AUSTRALIAN CHIRONOMUS SPECIES

Compiled by Jon Martin

Genetics, Genomics and Development, School of Biosciences, The University of Melbourne, Victoria, 3010, Australia

When Freeman (1961) revised the Australian Chironomidae he recognized six species of the genus *Chironomus* (s.s.): *C. alternans* Kieffer, *C. australis* Skuse, *C. nepeanensis* Skuse, *C. tepperi* Skuse and *C. vitellinus* Skuse. However, even at this stage it was known that adults of *C. alternans* could be produced from different larval types, and with quite distinct polytene chromosomes, which therefore appeared to be distinct species.

Bugledich *et al*. (1999) 'Family Chironomidae' from Zoological Catalogue of Australia, recognize 12 species of *Chironomus* in Australia, with another nine species that are *Incertae cedis*. Only two of these latter nine, which are currently *nomena nuda*, are considered here.
There is also one species of *Einfeldia* in Australia, *E. australiensis* (Freeman) which Freeman placed in *Chironomus* (*Xenochironomus*). This species is included here as the relationship of *Einfeldia* to *Chironomus* has been subject to much discussion.

In general, the morphological terminology used in this document follows Sæther (1980), Webb & Scholl (1985) and Vallenduuk & Moller Pillot (1997).

Abbreviations

AR – Antennal ratio. In larvae it is A1/A2-A5, measured only from the scleratized parts of each segment as the soft tissue between each segment can stretch to different extents during slide mounting.

AT – Anal tubules

BOLD - Barcoding of Life Database (http://www.boldsystems.org/index.php)

BR - Balbiani ring

COI - Cytochrome oxidase subunit I

Cyt B - Cytochrome b

FC - Frontoclypeus

Gb2B - Globin II Beta

Gb9 - Globin IX

GC - Gonocoxite IX

GP – Gonopopheses VIII

GS – Gonostylus

HR – ratio of length to width of pupal respiratory base

IVo – Inferior volsella

LR – Leg Ratio (Ta1/Ti, usually of fore leg)

MD – male determining (gene)

Mdt-Mat – distance from the tip of dorsal tooth to the tip of apical tooth of the mandible.

Mt – Mitochondrial

MTR – Mdt-Mat divided by length mandible inner tooth row

MW – width of Mentum

N – Nucleolus (i.e. the sac produced by an active NOR)

NOR – Nucleolar Organizing Region (i.e. the chromosomal locus capable of producing a nucleolus)

PE - Pecten epipharyngis

PLT – Posterolateral tubules

PMa – Pecten mandibularis

PrM – Premandible

PSA – Pedes spurii A

PSB – Pedes spurii B

RO – Ring organ

S4A – distance between larval S4 setae

SCf - Sensilla campaniformia (on brachiolum)

SCh - Sensilla Chaetica

SVo - Superior volsella

VHL - Ventral head length

VM – Ventromental plates

VML – length of VM

VMR – Ventromental plate ratio

VPA – distance between the inner margins of the two VM.

VT - Ventral tubules

¿ - presence at locality not confirmed.

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1. **Adult morphology**

Species with an Australia-wide distribution:

Chironomus cloacalis Martin, 1971

Chironomus 'februarius' - currently nomen nudum, although described by Martin 1966

Chironomus nepeanensis Skuse, 1889

Chironomus 'pseudoppositus' - currently nomen nudum, although described by Martin 1966

Chironomus tepperi Skuse, 1889

Species with a tropical distribution:

Chironomus bicoloris Tokunaga, 1964

Chironomus circumdatus (Kieffer, 1916)

Chironomus ‘orientalis’ – manuscript name

Chironomus javanus Kieffer, 1924

Chironomus pallidinubeculosus Tokunaga, 1964

Chironomus magnivalva Kieffer, 1917

Chironomus 'queenslandicus' - manuscript name

Chironomus sp. (bathophilus type)

Species with a south eastern distribution:

Chironomus australis Macquart, 1847

Chironomus duplex Walker, 1856

Chironomus 'jacksoni' - manuscript name

Chironomus maddeni Martin & Cranston, 1995

Chironomus oppositus Walker, 1856:

- form connori
- form oppositus
- form whitei

Chironomus 'timmsi' - manuscript name

Chironomus ‘tyleri’ - manuscript name

Einfeldia australiensis

Species with a western distribution

Chironomus occidentalis Skuse, 1889

Chironomus ‘edwardi’ – manuscript name

Species from Norfolk Island

Chironomus ‘februarius’ (?)

Chironomus species NI 1 (may be as *Chironomus flaviplumus* Type 3)

Chironomus species NI 2

The description of *Chironomus alternans* Walker and the synonyms listed by Freeman (1961) are also included, although they are considered as uncertain. Further description is provided for those where the types are still available.

In the adult descriptions reference is made to the types of superior volsella (SVo) shape as recognized by Strenzke (1959). This is a helpful initial classification, but experience has shown that the types are not discrete, rather part of a continuum. The three categories as described by Strenzke are:

S-type: The SVo is shoe shaped, i.e. it is drawn out distal-medially into a broad, rounded lobe (Fig. a-c, below) (Strenzke’s figure suggests the most distal point will be at the toe of the shoe),

D-type: The SVo is ribbon-like: distally it may have a weakly thickened shoulder (Fig. d, below) (most distal point is not at the internal margin), or bent in a shallow sickle-shape (Fig. e-f, below).

E-type: The SVo has the form of an elephant’s tusk; distally it is sharply graded to a point, or with an expanded knob (Fig. g-i, below) (line from base to most distal point goes outside the limits of the SVo).

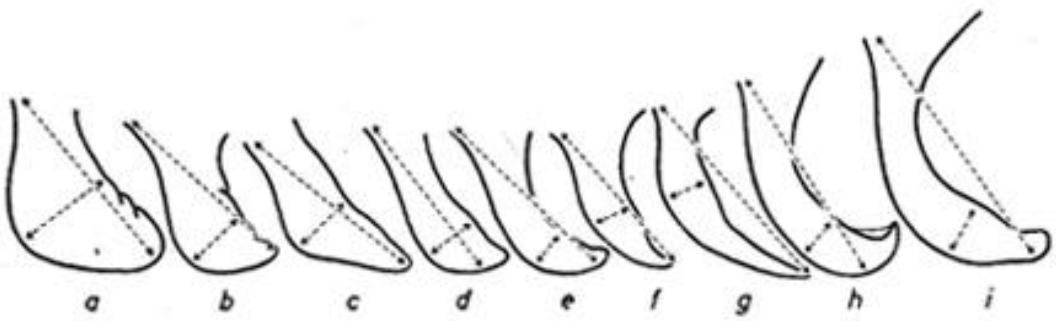


Abb. 4. Grundformen der Claspette des *Chironomus*-Hypopygs (♂). a—c S-Typ (a *halophilus*, b *thummi thummi*, c *luridus*), d—f D-Typ (d, e *dorsalis*, f *striatus*), g—i E-Typ (g *cingulatus*, h *salinarius*, i *annularius*).

Key to Adults

1. Yellow/green species, Anal point short and relatively broad . . . . . .2.

   Anal point longer or tubular . . . . . 3.

2. Anal point bulky and strongly turned down, abdomen greenish . . . . . *Einfeldia australiensis*

   Anal point not bulky or strongly turned down, abdomen dark . . . . . .*C.* 'queenslandicus'

3. Wing with dark spot over cross vein and with fuscous clouds, particularly in cell R5 . . . . . .*C. pallidinubeculosus*

   Wing with at most darkening of cross vein . . . . . 4.

4. Cross vein strongly darkened, LR about 1.5, wing length 4-5 mm . . . . . *C. nepeanensis*

   Cross vein not strongly darkened . . . . . 5.

5. Legs shorter than usual, posterior LR about 0.5; male hypopygium enlarged, anal point deep and laterally flanged . . . . . .6.

   Posterior LR about 0.7 or higher; male hypopygium of normal type; . . . . . 7.

6. Thorax dull grey, pits of dorsocentral setae very distinct; inferior volsella of male very swollen . . . . . .*C. tepperi*

   Thorax greenish with brown stripes, pits normal; inferior volsella of male not swollen . . . . . *C. magnivalva*

7. Wing length greater than 5 mm; anterior tarsi of males bearded . . . . . 8.

   Wing length less than 5 mm; anterior tarsi of males bearded or unbearded . . . . . .10.

8. Distributed on east of the continent, including Tasmania . . . . . .9.

   Distributed on the west of the continent, including Northern Territory . . . . . .*C. occidentalis*

9. Mid femur more than 1.12 x the anterior femur (likely to be) . . . . . *C. duplex*

   Mid femur less than 1.10 x the anterior femur (likely to be) . . . . . *C. australis*

10. Blackish species. Male with bearded anterior tarsi and spatulate superior volsella . .*C.* "timmsi"

    Paler species, at most brown. Male tarsi not bearded. . . . . .11.

11. Thorax pale, anterior femur and tibia pale, tarsi with dark pattern . . . . . 12.

Thorax pale to brown, legs unbanded .(mainly members of the "C. alternans" group) . . . . . 13.

12. Tarsi darkened at both apex and base, anal point tubular. . . . . .*C. javanus*

Tarsi darkened only at distal ends, anal point larger and narrowed at base, LR above 1.80, anterior tarsus 5 at least 0.35 times the length of the tibia, SVo often beaked. . . . . .*C.* "orientalis"

13. Wing length over 4 mm . . . . . 14.

Wing length less than 4 mm. . . . . 15.

14. Abdomen generally greenish with saddle markings on the anterior segments, gradually extending in length from about 5th tergite to occupy most of segment by 8th tergite (AR 2.9-3.2) . LR 1.53-1.66. . . . . *C.* 'tyleri'

Abdominal tergites generally dark with pale posterior band, but may have saddle spots;.(AR 3.3-4.25); wing length up to 4.6 mm. LR 1.44-1.78. . . . . *C. cloacalis* in part

15. *C. oppositus* type (AR 3.6).

Abdominal tergites generally dark, may have pale posterior band, saddle spots, or dark band across the centre of the segment . . . . . 16.

16. as 14a, but wing length from 2.6 mm. . . . . *C. cloacalis* part

(Abdominal tergites may be as *C. cloacalis*, or may have; AR 2.9-3.4; LR 1.56-1.65.), *C.* 'pseudoppositus' (Abdominal tergites as in *C. cloacalis* AR 2.5-3.1; LR 1.5-1.8; *C.* 'februarius' superior appendage less curved than in other members of the oppositus-group - D(d)-type),
Abdomenal tergites with saddle spots: *C. oppositus* (LR 1.5-1.8; wing length 2.8-3.6, *C. maddeni* (AR 2.55-2.86; LR 1.6-1.8; wing length 2.4-3.36 mm), *C.* 'jacksoni' (AR 2.4–3.0) ; LR; Wing length about 3.64-3.72);

Norfolk Island species:

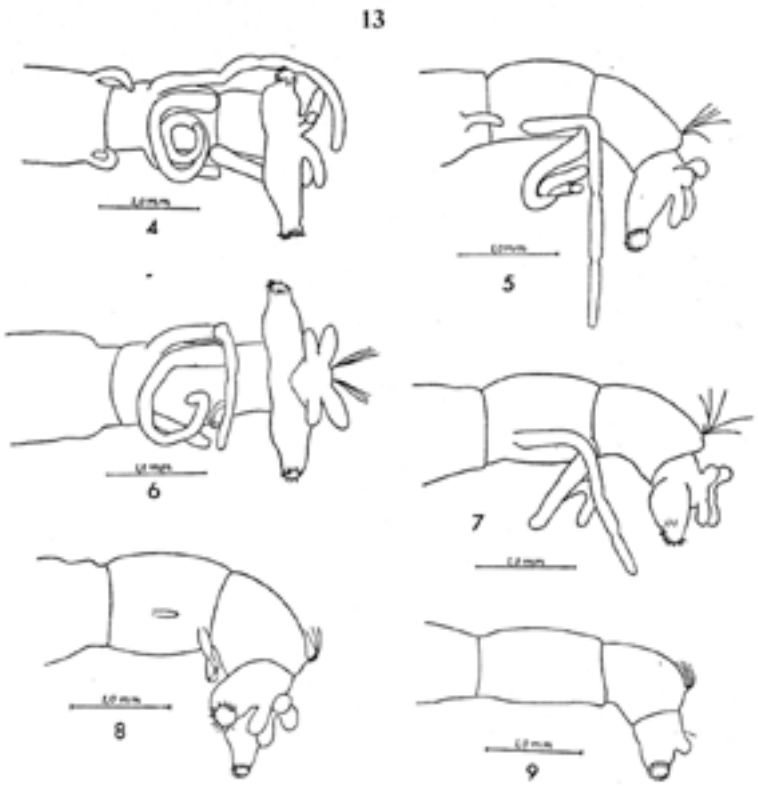
1. LR about 1.5, superior volsella closest to Strenzke's type D(d), ... may be near *C. samoensis*, LR lower than *C.* nr. *samoensis* from other regions, but in range of *C. samoensis* itself). . . . . Species 1

   LR about 1.27, superior volsella closest to Strenke's type D(f), but appears to have a flattened end. . . . . .. Species 2

2. **Larval types and Karyotypes**

In the Key and the following descriptions, reference is made to the larval type. The scheme used here is the revision of older classifications as proposed by Proulx *et al*. (2013), who recognize 9 categories.
The categories are:
salinarius - lacking posterolateral (PLT) and ventral tubules (VT)
Lacking PLT:
halophilus - anterior VT very short or absent, posterior VT short
bathophilus – moderate to long, essentially straight VT.
fluviatilis - VT slightly curved and coming to a point at ends. (often hard to distinguish from bathophilus-type, particularly in some fixed material)
thummi – long, anterior VT with 'elbows', posterior VT coiled
Possessing PLT:
reductus – lacking ventral tubules.
semireductus – short straight or slightly curved VT.melanotus
melanotus – moderate to long, essentially straight VT.
plumosus – long, anterior VT with 'elbows', posterior VT coiled.

Not all these types have been found in Australia.



Figs. 4—9. Hind parts of larvae.
4. plumosus type (total length 15 cm; loc. 12; 13.VII.1943); ventral view; right tubuli cut off.
5. as 4, but seen from the left; left tubuli only drawn.
6. thummi type (total length 17 cm; loc. 1; 5.VII.1944) ventral view; right tubuli cut off.
7. as 6, but seen from the left; left tubuli only drawn.
8. halophilus type (total length 12 cm; the fjord; 27.IV.1942); seen from the left, slightly from the ventral side.
9. salinarius type (total length 15 cm; the fjord; 27.IV.1942); seen from the left.

from Andersen 1949

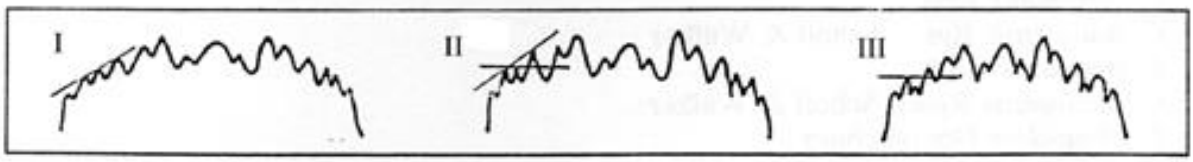
Reference is also made to a number of larval characters including the mentum and mandible types originally devised by Webb & Scholl (1985), Vallenduuk & Moller Pillot (1997) and Proulx *et al.* (2013). These classifications were made for relatively small numbers of species, but with the much larger number of species, such as in the North American fauna, they do not cover all the variability seen in these characters and so further modification has been necessary.

The mentum type is defined only by the degree of development of the 4th lateral teeth:

Type I - height in same line as the rest of the lateral teeth;

Type II - 4th laterals reduced, height about equal to that of the 5th laterals;

Type III - 4th laterals further reduced, height less than that of the 5th laterals.



From Vallenduuk and Moller Pillot 1997

The mentum may be further classified by the characters of the central trifid tooth:

Type IA - c2 teeth only partially separate from c1, i.e. as shoulders on c1. (figure a)

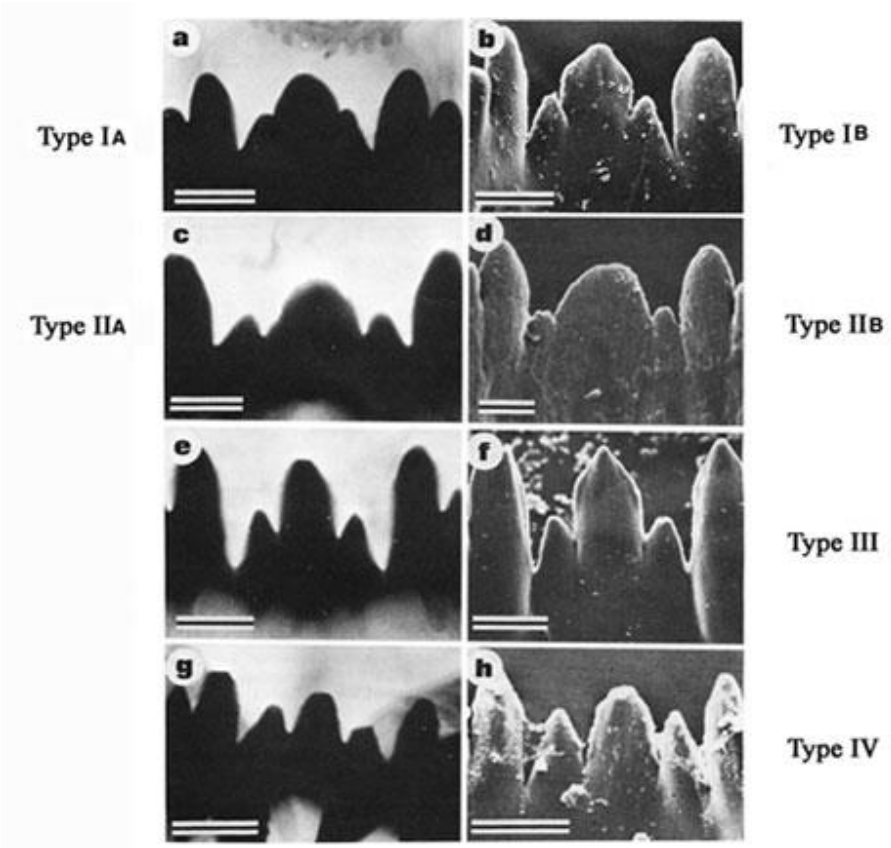
Type IB – c2 teeth slightly more separated (figure b).

Type IIA - c1 broad, c2 teeth distinctly separated (figure c).

Type IIB – c1 very broad, c2 less separated (figure d).

Type III - c1 tooth relatively narrow and much higher than the separated c2 teeth (figs e and f).

Type IV - c2 teeth well separated, not much lower than the relatively narrow c1 tooth (figs g and h).



From Webb and Scholl 1985

The mandible type is defined by the degree of darkening and separation of the 3rd inner tooth:

It appears preferable to consider these as separate characters:

Separation

Type I - almost completely fused on lower margin;

Type II - tooth partly free on lower margin;

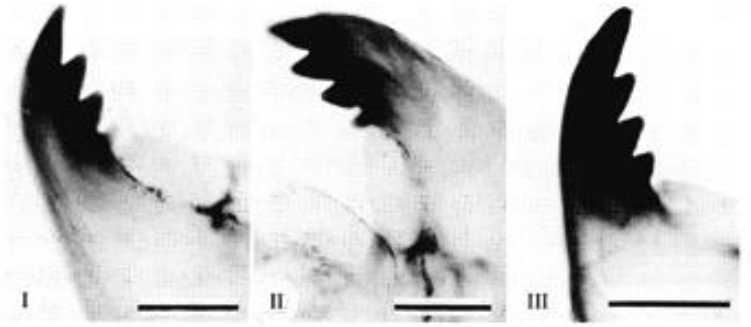
Type III - 3rd tooth completely separate.

Colour

Type A – pale

Type B – slightly darkened

Type C – as dark as other teeth



From Webb and Scholl 1985.

These would represent IA, IIB, and IIIC respectively

Mandible length and Mdt-Mat:

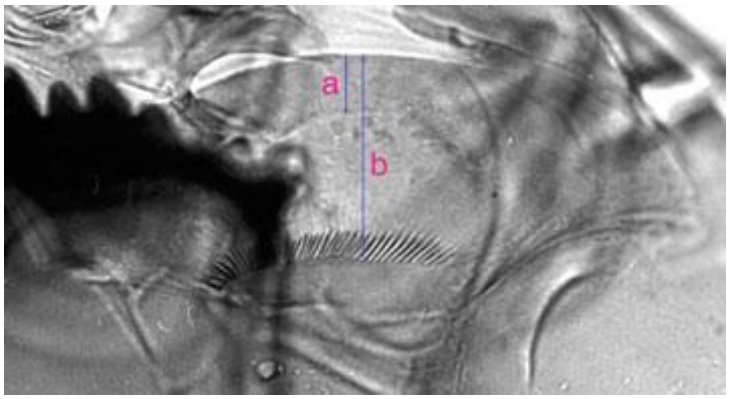
Hirvenoja and Michailova (1998) illustrated that the distance between the tip of the dorsal tooth and the apical tooth could differ between related species (Mdt-Mat) (blue line in figure below).

However for different sized species it may be preferable to divide this value by the length of the mandible (black line in figure above) to obtain the MTR.

Ventromentum

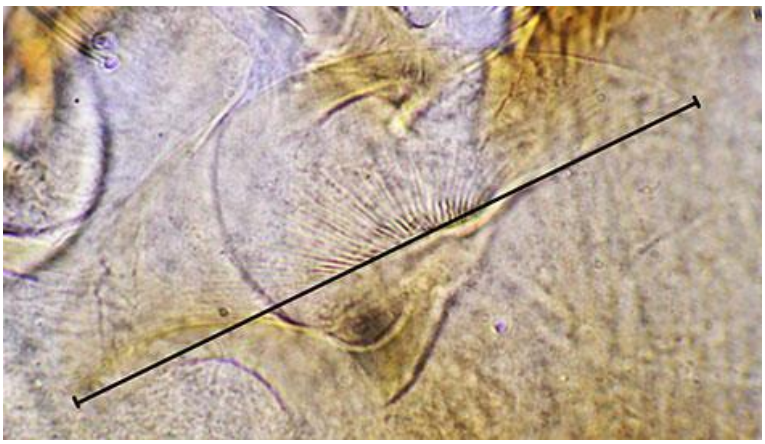
There are several measures that can be made from the ventromental plates including VPA and the number of striae. Two others need some explanation:

VMR – the ratio of the outer clear anterior margin to the depth to the bottom of the striae:



VMR = a/b

'b' also serves as a measure of the depth of the VM for the ratio of length to depth of the VM plates. VM length (VML) is measured directly from inner margin to outer margin:



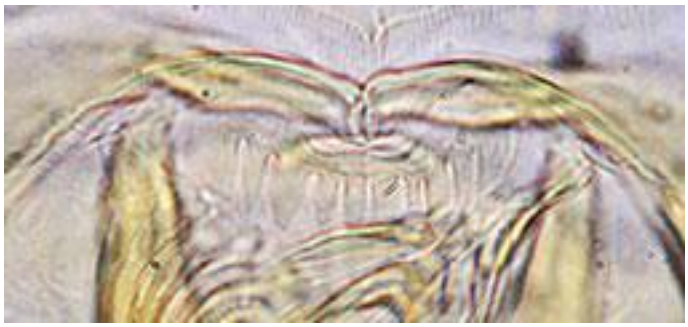
This seems preferable to the sometimes used 'horizontal length' which can be subject to parallax error and to the effects of rotation of the plates under pressure during slide mounting.

Pecten epipharyngis

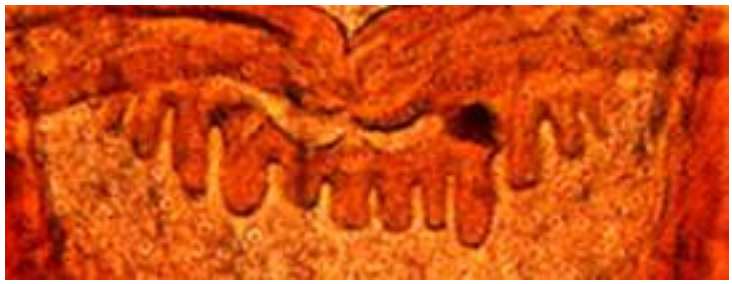
Proulx *et al.* (2013) recognised 4 types of PE in North American species. These are useful if the teeth are not worn down as they often are in older larvae. Type D does not occur in any known Australian species.

Type A – fine sharp rather uniform teeth.

Type B – teeth broader but still sharp. Sometimes with one or two fine smaller teeth interspersed.



Type C - rounded and usually short. Worn type B teeth may be mistaken for this type.



Type D - rounded teeth with smaller teeth interspersed (generally found in the subgenera *Lobochironomus* or *Chaetolabis* which have not been found in Australia).

Relationship on the FC of the distance between antennal bases and distance between S4 setae

This character gives some indication of the shape of the anterior region of the FC: the amount and extent of the narrowing at the anterior end near the antennal bases, and where the S4 setae are in relation to the broadening of the clypeus (see figure below). This relationship can be further characterized by the distance of the S4 setae from the margins of the FC – most easily expressed by the fraction of the FC width between the two S4 setae. This has two components: how far the setae are from the FC margin, and how close they are to the widest point of the FC.

Frontoclypeus with approximately equal distance between antennal bases and S4 setae
Note also the barely visible 'ring organ' of Yamamoto *et al*. (2015), (more obvious at top) immediately opposite the S5 setae. This is a characteristic of species of *Chironomus*.

Provisional key to 4th instar larvae of Australian *Chironomus* species:

1. Larger larvae, length up to about 23 mm,
(Either thick bathophilus-type larvae with large, very darkly pigmented heads, ...
. 2.
or a slim plumosus-type larva with a small, pale head capsule)

Medium sized larvae, length up to about 19 mm, head length less than 400 mm. . . . . .
.5.

2 (1). Head capsule heavily darkened, bathophilus-type . . . . . .

3.

Head capsule pale, except NT and Vic where slight darkening of the gula & FC occurs, slender plumosus-type . . . . . .*C. nepeanensis*

3 (2). Distributed on east side of the continent only (NSW, VIC, SA, TAS) . . . .

. 4.

Distributed on west of continent only (WA & perhaps NT) . . . . . *C. occidentalis*

4.(3) Teeth of mentum rounded (when not worn), c2 teeth of centre trifid tooth . . . . . .*C. australis*
only partially distinct from c1 tooth (type IIa). Four polytene chromosomes

Teeth of mentum square sided and pointed, c2 teeth well separated from . . . . . *C. duplex*
c1 tooth. Three polytene chromosomes, inversion polymorphism

5 (1). Larvae with PLT (species often polymorphic) . . . . . .
. 6.

Larvae without PLT (species often polymorphic). . . . . .
.12.

6 (5). Larvae of the true plumosus type (posterior VT coiled) . . . . . .
.7.

Larvae of the melanotus- or semireductus- type (posterior VT may be bent) . . . . . .
16.

7 (6). Head capsule generally quite heavily darkened on both FC & gula . . . . . .
.8.

Head capsule darkened on gular region only . . . . . .
10.

8 (7). Both gula and FC quite heavily darkened . . . . . *C. cloacalis*
(majority)

Gula and FC slightly to moderately darkened, tropical species . . . . . .
.9.

9 (8). c2 teeth of mentum sharp and well separated (type III), 3rd inner tooth of mandible type IA/B
. . . . . .

C.'orientalis'

c2 teeth of mentum only partially separated (type IB), 3rd inner tooth of mandible type IIIB . . . .
. . . . . *C.*
magnivalva

10 (7). PLT tending to be more ventrally placed, PrM with 7 teeth .. . . . . *C.*
javanus

Larvae not as above, PrM with the normal 2 teeth . . . . . .
11.

11 (10). Head capsule often completely pale, but sometimes slightly darkened at posterior of gula, basal segment of antenna less than 4 times as long as wide. . . . . *C.*
pallidinubeculosus

Basal segment of antenna more than 4 times as long as wide . . . . . .
12.

12 (11). Larvae of the halophilus-type (i.e. VT reduced, often only the posterior pair), hind prolegs sharply narrowing. . . . . *C. tepperi* (part)

Larvae with VT of long or moderate length. . . . . .

13.

13 (12). Larvae of the plumosus-type . . . . . .

.14.

Larvae of the bathophilus type. . . . . .

18.

14 (13). Gula darkened at least on posterior half . . . . . .

15

Gula pale or only slightly darkened on posterior third . . . . . .

17

15 (14). Gula dark, centre tooth of mentum of type III . . . . . *C. circumdatus*

Gula moderately darkened, mentum of type IB . . . . . pale headed form of *C. cloacalis*

16 (6). PLT over 200 micron, ventromental plates separated by only about 0.2 of mentum width; AR abt 1.40-1.64. . . . . .*C.* 'queenslandicus'

PLT often less than 200 micron, ventromental plates separated by about 0.3 of mentum width, AR >1.9 . . . . . .some *C.*'tyleri*', C.* 'edwardi' and *C. oppositus* f. *oppositus*

17 (14). Mentum of type II; Central trifid tooth type III . . . . . .*C.* 'februarius'

Mentum of type I; Central trifid tooth type III . . . . . .*C. bicoloris*

18 (13). Basal segment of antenna 3 to 3.5 times longer than wide; four polytene chromosomes . . .

19.

Basal segment of antenna about 4 times longer than wide; three or four polytene chromosomes 20.

19 (18) Gula and FC pale; antennal segments A2/A1 less than 0.3 . . . . . .*C.* ‘timmsi’.

Gula and FC at least slightly darkened, A2/A1 more than 0.3 . . . . . Most members of the *C. oppositus* complex, *C.* ‘pseudoppositus’, *C. maddeni* & *C.* ‘jacksoni’

Accurate identification only possible from examination of the polytene chromosomes.

20 (18) Basal segment of antenna about 4 times as long as wide; three polytene chromosomes. . . . . .*C.* sp. Bakers Beach

A4 hardly longer than A3, four polytene chromosomes . . . . . *C.* sp. bathophilus type.

(some specimens of *C. tepperi* may key to here if they have relatively well developed VTs They have a sharply narrowing hind proleg; basal segment of antenna up to 5 times as long as wide; and four polytene chromosomes)

Chironomus alternans Walker, 1856

240. CHIRONOMUS ALTERNANS, Walker.

Chironomus alternans, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 423 (Div. 1, Alæ nudæ. Sub-div. 1, Halteres pallidi).

"♂.—*Testaceus; antennæ fuscæ; thorax vittis duabus dorsalibus lateribusque viridibus; abdomen viride, pubescens, vitta interrupta fusca dorsali; pedes virides, pubescentes, tibiis et tarsorum articulis apice fuscescentibus; alæ limpidæ, venis testaceis, litura discali sub-obscuriore.*

"Testaceous. Antennæ brown. Thorax green on each side, and with two green dorsal stripes. Abdomen green, pubescent, with an interrupted brown dorsal stripe. Legs green, long, slender, pubescent; tips of the tibiæ and of the joints of the tarsi brownish; fore-tibia very much longer than the fore-metatarsus. Wings limpid; veins testaceous; discal mark a little darker, not distinct. Length of the body 4 lines, of the wings 6 lines.

Hab.—"New South Wales."

Walker's description of *C. alternans*, with the translation by Skuse 1889.

To this description can be added:

Head – Face yellow, palps and antennae brownish. AR about 3.05, Palps (µm): 200? : 73 : 252 : 263 : 431. Frontal tubercles 37 x 15 µm. Clypeal setae 31.

Thorax green yellow, vittae, postnotum and sternopleuron brown; Length about 1.84 mm, width about 0.94 mm, depth about 1.68 mm.

Setae – Acrostichal at least 7?; Dorsolateral 15 in 2 rows; Prealar, 5,7; Supraalar 1; Scutellar ant. row 4, post. row 12.

Pronotum broad, apically tapered, then abruptly widened at the apex, anteriorly with a broad notch. Mesonotum with a barely discernable median tubercle.

Wing length 4.36 mm; width 0.94 mm; VR 1.0.; SCf on brachiolum 3.

R4+5 ends level with M; R2+3 evanescent at tip, ending at 0.25 of the distance between the apex of R1 and R4+5; Anal ends distal to f-Cu at 0.77 of the distance between f-Cu and apex of Cu2; anal lobe well developed, right angled; squama fully fringed.

Halteres yellowish, width 205 µm.

Legs yellow, tarsi becoming brown. Proportions (µm):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1600	1440	-	-	-
PII	1720	1580	980	520	380
PIII	1860	1940	1380	760	580
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	-	-	-	1.11	No beard
PII	240	160	0.62	1.09	-
PIII	360	240	0.71	0.96	-

Abdomen green with dark saddle spots on tergites II-V, then all dark.
Genitalia missing.

Synonyms as recognized by Freeman (1961):

C. egregius Skuse 1889

C. januarius Skuse, 1889

227. CHIRONOMUS JANUARIUS, sp.n.

♂.—Length of antennæ..... 0·040 inch ... 1·01 millimètres.
Expanse of wings..... 0·110 × 0·027 ... 2·79 × 0·68
Size of body...,..... 0·140 × 0·020 ... 3·55 × 0·50

Antennæ pale brown; first joint of scapus reddish-brown. Head brown. Clypeus and palpi light reddish-brown. Thorax greenish-yellow or pale ochreous, with three somewhat indistinct light brown bands, the anterior one united to the scutellum by a light brown line; a longitudinal row of yellow hairs between the bands and on anterior portion of the intermediate one; pleuræ and pectus pale ochreous-brown; scutellum sordid ochreous-yellow, fringed with long yellow hairs; metanotum purplish-brown. Halteres pale green. Abdomen rather more than thrice the length of thorax, umbrous-brown, sub-levigate, rather densely clothed with moderately long yellow hairs. Legs yellow, the tibia terminating in deep brown or black spines, the tarsi except metatarsal joint of fore legs light brown, dark brown at the extreme apices of the joints. In fore legs metatarsus twice the length of tibia. Wings rather shorter than abdomen, hyaline; costal, first and third longitudinal, and basal half of the fourth longitudinal vein, brownish-yellow. Costal and third longitudinal vein meeting a short distance before apex of wing; auxiliary vein joining costa before middle of posterior branch of fifth longitudinal fork; second longitudinal vein joining costa a little beyond tip of first longitudinal vein; fourth longitudinal vein pale almost reaching the wing-margin, its tip situated nearer to tip of costa than to that of anterior branch of fifth longitudinal fork; base of latter lying opposite middle cross-vein, its posterior branch a little more than half the length of anterior.

Hab.—Wheeney Creek, N.S.W. (Skuse). January.

To this description can be added:

Head: AR about 3.0; palps crumpled, but segment 3 about 160 µm; clypeus about 0.69 times the width of the antennal pedicel, with about 16 setae.

Thorax: length 1.05 mm, depth 0.91 mm, width 0.51 mm. Setae: Acrostichal not clear; Dorsolateral at least 13, Prealar 4, Scutellar ant. row about 8, post. row about 10.

Wing: VR about 1.04, SCf on brachiolum 2.

Halteres about 320 x 110 µm.

Leg lengths and proportions (µm):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1100	800	-	-	-

PII	1120	1000	560	280	220
PIII	1240	1280	880	700	400
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	-	-	-	1.38	No beard
PII	160	120	0.56	1.12	-
PIII	240	120	0.69	0.97	-

Type locality: New South Wales - Wheeny Creek (33.45ºS, 150.67ºE).

C. subdolus Skuse 1889

224. CHIRONOMUS SUBDOLUS, sp.n.

♂.—Length of antennæ..... 0·055 inch ... 1·39 millimètres.
Expanse of wings..... 0·130 × 0·030 ... 3·30 × 0·76
Size of body..... 0·200 × 0·027 ... 5·08 × 0·68

Antennæ brown, with somewhat bronzy-brown plumes; first joint of scapus umber-brown. Head pale greenish-yellow with pale yellow hairs. Clypeus and palpi light greenish-brown. Thorax, pleuræ, and scutellum pale greenish or greenish-yellow, the former with three ochraceous-ferruginous bands; pale yellow hairs; pectus brownish; metanotum deep brown, pale greenish-yellow anteriorly, and with a very fine pale median line. Halteres very pale green. Abdomen nearly three times length of thorax, prasinous, second to fifth segments with a diamond-shaped olive-brown spot superiorly, last two segments entirely blackish-brown; rather moderately clothed with short pale yellow hairs; anal joint and forceps dusky brown, with short hairs. Coxæ and femora pale greenish-yellow. Tibiæ and tarsi of a more ochreous-yellow, joints of tarsi almost imperceptibly tipped with brown. Tibial spurs deep brown or black. In fore legs metatarsus twice length of tibia. Wings shorter than abdomen, hyaline: costal, first three longitudinal veins and basal half of fourth longitudinal vein brownish-ochreous. Costal and third longitudinal veins meeting a little before apex of wing; auxiliary vein indistinctly reaching costa opposite middle of posterior branch of fifth longitudinal fork; second longitudinal joining costa a short distance beyond tip of first longitudinal: fourth longitudinal pale beyond middle cross-vein, not reaching wing-margin, its tip situated at a point ⅓ the distance from tip of costa to that of anterior branch of fifth longitudinal fork; latter very pale, its base lying opposite middle cross-vein, posterior branch ½ the length of anterior.

Hab.—Clifton, Illawarra district, N.S.W. (Skuse). December.

To this can be added from the Lectotype male:

Head A R about 3.11; eyes about 5 facets wide near apex; palps (segs 2-5, micron) 40 : 170 : 210 : 330. Frontal tubercles present; clypeus about 0.61times the width of the antennal pedicel, with at least 15 setae.

Thoax: length 1.41 mm, depth 1.28 mm; width 0.68 mm. Setae: Acrostichal not clear; Dorsolateral at least 15; Prealar 4, Supraalar 1; Scutellar ant. row about 5, post. row about 12.

