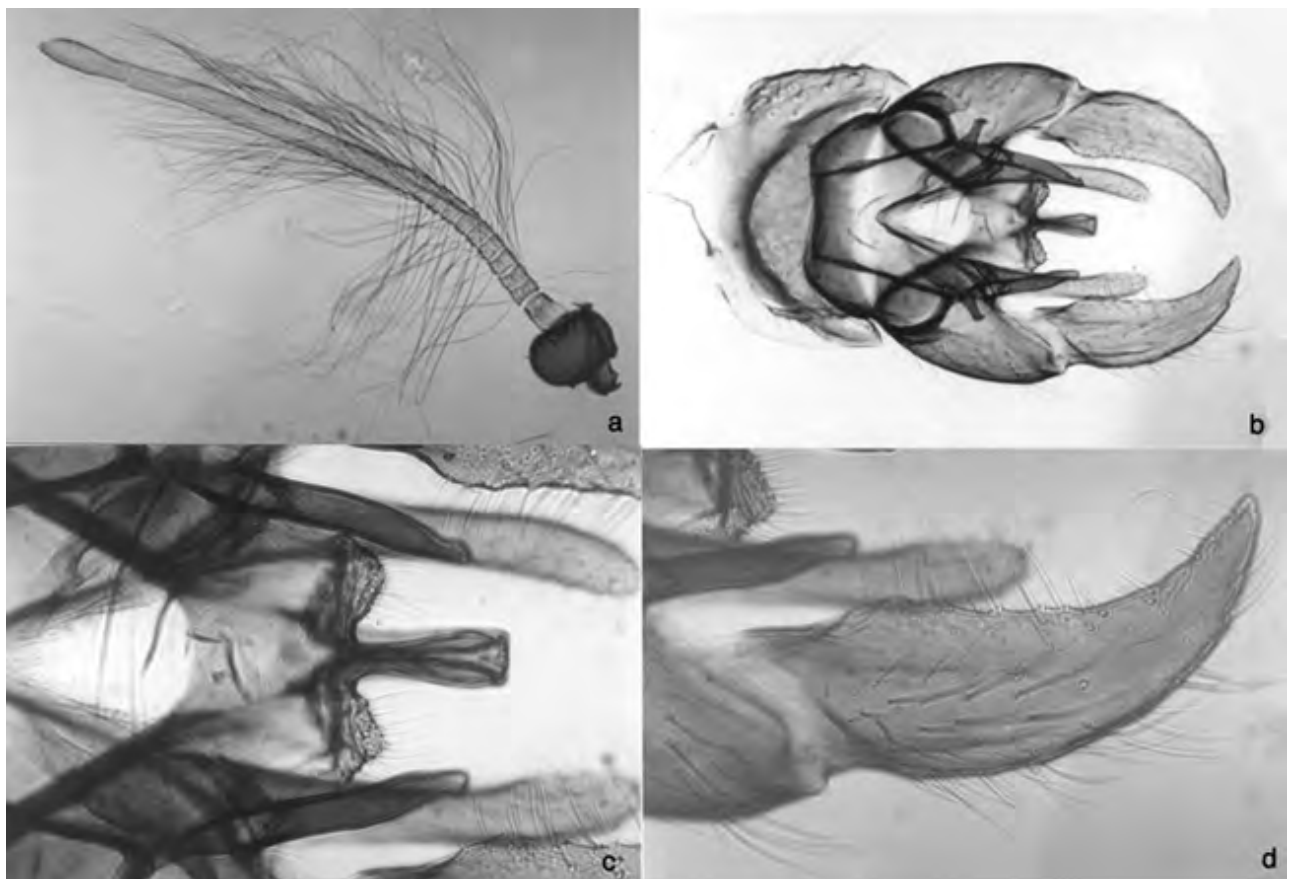
Wing squama with 19-25 marginal setae.

Head: Frontal tubercles present, length about 250  $\mu$ m. Palpal proportions (segs 2-5)( $\mu$ m): 68 : 188 : 182 : 245; P5/P4 1.35. P5/P3 1.30. Clypeus with 21-38 setae.

Thorax: Mesonotal tubercle well developed. Setae - Acrostichal 8-18; Dorsocentral 25-54, uni- to tri-serial; Prealars 7-14, uni- to bi-serial; Supraalars 1-2; Scutellars 29-46, uniserial laterally to multiserial medially, about 14-16 in most posterior row.

Leg proportions (micron):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
<b>PI</b>	1610	1310	1450	820	620	440	260	0.95-1.09	1.14	1.05-1.24
<b>PII</b>	1530	1550	690	470	370	270	200	0.44-0.45	0.99	-
<b>PIII</b>	1680	1760	940	580	510	310	210	0.53	0.95-0.96	-



*Paratype male of C. vockerothi*

a. antenna; b. hypopygium; c. Superior volsella (note the length); d. gonostylus.

Male terminalia enlarged, suggesting the species mates on the substrate. Gonostyles strongly curved and narrowing evenly; anal point broad with a squared off end, with

two setose lobes flanking it. SVo large, darkly pigmented, curved ventrally towards the apex, and lacking setae. IVo long and narrow.

Female:

Coloration, squamal setation, and thoracic characters stated to be similar to those of the male. Additional information from paratype 18183:

Wing length abt 3.50 mm, width abt 0.94 mm., VR 1.00-1.01. SCf on brachiolum – abt 4.

Antennal proportions ( $\mu\text{m}$ ): 105 : 80 : 98 : 113 : 185. AR about 0.47, A5/A1 about 1.76.

Palp proportions (segs. 2-5) ( $\mu\text{m}$ ): 80 : 180 : 173 : >245 (shriveled). 37 clypeal setae

Thoracic setae: abt. 12 acrostichals; 19-23 dorsocentral (incl. humerals?); 6 prealar; scutellars in 2 approximate rows 24 in anterior, 12 in posterior row (total 36).

Leg proportions of 1 specimen (micron):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
<b>PI</b>	1080	1120	1080	620	500	360	180	0.96-1.25	0.96	0..32
<b>PII</b>	1300	1260	620	380	300	200	180	0.42-0.49	1.03	
<b>PIII</b>	1420	1420	900	540	460	260	180	0.57-0.65	1.00	

Genitalia: Dorsomesal lobe of GpVIII somewhat reduced, with inner margin distinctly sclerotized. GcIX small with 1-2 setae. Segment X large and produced into posterolateral lobes, each bearing 22-35 setae. Ventrolateral lobe short, apodemal lobe small and on most specimens indistinct

Pupa not known.

Fourth instar larva and Cytology not known.

**Found:** Alberta– Elkwater (49.65°N, -110.28°W); Hastings Lake (**Type locality**).

Adult alone described by Rasmussen (1984). Distinguished from *C. dilutus* and *C. pallidivittatus* by the smaller size and well developed mesonotal tubercle. The males can be distinguished by the long superior volsella; females by the long extended gonopophysis X.

**end of camptochironomus-group**

### **Species with unknown cytology:**

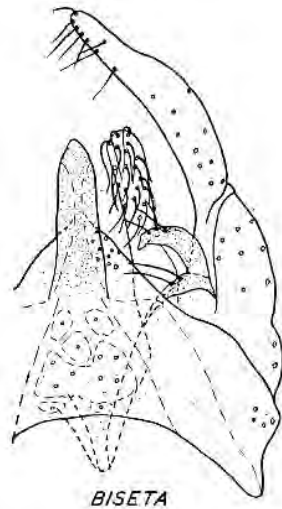
*Chironomus biseta* Townes 1945 (Species 4p)

Confirmed as *Chironomus* by Sublette and Sublette (1965).

Known only from the adults.

**Adult**

From the description of Townes (1945):



Male genitalia of *C. biseta* (Townes 1945)

Male: Wing length 5.5 mm; fore LR 1.4; antennal ratio 4.0.

Frontal tubercles small, clypeus of moderate size.

Middle portion of pronotum moderately broadened; mesoscutum without a tubercle

Fore tarsus without a beard.

Dark brown, legs pale brown at their bases, dark brown towards the apices; abdomen with the apical part of each segment pruinose and slightly paler than the rest.

The genitalia is unusual in having several setae on the SVo, which otherwise is an E type closest to E(h) of Strenzke (1959).

Female: Described only as similar to the male except for the usual sexual differences.

Pupa: Not known

Fourth instar larva: Not known

Cytology: Not known

Found: Hudson Bay Territory - (Type locality)

Townes (1945) notes that it is similar to *C. atritibia* in size, coloration and lack of tarsal beard, but differs in the genitalia and the smaller clypeus.

***C. tuberculatus* Townes 1945 (Species 4d)**

Known only from adult male and female.

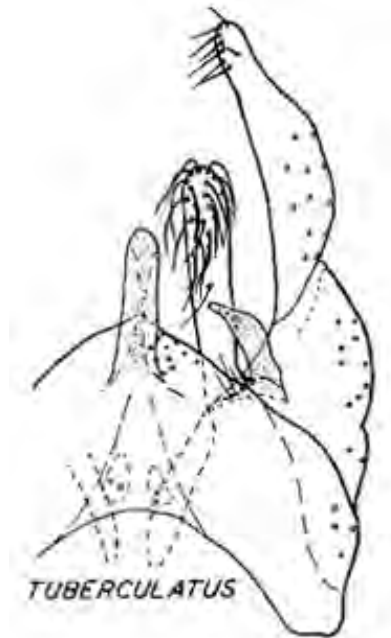
Adult

Male (from Townes 1945): Wing length 4.6 mm; fore LR 1.15; antennal ratio 6.0.

Body rather stout.

Frontal tubercles small, clypeus of medium size.

Middle portion of pronotum slightly broadened; mesoscutum with a strong, more or less double, tubercle  
Fore tarsus with a long dense beard.  
Blackish brown, legs brown.



Drawn from type (Townes 1945)

Superior volsella of D type of Strenzke (1959).

Female: Described only as similar to the male except for the usual sexual differences.

**Pupa:** not known

**Fourth instar larva:** not known

**Cytology:** Not known.

The strong mesoscutal tubercle is stated as an easy recognition point. Otherwise species noted as superficially similar to *C. utahensis*.

**Found:** 'Hudson Bay Territory' (Type)  
Alberta - Lesser Slave Lake.  
South Dakota - ♂ (Oliver et al. 1990)

***Chironomus* species "Florida" of Epler (2001)** (Species 4w)

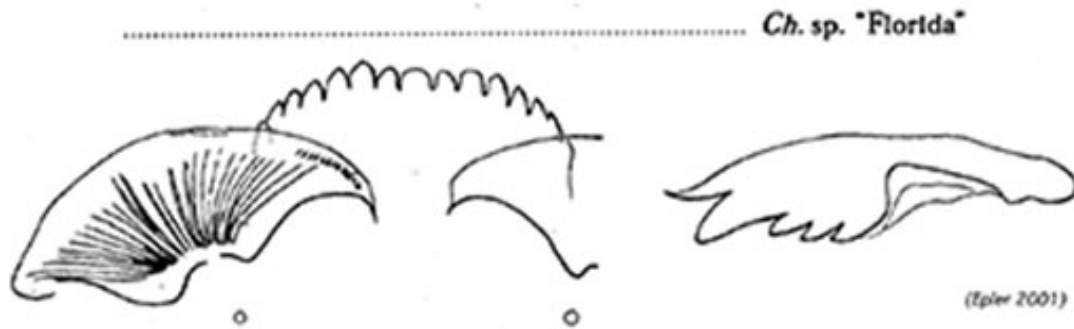
**Adult:** Now known but not yet described.

**Pupa:** Now known but not yet described.

**Fourth instar larva:** a plumosus- or semireductus-type, TLt as long as the segment width (Bolton 2012).

Mentum with simple central tooth and 14 lateral teeth, although it seems likely that this can be interpreted that the c2 teeth are relatively large and quite separate from the c1 tooth, and the first laterals are hardly higher than the other teeth.

Premandible with numerous teeth (figure shows 5).



**Cytology:** not known.

Reyes-Maidonado et al. (2021) describe the rearing of the species in the laboratory and its very short life cycle.

**Found:** Florida – several localities.  
Puerto Rico

***Chironomus* sp. 5d.**

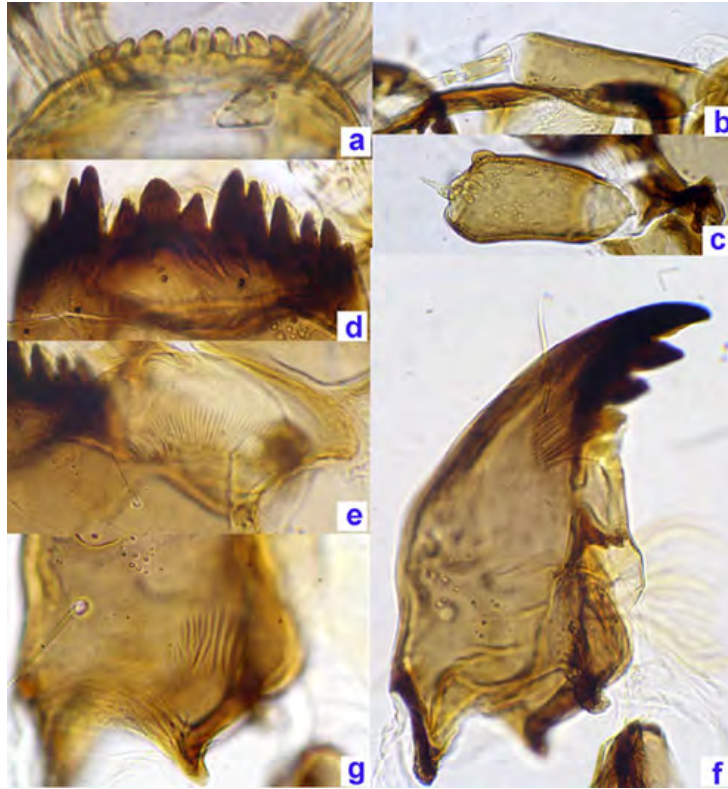
Currently known from only a single larva, with no DNA sequence yet available.

**Adult and Pupa:** Not known.

**Fourth instar larva (GP8.2.1 22):** A medium sized (12.2 mm) salinarius-type larva. Dorsal ATs essentially spherical in shape (400 x 380 µm), ventral pair about 2 times longer than wide (540 x 280 µm).

Gula slightly dark on the posterior third, frontoclypeus slightly dark and slightly dark outside it, becoming darker towards the posterior margin.





Mentum (Fig. d, above) width about 0.7 of the VHL, with 4th laterals hardly reduced (type 1) and c2 teeth relatively well separated from c1 (Type 4 or possibly a slightly worn type 3). VM plates (Fig. e, above) separated by about 40% of the mentum width, VMR about 0.23, and either notches or small hooks near inner margin (as in other Greenland species studied); about 45-46 striae.

PE (Fig. a, above) with about 11 teeth of type C. Prementum with teeth about equal in length, inner tooth about 3 times the width of the outer tooth.

Distance between the antennal bases just slightly larger than that between the S4 setae, which are separated by 78% of the FC width.

Antenna (Fig. b, above) with A1 about 40% of VHL, 3.3 times longer than wide, RO between a third and half way up from the base; AR about 2.35; antennal proportions ( $\mu\text{m}$ ) 152 : 32 : 10 : 15 : 8.

Mandible (Fig. f, above) with 3<sup>rd</sup> inner tooth partially to fully separated, but only partly colored (type II-IIIB); 13 furrows on outer surface near the base; and 13 taeniae in the PMA.

This larva has a number of deformities, such as a very aberrant antenna (Fig. c, above) and irregular furrows on the mandible (Fig. g, above).

**Cytology:** 4 polytene chromosomes. Cytology of only known specimen not clear – but only 1 nucleolus, essentially terminal on arm G.

**Found:** Greenland - Nedre Midsommer Sö, Peary Land, sample GP8 (82.63°N, 32.50°W).

**Species 5j** from BOLD Database

The current identity of this species is unknown – it may be one of the previously named Arctic species, of which there are a few possibilities.

In BOLD Bin: [BOLD:ADA8845](#)

The species in this Bin are identified as *C. nr. longistylus*, *C. riihimakiensis* and *C. sp. 8TE* (This last species is actually in Bin [BOLD:AAC0595](#))

These identifications suggest this is a member of the *C. riihimakiensis*-group, if not actually *C. riihimakiensis*.

#### Adult:

Some information on the adult male can be obtained from a photograph from the BOLD Database:

Male: The male of this species is very similar to that of *C. sp. 5j* (8TE), and the Norwegian specimen had been identified as that species.

Color dark brown, some pale brown on lateral thorax; haltere pale, abdomen also with a thin pale stripe at the posterior margin of segments II-VII, but base color not as dark; legs apparently pale, but with distinctly darkened knees, and tarsi becoming darker.



Adult male of *C. sp. 5j* from Norway (BOLD Database)

AR about 3.

Wing length about 4.3 mm

Palps dark, approximate segment lengths (segs 2-5) (micron): 120 : 325 : 265 : 430.

Few leg measurements able to be made, but Hind LR abt 0.6 and F/T abt 0.88.

**Pupa and Fourth instar larva:** Unknown.

**Cytology:** Unknown.

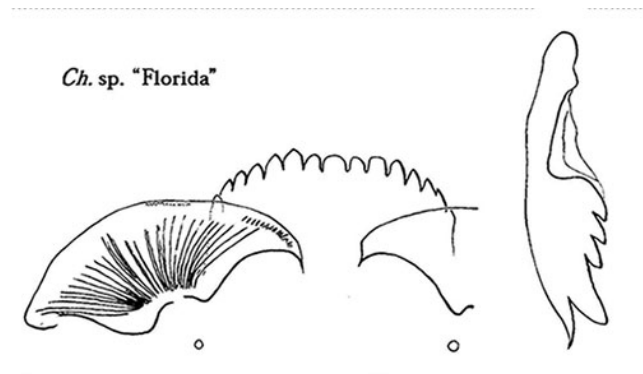
**Molecular sequence:**

*mtCOI*: There is sequence in the BOLD Database.

**Found:** Yukon Territory - Lake Laberge (60.958°N, 135.184°W). (BOLD).

***Chironomus* species Florida of Epler (2001) (Species 4w)**

Only a larva is described for this species. It is characterised by a premandible with 5 teeth. The other life stages are now known but have not yet been described.



From Epler 2001

**Fourth instar larva:** a plumosus- or semireductus-type, TLt as long as the segment width (Bolton 2012).

Mentum with simple central tooth and 14 lateral teeth, although it seems likely that this can be interpreted that the c2 teeth are relatively large and quite separate from the c1 tooth, and the first laterals are hardly higher than the other teeth.

However, other species with a similar premandible have also been described, including *C. phytophilus* Correia & Trivinho and *C. oliveiri* Correia & Trivinho from Brazil (although they are thummi-type larvae and their mentum is different).

Inhabits burrows in *Nuphar* made by the aquatic moth *Bellura* (Pyrilidae). In NE Ohio reported from a wetland stream and a natural lake (Bolton 2012). Also will populate bird baths.

**Cytology:** Unknown.

Epler notes that a species in which the larva (only known stage) has a similar premandible was described from Amazonia by Reiss (1974), however it is likely that this is *C. phytophilus* Correia & Trivinho (2007), which is certainly not this species, as it has a thummi-type larva and a normal central trifid tooth on the mentum.

**Found:** Florida- peninsular Florida.

Ohio - NE Ohio.

Puerto Rico

***Chironomus* species 5x of Hudson & Namayandeh**

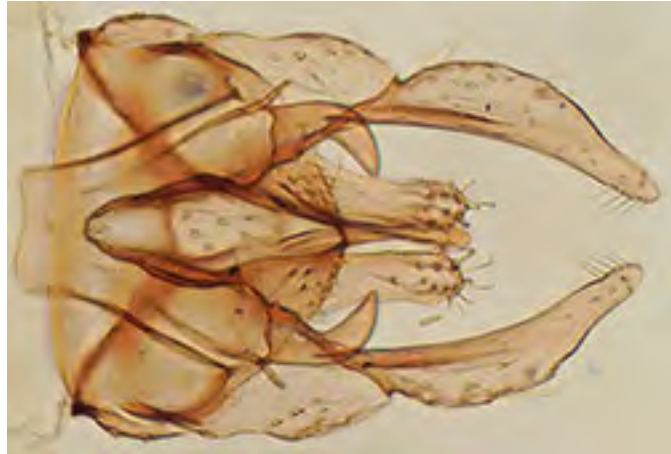
An adult male collected by P.L. Hudson and A. Namayandeh does not easily fit any currently known species, so it is tentatively entered as a new species:

**Adult:**

Male - A dark species; head and thorax dark brown, abdomen slightly lighter but uniformly colored. Total length 5.3 mm. Wing length 3.56 mm, width 0.77 mm. with about 8 setae in squamal fringe.

Fore LR 1.43.

About 8 setae in individual pale spots on TIX.



Hypopygium of male (from Hudson & Namayandeh)

SVo closest to D(e) type of Strenzke (1959), reaching only about halfway along the length of the IVo which has simple setae, but restricted to the distal end; gonostylus moderately swollen, reducing over posterior third and with 5 setae at the tip. Anal point about the same length as the IVo and could be narrowed at the base.

**Pupa, Fourth instar larva and Cytology:** Unknown.

**Found:** Alaska– Juneau Peterson Creek at Salt Chuck.

**Other names in the literature:**

*C. n. sp. A* of Hilsenhoff & Narf (1968) - not identified.

*C. n. sp. B* of Hilsenhoff & Narf (1968) - probably *C. cucini*.

*C. n. sp. C* of Hilsenhoff & Narf (1968) - (see *C. nr. anthracinus*).

*C. n. sp. D* of Hilsenhoff & Narf (1968) (see *C. nr. annularius*).

*C. species Coyote Creek* of Wülker *et al.* (see *C. calligraphus*)

*C. sp. 51 sensu Bay & Anderson et al.* (see *C. anonymus*)

*C. sp. 51 sensu Nordland et al.* (see *C. calligraphus*)

*C. sp. 52 sensu Wülker & Morath* (see *C. calligraphus*)

*Species Ea* of Butler & Kiknadze (see *C. atrella*)

BOLD species cf. saxatilis (see [C. sp. 1TE](#))

### Subgenus *Lobochironomus*

Five species are reported from North America, but only *C. dorsalis* and *C. mendax* are known cytologically

#### *Chironomus (Lobochironomus) austini* (Beck & Beck, 1970) (Species 4h)

*Einfeldia austini* Beck & Beck, 1970. transferred to *Chironomus (Lobochironomus)* by Epler (2001, p. 1.3)

Description based on Beck & Beck 1970.

Adult:

Male:

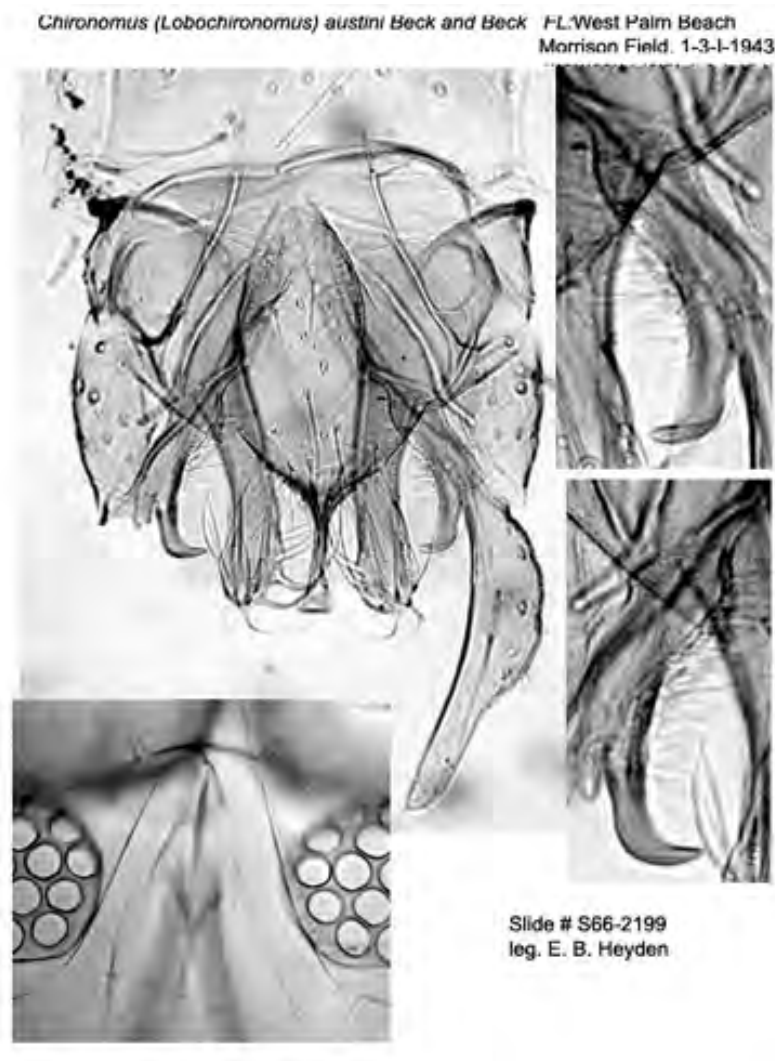


Figure courtesy of J. E. Sublette

A brownish, ochraceous species. Frontal tubercles twice as long as basal width. Thorax light brown, mesonotal vittae, scutellum and sternum medium brown to ochraceous, postnotum almost black.

Thoracic setae: dorsocentral – about 10; prealar – 3; scutellar 48 (36-62).

AR – 2.76, wing length 1.95 mm.

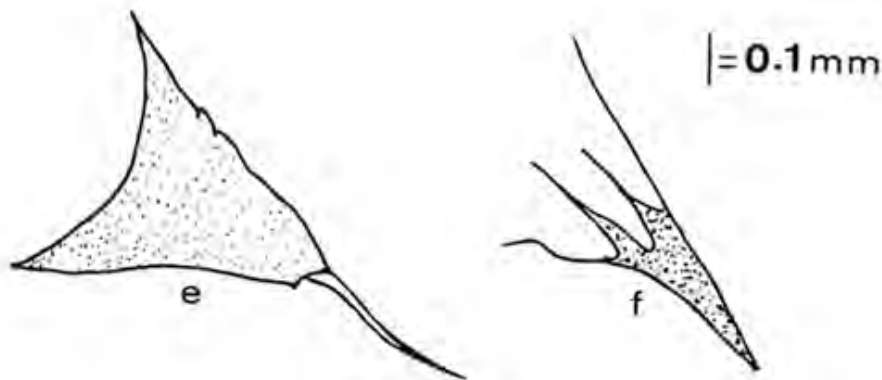
Legs – darker at apices of tibiae and of tarsal segments brown. Fore tarsus apparently without beard, fore LR 1.9- 2.0.

Setae on TIX in several pale areas (appear diamond shaped in above photograph).

Hypopygium as in figure. SVo closest to an E-type, but not really as any of Strenzke's (1959) illustrations. Anal point narrow but broadens at distal end. Ivo reaching to end of anal point and midpoint of gonostylus, with setae only at tip.

Gonostylus moderately swollen and narrows markedly from just after midpoint.

**Pupa:** About 5.7 mm long, brown in color. Cephalic tubercles (e, below) fairly large (about 0.8 times longer than width at base), with preapical bristle. Tergite I bare, II with median longitudinal band of shagreen and posterior row of approximately 60 hooks. Tergites III-V with broad median longitudinal shagreen band; VI with antero-lateral patches of shagreen, and VIII with an area of fine shagreen on either side of midline; lateral filaments on V-VIII: 4-4-4-4; caudolateral spur of segment VIII with a single spine ((f, below). Anal fins with 44 lateral filaments, plus a small filament near outer margin, about half way from base of fin.