Wing: Length about 3.26 mm, width about 0.74 mm, VR about 1.02. SCf on brachiolum 3

Halteres about 360 x 160 µm.

Leg lengths and proportions (µm):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1200	1040	1640	900	720
PII	1300	1180	760	380	300
PIII	1440	1420	1040	540	440
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	660	280	1.58	1.15	No beard
PII	160	140	0.64	1.10	-
PIII	240	-	0.73	1.01	-

Female from same locality and with the Lectotype, but not mentioned in the original description:

Identification queried on label.

Head: Antennal proportions (micron) 180 : 150 : 140 : 130 : 190. Frontal tubercles about 200 µm long, eyes about 6 facets wide near apex; palps (segs 2-5, micron) 80 : 240 : 250 : 320. Clypeus about 1.08 times the width of the antennal pedicel, with about 27 setae.

Thorax greenish with brown stripes, sternopleuron and postnotum. Length 1.63 mm, depth 1.41 mm; width 0.74 mm. Setae: Acrostichal at least 8; Dorsolateral about 18; Prealar 5, Supraalar 1; Scutellar ant. about 12 in 2 indefinite rows, post. row about 15.

Wing length about 3.60 mm, width 0.90 mm, SCf on brachiolum 3.

Halteres about 400 x 200 µm.

Legs yellowish, length and proportions (µm):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1460	1200	2100	1000	840
PII	1540	1400	800	420	300
PIII	1620	1760	1160	640	500
	Ta4	**Ta5**	**LR**	**F/T**	**Ta4/Ti**
PI	740	300	1.75	1.22	0.62
PII	200	160	0.57	1.10	0.29
PIII	300	200	0.66	0.92	0.17

Type locality: New South Wales – Clifton (34.26ₒS, 150.25ₒE). Illawarra District,

Chironomus australis Macquart, 1847

Synonyms:

C. applicatus Walker 1856 (see transcription of original description below)

Orthocladius applicatus Kieffer 1906, 1917.

In BOLD Bin: BOLD:ACQ5133

Adult:

Original description of Macquart (1847)
♂. - Thorace rufescente, vittis fuscis; scutello rufescente. Abdomine nigricante, incisures rufis. Pedibus rufis. Alis pallidis.
♀ - noted as differing only by the ordinary sexual characters.

Male:

Thorax brownish, vittae fuscous, scutellum brownish. Abdominal segments largely blackish, pale posterior margin on anterior segments. Legs brownish. AR 3.93 (3.63 – 4.65). LR 1.36 (generally higher in Lake Eucumbene specimens).

Wing length 4.5 – 6.6 mm, width 1.05 – 1.21 mm. VR 0.96 – 1.09. About 16 to 23 setae in squamal fringe.

Cephalic tubercles 40 – 53 µm, about three times longer than wide, setae generally lost.

Palpal proportions (µm): 80 : 74 : 248 : 301 : 422. About 33 (24-47) clypeal setae.

Thoracic setae: Acrostichals not clear – at least 9; Dorsolaterals 13-27; Prealars 5-7; Supraalars 1-2; Scutellars in two to three rows, anterior row(s) 9-16, posterior row 15 -25

(total 25-41).

Leg lengths and proportions (micron):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1440	1430	1911	1134	1012
PII	1757	1705	1040	586	432
PIII	2123	2228	1502	840	662
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	933	434	1.23-1.42	0.99-1.05	3.6-7.5
PII	304	228	0.57-0.64	1.01-1.05	-
PIII	441	266	0.65-0.69	0.91-0.97	-

Abdomen black with a pale posterior margin on the anterior segments, 4 – 11 setae on 9th tergite.

Gonostylus narrowing fairly sharply over posterior third to quarter. SVo of D(e)-type of Strenzke 1959 (above), setae of IVo simple.

Female:

Coloration essentially as in male, although generally darker, especially on the abdomen. Wing length about 4.96-5.77 mm; width about 1.48-1.77 mm; VR 1.01-1.10. About 12-32 setae in squamal fringe (low values from Victorian specimens), in up to three rows. LR about 1.42.

Relative lengths of antennal segments (micron): 222 : 133 : 145 : 141 : 310; AR 0.44-0.53; A5/A1 1.21-1.51. Cephalic tubules present but variable 19-58 µm and about 1.0-3.8 times higher than wide at base, seta usually lost. Clypeus about 1.6-2.2 times the width of basal antennal segment; about 25-54 clypeal setae. Palpal proportions (micron): 92 : 90 : 263 : 324 : 514.

Thoracic setae: Acrostichals – up to about 18; Dorsolaterals – 25-45; prealar 5-7; supraalar usually 1; Scutellar in multiple rows 11-30 in anterior rows, 19-22 in posterior row (total 31-50).

Legs greenish, with tips and bases of femora and tibiae and tips of tarsi brown.

Leg lengths and proportion (micron):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1908	1861	2618	1179	1032
PII	2000	1961	1097	553	416
PIII	2354	2588	1632	863	679
	Ta4	**Ta5**	**LR**	**F/T**	**Ta5/Ti**
PI	994	466	1.36-1.46	1.00-1.05	0.25-0.27
PII	305	292	0.55-0.58	0.99-1.09	0.12-0.14-

PIII	442	290	0.61-0.68	0.91-0.94	0.10-0.13

Fore Ta4/Ti 0.52 – 0.56; Mid Ti/Ant Ti - 1.03-1.08; BR about 1.1-2.7.

Abdomen brown with paler band on hind border of each segment. Segment GcIX small, oval, with about 3-5 setae, segment GpVIII relatively narrow, with about 17-32 setae.

Morphologically very similar to *C. occidentalis* and *C. duplex*, but is distributed allopatrically to the former and differs from the latter by the generally shorter length of the mid and hind femur and tibia. (A complex discriminant function formula that partially separates the two eastern species was used by J. Martin (Ph.D. Thesis 1966). As well *C. duplex* tends to have more setae, particularly on the clypeus (xx cf. yy), GcIX (4-16 cf. 3-5) and GpVIII (28-42 cf. 17-32), while the ratio of fore Ta4/Ti in *C. australis* (0.52-0.56) appears the be greater than in both *C. duplex* (0.39-0.42) and *C. occidentalis* (0.39-0.42).

Pupa: Large (Len. 9.7-13.7 mm; inner margin of wing case 2.15-2.76 mm) relatively dark exuvia, shagreen large spines central on segment II, expanding laterally to segment IV, then becoming patches of finer spines on segments V and VI, no spines on segment VII, but patch of very fine spines on posterior half of segment VIII.

Respiratory base tending to kidney shape, about 225µm long by 90 µm wide; bases of filaments virtually bilobed.

L-setae at anterior margin of intersegment of III/IV and IV/V, quite long, but those of IV/V probably shorter.

Some characters given in Table below.

	Females		Males	
	Mean	Range	Mean	Range
Length (mm)	12.2	9.7 - 13.7	10.9	9.6 - 12.9

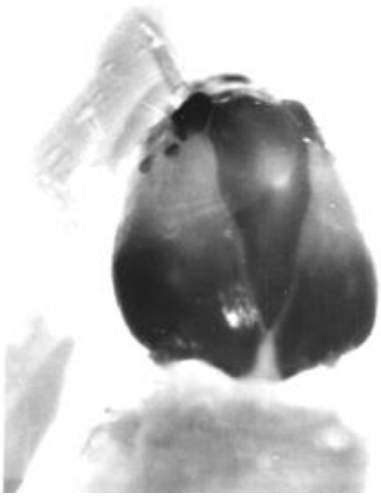
Inner margin wing case (mm)	2.43	2.0 - 2.76	2.37	2.04 - 2.76
Cephalic tubercles (µm)	80		100	70 - 175
Cephalic bristles (µm)			c.30	
Recurved hooks on abd. seg. 2	98	87 - 109	82	73 - 91
Swim fin taeniae (one side)	125	96 - 149	116	100 - 135

Caudolateral spur with 8-16 spines in female, 7-13 in male; sometimes including 1-3 very small basal spines.

C. australis can be readily separated from *C. duplex* at the pupal stage on the basis of the caudolateral spurs, on which the spines are closely applied in *C. australis* but spread in *C. duplex*. The pupal spur of *C. australis* resembles that of *C. occidentalis*. There also tend to be more recurved hooks on the second tergite, but with considerable overlap.

Larva: large bathophilus-type larva. Length about 12.5-21.2 mm (fem. 13.7-21.2 mm; male 12.5-17.7 mm). Relative length of VT appears to vary geographically, with the anterior pair generally longer in N.S.W. and S. Aust., but generally shorter in Tas. and Vic. (Ant. fem. 0.76-2.20; male 0.68-1.84 mm: Post. fem 0.84-2.25; male 0.80-2.00 mm). AT from 127-300 µm in length, ventral pair often longer, generally about twice as long as wide, but ventral pair may be up to 4.2 times longer.

Head capsule (see below) with heavily darkened posterior half to two thirds of gula, FC and dark to very dark on other areas of the head capsule. Distance between the S4 setae of the FC generally greater than the distance between the antennal bases.

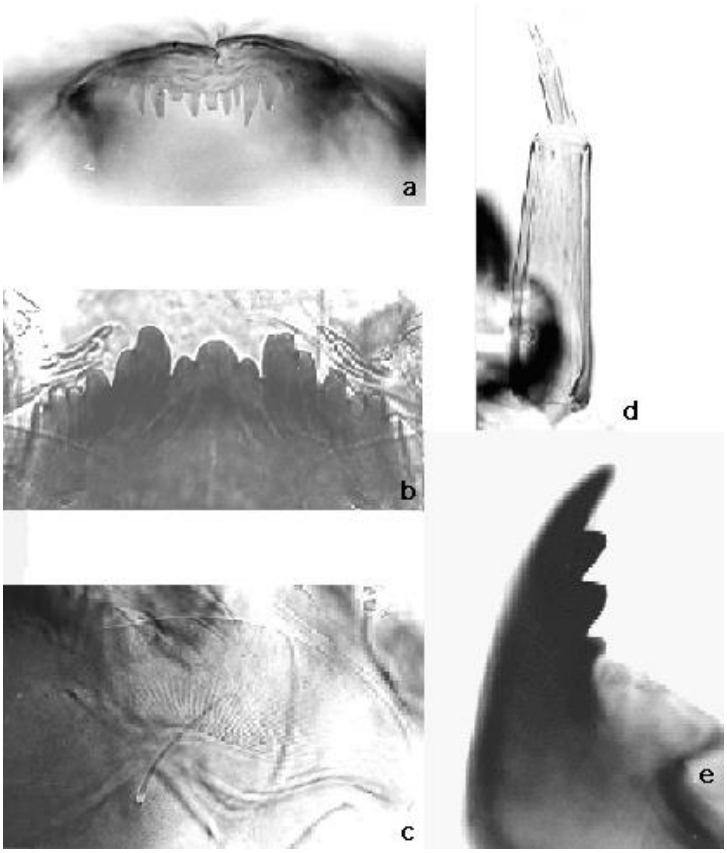


Mentum (b, below) with generally rounded teeth; c2 teeth of central trifid tooth well separated from relatively broad c1 (type IIa-III); 4th laterals reduced to or below level of 5th laterals (type II-III). VMs (c, below) separated by about 0.37-0.48 of mentum width, with about 36-48 striae, reaching about two thirds of way to anterior margin. PE (a, below) with about 10 – 17 sharp, variable teeth. Prm teeth about equal in length and inner tooth at least 1.5 and up to 3 times wider than the outer tooth (lower values due to Prm not lying flat).

Basal segment of antenna (d, below) about 2.8 - 3.8 times as long as wide; AR about 2.01 - 2.39; antennal proportions (µm) 158 : 29 : 8 : 11 : 8.

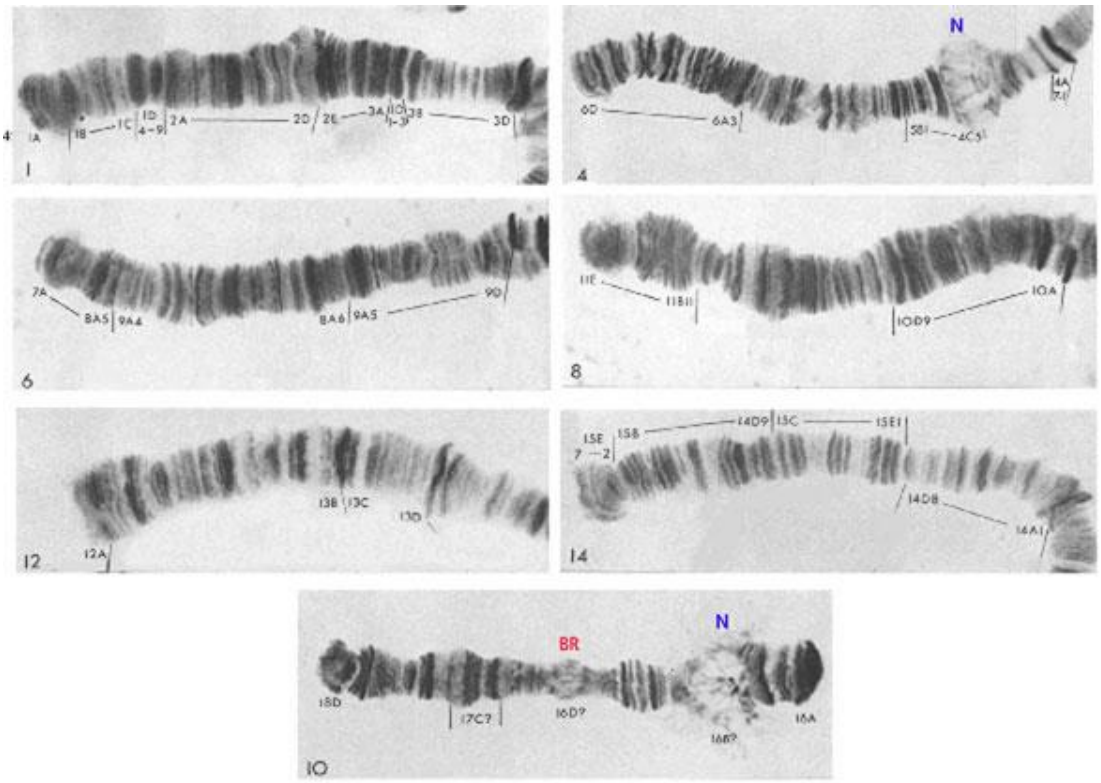
Distance between the S4 setae equal or greater than the distance between the antennal bases.

Mandible (e, below) with third inner tooth at least partially separated and partially darkened (type II or IIIB). Tasmanian specimens may have a relatively pale tooth (IIIA). About 14-16 furrows at base.



Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G closely paired with a subterminal NOR about 20 bands from the heterochromatic centromere, and a BR about the middle of the arm. There is a NOR near the centromere of arm F, at about band group 19.

No inversion polymorphism is known, but there is a sex-linked polymorphism (the MD) associated with the centromere of the CD chromosome (Martin *et al*. 1980), such that the females have two homozygous heterochromatic bands, in males these bands are heterozygous.



ausA1: 1a-e, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 12c-a, 4 - 7, 13 - 19 as oppositus A4

ausB1: A large puff is developed near the middle of the arm, with dark bands proximally (groups 7-8).

ausC1:

ausD1: 1 - 2, 16 - 10d, 3a-d, 9 - 3e, 10a-c, 17 - 24

ausE1: 1 - 3e, 10b - 3f, 10c - 13 as *oppositus* E1, halophilus, etc.

ausF1: 1 - 2a, 10 - 2c, 15c - 11a, 2b, 15d – NOR - 23 as oppositus F3

ausG1 Centromere heterochromatic, with subterminal NOR and BR about middle of arm.

Larva morphologically very similar to those of *C. duplex* and *C. occidentalis*. Separable from the former by the difference in chromosome number, and from the latter by eastern distribution.

Polytene chromosomes published in Martin (1971b), mapped according to the Australian standard system of Martin (1969). However the sequence given for arm F is incorrect.

Nucleoli and location of C-bands studied by Lentzios & Stocker (1979) and Lentzios *et al.* (1980).

Molecular:

Mt*COI*: GenBank Accession numbers KC750267-KC750279

Mt*CytB*: GenBank Accession numbers KC750719-KC750720, KC750590.

CTRT1-like SINE region: GenBank Accession numbers AF356451-AF356458.

Found:

Australian Capital Territory - Belconnen.

New South Wales - Adaminaby; Lake Eucumbene.

South Australia - Dawesley Hill (35.04oS, 138.94oE); Kimba (38.13oS, 136.42oE); Mt. Gambier (37.83oS, 140.77 oE).

Tasmania (Type locality) - Babel Farm, Lackrana (40.10oS, 148.20oE) and West End Farm, Leeka (39.87oS, 147.80oE); Flinders Island; Bothwell (42.38oS, 147.00oE); Cambridge (42.83oS, 147.33oE); Campbell Town (41.92oS, 147.50oE); 3 Km se Carrick (41.55oS, 47.01oE); Jordan River, Jericho (42.22oS, 147.17oE); Longford (41.60oS, 147.12oE); New Norfolk (42.77oS, 147.05oE); Lake Dulverton, Oatlands (42.28oS, 147.35oE); Sandford (42.94oS, 147.50oE); 6.1 Km Swansea (42.13oS , 148.08oE); Tooms Lake (42.32oS, 148.18oE); Whites Lagoon (42.10oS, 147.45oE).

Victoria – Box Hill Gardens Box Hill (Carew *et al*. 2013); LaTrobe University, Bundoora (Carew *et al*. 2013); Station Waters, Cairnlea (Carew *et al*. 2013); Cann River (37.57oS, 149.15oE); Newells Paddock Wetlands, Footscray (Carew *et al*. 2013); Heatherton (Carew *et al*. 2013); 7 Km n. Hepburn Springs (37.26oS, 144.11oE); Lake Boga (35.33oS, 149.17oE); nr. entrance You Yangs Park, Lara (37.83oS, 144.33oE); Leslie Manor; Lilydale (37.92oS, 145.17oE); Meredith (37.49oS, 144.30oE); Lynbrook Estate Wetlands, Lynbrook (Carew *et al*. 2013); Sir William Fry Pk, Moorabin (Carew *et al*. 2013); Spectacle Lake, Point Cook (Carew *et al*. 2013); Roxborough Park (Carew *et al*. 2013); Streatham (37.68oS, 143.06oE); Platypus Ponds and Spavin Lake, Sunbury (Carew *et al*. 2013); Wallington (38.20oS, 144.48oE); Monash Gallery, Wheelers Hill (Carew *et al*. 2013); Wycheproof (36.08oS, 143.22oE).

Description of *Chironomus applicatus* (synonym of *C. australis*)

241. CHIRONOMUS APPLICATUS, Walker.

Chironomus applicatus, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 424 (Div. 1, Alæ nudæ. Sub-div. 1, Halteres pallidi).

"♀.—*Canus; antennæ fuscæ; thorax fusco trivittatus; abdomen fuscum, fasciis ventreque canis; pedes viridescentes, sub-pubescentes, tarsis fere totis femoribusque tibiisque apice fuscescentibus; alæ sub-cinereæ, venis fuscis, litura discali obscuriore.*

"Hoary. Antennæ brown, testaceous at the base. Thorax with three brown stripes, the lateral pair indistinct. Abdomen brown, with a hoary band on the hind border of each segment; under side hoary. Legs greenish, long, slender, slightly pubescent; tarsi, except towards the base and tips of the femora and of the tibiæ, brownish; fore tibia very much longer than the fore metatarsus. Wings greyish; veins brown; discal mark darker brown. Halteres testaceous. Length of the body, 4½ lines; of the wings, 7 lines.

Hab.—"Van Diemen's Land."

Transcription of original description by Skuse 1889

Chironomus bicoloris Tokunaga, 1964

Chironomus (Chironomus) bicoloris Tokunaga, n. sp. (fig. 10, *f*).

Large yellow species, allied to *plumatisetigerus,* but distinguished from it by smaller frontal tubercles (at most as long as two facets) and dark brown subtriangular or oval markings of scutal vittae. AR about 3.1; LR 1.6-1.7; frontal tubercles small, only as long as 1.5 times of diameter of facet in male and two facets in female; scutal vittae of thorax yellow and with four dark-brown spots, two of these spots elongate subtriangular on posterior half of median vittae and other two on anterior parts of lateral vittae; legs with knee parts dark brown, but knee joints very narrowly pale and usually posterior two pairs with knee parts faintly brownish, rarely tibial base without brown marking; tibial apical ends usually brownish, but in fore leg very faint and sometimes quite pale.

Male: Body 6.18-6.24 mm. long; wings 2.96-3.15 mm. by 0.8-0.82 mm. Head yellowish brown or yellowish pale brown, with mouthparts more brownish, frontal tubercles small, at most as long as 1.5 times diameter of facet, eyes separated above by one-seventh to one-eighth length of eye; palpal segments about 22.5: 17.5: 70.5: 84.5: 112.5; antenna with scape yellowish brown, flagellum and plumose hairs brown, AR 3.1 (3.08-3.11). Thorax mainly yellow, scutum pale yellow, with four yellow vittae and four subtriangular dark brown spots on vittae, scutellum pale yellow, with 15 to 17 bristles along caudal margin and 19 to 27 small setae scattered on anterior part, postscutellum dark brown on anterior half and yellow on caudal half. Legs mainly yellow or pale brownish yellow, but all knee parts dark brown and joints very narrowly pale, all tarsal segments apically brown, last one or two segments somewhat more brownish, fore tibia sometimes pale brown at tip, other tibiae usually more brownish at distal ends and sometimes basal brownish bands absent; LR about 1.69, RL-FT about 115: 99.5. Wing with veins very pale, but fR and r-m dark and covered by small dark spot, fMCu under end of r-m, RL-V 94.3: 70: 110: 94.3. Halter white or yellowish white. Abdomen pale brown, gradually fuscus brown caudad, tergites with somewhat T-shaped basal bands; hypopygium (fig. 10, *f*) brown, anal point slender, style slender, apical half suddenly tapered, dorsal appendage with basal pubescent part oval and setigerous, bare caudal projection not distinctly swollen or curved at tip, ventral appendage almost straight, slightly clavate, with 13 to 15 long curved apical bristles, some of these bristles finely plumose apically.

Female: Body about 6.76 mm. long; wings about 3.33 mm. by 0.98 mm. Generally similar to male, but lateral scutal vitta more brownish. Head with eyes separated above by one-sixth to one-seventh length of eye, frontal tubercles small and about as long as two facets; palpal segments about 25: 25: 85: 99: 143; antenna almost entirely pale brownish yellow, neck parts of intermediate flagellar segments as long as half of segments, six-segmented (25: 64: 45: 50: 41: 69). Scutellum with about 20 bristles along caudal margin and about 25 small setae scattered on anterior part. Leg with RL-FT about 130: 111. Wing with fMCu under origin of r-m, RL-V about 96: 87: 135: 102. Abdomen almost uniformly very pale brown or pale brownish yellow, anterior tergites 2 to 6 with very faint broad fuscus clouds, ultimate segment and cerci brown.

Tokunaga's (1964) description of C. bicoloris.

Type data: holotype USNM US66552 adult male, paratype(s) USNM 2 adult males.

Type locality: Dugor, Weloy, Yap Island.

Australian specimens

Adult:

Male: AR about 3.10 - 3.16.

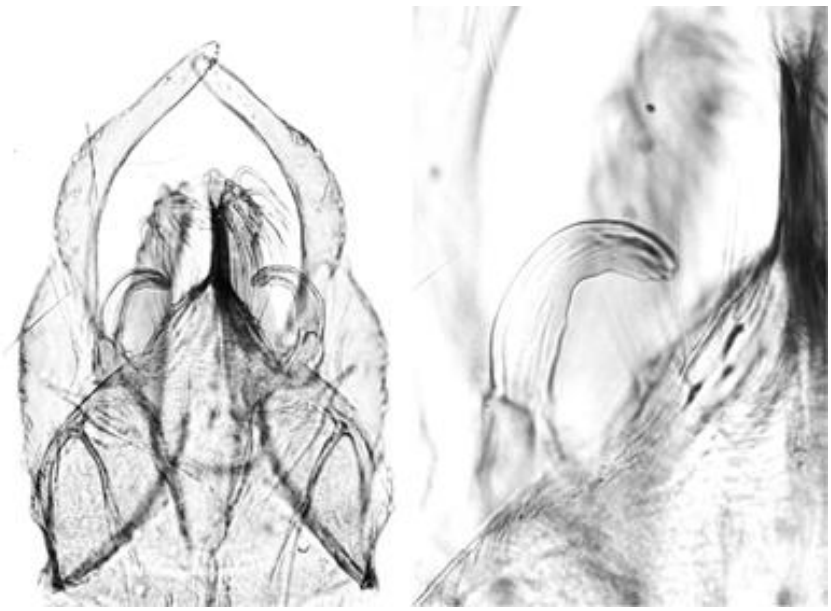
Frontal tubercles longer than in Micronesian specimens - about 28 micron - longer than the width of two eye facets.

Palp proportions: 30 : 127 : 127 : 220

Wing length: 3.34 - 3.76 mm; wing width 0.82 - 0.86 mm; VR about 1.0

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1460	1405	2275	-	-
PII	1540	1450	895	530	390
PIII	1675	1805	1335	750	600
	Ta4	**Ta5**	**LR**	**BV SV**	**BR**
PI	-	-	1.62	1.04	-
PII	215	150	0.61-0.63	1.06	-
PIII	350	155	0.73-0.75	0.93-0.94	-



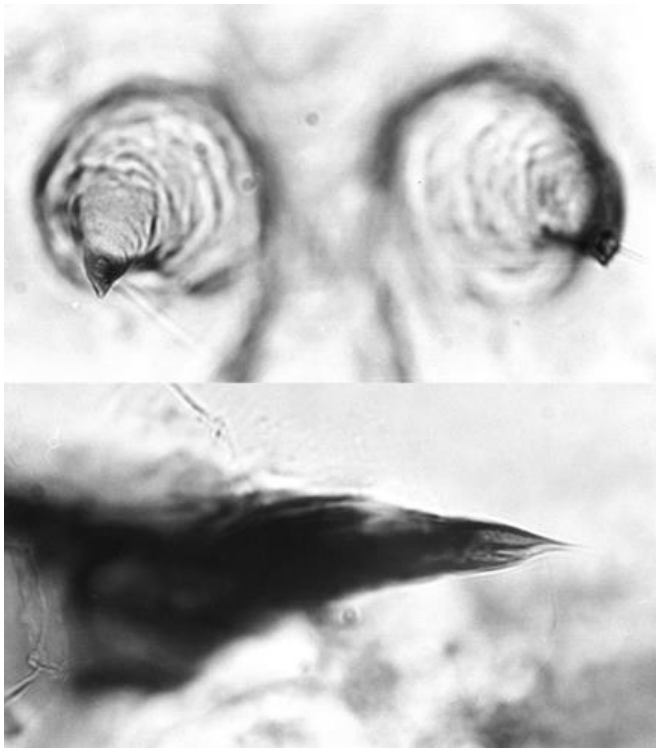
C. bicoloris: Male hypopygium (left) and superior volsella (right)

Setae on 9th tergite: 14-16; setae on inferior volsella forked. Superior volsella of the E-type (see above) (most like h of Strenzke 1959); gonostylus tapers gently over posterior half.

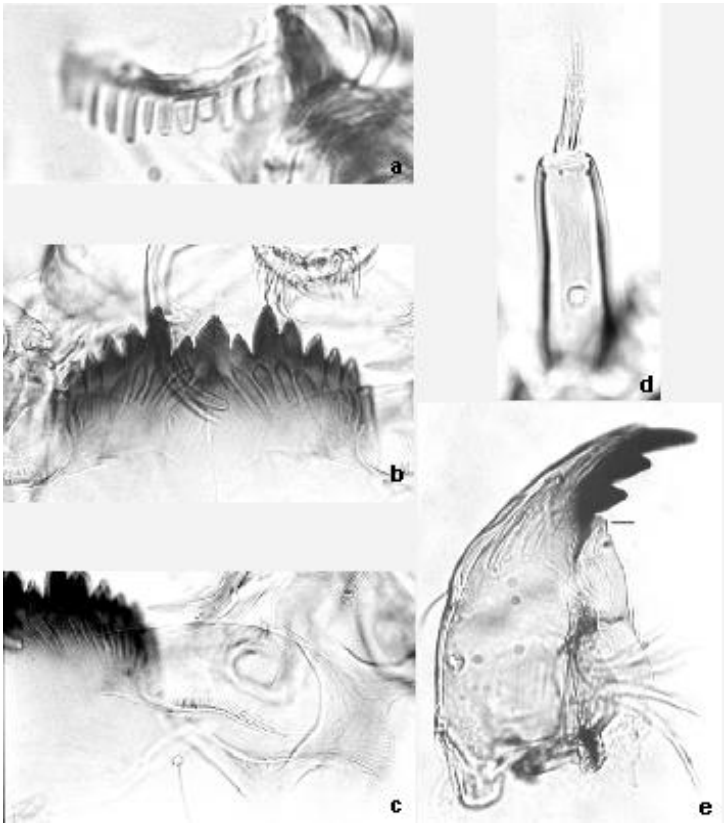
Pupa: Not previously described. One exuvia is available - length about 6.75 mm, inner margin of wing case 1.59 mm. Cephalic tubercles (below) small, 53 x 46 µm, with subterminal seta at least 43 µm.

Basal scar 121 x 68 µm, slightly narrowed in middle, and respiratory base filling almost whole space.

Shagreen sparse in centre of TI, on posterior 2/3 of TII, posterior 3/4 on TIII and TIV, 5/6 on TV, more midline constrained on TVI, mainly on centre line of TVII, and sparse on posterior of TVIII.
L-seta at anterior margin of intersegment of IV/V about 56 µm long.
Caudolateral spurs of segment VIII have 1-2 spines. About 72 taeniae, partly biserial, on each side of swim fin.



Larva: a medium sized plumosus-type larva (Length about 15.2 mm). Anterior VT (1.06 mm) shorter than posterior pair (1.40 mm); PLT about 320 µm. Gula pale or sl. dark over post 1/2; FC pale or very slightly darkened.
Mentum (b, below) with sculpturing along ventral surface and relatively sharp broad teeth; c2 teeth of central trifid tooth well separated from c1 tooth (type IB-IIA), 4th laterals slightly reduced (type I-II).
PE (a, below) with about 16-18 teeth (type B). Ventromentum (c, below) with about 36-39 striae; distance between VM plates about 0.28-0.38 of mentum width; VMR about 0.32-0.33.
Distance between the antennal bases probably greater than that between the S4 setae, which are separated by about 70% of FC width at that point.
Antenna (d, below) with basal segment about 3.5 times as long as wide, RO about a third up from the base; AR about 2.43-2.54; antennal proportions: 127 : 24 : 7 : 13 : 6.
Mandible (d, below) with third inner tooth only slightly separated and darkened (Type IB), and with about 18-20 furrows on outer surface at the base and about 7 taeniae in PMa.



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

Arm G closely paired with a small subterminal nucleolus. Main nucleolus near middle of arm C. Polymorphism at least in arm A.

bicA1: 1 - 2c, 10 - 12, 3i - 2d, 9 - 4, 13 - 19 as *holomelas*?

bifA2: approx 1 - 2c, 10 - 12, 3ih, 6 - 9, 2d - 3g, 5 - 4, 13 - 19

bicB1: typical bands (groups 23-28) near centromere, puff (group 7) near middle of the arm

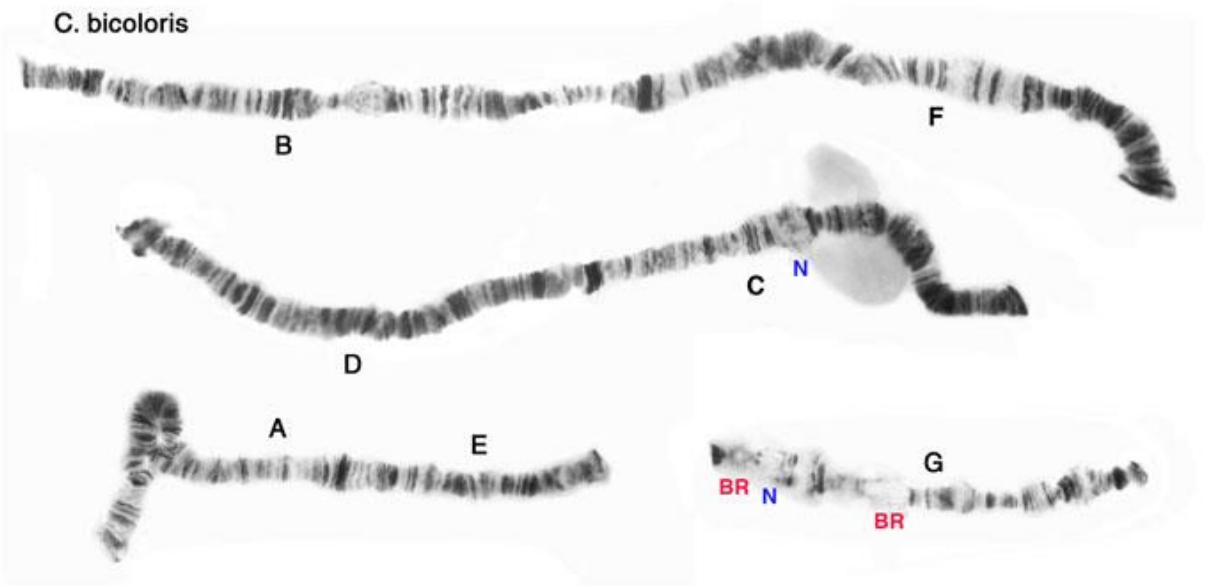
bicC1: NOR near middle of the arm with groups 3-4 immediately distal to it

bicD1:

bicE1: possibly 1 - 3a, 5 - 10b, 4h - 3f, 10c – 13 i.e. as in *aprilinus, atrella, athalassicus*

bicF1: Groups 9-7, 14-15 about 1/3 from end of arm.

bicG1: Small subterminal nucleolus, with a BR between the NOR and the centromere, and another just proximal of the middle of the arm.



Polytene chromosome complement of *C. bicoloris*

Note arm A is heterozygous A1.2

Found: Queensland - Lake Boemingen and Lake Wabby (25.27₀S; 153.80₀E), Fraser Island; 3 km w. Sarina Beach (21.40₀S; 149.25₀E).

Also found in Micronesia - Caroline Islands: Pelau Islands and Yap Island.

Chironomus circumdatus **(**Kieffer, 1916, as *Tendipes*)

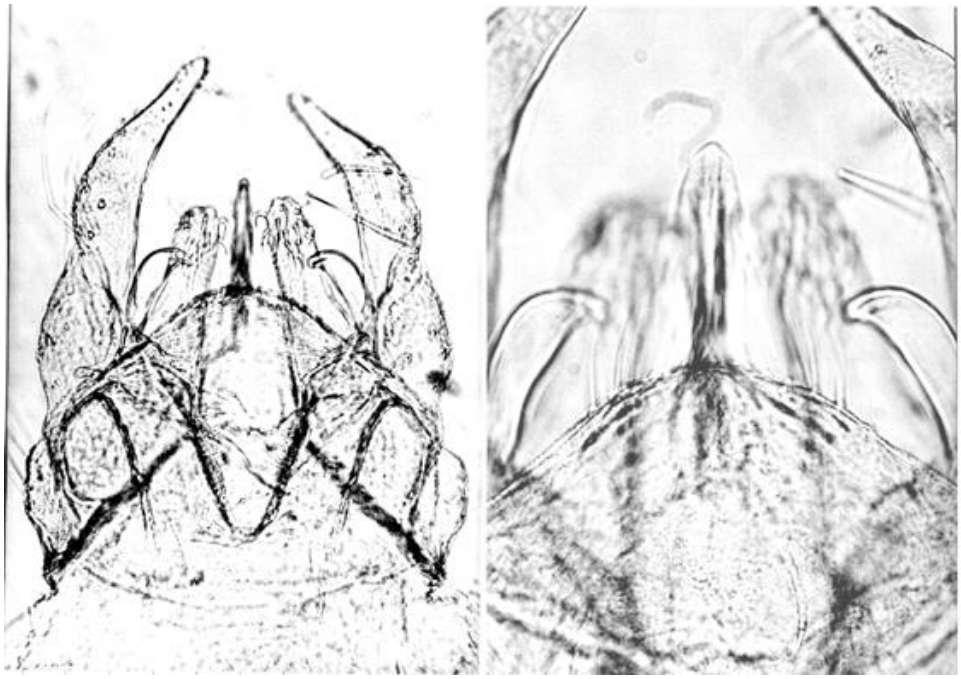
Synonyms

C. basitibialis Tokunaga 1936
C. bharati Singh & Kulshretha 1976
C. costatus sensu Karunakaran 1969 (mt*COI* - Wong, unpubl.; cytology - Martin unpubl.)
C. plumatisetigerus Tokunaga, 1945 (Martin & Saxena 2009)
C. setonis Tokunaga 1936 (Yamamoto 2013)

In BOLD Bin: BOLD:AAG5483

Adult:

Male



Male terminalia of *C. circumdatus*

Anal point relatively narrow, superior volsella strongly curved at the tip.

AR about 3.5.

Frontal tubercles about 38 micron

Mesonotal vittae forming narrow dark stripes.

Wing length: 2.80 mm; wing width 0.67 mm. VR about 1.0

Wings without darkening of the crossvein.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1075	1030	1520	800	700
PII	1120	1000	660	380	260
PIII	1240	1215	980	500	395
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	580	280	1.48	1.04	1.78
PII	165	115	0.66	1.12	
PIII	225	140	0.80	1.01	

Anal point narrow, with 7 setae on 9th tergite. SVo of the D-type, closest to e of Strenzke (1959), but tip may be more bent.