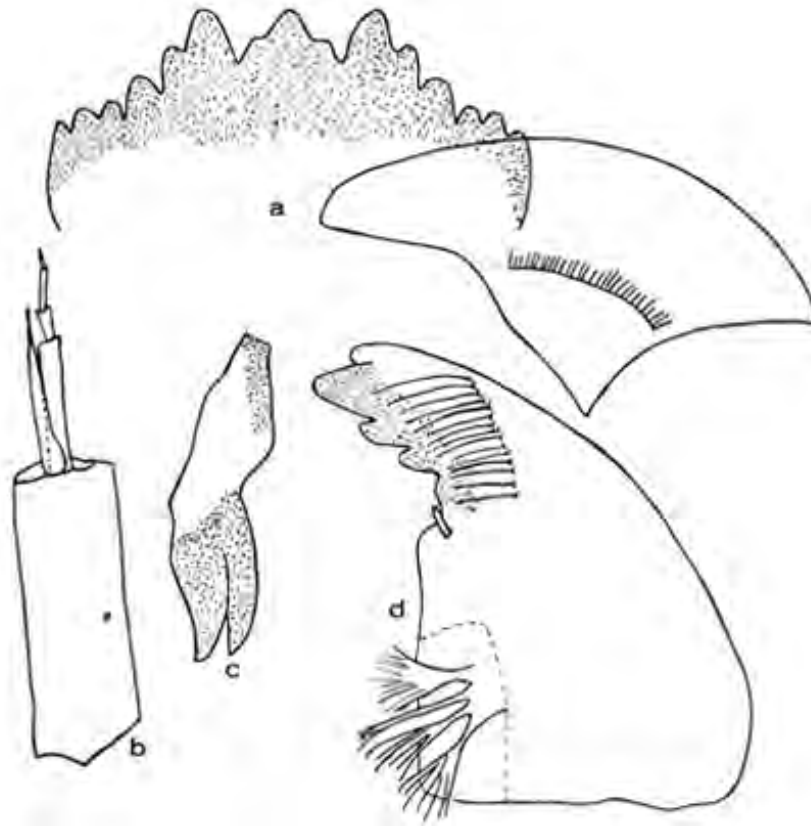


Pupal cephalic tubercle and caudolateral spur of segment VIII (from Beck & Beck 1970)

**Fourth instar larva** with pale head capsule. 2nd laterals of mentum less separated from 1st laterals than in *C. longipes*, 4th lateral teeth reduced about to level of 5th lateral (type II). Pecten epipharyngis with some thinner teeth interspersed between normal teeth. Premandible with two broad lobes, about equal in length and coming to broad points, but inner tooth perhaps twice as wide as the outer.

Antenna with basal segment about three times longer than wide, Ring organ about half way up the segment; AR about 1.2; ratio of antennal segments 50 : 24 : 6 : 8 : 3.

Mandible with 3rd inner tooth not separated, but possibly darkened to some extent (ty. IB); furrows on outer surface at base not mentioned; Pma illustrated with 15 taeniae.



Larval mouthparts of *C. (Lobochironomus) austini*

a. Mentum and ventromentum, b. Antenna, c. Premandible, d. Mandible. (From Beck & Beck, 1970)

**Cytology:** Not known.

**Found:** Florida - Duval Co. (Type)

North Carolina - Juniper Swamp, Onslow Co (Epler 2001)

South Carolina - (Epler 2001)

A very similar species, *C. antonioi*, has been described from Brazil (Correia & Trivinho-Strixino 2007).

Streams associated with swamps, possibly acidic.

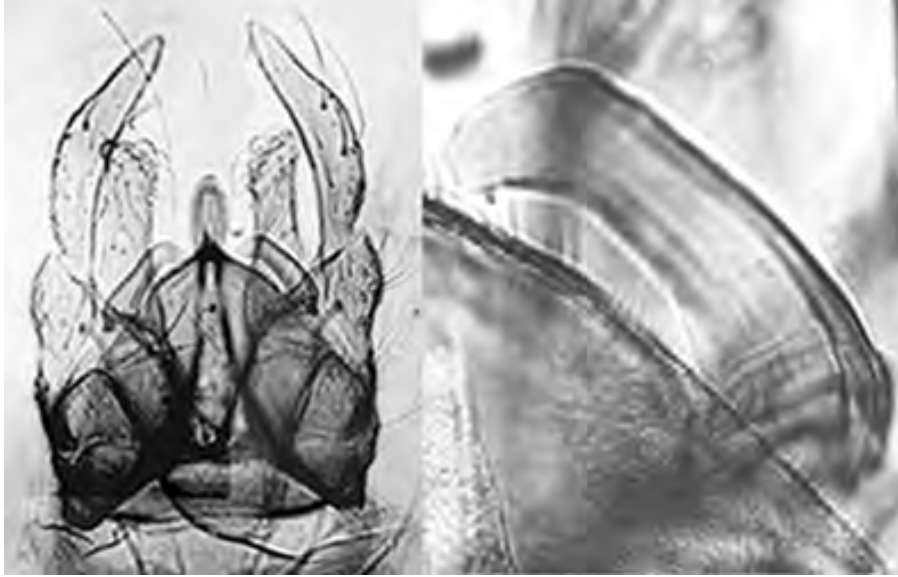
All life stages briefly described by Beck & Beck (1970) and some larval characters in Epler (2001).

***C. (Lobochironomus) ?nr. austini*** (Species 2e)

**Adult:**

The adults and rearings of this species are in the collection of James E. Sublette, now in the Museum of the University of Minnesota, St. Paul, MN.

Only photographs of the male terminalia and the SVo are available for study. These suggest that the color may be similar to that of *C. austini*, or perhaps darker.



Male hypopygium (left) and superior volsella (right) of *C (Lobochironomus) ?nr. austini*

It appears there are setae in individual clear spots on TIX. The anal point is narrowed at the base and comes to a point at the distal end. The IVo reaches beyond the end of the anal point to about the middle of the gonostyle which is only moderately swollen and narrows relatively gently over the distal third. The setae of the IVo are probably simple.

**Pupa:**

This specimen is in the Sublette collection as it is associated with reared M1. The caudolateral spurs on segment VIII have one major spine and one or two smaller ones flanking it.



Caudolateral spur of *C (Lobochironomus) ?nr. austini*

**Fourth instar larva** a small thummi-type (length, fem. 12.2 (10.1-13.5) mm; male abt 9.4 mm); posterior pair of VT usually longer (ant 0.85 (0.69-1.02) mm; post. 0.94 (0.73-1.19) mm). AT about 4 times longer than wide, ventral pair thicker. Gula and FC pale. Mentum (Fig. d, below) with somewhat rounded teeth; c1 tooth relatively narrow and rounded, c2 teeth well separated and quite tall (type IV), 4th laterals sometimes slightly reduced (type I-ii).



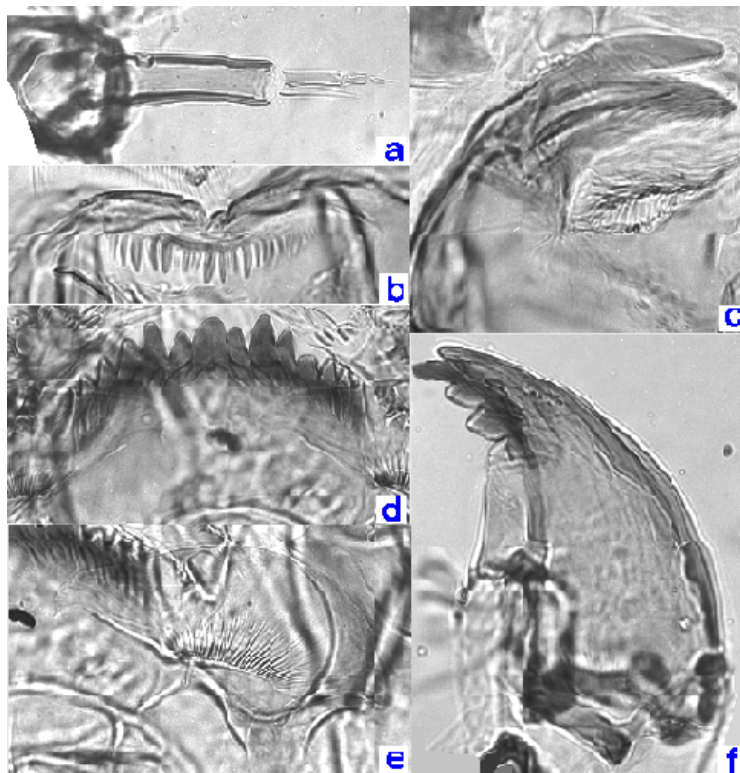
VM (Fig. e, below) about 196.3 (186.5-207)  $\mu\text{m}$  wide and 3.17 (2.96-3.42)  $\mu\text{m}$  deep, and 1.13 (1.07-1.18) times the mentum width; with about 39-41 striae; VMR 0.21 (0.20-0.22). PE (Fig. b, below) with about 19 (17-23) teeth, including many small teeth.

Premandible (Fig. c, below) with equally long broad teeth, inner tooth about 2.9 (2.7-3.35) times wider than the outer tooth (Ty. E).

Antenna (Fig. a, below) with basal segment about 3.8 (3.3-4.3) times wider than long, RO about 40 (30-45)% of way up from base; AR about 1.84 (1.67-1.90); 3<sup>rd</sup> segment longer than 4<sup>th</sup> or 5<sup>th</sup> segment; segment proportions (microns): 126 : 33.5 : 13.5 : 12 : 8.

Distance between antennal bases (125-172  $\mu\text{m}$ ) greater than that between S4 setae (117-143), which are separated by about 0.72 (0.69-0.76) of the width of the FC at that point.

Mandible (Fig. f, below) with third inner tooth poorly to moderately separated and with some coloration (type I-IIA-B); about 18.7 (18-20) furrows on outer surface at base and 13.75 (13-14) taeniae in PMA; Mdt-Mat about 25.5 (23-28); MTR about 0.33 (0.29-0.37).



Larval mouthparts of *C. (Lobochironomus) ?nr. austini*

**Cytology:** 4 polytene chromosomes with the thummi arm combination AB, CD, EF, G. Keyl pattern difficult to distinguish because of lack of pairing in many areas. Arm G unpaired with a subterminal nucleolus and a BR near the other end. No nucleoli in the long chromosomes. Polymorphism in arms B and F.

Arm A1:

Arm B1: No obvious puff/BR.

Arm B2: Small inversion of distal third of arm.

Arm C1: Band groups 2-4 not readily obvious

Arm D1:

Arm E1:

Arm F1:

Arm F2: differs from F1 by simple inversion about one third from distal end

Arm F3: differs from F1 by a complex inversion of distal third of arm



Polytene chromosome complement of *C. species 2e*.

**Found:** Ontario - 2 ml e. Morven (44.24°N, 76.84°W).

Pool with thick leaves and some algal growth.

The larval characters of this species correspond relatively well with Epler's (2001) description of *C. (Lobo.) austini*, but the adult has a much more robust SVo and the pupal spur has multiple spines.

***Chironomus (Lobochironomus) dorsalis* Meigen, 1818** (Species 4g)

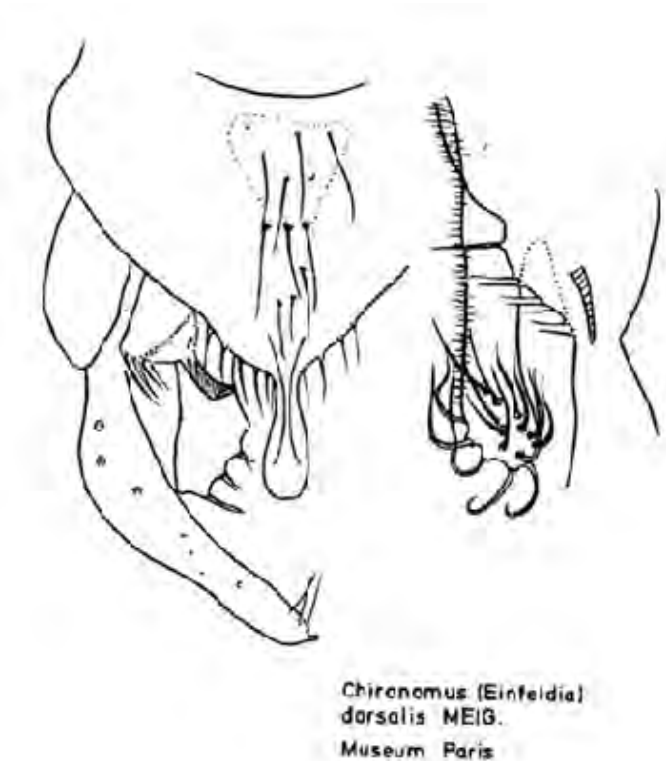
Syn: *Chironomus longipes* Staeger, 1839.

In BOLD Bin: [BOLD:AAW4008](https://www.boldsystems.org/index.php/AWW4008)

The name *Chironomus dorsalis* was misapplied to a *Chironomus* (s.s.) species by Edwards (1929). Townes (1945) indicated that the terminalia of the Meigen specimen was consistent with the present species rather than a *Chironomus* (s.s.) and placed it as *Tendipes (Einfeldia)*. After further re-examination of the type specimen (see below), *C. dorsalis* Meigen was placed in *Einfeldia*, but later recognized as a member of the new subgenus *Lobochironomus* of *Chironomus* by Ryser, Wülker and Scholl (1985). Epler (2001) did not accept the synonymy of *C. dorsalis* and *C. longipes*, considering that *C. dorsalis* was *Einfeldia*, but *C. longipes* was *Lobochironomus*. However Spies and Sæther (2004) confirmed this synonymy.

Egan & Ferrington (2015) incorrectly attribute this species to Strenzke, but the species described by Strenzke (1959) is not a *Lobochironomus* species and is now considered to be a synonym of *C. alpestris*, and found only in the Palearctic.

Further, use of the name “*dorsalis*” is most confused as it has been used in at least six different ways and it is not always clear in the literature to which species it is applied. It has included the amazing suggestion that the name *C. dorsalis* should be restricted to *C. dorsalis sensu* Edwards because there was no valid name for that species, and that the Meigen species should be called by the junior synonym *C. longipes*.



Male terminalia of the type specimen of *C. (Lobochironomus) dorsalis* Meigen. Drawn from the type specimen in the Paris Museum. (drawing courtesy of W.F. Wülker).

Adults of North American specimens were described by Townes (1945) as *Tendipes (Einfeldia) dorsalis*:

Male: Wing length 2.96 (2.68-3.20) mm; LR 1.69; AR 3.0, frontal tubercles minute 23-35µm x 66-20 µm (l/w 1.8-3.6), fore tarsus without beard.

Pale green, with thoracic markings, etc., ochraceous; apical segments of tarsi brown; abdominal tergites each with a central brown mark over most of the length of the segment, apical tergites entirely brown

Approximate measurements(micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1120	880	1490	835	710	685	240	1.65-1.72	1.21-1.35	low
PII	1135	1030	675	365	265	160	115	0.64-0.67	1.08-1.12	
PIII	1280	1300	920	565	350	225	150	0.70-0.72	0.96-1.00	

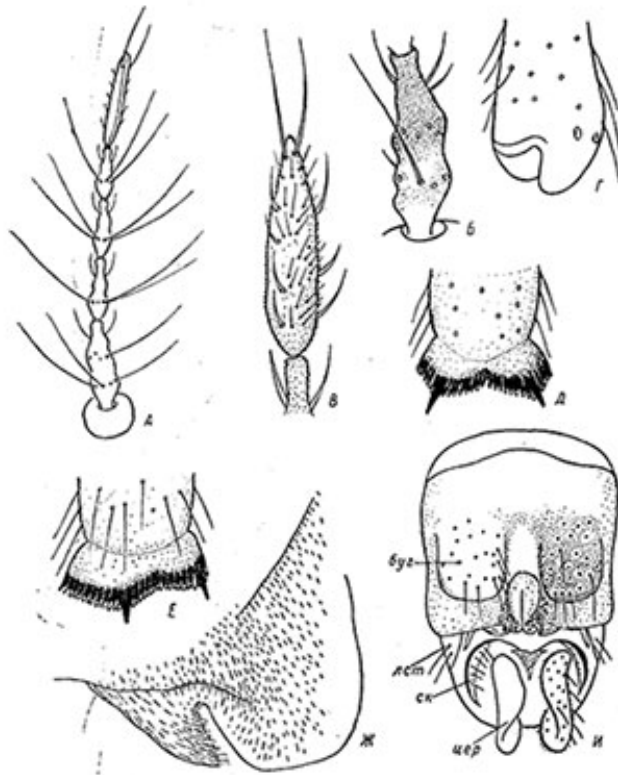
About 9-19 setae in a single triangular area on tergite IX. SVo not any of Strenzke (1959) types, but on a triangular base with the chitinised apical part with a sharply bent end. IVo with simple setae, and reaching beyond the end of the anal point to about 1/3 of the moderately swollen gonostyle, which narrows over the posterior half with 3+1 to 4+1 setae at tip. Anal point narrow at base.

Female: Similar to male except for the usual sexual differences.

Only description found is that of Rodova (1978) although it is not clear which form she is describing (She mentions *Einfeldia* but does not identify to which species this refers).

Length 6-7 mm, wing length about 5 mm.

Antennal ratios (units) 17 (neck 0.3) : 11 : 11 : 9 : 18; AR about 0.38; A5/A1 about 1.06.



From Rodova 1978.

Tergite X long and narrow like a crescent moon. Cercus appears to have a curved ventral margin with a basal bulge, posterior margin curved.

**Pupa:** (partly from Langton & Visser (2003): Length 5.61 (5.0-6.2) mm.; inner margin of wing case 1.38 (1.32-1.42) mm.

Cephalic tubercles 63 (56-75) x 61.2 (55-76)  $\mu\text{m}$  (i.e. height of tubule about the same as the diameter of the base), frontal setae 43  $\mu\text{m}$ .

Basal ring of thoracic horn 95.8 (78-109) x 45.5 (33-56)  $\mu\text{m}$ ., slightly kidney shaped; HR 2.15 (1.86-2.43). Thoracic granulation well-developed anteriorly and along suture, evanescent elsewhere.

Abdomen: Hook row of segment 2 complete, 67.4 (50-81) hooks in row 0.45-0.65 of the width of the segment. Pedes spurii B obvious on segment II; PsA on segment IV large, 118.5 (107.5-127)  $\mu\text{m}$  long, about 76 (63-89)  $\mu\text{m}$  wide and about 0.18-0.22 of segment length.

Abdomen colorless with sooty markings. The point patches are strong points, increasing in size posteriorly, and increase in extent from tergite II to V, but is reduced on VI. Spur of

Segment VIII with 1 stout tooth or with a small accessory tooth (Langton & Visser state this only occurs occasionally in the Palearctic specimens). Anal lobe with a fringe of 57.7 (43-71) taeniae, mostly in a single row but becoming double at posterior end.

**Fourth instar larva:** (2 larvae) a medium (female about 7.2 mm) melanotus-type (with small TLt to about 160  $\mu$ m) and well developed VT, anterior pair shorter (ant. 1.2 mm; post 1.36 mm). Gula and FC not darkened. Salivary reservoir not seen. AT about 250  $\mu$ m, 3 times longer than wide.

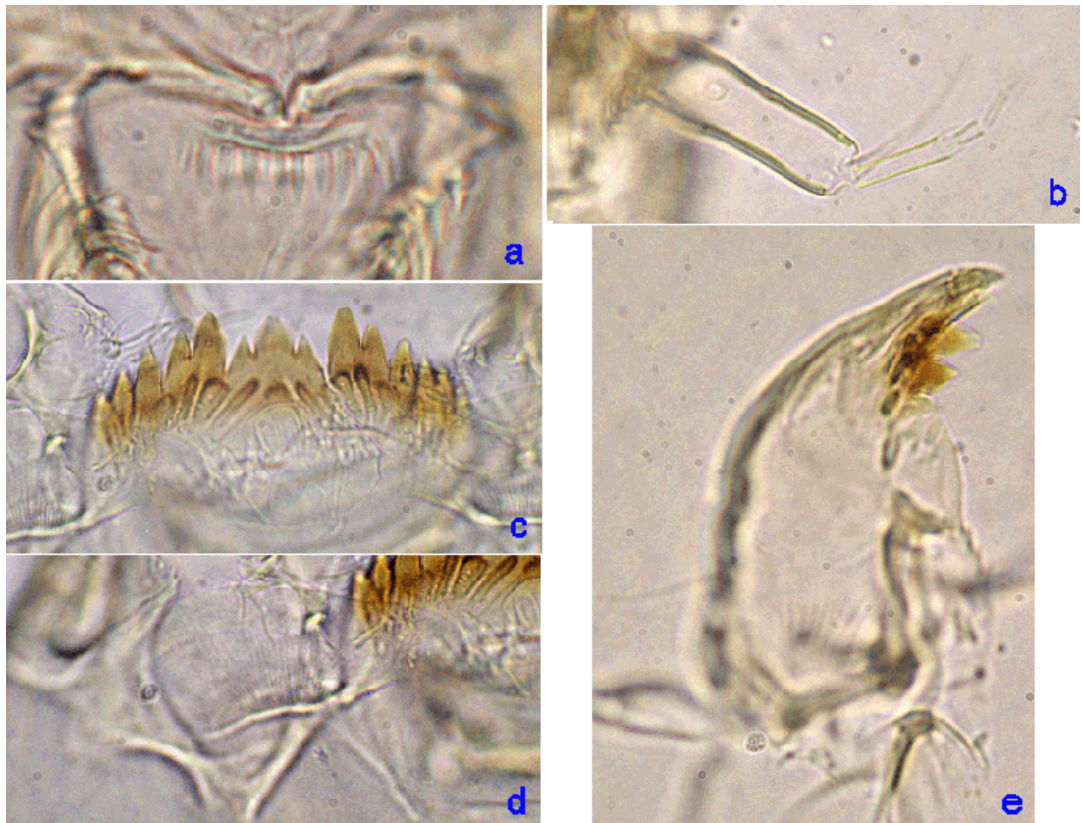
Mentum (c, below) with 4th lateral slightly reduced (type I-II), c1 relatively narrow and tall, with c2 teeth relatively well separated (type III).

Ventromental plates (d, below) about 3.7 times wider than deep, 0.90-0.93 of mentum width ; separated by about 37-46% of mentum width; with about 42-47 closely spaced striae reaching about half way to smooth anterior margin, VMR 0.21.

PE (a, below) with about 20-21 teeth (14 normal teeth, the others thinner teeth interspersed between the normal teeth). Premandible teeth broad and sharp, inner tooth 3.3-4 times wider than outer tooth.

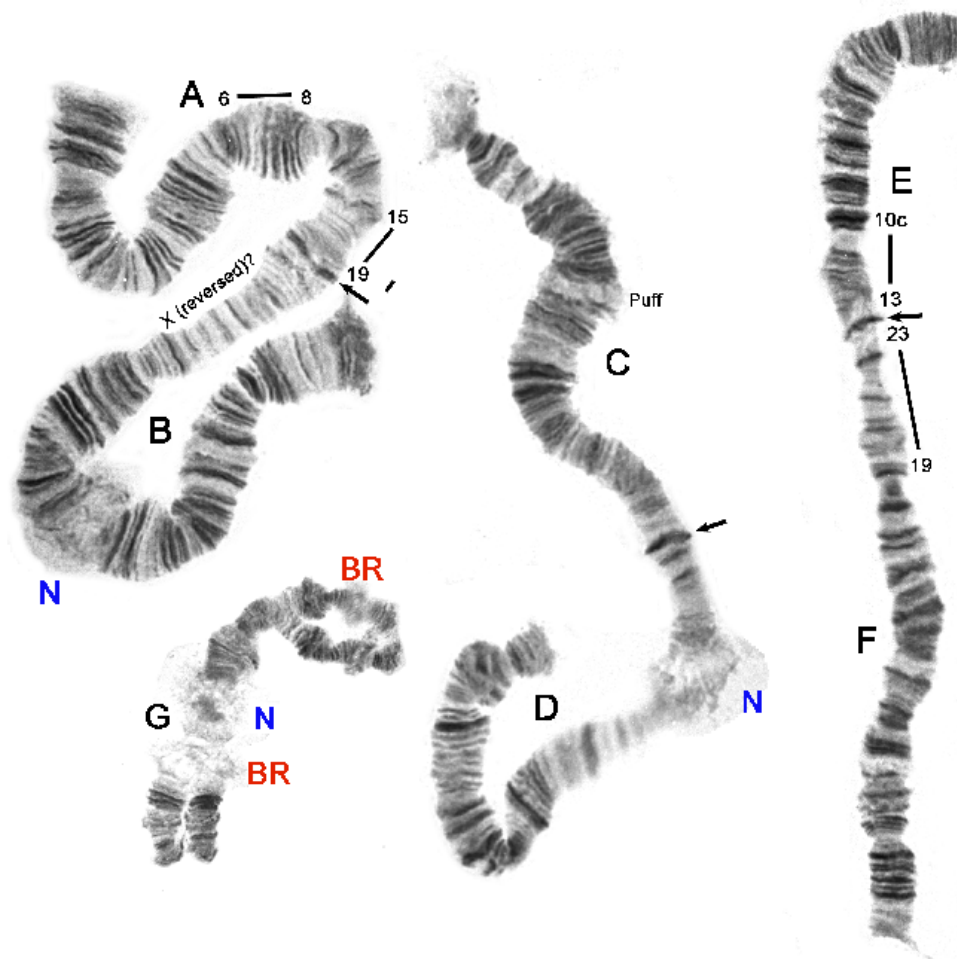
Antenna (Fig. b, below) with basal segment 3.62 times longer than wide and 0.35-0.39 of VHL; A2 quite long compared to A1 (A2 about 0.37-0.40 length of A1); AR about 1.35-1.43; ratio of segments (micron) 81.5 : 32 : 8 : 12.5: 6.

Mandible (e, below) with third inner tooth partly separated and slightly darkened (type IIB), and with 12.3 (12-15) furrows on outer surface at base; 11-12 taeniae in PecM; Mdt-Mat 0.32-0.41; MTR 0.32-0.40.



**Cytology:** 4 polytene chromosomes with the thummi-cytocomplex combination AB, CD, EF, G. Arm G with a medial nucleolus, a large BR just proximal to it and another BR near other end of chromosome. Other nucleoli on arms B and D.

- dlsA1: Only a few bands of the Keyl system can be recognized, such as 15-19 proximally.
- dlsB1: Nucleolus (could be the BR found in other *Lobochironomus* species) near middle of the arm, typical bands 24-28 slightly removed from the centromere (region "X" of Ryser *et al.* (1985) reversed?).
- dlsC1: Large puff about one third from distal end.
- dlsD1: Nucleolus near the centromere.
- dlsE1: possibly 1 - 3c, 9 - 10a, 8i-a, 3ed, 10b, 5 - 7, 4 - 3f, 10c - 13.
- dlsF1: Bands 8-9 about one third from centromere.
- dlsG1 Subterminal nucleolus with proximal BR and another distal BR.



- Found:** Ontario – (Oliver & Dillon 1990)  
 Arkansas – White River National Wildlife Refuge (Chordas *et al.* 2004) (as *C. longipes*).  
 Florida – (Townes 1945)  
 Idaho - Coeur d'Alene Lake (Townes 1945)  
 Iowa - Davenport (Townes 1945)  
 Massachusetts - Worcester (Townes 1945)  
 Missouri - Atherton and St. Louis (Townes 1945)  
 New Jersey - Atsion, Medford Lakes, Moorestown and Westville (Townes 1945)  
 New York - Buffalo, Canadarago Lake, Canajoharie, Hudson, Ithaca, Niskayuna, Oneonta, Otsego Lake, and Ringwood, Tompkins Co. (Townes 1945)  
 North Carolina - Raleigh, Wake Co. (35.77°N, 78.63°W) (Townes 1945)

Ohio - Summit Co. (Townes 1945)

Rhode Island - Westerly (Townes 1945)

South Carolina - (Epler 2001)

Wisconsin – Arboretum, Madison, Dane Co. (43.03, -89.42).

Also occurs in Europe (?France (**Type locality**); Denmark (type locality of *C. longipes* Staeger)

**DNA sequence:** *COI* sequence in GenBank, Accession number DQ648200.

*Cytb* sequence in GenBank, Accession number DQ648243.

*18S rDNA* sequence in GenBank, Accession number DQ657926

The larva of *C. dorsalis* from the Palearctic has been described by Vallenduuk and Langton (2010), who noted some differences between their German material and the more eastern samples of Shilova (1980). The antenna of our North American specimens has some characters similar to those of Shilova's (seg. 3 shorter than seg. 4), and others (AR) similar to the German specimens.