Female (based on Sasa 1978):

Wing length 2.8 mm.

Antennal proportions (µm): 80 : 190 : 120 : 120 : 130 : 280.

Frontal tubercle short and stout, 24 µm long and 17 µm wide.

Palpal proportions (segs. 2-5) (mm): 60 : 240 : 250: 540.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1440	1150	2050	1000	930
PII	1630	1340	810	410	290
PIII	1490	1490	1150	560	460
	Ta4	**Ta5**	**LR**	**F/T**	**Ta5/Ti**
PI	880	410	1.79	1.25	0.36
PII	180	150	0.60	1.22	0.11
PIII	270	180	0.77	1.00	0.12

Abdominal tergites almost entirely dark brown, with narrow apical pale bands on tergites I to VII.

Pupa (Basic description from Asian material) Brown. Exuviae pale brown. Body about 6.6 - 7.7 mm (male) and 6.5 - 7.6 mm (female). Frontal tubercles about 70 - 100 µm, with a subapical seta (40 - 80 µm). Thorax rugose, with 2 pairs of precorneal setae. Abdominal tergite II with median shagreen and about 45 hooklets, tergites III-V entirely with shagreen, tergite VI with T-shaped shagreen, tergites VII-VIII with 2 broad patches of shagreen, and about 3 - 5 spines on the caudolateral spur of segment VIII.

Larva: medium sized plumosus-type larva. Length about 11.3-14.3 mm (Fem. 12.7-14.3 mm; Male 11.3-12.3; Ventral tubules relatively long, posterior pair coiled (Ant. 1.40-1.92; Post. 1.68-2.44 mm); PLT well developed (280-440 µm). VHL about 280-300 µm. AT relatively long, ventral pair slightly longer (320 - 360 µm), about 2.7 - 3.3 times longer than wide. Gula very dark; FC pale to slighly darkened (although in other parts of the distribution it may bevery dark.

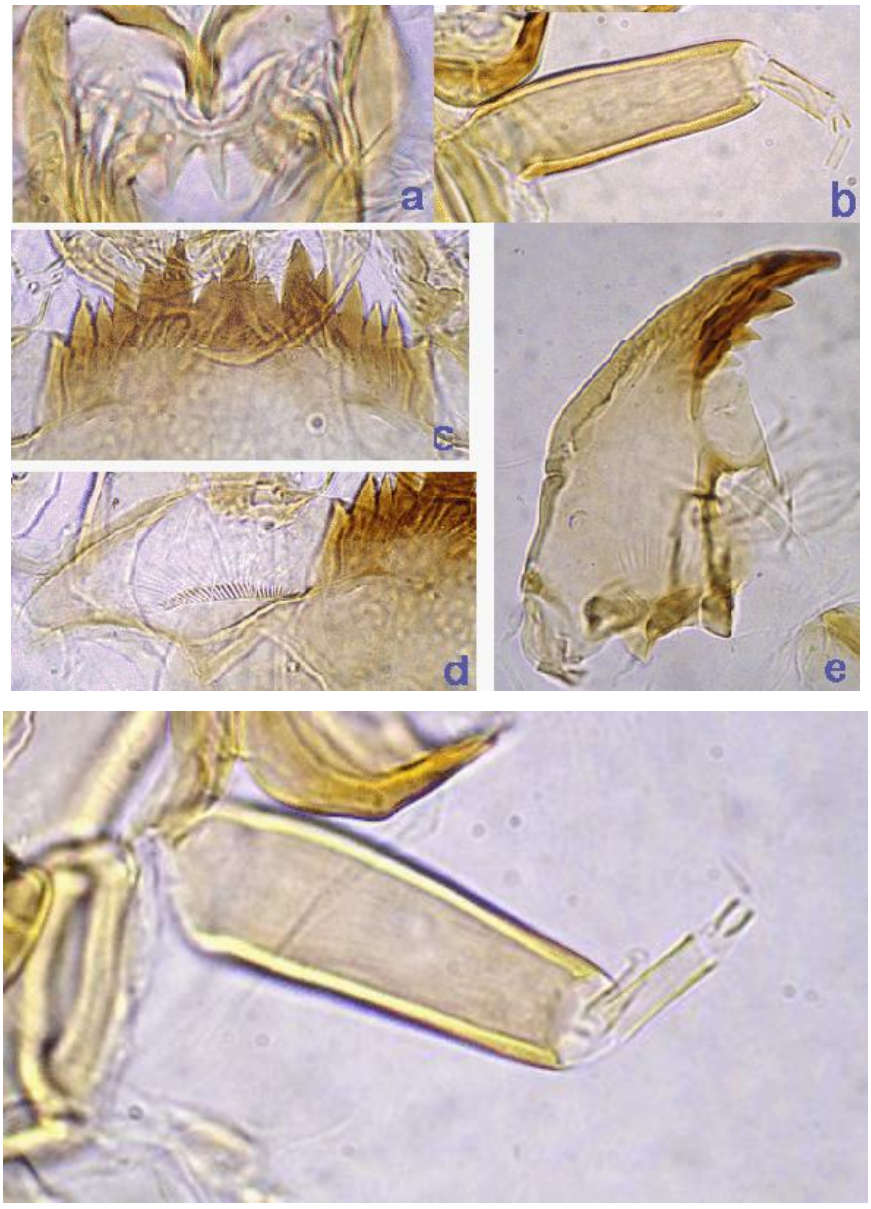
Mentum (c, below) with fourth laterals reduced to about the level of the 5th laterals (type II), 6th laterals pointed outwards; c2 teeth of the tall central tooth (type III) well separated. Ventromentum (d, below) with about 30-36 striae, inner margins separated by about 0.33-0.41 of the mentum width. PE (a, below) with about 12-14 moderately broad, regular teeth (type II or III) .

Prm with inner tooth about 2-2.4x the width of the outer, which is also shorter.

Distance between antennal bases generally less than that between the S4 setae.

Antenna (b, below) with basal segment less than 3.5 times as long as wide; AR about 2.04-2.91; A2/A1 about 0.19-0.24; A4/A3 about 2.3-2.6. Relative length of segments (micron) 105 : 24 : 5 : 12 : 8. Some specimens examined had a four segmented antenna (see below), lacking segment 4 and with segment 5 longer than usual.

Mandible (e, below) with 3rd inner tooth well developed but narrow and pale (type IIIA), and with about 11 - 15 furrows on outer surface near the base.



Antenna of *C. circumdatus* with segment 4 missing

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G is closely paired, with a small subterminal nucleolus, and three BRs from the midlle to near the opposite end. There are nucleoli in arms B (about mid-arm) and arm C (about

one third from distal end). The arm B nucleolus was not found in Darwin.

No polymorphism is known in the Australian samples, but sequence C1 is found at Cairns while C3 occurs at Darwin. B2 and A2, which are not common in Asian populations, are fixed in Australian samples. Polymorphism is known in arms A, B, C, D, and G of Asian populations.

cirA1: 1 - 3, 12 - 4, 13 - 19 as *pseudothummi* (not known in Australia)

cirA2: 1 - 2c, 10 - 12, 3 - 2d, 9 - 4, 13 - 19 as *holomelas*

cirB1: Large puff, with distal dark bands (gps. 8-7) about the middle of the arm; with NOR about one third from centromere. (not known in Australia)

cirB2: Large puff in same relative position, but dark bands proximal (gps. 7-8).

cirC1: Median nucleolus, with characteristic region (gps.3-4) immediately proximal to it.

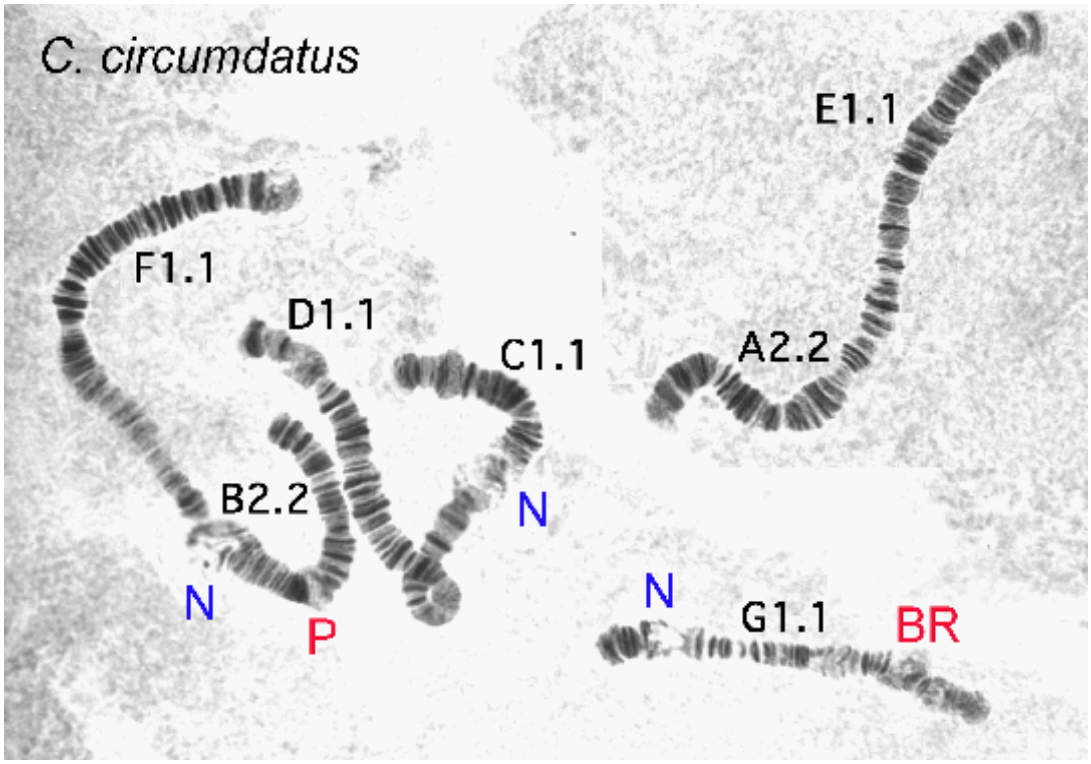
cirC3: A small inversion of the middle of the region distal to the NOR.

cirD1:

cirE1: 1-2, 4-10b, 3e-a, 3f, 10c-13 from *aprilinus* by Inv4-3a

cirF1: 1 - 2a, 10 - 2c, 15c - 11a, 2b, 15d - 23 as oppositus F3

cirG1: Nucleolus near one end, three BRs from just distal to the NOR (not always visible) to near the other end.



Salivary gland chromosomes of Australian *C. circumdatus*

Chromosome arms A, E and F were described by Saxena (1995) as *C. plumatisetigerus*, although an error in the arm F pattern is corrected above.

DNA Sequence:
mt*CO1*: sequence is in GenBank for India (acc. no. KX271850), Pakistan (acc. no. KJ768129), Malaysia acc. no.), Thailand (acc. nos.GU944724, JQ287743-51, KT212956 - 977), Singapore (acc. no. KJ530964-69, KP462069-74, KP462468-69, KP462389-94,68-70, KP462650, 53-56, 59, 62-70, 84), Australia (acc. no. AF19225), China (acc. no. KP902724-29), Japan (acc. no. LC050935). There are also sequences in the BOLD database (see above).

Found: Type locality - Tainan, Yentempo, Takao, FORMOSA (TAIWAN)

Northern Territory - Jabiru East, Alligator Rivers region; Northlakes Golf Club, Darwin.

Queensland – "Aeroglen", Cairns; Sarina Beach.

and New Guinea - Lake Wisdom, Long Island, Madang District.

Also found in Taiwan (Type locality - Tainan, Yentempo, Takao, FORMOSA); India, Malaysia, Singapore, Thailand and Pacific Islands.

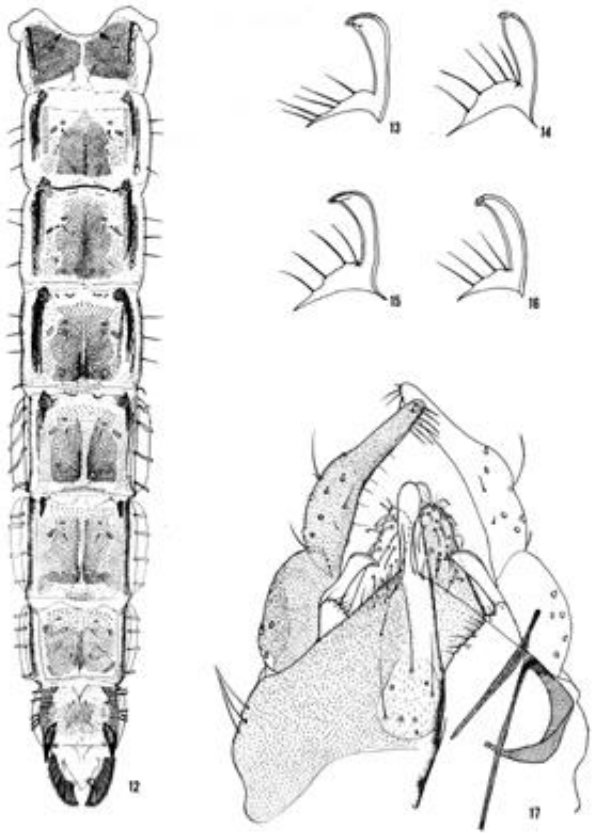
There have been redescriptions of morphology of Asian specimens by Sasa (1978) and Chaudhuri *et al*. (1992). Chaudhuri *et al*. claim the larval VT are not coiled.

Chironomus cloacalis Martin, 1971

Initially attributed to Atchley and Martin, but later corrected to just Martin as original Atchley and Martin (1971) paper was not a valid description.

In Bold Bin: BOLD:AAJ4272

Chironomus alternans C – Martin 1961.



Illustrations of the pupal exuviae and parts of the hypopygium of *C. cloacalis*

Fig. 12, Dorsum of pupal exuviae; Figs. 13-16, Variation of the superior appendage in the type series; Fig. 17, Lectotype male genitalia.

From Martin (1971a).

Adult:

Male:

Head antennae and mouth parts brown; thorax greenish grey; stripes, postnotum, sternopleuron and pedicel of antennae dark brown.

AR 3.56 (3.24-4.24). Palpal proportions (segments 2-5) (microns) 60 ; 230 : 265 : 365. Length frontal tubercles 29 (18-44) micron. Clypeus moderately broad, 0.75 times width of antennal pedicel; 23 (11-38) clypeal setae.

Pronotum broad, apically tapered, then abruptly widened at the apex, anteriorly with a broad notch. mesonotum with a scarcely discernible median tubercle. Thoracic setae – acrostichal abt 14-16; dorsolateral about 14 (13-19) in two rows; prealar about 4 (4-5); supra-alars 1 (1-2); scutellars in two rows, more in the posterior row, in total 24 (15-40).

Wing length about 3.76 (2.66-4.60) mm, width 0.91 (0.76-1.10). SCf on brachiolum 3 (2-5). VR about 1.02.

Legs yellowish brown without definite markings, tarsal segments darkened.

Leg proportions (microns):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1510	1330	2090	1000	850
PII	1600	1490	850	440	330
PIII	1820	1860	1290	710	580
	Ta4	**Ta5**	**LR**	**Fe/Ti**	**BR**
PI	690	310	1.44-1.78	1.11-1.35	1.1-1.8
PII	240	180	0.55-0.58	1.03-1.09	-
PIII	310	200	0.67-0.75	0.98-1.00	-

Male abdomen variable, generally darkened, with pale posterior band, but may be green with only a dark saddle spot. About 8 (5-11) setae on the 9th tergite. SVof D-type, between d and e of Strenzke (1959). IV with forked setae.

Female:

General coloration as in males, but with dark markings more extensive.

Antennal proportions (microns) 190 : 135 : 155 : 140 : 225; AR abt. 0.30-0.36; A5/A1 abt. 1.0-1.18.

Palpal proportions (segments 2 to 5) (microns) 75 : 225 : 265 : 395. Length of frontal tubercles 26 (15-32) micron.

Clypeus broad, 1.5 times the width of the antennal pedicel; 31 (20-43) clypeal setae.

Pronotum as in males, mesonotum with a very slight median tubercle. Thoracic setae – acrostichal about 14-15; dorsolaterals 18-21 in roughly two rows, becoming single posteriorly; pre-alars about 5 (5-6), supra-alar 1, scutellum with 10-19 setae in posterior row, 6-11 in anterior row (range 18-43 in total).

Wing length: 3.95 (2.76-5.05) mm, width: 1.14 (0.88-1.33) mm. Squama fully fringed, 3 (2-6) SCf on brachiolum. Haltere pale.

Leg proportions (microns):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1470	1220	1880	850	780
PII	1550	1420	760	400	310
PIII	1730	1690	1150	600	490
	Ta4	**Ta5**	**LR**	**Fe/Ti**	**Ta4/Ti**
PI	740	330	1.45-1.88	1.20-1.24	0.61-0.73
PII	220	180	0.51-0.59	1.08-1.09	-
PIII	310	200	0.65-0.70	0.97-1.02	-

Abdominal fasciae much broader than in male, segments two to nine dark with a light posterior border. Genital lamellae as in other members of the genus.

Pupa: General coloration is dark on the cephalothorax and abdomen. Some characters given in Table below. Queensland specimens are smaller (abt. 9.37 mm, females; 8.66 mm, males) than those from Victoria (abt. 10.81 mm., females; 9.66 mm., males).

Frontal tubercles are short and conical; base of respiratory organ 155 x 75 µm. Anterior to this base is a small elevated patch of wartlike tubercles; dorsal to the base is a larger, more elongated patch of smaller tubercles.

Shagreen pattern and chaetotaxy as in Fig. 12 (above)..

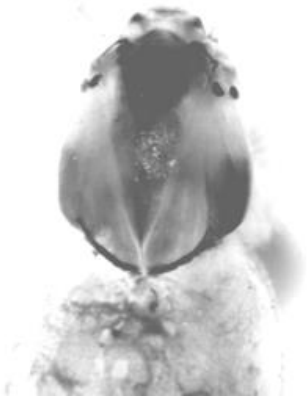
Caudolateral spur on segment VIII (Fig. 9-11, below) normally with 3 or 4 spines, range 1 - 6.

	Females		Males	
	Mean	Range	Mean	Range
Length (mm)	9.8	7.6 – 10.8	9.2	7.6 - 10.4
Posterior margin wing case (mm)	2.0	1.4 - 2.2	1.9	1.7 - 2.1
Cephalic tubercles (µm)				
Cephalic bristles (µm)	39	32 - 42	43	38 - 45
Recurved hooks on abd. seg. 2	95	81 - 108	74	70 - 106
Swim fin taeniae (one side)	131	72 - 173	116	98 - 154

Larva: a medium sized (9.6-18.0 mm; mean length female 14.7 mm; male 13.1 mm) plumosus-type; VT well developed, posterior pair longer (Ant.: fem. 0.92-2.59; male 0.83-2.75 mm: Post.: fem. 1.17–2.75; male 0.92-2.67 mm). Lateral tubules usually well developed, but occasionally shorter (120- 480 µm).

Gular region generally darkened, FC dark, but occasionally pale; also very occasionally with

some darkening on other parts of the dorsal head capsule. Pale headed larvae are very difficult to distinguish from *C.* 'februarius', although the gula region should be more heavily darkened over the posterior half.



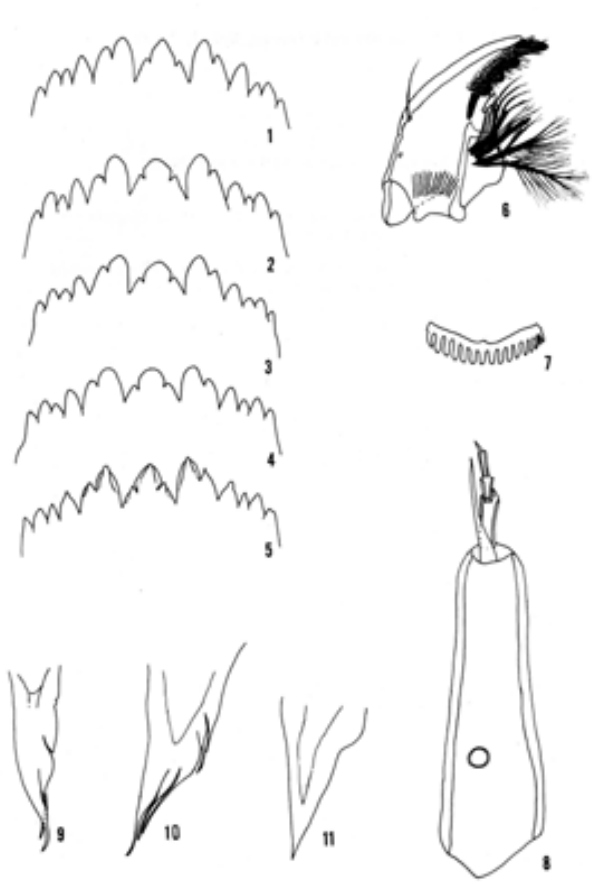
Mentum (Figs. 1-5) of type II or III, and c2 teeth generally notches on the c1 tooth, i.e. type IA or B, but may be more developed to type III.

Ventromental plates about 3.4 times longer than deep: separated by 0.27-0.31 of mentum width; with about 33-35 striae; VMR abour 0.25-0.28. PE (Fig. 7) with about 12-21 (mean 16) teeth of type B.

Basal segment of antenna (Fig. 8) relatively long and narrow, about 4-5 times longer than wide; RO from a quarter to a half up from base of segment; AR about 2.3- 3.0; A2/A1 about 0.18; A2 less than width of A1; A4/A3 about 0.9-1.2; antennal proportions (µm) 144 : 30: 12 : 14 : 6.

Distance between S4 setae about 0.8 of FC width and equal to or greater than the distance between the antennal bases.

Mandible of type IIB-IIIC, with about 12-15 furrows on the outer surface near the base; PecM with 10-13 taeniae.



Illustrations of parts of the larval head capsule and the pupal spur of *C. cloacalis*
Figs. 1-5, variation in mentum; Fig. 6, Mandible of lectotype; Fig. 7, Pecten epipharyngis;
Fig. 8, Antenna; and Figs. 9-11, Variation in posterolateral spurs of the pupae.
From Martin (1971a).

C. cloacalis appears to have a lower number of ventromental striae (33-35) than does *C.* 'februarius' (39-44).

Cytology: 4 polytene ochromosomes with the pseudothummi arm combination AE, BF, CD, G.
All chromosomes generally closely paired.
Arm G with an almost terminal nucleolus, with 2 Balbiani rings; two of the known BRs are not developed, BR1 proximal to the median BR, and BR4 virtually at telomere. No nucleoli in long chromosomes. Low level of polymorphism in arms A, B, C, D, F, and G. The MD is on arm G (Martin & Lee 1984).

cloA1: 1a - 2c, 10a - 12c, 3i - 2d, 9e - 4a, 13a - 19 as holomelas, etc.

cloA2: approx 1a - 2c, 11e-a, (6?)7 - 9, 2d - 3, 12a-c, (6?)5 - 4, 13 - 19

cloA3: 1a-e, 13e-a, 4 - 9, 2d - 3, 12 - 10, 2c-a, 13f - 19

cloB1: Puff and distal dark bands (groups 7-8) about 1/3 from centromere.

cloB2: Inversion of distal 2/3 of arm, proximal break in or just distal to puff, distal break near end of arm.

cloB3: Small inversion at distal end of the arm. Distal break closer to end than in B2.

cloC1: 1, 14 - 11d, 6b - 2, 15, 8 - 11c, 6gh, 17a - 16, 7d-a, 6fc, 17b - 22 (Wülker)

cloC2: abt 1, 14 – 11d, 6b-4, 6hg, 11c – 8, 15, 2 - 3, 17a -16, 7d-a, 6fc, 17b - 22

cloC3: abt 1a, 5e - 6b, 11d – 14, 1i-b, 5d – 2, 15, 8 - 11c, 6gh, 17a - 16, 7d-a, 6fc, 17b - 22

cloD1: 1 - 2, 17 - 12b, 10 - 7, 3g-a, 6 - 4, 12a - 11, 18 - 24, i.e as febD1 (Kiknadze)

cloD2: 1 - 2, 17 - 12, 4 - 6, 3a-g, 7 - 11, 18 – 24 i.e the phylogenetically older sequence

cloE1: 1a - 2b, 5a - 10b, 3e - 2c, 4h - 3f, 10c - 13

cloF1: 1a - 2a, 4a - 10d, 3f - 2b, 11a - 23

cloF2:

cloG1:

cloG2

Nucleoli and location of C-bands studied by Lentzios and Stocker (1979) and Lentzios *et al*. (1980).

Molecular:

Mt *COI* - GenBank (Acc. No. AF192214.1, and several others) and BOLD (CAUS025-10, CAUS026-10).

Mt*CytB*- GenBank (Accession number AF192183.1).

Found:

Australian Capitol Territory – Belconnen (35.23oS, 149.05oE).

New South Wales - Asquith; Carlisles Gully, 21 Km ne. Bendemeer; 9 Km s. Broken Hill; Clifton; Goulburn; Kolstap Bore, w. Perri (Peri) Lake; Thredbo Village.

Northern Territory - N'dhala reserve, East Macdonnell Ranges.

Queensland - Atkinsons Dam; Balonne Riv.; Babinda Creek, Babinda; 2 Km s. Bindle; 20 Km sw. Bell; Calliope; Lotus Creek; Noosaville; St. Lucia; Toowoomba; Woodridge.

South Australia - Bolivar Sewage Works; Hawker; Naracoorte; Oratunga Creek, Parachilna.

Tasmania – Bellerive (42.83oS, 147.33oE).

Victoria - Albert Park; Altona; Bacchus Marsh; Ballarat East; Berwick Views, Beaconsfield (Carew *et al*. 2013); 22Km n. Bendigo; Dandenong; Dandenong Creek, Dandenong (Carew *et al*.

2013); Dandenong South (Carew et al. 2013); Nilimbik pond, Diamond Creek (Carew *et al*. 2013); Doncaster; Endeavour Hills (Carew *et al*. 2013); Kalparrin Reserve, Greensborough (Carew et al. 2013); Ovens Track nr. Harrietville (Carew et al. 2013); Lara; Leslie Manor; Lilydale; Lower Templestowe; Meredith; Mildura; Red Leap, Mill Park (Carew et al. 2013); Nar Nar Goon; Noble Park; North Balwyn; Parkville; 'Strathfieldsaye' Perry Bridge; Spout Creek; Wantirna Rd., Wantirna (Carew et al. 2013); Melbourne Water Metropolitan Farm, Werribee (37.92oS, 144.67oE) (Lectotype locality); Wilsons Promontory National Park, nr. Yanakie.

Western Australia – Armadale (32.253oS, 116.015oE); Lake Gwellup (31.867oS, 115.800oE), nr. Perth; Lake Seppings (35.015oS, 117.911oE), Mira Mar, Albany; Albany (Carew et al. 2013); Sherlock River (20.578oS, 117.378oE), Sherlock.

Some data on mentum given by Atchley and Martin (1971). Larval morphology and polytene chromosomes figured by Martin (1971a). Sequences of arms A, E and F given by Wülker et al. (1989).

Chironomus duplex Walker, 1856

Synonyms:

Chironomus imitans Walker 1856 (see transcription of original description, below)

In BOLD Bin: BOLD:AAM6665

A large species with the anterior tarsi of the male strongly bearded; Leg ratio about 1.2 - 1.3. Antennal ratio (AR) about 3.81 - 4.75.

242. CHIRONOMUS DUPLEX, Walker.

Chironomus duplex, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 424 (Div. 1. Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♀.—*Albido-viridis; antennæ testaceæ, fusco fasciatæ; thorax vittis tribus obscure cinereo-fuscis; abdomen fuscum, albido tomentosum, fasciis lateribusque albido-viridibus; pedes virides-centes, tarsorum articulis apice fuscis, alæ limpidæ, venis halteri-busque testaceis, litura discali fusca.*

"Whitish-green. Antennæ testaceous; sutures and tips brown. Thorax with three dark greyish-brown stripes. Abdo-men above brown, with whitish tomentum; sides and hind borders of the segments whitish-green. Legs greenish, long, slender; tips of the joints of the tarsi brown. Wings limpid; veins testaceous; discal mark brown. Halteres testaceous. Length of the body, 4½ lines; of the wings, 7 lines.

Hab.—"Van Diemen's Land."

Original description of *Chironomus duplex* from Skuse 1889

Male:

Male terminalia of *C. duplex*
about 1 - 8 setae on 9th tergite

Wing length 4.80 – 6.25 mm; width 1.08 – 1.24 mm, VR 1.02 – 1.07. 2 – 5 SCf on brachiolum; 12- 19 setae on squamal fringe.

Frontal tubercles present, length about 28 - 73 micron and 2–5.5 times the width at the base (i.e. a few specimens have very small tubercles); Clypeus roughly triangular, width about 0.85-1.2 two times the diameter of the antennal base; 29 - 55 clypeal setae. Lengths of palpal segments (micron) 68 : 72 : 251 : 262 : 381.

Thoracic setation: About 19 acrostichal; 18 - 30 dorsocentral setae; 5 - 9 prealar; 1 – 2 supra alar. Scutellum with setae in two rows; anterior with 11 - 23 setae (higher numbers generally in two rough rows), posterior with 15 - 23 setae.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1720	1670	2140	1230	880
PII	1920	1870	1080	670	520
PIII	2370	2440	1580	950	740
	Ta4	**Ta5**	**LR**	**F/Ti**	**BR**
PI	920	400	1.22-1.42	1.00-1.05	4.1-7.8

PII	190	140	0.54-0.62	0.98-1.07	-
PIII	280	170	0.63-0.70	0.94-1.01	-

MidT1/AntT1 – 1.04-1.15

Abdomen black with a pale posterior margin on the anterior segments. 1 – 6 setae at center of 9th tergite; SVo closest to E(h) type of Strenzke (1958); setae of IVo simple; gonostylus reducing sharply over about the posterior third.

Female

Wing length 4.95 – 7.30 mm; width 1.24 – 2.10 mm; VR 1.03 – 1.08. About 21-38 setae in squamal fringe. LR about 1.28.

Relative lengths of antennal segments (micron): 243 : 137 : 153 : 148 : 320; AR 0.41-0.59; A5/A1 1.18-1.29. Cephalic tubules quite variable in length, 23-76 µm (usually more than 50 µm) and about 1.3 – 3.0 times longer than width at base, seta usually lost. Clypeal width about 1.6-1.8 times the diameter of the antennal base, about 29- 70 clypeal setae. Palpal proportions (micron) 84 : 68 : 256 : 272 : 410.

Thoracic setae: Acrostichals – at least 10-13; Dorsocentrals – 29-43; Prealar – 6-11; Supraalar – normally 1, occasionally 2; Scutellar in multiple rows - 11-32 in anterior rows; 19-27 in posterior row (total 30-56).

Legs greenish, tips of tarsi dark brown. Leg lengths and proportions (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1823	1766	2254	1147	830
PII	2000	1980	1120	645	468
PIII	2448	2612	1702	968	756
	Ta4	**Ta5**	**LR**	**F/Ti**	**Ta5/Ti**
PI	746	380	1.21-1.42	0.97-1.06	0.20-0.21
PII	345	275	0.53-0.55	0.97-1.05	0.13-0.14
PIII	471	319	0.63-0.66	0.86-0.97	0.12-0.13

Ant. Ta4/Ti - 0.39-0.42. MidTi/AntTi – 1.07-1.16; BR about 0.90-0.97.

Abdomen brown with pale anterior margins.

Morphologically very similar *to C. occidentalis* and *C. australis* (with which it was incorrectly synonymised by Freeman 1961), but is distributed allopatrically to the former and differs from the

latter by the generally longer length of the femur and tibia of the mid and hind legs. (A complex discriminant function formula that partially separates the two species was used by Martin, J. (Ph.D. Thesis 1966)). The ratio of Mid femur/Ant femur = 1.08 - 1.17; Mid tibia/Ant tibia = 1.04 - 1.18; Hind femur/Ant femur = 1.25 - 1.45; Hind tibia/Ant tibia = 1.38 - 1.53.
It seems likely that a male with a mid femur greater than 1.12x the anterior femur will be *C. duplex*. The values for females are lower, and there is more overlap, but a value of 1.10 or above is likely to be *C. duplex*; as well GpVIII generally with more than 27 setae, while females of *C. australis* and *C. occidentalis* generally have less than 25.

Pupa: General coloration is dark. Some characters given in Table below.

	Females		Males	
	Mean	Range	Mean	Range
Length (mm)	12.9	10.3 - 15.3	11.9	7.8 - 14.0
Inner margin wing case (mm)	2.6	2.2 - 3.1	2.3	1.8 - 2.9
Cephalic tubercles (µm)				
Cephalic bristles (µm)				
Recurved hooks on abd. seg. 2	84	71 - 98	71	55 - 80
Swim fin taeniae (one side)	127	64 - 175	121	95 -146

Caudolateral spurs (below) of segment VIII with about 10 spines, ranging from 4 - 16.

C. duplex can be readily separated from *C. australis* and *C. occidentalis* at the pupal stage on the basis of the pupal spurs, on which the spines are spread in *C. duplex* but closely applied in *C. australis* and *C. occidentalis*. There also tend to be fewer recurved hooks on segment 2 than in *C. australis*, but there is considerable overlap.

Larva: Large bathophilus-type larva, length about 15.9 - 21.2 mm (female); 14.7 - 18.8 mm (males). Ventral tubules relatively short (from about 0.8 – 1.1 times width of segment), anterior pair usually shorter (ant: fem, 1.00-2.67; male, 0.96-2.17 mm: post: fem, 1.25-2.76; male 1.12-2.33 mm). Anal tubules relatively short and rounded (about 380-530 x 250-330 µm), i.e. about 1.5-1.7 times longer than wide.

Head capsule (Fig. f, below) heavily darkened on the gula, FC and other regions.

Mentum (Fig. c, below) with pointed teeth, particularly on central trifid tooth, which is type II; fourth laterals reduced, sometimes to about the level of the fifth laterals (type I-II).

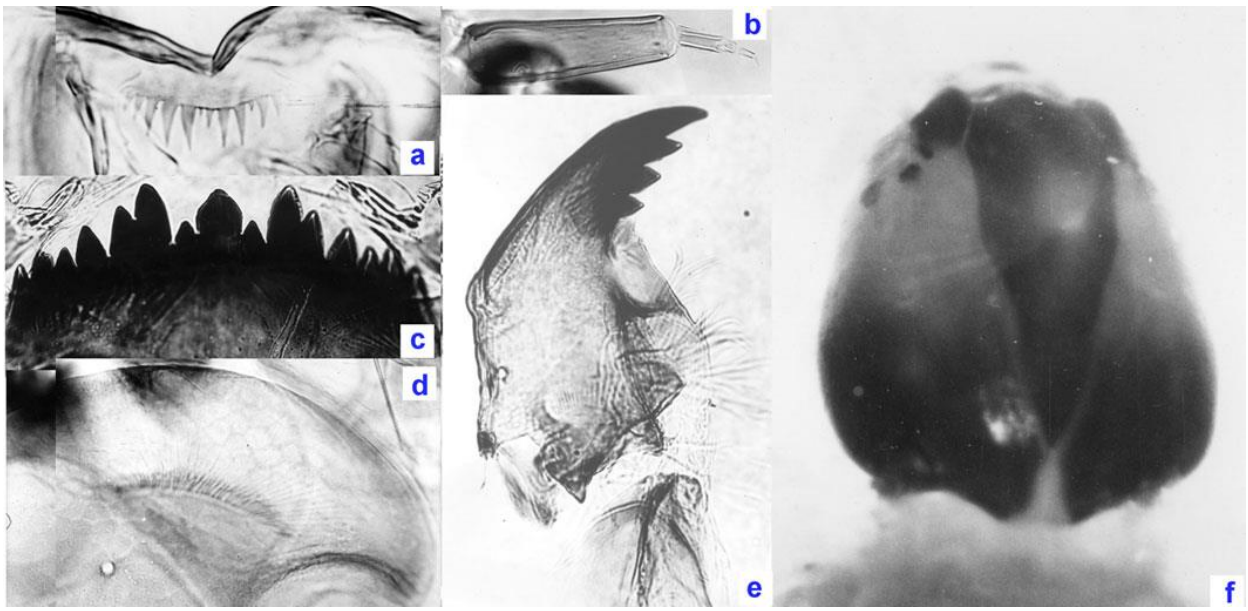
Premandible with the inner tooth about 5x the width of the outer tooth.

Ventromentum (Fig. d, below) with about 42-57 teeth. Pecten epipharyngis (Fig. a, below) with about 14 - 17 sharp teeth.

Antenna (Fig. b, below) basal segment 3.0 - 3.4 times as long as wide; with AR about 2.4 (2.0 - 2.8) ; antennal proportions (µm): 170 : 33 : 8 : 15 : 8.

Distance between S4 setae sometimes greater, sometimes less than that between the antennal bases.

Mandible (Fig. e, below) with a distinct, sharp and fully separated third inner tooth (type IIIC).



Cytology: 3 polytene chromosomes with the modified pseudothummi arm combination AEG, BF, CD. Arm G with medial nucleolus, with adjacent BR and other BRs more proximal. Other

nucleoli in arms A, C and F. Polymorphism in arms A, B (often sex linked to MD (Martin *et al*. 1980)), D, F, and G.

dupA1: 1a-e, 4c-a, 12a-c, 3i-f, 9 - 8a, 2d - 3e, 1f - 2c, 10a - 11, 4d - 7, 13a - 19

dupA2: an overlapping inversion or transposition.

dupB1:Puff and proximal dark bands (groups 7-8) about middle of arm as in *oppositus* and *australis*

dupB2: Bulb (7) separated from dark bands (8) to near tip of arm.

dupC1: NOR about one third from distal end.