Some larvae from Why Not Bog Lake in Wisconsin are similar to those of this species, but have very long TLt, rather than the short ones found in the Madison egg mass larvae (see sp. 4v).

***Chironomus (Lobochironomus) montuosus* Ryser, Wülker and Scholl, 1985, (Species 5f)**

Egan and Ferrington (2015) reported *C. (Lobochironomus) montuosus* from Yosemite National Park on the basis of pupal exuviae, but the correct locality is coastal rock pools in Isle Royale National Park, Michigan, which may mimic the alpine conditions from which it is reported in Europe.

There is currently no independent confirmation for the existence of *C. montuosus* in the Nearctic. If confirmed, this species is of Holarctic distribution.

**Adults:** No adults are known from the Nearctic.

Male: Based on Palearctic material, the ground color is dark, with the thoracic segments uniform deep black and the abdominal segments dark brown, the rear edge of segment VII brightly colored. The femur and tibia are dark brown, clearly darker than the tarsal segments. Wing with crossvein darkened.

About 13 setae in a clear patch on tergite IX. Svo with a hooked end; Ivo a little stretched and slightly bent. Gonostylus reduces to be very narrow over posterior third.

The female is also very dark, with the genitalia very similar to those of the subgenus *Chironomus*.

**Pupa:** (from 2 exuviae collected by Alex Egan – data and photos used with his permission).

These pupae fit the Langton description.

Length abt. 8 mm. General brown color except for intersegments and anterior anal lobe, marbling of tergite armament laterally, dense small granulation on thorax, small lateral seta at conjunctive IV/V; rims of tergites II-VI rather heavily pigmented; PsB conspicuous.

Cephalic tubercles about 1.3 times longer than wide; no secondary tubercle or frontal warts.

Hook row medially broken, 32-33 hooks with a 25µm gap. Postero-lateral spur of segment VIII with 2 dark teeth.

About 80 taeniae on the anal lobe.



a. Cephalic tubercles; b. hook row with medial break; c. lateral tergite coloration; d. pupal spur.

**Fourth instar larva:** Not known from North America.

Based on Palearctic material, the larva should be a plumosus-type with relatively short TLt (<150  $\mu\text{m}$ ). Head capsule pale.

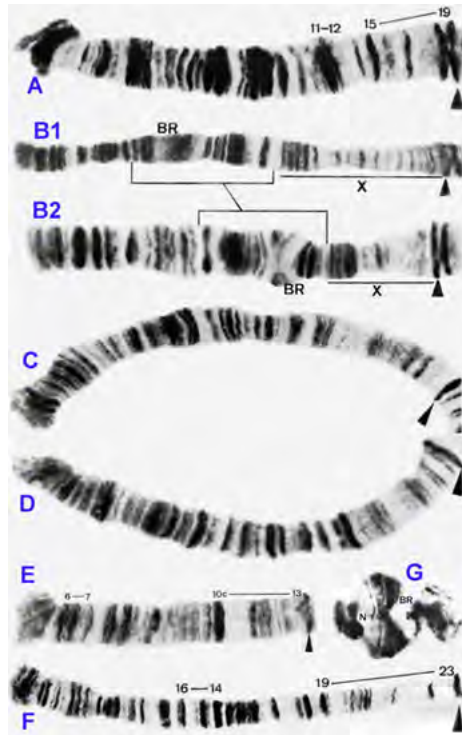
16-25 teeth in the PE. Antennal segment 1 about 104  $\mu\text{m}$  and segment 2 about 34  $\mu\text{m}$ ., i.e. A2/A1 about 0.33.

**Cytology:** 4 polytene chromosomes with the thummi-cytocomplex arm combination AB, CD, EF, G. Nucleolus subterminal in the very short arm G; a BR just near the middle of the arm – further from the end than in the other described *Lobochironomus* species.

Only a few bands can be identified on the Keyl-system. A large puff, or a BR according to Ryser *et al*, perhaps group 7, is just distal of the middle of arm B1, with a group of dark bands (perhaps group 8) distally.

The only recorded polymorphism in the Palearctic material is a simple inversion of about the central third of arm B, with one break just distal to the puff, moving it much closer to the centromere, now with two groups of dark bands immediately proximal to it in sequence B2 (below).





(modified from Ryser *et al.*, 1985)

**Found:** Michigan - Isle Royale National Park (abt. 48.10°N, 88.50°W).

### *Chironomus (Lobochironomus) pseudomendax*(?) (Species 4i)

This North American material was initially identified as *C. mendax* by W. Wülker in Ryser *et al.* (1985). However, the Palearctic material was subsequently shown not to be *C. mendax* Storå, and given the new name “*pseudomendax*”; by Wülker (1998), on the basis of a difference in chromosome number. Although not specifically stated, the larval mentum of the North American material was apparently similar to that of *C. pseudomendax*, not like that of *C. mendax*. Since the cytology of the North American material is not known, it is not certain as to which species it really belongs.

#### Adult:

##### Male

Lighter in color than *C. montuosus*, with a yellow mesonotum, The superior volsella is rather similar to that of *Einfeldia* species, but the narrower curved lobe arises from the dorsal surface near its base, whereas in *Einfeldia* it arises apically or subapically from the ventral lobe (Grodhaus and Ferrington (1989).

**Pupa:** Not described but there may be some specimens in the collection of the Kansas Biological Survey (Grodhaus and Ferrington, 1989) and that of Palearctic specimens is given in Langton and Visser (2003). The hook row of tergite II is interrupted and the spur of segment VIII has 1 or 2 spines.

**Fourth instar larva:** Apparently similar to that of European *C. pseudomendax*, i.e. a plumosus-type larva with unpigmented head capsule. TLt longer than 150 µm. c2 teeth of

central trifold tooth of mentum relatively well separated (perhaps type III), as are the 2nd laterals. Antennal segments ( $\mu\text{m}$ ) A1 109-136 : A2 31-44; RO a quarter to a third up from base of segment A1.

**Cytology:** Not known for North American material. If it is *C. pseudomendax* it will have 4 polytene chromosomes with the thummi-cytocomplex combination AB, CD, EF, G, as in Ryser *et al.* (1985), but if nearer *C. mendax*, it will only have 3 chromosomes (AB, CD, GEF). Palearctic *C. mendax* is more polymorphic than *C. pseudomendax*.

Arm A: Groups 15-19 can be recognized near the centromere.

Arm B: Groups near the centromere as in *C. montuosus*, etc. Medial inversion in *C. mendax*.

Arm C: Polymorphic in Palearctic populations of both *C. mendax* and *C. pseudomendax*, but nearer the distal end in *C. pseudomendax*.

Arm D: Polymorphic for a simple inversion of distal region in *C. mendax*.

Arm E1 of *C. mendax* is identical to that of *C. montuosus* and differs from *C. pseudomendax* by an inversion that includes band group 9. E2 of *C. mendax* is an inversion of about the middle third of the arm

Arm F should have a puff (called a BR by Wülker) about a third to half way from centromere.

Arm G will be short with a large nucleolus near the presumed centromeric end (end attached to arm E if only three chromosomes) and a large BR near the other end.

**Found:** California- Dana Meadows (37.89°N, 119.26°W), Yosemite National Park Tuolumne Co. (Grodhaus & Ferrington 1989); Yosemite National Park (Ryser *et al.* 1985).

The larva is given by Ryser *et al.* (1985). Grodhaus and Ferrington (1989) give notes on the adult of North American specimens.

***Chironomus (Lobochironomus) storai*, Goetghebuer, (1937-54) (Species 5a)**

*Tendipes storai* – Goetghebuer (1937-54)

*Einfeldia storai* – Ashe & Cranston (1990)

This is BOLD Bin: [BOLD:ADD2757](#)

This species has been reported from California by Deiner *et al.* (2013), with the note that the identification was confirmed from the mtCOI sequence by comparison to two specimens from northern Finland and Sweden in the BOLD database from the Norwegian University of Science and Technology.

This means that *C. storai* is Holarctic in distribution at either high latitude or high elevations. No morphological information is available for the Californian specimens, so descriptions and cytology must be based on Palearctic material.

**Adult:**

Male: AR 3.46-4.21, LR 1.44-1.64, BR 2.77-5.27.

Wing length 3.30-3.92 mm.

Thoracic setae – acrostichal 9-20; dorsocentral 21-36; prealar 6-9; supraalar 1-2; scutellar 39-64.

Abdomen - setae near middle of tergite IX - 2-17. SVo bent almost at right angles.

**Pupa:** Caudolateral spur of segment VIII often with only one spine.

**Fourth instar larva:** A plumosus-type larva, TLt about 150 µm (abt. half segment length). Head capsule pale.

Mentum appears to be of type 1A-B, with the c2 teeth little more than notches on the C1 tooth, 4<sup>th</sup> laterals not figured.

**Cytology:** Four polytene chromosomes with the thummi cytochrome arm combination AB, CD, EF, G. Centromeres obvious and heterochromatic on some chromosomes (CD and EF?). Polymorphism of arm A found in one Swedish population.

Alpine lakes (littoral).

**Molecular sequence:**

mtCOI: Sequence for specimens from Finland and Sweden is on BOLD, while the California sequence is in GenBank (accession number KF000109)

**Found:** California – Sequoia National Park, Sierra Nevada (Deiner *et al.* 2013)

Finland: Kuusamo kyrkoby; Isosuo (Type locality)

***Chironomus (Lobochironomus) sp. 4v*** (Species 4v)

**Adult:** Not known.

**Pupa:** Not known.

**Fourth instar larva:** A small plumosus- or melanotus-type larva, about 8.7 (male)-10.2 (female) mm. VT relatively long, posterior pair may be longer (ant. 1.03-1.67 mm; post 1.09-1.1+ mm), TLt long (400-720 µm). Anal tubules relatively short (about 200 µm) but essentially rounded (width 80 µm) so 2.5 times longer than wide.

Head capsule darkened only around the posterior margin. Salivary reservoir (Fig. a, below) relatively short (50-55 µm) but deeper (12.5-20 µm) so length/width 2.5-4.4.

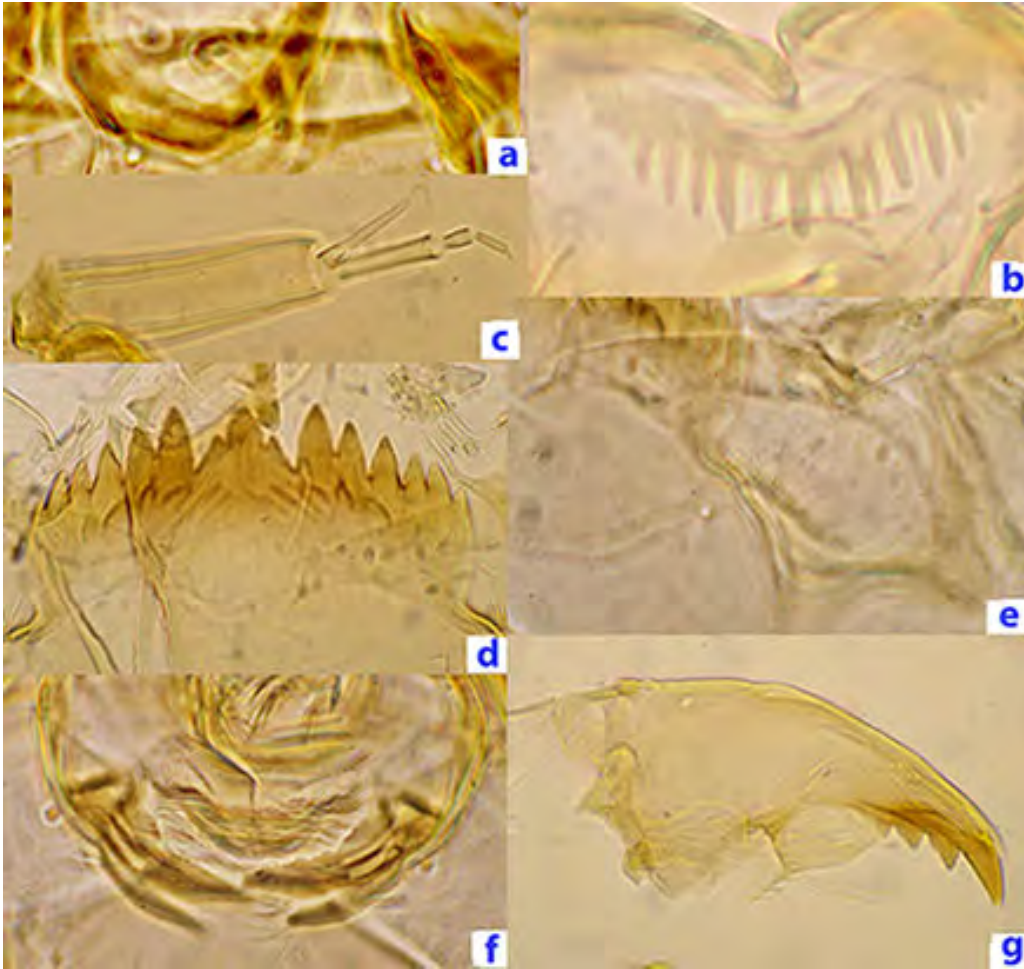
Mentum (Fig. d, below) about 144-157 µm wide, with 4<sup>th</sup> laterals barely reduced (type I), central tooth relatively tall with c2 teeth partly distinct (type III or could be type IB). First and second laterals well separated.

Ventromental plates (Fig. e, below) about 150-159 µm wide; 3.11-3.23 times wider than deep and 1.02-1.04 times the mentum width; separated by about 21-27% of width of mentum, with about 39-40 striae; VMR 0.26-0.31.

PE (Fig. b, below) with about 17-19 teeth, including small interstitial teeth between some of the normal teeth. Premandible (Fig. f, below) with relatively broad teeth, coming to a broad point; inner tooth about 3.0-3.3 times wider than the outer tooth.

Antenna (Fig. c, below) with A1 about 3.4-3.6 times longer than wide (about 40% of the VHL), RO between 2/5 and half way up from the base of segment; AR about 1.39-1.42; relative lengths of antennal segments (µm) 101 : 41 : 10 : 14 : 6.5.

Mandible (Fig. g, below) with third inner tooth hardly separated, but somewhat darkened (type IB-C), and with about 12-15 furrows on outer surface at the base; PecM with 10-11 setae; Mdt-Mat 19-20 µm; MTR 0.31.



Mouthparts of *C. (Lobochironomus) sp. 4v*

a. Salivary reservoir; b. Pecten epipharyngis (some reduced teeth); c. Antenna;  
d. Mentum (ty. I), central teeth (ty. IB); e. Ventromental plate; f. Premandibles  
(with relatively broad points); g. Mandible (Ty. IIB).

**Cytology:** not known.

In thick mud, at depth of about 1m in a bog lake.

**Found:** Wisconsin - Why Not Bog Lake, County Road N, Vilas Co.

The presence of TLt and of smaller interstitial teeth in the PE suggest that this is a species of *Lobochironomus*. The larger TLt suggest it may be a previously unknown species, but it is possible that this is a polymorphism or an effect of environment. The mentum is similar to that described for *C. mendax*, but the second antennal segment is relatively longer.

### **Subgenus *Chaetolabis***

*Chaetolabis* is normally considered a subgenus of *Chironomus*, but [Yamamoto \(1987\)](#) considered it should have full generic status.

***C. (Chaetolabis) bitumineus* Langton & Vallenduuk, 2013** (Species 2h)

*Chironomus (Chaetolabis) macani* – misidentification by Wiederholm (1979)

**Adult:**

Adult male and female originally described by Wiederholm (1979) as *C. macani*.

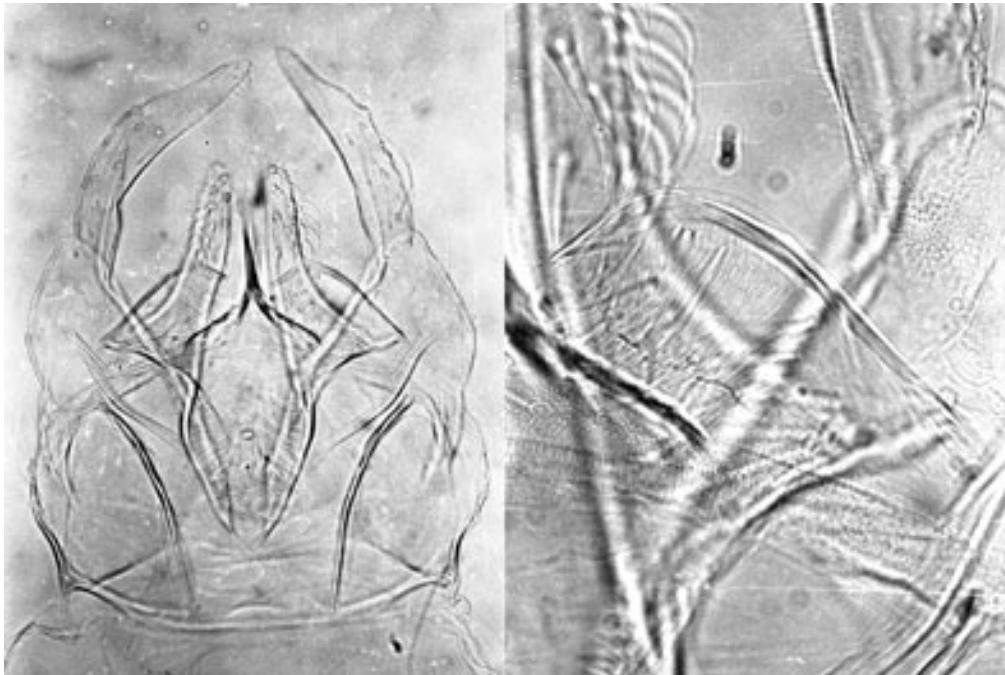
Several reared males from Ontario are either in the Sublette Collection at the University of Minnesota, or in the Canadian National Collection of Insects.

Based on the Wiederholm description, the following points can be made:

**Male:**

Dark species. AR 4.72 (4.61-4.86). Wing length 4.1 (3.9-4.3) mm. LR 1.38 (1.34-1.43); tarsi with a thin beard, easily broken off.

Frontal tubercles 11-14 µm long; Palp proportions (segs 2-5, µm) 86 : 315 : 291 : 350.



Male hypopygium (left) and superior volsella (right) of *Chaetolabis bitumineus*.

Anal point narrow, SVo broad with a strongly sclerotized hook, largely covered with microtrichia; setae of IVo appear to be simple. Tergite IX with 17 (14-20) setae in lighter fields. GS narrowing in the distal third.

**Female:**

Dark as male.

Wing length 4.6 (4.4-4.7) mm. LR 1.42 (1.39-1.47).

Antennal segment lengths (µm): 208 : 137 : 146 : 123 : 247. AR - 0.40; A5/A1 - 1.89.

Frontal tubercles about 23 (14-30) µm long.

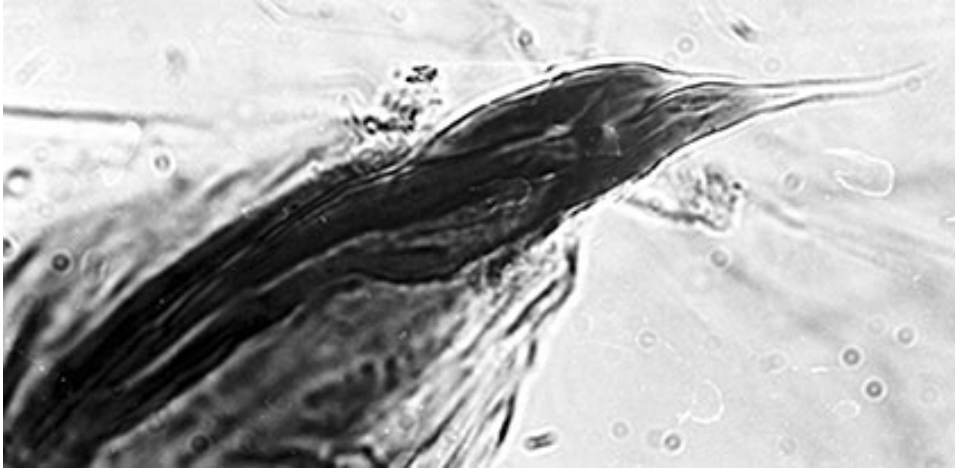
Palp proportions (segs 2-5, in µm): 86 : 290 : 294 : 382.

GpVIII with about 10 setae, GcIX with about 4 setae.

**Pupa:** (Largely based on European specimens) Length about 10.1-10.2 mm.

Conspicuous pedes spurii B on segment II; hook row with about 70 hooks.

Caudolateral spur of segment VIII with about 2 spines on North American specimen (below), but only one on European specimens.



**Fourth instar larva** a medium to large thummi-type (length about 17.8-18.0 mm). Anterior ventral tubules shorter than posterior pair (ant. 1.24 mm; post. 1.32 mm). AT long (abt. 530-710  $\mu\text{m}$ ) with a median constriction, about 3.5-5.5 times longer than wide; ventral pair possibly slightly longer and thicker.



Long anal tubules with constriction

Gular region dark on posterior half, FC slightly darkened.

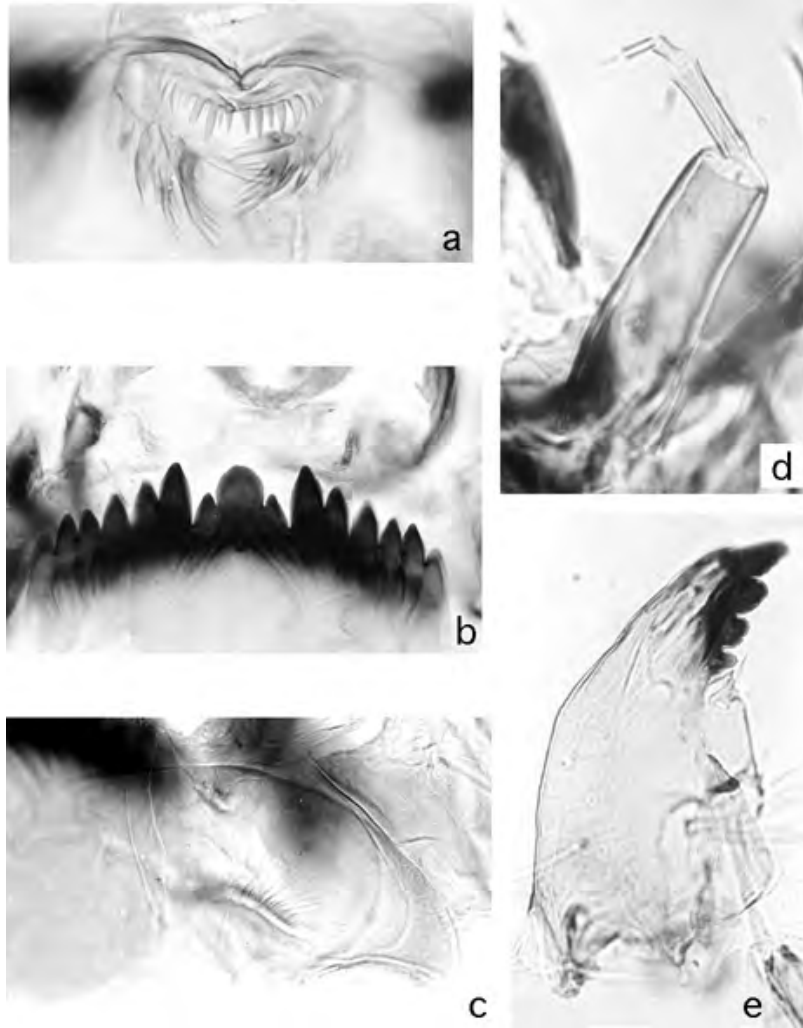
Mentum (b, below) as in *Chironomus*; central tooth relatively broad with short parallel sides (or possible diverge slightly), side teeth well developed (type III or II); 4th laterals slightly reduced (type I-II).

VM (c, below) with about 40 striae. PE (a, below) with about 16 irregular teeth.

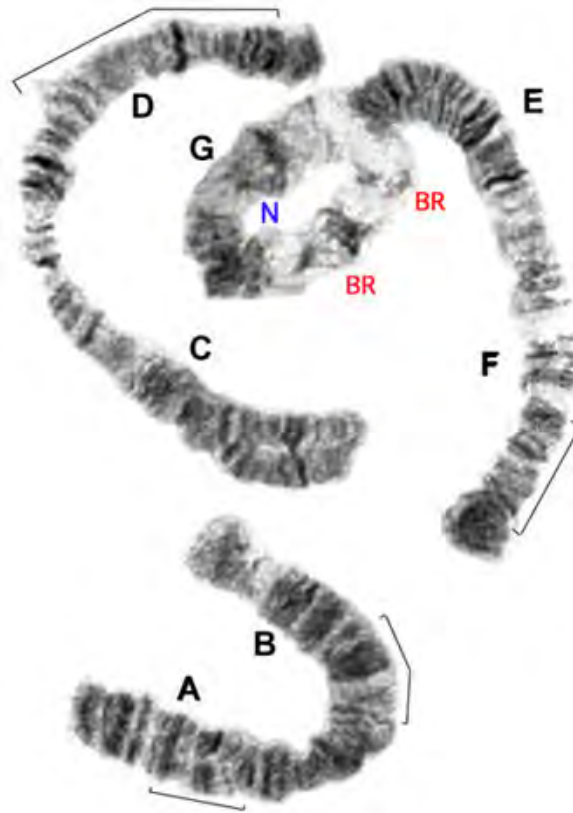
Premandible with inner tooth about twice as wide as inner tooth, and slightly longer.

Antenna (d, below) with AR about 1.8; basal segment about 3.5x as long as wide.

Mandible (e, below) with third inner tooth relatively well separated and darkened (type IIC).



- Cytology:** 3 polytene chromosomes with some indications of Keyl pattern - appears to be modified thummi arm combination AB, CD, GEF.  
 Nucleolus subterminal in arm G, followed by two BRs. No nucleoli in other chromosomes.  
 Polymorphic in all three chromosomes.
- bitA1: as in Palearctic specimens; olive not obvious.
  - bitA2: Inversion of central part of the arm. as atrA2?
  - bitB1: Typical bands near the centromere still present but quite contracted in available material.
  - bitB2: Inversion of almost half the arm, beginning about 1/5 from centromere..
  - bitC1: as in Palearctic specimens but typical bands (groups 3-4) not as obvious and may be nearer the centromere. as atrC2?
  - bitD1: Available specimens are heterozygous, but may be identical to the Palearctic sequence.
  - bitD2: Inversion of about 2/3 of the arm.
  - bitE1: as in Palearctic specimens, bands 10-13 obvious near the centromere.
  - bitF1: Available specimens heterozygous, but bands 20-23 obvious near the centromere, as in Palearctic specimens.
  - bitF2: Inversion of about the distal half of the arm. as atrF2?
  - bitG1: Tandem fusion with arm E; subterminal nucleolus followed by two BRs.



N – nucleolus, BR - Balbiani ring, brackets – approximate limits of known inversions

**Found:** Ontario - Costello Creek, Algonquin Provincial Park (45.58oN; 78.32oW); Beaver swamp near Dunrobin (45.45°N; 76.00°W); Cranberry creek, abt. 1 km n. Kars, Carleton Co. (45.13°N; 75.63°W).

Quebec - Lake Marlon, Rouyn-Noranda (48.27°N, 79.07°W)(Proulx et al. 2013).  
Also found in Palearctic: **Venetjärvi, FINLAND (Type locality), SWEDEN.**

Pools with grass on the bottom.

Morphology described by Wiederholm (1979) and Langton & Vallenduuk (2013). Cytology of European specimens described by Wülker (1987) (as *C. macani*), that of Nearctic specimens by Martin (2014).

The shared chromosome banding patterns and the extremely similar *COI* DNA sequence to that of *C. atroviridis* suggests that recent hybridization has occurred and may still be occurring.

***C. (Chaetolabis) atroviridis* Townes 1945 (Species 2i)**

*Tendipes (Chaetolabis) atroviridis* – Townes 1945

*Chironomus viridicollis* – Johannsen 1905, Needham 1908, Branch 1937, all misdeterminations of *viridicollis* van der Wulp

*Chironomus* nr. *viridicollis* Townes 1937

*Chironomus (Einfeldia) viridicollis* – Johannsen 1937

It is possible some of these may refer to *C. (Chaetolabis) bitumineus*.

**Adult:** Based on description of Townes (1945).



Male

Wing length 5.0 mm. LR 1.55, fore tarsus without a beard. AR 4.0

Frontal tubercles small but rather long.

Head brown, clypeus and appendages dark brown.

Thorax ochraceous slightly tinged with green, vittae and posterior part of postnotum dark brown, median vitta divided by a pale line.

Abdomen blackish green, basal part more or less green.

Legs greenish, grading to brown on apical tarsal segments; dark brown at apices of femora, base and apices of tibiae (although some fore tibiae are entirely dark), apex of basitarsus and becoming more extensive on subsequent tarsi.

Hypopygium quite similar to that of *C. (Chaetolabis) bitumineus*.

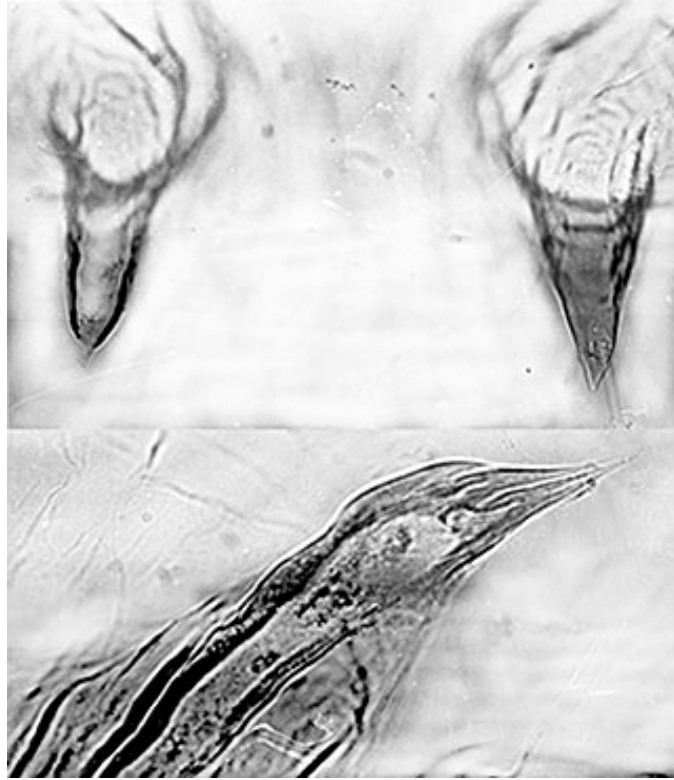


130. ATROVIRIDIS

Townes (1945) figure of hypopygium

Female: Townes (1945) only notes that it is similar to the male except for the usual sexual differences

**Pupa:** Has not been described. Two characters are known: The cephalic tubercles (below) are long, almost twice as long as wide, with a subapical seta. The caudolateral spur of segment 8 (below) has about 4 closely applied spines .



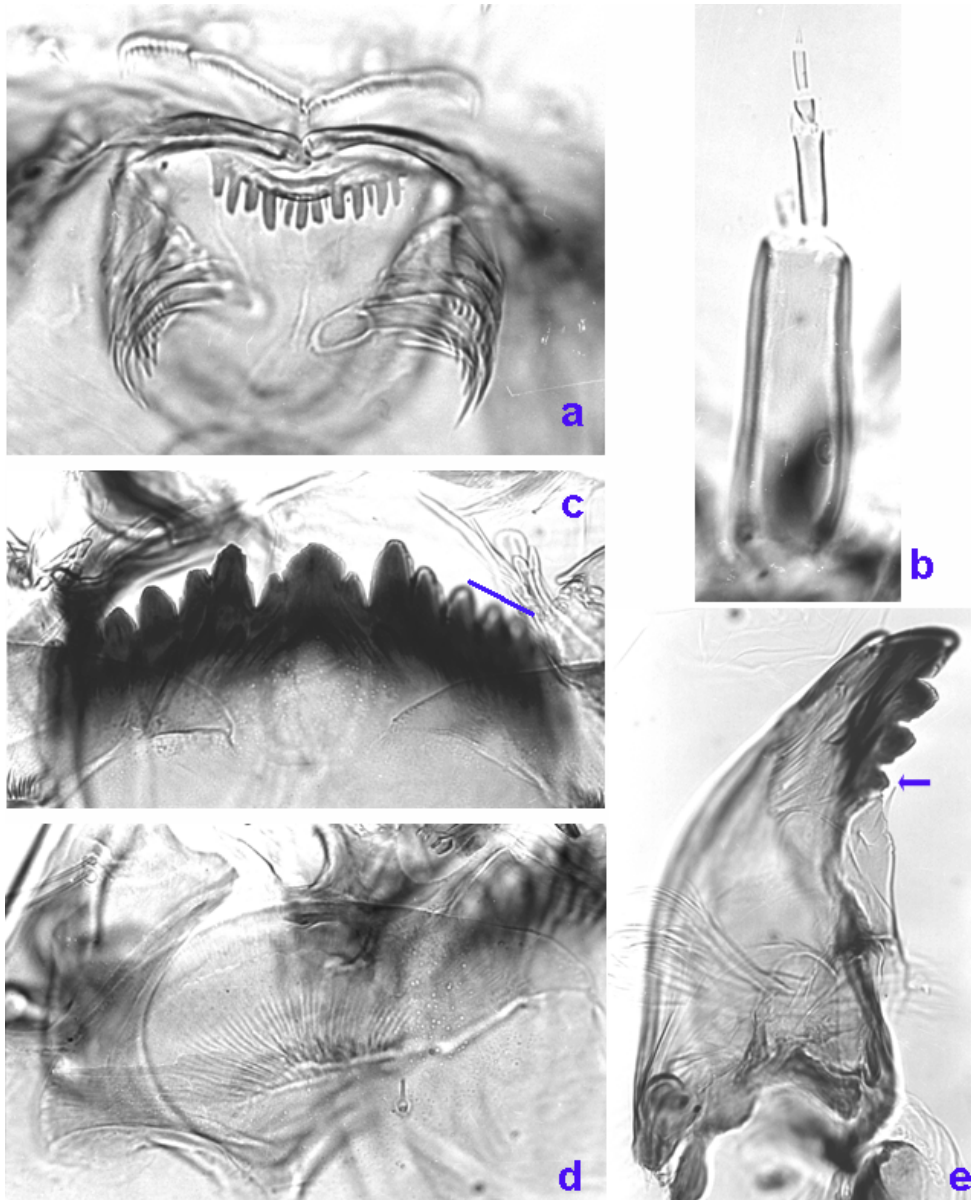
**Fourth instar larva** a medium to large bathophilus-type, length (male) 15.3-17.8 mm. VT about equal, ant. 0.80-1.04 mm, post. 0.80-0.95 mm long. Gula dark on posterior half, FC pale or slightly darkened.

Salivary reservoir about 2.9 times wider than deep. Mentum (c) as in *Chironomus*; 4th lateral barely reduced (type I); c1 tooth broad with short diverging sides, c2 teeth only moderately developed, notches about 45° (type IA, but sometimes c1 tends to type IIA).

Ventromental plates (d, below) separated by about 0.29-0.33 with about 50-54 striae. PE (a) with about 14-18 teeth, including 3 or 4 small teeth. Premandible with inner tooth about 2.5-3 times wider than outer tooth, teeth about equal in length or outer tooth slightly shorter.

Antenna (b, below) with basal segment about 3.3-3.5 times as long as wide, RO near middle of the segment; AR about 1.77-1.85; A2/A1 about 0.27; A3 shorter than A4, and sometimes longer than A5.

Mandible (e, below) with 3rd inner tooth (arrowed) pigmented and partly separated (type II-III), about 18-20 furrows on the outer surface near the base.



**Cytology:** 4 polytene chromosomes with indications of thummi chromosome arm combination, AB, CD, EF, G.

Arm G short, generally unpaired with a virtually terminal nucleolus then two BRs before a constricted chromosome end. No nucleoli in the long chromosomes.

Polymorphism in arms A, C, F, and possibly a small terminal inversion in arm E.

atrA1: Keyl pattern not clear, other than the proximal 16 - 19

atrA2: simple inversion of about the middle half of arm as bitA2?

atrB1:

atrC1:

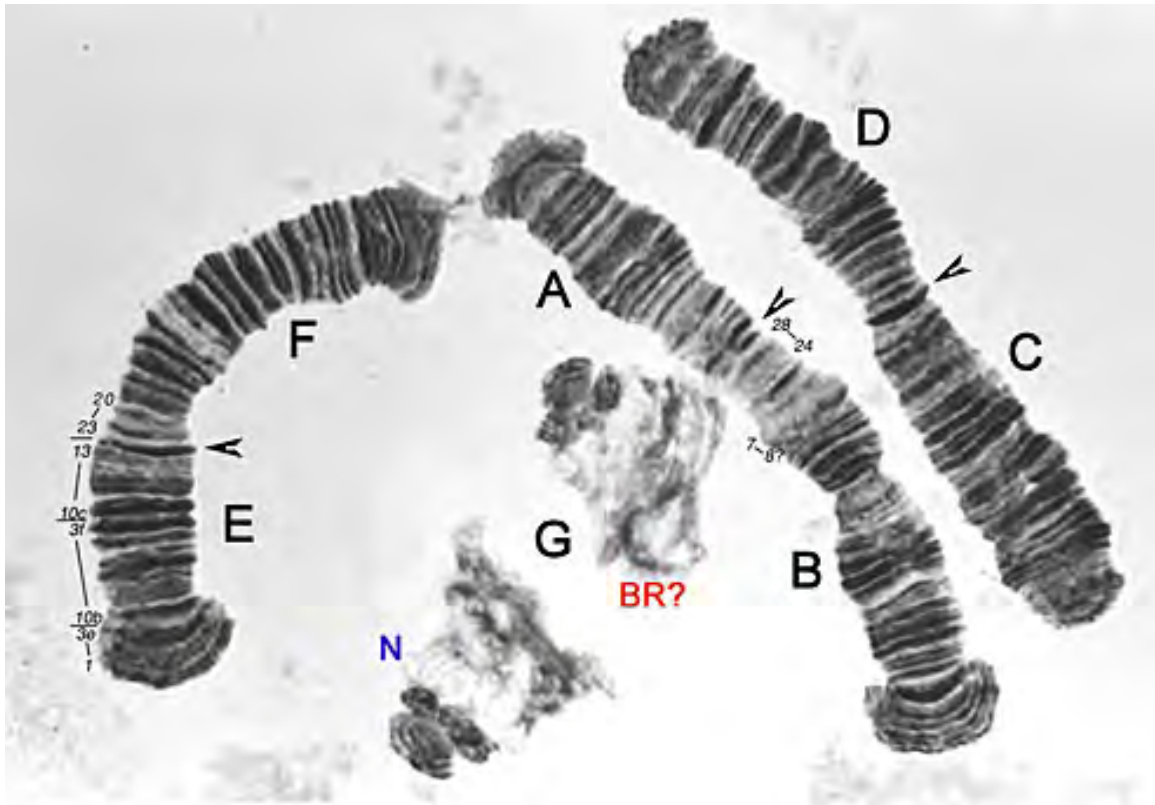
atrC2: inversion of about half of the arm beginning about 16 bands from the distal end of the arm - as bitC1?.

atrD1:

atrE1: possibly 1- 3e, 10b – 3f. 10c – 13 i.e. basic sequence as *luridus*, etc.

atrF1: only the proximal bands 20 – 23 can be readily recognized.

atrF2: simple inversion of about the middle half of the arm as bitF2?.



**DNA analysis:**

mtCOI: GenBank accession numbers KF278329.1 – 332.1, KF278342.1 & 360.1

gb7A: GenBank accession number KF278450.

The COI sequences are very similar to that of the known *C. bitumineus* sequence.

**Found:** British Columbia - Terrace (Townes 1945).

Manitoba - Southern Indian Lake (Rosenberg *et al.* 1984).

Ontario - White Lake, Three Mile Bay (48.70, -85.75); Orillia; Point Pelee (41.959, -82.518) (last 2, Townes 1945).

Quebec - Lac Marlon, Rouyn-Noranda (48.27, -79.07) (Proulx *et al.* 2013).

Saskatchewan - Oxbow (Townes 1945).

Arkansas – White River National Wildlife Refuge (Chordas *et al.* 2004).

Connecticut - Stafford (Townes 1945).

District of Columbia - Washington (Townes 1945).

Idaho - Cataldo (Townes 1945).

Illinois - Urbana; (Townes 1945).

Iowa - Crystal Lake, Davenport; Dickinson Co. (Townes 1945).

Massachusetts - Amherst; Edgartown; Holliston; Wellesley (Townes 1945).

Michigan - East Lansing; Iosco Co.; Manistee Co.; Nottawa; Silver Lake, Oceana Co. (Townes 1945).

Minnesota - Cass Lake; Chisago Co.; Crystal Lake; Hennepin Co.; Mendota, Dakota Co. (Townes 1945).

New York - Amsterdam; Bemus Point (**Type locality**); Canandarago Lake; Ithaca; Mayville; Otsego Lake; Ringwood, Tompkins Co.; Round Island; Tuxedo. (Townes 1945)

Ohio - Summit Co. (Townes 1945).

Virginia - Dyke; Falls Church (Townes 1945).

Some of the Townes (1945) localities may refer to *C. bitumineus* (sp. 2h), although Townes notes that all samples came from lakes.

In lakes, possibly shallows with vegetation.

The adult male was described by Townes (1945). Notes on the larval morphology, cytology and DNA sequence were given by Proulx *et al.* (2013), and the species was confirmed as *C. atroviridis* and the sequences further defined by Martin (2014).

The shared chromosome banding patterns and the extremely similar *COI* DNA sequence to that of *C. bitumineus* (see below), suggests that recent hybridization has occurred and may still be occurring.

***C. (Chaetolabis) ochreatus* Townes 1945** (Species 3e) as *Tendipes (Chaetolabis) ochreatus*

This species is in BOLD Bin: [BOLD:AAP5112](#)

#### Adult:

Male:

Wing length 3.9-4.6 mm, width 0.93-1.03 mm, VR – 0.93-0.96.

Head yellowish green; antennae and palps dark. AR about 3.9-4.1. Frontal tubercles small, about 5-10 x 8 µm. Palps (micron): 80 : 72 : 277 : 304 : 420. About 30-45 clypeal setae.

Thorax greenish, mesosternum and mesonotal vittae brownish yellow, posterior part of postnotum brown. Setae: Acrostichal – 12; Dorsocentral – 25–26; Prealar – 7; Scutellar, anterior (two rows) 4+10; posterior 13 (total scutellar 27).

Wings clear, anterior veins slightly darkened, 3-4 Scf on the brachiolium; about 20 setae on squamal fringe.

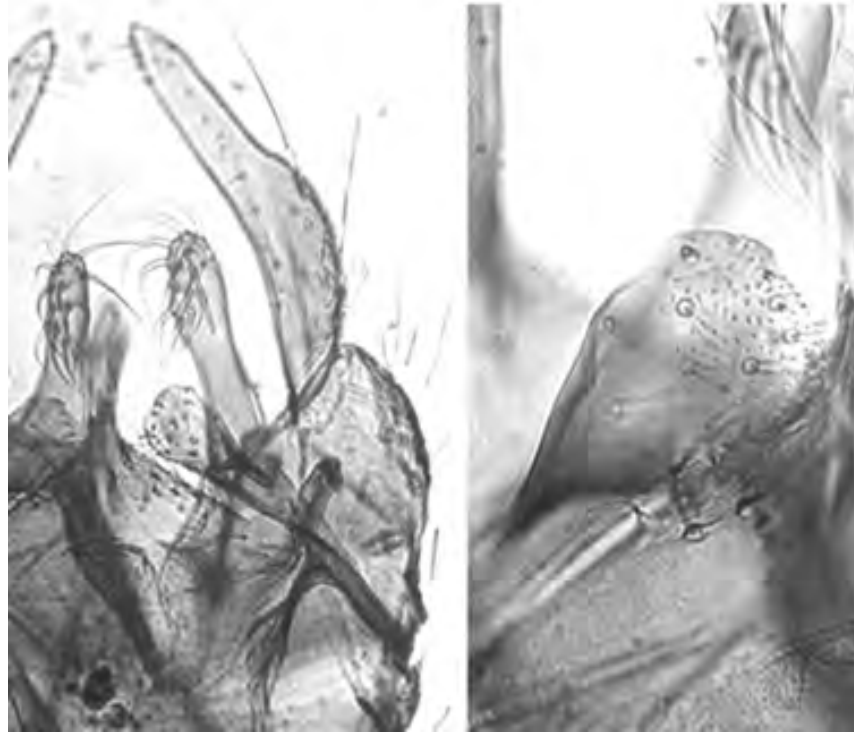
Legs yellowish green, anterior legs darkened at the knees, tibia and tarsi dark; other legs with tibiae yellow brown shading to black on distal tarsal segments. Anterior tarsus without a beard.

Leg lengths (in microns) and proportions as below:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
<b>PI</b>	1690	1580	2480	1225	900	780	355	1.55-170	1.07-1.08	2.06-2.11
<b>PII</b>	1810	1740	1062	610	435	283	192	0.57-0.61	1.03-105	
<b>PIII</b>	1950	2105	1428	850	583	350	228	0.68	0.92-0.94	

ForeTa5/Ti about 0.21.

Abdomen: Basal segment yellowish green, the rest blackish brown. Superior volsella club shaped, which is distinctive. 9 setae on tergite of segment IX in individual pale areas. IVo extending beyond the anal pint and to about the midpoint of the gonostylus where it begins to narrow markedly.



Male hypopygium (left) and superior volsella (right) of *C. (Chaetolabis) ochreatus*

**Female:**

Median mesoscutal vitta dark brown and divided longitudinally by a pale line.

Otherwise similar to the male except for the usual sexual differences. Further data based on one reared specimen:

Wing length 4.98 mm, width 1.40 mm. VR 0.90. 3-4 SCf on brachiolum, 23-26 setae in squamal fringe.

Head: Antennal segments (micron), proportion of neck in brackets: 230 (0.28) : 160 (0.47) : 175 (0.46) : 135 (0.43) : 295, segments not sufficiently swollen to give obvious necks (see figure below). AR 0.42, A5/A1 1.28.

Frontal tubercles small, about 9-10 x 12.5 µm.

Palpal proportions (microns): 75 : 60 : 293 : 333 : 426: P5/P4 1.28; P5/P3 1.45.

Width of clypeus 1.9 times the diameter of the antennal pedicel; about 54 clypeal setae.

Thoracic setae: Acrostichal – abt 13; Humeral 5 in a patch + 2linear and 6 in loose patch; Dorsocentral – 33-36 (Humeral + Dorsocentral 43-46); Prealar – 8-9; supraalar – 1; Scutellar, anterior row 14, posterior row 21 (total 35).

Leg lengths (in microns) and proportions as below:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
<b>PI</b>	1920	1850	-	-	-	-	-	-	1.05	-
<b>PII</b>	2000	1940	1100	590	420	300	230	0.56	1.03	
<b>PIII</b>	2120	2340	1580	820	610	360	260	0.68	0.91	

Setae on GcIX – 4; segment X long and narrow (see figure below) about 239 x 27 µm, 8.6-9.4 times longer than greatest width, with 7-8 setae; cercus (below) a rounded square with a small basal extension on the dorsal margin.



Adult female antenna (left) and ventral abdomen (right) of *C. (Chaetolabis) ochreateus*

**Pupa:** Length of exuvia about 10.3 mm (male), inner margin of wing case about 2.04 mm; color yellowish brown; with well-developed narrow cephalic tubercles (70 x 20  $\mu\text{m}$ ) arising from a broad base, with subapical seta about 56-58  $\mu\text{m}$  long; also a large frontal wart about 56-68  $\mu\text{m}$  long and 43-48  $\mu\text{m}$  wide at the base.

Basal ring kidney shaped, about 177x82  $\mu\text{m}$ , i.e. HR about 2.1-2.2.2 vacuoles slightly anterior to it.

Abdomen with a central patch of shagreen on segments II-V, grading from posterior 2/3 on seg. II, to whole length of segment on segment V; on segment VI the shagreen is restricted to the anterior third.

Pedes spurii B on segments II and III small; PsA on segment IV 243  $\mu\text{m}$  long (0.25 of segment length) and 134  $\mu\text{m}$  wide. Numbers of L-setae on segments II-IV also as usual, the posterior two on segment IV arising reasonably separated.

Hook row on segment II with about 93 hooks, occupying about 42% of width of segment.

Posterolateral spur of segment VIII with 1-2 large spines with 0-3 small spines at their base, all spines closely applied and main spines extended to a fine curved point.

About 142 taeniae in multiple rows on each side of anal lobe.



*C. ochreatus* pupal cephalic region (above) and variability of the spurs (below)

**Fourth instar larva** a medium sized thummi-type, length about 12.8-16.8 mm. (Female 15.5 (14.8-16.1) mm; male 14.1 (12.8-15.3) mm); posterior pair of VT longer and coiled (ant. 1.34 (1.0-1.57) mm; post. 1.50 (1.41-1.92) mm), those of the Quebec specimens much shorter than those from Wisconsin. AT very large, about 4.5-6.4 times longer than wide, with a constriction about one third from the base (dors: 1120 x 200  $\mu$ m; vent. 1180 x 170  $\mu$ m). Gular region and FC usually pale, but some specimens have very slight darkening of both. Width of FC between the antennal bases about 186-195  $\mu$ m, greater than the distance between the S4 setae (about 160-175  $\mu$ m). Salivary reservoir about 83.5  $\mu$ m wide and 3.7 times wider than deep.

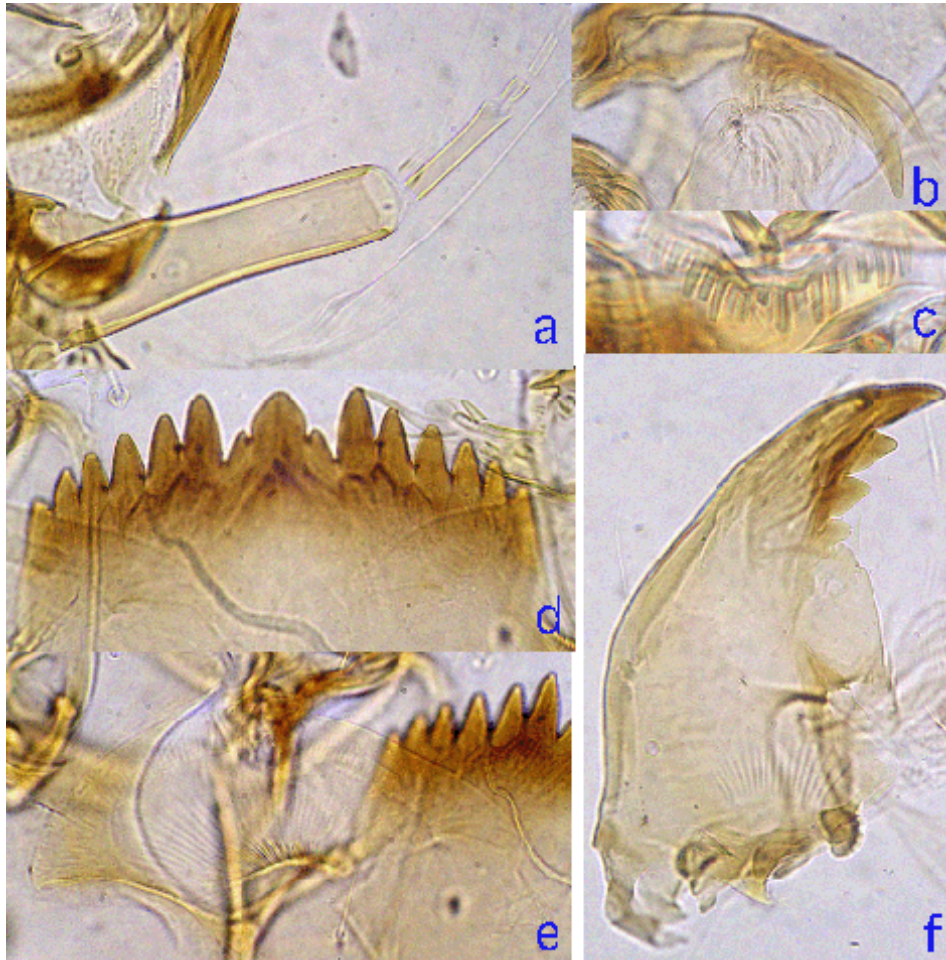
Mentum (d, below) with relatively pointed teeth; c1 tooth moderately broad with short parallel sides, c2 teeth moderately well separated (type IB); 4th laterals hardly reduced (type I); 6th laterals arising at about the same level as other teeth.

Ventromental plates (e, below) about 248-250  $\mu$ m wide; 3.06-3.38 times wider than deep and 1.08-1.09 times the mentum width; IPD about one third of mentum width; with about 39-45 striae (Webb *et al.* 1987). Premandible (b, below) with narrow, sharp outer tooth, often shorter than the inner tooth, which is 4-5 times wider. PE (c, below) with about 23.2 (21-25) irregular teeth, with small interstitial teeth (type D).

Antenna (a, below) with A1 about 35-44% of the VHL; A2 long, over 1/3 length of A1, which is about 3.3-4.3 times longer than wide; ring organ a third to almost half way up from the base; AR 1.95 (1.50-2.27); antennal segment proportions (micron) 154 : 44 : 11 : 18 : 8. i.e. A5 about the same length as A3.

Mandible (f, below) with 3rd inner tooth partly separated but only moderately pigmented (type IIB); with about 19 (17- 21) furrows on outer surface at base; PecM 13.2 (12-15) taeniae; Mdt-Mat about 28, MTR 0.31-0.47.