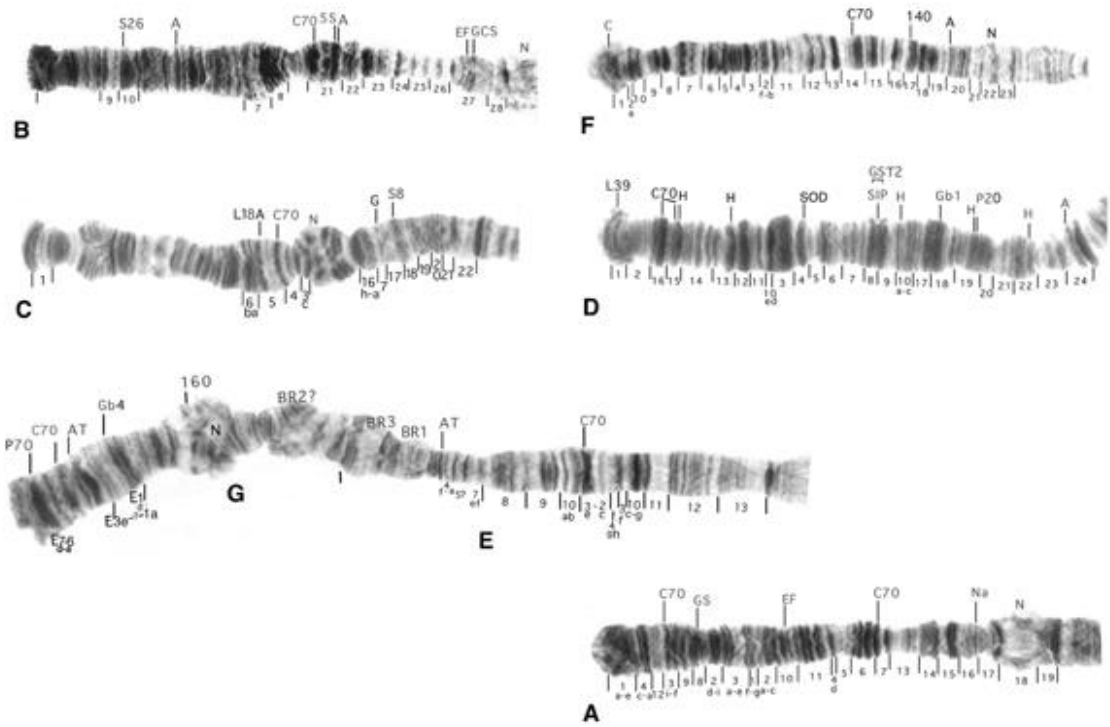
dupD1: 1 - 2, 16 - 10d, 3 - 10c, 17 - 24

dupD2: 1 - 2c, 17c - a, 10c - 3, 10d - 16, 2h-d, 17d - 24

dupD3: 1 - 2c, 8 - 10c, 17a-c, 7 - 3, 10d - 16, 2h-d, 17d - 24

dupE1: approx. 7d - 6, arm G, 3e - 1a, arm G, 4(f-a?), 5?, 7e - 10b, 3e - 2c, 4gh, 3f, 10c - 13

dupF1: 1 - 2a, 10 - 2b, 11 - 23 as. *oppositus* F1



Polytene chromosomes of *C. duplex* showing the location of some genes

Larva morphologically very similar to those of *C. australis* and *C. occidentalis*. Separable from the former by the difference in chromosome number, and from the latter by eastern distribution.

Polytene chromosomes published in Martin (1971b) and Martin et al. (2010). Nucleoli and location of C-bands studied by Lentzios Stocker (1979) and Lentzios *et al*. (1980).

Molecular data:

mt *COI*: see GenBank accession numbers AF192179, AF192210, and others; and BOLD CAUS026-10

mt *cytB*: see GenBank accession numbers KC750721 - KC750729.

gb2ß: see GenBank accession numbers AJ003790, AJ003791.

γ *-glutamylcysteine synthase*: see GenBank accession number AY490748.

Ribosomal protein S26 (*RpS26*): see GenBank accession number AY490754.

glutathione synthase: see GenBank accession number AY490750.

CRT1-like SINE region: see GenBank accession numbers AF356441 - AF356450.

Found:

New South Wales – Forbes (33.22.85ₒS, 148.00.66ₒE).

South Australia – Barmera (34.25ₒS, 140.47ₒE); Lake Edward & Lake Leake, Kalangadoo (37.62ₒS, 140.58ₒE); Brown Lake, and Valley Lake, Mt. Gambier (37.80ₒS, 140.75ₒE).

Tasmania (Type locality) - Flinders Island - Stoney Lagoon and Babel Farm, Lackrana area (40.10ₒS, 148.22ₒE); Kronstadt farm, Emita (40.00ₒS, 147.92ₒE); West End farm, Leeka (39.87ₒS, 147.80ₒE).

King Island - Cape Wickham Rd., nr. Little Cask Lagoon (39.60ₒS, 143.93ₒE).

Lake Dulverton, Oatlands (42.28ₒS, 147.35ₒE).

Victoria - Albert Park Lake, South Melbourne (37.85ₒS, 143.05ₒE); Lake Bullen Merri, Camperdown (38.25ₒS, 143.10ₒE); Snake Gully, Monash University, Clayton (37.9083ₒS, 145.138ₒE); French Island (38.35ₒS, 145.38ₒE); Hoddles Creek; Lara (37.83ₒS, 144.33ₒE); Lake Learmonth, Learmonth (37.43ₒS, 143.70ₒE); Leslie Manor (abt 38.17ₒS, 143.50ₒE); Royal Botanical Gardens, Melbourne (37.83ₒS, 144.00ₒE); Edwardes Lake, Reservoir (37.42.77ₒS, 144.59.67ₒE); Emu Bottom, Sunbury (37.53ₒS, 144.73ₒE); 7 Km s. Wangaratta (36.44ₒS, 146.25ₒE); Melbourne Water Metropolitan Farm, Werribee (abt. 37.92ₒS, 144.67ₒE); Wycheproof (35.08ₒS, 143.22ₒE).

Description of *Chironomus imitans* Walker (synonym of *C. duplex*)

243. CHIRONOMUS IMITANS, Walker.

Chironomus imitans, Walk., Insecta Saundersiana, Vol I. Diptera, 1856, p. 425 (Div. 1. Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♂.—*Pallide viridis; antennæ fuscæ; thorax vittis tribus pectorisque disco nigro-cinereis; pedes tibiis et tarsorum articulis apice fuscescentibus; alæ limpidæ, venis albidis, litura discali fusca.*

"Pale green. Antennæ brown. Thorax with three blackish-grey stripes. Pectus with a blackish-grey disc. Abdomen with a broad blackish-grey band on the fore border of each segment. Legs pale green, long, slender; tips of the tibiæ and of the joints of the tarsi brownish. Wings limpid; veins whitish; discal mark brown. Length of the body, 4 lines; of the wings, 6 lines.

Hab.—"Van Diemen's Land."

Transcription of original description by Skuse 1889

***Chironomus* 'edwardi',** Martin (manuscript name)

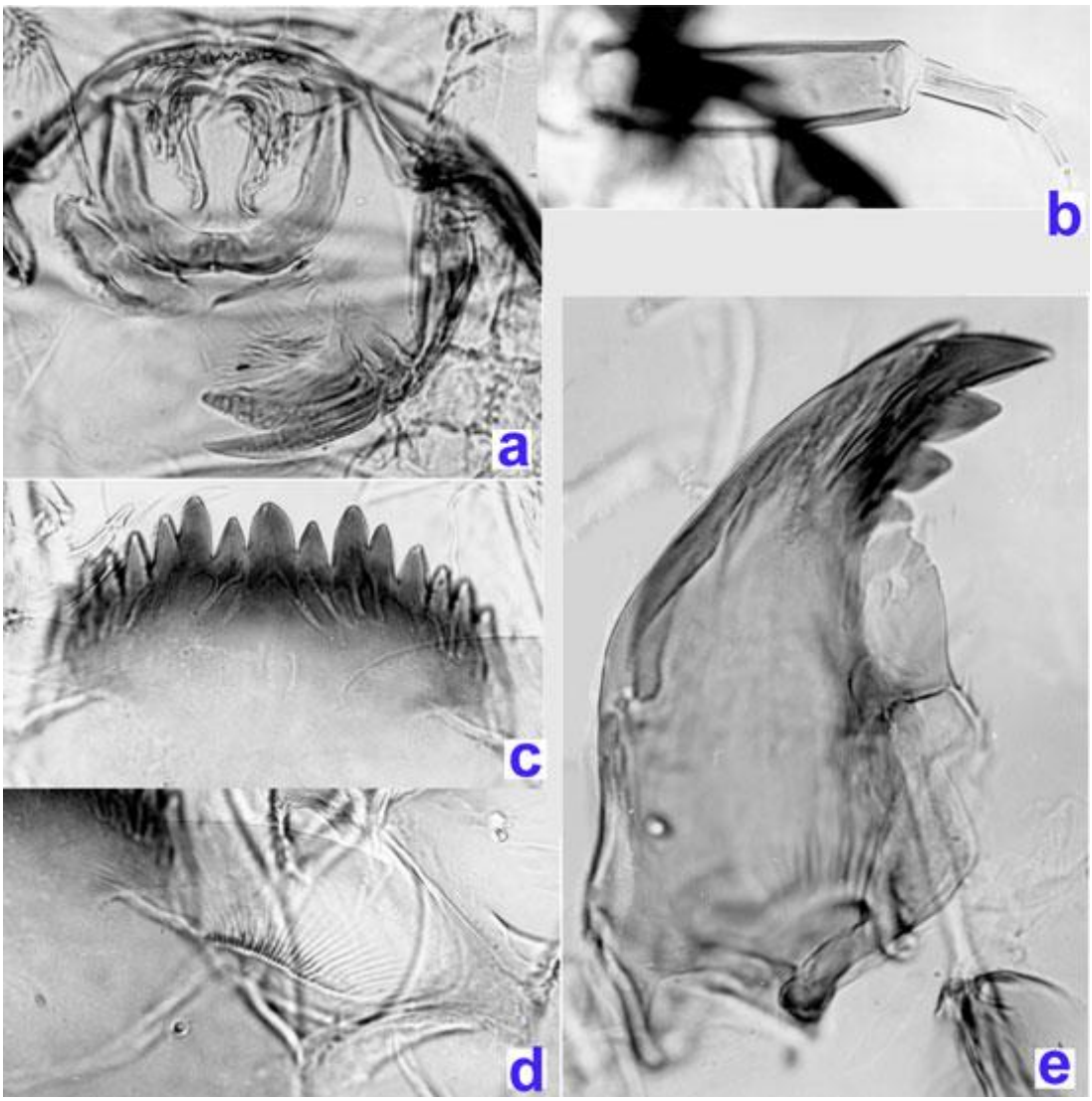
Previously *Chironomus oppositus* f. edwardi. (Martin 2011)

Don Edward collected specimens of a species similar to *C. oppositus* from Lake Gwellup, near Perth, Western Australia. He obtained all life stages, but only provided larval specimens. The species is therefore described on the basis of the larval morphology and cytology, which indicates that it is distinct from the species in the eastern states.

Larva is a medium sized melanotus type (female 15.0 mm (8); male 12.8 mm (6)), the lateral projections short (120-130 µm). Ventral tubules in general about the same length (ant. 0.94-1.14; post. 0.99-1.07 mm) although on average the posterior pair are slightly longer. Anal tubules about 300 µm, and about 4 times longer than wide.

Gular region slightly dark or dark over posterior half, some degree of darkening of the FC. Mentum (c, below) with 4th laterals only slightly reduced (type I), c2 teeth relatively distinct, c1 tooth relatively narrow and tall (type III).

Ventromental plates (d, below) about 1.09-1.12x the MW and about 3.75-3.95x longer than deep, with smooth anterior edge, inner edges separated by about 0.30 (0.28 - 0.32) of the width of the mentum; with 31-33 striae on each plate; VMR about 0.36 (0.29-0.42).
PE (a, below) with 11-17 teeth, which are sharp (type B) when not worn down and appear as type C. PrM (a, below) with the usual two teeth of about equal length, inner tooth less than twice the width of the outer (1.71).
Antenna (b, below) with basal segment about 4-4.1 times longer than wide; RO about a third to half way up from base of segment; AR about 2.1; ratio of segments (µm): 136 : 33 : 11: 14 : 7.
Distance between the antennal bases greater than that between the S4 setae, which are just near the beginning of the widening of the FC and are separated by about 0.8 of the FC width at that point.
Mandible (e, below) with third inner tooth almost separated and partly darkened (type IIB), with about 13-15 furrows on the outer surface near the base. About 11 tainiae in PMa.



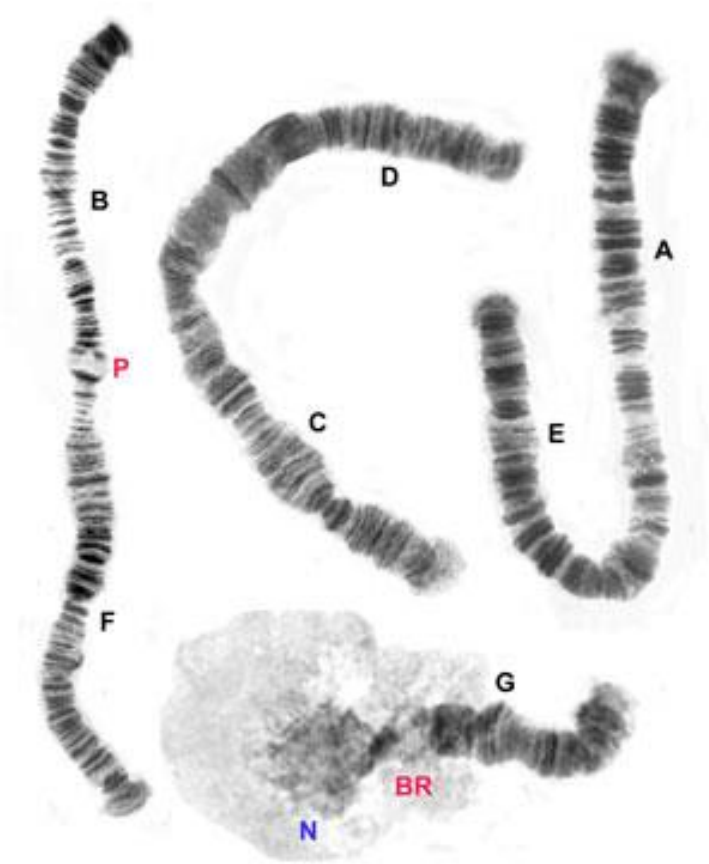
Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Some patterns as in other forms of *C. oppositus*, but some differ.

Arm G with subterminal nucleolus and a relatively nearby BR. No nucleolus in any other arm.

No polymorphism in the larvae available for study.

edwA1:	1a-e, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 12c-a, 4 - 7, 13 - 19	as oppA4
edwB1:	Inversion of oppB2, puff (group 7) very near 4 distinctive bands (groups 24-26)	
edwC1:	Typical groups, 3-4, about one third from distal end	as oppC1
edwD1,	1 - 2, 16 - 10d, 3a-d, 9 - 3e, 10a-c, 17 – 24	as ausD1
edwE1:	1 - 3e, 10b - 3f, 10c – 13	as halophilus, oppE1, etc.
edwF1:	1 - 2a, 10 - 2b, 11 – 23	as oppF1

edwG1: subterminal nucleolus with nearby BR. possibly as oppG3



The obvious cytological differences from the *C. oppositus* forms of the Eastern states are the position of the puff in Arm B, and the absence of a nucleolus near the centromere of arm F.

Types: Holotype – Salivary gland chromosome squash 5?

Found:

Western Australia – Lake Gwellup, Perth.

Molecular data:

mt *COI*: Partial Barcode sequence is available from one specimen.

***Chironomus* 'februarius'** Martin (Manuscript name)

Other names:

Chironomus alternans a– Martin 1961; Lentzios & Stocker (1979); Lentzios et al. 1980; Martin & Lee 1984

Chironomus alternans Type II - Edward 1964

Chironomus februarius - Martin 1966 (manuscript name)

Chironomus februarius (Nomen nudum) - Martin 1967; 1969a; Cranston & Martin 1989; Bugledich et. al. 1999.

Chironomus alternans a -

In BOLD Bin: BOLD:AAG5440

Adult:

Male

Wing length about 3.14 (2.6 - 4.6) mm. Antennal ratio (AR) about 3.1 (2.9 - 3.4).

Head, antennae and mouth parts varying from light to dark brown. Frontal tubercles present mostly about 10-15 µm, but occasionally to 35 µm. Palpal proportions (µm) about 50 : 54 : 188 : 233 : 375. About 20 (15–28) clypeal setae.

Thorax has a greenish grey, greyish or brown background; stripes, postnotum and sternopleuron dark grey or brown; thorax pruinose. Perhaps 12 acrostichal setae; 9-25 dorsolaterals; 4-6 prealars; ?? supraalars; setae of scutellum in approximately two rows, about 2-9 in anterior row, about 9-16 in posterior row.

Wings with anterior veins hardly darker than posterior; crossvein slightly darkened. VR about 0.95-1.05.

Legs yellowish brown or yellowish green without definite markings. LR about 1.5 - 1.7.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1205	1085	1745	905	775
PII	1285	1195	655	375	260
PIII	1490	1480	1120	635	480
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	645	320	1.56-1.65	1.08-1.15	2.0-2.6
PII	180	140	0.56-0.59	1.06-1.11	
PIII	300	180	0.72-0.80	1.00-1.01	

Male terminalia of *C.* 'februarius'

Male abdomen variable in coloration, may be like that of *C. cloacalis*, or may have a dark band across the centre of each segment. About 6 - 11 setae near centre of 9th tergite.
Superior volsella of the D-type, closest to Strenzke's figure h.

Females:
Wing length about 3.46 (2.6 - 4.6, 51) mm; wing width about 0.87 mm; VR 1.12; about15 setae in squamal fringe.
Head: Frontal tubercles present mostly about 25 µm long, 10 µm wide. Antennal proportions (µm): 135 : 105 : 121 : 116 : 165; neck of segment 4 about 48% of segment length; AR 0.35, A5/A1 1.22. Palpal proportions (µm) about 53 : 48 : 158 : 210 : 266. About 15 - 28 clypeal setae.
Thorax colour generally similar to males, although stripes can have a grey or purplish tinge. 11 acrostichal setae; 13 - 14 dorsocentrals; 5 prealars; setae of scutellum in approximately two rows, about 8 in anterior row, about 11 in posterior row.
Legs generally yelowish, but with green or brown tinge. LR about 1.6 - 1.7.
Leg lengths (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1195	935	1490	810	755
PII	1110	1090	635	300	200
PIII	1310	1330	1020	540	425
	Ta4	**Ta5**	**LR**	**F/T**	**Ta4/Ti**

PI	745	315	1.61-1.70	1.14-1.38	0.79
PII	145	125	0.55-0.58	1.02	-
PIII	270	155	0.74-0.77	0.98	-

Abdomen similar to *C. oppositus.*

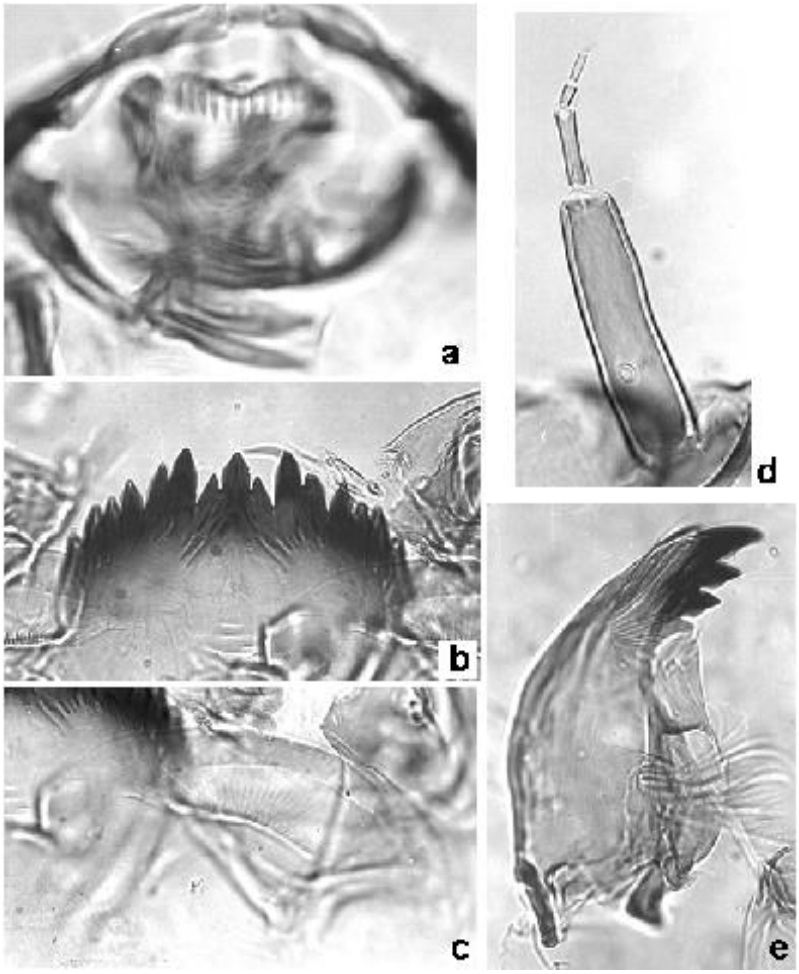
Pupa: Some characters given in Table below.

Caudolateral spurs on segment VIII with about 4 spines, ranging from 2 - 5.

	Females		Males	
	Mean	Range	Mean	Range
Length (mm)	7.9	6.3–8.6	7.5	6.4-8.2
Inner margin wing case (mm)	1.86	1.72-2.00	1.76	1.70-1.82
Cephalic tubercles (µm)	53	48-58	74	48-91
Cephalic bristles (µm)	40	30-59	43	28-58
Ped spi IV/len seg IV		0.24	0.26	0.21-0.33
Recurved hooks on abd. seg. 2	83	57-97	63	51-79
	Females		Males	
	Mean	Range	Mean	Range
Length (mm)	7.9	6.3 – 8.6	7.5	6.4 - 8.2
Inner margin wing case (mm)	1.86	1.72-2.00	1.76	1.70-1.82
Cephalic tubercles (µm)	53	48 - 58	74	48 - 91
Cephalic bristles (µm)	40	30 - 59	43	28 - 58
Ped spur A IV/len seg IV		0.24	0.26	0.21-0.33
Recurved hooks on abd. seg. 2	83	57 - 97	63	51 - 79
Swim fin taeniae (one side)	101	72- 117	95	78 - 105
Swim fin taeniae (one side)	101	72-117	95	78-105

In general the pupae are smaller than those of *C. cloacalis*, but there is considerable overlap.

Larva a medium sized (len. 9.0 – 16.3 mm; fem. 9.7 – 16.3, male 9.0 – 14.0) plumosus-type; VT well developed, posterior pair longer (Ant. 0.83 – 2.50; Post. 1.20 – 3.34 mm). PLT well developed (200 – 440 µm). Gular region pale, FC normally not darkened, but may show slight darkening in about 2% larvae. Larvae are very difficult to distinguish from *C. cloacalis* pale headed form. Mentum (Fig c, below) of type II, and c2 teeth notches on the c1 tooth (i.e. type IB or III). Ventromentum (Fig. c, below) with about 39 - 44 striae. PE (Fig. a, below) with about 12 - 17 sharp teeth (type A). Basal segment of antenna (Fig. d, below) relatively long and narrow, about 3.5 - 5 times as long as wide; A2/A1 about 0.18 - 0.21; A3 shorter than A4, but longer than A5. Mandible (Fig. e, below) of type IIB, with about 14-18 furrows on the outer surface near the base.



C. 'februarius' appears to have a higher count of striae on the ventromental plates than does *C. cloacalis*.

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

Arm G with an almost terminal nucleolus and sometimes a second approximately medial, with 2 Balbiani rings, one medial and one (BR3) about one quarter from distal end; the MD appears to be near the NOR. Nucleoli may also be developed in arms A or C, but the extra nucleoli have only been seen in some Queensland populations. Polymorphism in arms A, D, E, and G.

Irradiation experiments suggest that the dominant male determining gene may be on arm G but some results suggest it is on arm B.

febA1: 1 - 2c, 10 - 12, 3i - 2d, 9 - 4, 13 - 19 as holomelas, cloacalis, etc (rare)

febA2: 1 - 2c, 15 - 13, 4 - 7, 10 - 12, 3 - 2d, 9 - 8, 16 - 19 (common)

febB1: Bulb and some distal dark bands about 1/3 from end of arm?

febC1: 1, 14 - 11d, 6b - 5p, 15, 8 - 11c, 2 - 5p, 6gh, 17a - 16, 7d-a, 6f-c, 17b - 22 (Kiknadze)

febD1: 1 - 2, 17 - 12b, 10 - 7, 3g-a, 6 - 4, 12a - 11, 18 - 24, (as cloD1)
(Kiknadze)

febD2: 1 - 2, 17 - 15, 4 - 6, 3a-g, 7 - 10, 12b - 14, 12a - 11, 18 - 24

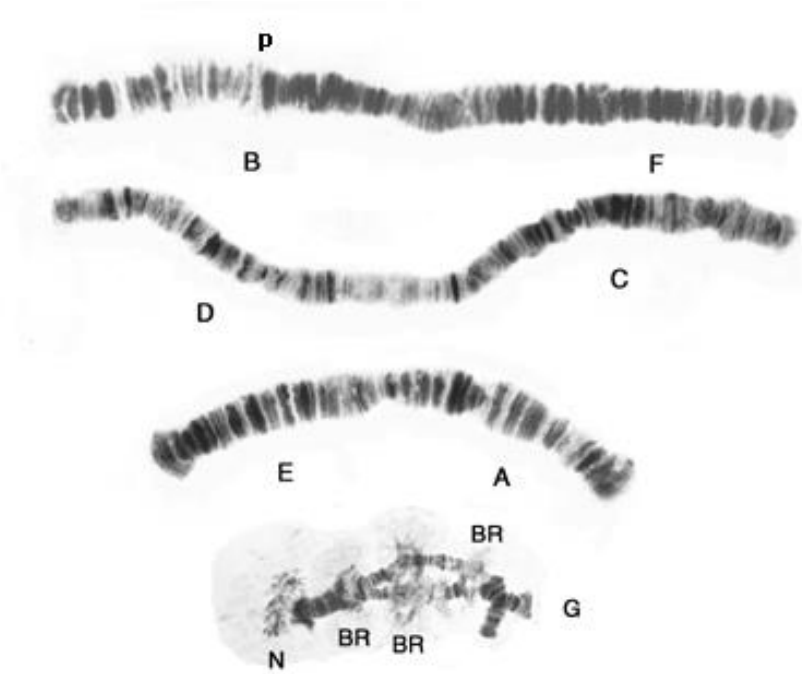
febE1: 1 - 3e, 10b - 3f, 10c - 13 known only as heterozygote

feb E2: 1 - 2b, 5 - 10b, 3e - 2c, 4 - 3f, 10c - 13 as cloacalis

febF1: 1 - 2a, 10 - 2b, 11 - 23 as oppositus F1 (see Martin 1979)

febG1: Essentially terminal nucleolus and 3 BRs about equally spaced through rest of chromosome

febG2: Small simple inversion in region between BR3 and distal BR.



BR - Balbiani ring; N - nucleolus; P - puff.
ArmG is heterozygous for an inversion involving the region of the BR at the distal end.

Nucleoli and location of C-bands studied by Lentzios Stocker (1979) and Lentzios *et al*. (1980).

Proposed type series: Echuca, Victoria (36.133ºS, 144.750ºE), 24.x.1962, J. Martin, (♂10 & ♀9); slide mounted larva with polytene chromosome spread

Others: 9 ♂, 13 ♀, data as above but various dates from February 1960 to October 1962.

Most members of the type series will be lodged in the Australian National Insect Collection.

Molecular data:

mt *COI*: numerous sequences are available in GenBank. Also in BOLD database.

Found:

New South Wales - Barmah Ferry; Cooranbong (33.08oS, 151.45oE); Corowa (36.008oS, 146.3835oE); Deniliquin; Griffith (34.27oS, 146.03oE); Hexham Swamp (32.08oS, 151.70oE), Hexham; Holbrook 35.68oS, 147.30oE; Tenterfield (29.10oS, 152.07oE); Thredbo Village (38.50oS, 148.30oE); Wheeny Creek (33.45oS, 150.67oE), near Upper Colo; Willbriggie (34.47oS, 146.03oE).

Queensland - Atkinsons Dam (27.42oS, 152.44oE); Toomba Lake (20.00oS, 145.59oE), 100 Km nw Charters Towers; Dawson River (abt. 25.00oS, 150.05oE)(second crossing), Fernvale (27.46oS, 152.67oE); 60 Km n. of Injune; Kilcoy (26.94oS, 152.56oE); Lotus Creek (22.50oS, 149.16oE); Mackay (21.14oS, 149.20oE); Noosaville; St. Lucia; Sarina; Somerset Dam; Tarampa; Toowoomba (abt 27.60oS, 152.37oE); Common, Townesville; Townesville South; Woodridge (27.63oS, 153.10oE); Yeerongpilly.

South Australia – Waste water plant, Bolivar (Carew et al. 2013); Dawesley Hill, 1.6 Km e. Dawesley; Hawker; Lake Edward, w. Kalangadoo; Brown Lake, Mt. Gambier; Oratunga Creek; Wilpena Creek (31.88oS, 138.42oE), Wilpena Pound, Flinders Ranges.

Victoria - Albert Park; Bairnsdale; Bridgewater; Station Water, Cairnlea (Carew et al. 2013); Exhibition Gardens, Carlton; Chiltern; Yarrunga Reserve, Croydon Hills (Carew et al. 2013); Echuca ((36.133oS, 144.750oE) (type locality); Elphinstone; 7 Km n. Hepburn Springs; Kew Billabong, Kew (Carew *et al*. 2013); Royal Botanical Gardens, Melbourne; Merbein; North Balwyn; Nyah; Ocean Grove; 5 Km Orbost; Perry Bridge; Edwardes Lake, Reservoir; Shanklin upper wetland, Roxborough Park (Carew *et al*. 2013); South Warrandyte; Emu Bottom, Sunbury; Warracknabeal; Melbourne Water Metropolitan Farm, Werribee (37.92oS, 144.67oE); Wycheproof.

Western Australia – Armadale (32.253oS, 116.015oE); Bell Swamp (31.77oS, 116.03oE), Upper Swan; Bibra Lake (32.01oS, 115.82oE); Lake Goollelal (31.81oS, 115.80oE), Kingsley (Carew *et al*. 2013); Murdoch Swamp (abt 32.1oS, 115.8oE); 1.5 Km s. Yarloop (32.97oS, 115.90oE).

Possibly also found on Norfolk Island - Bridle Trail, but may be a related species.

Although classed as a nomen nudum, this species was described and types designated in an unpublished Ph.D. Thesis by J. Martin at The University of Melbourne (1966). A multiple

discriminant function analysis in that thesis indicated some morphological differences from the *C. oppositus* group, but none from *C. cloacalis*

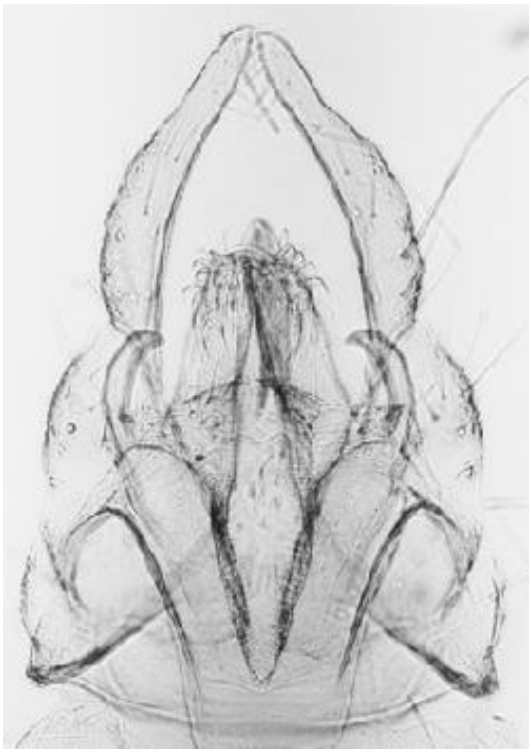
***Chironomus* 'jacksoni'** (Manuscript name)

This species is named for Prof. Bill Jackson, University of Tasmania, who guided us to the locality where it was first identified.

Chironomus alternans c - Martin and Lee 1981 and 1984; Martin and Cranston (1995)

C. 'jacksoni' Guryev *et al*. (2001), Martin (2011a)

In BOLD Bin: BOLD:AAF3284
(along with the forms of *C. oppositus*)



Male terminalia of *C.* 'jacksoni'.
This is a typical *C. oppositus*-group hypopygium
with E-type superior volsella..

Adults: The adults are very similar to those of *C. oppositus*, but generally paler than those of *C. pseudoppositus*.

Males: Wing length about 3.64 - 3.72. Frontal tubercles present, length about 25 - 33 micron. About 28 - 30 clypeal setae. Palpal proportions (microns): 70 : 75 : 205 : 220 : 335.
Thorax generally green with yellow brown stripes; thorax pruinose. Thoracic setae: about 13 achrostichals; dorsolaterals 14 - 16; prealars 5 - 6; scutellars in two rough rows, 2 - 9 in anterior row, 12 - 13 in posterior row. Legs yellowish green, unbanded. Wings with anterior veins hardly darker than posterior, crossvein slightly darkened.
Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1345	1115	1790	980	790
PII	1400	1300	800	465	335
PIII	1615	1650	1170	680	530
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	630	280	1.57-1.64	1.19-1.22	1.57-1.92
PII	225	160	0.61	1.08	
PIII	325	185	0.71	0.97-0.99	

Abdomen greenish with dark saddle spots on anterior segments, segments 6, 7 and 8 wholly dark; about 9 - 11 setae near centre of 9th tergite.

Female:

Pupa is also typical of the *C. oppositus*- group, with only one or two spines on the spur.

Pupal cephalic tubules (above), and spur (below)

Larva: a medium sized bathophilus- larva. Very difficult to distinguish from other members of the *C. oppositus*-group. Ventral tubules relatively short, posterior pair longer. The gula and FC dark to very dark, sometimes also with some darkening of the area outside the FC. Ventral head length (VHL) 263 micron, width of mentum about 0.6-0.7 times the VHL.

Mentum as in other members of the *C. oppositus*-group, i.e c2 teeth largely separated from c1 (type III) and 4th laterals reduced to about the level of the 5th laterals (type II).

Ventromentum with about 32 - 42 striae. PE with about 14 - 16 teeth.

Prm with the usual two teeth, inner tooth about twice the width of the outer (1.9 – 3.0). Antenna generally slightly shorter than in *C. pseudoppositus*; AR 2.08 - 2.37; A1 about 2.8 to 3.8 times as long as wide, and about 0.38 - 0.43 of VHL, ratio of antennal segments (µm) 119 : 27 : 8 : 12 : 7. Width between the antennal bases at least slightly longer than that between the S4 setae.

Mandible length about 220 - 255 micron from tip to heel; with third inner tooth pigmented and usually partially separated (type IIB); 10 - 14 bristles in the pecten mandibularis and 11 - 17 furrows on the outer surface near the base.

Cytology: There are four polytene chromosomes with the pseudothummi-cytocomplex combination AE, BF, CD, G. Arm G commonly without a nucleolus, although a small one may be developed near the middle of the arm. There is an obvious BR (BR2?) near the middle of the arm, the small BR3 is about half way between the large BR and the distal end of the chromosome, and the site of the potential BR4 is at the presumed centromere. Polymorphism found in arms C, D and E. One individual from Bellerive, Tasmania was heterozygous for a centric fusion between arm D and arm G, i.e. one homolog was DG, other CD with one acrocentric G and an acrocentric arm C, while an individual from Squeaky Beach, Wilsons Promontory, Victoria was heterozygous for a translocation between the BF and CD chromosomes.

The MD is on chromosome CD, probably near the centromere (Martin & Lee 1984; Martin 2011).

jacA1 1a-e, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 12c-a, 4 - 7, 13 - 19- i.e. as *oppositus* A4

jacB1 Large puff (group 7) is developed towards the distal end of the arm, with the dark bands (group 8) on the distal side as *oppositus* B2

jacC1: as *oppositus* C5

jacC2: simple inversion

jacD1: 1-2, 16-14h, 19c-a, 8-3e, 10a-c, 17-18, 12-10d, 3a-d, 9e-a, 13-14g, 19d-24 i.e. as *oppositus* D4

jacD2: approx. 1 - 2, 16 - 14h, 19c-a, 8 - 3e, 10a-c, 17 - 18, 12 - 10d, 3a-d, 9e-c, 14g - 13, 9ab, 19d - 24

jacE1: 1 - 3e, 10b - 3f, 10c - 13 i.e. as *oppositus* E1, halophilus, etc.

jacE2: 1 - 3e, 10b - 7c, 3f - 7b, 10c - 13

jacF1: 1 - 2a, 10 - 2b, 11 - 23 i.e. as *oppositus* F1

Proposed type series: Bellerive, Tasmania (42.83₀S; 147.33₀E) AT.9. ; Squeaky Beach, Wilsons Promontory (39.027₀S; 146.303₀E), Victoria AV.15 ;; also chromosome squashes with larval bodies mounted on same slide.

Most members of the type series will be lodged in the Australian National Insect Collection.

Found:

Tasmania - Bellerive; Bicheno; Whitemark, Flinders Island (including apparent hybrids with *C. oppositus* f. *whitei*).

Victoria - Squeaky Beach, Wilsons Promontory.

***Chironomus javanus* Kieffer, 1924**

Synonyms:

Chironomus vitellinus Freeman 1961

Yamamoto (2002) has suggested that this species should be in a separate subgenus *Austrochironomus*.

In BOLD Bin: BOLD:AAG6924

Adult:

Kieffer's original description of *C. javanus.*

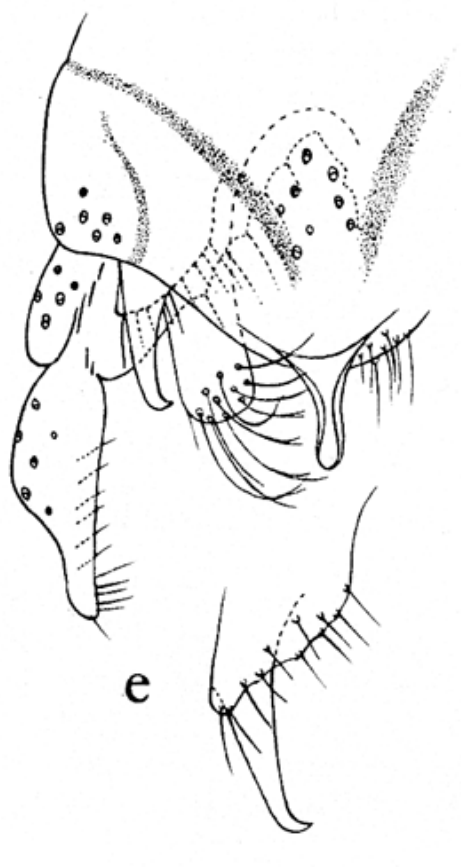
Female. Yellow. Eyes separated by not more than their terminal width, gradually thinning at the top. Palps long, brownish black, 4th segment matching the previous two segments combined, 2nd shorter than 3rd, 1st much longer than wide [these are actually segments 2 – 5]. Antenna 2nd segment narrowed in the middle, the neck a little longer than wide, the rest broken. Metanotum, three short bands, mesonotum and mesonotum reddish. Halteres light green. Wing whitish, not distinctly stippled, veins a whitish yellow, crossvein and base of the cubital black, cubital arched, ending very near the tip of the wing. Legs light green, fore tarsus long and thin, white, both ends of segments 1-4 deep black, 5th slightly clouded, pulvilli a little wider, with long hairs, not exceeding the middle of the crotchets, hardly shorter than the empodium, probably branched four hind tarsi broken; fore femur much longer than the tibia, the latter and the tarsal segments are 2 : 3 2/3 ; 2 : 1 ½ : 2 : 3/4 [i.e. LR = 1.80], the 4th segment is longer than 3rd, the four hind tibias have confluent combs which occupy two thirds of the circumference, the two spurs short. Abdomen a bright green, unmarked. L. 4 mm.

Male. Pale yellow, abdomen spotless, four bands on mesonotum, metanotum and mesosternum fawn, red scape, flagellum broken. Wing as female. Legs white, distal end of tarsomeres 1-4 and 5th tarsal segment black. Anterior tarsus broken. Eyes separated by 1.5 times their terminal width. Terminal articles of the genitalia ('pince') arcuate, the distal half suddenly narrowed in a straight beak, glabrous, having only one third of the width of the proximal half and carrying on the distal half of the medial side straight six large rigid bristles. Superior appendages very thin, glabrous, linear, reaching the end of the basal article (gonocoxite), weakly curved and ending in a point; inferior appendages large, pubescent, exceeding just the gonocoxite and bearing dorsally the usual long and thick cured setae. Anal point long and thin. L. 4.5 mm.

Male

A yellowish-green species with dark bands on the tarsi, and darkening of the cross veins of the wings.

Palps and clypeus brown. Thorax yolky colour, dull with practically no pruinosity. Legs greenish yellow, tarsi darkened, particularly at joints. Abdomen without dark markings but with strong pruinosity at the incisures and on segments 5 and 7.



From Tokunaga (1964)

Anal point of male narrow. Freeman (1961) quotes the AR as about 4.5, but in other populations the AR is quoted as lower (2.9 - 3.82 (Tokunaga 1964; Chaudhuri *et al*. 1992)). LR about 1.6 - 1.8. Wing length 2.5 - 3.0 mm; VR 1.05 - 1.08.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1220	1050	1120	955	840
PII	1305	1130	760	395	280
PIII	1435	1445	1130	610	465
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	770	350	1.60	1.16	No beard
PII	190	140	0.64-0.70	1.14-1.16	
PIII	290	160	0.77-0.79	0.99-1.00	

Hypopygium with long tubular anal point, superior volsella well developed and curved, inferior volsella with 12 -14 incurved setae.

Originally described in Australia and Papua New Guinea by Freeman (1961) as *C. vitellinus*.

Further details from a *C. vitellinus* paratype male:

Frontal tubercles about 30µm; about 14 clypeal setae;

Palpal proportions (segs. 2 - 5) (µm): 60 : 170 : 200 : 140+ (shrivelled).

Thoracic setae: achrosticals not evident; 6 -7 dorsolaterals; 4 prealars; scutellars not evident.

Female

Wing length 2.92 - 3.16 mm, width 0.82 - 0.90 mm; VR 1.11 - 1.17.

Coloration essentially as in male.

Antennal segments (micron): 180 : 120 : 120 : 130 : 180.

Palpal segments (micron) : - : 60 : 160 : 220 : 140+ (shrivelled). Clypeal setae - abt 16-18.

Thoracic setae: Achrosticals - 11-13; Dorsolaterals - 14-15; Prealars - 5-6; Scutellars in two rows - 5-6 and 8-9.

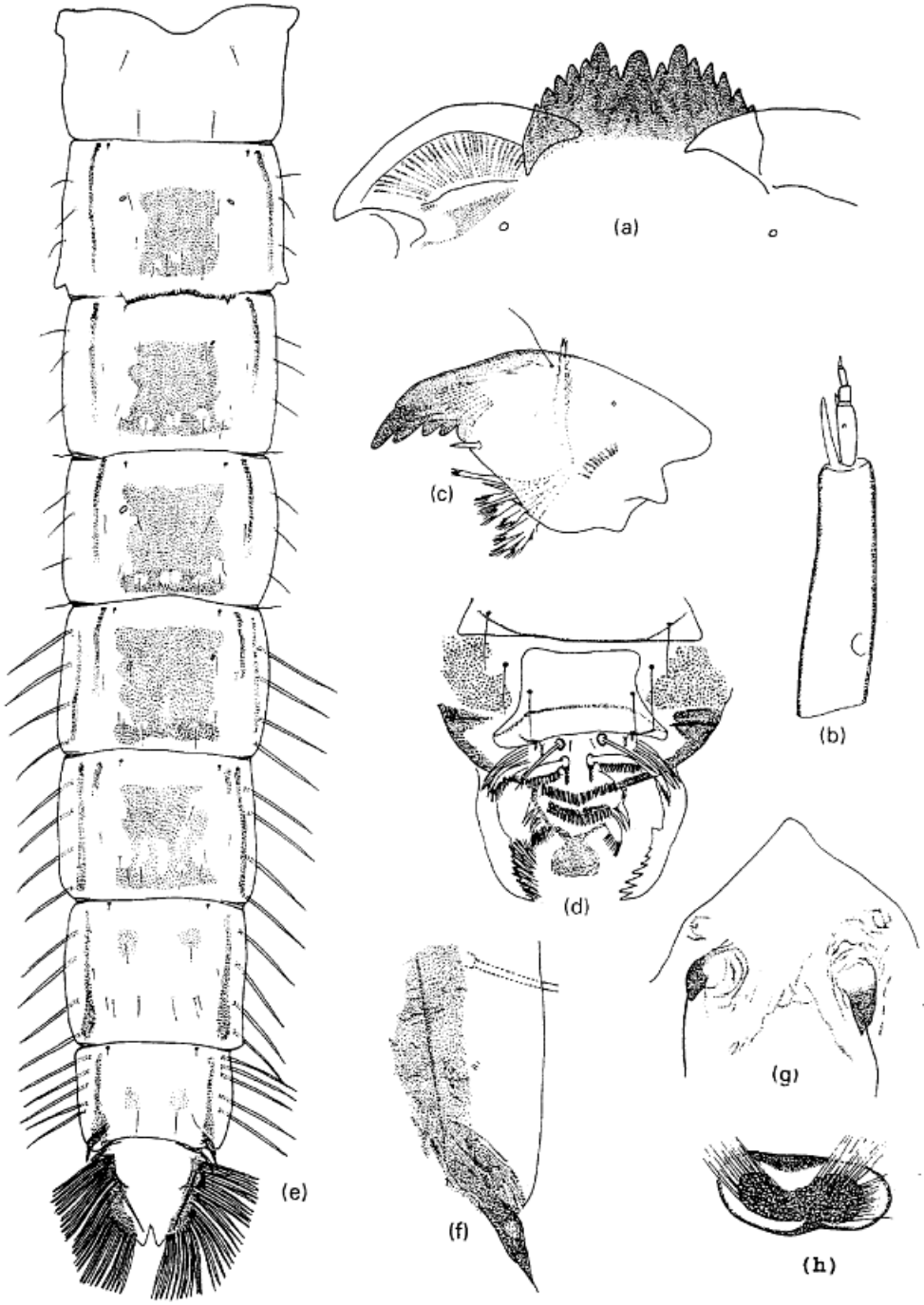
Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1310	1070	1910	940	770
PII	1300	1290	760	370	260
PIII	1500	1520	1140	590	440
	Ta4	**Ta5**	**LR**	**F/T**	**Ta4/Ti**
PI	930	420	1.77-1.80	1.16-1.29	0.83-0.91
PII	180	120	0.63-0.65	1.06-1.12	0.13-0.18
PIII	280	150	0.73-0.77	0.99	0.17-0.19

Anterior Ta4 longer than Ta3 or Ta5.

Pupa has been described by Chaudhuri *et al*. (1992), and also illustrated by P.S. Cranston in his Electronic Guide to Chironomidae of Australia, as *C. vitellinus* (below):

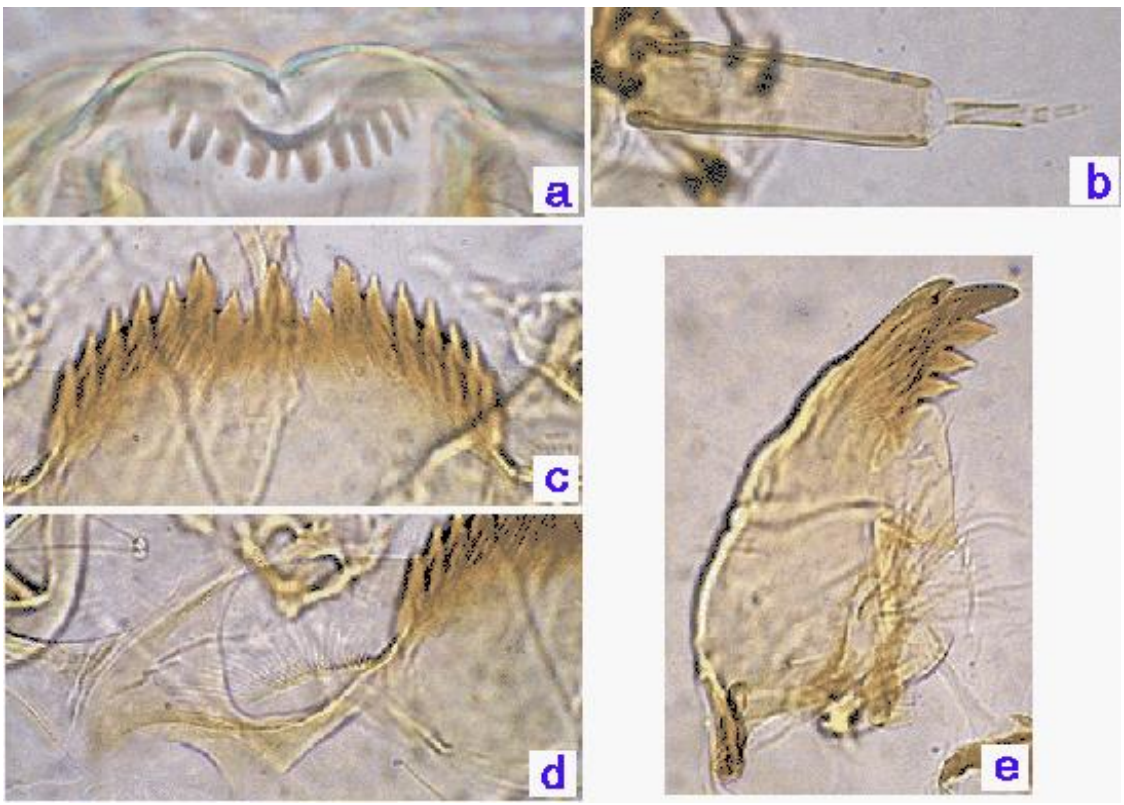
Length: Male 6.38–6.70 (6.40) mm; female 6.90–7.14 (7.01) mm (6–7 mm in Lenz 1937). Exuviae grey. Frontal tubercles 0.10-0.11 long and 0.06-0.07 in diameter, subapical seta 0.09-0.10 long, i.e. about as long as the tubercles. Respiratory base about 0.11-0.14 wide. 2 pairs of precorneal setae. Abdomen with PSA caudolateral on segments IV-VI, PSB basolateral on segment I and caudolateral on segment II, which also bears a caudal row of about 66-70 hooks. Caudolateral spur of segment VIII with 1-4 spines.



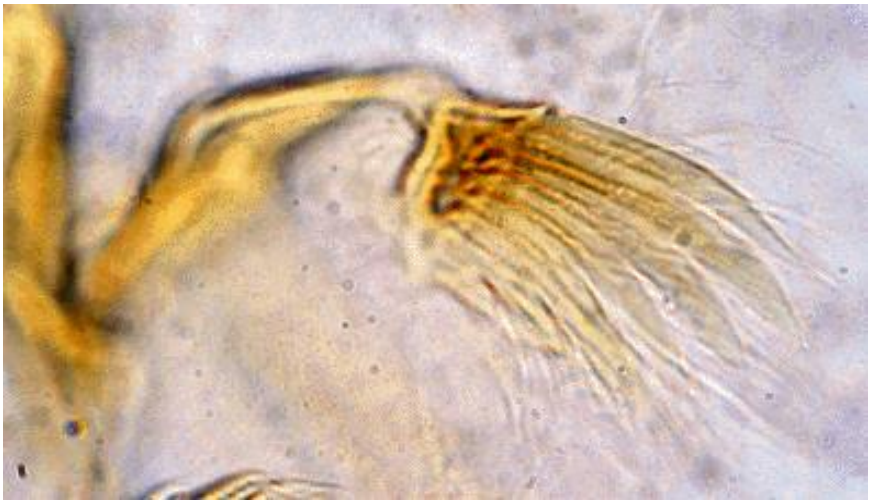
CHIRONOMINAE: Chironomini: *Chironomus vitellinus* Freeman. Larva: (a) mentum, (b) antenna, (c) mandible, (d) dorsal head; Pupa: (e) tergites, (f) posterolateral spur, (g) cephalic area, (h) base of thoracic horn.

Reproduced from Cranston's Electronic Guide to Chironomidae of Australia, (with permission)

Fourth instar larva: a medium sized, essentially plumosus-type larva, although PLT (about 380 micron long) are more ventrally placed than in other species. VT long (generally 1 – 2.5 mm), anterior pair generally longer. AT about 425 microns long, with median constriction.
Gula pale or slightly darkened on posterior third; FC pale.
Mentum (c, below) with the central trifid tooth set below the 1st laterals, and the c2 teeth markedly separated from c1 tooth (type III) and pointed towards it; 4th laterals at most slightly reduced (type I). PE (a, below) with about 12-13 often irregular teeth (Type D). Ventromentum (d, below) with about 27-28 striae.
Antenna (b, below) with the basal segment about 4 times as long as wide; AR about 2.4; ratio of segments 125 : 29 : 6 : 9 : 5. Distance between S4 setae slightly larger than with between antennal bases.
Mandible (e, below) with third inner tooth darkened and completely separated (type IIIB), with three spines on inner margin, and about 12-13 furrows on the outer surface at the base.

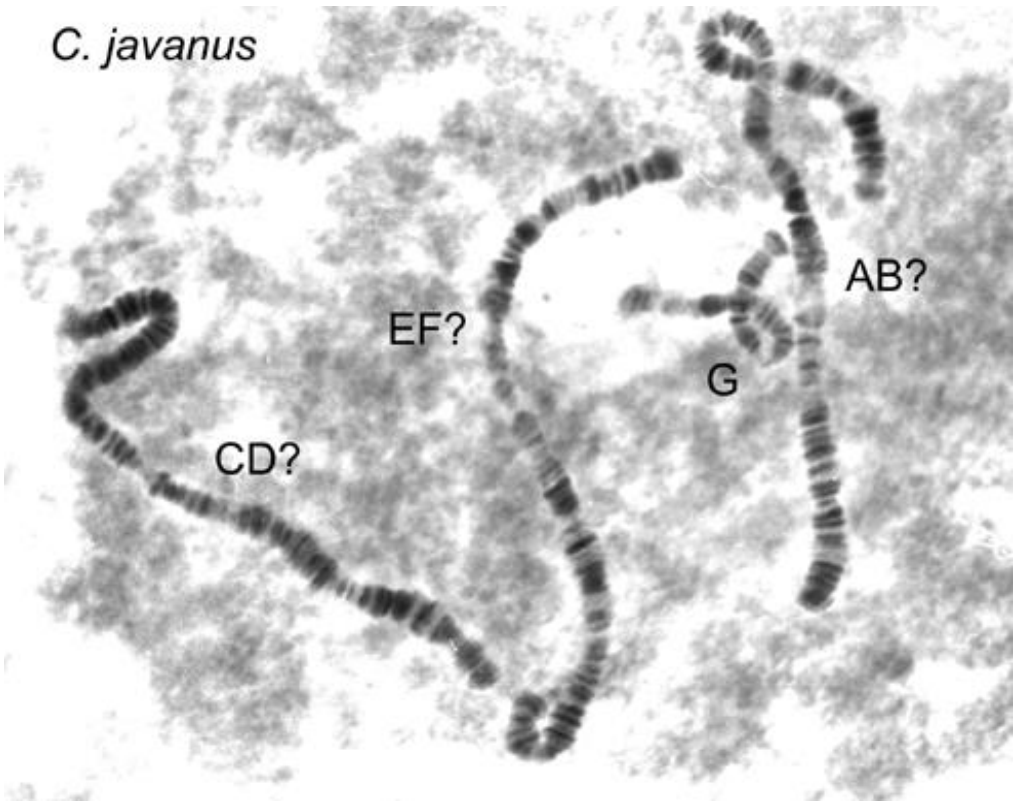


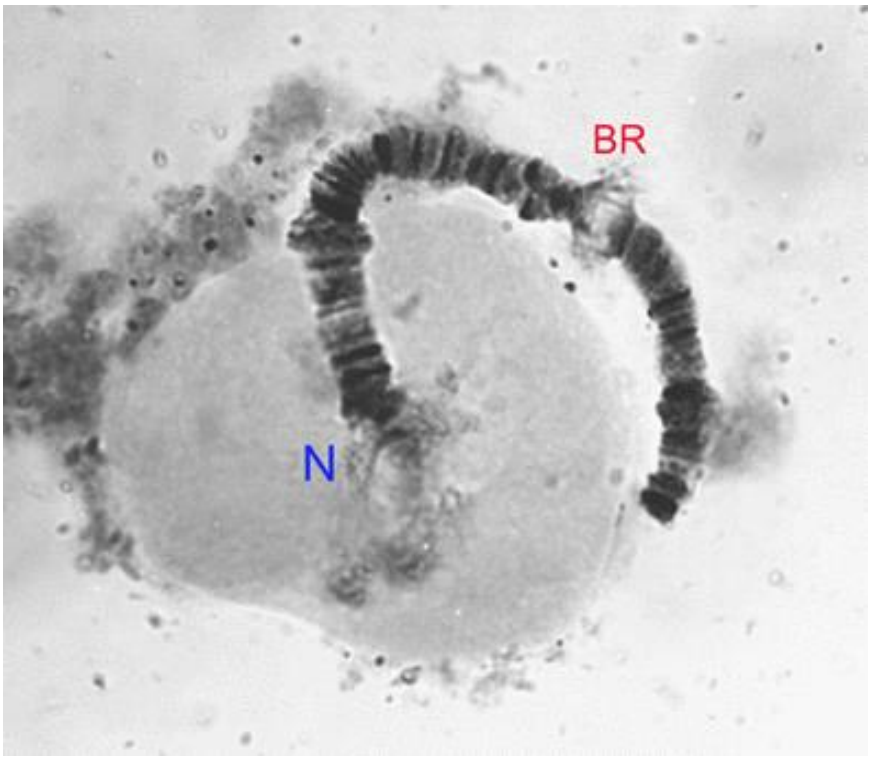
The larva is most readily recognised by the unusual premandible, which has 7 teeth (or sometimes 6) rather than the usual two.



Some larval characters have also been illustrated by P.S. Cranston in his Electronic Guide to Chironomidae of Australia, as *C. vitellinus*. These are reproduced with the pupa above (with permission).

Cytology: 4 polytene chromosomes, possibly with the thummi arm combination AB, CD, EF, G, but Keyl arms very difficult to recognize. Nucleolus virtually terminal in arm G, with large BR near middle of the arm; closely paired. No nucleolus in long chromosomes.





Found: Type locality - Buitenzorg, Java, INDONESIA.

New South Wales - Manning River, Kundibakh.

Northern Territory - Darwin (type locality of *C. vitellinus*).

Queensland - Mareeba; Sarina; 3 km w. Sarina Beach.

Broadly distributed through India, Indonesia, Japan and Pacific Islands such as New Guinea, Fiji, Caroline Islands and Marshall Islands. Also recorded at Blantyre, Malawi.

***Chironomus maddeni* Martin & Cranston 1995**

A typical member of the *C. oppositus* group of species.

Adults:

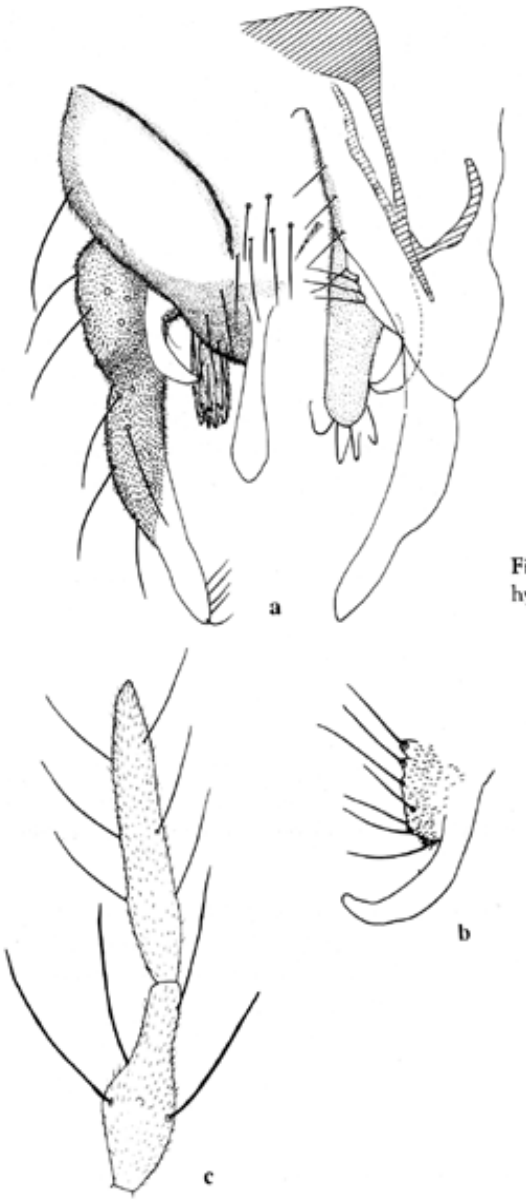


Figure 4. *Chironomus maddeni* sp. nov., adult: (a) male hypopygium; (b) superior volsella, (c) female antenna apex.

Illustration of the hypopygium and female antennal apex of *C. maddeni*
From Martin and Cranston (1995)

Male:

AR about 2.55 - 2.86. Wing length about 2.4 - 3.36, width about 0.72 mm. VR abt 1.03 - 1.05. Legs pale, unbanded.

Frontal tubercles present but very small, about 4 - 8 micron (not absent as stated by Martin and Cranston 1995). Palpal proportions 52 : 55 : 155 : 255 : 295. Clypeal setae abt 19 - 29. Thoracic setae: abt 8 - 9 Acrostichal; 10 - 14 Dorsolateral; 5 Prealar; 3 - 5 anterior, 9 - 13 posterior Scutellars. SCf on branchiolum, abt 3.

Leg lengths (microns) and ratios as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1135	960	1640	820	615
PII	1230	1100	660	365	280
PIII	1355	1345	980	555	405
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	535	250	1.63-1.80	1.16-1.20	1.9-2.5
PII	185	120	0.58-0.61	1.03-1.17	
PIII	235	155	0.72-0.73	0.99-1.03	

Abdomen pale, with brown, broadly diamond shaped transverse area in basal half of tergites 1-4. About 3-5 setae near centre of 9th tergite.

Female:

Pupa: The pupal tergum and some other pupal characters are shown in Figs. e – g.
Pale brown, with tracheal bases, abdominal apophyses, posterolateral spur and bases of anal lobe taeniae all darker brown. Thorax with dense brown rugulosity to midpoint.
Length about 7.9 mm, inner margin of wing case about 1.58 mm. Cephalic tubercles about 122 - 157 µm long, with a seta about 28 - 32 µm in length.
Abdomen with very restricted shagreen, present only along apophyses on TV and TVI. Pedes spurii B quite strong on II, pedes spurii A on IV, much weaker on V, absent on VI.Tergal spinule pattern as in Fig. f. Hook row on segment II with about 60-77 hooks, taking about 50-80% of the width of the segment. Conjunctives all bare. Paratergite IV with narrow spines, remainder bare. Setation typical for genus. Posterolateral spur simple, narrow, tapering to a point, with 1–2 spines; anal lobe with about 75–92 at least double ranked taeniae on each side.

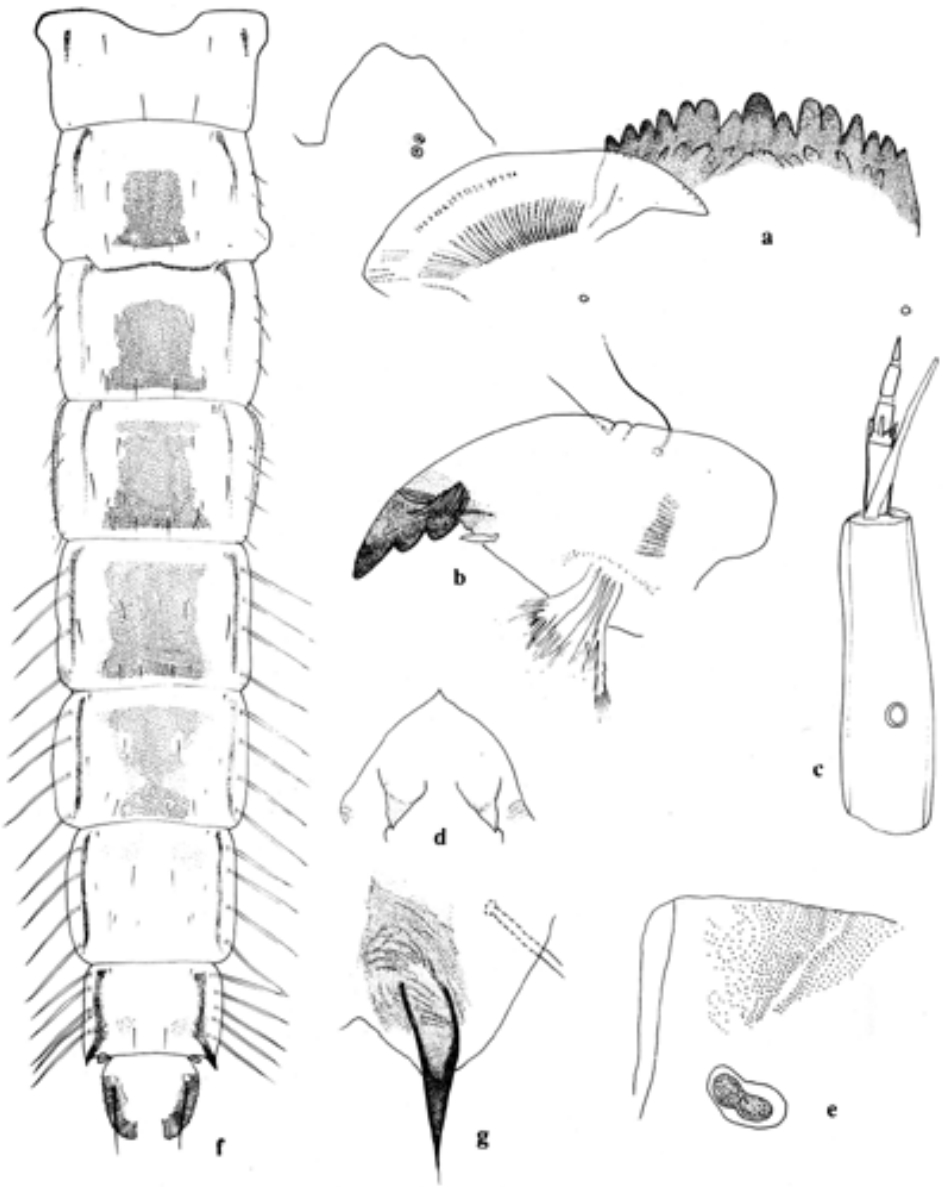


Figure 5. *Chironomus maddeni* sp. nov. larva and pupa. (a)-(c) Larva: (a) mentum, (b) mandible, (c) antenna; (d)-(g) Pupa: (d) cephalic tubercles and frontal setae, (e) anterior thorax, (f) tergites (anal lobe fringe not figured), (g) posterolateral comb.

Illustrations of the immature stages of *C. maddeni*

From Martin and Cranston (1995)

Larva: Medium size bathophilus-type larva, length about 15-18 mm (female), 13-14 mm (male). Posterior ventral tubules usually slightly longer, anterior about 0.66-1.25 mm; posterior about 0.68-1.30 mm.Head capsule with slight darkening towards the posterior margin of gula, and very slight darkening of FC. Similar to larva of other members of the *C. oppositus* group. Mentum (Fig. a) of type II, c2 teeth separated from relatively narrow c1 (type III). Ventromentum (Fig. a, above) with

about 29-35 striae. Prm with the usual two teeth, inner tooth broader.

Basal segment of antenna (Fig. c, above) about 3.5 times as long as wide; RO about a third to 2/5 up from base; AR about 2.28-2.32; A2/A1 about 0.23; relative segment lengths (micron) 131 : 31 : 9 : 12 : 6.

Mandible (Fig. b, above) with third inner tooth pale and unseparated (type IA), about 12-13 grooves on outer surface near base.

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G with a median nucleolus and one obvious BR between it and the presumed centromere. Large nucleolus developed near the centromere of arm F. No polymorphism known. The MD is on the CD chromosome.

madA1: 1a-e, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 14c - 13, 7 - 4, 12a-c, 14d - 19

madB1: Bulb with distal dark bands about one third from distal end. as oppositus B2

madC1:

madD1

madE1: 1 - 3e, 10b - 3f, 10c - 13 as *oppositus* E1, halophilus, etc.

madF1: 1 - 2a, 10 - 2b, 11 - 23 as oppositus F1

Found:

South Australia - Glen Osmond (Type locality).

***Chironomus magnivalva* Kieffer, 1917**

Placed in the subgenus *Camptochironomus* by Cranston & Martin 1989, but this is an artificial grouping of species that mate on the substrate and have enlarged male terminalia. Returned to *Chironomus* by Bugledich *et al*. (1999).

Synonyms: *Chironomus crassiforceps* - incorrect synonymy by Guryev *et al*. (2001) and Peck *et al*. (2002).

In BOLD Bin: BOLD:AAJ4269
probably along with *C. crassiforceps*.

Adult

A greenish brown species with an enlarged hypopygium, typical of species that mate on substrate.

CHIRONOMUS (CHIRONOMUS) MAGNIVALVA Kieffer

Chironomus magnivalva Kieffer, 1917, p. 219.

Antennae and legs rather short, thorax greenish, stripes brown, abdomen somewhat flattened, male hypopygium not unlike *tepperi* at first sight, but appendage 2 of a more normal, elongate form. This species seems allied to *tepperi* on account of the shape of the styles; it is readily recognized from Kieffer's figure and appears only to be known from Townsville.

Wing length.—2·4–2·5 mm.

Male.—Head and mouthparts greenish, antennae browner, A.R. about 2·5, antennae rather short. *Thorax* greenish, stripes either brown or partially brown, dorsocentral bristles not arising from very distinct pits, thorax slightly shining. *Legs* darkened at the knees, somewhat shorter than in most species but not as short as in *tepperi*; L.R. 1·7, posterior L.R. about 0·5, whole posterior tarsus less than one and a half times length of tibia. *Abdomen* rather flattened, brownish green. Hypopygium similar at first sight to *tepperi*, but examination shows resemblance confined to anal point, appendage 1, and styles; appendage 2 not swollen, but of normal elongate form, styles not rounded as they are in *tepperi*.

Female.—Resembles male in colour and general appearance.

Type.—Holotype ♂ from Townsville, Qld., was in the Hungarian National Museum.

Specimens seen.—Townsville, Qld., A. K. O'Gower, 22.i.1959–12.ii.1959, 31 ♂♂, 16 ♀♀.

From Freeman (1961)

Antennal ratio (AR): Kieffer gave the AR as about 2, while Freeman pushed this up to about 2.5. However in one specimen that he measured, it is only about 1.5. I estimate AR at about 1.5-1.9 on slide mounted specimens.

Wing Length: 2.2-2.7 mm; wing width 0.48 - 0.56, VR 1.12-1.17.

Head: Frontal tubercles about 29-36 µm; 19-25 clypeal setae.

Palpal proportions (segments 2-5 in micron): 43 : 158 : 156 : 193.

Thoracic setae: perhaps 12 or 13 achrostichals; dorsolaterals 14-22; prealars 5-7; scutellars in two rough rows, 4-9 in anterior row, 8-10 in posterior row.

LR about 1.65-1.74.

Leg measurements (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1213	973	1660	840	730
PII	1190	1160	687	340	270
PIII	1330	1340	820	460	410
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	710	335	1.65-1.74	1.15-1.29	1.33-1.50

PII	190	160	0.50-0.51	0.97-1.05	
PIII	240	180	0.56-0.62	0.99-1.00	

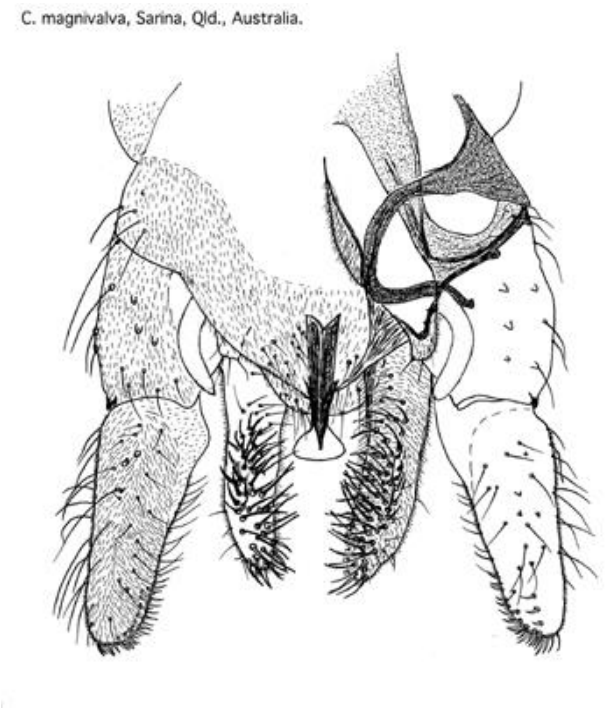


Illustration of the hypopygium of *C. magnivalva*

Gonostyle broadest at base, narrowing slightly and evenly along its length; with numerous spines rather than setae at the tip.

Pupa: Length about 6.0 - 6.8 mm (female) and 5.2 - 6.8 mm (male); about 60 to 94 recurved spines on second segment; about 170 taeniae on the swim fin (150 - 186). Spurs with about two or three spines in female, 1 to 2 spines in male.

Larva: a medium sized plumosus-type larva. Length (females) about 11.3 - 14.5 mm. Anterior VT slightly longer than the posterior pair.

Gular region at least slightly darkened on posterior half, FC also darkened to some extent. Mentum with 4th laterals only slightly reduced (essentially type I), and c2 teeth only partly separated from c1 (type I). Ventromentum with about 28-29 striae. PE with about 14-15 teeth. Antenna with relatively long basal segment, over 4 times as long as wide; AR about 1.88 - 2.13. Mandible with 3rd inner teeth showing some colour and separate (type IIIB); about 11-16 furrows near the base.

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G closely paired with a small nucleolus near the middle of the arm, and three Balbiani rings (BRs), two just distal to the NOR and the other near the somewhat heterochromatic centromere. The most distal BR is not always developed. Nucleolus in arm F with NOR at about group 19. No polymorphism known in Australian samples. Irradiation experiments suggest the MD may be on either arm B or on chromosome CD.