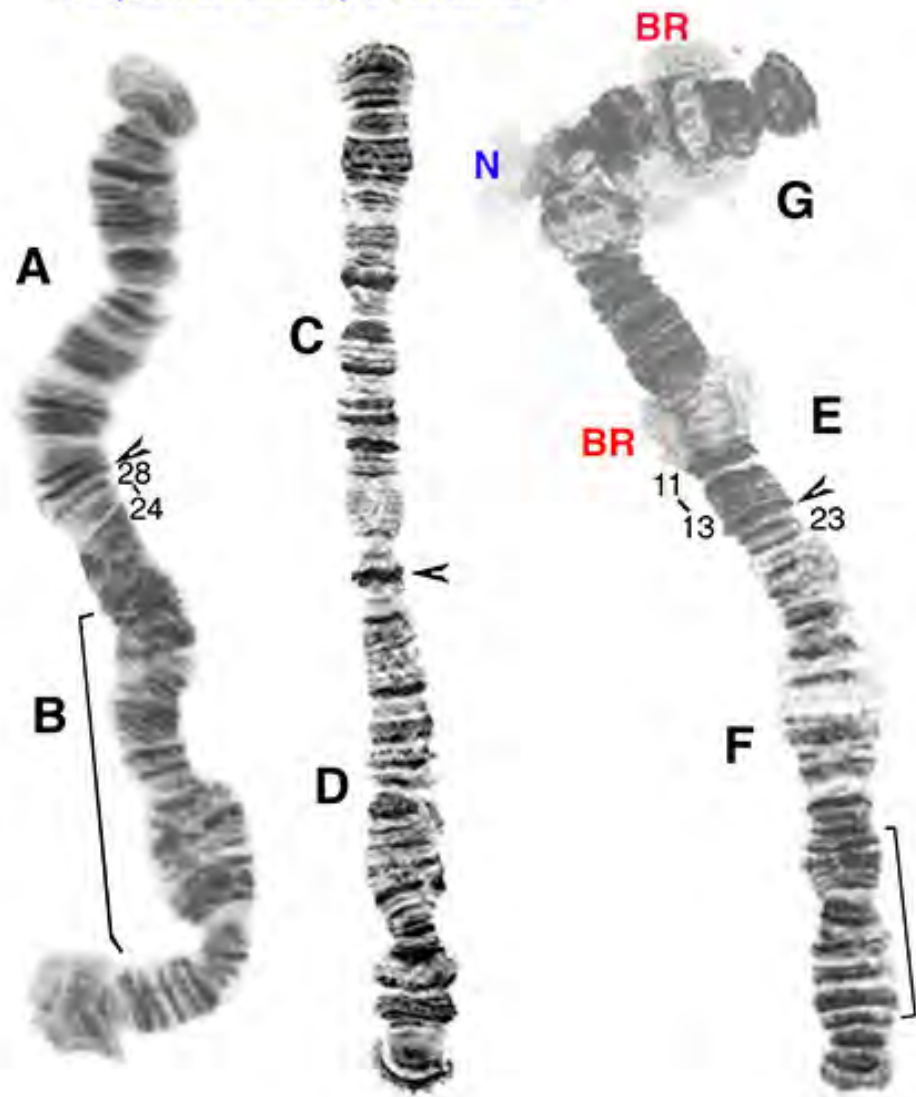




Larval mouthparts of *C. (Chaetolabis) ochreatus*

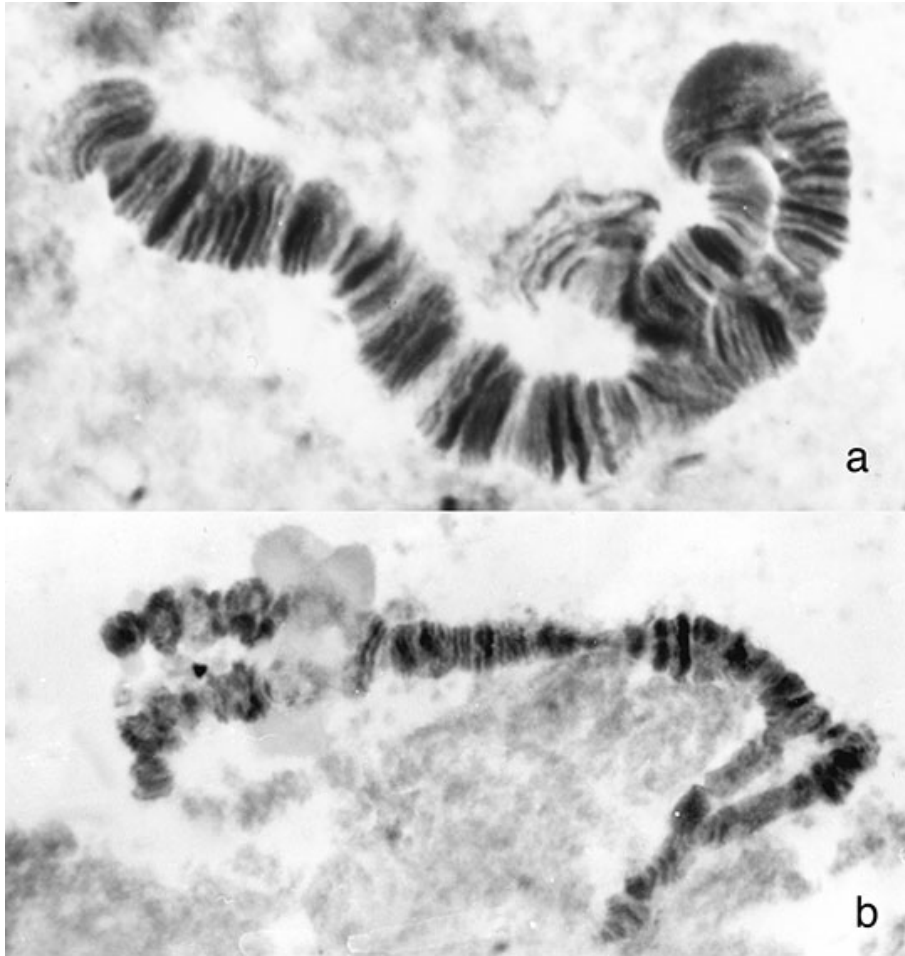
**Cytology:** 3 polytene chromosomes which have a modified thummi arm combination, AB, CD, GEF; but Keyl pattern very difficult to recognize. Nucleolus near the junction of arm G with E, arm G generally unpaired; two BRs between nucleolus and end of arm, with another in arm E, found in some cells of one larva only. No nucleolus in the long chromosomes.

*C. (Chaetolabis) ochreatus*



Polytene chromosome complement of *C. (Chaetolabis) ochreatus*

Polymorphism in arms B and F.



a. heterozygous arm B, b. heterozygous arm F.

**Found:** Quebec - Lake Opasatica, Rouyn-Noranda (48.17°N; -79.33°W).  
Arkansas - Galloway (Townes); White River National Wildlife Refuge, Arkansas (Chordas *et al.* 2004.)  
Georgia - roadside pond (B. Caldwell, in Epler 2001)  
Main - Lincoln Co (Townes)  
Massachusetts - Holliston (Townes)  
Michigan - Empire (Townes)  
New Jersey - Medford Lakes (**Type locality**); Chesilhurst; Glassboro (Townes)  
New York - Lake Sebago, Bear Mountain State Park (Townes)  
Rhode Island - Westerly; Wickford (Townes)  
South Carolina - Greenville, Table Rock State Park, Pickens Co. (Townes)  
Virginia - Four-mile Run; Norfolk Co. (Townes)  
Wisconsin - Little John Jr Lake, Vilas Co. (46.00°N, -89.63°W); Mud Lake, Vilas Co. (46.02°N, -89.62°W).

At depth of about 4 m amongst *Drepandocladus exannulatus*.

Wiederholm (1979) considered *Ch. ochreatus* to be a synonym of *Ch. atroviridis*, but did note that this was subject to confirmation by further analysis. The presence of the large frontal warts in the pupa (above) and the narrower, finer pupal spurs show that it is clearly distinct. Detailed features of the larval ventromental plates are given by Webb *et al.* (1987).

**DNA analysis:** Sequence for the mitochondrial *COI* and the nuclear *gb2 $\beta$*  genes are available. *COI*: Gene bank accession numbers KF278351; KF278327; KF278328. Also Barcode sequences in BOLD database.

## Genus *Einfeldia* (s.l.)

### *Benthalia brunneipennis* (Johannsen, 1905) Species 3k

*Chironomus brunneipennis* – Johannsen 1905

*Tendipes (Einfeldia) brunneipennis* – Townes 1945.

The concept of the genus *Benthalia* is not completely clarified. It comprises some of those species previously included in *Einfeldia* group B, with particular confusion concerning the relationship to the species allocated to the genus *Fleuria* Kieffer 1924. One character of the adult male that I believe deserves more consideration is the arrangement of the setae on TIX – unlike those of species in *Chironomus* or *Einfeldia*, which include a lateral component to their distribution, those of species currently assigned to *Benthalia* are distributed longitudinally in approximate rows. This is true of this species.

The immatures of this species were not previously described.

#### Adult:

Male:

The adult male is characterized by its brown thorax, abdomen and haltere knob; large frontal tubercles; strongly spatulate anal point and pediform basal part of superior volsella.

Wing length 2.8-3.1 mm; LR 1.70-1.86; AR 2.81-2.86; frontal tubercles large; front tarsus without beard.

Frontal tubercles 41-50  $\mu$ m high, 22-23  $\mu$ m wide. Clypeus with 19-22 setae. Palpal proportions (micron): 50-64, 58-68, 168-183, 185-196, 283-303.

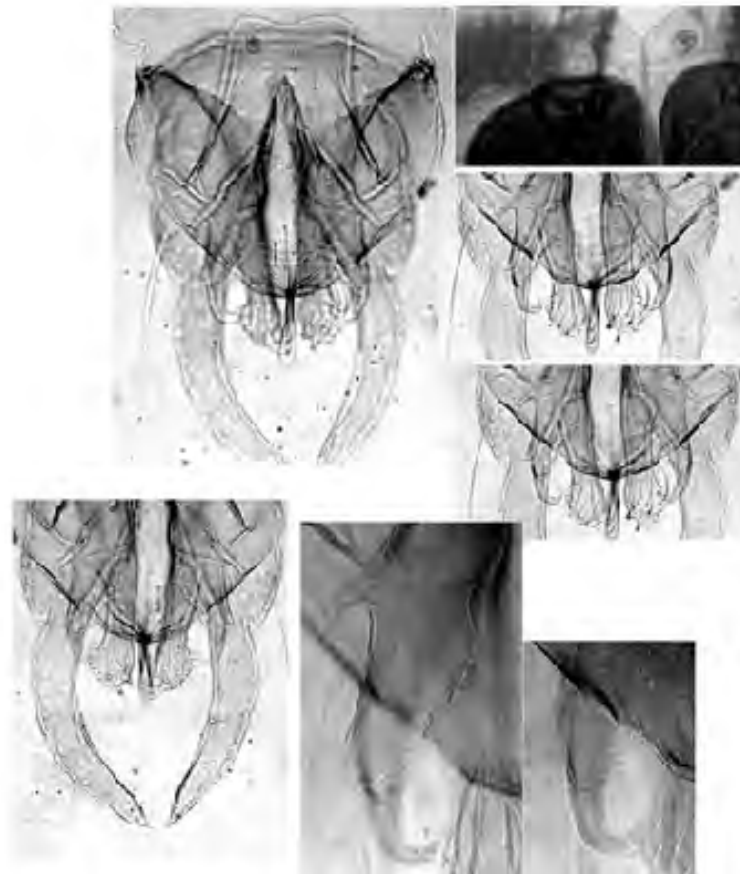
Thorax: Antepnotum bare. Dorsocentrals 13-18, acrostichals absent, prealars 4-5, supraalar 1. Scutellum with 15-21 setae.

Lengths and proportions of legs (micron)

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	1613	890	1644	724	600	485	184	1.83-1.90	1.79-1.86	0.21
PII	1157	1055	625	322	233	132	92	0.57-0.60	1.0-1.10	
PIII	1245	1316	963	473	365	184	120	0.71-0.73	0.94-0.95	

*Ch. (Einfeldia) brunneipennis* Joh.  
[det. H. K. Townes]

IA: L. Okoboji 12-VII-1939  
[Hauber Coll.] Hypo 332 cf. ph  
332



Male terminalia of *B. brunneipennis* (left), with frontal tubercles (upper right), superior volsella, inferior volsella and anal point. (Photo courtesy of J. E. Sublette)

Tergite IX with 30-36 setae arranged approximately linearly. Tip of SVo markedly curved, not conforming to any of the types of Strenzke (1959), base pediform. IVo slightly club-like at the end - expanded laterally, not quite reaching to the end of the narrow anal point and only to about basal quarter of the GS, which is narrow and tends towards a point over the distal quarter.

Female: Townes states only that they are similar to the male except for the usual sexual differences.

**Pupa** with frontal warts, lacking comb or spur on abdominal segment VIII.

**Fourth instar larva** not a typical *Chironomus* type: small, with only one pair of VT. Gula region dark over post 2/3, wider than mentum with slightly convex anterior margin and widest above the posterior margin; also dark spots at base of antenna. FC (Fig. c) without a depression. Dorsal sclerite S1 (Fig. c) with slight rugosity anteriorly.

Mentum (Fig. b) also not typical *Chironomus*; c1 tooth narrow with only slight notches near the apex (Type I), which may be easily lost due to wear; all lateral teeth lower than the central tooth; 4th laterals quite reduced (Type III).

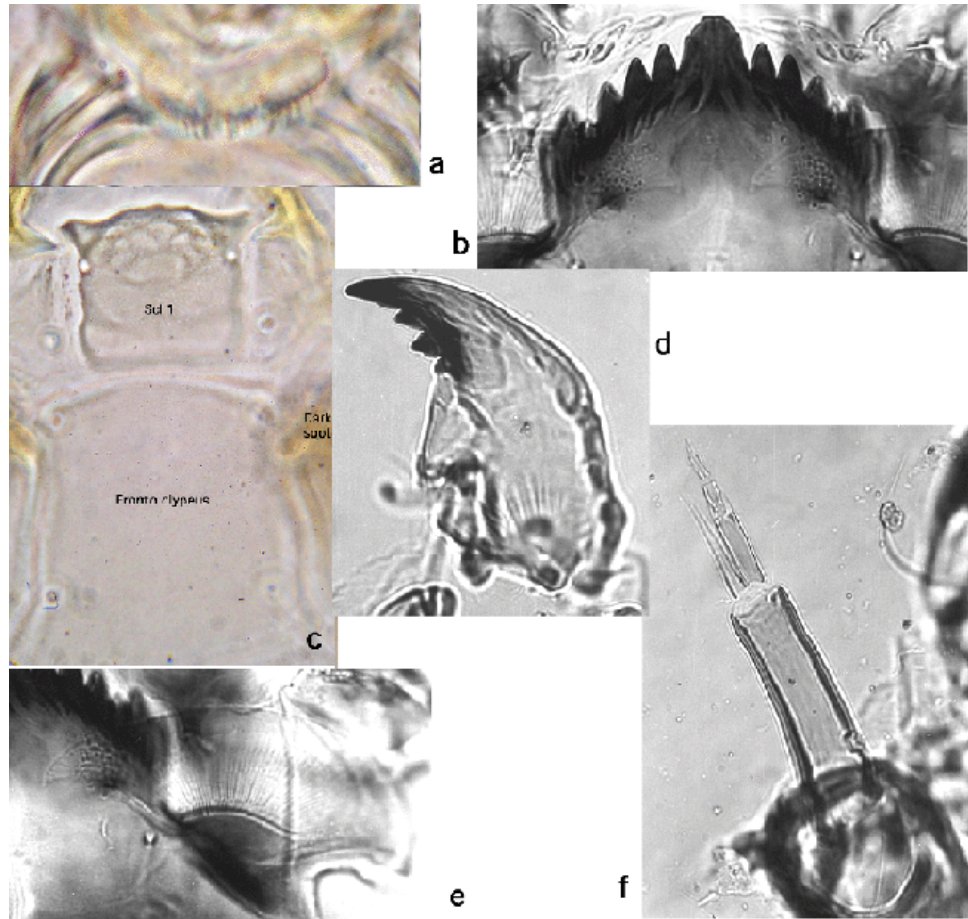
VM (Fig. e) similar to that of *Chironomus*, about 158  $\mu\text{m}$  long; about 4 times wider than deep and 1.28 times the width of the mentum; with about 38 striae; IPD about 30  $\mu\text{m}$  or about

one quarter of width of mentum; VMR about 0.26. PE (Fig. a) partially tripartite, with about 30 fine teeth.

Antenna (Fig. f) relatively short, AR about 1.3; basal segment about 3 times longer than wide, RO about 0.3-0.45 up from the base; A2/A1 about 0.19-0.34; A4/A3 about 1.63-1.66; A5/A3 about 0.92; segment length about 55.5 : 19 : 6 : 10 ; 5.5.

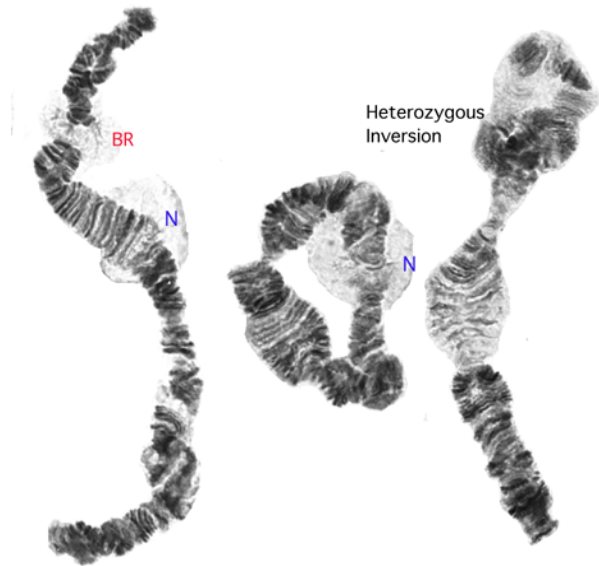
Distance between the antennal bases abt. 94  $\mu$ m and greater than that between the S4 setae which are separated by about 84% of the FC width.

Mandible (Fig. d) about 162  $\mu$ m long, the 3 internal teeth dark (Type IIIC), and with about 11 furrows near base.



Parts of head capsule of *Benthalia brunneipennis*. a. Pecten epipharyngis; b. Mentum; c. dorsal sclerites; d. Mandible; e. Ventromentum, f. Antenna.

**Cytology:** 3 polytene chromosomes with no obvious sign of Keyl pattern. Fused chromosome 4 visible as narrow section following a BR, on longest chromosome; 2 nucleoli present, one of which is on the longest chromosome. A third small nucleolus may sometimes be developed on the longest chromosome. Some inversion polymorphism present.



- Found:** **Manitoba** - Lake Winnipeg (Sæther 2012)  
**Ontario** - Mooney's Bay (45.35°N; 75.68°W), Ottawa, Carleton Co.  
**Arkansas** - Galloway, Pulaski Co. (Townes 1945).  
**Florida**- Orlando; West Palm Beach (Townes 1945).  
**Iowa** - Davenport (Townes 1945).  
**Massachusetts** - Amherst (Townes 1945).  
**Michigan** - Manistee Co.; Midland Co. (Townes 1945).  
**Minnesota** - Cass Lake; New Brighton; Nisswa (Townes 1945).  
**New Jersey** - Moorestown (Townes 1945).  
**New York** - Bemus Point, Buffalo; Ithaca; Mayford; Milford Center; Peekskill (Townes 1945).  
**North Carolina** - Raleigh, Wake Co. (35.77°N, 78.63°W) (Townes 1945).  
**South Dakota** -

The characters of the larva indicate that this species does not belong to *Einfeldia* (s.s.). They suggest it belongs to Group B or D of Pinder & Reiss (1983), which probably should be combined. The name *Benthalia* Lipina 1939 is available for this combined grouping (Spies, personal communication). However, Spies also points out that Townes (1945) description of the adult describes characters, such as large frontal tubercles and small base to superior appendage, that do not fit the diagnosis of *Einfeldia* (s.l.). The unexpanded base of the superior volsella is, however, not consistent with specimens identified as this species by Townes himself. The species is very similar to the Japanese specimens described as *B. dissidens* (Walker), so may be Holarctic in distribution. The larva of *B. natchitochae* (Sublette) is quite similar.

The presence of grooves on the mandible suggests that this group belongs in an expanded *Chironomus*.

The adult was briefly redescribed by Sæther (2012).

***Benthalia natchitochae* (Sublette, 1964)** Species 4n  
*Chironomus* (*Einfeldia* gp.) – Sublette 1964.  
*Einfeldia* (s.l.) Oliver 1981, Epler 2001

**Adult:** Described by Sublette

Male:

Wing length 2.39-2.70. AR 2.82-3.10. No beard.

Head brownish; frontal tubercles developed; palp segments (2-5): 5 : 12 : 20 : 27;  
P5/P4 1.35, P5/P3 2.25.

Thorax yellowish brown, vittae, postnotum and sternopleuron blackish brown, mesonotum with a slight central hump. Abdomen entirely blackish brown.

Legs darkened on distal third of femur and on tarsi.

Leg proportions (units):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta5/Ti
<b>PI</b>	57	40	88	44	34	28	11	1.85-2.2	1.42	0.28
<b>PII</b>	58	50	30	15	10	5	4	0.60	1.16	
<b>PIII</b>	60	65	48	23	17	10	6	0.74	0.92	

*Chironomus (Lobochironomus) natchitocheae* Sublette



SC: Aiken Co.,  
Lower 3 Runs Cr.  
Savannah R. Plant  
30-IX-1X-1979  
P. L. Hudson



Head with frontal tubercle, hypopygium, and SVo (on right).  
(Photographs courtesy of J. E. Sublette)



Tergite IX with setae from anterior to distal: about 5 setae on anterior part, and smaller setae flanking the anal point. SVo with chitinous hook on a pedicel covered with small setae and some longer setae (as above); IVo with a terminal knob covered in setae and reaching just beyond end of the anal point and to about 1/3 along the gonostylus, which hardly narrows distally; anal point broadening towards the tip.

Female: (Allotype)

Wing length 3.15 mm.

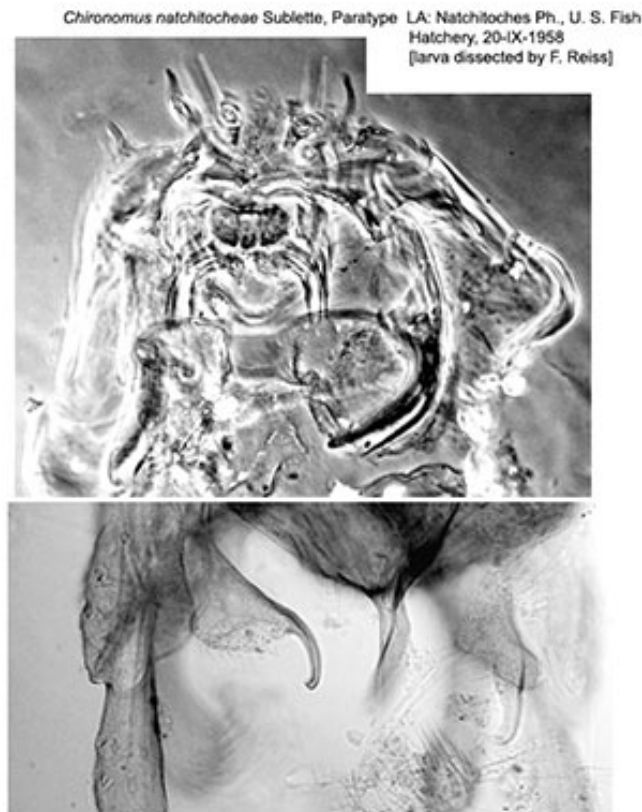
Coloration essentially as in male.

Leg proportions (units):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
<b>PI</b>	60	45	98	38	33	27	12	2.18	1.33	0.60
<b>PII</b>	65	55	32	16	12	6	5	0.60	1.18	0.11
<b>PIII</b>	68	70	50	23	18	11	8	0.71	0.97	0.16

**Pupa:** Length about 8 mm; almost entirely blackish. Cephalic tubercle long and pointed with a conspicuous preapical bristle. Tergite II with posterior row of about 81 upturned hooks. Postero-lateral comb on segment VIII with about three spines; caudal fin with about 116 setae in an approximate double row.

**Fourth instar larva:** One pair of VT. Gula darkened, dark spots at base of antenna. Median tooth of mentum, with small notches, projecting far beyond first lateral teeth; 5th lateral tooth of mentum larger than 4th and 6th; FC without fenestra; mandible with 2 inner teeth and wide radial grooves near base; PE (see below) composed of three small scales (Epler 2001).



Epipharyngeal region of paratype larva (above) and SVo of paratype male (below)

**Cytology:** Not known.

**Found:** **Arkansas** – White River National Wildlife Refuge (Chordas *et al.* 2004).  
**Louisiana:** - U.S. Fish Hatchery, Natchitoches (**Type locality**)  
**South Carolina:** - Lower 3-runs Creek, Aiken Co.

Common in eutrophic lakes and ponds on the Coastal Plain of the Carolinas, but also occurs in rivers and streams.

Has been included in *Einfeldia* (sens. lat.) (Epler 2001), and also suggested to be *Chironomus* (*Lobochironomus*), but appears to fit into that section of *Einfeldia* (sens. lat.) for which the name *Benthalia* has been suggested., although Cranston suggests it fits best with *Fleuria*.

All life stages described by Sublette (1964), partial description and some figures of larva in Epler (2001).

***Einfeldia chelonia* (Townes, 1945) Species 5q**  
*As Tendipes (Einfeldia) chelonia*

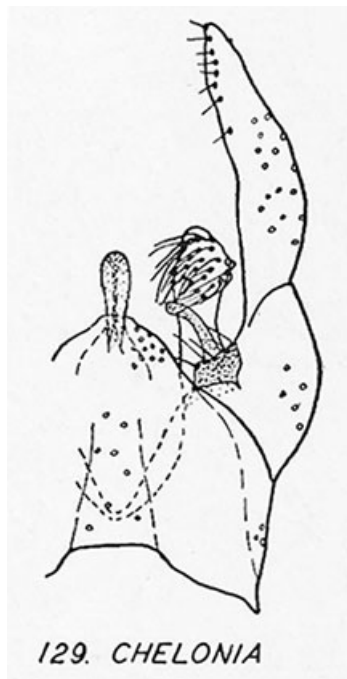
**Adult:** From Townes original description

Male: Wing 2.4 mm long; LR 1.3; AR 2.6.

Frontal tubercles not observed. Fore tarsus with short, sparse beard.

Pale green. Antennal pedicel ochraceous, flagellum and palps pale brown except at their bases. Thorax ochraceous; legs pale green, brown towards their apices.

Scattered setae on tergite IX (Townes figures about 9); anal point short, as is the IVo, which reaches to about proximal third of gonostylus, which is moderately swollen and narrows gently over posterior third.



129. CHELONIA  
From Townes 1945

Female: Not known.

Pupa and Larva: Not known.

**Found:** Arkansas – White River National Wildlife Refuge (Chordas *et al.* 2004).  
 District of Columbia – Washington (Townes)  
 New Jersey – Riverton (Townes).  
 New York Canajoharie (**Type locality**), Poughkeepsie, ( both Townes)

***Einfeldia pagana* (Meigen, 1838) Species 2k**

Originally *Chironomus paganus* Meigen 1838

Syn: *Einfeldia synchrona* Oliver 1971 (Oliver *et al.* 1990)

The species relationships in *Einfeldia* are so confused that any designation of synonymy is tentative at best. While these two species are undoubtedly in *Einfeldia*, there is insufficient evidence to confidently define them as synonymous.

Unfortunately, many specimens identified as *E. pagana* in GenBank and the BOLD database are really species of *Benthalia*.

In BOLD Bin: [BOLD:AAG5475](#)

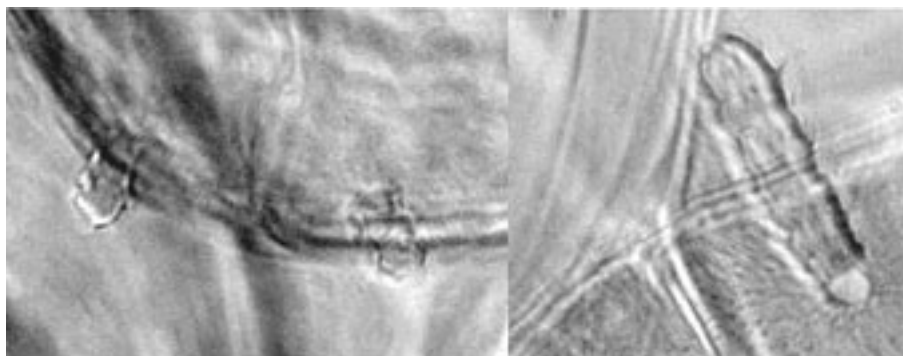
**Adult** of North American specimens as described by Townes (1945) as *Tendipes (Einfeldia) paganus*, and by Oliver (1971) as *E. synchrona*.

Male: Wing length 2.4-3.8 mm, VR 1.02-1.09; LR 1.45; AR 2.67-3.06; frontal tubercles variable in size, fore tarsus with a rather short beard.

Light pea green, with thoracic markings, etc. ochraceous but occasionally brown or black; legs green, brown towards their apices.

The inflated style abruptly constricted near the apex and the broad anal point are distinctive.

Head: FT variable in size depending on locality, with those from British Columbia about 3 times the length of those from Ontario (Sublette, unpubl. data); with a seta approx. 4 times the length of the smaller tubercle. Clypeus with 18-30 setae. Palp segment lengths (2-5) (µm) 50-80 : 190-300 : 130-220 : 200-280.



ONT

BC

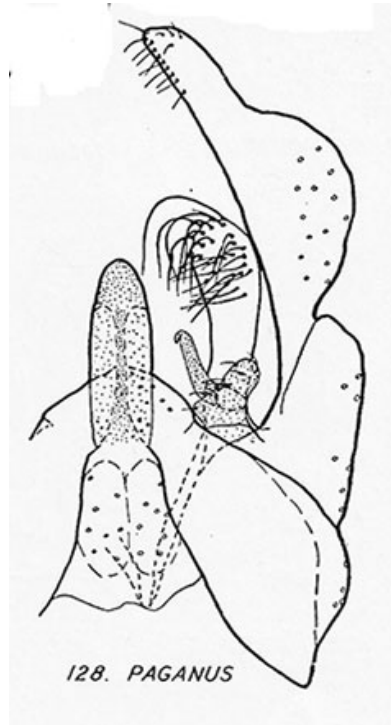
Frontal tubercles of *E. pagana* from Ontario (left) and British Columbia (right)

Thoracic setae: Acrostichals 5-11; Dorsocentrals 12-28, uni- to biserial; Prealars 5-6; Supraalar 1; Scutellar 7-13, uniserial laterally to multiserial medially. Scutellum with

a small central hump.