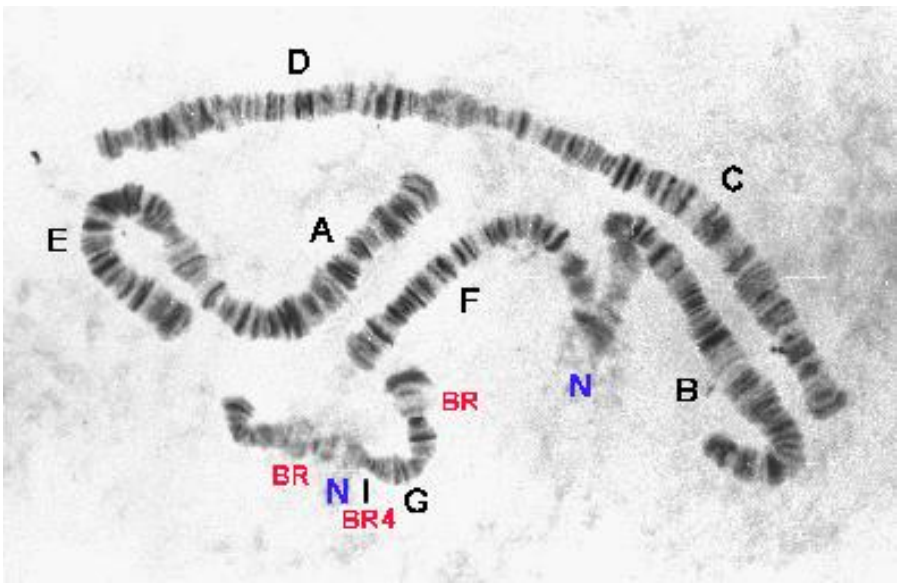
magA1: 1 - 2c, 3 - 2d, 10 - 12, 14 - 13, 4 - 9, 15 - 19 as *crassiforceps*

magB1: A puff with some dark bands on distal side, may be developed near the distal end of the arm

magE1: 1 - 3e, 5 - 10b, 4 - 3f, 10c - 13 i.e. as *cingulatus*, etc.

magF1: 1 - 2a, 10d-a, 2b - 9, 11 - 18 NOR 19 - 23 as *crassiforceps*

magG1: Nucleolus and at least one BRs near centre of the arm. Site of BR4 just proximal to NOR, and further BR subterminal.



Guryev *et al.* (2001) and Peck *et al*. (2002) referred Australian specimens from the Alligator Rivers region of the Northern Territory to *C. crassiforceps*. However this is incorrect.

Specimens identified *as C. magnivalva* in Australia, Fiji and Tahiti, differ from those identified as *C. crassiforceps* from Japan by a fixed inversion in arm E and more complex changes in arm G. They also differ in mt*COI* sequence.

A possible point of difference in the morphology of the males is that, while the gonostyle of *C. magnivalva* narrows evenly to the distal end, that of *C. crassiforceps* appears to remain the same width for most of its length and then rounds off.

Molecular Data:

mt*COI* AF192212 (as *C. crassiforceps* but now corrected)

mt*cytB* AF192181 (as *C. crassiforceps* but now corrected)

Found:

Northern Territory - Island Lagoon, Magela Creek, Alligator Rivers region (-12.57, 132.88).

Queensland - Noosaville; Sarina (-25.36, 149.20); South Townsville (-19.43, 146.80); Common, Townsville (-19.36, 146.70); Townsville (Type locality).

Cytologically identical material has been collected from Lautoka (-17.67, 177.50) and Laucola Bay (-18.25, 178.33), Viti Levu, Fiji and Punaauia, Tahiti (-17.53, 149.57).

***Chironomus nepeanensis* Skuse, 1889**

In BOLD Bin: BOLD:AAG7038

Adult

A larger species with a dark spot over the crossvein, and with dark knees.

Type specimen:

Morphology extensively described by Skuse, but the following additional data can be added:

Head: AR about 4.33. Palpal proportions (segs 2-5, micron) 60 : 270 ; 300 : shrivelled.

Thoracic width 1.04 mm. Setae: Acrostichals – at least 12; Dorsolateral – at least 14; Prealar – 5.

Leg lengths and proportions (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1680	1580	2500	1240	960
PII	1780	1720	940	500	400
PIII	1960	2040	1460	800	600
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	1000	460	1.58	1.06	-
PII	240	180	0.55	1.03	
PIII	360	220	0.72	0.96	

Note anterior Ta4 is longer than Ta3

CHIRONOMUS (CHIRONOMUS) NEPEANENSIS Skuse

Chironomus nepeanensis Skuse, 1889, p. 231. Kieffer, 1906, p. 20; 1917, p. 206.

Yellowish brown species with darker markings on thoracic stripes; thorax with strong silvery pruinose lines and spots; legs marked with black at knees and at apices of tarsal segments; crossvein strongly darkened, abdominal segments dark sub-basally and along mid-line.

Wing length.—4–5 mm.

Male.—Head and mouthparts brown, antennae rather paler, frontal tubercles present, A.R. between 4 and 5. *Thorax* yellowish brown; stripes, postnotum, and sternopleuron brown or partially dark brown, especially along the margins; whole thorax slightly pruinose, with 2 diagonal silvery pruinose stripes on shoulders, 2 brilliant silvery spots anteriorly between lateral and median stripes, and 2 on lateral stripes; anterior to silvery spots, the stripes are more or less fused across. *Legs* yellowish brown, femora with apical or subapical dark ring, tibiae with sub-basal dark ring, more marked on front legs, all tarsal segments dark at apices; tarsal beard absent, L.R. about 1·5, posterior basitarsus three-quarters length of tibia. *Wings* with crossvein and base of *Rs* rather strongly darkened; halteres pale. *Abdomen* yellowish, each segment dark sub-basally and along mid-line; incisures pruinose. Hypopygium (Fig. 19, *a*) of a very normal type for the subgenus, styles and appendage 2 fairly narrow; anal point in lateral aspect broad at base and tapered to apex.

Female.—Similar to male but darker markings and thoracic pruinosity more pronounced, apices of tibiae may also be darkened.

Description from Freeman 1961.

Additional data:

Male:

AR – 3.75 (3.33-4.60, 21)(measured from slide mounted specimens)

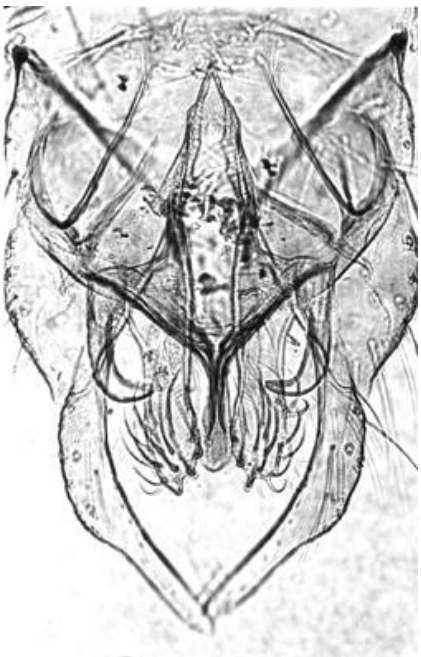
Frontal tubercles well developed about 47 x 20 µm. Clypeus about 0.9-1.0 times the diameter of

the antennal pedicel, with about 22 – 37 setae. Palp lengths (micron) 65-70 : 73-81 : 240-270 : 205-300 : 300-410.

Thoracic setae: Acrostichal about 9+ - 18+; dorsolateral 14+ - 31; prealar 5-8; supraalar 1; scutellar in 3 approximate rows 8-13, 6-13 and 16-23 (totals 34-49)

Leg lengths and proportions (micron):

Male	**Fe**	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**BR**
PI	1457	1419	2123	1175	920	960	460	1.41-1.59	0.97-1.08	abt 2
PII	1657	1657	928	545	395	250	170	0.55-0.60	1.0-1.03	-
PIII	1850	1855	1285	720	538	325	205	0.55-0.72	0.94-1.01	-



Hypopygium of *C. nepeanensis*.

Note superior volsella of the E-type.

Abdominal segments with a proximal dark band and a posteriorly directed median extension. About 9 setae on tergite IX, gonostylus tapering relatively abruptly over posterior half.

Female: Freeman (1960) notes only that it is similar to male but markings darker, thoracic pruinosity more pronounced and apices of tibiae may also be darkened. To this may be added: Wing length 4.07-4.47 mm. AR abt 0.32, A5/A1 abt. 1.22.

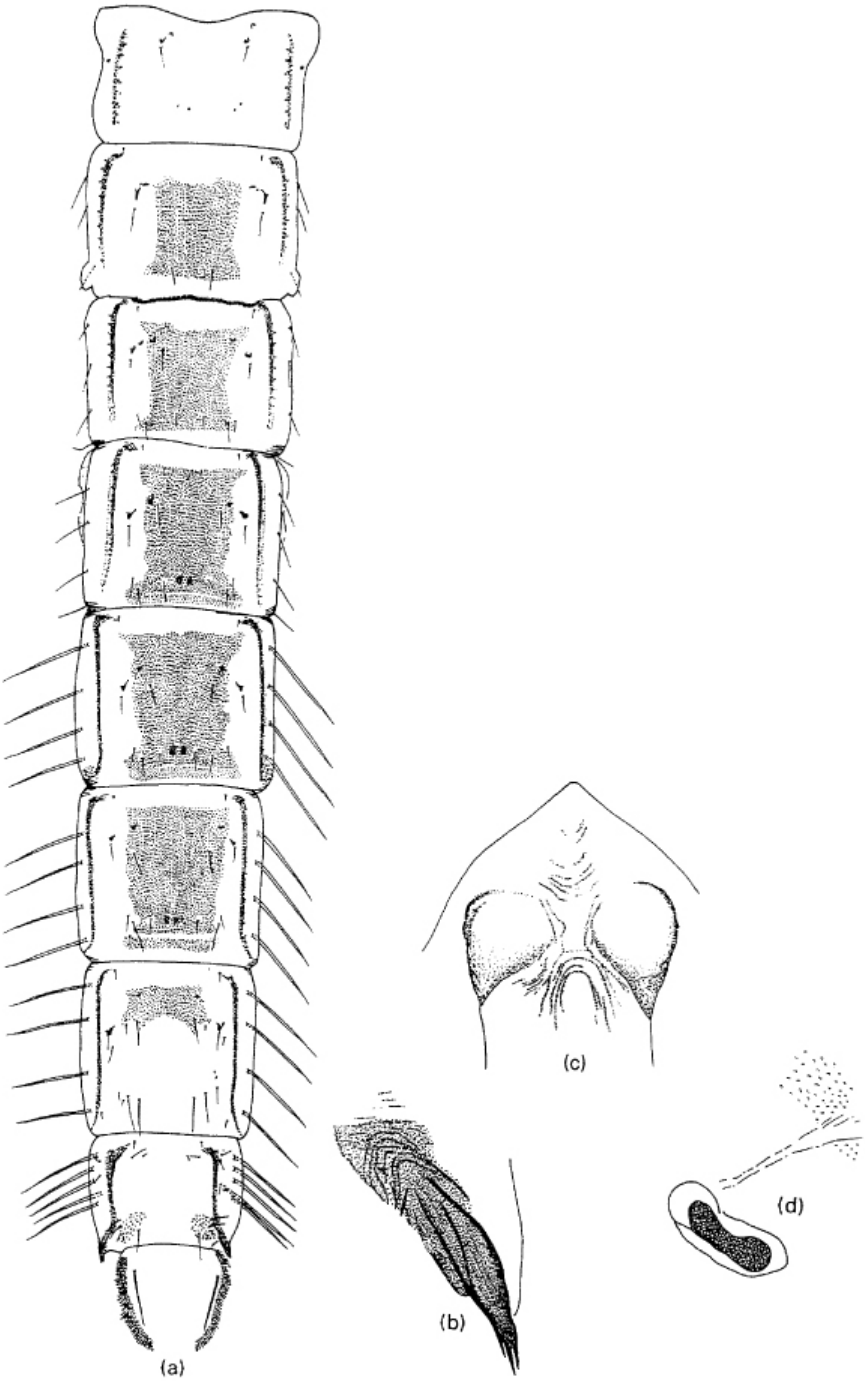
Thoracic setae: Acrostichal -abt 12-20; Dorsolateral at least 32-45; Prealar3-5; Supra-alar - ?; Scutellar - ?

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	Ta4/Ti
PI										
PII										-
PIII										-

Pupa: This has been illustrated by P.S. Cranston in his Electronic Guide to Chironomidae of Australia. This illustration is reproduced below (with permission). Some characters are given in the Table below. Large Pedes spurii B on segment II, small on segment III, large Pedes spurii A on segment IV, patches of spines on segments II and IV.

Spurs with mean of 4 (1 – 6) spines.

	Females		Males	
	Mean	Range	Mean	Range
Length (mm)	9.68	8.0 - 11.4	8.74	7.6 - 10.5
Inner margin wing case (mm)	1.92	1.68 - 2.13	1.78	1.52 - 2.07
Cephalic tubercles (µm)	131	125 & 137	129	80 - 137
Cephalic setae (µm)	50	50	58	58
Recurved hooks on abd. seg. 2	105	88 - 124	88	74 - 101
Swim fin taeniae (one side)	140	90 - 182	109	87 - 149



CHIRONOMINAE: Chironomini: *Chironomus nepeanensis* Skuse. Pupa : (a) tergites, (b) posterolateral spur, (c) cephalic area, (d) base of thoracic horn.

Larva: Normally a moderately large, relatively slender plumosus-type larva. Length about 15.5 mm (10.2 - 20.8 mm) (female 10.2 - 19.8 [37]; male 10.3 - 16.7 [26]); VT long, posterior pair coiled and usually slightly longer (ant. 1.34 - 3.52 mm; post. 1.40 - 3.80 mm), PLT well developed (180 - 940 µm). AT about 3.5 (2.5-4.9) times longer than wide, ventral pair slightly

shorter and narrower. Clypeal aperture (Fig. b, below), relatively wide and about 4.2 times longer than wide.

VHL 300 - 350 µm; mentum width about 195 - 230 µm. Head capsule with gula and FC pale, except in Northern Territory & Victoria, where there may be slight darkening.

Mentum (Fig. e, below) with 4th laterals slightly reduced (type I-II); and with c2 teeth of central trifid tooth clearly separated and sharp (type III) when not worn.

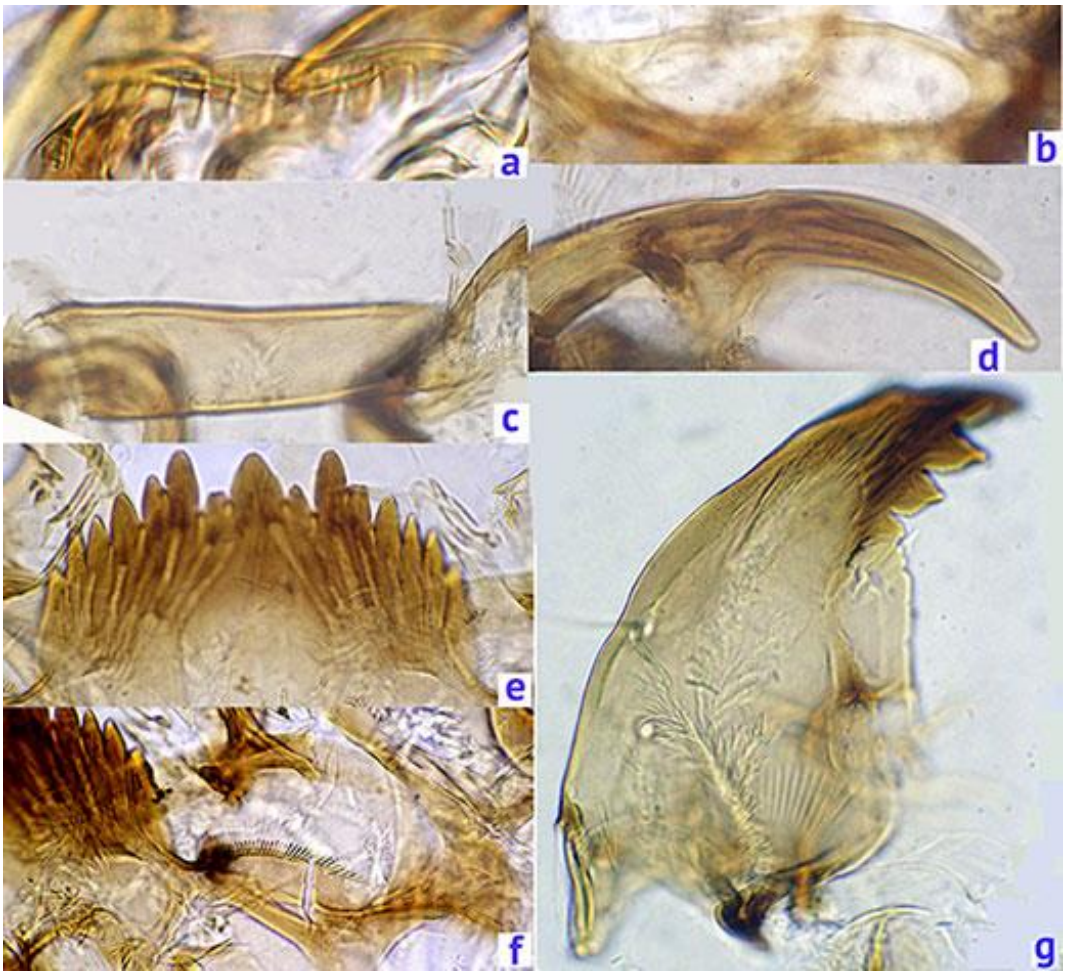
Ventromental plates (Fig. f, below) separated by less than a quarter of the mentum width, about 3.75 times longer than deep and about 1.1 times longer than the mentum width; about 37-42 striae; VMR about 0.21-0.33. PE (a, below) with about 11 - 17 mostly regular teeth.

PrM (Fig. d, below) usually with outer tooth shorter, inner tooth about 2.5-3 times wider than the outer tooth.

Basal segment of antenna (d, below) about 3.3 - 4.1 times as long as wide, RO about 1/3-1/2 way up from the base; AR about 2.27 (1.93-2.81); A2/A1 about 0.18 - 0.23, A4/A3 about 1.3 - 2.0 ; A3 about same length as A5; relative length of segments (micron) 140 : 35 : 7 : 13 : 6.

Distance between the antennal bases usually greater than that between the S4 setae, which are separated by about 0.86 of the frontoclypeal width at that point.

Mandible (Fig. g, below) with third inner tooth pale but distinct (type IA-IIB), about 16-17 furrows on the outer surface near the base and about 8-13 taeniae in the PMa; Mdt-Mat about 48 µm.



Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G normally paired, position of the 2 nucleolai and BRs dependant on sequence. Other nucleoli: in arm A (abt group 11), distal in arm B, and in arm F (group 7) but, other than arm G, not always developed. Polymorphism in all arms, complex in G.

The MD is on arm G (Martin & Lee 1984, Martin 2010), with G2 more common in males in some egg mases, but indicating that the MD is not within the inverted region. This is consistent with the MD being near the end of the arm as in other species such as *C. "tyleri"*.

nepA1: 1a-e, 3e - 2d, 8 - 9, 3f-i, 7 - 4, 12a-c, 1f - 2c, 10 – 11(NOR), 13 - 19

nepA2: 1a-e, 3e - 2d, 8 - 9, ~~11N - 10, 2c - 1f, 12c-a, 4 - 7, 3i-f~~, 13 – 19

nepB1: Nucleolus about middle of the arm

nepB2: Simple inversion, including the NOR, near the distal end of the arm

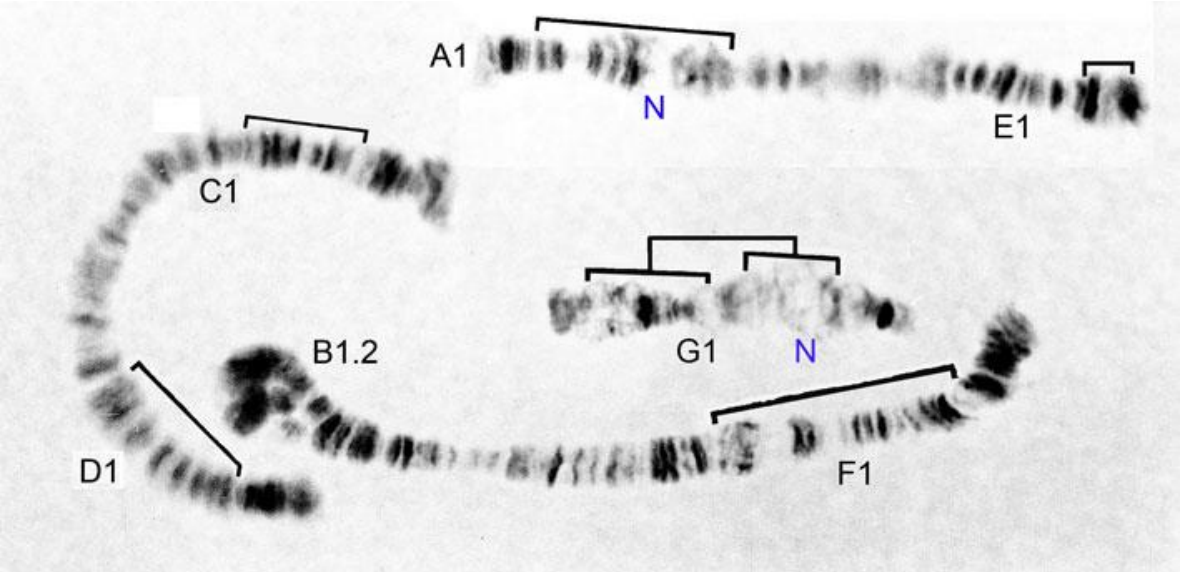
nepC1: Groups 3-4 about 1/3 from distal end

nepC2: Inversion of central half of arm such that groups 4-3 are about1/3 from centromere

nepD1:

nepD2: Simple inversion of about the distal third of the arm

nepE1:	1a-d,10g-c, 3f - 4, 2c - 3e, 10b - 5a, 2b - 1e, 11 – 13	In10g-1e from febE1
nepE2:	about 1a-d, ~~4-3f, 10c-g~~, 2c - 3e, 10b - 5a, 2b - 1e, 11 - 13	
nepF1:	1 - 2a, 10d-a, 4 – 7(NOR) - 9, 3 - 2b, 11 - 23	
nepF2:	1 - 2a, 10d-a, 4 - 6, ~~15 - 11, 2b - 3, 9 - 7~~, 16 - 23	
nepG1:	2 nucleoli, 2 BR	
nepG2:	Simple inversion from G1 (hypothetical)	
nepG3:	Simple non-overlapping inversion from G2	



Nucleoli and location of C-bands studied by Lentzios Stocker (1979) and Lentzios *et al.* (1984)., location of MD given in Martin and Lee (1984). W.R. Atchley, on the basis of unpublished work, suggested that there were two species included, one in the south and the other in the north. This remains to be confirmed but *COI* data does indicate the existence of two groups, one of N.S.W. and Queensland specimens, the other of South Australian and Victorian specimens.

Normally in depths of over a meter, but may also occur in some shallower permanent pools where the larvae may be much smaller, particularly if collected in the summer.

Molecular data:

mt *COI*: GenBank accessions AF192216 and two others, also sequences in BOLD database. The sequences available show consistent differences between NSW/Qld and Vic/SA sequences at 2 base pairs.

Found:

New South Wales - Barrington Tops abt 2 Km nw. Dungog; Blue Lagoon, Red Rock National Park (Timms 1982); Glenbrook Lagoon (33.757oS, 150.615oE); Hat Head (31.063oS, 153.052oE) (BOLD); 25 Km s. Narrabri; Nepean River, Penrith (Type locality).

Northern Territory - Island Lagoon (12.57oS, 132.88oE) and Radon Creek near Mt Brockman, (12.75oS, 132.93oE), Kakadu National Park; Manbulloo Station (Freeman 1961).

Queensland - Berner Creek; Burpengary (27.15oS, 152.97oE); Cairns; Lake Eacham (17.300oS, 143.633oE), 20 Km e. Atherton; Eidsvold; Gatton; Innisfail (Freeman 1961); Mary Smokes Creek, nr. Kilcoy (26.95oS, 152.67oE); Kilcoy (26.93oS, 152.55oE); Lake Manchester; University of Queensland, St. Lucia; Somerset Dam; nr Townesville (19.3811oS, 146.449oE) (BOLD).

South Australia - Paringa (34.18oS, 140.97oE); Railway Lake, Belair National Park (34.59oS, 138.38oE); Renmark (34.17oS, 140.73oE); Thorndon Park Reservoir (34.875oS, 138.687oE).

Victoria - 4 Km Anglesea (38.38oS, 144.18oE); Lake Barracoota abt 3.2 Km w. Cape Howe (37.53oE, 149.85oE); Lake Surprise, Nangiloc; Maribyrnong River, Hill Lake, Rowville (Carew *et al*. 2013); Platypus Pond, Sunbury (Carew *et al*. 2013).

Western Australia - Hammersley Range, Fortescue; Millstream Station (Freeman 1961).

***Chironomus occidentalis* Skuse, 1889**

Synonyms: *Chironomus australis* - incorrect synonymy by Freeman 1961.

In BOLD Bin: BOLD:AAJ0166

Adult

219. CHIRONOMUS OCCIDENTALIS, sp.n. (Pl. XI., fig. 1.).

♀.—Length of antennæ.....	0·042 inch	...	1·06 millimètres.
Expanse of wings.....	0·240 × 0·065	...	6·09 × 1·66
Size of body.....	0·310 × 0·047	...	7·87 × 1·18

Antennæ wholly ochre-yellow. Head ochreous-brown, with golden-yellow hairs. Clypeus and palpi ochreous-brown, densely covered with golden-yellow pubescence, that on the former longer. Thorax pale pinkish-ochreous with three longitudinal stripes of light fuscous, the lateral ones starting somewhat above middle of thorax, running almost to a point posteriorly and reaching hinder margin, intermediate one beginning at collare, terminating somewhat beyond the middle, with a light brown median line supporting a double row of short golden-yellow hairs; a row of longer hairs between the stripes; pleuræ pale pinkish-ochreous; scutellum yellowish, light fuscous along base, fringed with long golden-yellow hairs; metanotum pinkish-ochreous. Halteres pale yellow. Abdomen thrice length of thorax, umbrous-brown, each segment bordered posteriorly with very pale ochreous or whitish, the bands narrower on each succeeding segment, lamellæ of ovipositor ochre-yellow. Legs yellow; tarsi brownish-yellow, each joint slightly tipped with light fuscous (tarsal joints of fore legs and those with tibiæ of hind legs lost). In intermediate legs tibiæ exactly the length of femora and twice the length of metatarsus; metatarsus not quite twice the length of second tarsal joint, this joint $\frac{1}{3}$ longer than fourth and twice the length of fifth. Wings hyaline, glabrous, costal and first two longitudinal veins brownish-yellow, marginal cross-vein and portion of the second longitudinal vein between that and origin of third longitudinal vein suffused with brown. Costal and third longitudinal meeting nearly at apex of wing; auxiliary vein joining costa opposite middle of posterior branch of fifth longitudinal vein; second longitudinal vein somewhat indistinct, reaching costa nearly opposite tip of anterior branch of fifth longitudinal fork; fourth longitudinal almost reaching the wing-margin, its tip situated at a point $\frac{1}{3}$ the distance from tip of costa to that of anterior branch of fifth longitudinal fork; posterior branch of latter $\frac{3}{5}$ length of anterior.

Hab.—King George's Sound, West Australia (Masters). One specimen.

Original description of *Chironomus occidentalis* from Skuse 1889.

Male:

A large species with the anterior tarsi of the male strongly bearded; leg ratio about 1.2-1.3. Wing length 4.72 - 6.18 mm; VR about 0.93 – 1.05. AR about 3.33 - 4.29.

Frontal tubercles present, length about 28-70 micron; 39 (25 -70) clypeal setae. Palpal lengths (micron): 83 : 81 : 279 : 295 : 446.

Thoracic setae – acrostichal – about 12-15; dorsolaterals 17-27; prealar – 5-7; supra-alar – 1; scutellar – anterior 5-13, posterior 14-19.

Scutellum with setae in two rows; anterior with 8 - 16 setae (higher numbers generally in two rough rows), posterior with 14 - 19 setae.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1797	1737	2214	1171	871
PII	1985	1902	1125	677	450
PIII	2432	2488	1679	1000	755
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	776	380	1.19-1.32	0.99-1.06	4.21-7.08
PII	351	266	0.56-0.64	1.00-1.08	
PIII	483	295	0.65-0.70	0.96-1.02	

Male terminalia of *C. occidentalis*.
4 - 9 setae on 9th tergite

Female:

Wing length about

Morphologically very similar to *C. australis* and *C. duplex*, but is distributed allopatrically to them on the west of the continent.

Pupa: Dark, relatively large exuvia,, shagreen pattern of dark spines on posterior 2/3 of segment II, extending to the whole length by segment V and bilobed in VII & VIII. In female exuvia there is a clear region in the midline of each segment, less obvious in males. Pedes spurii B well developed on segment II, but much less so on segment II; pedes spurii A well developed on segment IV, about 154-300µm in length (the smallest figure is from a female), with spine patches on segments V-VII. Respiratory base more or less oval, about 116-187 µm long, 38-68 µm wide, but base of filaments almost bilobed.

L-setae at anterior margin of intersegment of III/IV and IV/V quite long (up to about 140 µm), but those of IV/V probably the longer.

Some characters given in Table below:

	Female		Males	
	Mean	Range	Mean	Range
Length (mm)	11.2		10.9	10.3 – 11.3
Inner margin wing case (mm)	2.15		2.13	
Cephalic tubercles (µm)	137			40 - 89
Cephalic bristles (µm)	abt 90		abt 75	
Recurved hooks on abd. seg. 2	72			66 - 71
Spines on postero-lateral spur	6		6	5 - 7
Swim fin taeniae (one side)	110			96 - 100

Cephalic tubercles of males about 0.75-1.2 times higher than width at base, of female about 1.4 times higher than wide. Recurved hooks on segment II, covering about 52-66% of segment width (again lowest value is for a female).

C. occidentalis can be readily separated from *C. duplex* at the pupal stage on the basis of the pupal spurs, in which the spines are closely applied in *C. occidentalis* but spread in *C. duplex*. The pupal spur of *C. occidentalis* resembles that of *C. australis* but with fewer spines.

Larva: Large bathophilus-type larva. Head capsule heavily darkened on the gula, FC and other regions. Mentum with generally sharp teeth; 4th laterals reduced to about level of 5th laterals (type II); c2 teeth reasonably well separated (type II), pointed, c1 tooth relatively broad with straight sides. Ventromentum with about 39-44 striae. Mandible with 3rd inner tooth pigmented and relatively well separated; about 12-16 furrows near base.

Cytology: 3 polytene chromosomes with the modified pseudothummi arm combination AEG, BF, CD. Arm G with a subterminal nucleolus followed by a large BR, separated by about 12 bands; a further BR is involved in a polymorphic inversion. Polymorphism in arms B, D and G-E. The MD is on arm A, near the centromere (Martin *et al*. 1980).

occA1: 1a-e, 4c-a, 12a-c, 3i-f, 9 - 8a, 2d - 3b, 6c - 4d, 11 - 10a, 2c - 1f, 3e-c, 6d - 7, 13a – 19
occB1:
occC1:
occD1: 1 - 2c, 17c-a, 10c - 7c, 2f-h, 16 - 10d, 3 - 7b, 2ed, 17d - 24
occE1: approx 7 - 3f, 10c - 12, 10b - 8, 3e - 1, 13 3 inv. steps from *australis* A1
occF1: 1 - 2a, 10 - 2b, 11 - 23 as *oppositus* F1

Nucleoli and location of C-bands studied by Lentzios & Stocker (1979) and Lentzios *et al*. (1980).

Morphologically very similar to *C. australis* and *C. duplex*, but is allopatrically distributed on the west of the continent.

Found:

Northern Territory - Magela Creek, Mudginberri Station (12.57oS, 132.88oE).

Western Australia - King George Sound (Holotype); Cape Naturaliste; Crawley; 3 Km w. Esperance (33.85oS, 121.87oE); Lake Monger, Perth area; Lake Sepping, Albany (33.85oS, 152.87oE); Upper Swan.

Chironomus oppositus Walker, 1856

In BOLD Bin: BOLD:AAF3284
(along with *C.* 'jacksoni')

Chironomus alternans form B – Martin 1961.

Adult

244. CHIRONOMUS OPPOSITUS, Walker.

Chironomus oppositus, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 425 (Div. 1, Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♂.—*Pallide testaceus aut viridis; antennæ fuscæ; thorax vittis tribus rufescentibus; abdomen pubescens, viride fasciis fuscis; pedes pallide virides pubescentes, tarsis apice fuscis; alæ limpidæ, venis albidis, litura discali fusca.*

"Pale testaceous, green (?) while living. Antennæ brown. Thorax with three reddish stripes. Abdomen pubescent, green, with a brown band on each segment. Legs pale green, long, slender, pubescent; tarsi brown towards the tip; fore tibia very much longer than the fore metatarsus. Wings limpid; veins whitish; discal transverse vein brown. Length of the body 3½ lines; of the wings 5 lines.

Hab.—"Van Diemen's Land."

Translation of Walker's (1856) original description by Skuse (1889)

Further description of type male:

AR: 3.6

Palpal proportions (segs 2-5; µm): 60 : 250 : 230 : 290. Length frontal tubercles 50 µm.

Clypeus moderately broad, about 0.67 times the width of antennal pedicel; 20 clypeal setae.

Thorax dimensions (microns): length 1720, width 780, depth 1560. At least 10 dorsolateral setae; acrostichals not evident; 6 & 7 prealars; 1 supraalar.

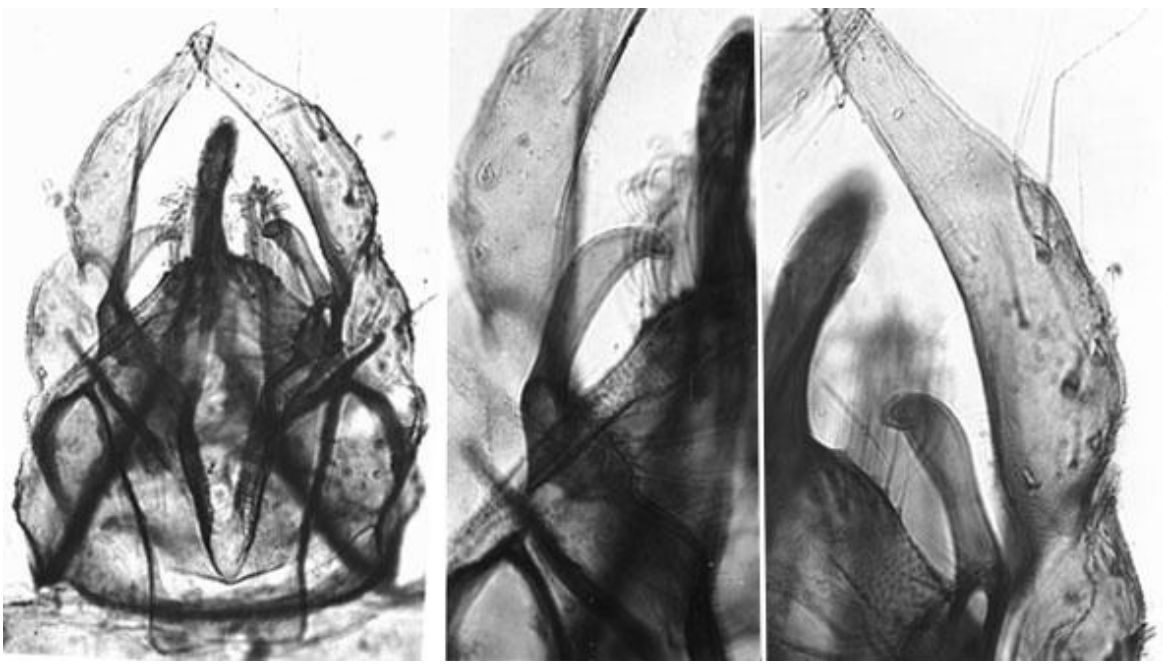
Scutellum with two approximate rows of setae, about 4 in the anterior row and 10 in the posterior row.

Wing length 4.56 mm; width 0.96 mm. VR: 1.02. SCf on branchiolum: 4.

Leg lengths (microns) and proportions as follows:

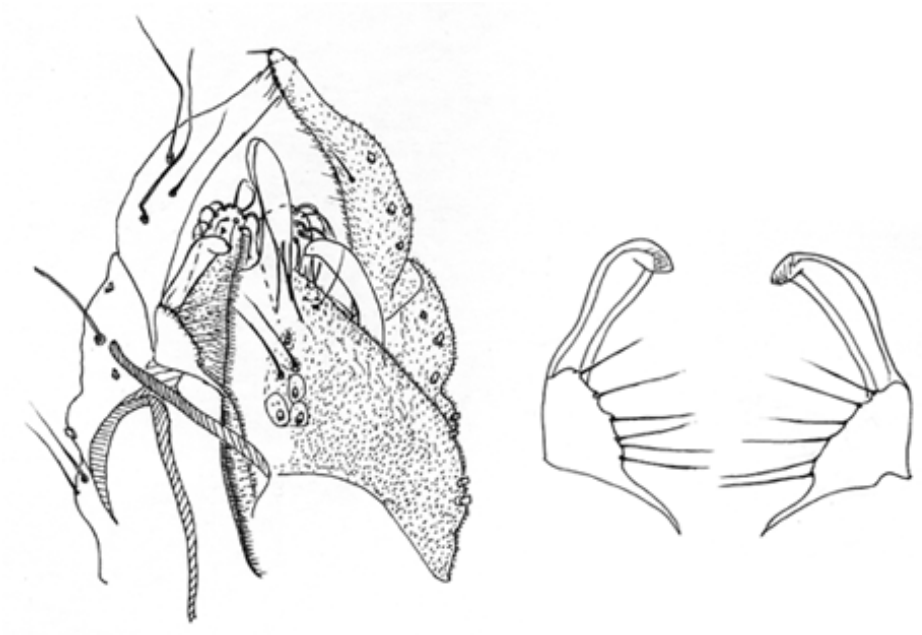
	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1580	1370	-	-	-
PII	1660	1560	-	-	-
PIII	1920	2020	1420	760	600
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	-	-	-	1.11	-
PII	-	-	-	1.06	-
PIII	380	200	0.70	0.95	-

Abdomen: Green with central brown band becoming larger on posterior segments; 6 setae near centre of 9th tergum. SVas D(e) of Strenzke (1959).