Legs with sparse beard, BR 3-5. Front LR 1.39-1.56; Mid LR 0.55-0.62; Hind L.R. 0.61-0.67. First tarsal segment of mid and hind legs with row of apically curved setae on anterior margin.

Townes figures the setae on tergite IX as in two large groups with about 8 setae in each group. Anal point large and broad, Ivo slightly swollen at tip and reaching about to middle of gonostylus which is quite swollen and narrows sharply over distal third.



From Townes 1945

Female: As male, but the thoracic markings, etc., are never darker than pale brown.

Antennal flagellum 5-segmented. segment lengths ( $\mu\text{m}$ ) 140-169 : 101-112 : 112-120 : 101-112 : 198-234; AR about 0.44-0.46; A5/A1 about 1.38-1.41.

Head: Clypeus with 6-24 setae. Palpal segments 2-5 ( $\mu\text{m}$ ) 50-60 : 150-210 : 150-180 : 220-300; P5/P4 1.47-1.67, P5/P3 1.43-1.47.

Thoracic setae: Acrostichals 7-8; Dorsocentrals 16-21; Prealars 5-6; Scutellar 12-14. Wing length 2.6-3.0; VR 1.10-1.18.

Legs Front LR 1.66-1.79; Mid LR 0.50-0.54; Hind L.R. 0.57-0.62.

Genitalia: Cercus quadrate, with sl. dorsal bulge; GcIX with 3 setae, TX with about 5 setae.

**Pupa:** Cephalic tubercle pointed with 1 fine terminal seta. Caudolateral spur comprising 0 - 2, but usually 1, spines.

**Fourth instar larva** not a *Chironomus* type but small (11.8-12.7 mm (2 male) with only one pair of VT (abt. 0.56- 0.66mm) and no TLt. Anal tubules about 300  $\mu\text{m}$  long and 2.5-3 times longer than wide (ventral pair may be thicker).

Gular and FC pale. Frontal sclerite with a large indistinct oval pit, with a large rugose area anterior to it.

Salivary reservoir about 3.6 times longer than wide.

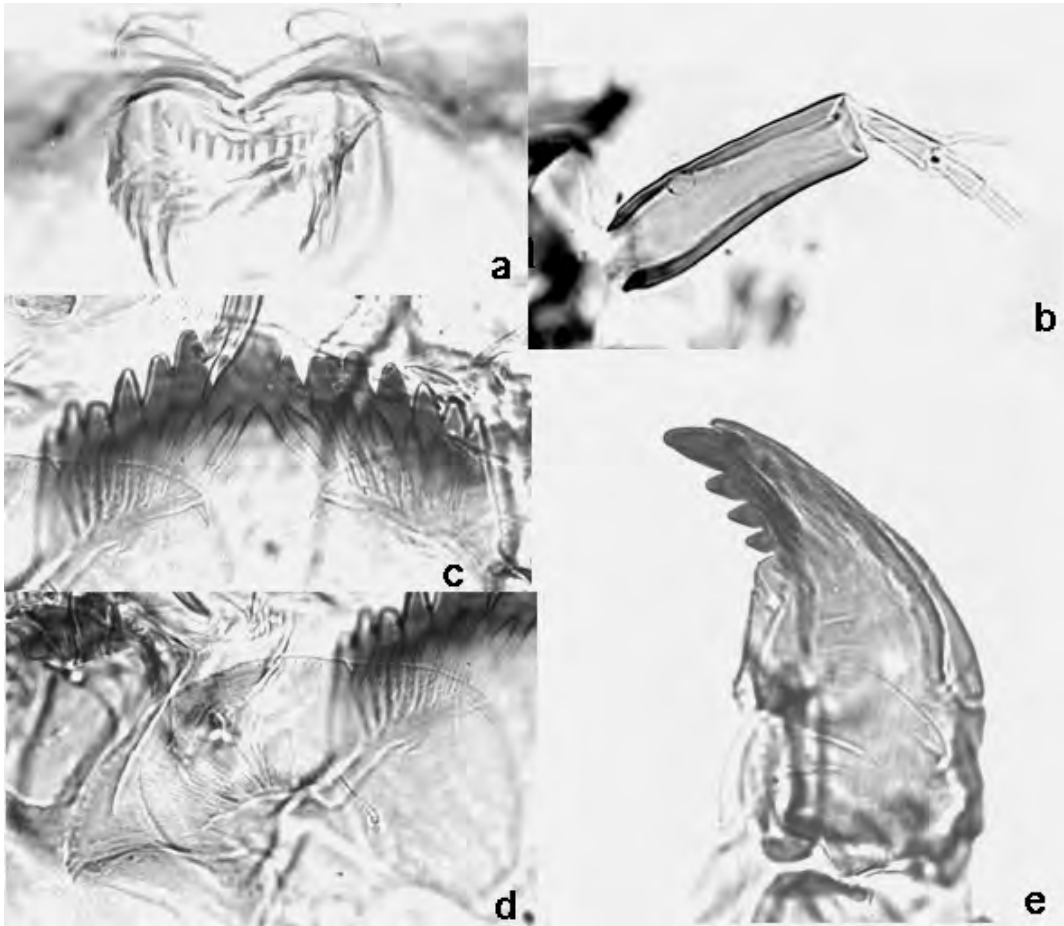
Mentum (c, below) with pointed teeth apart from central tooth which may be worn in the available specimen, c2 teeth little more than notches (type I); 4th laterals in line with other lateral teeth (type I).

VM (d, below) with a sharply downturned inner edge and a wavy anterior margin. PE (a, below) with about 12 rather irregular teeth.

Premandible with two teeth of about equal length, inner tooth wider than outer tooth.

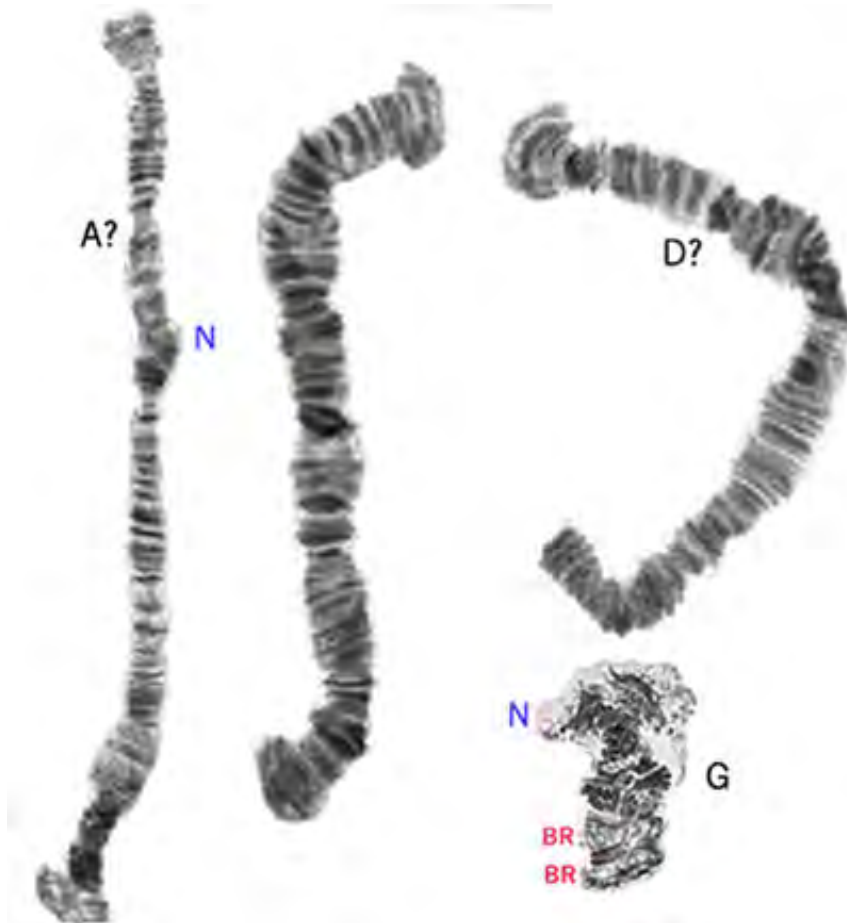
Antenna (b, below) with basal segment relatively short,  $AR = 0.8$ , about 3.3x as long as wide; A3 relatively long,  $A4/A3$  about 0.8.

Mandible (e, below) with pigmented and clearly separated third inner tooth (type IIIC).



**Cytology:** 4 polytene chromosomes with little indication of Keyl pattern.

Chromosome 4 with a terminal nucleolus which pairs, otherwise unpaired. A smaller nucleolus is sometimes developed close to the centromere of one of the long chromosomes. However, a visible nucleolar envelope is only visible in some cells, sometimes very large and fused between the two nucleoli. Centromeres heterochromatic.



Note that arm G is normally only paired at the nucleolus.

**Found:** British Columbia - (Sublette (unpubl.).  
 Manitoba - Lake Winnipeg (Sæther 2012).  
 Ontario - White Lake, Three Mile Bay (48.70°N; 85.75°N); Ottawa (45.40, -85.75),  
 and South March (**Type locality** *E. synchrona*) (44.88°N; 85.75°W), Carleton Co.  
 Saskatchewan - Floral (Driver 1971).  
 Idaho - Cataldo (Townes 1945).  
 Michigan - Isabella Co. (Townes 1945).  
 New York - Canadaroago Lake; Milford Center; Otsego Lake (Townes 1945).  
 Ohio – (Bolton 2012)  
 South Dakota - Waubay (Townes 1945).  
 Also found in the Palearctic (Belgium - region of Liège; **Type locality**).  
 Also reported to occur in Asia

Recorded from shallow eutrophic pools.

**DNA analyses:**

MtCOI barcode sequence is available from larvae from White Lake, Ontario. This sequence has 99% or better similarity to a large number of sequences in GenBank and BOLD which are only identified as *Einfeldia* sp. or Chironomidae sp.

The difference in adult cephalic tubercles reported by Sublette (see above) could indicate the presence of different species under this name in the east and west of North America. The specimens of Curry (quoted in Oliver 1971) with a PE with scale like teeth is *Einfeldia*

species A of Epler (2001) (see species 5b). The adult and pupa of this species are presumably similar to *E. pagana*, as Epler notes that J. E. Sublette identified an adult and pupa of species A as *E. pagana*.

Larval description recorded in Oliver (1971), as the synonym *E. synchrona*.

### ***Einfeldia* species A, Epler 2001 (Species 5b)**

**Adult:** The adult of this species has not been described, but it may bear some resemblance to those of *E. pagana*, since J. E. Sublette apparently misidentified an adult and pupa of this species as *E. pagana*.

**Pupa:** See note above concerning the adult.

**Fourth instar larva:** Frontal apotome with fenestra and rugosity anterior to it..  
Mentum with central tooth with slight notches (type I), lateral teeth grading evenly (type I).  
PE weakly tripartite and covered with minute spinules.  
Mandible with three inner teeth and no grooves near base.

**Cytology:** Not known.

Found in wetlands, lakes and streams in the south-eastern states.

**Found:** Florida – (Epler 29001)  
Georgia – (Epler 2001)  
Michigan – (Curry 1961 as *E. pagana*)  
North Carolina – (Epler 2001)  
Ohio – (Bolton 2012)

### ***Einfeldia* sp.**

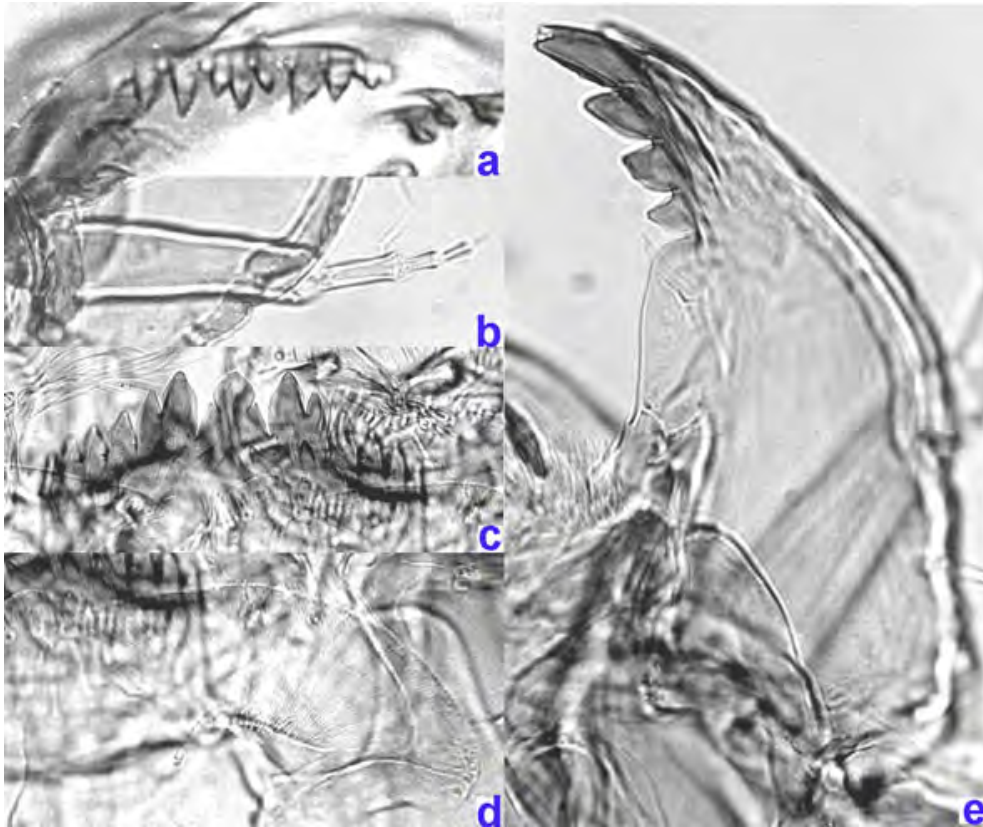
**Fourth instar larva** not a typical *Chironomus* type, relatively small; presence of VT unknown.

Mentum (Fig. c, below) with flanged teeth; c1 tooth definitely trifid with notches of c2 teeth at about 45° (type I).

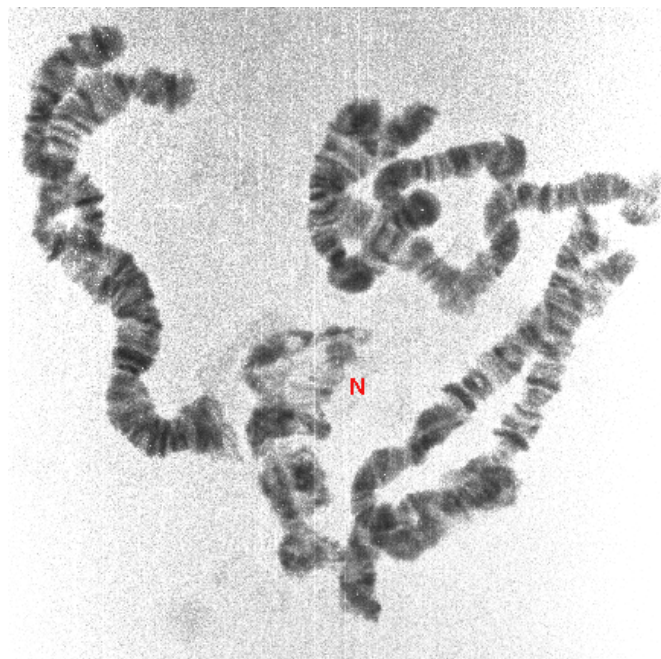
VM (Fig. d, below) with about 30 striae. PE (Fig. a, below) with about 17 irregular teeth (closest to type D).

Antenna (Fig. b, below) with basal segment relatively long and narrow, about 3.6 times as long as wide, AR about 1.75; A1/A2 about 3.5; A4/A3 about 1; relative lengths of segments: 100 : 27 : 11 : 11 : 6.

Mandible (Fig. e, below) with third inner tooth clearly separated and darkened (type IIIC)



**Cytology:** 4 polytene chromosomes, Keyl pattern cannot be readily determined. Arm G paired; nucleolus subterminal. Long chromosomes often largely unpaired (chromosomal polymorphism?)



**Found:** Alaska - Harding Lake.

**Included in *Tendipes* by Townes (1945)**



**Kiefferulus dux (Johannsen, 1905) (Species 5r)***As Chironomus dux*Synonyms: *Chironomus obscuratus* Malloch, 1915 (see below)In BOLD Bin: [BOLD:AAX0368](#)**Adult:**

Male - Wing length 2.4 mm long; LR 1.3; AR 2.6-4.8.

Frontal tubercles not observed, base 5 µm diameter. Fore tarsus with short, sparse beard (BR about 2).

Pale green. Antennal pedicel ochraceous, flagellum and palps pale brown except at their bases. Thorax ochraceous; legs pale green, brown towards their apices.

Thoracic setae: at least 14 acrostichal; 13-14 dorsocentral; 6 prealar; 2 supra alar; 12 scutellar in a single row.

Male hypopygium and superior volsella of *K. dux*

Scattered setae on tergite IX (Townes figures about 9, others abt 12 -13), some in individual spots, others with 2 in a single spot; anal point short, IVo broad and rounded at end, and reaches to about distal third of gonostylus (longer than illustrated by Townes, 1945 - his may be indicative that more than one species is included under this name, as suggested by Epler (2001). Anal point narrow at base.

Female: (1 specimen) Color essentially as male.

Antennal flagellum 5-segmented. segment lengths (µm), with % neck in brackets): 220 (0.26) : 135 (0.47) : 152 (0.38) : 132 (0.47) : 252; AR 0.40; A5/A1 1.14.

Head: FT very small abt 5x 7.5 µm (i.e. width at base greater than length). Clypeus with about 35 setae; width 1.7x antennal pedicel. Palpal segments (µm) 72 : 66 : 245 : 260 : 380; P5/P4 1.46, P5/P3 1.56.



a. Cercus & TX, b. small Frontal tubercle, c. Antenna

Thoracic setae: Acrostichals 16; Humerals 5-6 (with 2 pairs setae); Dorsocentrals 14 (humerals + dorsocentrals 19-20); Supraalars 1-2; Prealars 6-7; Scutellar 14 in a single row.

Wing length 3.52 mm, width 1.02 mm; VR 0.87.

Leg lengths (micron) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
PI	1580	1200	2000	1065	875	810	335	1.66	1.32	0.67
PII	1430	1405	825	395	290	190	150	0.59	1.02	
PIII	1315	1520	1065	530	425	245	160	0.70	0.87	

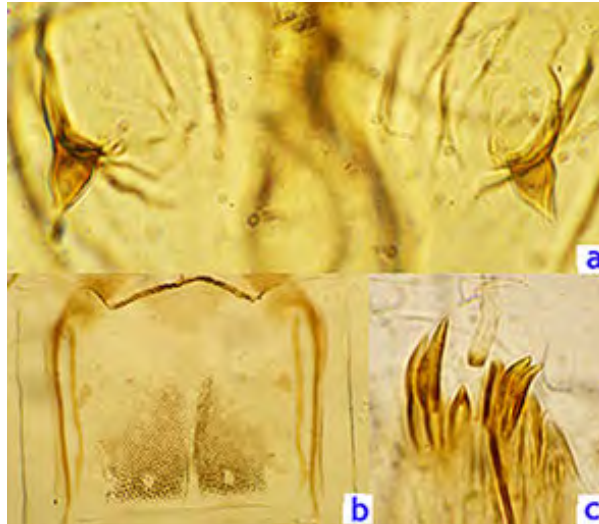
BR 1.95

4 setae on GcIX; Seg.X abt 147 x 72  $\mu$ m, 2.04 times wider than greatest depth, with 11-12 setae.

Cercus with rounded outline and a large bulge at base of ventral edge.

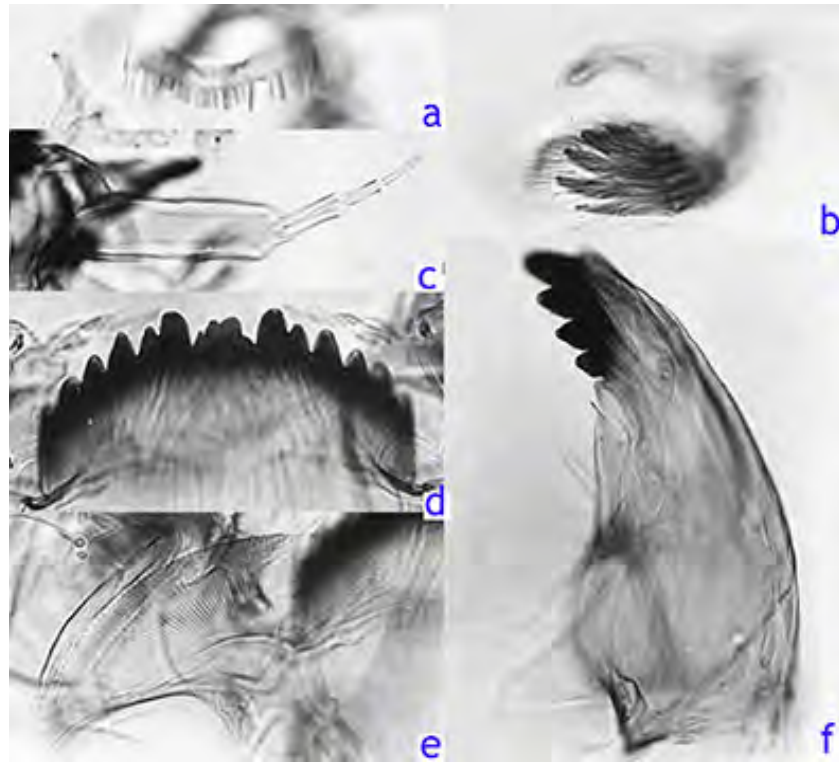
**Pupa:** Length about 7.15 mm (male), 7.97 mm (female). Female antennal sheath 886  $\mu$ m long, frontal tubules 20  $\mu$ m high and 20  $\mu$ m at base. Shagreen at posterior of segment, divided in midline so that each side is roughly triangular.

Abt 55 hooks at posterior of seg II, occupying abt 0.52 of segment width. Pedes spurii A quite large abt 252  $\mu$ m long and 54  $\mu$ m wide, about 0.24 of segment length. The spur of segment VIII has a posteriorly extended base with a number of points (about 8) of various sizes: 5-7 stout ones and 3-7 shorter ones, one of which is stout and between the longer spines with a setae inserted above it. About 136 taeniae on each side of anal fin, in about 3 rows distally.



Pupal morphology of *K. dux*: a. cephalic tubercles; b. shagreen of TIII; c. spur.

**Fourth instar larva:** A typical *Kiefferulus* larva with only one pair of ventral tubules. Head capsule somewhat flatter and broader than a typical *Chironomus* larva. Gula and frontoclypeus pale, although some darkening at posterior of frontoclypeus. Salivary reservoir firmly attached to ls-2, about 73 (66-78)  $\mu\text{m}$  wide and 18.5 (18-20)  $\mu\text{m}$  deep. Mentum (Fig. d, below) with 15 teeth, centre trifid tooth closer to type IB but c1 tooth broader (damaged in figure below), lateral teeth in an even slope. Ventromentum (Fig. e, below) with anterior margin crenulate, about 230  $\mu\text{m}$  wide and 4.5 times wider than deep with about 67 striae; median margin more sharply turned down than in other studied species. Premandible (Fig. b, below) with 6 teeth, typical of the genus, although the small 6th tooth may be difficult to see amongst the thick setal brush. PE (Fig. a, below) with about 24 irregular teeth. Antenna (Fig. c, below) proportions (units) 67 : 25 : 13 : 12 : 5, i.e. segments 3 and 4 subequal, A1 about 3.5 times longer than wide, AR about 1.2. Mandible (Fig. f, below) essentially as a type IIIC of *Chironomus*, lacking furrows, about 13 taeniae in PecM, Mdt-Mat about 30  $\mu\text{m}$ , MTR about 0.38 (0.36-0.42).



Mouthparts of *K. dux* larva: a. Pecten epipharyngis, b. Premandible, c. Antenna, d. Mentum, e. Ventromentum, f. Mandible

**Cytology:** Four polytene chromosomes. The pattern does not allow comparison with the arms of *Chironomus*, other than the smallest chromosome (below) which seems to be the homolog of arm G as it contains the nucleolus and at least two Balbiani rings. At least one polymorphic complex inversion was observed on chromosome I and a simple inversion on chromosome IV.



Polytene chromosome complement of *K. dux*

Note heterozygosity for a complex inversion on chromosome I and a simple inversion on Chromosome IV

**Found:** Ontario - Copanspin Farm, Dunrobin (45.42°N, 75.87°W), Carleton Co.; Bear Creek 1 km Carlsbad Springs (45.37°N, 75.47°W); Lake Opeongo (Townes)  
 Florida - Monticello; St. Augustine (both Townes)  
 Idaho - Cataldo (Townes)  
 Illinois - Dubois (**Type locality of *C. obscuratus***)  
 Indiana - La Fayette (Townes)  
 Iowa - Davenport (Townes)  
 Louisiana - Mound (Townes)  
 Michigan - Midland Co. (Townes)  
 Minnesota - Crookston; Houston Co. (both Townes)  
 Missouri - Atherton; St. Louis (both Townes)  
 New Jersey - Moorestown; Westville (both Townes)  
 New York - Ithaca (**Type locality**); Amsterdam; Canajoharie; Hudson; Kinderhook, Lake Sebago, Bear Mt. St. Pk.; Niskayuna; South Trenton; Tuxedo (all Townes)  
 Ohio - Summit Co. (Townes)  
 Oregon - (Independence (Townes)  
 Rhode Island - Westerly (Townes)  
 Wisconsin - Madison

The ventromentum has been studied in more detail by Cranston *et al.* (1990).

An apparently widespread species, but it needs to be clarified whether there is more than one species included and, if so, how they are distributed. Only one specimen is currently in the BOLD database, and the nearest neighbour is another recognised species of *Kiefferulus*, so provides no evidence of the existence of multiple species.

Malloch (1915) description of *Chironomus obscuratus*

60. *Chironomus obscuratus*, n. sp.

Male.—Bright green, slightly shining. Head green; scape of antennae yellow, flagellum fuscous, yellow at base, plumes brown, yellowish white at bases; palpi green, brownish apically. Mesonotum with reddish yellow vittae; spots on sternopleura and below wing-base, and the postnotum concolorous with vittae. Abdomen yellowish at apex, including the hypopygium. Legs green, tibiae and tarsi yellowish, fore tibiae and tarsi and apices of mid and hind tarsi brownish. Wings clear, veins yellowish, cross vein not darkened. Halteres green or yellowish. Frontal tubercles absent. Pronotum narrow. Hypopygium as in Figure 5, Plate XXXIV (below). Legs slender; fore tarsi without long hairs, basal joint about three fourths longer than fore tibiae (78:45), second joint one eighth shorter than tibiae (40); mid and hind legs with moderately long hairs, their tibiae with the apical combs produced into two points, each point armed with a spur. Third and fourth veins ending respectively at about the same distance before and behind apex of wing; cubitus forking distinctly, but not greatly, beyond cross vein.

Female.—Agrees in color with the male except that the fore tibiae and tarsi are more distinctly browned.

Length, 5-6 mm.

Type locality, Dubois, 111., April 24, 1914 (C. A. Hart and J. R. Malloch). Paratype from Lilly, III, June 11, 1914 (C. A. Hart).



*C. obscuratus* male hypopygium

***Kiefferulus* (?*Wirthiella*) *pungens* (Townes) 1945** (Species 4q)

*Tendipes* (*Tendipes*) *pungens* - Townes 1945.

Transferred to *Kiefferulus* by Epler (1995).

**Adult:**

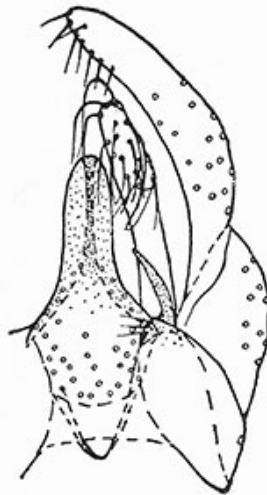
Male: from Townes 1945

Wing length 2.7 mm; LR 1.65, AR 2.9.