Male terminalia of C. oppositus type specimen.

General view (left), superior volsella (centre), gonostylus (right)



Male terminalia (left) and superior volsellae (right) of *C. oppositus* type specimen.

This specimen is from "Van Diemans Land" and is in the British Museum (Natural History)

Four forms are recognized (Martin and Lee 1984), mainly on the basis of larval polytene chromosome banding patterns, and a fifth form occurs in Western Australia. These forms were further defined by Martin (2011a).

No means of reliably distinguishing the adults is known. However, the type specimen is a large adult from Tasmania, and similar large adults were collected near the large central lakes, and these were associated with a single larval type, therefore called form *oppositus* (o).

The other forms are:

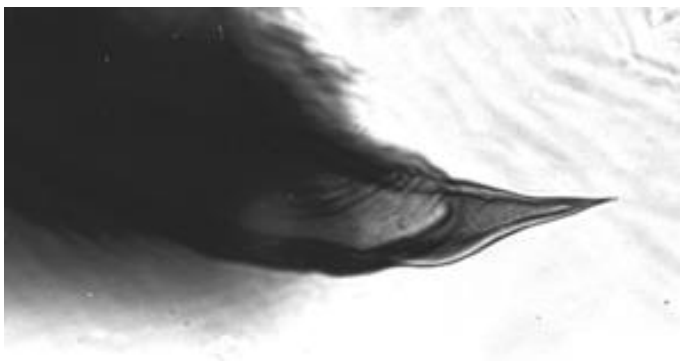
form *connori* (c)

form *tyleri* (t) - now considered a separate species, see listing under *C. tyleri*

form *whitei* (w) - results for this form suggest that it may be a composite of several other more or less differentiated forms, distinguishable by polymorphic sequences and the location of the MD gene.

These forms comprise those with the MD on arm A; near the CD centromere; on arm F; or on arm G.

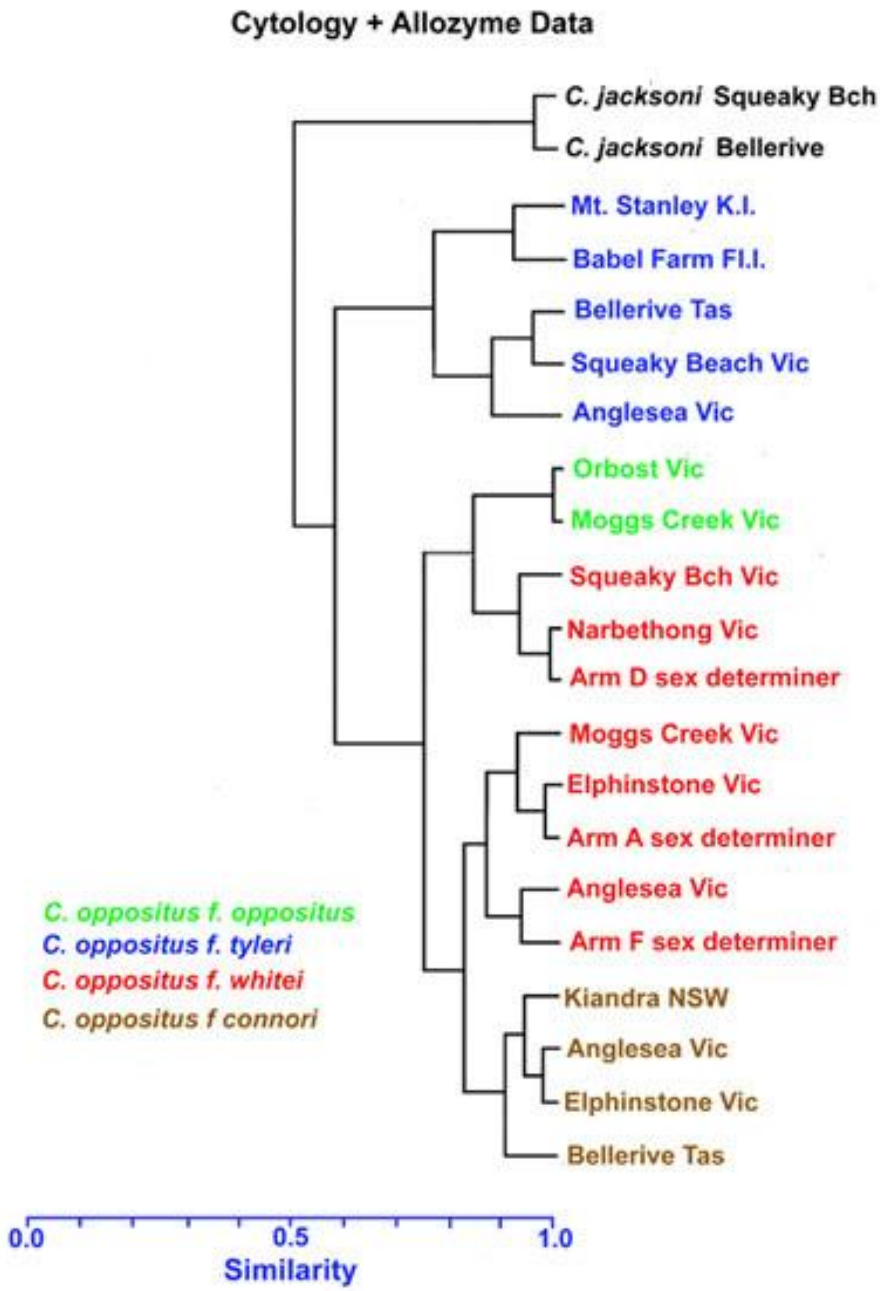
Pupa: Length about 7.3 mm (6.5 - 8.1) in female, about 7.2 mm (6.7 - 7.7) in male. About 73 (54 - 89) recurved hooks on second segment in females, about 66 (40 - 71) in males; about 185 (158 - 200) taeniae on swim fin in female, about 164 (148 - 188) in males. Pupal spur normally with only one spine, but may be 2 in males and up to 4 in females, as is common in the species of the oppositus-group.



Larva: Length about 11.5-18.5 mm (fem.); 11.2-16.5 mm (male), but PLT up to about 200µm developed in about 50% of larvae (apparently absent in South Australia, and Tasmania and rarte in N.S.W.; gula slightly dark to dark on posterior third, FC very slightly dark to dark.

The forms can be reasonably separated on the basis of allozyme and inversion frequencies (see below)

form *edwardi* (e) - this should probably be recognized as a separate species.



Phylogeny of the forms of *C. oppositus* forms on the basis of allozyme and inversion frequencies. Note that form edwardi could not be included. *C.* 'jacksoni' is included as an outgroup. Note that *C.* 'tyleri' is clearly separated from the other forms. (From Martin 2011a)

Larva: medium sized larvae, generally of bathophilus-type, but in all forms, except f. *connori* showing some degree of development of the lateral projections (less than 200 µm). Anterior VT with an elbow bend, generally slightly longer than the slightly curved posterior pair (ant 0.32 - 1.4; post 0.28 - 1.4 mm). Longer hooks of anterior parapods without teeth. Gular region slightly darkened, some degree of darkening of the FC.

Mentum with 4th laterals slightly reduced (type I-II), c2 teeth usually well developed, c1 relatively narrow (type (IIA-III).

Ventromentum with about 33 - 42 striae. Prm with outer tooth well developed and relatively blunt, sometimes almost equally as broad as the inner tooth but variable between populations, PE ratio from 1.2 - 2.5, both teeth about equally long.

Basal segment of antenna about 3.0 - 3.7 times as long as wide, AR 1.48 - 2.13.

Third inner tooth of mandible reasonably well developed (type IIB), and about 13 - 19 furrows on inner surface near base.

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G with subterminal nucleolus, and generally unpaired at the distal end. There are two visible BRs, a large one near the NOR (presumably BR2), and a smaller one near the distal end (BR3). BR1 appears to have been split, as in situ hybridization of cloned *spIa* gene (from BR1) to arm G shows localization to two places, one about the middle of the arm and the other very near the distal end, but no BR develops at either site. BR4 also does not develop, but cloned *ssp160* (from BR4) hybridizes at the edge of the nucleolar region, between the NOR and BR2.

There is also a nucleolus in arm F with the NOR at about group 19. Polymorphic in all arms.

All forms have the same basic chromosome complement, but different dominant sequences and different sets of polymorphic inversions: Occasional hybridization between forms in the east may lead to introgression of sequences between forms (e.g. E1 in forms *oppositus* and *whitei*).

oppA1: 1a-e, 7 - 4, 12a-c, 3i-f, 9 - 8, 11 - 10, 2c - 1f, 3e - 2d, 13 - 19

oppA2: 1a-e, 7 - 4, 12a-c, 3i-f, 9 - 8, 2d - 3e, 1f - 2c, 10 - 11, 13 - 19

oppA3: 1a-e, 7 - 5, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 12c-a, 4a-d, 13 - 19

oppA4: 1a-e, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 12c-a, 4 - 7, 13 - 19 (from A2)

oppA5: 1a-e, 2d - 3e, 1f - 2c, 10a - 11e, 8 - 9, 15 - 13, 7 - 4, 12a-c, 3i-f, 16 – 19 (complex from A1)

oppB1: A large puff is developed near the middle of the arm, with dark bands (groups 7-8) proximally.

oppB2: Large puff is towards the distal end of the arm, with the dark bands on the distal side (groups 8-7).

oppC1: Typical groups, 3-4, about one third from distal end. As C1 of New Zealand species *C. novaezelandiae* and *C.* "thermarum"

oppC2: Inversion of most of the arm, taking groups 3-4 to a proximal location

oppC3: A small distal inversion of C1, with one break in groups 3-4.

oppC4:

oppC5:

oppC6:

oppD1: 1 - 2, 16 - 13, 9a-e, 3d-a, 10d - 12, 18 - 17,10c-a, 3e - 8, 19 - 24 (from ausD1 by Inv 9 - 12 & 18 - 8)

oppD2: 1 - 2, 4 - 3e, 10a-c, 17 - 18, 12 - 10d, 3a-d, 9e-a, 13 - 16, 19 - 24

oppD3: 1 - 2, 16 - 15c, 8 - 3e, 10a-c, 17 - 18, 12 - 10d, 3a-d, 9e-a,13 - 15b, 19 - 24

oppD4: 1 - 2, 16 - 14h, 19c-a, 8 - 3e, 10a-c, 17 - 18, 12 - 10d, 3a-d, 9e-a, 13 - 14g, 19d - 24 as tylD2

oppD5: no longer in *C. oppositus* as tylD3

oppD6: 1 - 2, 16 - 13, 9a-e, 3d-a, 10d - 12, 18, 6 - 3e, 10a-c, 17, 7 - 8, 19 - 24

oppD7: 1 - 2, 16 - 15d, 18, 12 - 10d, 3a-d, 9e-a, 13 - 15c, 17,10c-a, 3e - 8, 19 - 24

oppE1: 1 - 3e, 10b - 3f, 10c - 13 as halophilus, etc.

oppE2: 1 - 2d, 7g - 10b, 3e -2e, 7f - 3f, 10c - 13

oppF1: 1 - 2a, 10 - 2b, 11 – 18 –19(NOR) - 23

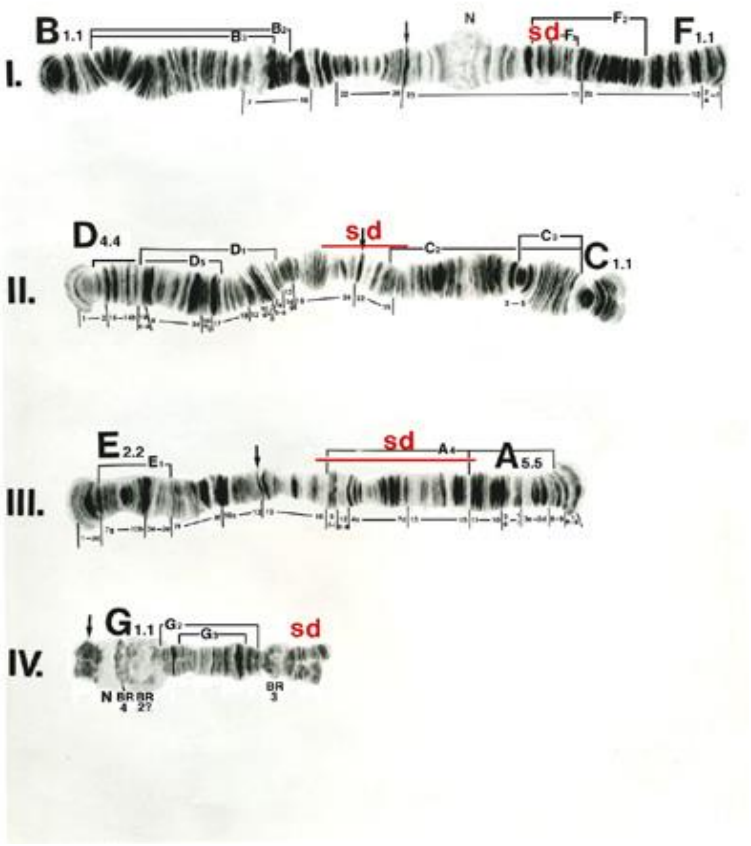
oppF2: 1 - 2a, 10 - 6c, 15g-11, 2b - 6b, 15d - 23

oppF3: 1 - 2a, 10-2c, 15c - 11a, 2b, 15d - 23 as australis F1

oppG1: Subterminal nucleolus with a nearby BR and another BR near the distal end. Most common sequence

oppG2: Inversion of about middle half of the arm, beween the two BRs.

oppG3: Smaller simple inversion of G1 within the limits of G2.



Representative photomap of the polytene chromosomes of *C. oppositus*, labelled where possible according to the Keyl/Devai system, and showing the limits of some inversions. SD – approximate sites of sex determining genes; N – nucleolus; BR – location of genes associated with specific Balbiani rings, which may or may not be expressed (Martin 2011a).

Specifc characters of the forms

f. *connori*: A2 (& A3)(males only), A5 (both sexes); B2 (& B1); C2; D1 & D2; E2; F1; G1.

f. *oppositus* A1 & A2; B1 (& B2); C2 (& C1); D1 & D2; E2 (& occasional E1); F1; and G1: sequences in arms C and D may appear sex linked.

f. *tyleri*: see listing under *C. tyleri*.

f. *whitei*: A5 & A4 with some A1 & A2; B2 & B1; C1 & C2, but also other less frequent sequences; D1, D2 & some D3; E2 (& rare E1); F1 & some F2 or F3; G1 (& G2, G3); sequences in arms A (A4), C, D, F and G may appear sex linked in different populations. These populations with different sex determiner (MD) locations appear to show some degree of differentiation of sequences present.

MD variants of form *whitei*:

Arm A MD: Larvae of this form have some development of the lateral projections (20 - 160 µm).
Cytologically characterized by A4.4 or A5.5 in females, while males are generally heterozygous for A4.5, but may be A4.4 - the MD is carried on A4. (Specimens are known in which both males and females carry both A4 and A5, but the MD location in these populations is not known, It could be on arm A, but equally could be on arm F or G). Also carry B1 and B2; C2; D1, D2 and D3, E2, F1 and G1.
Isozymes on arm A (e.g. Est1, ICD1 & 2, MPI) will show sex linkage in egg mass data. Consequently may often be identified in population or egg mass samples. (Specimens are known in which both males and females carry both A4 and A5, but the MD location in these populations is not known).

Arm CD MD:

Probably the most widely distributed MD location, but very rarely able to be recognized except from egg mass data, and then often requires electrophoretic data. Cytologically tends to be polymorphic in all chromosome arms, mostly - A5; B1 and B2, C1 and C2; D1 and D2; E2; F1; G1, but some G3.
Generally.
Isozymes on arms C or D (e.g. MDH, PGM) will show at least partial sex linkage in egg mass data.

Arm F MD:
Cytologically may carry F1 and F3, the MD being associated with F3. There seem to be two variants for the other arms: A4, B2, C2, D1, E2, G1; or A5, B1, C1, D2, E2, G1.

Arm G MD:
This appears to be a relatively rare MD location, known only from a couple of localities

south west of Melbourne, Victoria.

Cytologically may carry G1 and G3, but otherwise shows similarity to the variant with an arm F MD site (but lacking sequence F3). Appear to carry A4, B2, C2, D2 and E2. It is possible that the MD location is the result of introgression from *C. tyleri*.

f. 'edwardi': see under *Chironomus* 'edwardi'.

Molecular Data:

mt*COI* - GenBank (AF110155 - f. connori, KJ946667 - KJ946677) and BOLD. These sequences are shared between the forms of *C. oppositus* and with *C, tyleri*, presumably due to ongoing hybridization (Martin 2011a). Also many other sequences just listed as *C. oppositus.*

mt*Cyt B* - GenBank (AF109698 - f. connori), also KJ946795 & KJ946796

Gb2B - Genbank (AJ003799)

CAD1 - GenBank (KJ946479 – KJ946493)

ITS-2 - Martin (2011a)

and other genes.

Basic drawn chromosome maps according to the Australian standard, with some photographs, provided by Martin (1969). The sequences of arms A, E and F according to the Keyl system are given by Wülker, Dévai & Dévai (1989). Nucleoli and location of C-bands studied by Lentzios & Stocker (1979) and Lentzios *et al*. (1980). The basic evidence for the recognition of the forms was given in Martin (2011a).

Found:

Australian Capital Territory - Acton (w).

New South Wales - Barmah Ferry (w); Boggy Swamp Creek, n & e. Putty (w); 13 Km s. Bombala (w); Colo (w); Station Creek, Delegate (w); 30 Km n. Holbrook (w); Jeir Creek (w); Kiandra (c, o, w); Macquarie Pass (w); 3 Km s. Nowra (w); Tarago Swamp (w); 13 Km n. Tooma Dam (w or c).

South Australia - Kangaroo Island: Kingscote (w). Barmera (o); Lake Leake (o) and Lake Edward (o), via Kalangadoo; Warren Gorge, n. Quorn (w).

Tasmania (Type locality) – Flinders Island – Babel Farm, Lackrana (t); Mt. Strezleckie (w): King Island – Porky Lagoon (o); Sea Elephant River (c): Arthur River (c,); Bakers Beach (w); Bellerive (c, o); Bicheno (c); Butler Island, Gordon River (o); Cambridge (o,); Campbelltown (o); Coles Bay (o); Fossey River (c, w); George Town (c, o); Geeveston (o); Ida Bay (c, o, w); Lake Crescent (o); Little Swanport (o); Manning River, Sandy Bay (w); Maydena (c); 15 Km Queenstown (c, o); Smithon (c, o, w); Swansea (c, o); Wynyard (c).

Victoria - Anglesea (o); Armadale (w); Exhibition Gardens, Carlton (w); Cumerland River (w); Longlea (w); Eildon (w); Elphinstone (c, w); Frankston (w); Horden Vale (w); Manns Beach (o); Botanic Gardens, Melbourne (w); Moggs Creek (c, o, w); Narbethong (w); North Balwyn (o, w); Orbost (o); w. Orbost (o); Parker Road, Cape Horn (w); Reedy Creek (c, o); nr. Sale (o); Sassafras (w); Vermont (w); Warrandyte (c, o, w); West Preston (w); Squeaky Beach (c, w), Wilsons Promontory.

Western Australia - Lake Gwellup (e)

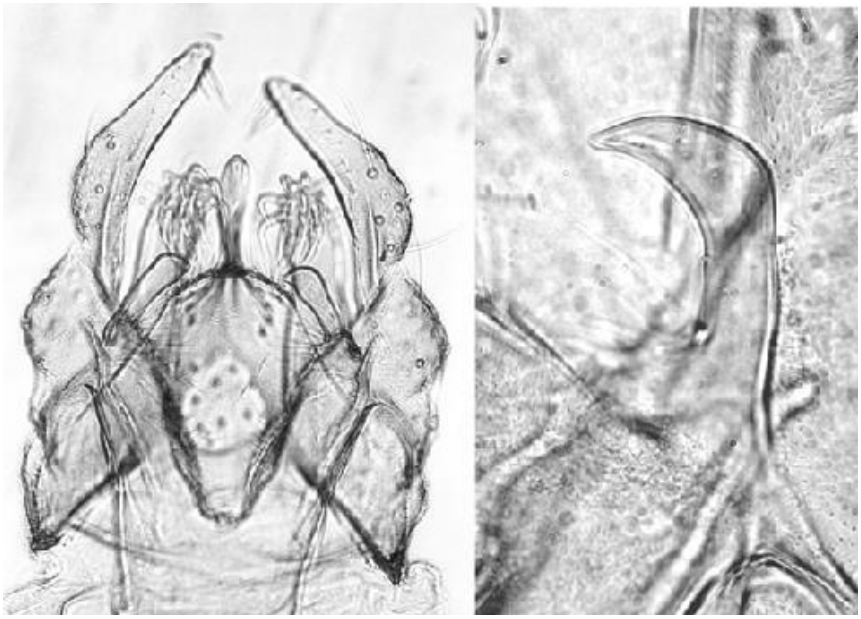
***Chironomus* "orientalis"**

This species is related to *C. flaviplumus* in Japan, but requires a new name (Martin 2011b). The name *C. orientalis* is suggested, as the species is widespread in Asia.

Probably in BOLD Bin: BOLD:AAV5954

Adults

Males



C."orientalis": Male hypopygium (left) and superior volsella (right) - note the beaked appearance.

AR about 2.4 - 2.9. (Specimens from Japan have an AR of 3.5 - 4.0, and should probably be placed as *C. flaviplumus* - see also below under Cytology)

Frontal tubercles about 33 - 39 µm.

Palp proportions: 44 : 53 : 189 : 222 : 315.

Wing length: 2.85 - 3.15 mm; wing width 0.30 - 0.67 mm. VR about 0.95

Leg lengths (microns) and proportions as follows:

Male	**Fe**	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**BR**
PI	1350	975	1820	925	837	712	362	1.82-1.96	1.35-1.44	1.7-2.2
PII	1305	1155	750	395	268	168	125	0.62-0.67	1.11-1.17	-
PIII	1478	1385	1180	595	448	262	152	0.81-0.92	1.05-1.09	-

The SVo is essentially a D(e)-type, although in some specimens of a beaked type not illustrated by Strenzke (1959), but possibly could be classed as an S-type, i.e. the SVo in this species is marginal between Strenzke's S- and D-types.

Setae near centre of 9th tergite: 9 - 12; some setae on IVo with simple or trifid fork. Gonostyle narrows gently or sharply from about the midpoint.

Female:

Only three damaged specimens have been available for study, two with the head missing.

Wing length 3.19-3.53 mm; width at cross vein 0.83-0.90 mm, VR 1.08-1.23. About 2-3 Scf on brachiolum and about 16 (14-18) setae on squamal fringe.

Head with frontal tubercles about 14 µm long and 13 µm wide.; about 27-55 clypeal setae.

Antennal segments (microns): 190 : 127 : 147 : 121 : 215. AR about 0.37; A5/A1 about 1.13.

Only palpal segments 1 and 2 were present, lengths 78 and 61 µm.

Leg lengths and proportions (micron):

Female	**Fe**	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**Ta4/Ti**
PI	1640	1180	2290	1347	1102	1112	410	1.91-1.92	1.37-1.42	0.90-0.97
PII	1565	1400	828	438	309	192	143	0.58-0.61	1.11-1.14	-
PIII	1703	1640	1322	695	544	311	185	0.79-0.82	1.02-1.06	-

Abdomen pale (probably greenish); about 4 setae on each side of segment X.

Fore Ta4 about same length as Ta3. About 91 - 96 Sensilla chaetica on hind tibia.

Differences from other members of the *C. samoensis/flaviplumus* group:

Important features of males are the AR of 2.4-2.9 (lower than that of *C. flaviplumus*, but similar to *C. samoensis)*, the LR of about 1.8 - 2.0 and fore Ta5, which is about 0.35 - 0.4 length of Ti. In Australia, it is the only presently known species with a boot-shaped superior volsella (variant of S-type of Strenzke 1956).

In the female the fore legs are very long, with LR about 1.9, and Ta3 and Ta4 are about equal in length, only a little shorter than Ta2, and Ta5 about a third of the length of the Ti.

Pupa: Exuvia length about 7.4 (7.2-7.8) mm; inner margin of wing case 1.45-1.54 mm.

Cephalic tubercles (see below) variable, length from 23-38 µm, with subterminal setae about 56-61 µm long. Basal ring of respiratory horn kidney shaped, about 124-137 µm long and 56-68 µm wide, HR 2.0-2.2.

Small Pedes spurii B and bout 68-72 recurved hooks on abdominal segment II; well developed Pedes spurii A on segment IV, about 34 µm long and 24 µm wide (l/w 1.4). Caudolateral spur (see below) of segment VIII with 1, 2 or sometimes 3 spines, the additional spines reduced in size. Anal fringe with about 65 (44-86) taeniae in multiple rows.

Fourth instar larva: a medium sized plumosus-type larva (length about 10.7 - 14.3 mm., lab. reared). Anterior VT (1.24 - 1.84 mm.) shorter than posterior pair (1.40 - 2.28 mm.).

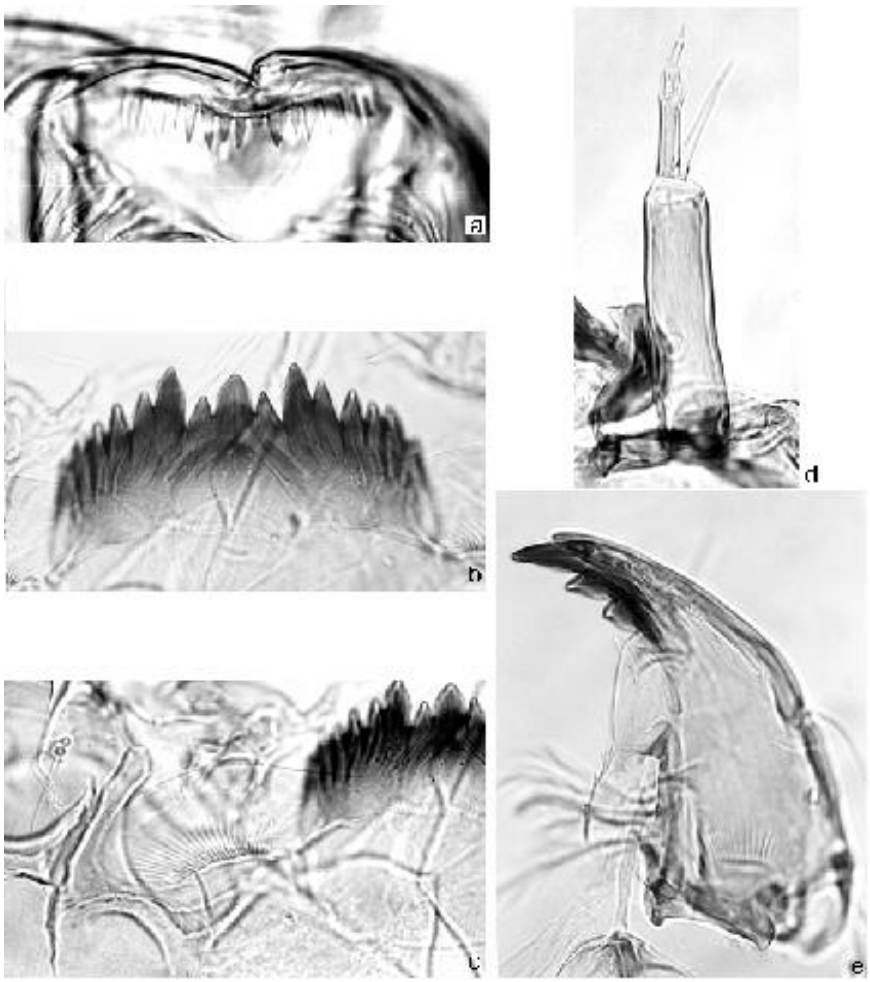
Gula pale or very slightly darkened on posterior third; FC pale to dark.

Mentum (Fig. b, below) with square sharp teeth, c2 teeth of central trifid tooth well separated from c1 tooth (type III), 4th laterals only slightly reduced (type I). PE (Fig. a, below) with about 16 - 21 sharp teeth which become much smaller at the ends. Ventromentum (Fig. c, below) with about 29 - 34 striae; VMR about 0.29-0.35.

Distance between the antennal bases about equal to the distance between the S4 setae.

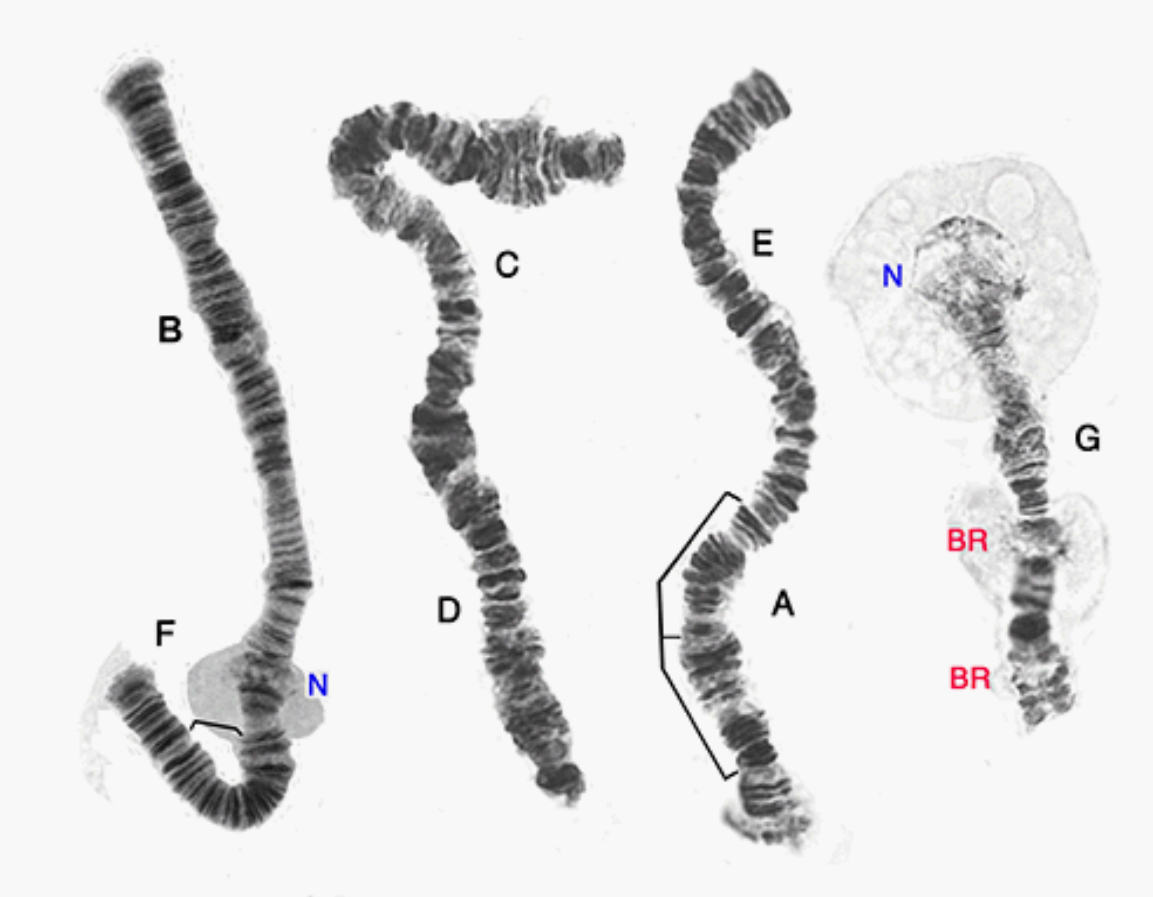
Antenna (Fig. d, below) with a moderately long basal segment, which is about 4 - 4.5 times as long as wide; AR about 1.70 - 1.96. Antennal proportions: 122 : 31 : 10 : 13 : 6.

Mandible (Fig. e, below) with third inner tooth only slightly darkened (Type IA/B), and with about 12 - 14 grooves on outer surface near the base.



Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Nucleolus virtually terminal in arm G; well developed BR about one third from the other end, and a smaller BR close to this other end; closely paired. No nucleolus in long chromosomes of Australian specimens, but one near the characteristic bands of arm F in *C. fluviplumus*. Arm A of Australian specimens differs from that of *C. fluviplumus* by a complex inversion, and arm F by possibly a simple inversion. Irradiation experiments indicated only that the MD region was not on the CD chromosome.

"orl"A1:	1 - 2c, 10 - 12, 3 - 2d, 9 - 4, 13 - 19	*holomelas* (Australia)
"orl"B1:	Puff of group 7 about the middle of the arm with dark bands distal of it.	
"orl"C1:	Characteristic groups 3-4 about one third from distal end of the arm.	
"orl"D1:		
"orl"E1:	1 - 3e, 10b - 3f, 10c - 13	as *aprilinus*, etc.
"orl"F1:	(possibly) 1 - 2a, 10a-d, 15 - 14e, 9 - 2b, 11 - 14d, 16 - 23	In14d-9 from *flaviplumus*
"orl"G1:	Subterminal nucleolus, median and distal BRs.	



Polytene chromosomes of *C.* "orientalis.
BR - Balbiani Ring; N - Nucleolus

Chromosome arms A, E and F of a "*C. samoensis*" were described by Wülker et al. (1989) based on Japanese specimens, but are probably *C. flaviplumus*. The sequences of arms A and F of this species are not the same, although closely related to the Japanese material.

A major difference to the cytology of specimens believed to be *C. samoensis* Edwards, from Tutuila, American Samoa, is the nucleolar position in arm G, which is medial in the Samoan specimens.

The Australian species is probably most closely related to the Japanese *C. flaviplumus* Tokunaga. Aspects of the relationships between some of the members of this group, from a molecular perspective, are given by Pramual *et al.* (2016)

Material identified as *C. samoensis* from India is also cytologically distinct, one species has been renamed *Chironomus indiaensis* (Martin 2011b), and others are the widespread species PK2.

Found:

Northern Territory - Radon Creek, Kakadu National Park (12.75oS, 132.93oE); Twin Falls, off Jim Jim Road, Kakadu area (13.00oS, 132.58oE)

Queensland - 3 km w. Sarina Beach (abt 21.45oS, 149.37oE); vicinity Townesville (19.2828oS, 146.801oE)(G.V.Cocks).

Also:

Bangladesh - Chittagong (22.4685°N, 91.7808°E)(BOLD)

China - Yangtze River basin (30.09°N, 115.12°E) (GeneBank)

Malaysia - Botanical Gardens, Univ. Malaya, Selangor (3.1295°N, 101.656°E)(BOLD)

Thailand - Mahasarakham University (16.242°N, 103.260°E), and Ban Keab (16.250°N, 103.210°E), Kantharawichai Dist., Maha Sarakham; Ban Tha Reu (15.303°N, 103.392°E), Satuek Dist. Buri Ram.

Molecular sequence

COI: There is sequence in BOLD and in GenBank

This species can be bred in the laboratory, as fertile egg masses were obtained from adults reared from wild collected larvae. The related Japanese species has also been maintained in a laboratory culture (Elbetieha and Kalthoff 1988).

***Chironomus pallidinubeculosus*Tokunaga 1964**

Synonyms:

Chironomus calipterus - misidentification in Bugledich et al. 1999., and other authors.

*Chironomus kiiensis*Tokunaga 1936- incorrect synonymy by Hashimoto *et al.* 1981.

Adult

Characterized by the patterned wings. This pattern is very similar to those of other patterned wing *Chironomus* species (see below)

Initially considered to be *C. calipterus*, because of the similar wing pattern. However, cytological examination of specimens from Israel, indicated that the two species were distinct, with the Israeli, and presumably African, chromosome arm combination belonging to the thummi cytocomplex, unlike this species, which belongs to the psuedothummi-cytocomplex.

The wing pattern is also similar to that of *C. kiiensis* and *C. striatipennis*, but the adults of those species are darker, and they show differences in mt*COI* sequences.

Tokunaga's original description (1964):

40. Chironomus (Chironomus) pallidinubeculosus Tokunaga, n. sp.

Rather large yellow species, wings with well-developed gray clouds and seams closely resembling African *calipterus* Kieffer; leg marking, value of LR, and structure of male hypopygium also similar to those of *calipterus*. Frontal tubercles large; AR 2.82-2.94, female antenna with last segment much shorter than preceding two together; scutum with yellow vittae on white ground color, lateral scutal vittae each with slender fuscus stripes on both sides, median scutal vittae each with similar fuscus stripe only on outer side in male and uniformly brownish in female. Legs with femora each with narrow preapical pale brown ring, LR 1.78-1.94. Wing with anal lobe well developed, gray clouds and seams rather distinct.