Pea green body of medium build. Frontal tubercles and clypeus small; middle portion of pronotum slightly widened, fore tarsus without a beard. Thoracic markings ochreas.

Femora and middle and hind tibia green, tarsi and fore tibia light brown.

Anal struts separate and extending posteriorly. Townes figures numerous scattered setae on TIX. Anal point broad, parallel sided; SVo short and very slender; IVo long and thin, shown as reaching about 3/4 of length of the gonostylus which is only moderately swollen and narrows very little distally.



134. PUNGENS

Hypopygium of *K. pungens* (Townes 1945)

Female: - not described.

**Pupa:** Rows of needle-like spines on sternites I-III, and a larger caudolateral spur on tergite VIII than *K. dux*.

**Fourth instar larva:** A typical *Kiefferulus* larva with one pair of ventral tubules. Epler (1995) gives postmentum length (shorter than VHL) as 255-290 µm, fewer than 75 striae on VM, basal antennal segment 75-98 µm long. Premandible with 5 teeth. He notes that it differs from *K. dux* (see below) only by its smaller size, but many important characters are not described.

**Cytology:** Not known

**Found:** District of Columbia - Little Falls.(Townes 1945)  
 Florida - Canoe Creek, 12 miles south of St. Cloud on Vermont Avenue (Type locality) (Townes 1945)  
 Georgia - (Caldwell *et al.* 1997)

Found in lakes (Hudson *et al.* 1990)

This species belongs to that section of *Kiefferulus* in which the anal struts of the adult male are separate and extend posteriorly. Such species have been placed in the subgenus *Wirthiella*, as Elper (2001) did with this species. However, it is currently disputed as to whether *Wirthiella* can be maintained as a subgenus, since no consistent characters seem to exist for any other life stage.

Whether or not *Wirthiella* is a valid grouping, the long narrow IVo and the broad anal point of the adult male and the noted pupal differences suggest that this species could belong in a separate subgenus with species such as the Indopacific *K. longilobus* (Kieffer).

***Goeldichironomus carus* (Townes), 1945** (Species 2s)

*Tendipes (Tendipes) carus* Townes (1945) *Goeldichironomus carus* - Contreras-Lichtenberg (1982).

**Adult**

(from Townes 1945)

Male - Wing length 3.1 mm; fore LR 1.25; antennal ratio 3.8.

Body of medium build.

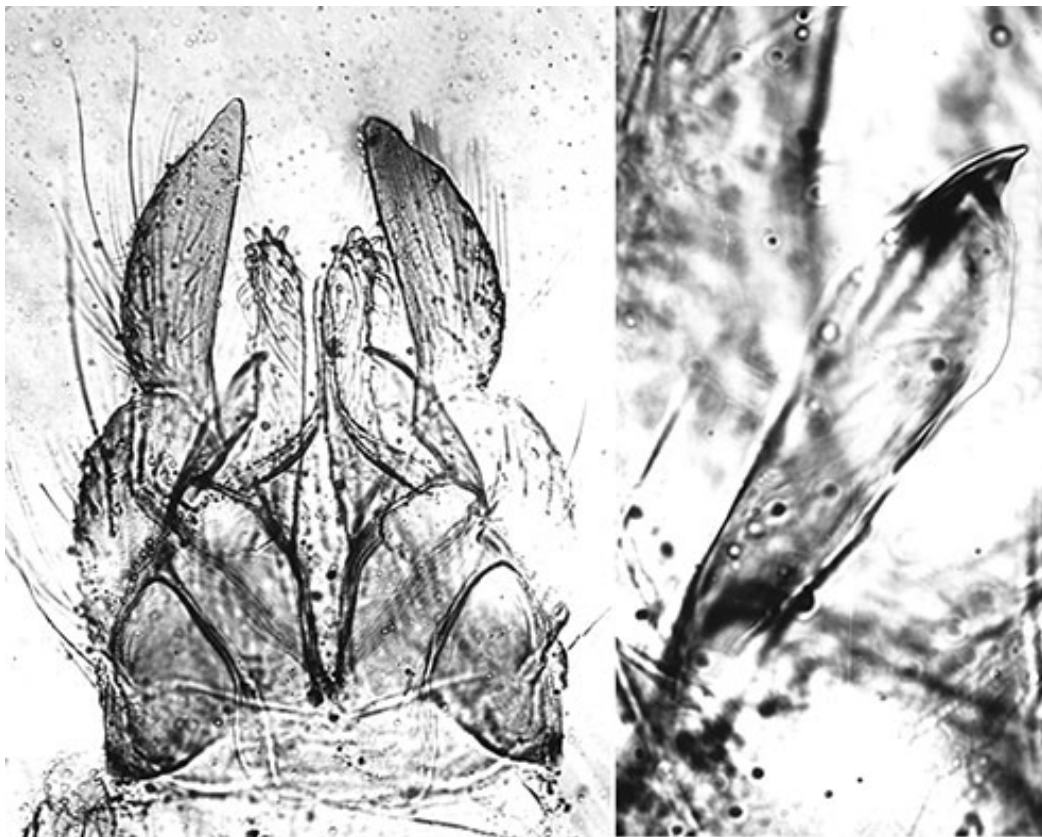
Frontal tubercles absent, clypeus very small.

Pronotum slightly narrowed in the middle.

Fore tarsus with a short beard.

Ground color ochraceous more or less tinged with green or brown, apices of femora, tibiae, and tarsal segments light brown, apical tarsal segments brown. Abdominal tergites 2-7 each with a more or less central rhomboidal brown patch.

Genitalia with narrow anal point and expanded superior volsella.



**Male terminalia of *Goeldichironomus carus***

Note the expanded superior volsella.

Female: Similar to male except for the usual sexual differences

**Fourth instar larva** a small bathophilus-type, but with a group of bristles at the rear margin of segment 10. Gula slightly darkened, FC as in *Glyptotendipes*, *Kiefferulus* and *Einfeldia* species.

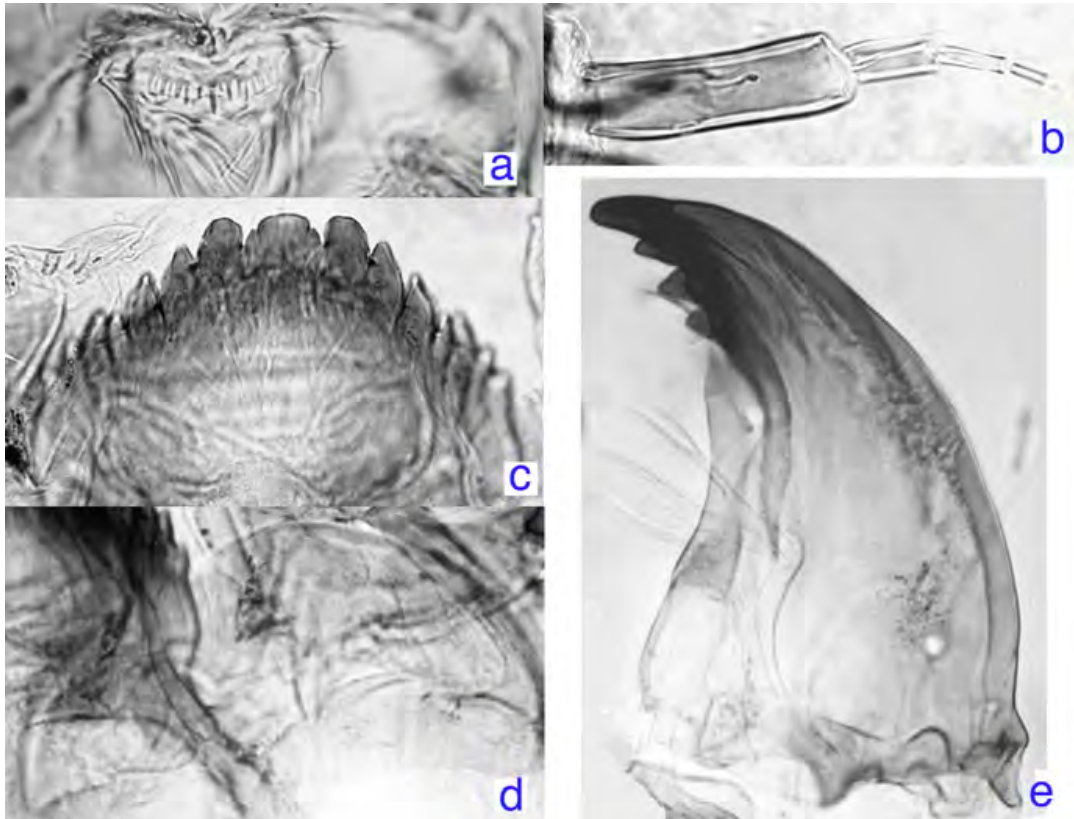


Mentum (Fig. c, below) not typically *Chironomus*, but as some other *Goeldichironomus* species; center tooth with only notches on the side, although sometimes these may be more obvious; 4th laterals reduced (typical for this species).

VM (Fig. d, below) with inner margin pointing ventrally. PE (Fig. a, below) with about 22 teeth of normal or reduced size.

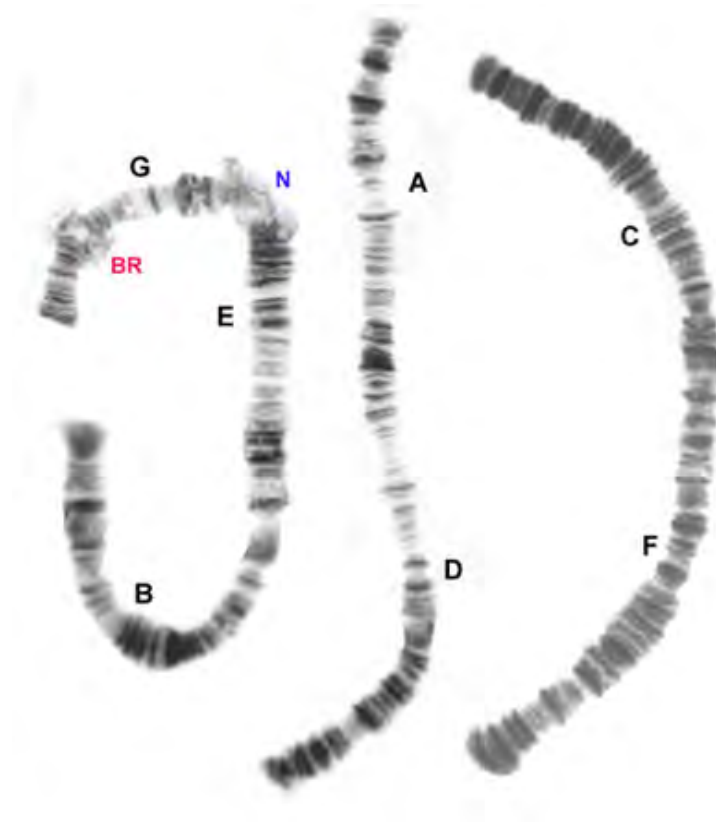
Antenna (Fig. b, below) with basal segment less than 4 times as long as wide, AR about 0.8; segment A3 relatively long, A4/A3 about 0.5.

Mandible (Fig. e, below) with 3<sup>rd</sup> inner tooth well developed and darkened, setae subdentalis with a fringed ventral margin.



The larva of this species is characterized as *Goeldichironomus* by the ventrally pointing inner margin of the ventromental plates and the serrate ventral surface of the seta subdentata, and as *G. carus* by the reduced 4th laterals of the mentum.

**Cytology:** 3 polytene chromosomes with the carus arm combination AD, BEG, CF. Keyl patterns not easily recognized. Nucleolus where arm G joins arm E; BR about  $\frac{1}{3}$  from end of arm G.



Chromosome complement of *Goeldichironomus carus*.

**Type locality:** La Mucuy, Merida, VENEZUELA.

**Found:** Florida - Winter Haven, Polk Co.

Georgia (Caldwell *et al.* 1997)

North Carolina (Caldwell *et al.* 1997)

Texas - Brownsville, Cameron Co.; Cedar Lane, Matagorda Co.; Galveston, Galveston Co.; San Antonio, Bexar Co. (all Townes 1945)

Also Barro, Colorado Island and Garun, Canal Zone; Baranquilla and Buenaventura, Columbia.

Townes notes that the adult is easily recognized by the mesoscutum, which has a brown band around the edge, just above which are three velvety-black subtriangular spots on each side, grading down in size from anterior to posterior.

Originally described as *Chironomus*, *G. carus* was transferred to *Goeldichironomus* by R. Contreras-Lichtenberg (1982) following an examination of the immatures. A photograph of the arm E-G fusion (above) was given in Martin *et al.* (1974).

***Goeldichironomus holoprasinus* (Goeldi), 1905** (Species 4r)

Syn: *Chironomus fulvipilus* Rempel (1939) - Fittkau 1965.

*Tendipes (Tendipes) fulvipilus* (Rempel) - Townes 1945.

Apparently no data in BOLD

**Adult:**

Male: from Townes (1945) and Fittkau (1985)

Wing length 2-2.7 mm. LR 1.65, AR 2.4; VR 1.2. Body slender.

Pale green with head, and thoracic vittae ochreas.

Frontal tubercles small, clypeus very small.

Thoracic setae – acrostichal 10 (8-12); dorsocentral 5 (4-8); prealar 4 (3-4); supraalar 1; scutellar 4 (4-6)

Apex of fore femur, apex and basal half of fore tibia, and tarsi, except the basal part of mid and hind tarsi, brown. Fore tarsi without a beard.

Leg Proportions *c.f.* value of 1.0 for each Tibia (Fittkau):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1.41	1	1.63	0.88	0.77	0.77	0.32	1.63	1.41	2.0
PII	1.15	1	0.59	0.31	0.25	0.16	0.11	0.59	1.15	
PIII	0.93	1	0.68	0.35	0.30	0.17	0.10	0.68	0.93	

Tergite IX with a group of 10-15 setae. Anal point long and evenly narrow, apically with a small hook; SVo curved, narrow; gonostylus swollen, but sharply narrowing at posterior end.

Female: Similar to male except for usual sexual differences.

Antennal proportions (Fittkau): 140 : 105 : 105 : 90 : 160. AR 0.36; A5/A1 1.14.

Thoracic setae – acrostichal 8.8 (8-10); dorsocentral 11.7 (11-13); prealar 4; supraalar 1; scutellar 5 (4-6).

Leg Proportions *c.f.* value of 1.0 for each Tibia (Fittkau):

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
PI	1.34	1	1.59	0.83	0.73	0.78	0.32	1.59	1.34	0.78
PII	1.09	1	0.55	0.29	0.22	0.14	0.11	0.55	1.09	
PIII	0.94	1	0.62	0.33	0.27	0.16	0.10	0.62	0.94	

Anal segments as in *Chironomus*.

**Pupa:** Length 5-15.5 mm. Exuvia hyaline; thorax tan, sometimes heavily pigmented in the region of the mesonotum; abdomen largely light but brownish on the hook row of tergite II, the shagreen and the anal spurs. Cephalic tubercles short. Basal ring kidney shaped with one tracheal branch. Dorsal hook row on TII; Pedes spurii B on segment II, Pedes spurii A present on segment IV. Dorsal shagreen on the anal segment. Posterolateral spur of segment VIII short, comb-like, slightly segmented with 2-6 small thorn-like spines. Fringe of anal lobe with about 50 lateral taeniae in a single row and 1 elongate, broad dorsal seta.

**Fourth instar larva:** Medium sized. Not a typical *Chironomus* larva – there are two pairs of ventral tubules, but the anterior pair are bifurcate, and where lateral tubules may be developed in *Chironomus*, there are split feathery bristles (Fig. f, below). The head capsule is tawny without markings. The dorsal head is basically similar to that of *Chironomus*, as is the mentum (Fig. b, below) (roughly type IA) although the center tooth and 1st laterals are raised compared to other laterals; 4th laterals not reduced.

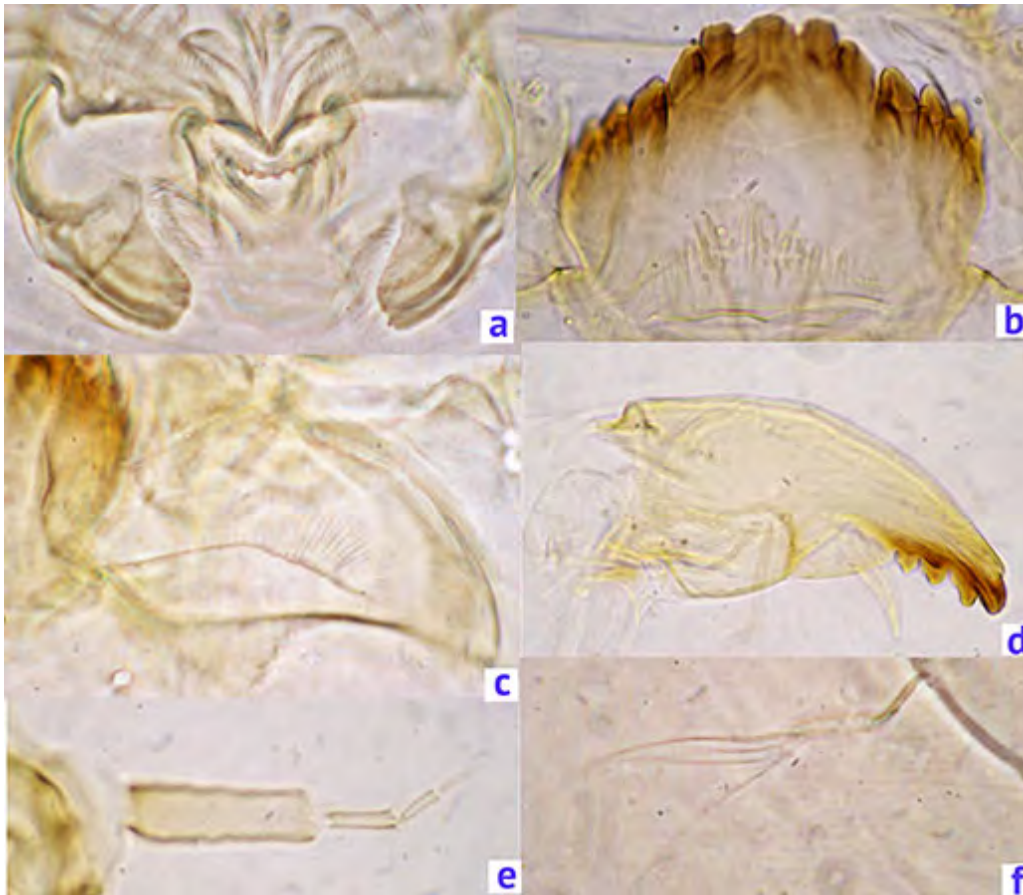
Ventromental plates (Fig. c, below) elongated (longer than mentum width) and almost touching in the midline, separated at most by width of center teeth (in *Chironomus* it is usually by the distance to between the 1st and 2nd laterals).

PE (Fig. a, below) with about 11-13 alternating small and large teeth (closest to type D, but not rounded). Premandible (Fig. a, below) of available specimens worn, but comprised of

two teeth, the inner very broad, about 7.5 times the width of the quite narrow outer tooth – not as any of the *Chironomus*-types.

Antenna (Fig. e, below) with five segments. A1 about 3.5 times longer than wide, RO in basal 1/4 to 1/3; AR about 1.17: segment proportions 21 : 7 : 5 : 4 ; 2.

Mandible (Fig. d, below) with 4 darkened inner teeth; seta subdentalis large with a row of small teeth along the inner margin. About 20 taeniae in PMA, but no furrows near base.



**Cytology:** 4 polytene chromosomes. Chromosome 4 long with a subterminal nucleolus and at least 2 BRs, a large one about 1/3 of arm length from nucleolus, and a possible smaller one near the other end of the arm.



Chromosome 4 of *G. holoprasinus*

Type locality: Belem, Para, BRAZIL

Found: Florida - St. Augustine; West Palm Beach (Townes 1945)

Maryland - Berlin (Townes 1945)

Texas - Austin, Travis Co.; Sugar Land.

Hawaii - (probably by human transport).

Also found in Central and South America.

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**GEOGRAPHIC DISTRIBUTION**

## Locality

## Alabama

- C. magnus, Pt 1
- C. plumosus, Pt 1
- C. staegeri, Pt 1

## Alaska

- C. acidophilus, Pt 2
- C. ?decumbens, Pt 1
- C. longistylus, Pt 1
- C. maturus, Pt 2
- ‡C. pilicornis, Pt 1
- C. prior (Type locality), Pt 1
- C. sanctipauli (Type locality), Pt 1
- C. tardus, Pt 1
- C. trabicola, Pt 1
- C. tentans, Pt 2
- Einfeldia sp. 2y, Pt 2
- C. sp. Anchorage, Pt 1
- C. sp. Le1, Pt 1
- C. sp. 3p, Pt 1
- C. sp. 4m, Pt 2
- C. sp. 5x, Pt 2

## Alberta

- C. acidophilus, Pt 2
- C. atrella, Pt 1
- C. annularius, Pt 1
- C. bifurcatus, Pt 1
- C. 'butleri', Pt 1
- C. dilutus, Pt 2
- C. hyperboreus, Pt 1
- C. melanescens, Pt 2
- C. pilicornis, Pt 1
- C. plumosus, Pt 1
- C. rempelii (Type locality), Pt 1
- C. tuberculatus, Pt 2
- ‡C. utahensis. Pt 1
- C. vockerothi (Type locality), Pt 2
- C. sp. 1TE, Pt 2
- C. sp. f, Pt 1
- C. sp. u, Pt 1
- C. sp. 2p, Pt 2

- C. sp. 2u, Pt 1

## Arizona

- C. bifurcatus, Pt 1
- C. nr. stigmaterus, Pt 1
- C. utahensis Pt 1

## Arkansas

- C. calligraphus, Pt 2
- C. crassicaudatus, Pt 1
- C. decorus(-gp), Pt 1
- C. harpi (Type locality), Pt 1
- C. sp. 4l (dec.gp.), Pt 1
- C. (Chaet) atroviridis, Pt 2
- C. Chaet ochreatus, Pt 2
- C. (Lobo.) dorsalis, Pt 2
- B. brunneipennis, Pt 2
- E. chelonia, Pt 2

## British Columbia

- C. annularius, Pt 2
- C. anthracinus, Pt 1
- C. athalassicus, Pt 1 (Type locality)
- C. atrella, Pt 1
- C. cucini, Pt 1
- C. dilutus, Pt 2
- C. entis, Pt 1
- C. plumosus, Pt 1
- C. staegeri, Pt 1
- C. trabicola, Pt 1
- C. vancouveri, Pt 1
- C. whitseli, Pt 2
- C. sp. NAI, Pt 1
- C. sp. nr. annularius, Pt 2
- ‡C. (Chaet) atroviridis, Pt 2
- E. pagana, Pt 2
- C. sp. f, Pt 2

## California

- ‡C. acerbiphilus, Pt 2
- C. anonymus, Pt 2
- C. anthracinus, Pt 1
- C. atrella, Pt 1
- C. bifurcatus, Pt 1
- C. 'butleri', Pt 1
- C. calligraphus, Pt 2
- C. cucini, 4l
- C. frommeri, Pt 1

- C. 'grodhausi'* Pt 1  
*C. hawaiiensis*, Pt 2  
*C. maturus*, Pt 2  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. nr. stigmaterus*, Pt 1  
*C. striatipennis*, Pt 2  
*C. utahensis*, Pt 1  
*C. whitseli*, Pt 2 (Type locality)  
*C. (L.) pseudomendax*, Pt 2  
*C. (L.) storai*, Pt 2  
*C. sp. 3b*, Pt 1
- Colorado
- C. atrella*, Pt 1  
*C. decorus*, Pt 1  
*C. dilutus*, Pt 2  
*C. entis*, Pt 1  
*C. maturus*, Pt 2  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. utahensis*, Pt 1
- Connecticut
- C. quinnitukqut* (Type locality), Pt 1  
*C. (Chaet) atroviridis*, Pt 2
- District of Columbia
- C. staegeri*, Pt 1  
*C. (Chaet) atroviridis*, Pt 2  
*E. chelonia*, Pt 2  
*K. pungens*, Pt 2
- Florida
- C. calligraphus* Ty.1, Pt 2  
*C. columbiensis*, Pt 2  
*C. crassicaudatus*, Pt 1  
*C. magnus*, Pt 1  
*C. stigmaterus*, Pt 1  
*¿C. tuxis*, Pt 1  
*C. sp. 2s*, Pt 2  
*C. sp. 2t*, Pt 2  
*C. sp. WOC*, Pt 2  
*C. (Lobo.) dorsalis*, Pt 2  
*C. (Lobo) austini*, Pt 2 (Type locality)  
*C. sp. "Florida"*, Pt 1  
*B. brunneipennis* Pt 2  
*Goeldich. carus*, Pt 2
- Goeldich. holoprasinus*, Pt 2  
*E. species A*, Pt 2  
*K. dux*, Pt 2  
*K. pungens*, Pt 2
- Georgia
- C. calligraphus*, Pt 2  
*C. crassicaudatus*, Pt 1  
*C. magnus* Pt 1  
*C. plumosus*, Pt 1  
*¿C. tuxis*, Pt 1  
*C. sp. WOC*, Pt 2  
*C. (Chaet.) ochreatus*, Pt 2  
*C. (Lobo.) dorsalis*, Pt 2  
*E. species A*, Pt 2  
*Goeldich. carus*, Pt 2  
*K. pungens*, Pt 2
- Greenland
- C. ?decumbens*, Pt 1  
*C. hyperboreus* (Type locality), Pt 1  
*¿C. pilicornis*, Pt 1  
*¿C. riihimakiensis*, Pt 1  
*¿C. riparius*, Pt 1  
*C. staegeri* (Type locality), Pt 1  
*sp. 5c (1TE)*, Pt 1  
*sp. 5d*, Pt 2  
*sp. 5e (TE11)*, Pt 1  
*sp. 5h*, Pt 1  
*sp. 5i (8TE)*, Pt 2  
*sp. julianehåb*, Pt 1  
*sp. 5p*, Pt 1
- Hawaii
- C. hawaiiensis*, Pt 2  
*Goeldich. holoprasinus*, Pt 2
- Hudson Bay Territory
- C. biseta*, Pt 2 (Type locality)  
*C. tuberculatus*, Pt 2 (Type locality)
- Idaho
- C. staegeri*, Pt 1  
*¿C. (Chaet) atroviridis*, Pt 2  
*C. (Lobo.) dorsalis*, Pt 2  
*E. pagana*, Pt 2  
*K. dux*, Pt 2
- Illinois

- C. crassicaudatus*, Pt 1 (Type locality)  
*C. harpi*, Pt 1  
*C. staegeri*, Pt 1  
*C. stigmaterus*, Pt 1  
 ⚡*C. (Chaet) atroviridis*, Pt 2  
*K. dux* Pt 2
- Indiana
- C. anthracinus*, Pt 1  
*C. annularius sensu Strenzke*, Pt 1  
*C. atrella*, Pt 1  
*C. 'butleri'* Pt 1  
*C. crassicaudatus*, Pt 1  
*C. cucini*, Pt 1  
*C. entis*, Pt 1  
*C. maturus*, Pt 2  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. (Chaet.) ochreatus*, Pt 2  
*B. brunneipennis* Pt 2  
*K. dux*, Pt 2
- Iowa
- C. crassicaudatus*, Pt 1  
*C. dilutus*, Pt 2  
*C. staegeri*, Pt 1  
*C. sp. 2u*, Pt 1  
*C. sp. 5i (sp. 8TE)*, Pt 2  
 ⚡*C. (Chaet) atroviridis*, Pt 2  
*C. (Lobo) dorsalis*, Pt 2  
*B. brunneipennis*, Pt 2  
*K. dux* Pt 2
- Kansas
- C. bifurcatus*, Pt 1  
*C. 'butleri'*, Pt 1  
*C. calligraphus*, Pt 2  
*C. crassicaudatus*, Pt 1  
*C. riparius*, Pt 1  
*C. staegeri*, Pt 1  
*sp. 3l*, Pt 2  
*sp. 4l*, Pt 1
- Kentucky
- C. magnus*, Pt 1  
*C. plumosus*, Pt 1
- Labrador
- C. longistylus*, Pt 1  
*C. staegeri*, Pt 1  
*C. sp. f*, Pt 1  
*C. sp. Anchorage (sp. 3p)*, Pt 1  
*C. sp. 5t*, Pt 1
- Louisiana
- C. crassicaudatus*, Pt 1  
*C. maturus*, Pt 2  
*C. staegeri*, Pt 1  
*C. stigmaterus*, Pt 1  
*C. sp. WOC*, Pt 2  
*sp. 4l*, Pt 1  
*B. natchitochaeae*, Pt 2  
*K. dux*, Pt 2
- Maine
- C. (Chaet.) ochreatus*, Pt 2  
*C. tuxis*, Pt 1
- Manitoba
- C. annularius*, Pt 1  
 ⚡*C. anthracinus*, Pt 1  
 ⚡*C. atrella*, Pt 1  
 ⚡*C. atritibia*, Pt 1  
*C. crassicaudatus*, Pt 1  
*C. dilutus*, Pt 2  
*C. entis*, Pt 1  
*C. hyperboreus*, Pt 1  
*C. maturus*, Pt 2  
*C. pallidivittatus*, Pt 2  
*C. pilicornis*, Pt 1  
*C. plumosus*, Pt 1  
*C. rempelii* Pt 1  
*C. riparius*, Pt 1  
*C. staegeri*, Pt 1  
 ⚡*C. tuxis*, Pt 2  
 ⚡*C. (Chaet.) atroviridis*, Pt 2  
*C. sp. u*, Pt 1  
*C. sp. 2u*, Pt 1  
*C. sp. 5i (sp. 8TE)*, Pt 2  
*sp. 5e (TE11)*, Pt 1  
*C. sp. 5t*, Pt 1  
*C. sp. Anchorage (sp. 3p)*, Pt 1  
*B. brunneipennis*, Pt 2  
*E. pagana*, Pt 2
- Maryland

- C. crassicaudatus*, Pt 1  
*C. riparius*, Pt 1  
 Goeldich. *holoprasinus*, Pt 2  
 Massachusetts  
   *C. atrella*, Pt 1  
   *C. bifurcatus*, Pt 1  
   *C. 'butleri'*, Pt 1  
   *C. dilutus*, Pt 2  
   *C. plumosus*, Pt 1  
   *C. quinnitukqut*, Pt 1  
   *C. staegeri*, Pt 1  
   *C. sp. 'Cape Cod'* Pt 1  
   ♣*C. (Chaet) atroviridis*, Pt 2  
   *C. (Chaet.) ochreatus*, Pt 2  
   *C. (Lobo.) dorsalis*, Pt 2  
   *B. brunneipennis*, Pt 2  
 Mexico  
   *C. alchichica*, Pt 1  
   *C. stigmaterus*, Pt 1  
 Michigan  
   *C. bifurcatus*, Pt 1  
   *C. 'butleri'*, Pt 1  
   *C. crassicaudatus*, Pt 1  
   *C. decorus*, Pt 1  
   *C. entis*, Pt 1  
   *C. mozleyi*, Pt 1  
   *C. plumosus*, Pt 1  
   *C. staegeri*, Pt 1  
   *C. tuxis*, Pt 1  
   *C. winnelli*, Pt 1  
   ♣*C. (Chaet) atroviridis*, Pt 2  
   *C. (Chaet.) ochreatus*, Pt 2  
   ♣*C. (Lobo.) montuosus* Pt 2  
   *E. species A*, Pt 2  
   *Benthalia brunneipennis*, Pt 2  
   *K. dux*, Pt 2  
 Minnesota  
   *B. brunneipennis*, Pt 2  
   *C. annularius*, Pt 1  
   *C. atrella*, Pt 1  
   *C. bifurcatus*, Pt 1  
   *C. 'butleri'*, Pt 1  
   *C. crassicaudatus*, Pt 1  
   *C. cucini* 41  
   *C. dilutus*, Pt 2  
   *C. entis*, Pt 1  
   *C. plumosus*, Pt 1  
   *C. staegeri*, Pt 1  
   *C. 'tigris'*, Pt 1  
   *C. tuxis*, Pt 1  
   *C. utahensis*, Pt 1  
   *C. sp. 3g*, Pt 1  
   *C. sp. Anchorage*, Pt 1  
   ♣*C. (Chaet) atroviridis*, Pt 2  
   *K. dux*, Pt 2  
 Mississippi  
   *C. anonymus*, Pt 2  
   *C. 'butleri'*, Pt 1  
   *C. decorus*, Pt 1  
 Missouri  
   *C. staegeri*, Pt 1  
   *C. riparius*, Pt 1  
   *C. (Lobo) dorsalis*, Pt 2  
   *K. dux*, Pt 2  
 Montana  
   *C. utahensis*, Pt 1  
 Nebraska  
   *C. crassicaudatus*, Pt 1  
   *C. stigmaterus*, Pt 1  
 Nevada  
   *C. atrella* (type locality), Pt 1  
   *C. utahensis*, Pt 1  
 Newfoundland  
   *C. longistylus*, Pt 1  
   *C. riparius* gp. sp. f, Pt 1  
   *C. sp. 3p*, Pt 2  
   *C. sp. 5t*, Pt 1  
 New Brunswick  
   *C. annularius*, Pt 1  
   *C. bifurcatus*, Pt 1  
   *C. 'proulxi'* (2b), Pt 1  
   *C. dec. gp. sp. j*, Pt 1  
   *C. dec. gp. sp. 3h*, Pt 1  
 New Hampshire  
   *C. anthracinus*, Pt 1  
   *C. staegeri*, Pt 1  
   *C. sp. k*, Pt 1  
 New Jersey

- C. crassicaudatus*, Pt 1  
*C. staegeri*, Pt 1  
*C. stigmaterus*, Pt 1  
*C. tuxis*, Pt 1  
*C. (Chaet.) ochreatus*, Pt 2 (Type locality)  
*C. (Lobo.) dorsalis*, Pt 2  
*B. brunneipenis*, Pt 2  
*E. chelonia* Pt 2  
*K. dux*, Pt 2
- New Mexico
- C. atrella*, Pt 1  
*C. 'butleri'*, Pt 1  
*C. decorus*, Pt 1  
*C. dilutus*, Pt 2  
*C. maturus*, Pt 2  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. stigmaterus*, Pt 1  
*C. utahensis*, Pt 1
- New York
- C. cucini*, Pt 1  
*C. decorus*, Pt 1  
*C. dilutus*, Pt 2  
*C. harpi*, Pt 1  
*C. maturus*, Pt 2  
*C. riparius*, Pt 1  
*C. staegeri*, Pt 1  
*C. stigmaterus*, Pt 1  
*C. tuxis*, Pt 1 (Type locality)  
*C. (Chaet) atroviridis*, Pt 2 (type locality)  
*C. (Chaet.) ochreatus*, Pt 2  
*C. (Lobo) austini*, Pt 2  
*C. (Lobo.) dorsalis*, Pt 2  
*E. chelonia*, Pt 2 (type locality)  
*E. pagana*, Pt 2  
*B. brunneipenis*, Pt 2  
*K. dux*, Pt 2
- North Carolina
- C. crassicaudatus*, Pt 1  
*C. staegeri*, Pt 1  
*C. riparius*, Pt 1  
*B. brunneipenis*, Pt 2
- C. (Lobo) austini*, Pt 2  
*C. (Lobo) dorsalis*, Pt 1  
*E. species A*, Pt 2  
*Goeldichironomus carus*, Pt 2
- North Dakota
- C. annularius*, Pt 1  
*C. athalassicus* Pt 1  
*C. atrella*, Pt 1  
*C. bifurcatus*, Pt 1  
*C. 'butleri'*, Pt 1  
*C. dilutus*, Pt 2  
*C. entis*, Pt 1  
*C. pallidivittatus*, Pt 2  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. utahensis* Pt 1  
*C. sp. Anchorage* Pt 1
- Northwest Territories
- C. longistylus*, Pt 1  
*C. pilicornis*, Pt 1  
*C. staegeri*, Pt 1  
*C. riparius*, Pt 1  
*C. jonmartini*, Pt 1  
*C. sp. NAII*, Pt 1
- Nunavut
- C. atritibia*, Pt 1  
*C. decumbens*, Pt 1 (Type locality)  
*C. hyperboreus*, Pt 1  
*C. islandicus*, Pt 1  
*C. trabricola*, Pt 1  
*C. sp. Greiner Lake*, Pt 1  
*C. sp. LE1*, Pt 1  
*C. sp. v*, Pt 2
- Nova Scotia
- C. melanescens*, Pt 2
- Ohio
- C. crassicaudatus*, Pt 1  
*C. magnus*, Pt 1  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. stigmaterus*, Pt 1  
*C. (Chaet) atroviridis*, Pt 2  
*C. (Lobo) dorsalis*, Pt 1  
*E. pagana*, Pt 2

- E. species A, Pt 2  
 C. sp. Florida, Pt 2  
 K. dux, Pt 2
- Oklahoma  
 C. crassicaudatus, Pt 1  
 C. magnus, Pt 1  
 C. entis, Pt 1  
 C. plumosus, Pt 1  
 C. stigmaterus, Pt 1
- Ontario  
 C. annularius, Pt 1  
 C. anthracinus, Pt 1  
 C. atrella, Pt 1  
 C. bifurcatus, Pt 1 (Type locality)  
 C. crassicaudatus, Pt 1  
 C. cucini, Pt 1  
 C. decorus, Pt 1  
 C. dilutus, Pt 2  
 C. entis, Pt 1  
 C. harpi, Pt 1  
 C. maturus, Pt 2  
 C. melanescens, Pt 2  
 C. plumosus, Pt 1  
 C. 'proulxi' (2b), Pt 1  
 C. riparius, Pt 1  
 C. staegeri, Pt 1  
 C. tuxis, Pt 1  
 C. sp. b ('parablaylocki'), Pt 1  
 C. sp. c, Pt 1  
 C. sp. f, Pt 1  
 C. sp. h, Pt 1  
 C. sp. j, Pt 1  
 C. sp. k, Pt 1  
 C. 'tigris', Pt 1  
 C. sp. u, Pt 1  
 C. sp. z, Pt 2  
 C. sp. 2a, Pt 1  
 C. sp. 2u, Pt 1  
 C. (Lobo.) nr.austini, Pt 2  
 C. (Lobo.) dorsalis, Pt 2  
 C. (Chaet) atroviridis, Pt 2  
 C. (Chaet) bitumineus, Pt 2  
 C. sp. 3h, Pt 1  
 C. sp. 3i, Pt 1
- C. sp. NAI, Pt 1  
 C. sp. NAII, Pt 1  
 C. sp. NAIII (c.f. venustus), Pt 1  
 C. sp. algonquian, Pt 1  
 C. sp. Obatanga, Pt 1  
 C. sp. parariprius, Pt 2  
 B. brunneipennis, Pt 2  
 E. pagana, Pt 2  
 K. dux, Pt 2
- Oregon  
 C. bifurcatus, Pt 1  
 C. frommeri, Pt 1  
 C. utahensis, Pt 1  
 K. dux, Pt 2
- Pennsylvania  
 C. crassicaudatus, Pt 1  
 C. dilutus, Pt 2  
 C. staegeri, Pt 1  
 C. stigmaterus, Pt 1  
 C. sp. u, Pt 2  
 C. sp. 3i, Pt 1
- Prince Edward Island  
 C. annularius, Pt 1  
 C. atrella, Pt 1  
 C. melanescens, Pt 2  
 C. sp. f, Pt 1
- Quebec  
 C. bifurcatus, Pt 1  
 C. 'butleri', Pt 1  
 C. cucini, Pt 1  
 C. harpi, Pt 1  
 C. hyperboreus, Pt 1  
 C. maturus, Pt 2  
 C. plumosus, Pt 1  
 C. staegeri, Pt 1  
 C. sp. f, Pt 1  
 C. sp. j, Pt 1  
 sp. tigris, Pt 1  
 C. (Chaet) atroviridis, Pt 2  
 C. (Chaet.) ochreatus, Pt 2  
 C. sp. NAIII (c.f. venustus), Pt 1  
 C. sp. NAI, Pt 1
- Rhode Island

- C. (Chaet) ochreatus*, Pt 1  
*C. (Lobo.) dorsalis*, Pt 2  
*K. dux*, Pt 2  
 Saskatchewan  
*C. annularius*, Pt 1  
*C. 'butleri'*, Pt 1  
*C. dilutus*, Pt 2  
*C. entis*, Pt 1  
*C. melanescens*, Pt 2  
*C. pallidivittatus*, Pt 2  
*‡C. pilicornis*, Pt 1  
*C. plumosus*, Pt 1  
*C. staegeri*, Pt 1  
*C. rempelii*, Pt 1  
*‡C. (Chaet) atroviridis*, Pt 2  
*C. sp.f.*, Pt 1  
*C. sp. u*, Pt 1  
*sp. 3j*, Pt 1  
*C. sp. NAII*, Pt 1  
 South Carolina  
*C. crassicaudatus*, Pt 1  
*C. riparius* Pt 1  
*C. staegeri*, Pt 1  
*C. sp. u*, Pt 1  
*C. (Chaet) ochreatus*, Pt 2  
*C. (Lobo.) austini*, Pt 2  
*C. (Lobo.) dorsalis*, Pt 2  
*B. natchitochaeae*, Pt 2  
 South Dakota  
*C. atrella* Pt 1  
*C. crassicaudatus*, Pt 1  
*C. decorus*, Pt 1  
*C. dilutus*, Pt 2  
*C. entis*, Pt 1  
*C. harpi*, Pt 1  
*C. maturus*, Pt 2  
*C. pallidivittatus*, Pt 2  
*‡C. pilicornis*, Pt 1  
*C. plumosus*, Pt 1  
*C. riparius*, Pt 1  
*C. staegeri*, Pt 1  
*C. stigmaterus*, 51  
*‡C. tuberculatus*, Pt 2  
*C. utahensis*, Pt 1  
*C. sp. u*, Pt 1  
*‡C. sp. 3g*, Pt 1  
*B. brunneipennis*, Pt 2  
*E. pagana*, Pt 2  
 Tennessee  
*C. blaylocki*, Pt 1  
*C. crassicaudatus*, Pt 1  
*C. magnus*, Pt 1  
*C. riparius*, Pt 1  
*C. staegeri*, Pt 1  
*C. species WOC*, Pt 2  
*C. (Lobo.) dorsalis*, Pt 2  
 Texas  
*C. 'butleri'*, Pt 1  
*C. crassicaudatus*, Pt 1  
*C. stigmaterus*, Pt 1  
*C. anonymus*, Pt 1  
*Goeldichironomus carus*, Pt 2  
*Goeldichironomus holoprasinus*, Pt 2  
 Utah  
*C. dilutus*, Pt 2  
*C. utahensis*, Pt 1 Type locality  
 Vermont  
*C. 'butleri'*, Pt 1  
*C. decorus* gp. sp. c, Pt 1  
 Virginia  
*‡C. (Chaet) atroviridis*, Pt 2  
*C. (Chaet) ochreatus*, Pt 2  
 Virgin Islands  
*C. columbiensis*, Pt 2  
 Washington  
*C. staegeri*, Pt 1  
 West Indies  
*C. sp. 2o*, Pt 1  
 Wisconsin  
*C. annularius sensu Strenzke*, Pt 1  
*C. anthracinus*, Pt 1  
*C. atrella*, Pt 1  
*C. bifurcatus*, Pt 1  
*C. 'butleri'*, Pt 1  
*C. crassicaudatus*, Pt 1  
*C. decorus*, Pt 1  
*C. dilutus*, Pt 2

- C. entis, Pt 1
- C. maturus, Pt 2
- C. melanescens Pt 2
- C. plumosus, Pt 1
- C. rempelii, Pt 1
- C. riparius, Pt 1
- C. staegeri, Pt 1
- C. tenuistylus, Pt 1
- C. utahensis, Pt 1
- C. sp. b ('parablaylocki'), Pt 1
- C. sp. tigris, Pt 1
- C. nr. anthracinus (sp. 3c), Pt 1
- C. (Chaet.) ochreatus, Pt 2
- C. (Lobo.) dorsalis, Pt 2
- C. sp. 4s (nr. *tenuistylus*), Pt 1
- C. (Lobo.) sp. 4v, Pt 2

Wyoming

- C. acerbiphilus, Pt 2
- C. dilutus, Pt 2
- C. riparius, Pt 1

Yukon Territory

- C. hyperboreus, Pt 1
- C. longistylus, Pt 1
- C. lugubris, Pt 2
- C. maturus, Pt 2
- C. sp. TE11, Pt 1
- C. sp. 5i ('8TE'), Pt 2
- C. sp. 5j, Pt 2
- C. sp. u, Pt 1



Species			
	<i>C. decorus</i> group (sp. 2a),		Pt 1
Benthalia brunneipennis (Johannsen) (sp. 3k),	<i>C. decorus</i> group (sp. 2t),		Pt 2
	<i>C. decorus</i> R.&F (sp.3f) - see also <i>decorus</i>		
Benthalia natchitochae (Sublette) (sp. 4n),	Joh.		Pt 1
	<i>C. decorus</i> group (sp. 3h),		Pt 1
<i>C. (Chaetolabis) atroviridis</i> Townes (sp. 2i),	<i>C. decorus</i> group (sp. 3i),		Pt 1
	<i>C. decorus</i> group (sp. 3j),		Pt 1
<i>C. (Chaetolabis) bitumineus</i> L & V. (sp. 2h),	<i>C. decorus</i> group? (sp. 4l)		Pt 1
	<i>C. decorus</i> group sp. 1- see <i>bifurcatus</i>		
<i>C. (Chaetolabis) ochreatus</i> Townes (sp. 3e),	<i>C. decorus</i> group sp. 2 - see 'butleri'		
	<i>C. decorus</i> or <i>riparius</i> group (sp. 3l),		Pt 2
<i>C. nr. aberratus</i> according to Wülker (sp. 3b),	<i>C. ?decumbens</i> (sp. 2x)		Pt 1
	<i>C. nr. decumbens</i> (sp. h),		Pt 1
<i>C. acerbiphilus</i> Tokunaga (sp. 4j)	<i>C. dilutus</i> Shobanov et al. (sp. t),		Pt 2
<i>C. acidophilus</i> Keyl (sp. 4f)	<i>C. (Lobo.) dorsalis</i> Meigen (sp. 4g)		Pt 2
<i>C. alchichica</i> Acosta et al.	<i>C. entis</i> Shobanov&Djomin (sp. 3o),		Pt 1
<i>C. annularius</i> sensu Strenzke	<i>C. flaviventris</i> - see <i>C. staegeri</i>		
<i>C. anonymus</i> Williston (sp. 2o),	<i>C. frommeri</i> Sub. & Subl. (sp. 2d),		Pt 1
<i>C. anthracinus</i> Zetterstedt (sp. q),	<i>C. fulvipilus</i> - see <i>Goeldichironomus</i>		
<i>C. annularius</i> (sp. 3d),	<i>holoprasinus</i>		Pt 2
<i>C. nr. anthracinus</i> (sp. 3b),	<i>C. grodhausi</i> (sp. 2r),		Pt 2
<i>C. nr. anthracinus</i> (sp. 3c),	<i>C. harpi</i> Sublette (sp. 2z),		Pt 1
<i>C. athalassicus</i> Cannings (sp. 2v),	<i>C. hawaiiensis</i> (sp. 5o)		Pt 2
<i>C. atrella</i> Townes (sp. i),	<i>C. hyperboreus</i> (sp. x),		Pt 1
<i>C. nr. atrella</i> Anderson&Hitchcock (sp. 2n),	<i>C. islandicus</i> (sp. 5s)		Pt 1
	<i>C. jonmartini</i> Lindeberg & Wiederholm (sp. 4e)		Pt 1
<i>C. ?nr. atrella</i> (sp. 2r),	<i>C. karensis</i> - see <i>C. anonymus</i>		
<i>C. atritibia</i> Malloch (sp. 4c)	<i>C. laetus</i> (sp. 8TE) (sp. 5i),		Pt 2
<i>C. (Lobo.) austini</i> (Beck&Beck) (sp. 4h)	<i>C. longistylus</i> Goetghebuer (sp. 3n),		Pt 1
<i>C. (Lobo.) ?nr. austini</i> (sp. 2e),	<i>C. lugubris</i> (sp. 5n)		Pt 2
<i>C. balatonicus</i> (misident) (sp.3q)	<i>C. magnus</i> White & Ramsey (sp. 2q),		Pt 1
<i>C. bifurcatus</i> (sp. a)	<i>C. major</i> Wülker et al. - see <i>C. magnus</i>		
<i>C. biseta</i> (sp. 4p)	<i>C. maturus</i> Johannsen (sp. d),		Pt 2
<i>C. blaylocki</i> (sp. l),	<i>C. melanescens</i> (sp. e)		Pt 2
<i>C. 'butleri'</i> (sp. 2g),	<i>C. (L.) montuosus</i> Ryser et al. 1985 (sp. 5f)		Pt 2
<i>C. calligraphus</i> Goeldi (sp. 2w)			
<i>C. hawaiiensis</i>	<i>C. mozleyi</i> Wülker (sp. 3u),		Pt 1
<i>C. carus</i> - see <i>Goeldichironomus carus</i>	<i>C. muratensis</i> (misident) (sp.3t)		Pt 1
<i>C. columbiensis</i> Wuelker et al. (sp. 4a)	<i>C. pallidivittatus</i> sensu Beermann (1955) (sp. 2l),		Pt 2
<i>C. conformis</i> (see <i>C. sanctipauli</i> )	<i>C. pilicornis</i> (Fabricius) (sp. m),		Pt 1
<i>C. crassicaudatus</i> Malloch (sp. 2j),	<i>C. plumosus</i> (Linn.) (sp. p),		Pt 1
<i>C. cucini</i> Webb (sp. o),	<i>C. prior</i> Butler (sp. 3z)		Pt 1
<i>C. decorus</i> Johannsen (sp. 3a),	<i>C. 'proulxi'</i> (sp. 2b),		Pt 1
<i>C. decorus</i> group (B=sp. l),	<i>C. (L.) pseudomendax</i> (?) (sp. 4i)		Pt 2
<i>C. decorus</i> group ('parablaylocki'),	<i>C. pungens</i> - see <i>Kiefferulus pungens</i>		
<i>C. decorus</i> group (sp. c),	<i>C. quinnitukqut</i> (sp. 2n)		Pt 1
<i>C. decorus</i> group (sp. j),			
<i>C. decorus</i> group (sp. z),			

<i>C. rempeli</i> Thienemann (sp. 2m),	Pt 1	<i>Einfeldia pagana</i> (Meigen) (sp. 2k),	Pt 2
<i>C. riparius</i> group (sp. f),	Pt 1	<i>Einfeldia synchrona</i> -	see <i>E. pagana</i>
<i>C. riparius</i> Meigen (sp. y),	Pt 1	<i>Einfeldia</i> sp. (sp. 2y),	Pt 2
<i>C. sanctipauli</i> (sp. 5g),	Pt 1	<i>Einfeldia</i> sp. A (sp. 5b)	Pt 2
<i>C. staegeri sensu</i> Townes (sp. s),	Pt 1	<i>Goeldichironomus carus</i> (Townes) (sp. 2s),	Pt 2
<i>C. stigmaterus</i> Say (sp. n),	Pt 1		
<i>C. nr. stigmaterus</i> (sp. 5v),	Pt 1	<i>Goeldichironomus holoprasinus</i> (Rempel)	
<i>C. (L.) storai</i> (sp. 5a)	Pt 2	(sp. 4r)	Pt 2
<i>C. striatipennis</i> Kieffer (sp. 4b)	Pt 2	<i>Kiefferulus dux</i> (Joh.) (sp. 5r)	Pt 2
<i>C. tardus</i> Butler (sp. 3s),	Pt 1	<i>Kiefferulus</i> (? <i>Wirthiella</i> ) <i>pungens</i> (Townes)	
<i>C. tentans</i> Fabricius (sp. 3y)	Pt 2	(sp.4q)	Pt 2
<i>C. tenuistylus</i> Brundin (sp. 3m),	Pt 1	Species 1 of Poulson & Metz (1938) ( <i>C.</i>	
<i>C. nr. tenuistylus</i> (sp. 4s)	Pt 1	<i>riparius</i> )	Pt 1
<i>C. 'tigris'</i> Butler & Kiknadze (sp. r),	Pt 1	Species 2 of Poulson & Metz ( <i>C. decorus</i>	
<i>C. trabicola</i> Shobanov <i>et al.</i> (sp. w),	Pt 1	group, probably sp. j)	Pt 1
<i>C. tuberculatus</i> Townes (sp. 4d)	Pt 2	Sp. 9 of Wülker et al. (1989) (sp. 3d)	Pt 1
<i>C. tuxis</i> Curran (sp. 4o)	Pt 2	Sp. 51 of Frommer (sp. 2o),	Pt 2
<i>C. nr. tuxis</i> (sp. u),	Pt 1	Sp. 52 (sp. 2w),	Pt 2
<i>C. utahensis</i> Malloch (sp. 2p),	Pt 1	Species algonquian (sp. g)	Pt 1
<i>C. vancouveri</i> (sp. 5m),	Pt 2	species Anchorage (sp. 3p),	Pt 1
<i>C. c.f. venustus</i> (sp.NAIII)	Pt 1	species Apple Valley (sp. 3b),	Pt 1
<i>C. vockerothi</i> Rasmussen (sp. 3w),	Pt 2	species Cape Cod (sp. 4k)	Pt 1
<i>C. whitseli</i> Subl. & Subl. (sp. 2f),	Pt 2	species Coyote Creek (sp. 2w),	Pt 2
<i>C. winnelli</i> Wülker (sp. 3v),	Pt 1	species Florida of Epler (sp. 4w)	Pt 2
<i>C. sp. k,</i>	Pt 1	species Greiner Lake (sp. 5k)	Pt 1
<i>C. sp. u</i> (nr. <i>hyperboreus</i> , <i>aberratus</i> , <i>sororius</i> )	Pt 1	species B of Hilsenhoff & Narf (poss. sp. o)	Pt 1
<i>C. sp. nr. sp. u,</i>	Pt 1	species C of Hilsenhoff & Narf (sp. 3c)	Pt 1
<i>C. sp. 1</i> (sp. 2o),	Pt 1	species D of Hilsenhoff & Narf (sp. 3d)	Pt 1
<i>C. sp. v ,</i>	Pt 2	species Julianehåb (sp. 5l)	Pt 1
<i>C. sp. 2t</i> ( <i>calligraphus</i> gp.?)	Pt 2	species Le1 of Kiknadze et al. (sp. 3x),	Pt 1
<i>C. sp. 3g,</i>	Pt 1	species Obatanga (sp. 4z)	Pt 1
<i>C. sp. 4m,</i>	Pt 2	species <i>parariparius</i> (sp. 2c),	Pt 2
<i>C. sp. Florida</i>	Pt 2	species WOC of Wülker & Morath (sp. 3r),	Pt 2
<i>C. sp. NAII</i> (sp. 4t)	Pt 1		
<i>C. sp. NAIII</i> (c.f. <i>venustus</i> ) (sp. 4u)	Pt 1		
<i>C. sp. NAI</i> (sp. 4x) (nr. <i>anthracinus</i> )	Pt 1		
<i>C. sp. TE11</i> (sp.4y) (BOLD DB)	Pt 1		
<i>C. (Lobo.) sp. 4v,</i>	Pt 2		
<i>C. sp. 4w,</i>	Pt 2		
<i>C. sp. 5c</i> (1TE) (BOLD DB)	Pt 2		
<i>C. sp. 5d,</i>	Pt 2		
<i>C. sp. 5e,</i>	Pt 1		
<i>C. sp. 5h,</i>	Pt 2		
<i>C. sp. 5i</i> (8TE) (BOLD DB),	Pt 2		
<i>C. sp. 5p</i> (? <i>staegeri</i> Lundbeck),	Pt 1		
<i>C. sp. 5t,</i>	Pt 1		
<i>Einfeldia chelonia</i> (sp. 5q)	Pt. 2		