Male: Body 4.2 mm. long; wings 2.07-2.35 mm. by 0.53-0.64 mm. Head pale brownish yellow, with mouthparts pale brown, eyes separated above by about one-fourth length of eye, frontal tubercles large, subcylindrical and as long as about two or two and one-half facets together; palp pale brown and five-segmented (13.3: 13.7: 41.7: 41.3: 64); AR 2.89 (2.82-2.94), scape yellowish brown, other segments and plumose hairs brown, last segments pointed at apex. Thorax mainly white, scutum with four yellow vittae, fuscus slender stripes on both sides of lateral vitta and only outside of median vitta, anterior part of scutum, just behind head, pale fuscus, postscutellum pale brownish yellow, pleural sclerites beneath wing base pale brownish, sternum yellow, scutellum with six bristles along caudal margin. Legs mainly yellow or yellowish white, coxa somewhat brownish, femur with narrow pale-brown ring on preapical part, tarsal segments with apical end brown, last one or two tarsal segments uniformly brown; pulvilli large, LR 1.85 (1.78-1.94), RL-FT 82.7: 64.3. Wing (fig. 10, *a*) with anal lobe well-developed, pale gray clouds and seams rather distinct but ill-defined, main veins white, but r-m and fR dark, fMCu under r-m, RL-V 70.7: 43.7: 79.3: 76.5. Halter white. Abdomen mainly pale brown or yellowish pale brown, tergites 1 to 6 slightly fuscus; hypopygium (fig. 10, *b*) with anal point slightly beyond tip of ventral appendage, oblong at apex and curved downward, style normal, dorsal appendage with basal area subtriangular, setigerous and pubescent, apical bare projection almost straight, slightly curved and not painted at tip, ventral appendage almost straight, with 10 to 11 curved apical bristles, some unequally bifid at tip.

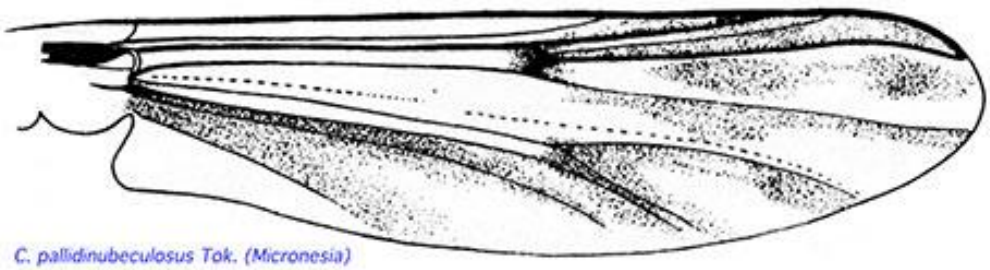
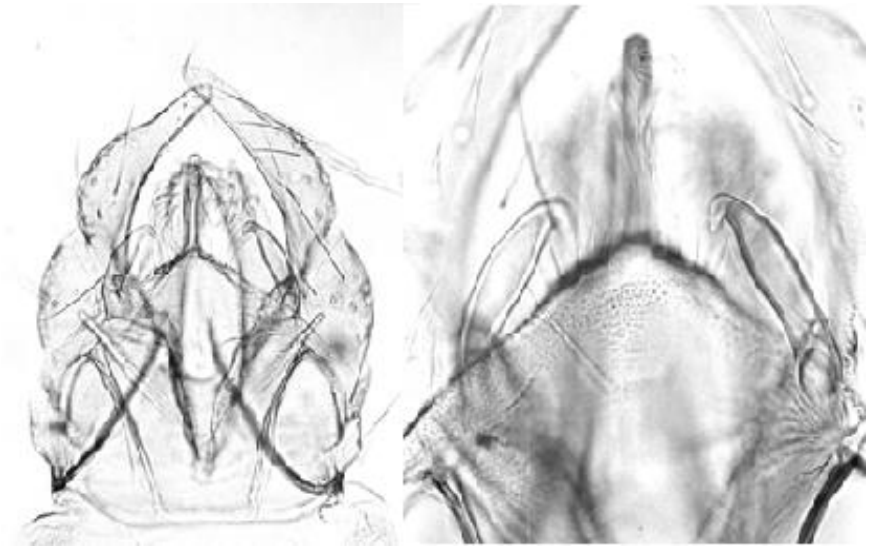


Figure of wing from Tokunaga 1964.

Male:

In details below, values for Australian specimens are followed by the range in Micronesia, given in brackets.



Male hypopygium of Australian specimen of *C. pallidinubeculosus* (left) and superior appendage (right)

Wing length 2.44-2.82 (2.07-2.35) mm; width 0.60-0.68 (0.53-0.64) mm; VR 1.00-1.07 (1.04-1.09). LR 1.59-1.63 (1.78-1.94).

Face yellowish brown, antennae and palps brown. AR about 3.00 - 3.13 (2.82 - 2.94).

Frontal tubercles quite large, about 30 - 56 µm long and 10 - 15 µm wide. 16 - 19 (16) clypeal setae. Palpal proportions (µm): 45 (40) : 48 (40) : 143 (136) : 161 (136) : 234 (200).

Thorax yellowish green with brown stripes, lateral stripes darker along the medial edge, and ending in a darker spot; postnotum and sternopleuron brown.

Setae: acrostichals - 9–11; dorsocentrals - 9-11; prealar - 4-5; scutellar in two rows – 2-3 in anterior row, 6-9 in posterior row.

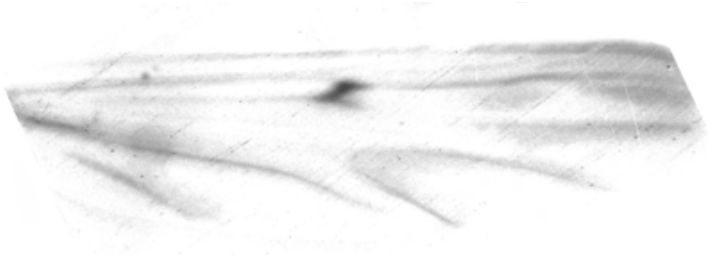
Legs yellow, femur with a dark band just before the knee; tarsal joints darkened.

Leg lengths (microns) (n = 3) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1000	915	1470	800	580
PII	1045	1050	600	353	265
PIII	1150	1283	985	600	457
	Ta4	**Ta5**	**LR**	**Fe/Ti**	**BR**
PI	480	234	1.59-1.63	0.97-1.20	2.1-3.0
PII	190	138	0.52-0.63	0.98-1.00	-
PIII	273	173	0.75-0.80	0.91-0.93	-

Ant Ta5 about 0.26-0.30 (0.32) length of Ti. About 7 sensilla chaetica on mid Ta1, and perhaps 5 on hind Ta1.

Wings with dark spot over the crossvein and with obvious dark clouds and seams, particularly in cell R5. 17-22 setae in squamal fringe, 2 SCf on branchiolum.



Wing of an Australian female specimen

Haltere pale.

Abdomen brown, no obvious bands on the segments. 5 - 6 (14) setae near centre of 9th tergite.

SVo essentially an E-type, perhaps closest to fig. h of Strenzke 1959, but end more sharply curved.

Gonostylus abruptly narrowing at distal third. IV

Female:

40. Chironomus (Chironomus) pallidinubeculosus Tokunaga, n. sp.

Female: Body about 3.12 mm. long; wings about 2.13 mm. by 0.65 mm. Coloration somewhat more brownish than in male, but structures mainly as in male with usual sexual differences. Head brown, with mouthparts dark brown, eyes separated above by one-fifth length of eye; palp five-segmented (10: 10: 32: 40: 55); antenna fuscus pale brown, last segment dark, neck parts of intermediate flagellar segments little shorter than one-half of segments, six-segmented (17: 40: 29: 31: 29: 41). Thorax mainly pale yellow, median scutal vittae uniformly brown or pale brown, postscutellum brown, sternum pale brown, scutellum with six bristles along caudal margin and two small accessory setae on anterior part, RL-FT about 70: 55. Wings with anterior veins pale brown, RL-V about 63: 50: 85: 70. Abdomen, including cerci, uniformly pale

Original description of *C. pallidinubeculosus* female from Tokunaga 1964

Additional data from Paratype female:

Wing length 2.60 mm, width 0.73 mm, VR 0.89. LR not available.

Antennal proportions (µm): 142 : 99 : 114 : 91 : 165 . Cephalic tubercles about 390 µm.

Palpal proportions (segs. 2 - 5) (µm): 40 : 136 : 136 : 170. 14 clypeal setae.

thoracic setae: acrostichals - 14; dorsocentrals - abt 22; prealar - at least 2; scutellar in two rows – 5 in anterior row, 8 in posterior row.

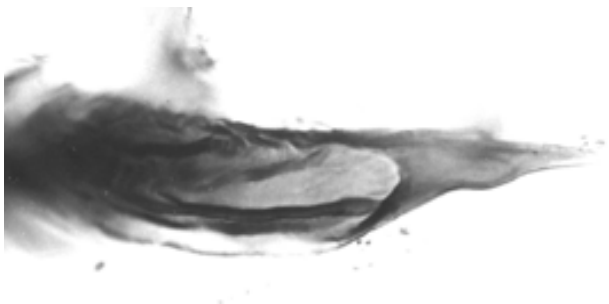
2 SCf on branchiolum of wing.

Leg lengths (µm) and proportions as follows:

	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	F/T	BR
PI	1040	860	-	-	-	-	-	-	1.21	-
PII	1060	1060	600	320	250	170	110	0.57	1.00	-
PIII	1220	1320	-	-	-	-	-	0.92	-	-

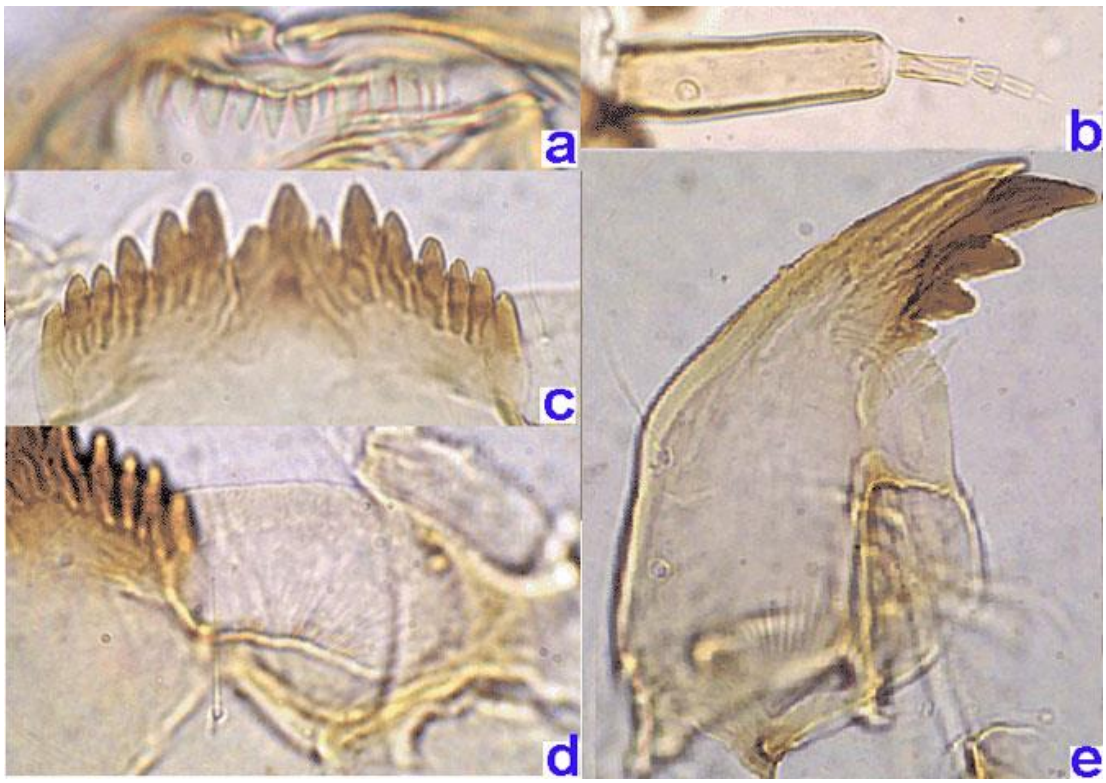
No information available for Australian specimens.

Pupa: Length about 6.7 - 7.0 mm, posterior margin of wing case about 1.35 - 1.60 mm.
Head: Cephalic tubercles about 63 – 79 µm long and about 40 – 67 µm wide at the base, with a subterminal seta about 40 – 57 µm long.
Thorax: Prealar tubercle present but small, about 18 – 23 µm long and 8 – 10 µm wide. Basal scar of respiratory horn with edge thicker at the anterior end, and pinched at the centre, about 113 – 116 µm long and 49 – 57 µm wide. There are a number of small pits (2 – 4) immediately anterior to the basal scar, and a large, possibly muscle scar just posterior to it.
Abdomen: About 61 – 75 recurved hooks on posterior margin of segment II, the hook row covering about 60 – 85% of the width of the segment. Pedes spurii B on segment II, and larger on segment III, and pedes spurii A on segment IV, while those of segment V and VI are small and mainly identifiable by the spinules. Only 3 L-setae seen on segment III, while the last one on segment IV is at the junction with segment V. Segment VIII with two pairs of larval ventral tubules; caudolateral spur with one main spine and 1 or 2 smaller ones. Anal lobe with about 59 - 60 taeniae on each side, mostly in a single row but multiple rows at posterior end.



Larva: a medium sized (8-10.5 mm) plumosus-type larva. Gula pale or darkened on posterior third; FC slightly dark or dark. Ventral tubules moderately long (ant. 0.84-1.36 mm; post. 0.76-1.48 mm), relative length of anterior and posterior pair variable.
Mentum (c, below) with c2 teeth of central trifid tooth well separated from c1 tooth (type III), 4th laterals slightly reduced (type I).

PE (a, below) with about 16-21 variable but sharp teeth. Ventromental plates (d, below) separated by about 0.32-0.38 of width of mentum; with about 29 - 34 striae. Prm with the two teeth about equal in length, inner tooth about a third wider than the outer tooth. Antenna (b, below) with a moderately long basal segment, which is about 4-4.5 times as long as wide; AR about 1.9-1.96. Antennal proportions: 120 : 27 : 10 : 13 : 6. Mandible (e, below) with third inner tooth only slightly darkened (Type I), and with about 12-14 furrows at the base; also reported to have a double bulge on the inner contour.



Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Nucleolus virtually terminal in arm G, with very large BR adjacent, separated by only 4-5 bands; normally closely paired, but NOR and BR region may be unpaired. No nucleolus in long chromosomes. Polymorphism in arm F seen in Australian specimen examined.

pnbA1: 1 - 2c, 11 - 7, 4 - 6, 2d - 3, 12 - 19 as *striatipennis*

pnbB1: Puff near the middle of the arm with the dark bands proximal.

pnbC1:Constriction (groups 3 and 4) about one quarter from distal end.

pnbD1:

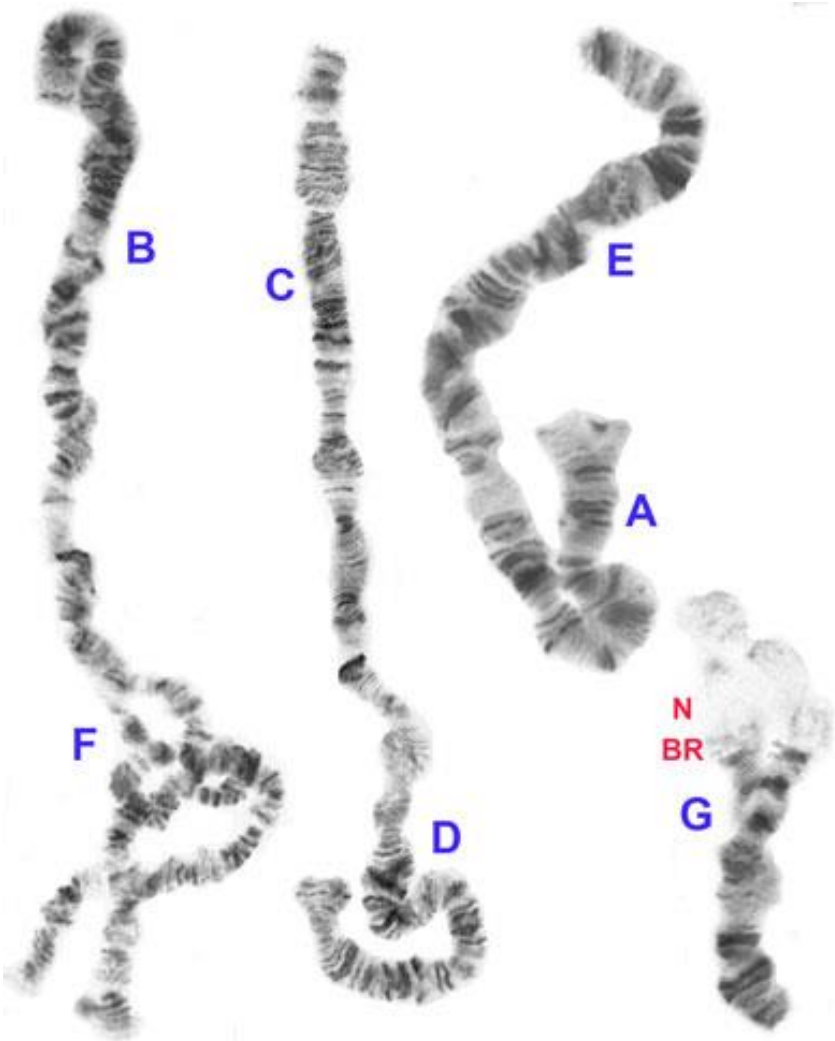
pnbD2: a simple inversion of about 1/3 of the arm towards the distal end.

pnbE1: 1 - 13 as *piger*, striatipennis.

pnbF1: 1 - 2a, 10 - 6, 15 - 11, 2b - 5, 16 - 23 i.e. from *oppositus* F1 by Inv15-5

pnbF2: A simple inversion of about the distal half of the arm

pnbG1: Virtually terminal nucleolus with adjacent BR.



Found: Micronesia - Ulimang, Babelthaup Island, Palau Islands (Type locality).
Queensland - Noosaville.

Molecular

mt*COI*:

Chironomus 'pseudoppositus' Martin

Chironomus alternans b - Martin and Porter 1977; Lentzios and Stocker 1979; Lentzios et al. 1980, Martin and Lee 1981 and 1984, Martin and Cranston 1995.

Chironomus pseudoppositus (manuscript name) - Martin 1974.

Chironomus pseudoppositus (nomen nudum) - Martin 1969b; Cranston and Martin 1989

In BOLD Bin: BOLD:AAW3993

Adult: Very similar to those of *C. oppositus*, but are generally smaller and darker in colour.

Males:

Head, antennae and mouth parts brown. Frontal tubercles present, length about 10-16 micron, width about 9-10 micron. About 19 - 25 clypeal setae. Palpal proportions (micron): 52 : 66 : 199 : 224 : 354.

Thorax generally brown with purplish brown stripes; thorax pruinose.

Thoracic setae: Acrostichal - abt. 12-17, Dorsolateral 12-20, Prealar - 4-6, Scutellar - 2 approximate rows, Ant.- 2-8, Post. - 12-14.

Wings with anterior veins hardly darker than posterior, crossvein slightly darkened.

Wing length 2.95 - 3.38 mm, width at crossvein 0.68 - 0.80 mm, VR. 1.03 - 1.06.

Legs yellowish green, unbanded.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**BR**
PI	1265	1045	1785	910	740	645	291	1.5-1.8	1.18-1.23	1.6-2.1
PII	1310	1165	735	410	295	195	145	0.58-0.63	1.06-1.14	-
PIII	1420	1425	1050	585	455	280	170	0.67-0.75	0.96-1.01	-

Male terminalia of *C.* 'pseudoppositus'

Male abdomen generally black with a white posterior margin on the anterior segments. Hypopygium similar to those of other members of the *C. oppositus* group. SVo generally of the D-type, but occasionally E-type, varying from Strenzke's Fig. e to g, but with some development of a beak. Setae on the IVo not branched.

Females:

Wing length 2.8 - 3.6 mm; width at cross vein 0.96 - 1.20 mm, VR 1.10 - 1.12.

Head with frontal tubercles of variable length: 19 - 48 µm; about 27 - 55 clypeal setae.

Thorax and wings similar to those of males. Thoracic setae: Achrostichal abt. 17 - 22; Dorsolateral 23-35; Prealar 5-7; Scutellum, ant row 9-14, posterior row 11-20.

Leg lengths (microns) and proportions as follows:

Female	**Fe**	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**Ta4/Ti**
PI	1548	1217	2310	1140	925	860	373	1.68-1.82	1.23-1.32	0.71
PII	1539	1417	811	413	300	194	149	0.56-0.61	1.09-1.11	-
PIII	1661	1694	1199	653	510	300	188	0.67-0.72	0.98-0.99	-

BR - 1.6-1.7

Abdomen similar to *C. oppositus.*

Pupa: Length about 8.4 mm. 54 hooks in row on segment II, 1-2 spines on caudolateral spur of segment VIII; 86 filaments on each side of the swim fin.

Caudolateral spur on 8th abdominal segment of pupa

Larva generally a medium sized bathophilus-type; length about 10.2-15.3 mm (female), 10.0-12.5 (male), VT well developed, posterior pair longer, length of anterior 0.42-1.67 mm; of posterior about 0.66-2.92 mm. Anal tubules usually about 3-4 times longer than wide.

Gula varying from pale to posterior third dark (generally paler in more northern populations), FC often slightly or moderately darkened.

Mentum (c, below) with 4th laterals slightly reduced, sometimes to level of fifth laterals (i.e. between type I-II), and c2 teeth well separated, sometimes the c1 tooth is quite long (i.e. type III, but can appear as IIA when worn).

Ventromentum (d, below) about 3.5 times longer than deep; 1.08 times the mentum width; with about 30-40 striae; VMR 0.23-0.33. PE (a, below) with about 11-18 teeth sharp teeth (i.e. type 1 of Proulx *et al.* 2013), occasionally with some reduced teeth.

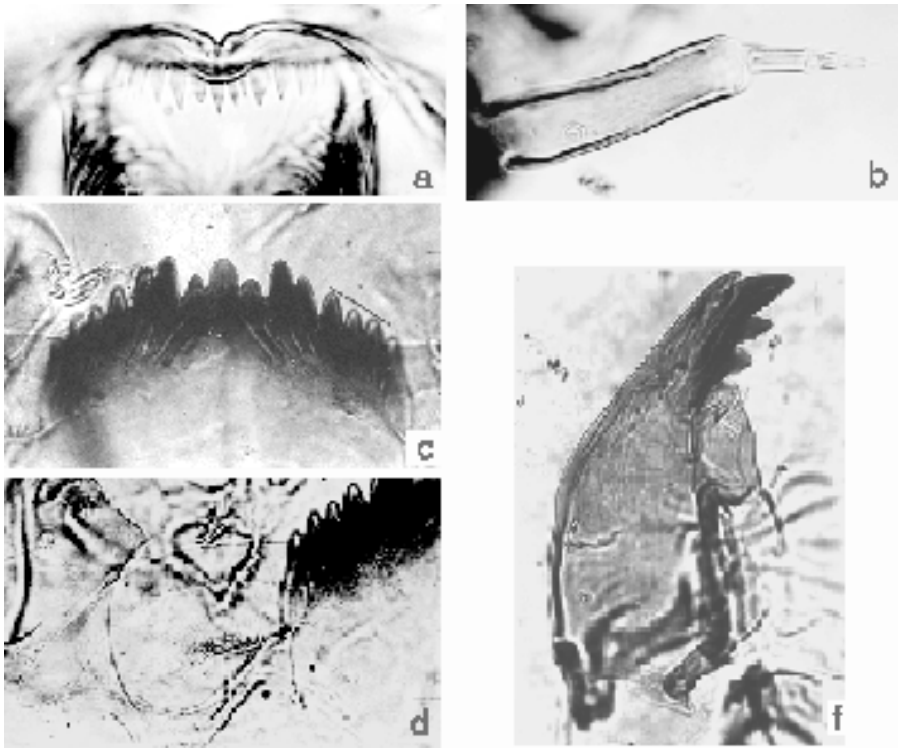
PrM with the normal two teeth, about equal in length, inner tooth usually at least twice the width of the outer (1.6 –2.9).

Basal segment of antenna relatively long and narrow, about 3.5-4.6 times as long as wide, RO about a third to a half way up from base; AR about 2.15 (2.02-2.26); A2/A1 about 0.25; A4/A3 about 0.9-1.3; segment proportions (micron) 128 : 31 : 9 : 12 : 7.

Distance between the antennal bases usually greater than distance between S4 setae, but may be equal or even less in about 1/3 of specimens.

Mandible (e, below) generally of type IA or B, but may be IIB, with about 11-17 furrows on outer surface at base; about 11-17 taeniae in PMa; MTR about 0.375.

Larvae are very difficult to distinguish from other members of the oppositus-group, although not known to ever show any development of PLT.



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

Arm G with a median nucleolus and two BRs, the larger (probably) BR2 proximal of the nucleolus and the smaller BR3 near the distal end. There appear to be two pieces of BR1, one between the nucleolus and BR2 and the other just distal of the nucleolus. The potential site of BR4 is immediately distal to the BR1 fragment between the nucleolus and BR2. Nucleolus in arm F with NOR at about group 19. Polymorphism in arms A, C and D, that in chromosome CD associated with the MD (Martin & Lee 1984). Possible small deletion heterozygous at distal end of arm G in one specimen.

psoA1: 1a-e, 6e - 7, 13 - 14c, 3i-f, 9 - 8, 2d - 3e, 1f - 2c, 10 - 11, 6d - 4, 12a-c, 14d - 19
i.e 14c-12c and then 6e-11 from opp A4

psoA2: about 1a-e, 6e, ~~3e - 2d, 8 - 9, 3f-i, 14c - 13, 7d-a~~, 1f - 2c, 10 - 11, 6d - 4, 12a-c, 14d - 19

psoB1: Sequence as oppB2

psoC1: Sequence as tepC1.

psoC2: Sex linked and only as heterozygote in some males; generally includes D2

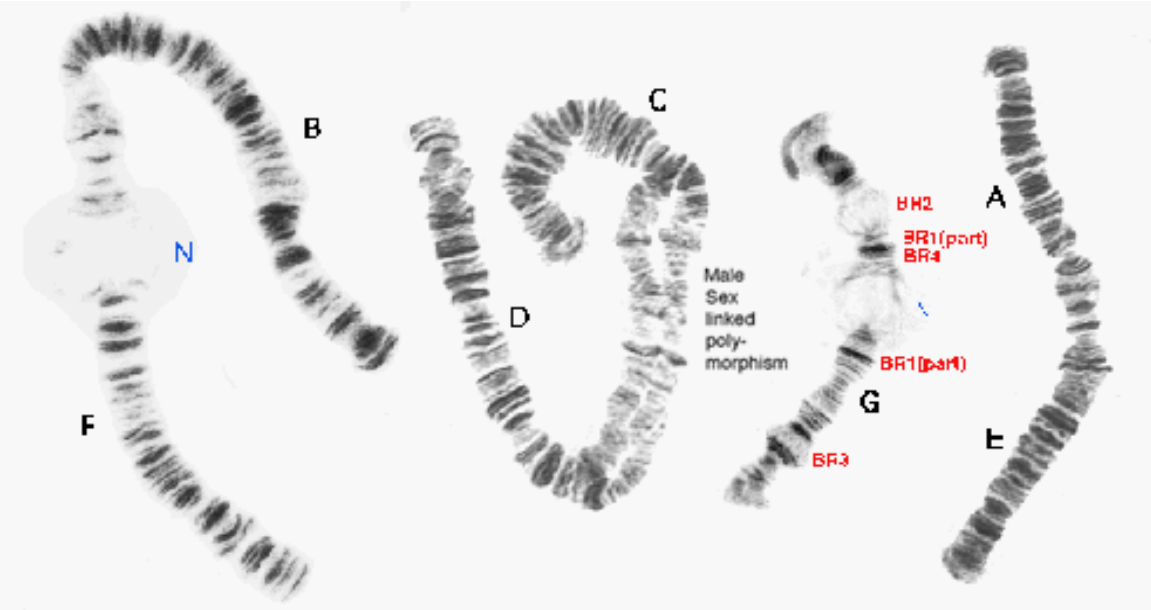
psoD1: 1-2e, 6-8, 19a-c, 14h-16, 2i-g, 18a-g, 12-10d, 3a-d, 9e-b, 2f, 5-3e, 10a-c, 17a-f, 9a, 13-14g, 19d-24 i.e. inv6-2f from tepD1

psoD2: includes C2; sex linked and only in some males as heterozygote

psoE1: 1 - 3e, 10b - 3f, 10c - 13 as *oppositus* E1, halophilus, etc.

psoF1: 1 - 2a, 10 - 2b, 11 – 19(NOR) - 23 as oppositus F1

psoG1: Median nucleolus



Nucleoli and location of C-bands studied by Lentzios Stocker (1979) and Lentzios *et al*. (1980).

A colonizing species, often found in relatively small artificial containers, shallow ponds and creeks.

Molecular data

mt*COI*: BOLD - CAUS027-10; CAUS034-11; CAUS035-11; CAUS036-11. Also sequences in GenBank.

Proposed type series: Asquith, New South Wales (33.68ºS, 151.10ºE), 20.ii.1963, (leg. J. Martin) 3m and 5f, various dates in 1963.

Proposed types are currently in collection of Jon Martin, but will eventually be distributed to the ANIC and other institutions.

Although classed as a nomen nudum, this species was described and proposed types designated in an unpublished Ph.D. Thesis by J. Martin at The University of Melbourne (1966).

Found:

Australian Capital Territory - Australian National University wildlife reserve.

New South Wales - Asquith (33.68526ºS; 151.11647ºE) (type locality); Cooranbong (33.08ºS, 151.45ºE)

Queensland – Auchenflower (27.48ºS, 153.00ºE); Mt. Ngungun.

South Australia - 1 Km n. Denial Bay; Middle Gorge, Flinders Ranges (32.11ºS, 138.00ºE); Koppio; Eyres Waterhole, Streaky Bay; Oratunga Creek, Parachilna (31.05ºS, 138.55ºE); Warren Gorge, 20 Km n. Quorn (32.11ºS, 138.00ºE); Tumby Bay.

Tasmania - Bakers Beach; 3 km nw Queenstown.

Victoria – Aireys Inlet (38.47ºS, 144.10ºE); Armadale; Balwyn North (37.79052ºS, 145.10037ºE); Beechworth; Box Hill North (39.82ºS , 145.12ºE; Bulleen (37.77577ºS, 145.09552ºE); 7 Km s. Castlemaine; Eildon (37.23ºS, 145.92ºE); Edwardes Lake, Reservoir; Frankston (38.08ºS, 145.08ºE); Ringwood North; Templestowe Lower; Warburton; Warrandyte South; Wartook Reservoir, Grampians; Melbourne Water Metropolitan Farm, Werribee.

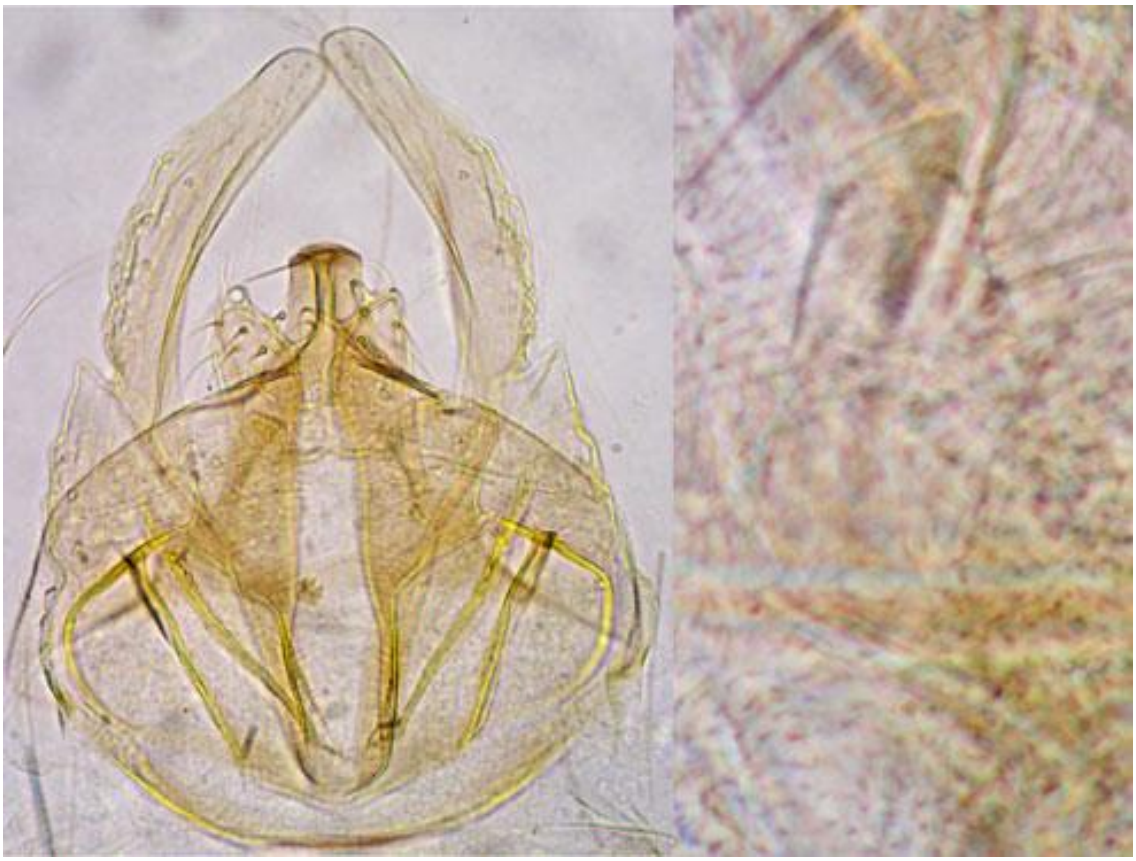
New Zealand – there are records in the BOLD database for specimens from Hamilton, Waikato, North Island (37.802ºS, 175.334ºE).

***Chironomus* 'queenslandicus'** (manuscript name)

It is possible that this species may belong in the subgenus *Lobochironomus.*

Adult:

Male:



Male terminalia of *C.* 'queenslandicus'.
Note the distinctive superior volsella with a large hairy base (right).

Face, antennae, palps, brown. Frontal tubercles present. AR about 2.84 - 3.1

Palp proportions (segs 2-5) (micron) 40 ; 170 ; 165+ : 250. Clypeal setae - 22.

Thorax green, stripes reddish brown with a dark spot at the posterior end of the lateral stripes.

Thoracic setae: Achrostichal - 16, Dorsolateral 11 -13, Prealar - abt 4, Scutellar - 2 approximate rows, Ant.- 10, Post. - 12.

Legs pale. Anterior basitarsus not bearded. Ant LR = 1.76-1.80; Ant Ta4 longer than Ta3.

Wings pale, halteres greenish. Wing length 3.20 mm; wing width 0.83 mm; VR 1.11.

Leg proportions (microns):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**BR**
PI	1320	920	1620	850	670	710	280	1.76-1.80	1.43	1.73
PII	1310	1075	720	405	245	180	135	0.66	1.22	-
PIII	1415	1330	1050	565	400	270	170	0.79	1.06	-

Abdomen dark, slightly paler at posterior of segments; about 9 setae medially on 9th tergite.

Male genitalia distinctive due to nature of the SVo. This appendage appears to have an extensive membranous base which can fold rather differently during slide-mounting, often

hiding the bare apicomedian projection, and so lead to a quite variable appearance of the SVo. The apicomedian projection is unlike any described by Strenzke (1959), but rather like that illustrated for *C.* (*Lobochironomus*) *montuosus* by Cranston *et al*. (1989). Anal point broad, as in *Xenochironomus*; gonostylus only slightly tapered at the ends. Setae of IVo simple.

Female:

Wing length: 3.26 mm. Wing width: 0.85 - 0.86 mm. VR 1.07. About 22 setae in the squamal fringe.

Antennal segments (µm) (2): 158 : 118 : 118 : 103 : 229. Frontal tubercles: about 18 - 38 µm long, 10 - 13 µm wide.

Palps (µm) (2): 39 : 41 : 157 : 212 : 307. Clypeal setae - abt 18-20.

Thoracic setae: Achrostichal - abt. 17, Dorsolateral 18-19, Prealar - abt 3-4, Scutellar - 2 approximate rows, Ant.- 9, Post. - 13.

Leg proportions (microns) (2):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**Ta4/Ti**
PI	1268	907	1667	838	690	870	345	1.77-1.90	1.39-1.40	0.95-0.96
PII	1271	1098	692	341	240	168	126	0.50-0.62	1.14-1.18	0.14-0.16
PIII	1385	1318	1044	522	395	247	161	0.79	1.05	0.19-0.23

Fore Ta4 longer than Ta3 and Ta5, about same length as Ta2.

BR 2.0 - 2.6. About 38 - 43 sensilla chaetica on hind Ta1.

About 7 setae on Gonopophysis VIII, 2-3 setae on Gonocoxite IX.

Pupa: A typical *Chironomus* pupa. Exuvia relatively pale, brownish; various characters as in table below. Respiratory base essentially kidney shaped, about 129-153 µm long and about 2.5 times longer than wide. Hook row of segment II occupying about 2/3 of width of segment. Slender L seta on anterior margin of conjunctives III/IV and IV/V, that of IV/V generally longer (abt 115 cf. abt 90 µm). Pedes spurii of segment II very obvious, barely visible on segment II, pedes spurii A of segment IV well developed, but just a patch of spines on segment V.

	Females (2)		Males (4)	
	Mean	Range	Mean	Range
Length (mm)	7.36	7.07 - 7.64	6.97	6.67 - 7.32
Inner margin wing case (mm)	1.47	1.45 - 1.48	1.36	1.27 - 1.49
Cephalic tubercles (µm)	61	51 - 72	71	64 - 82
Cephalic bristles (µm)	46	43 - 49	38	37 - 38
HR	2.4	2.2 - 2.5	2.3	2.1 – 2.5
Len. PSA of abd seg IV (µm)	150	150	168	105 - 195
Hooks on abd. segment II	69	64 - 74	72	64 - 82
Swim fin taeniae (one side)	78	78 - 79	62	47 - 72

Caudolateral spur of segment VIII generally with only 1 spine, but sometimes with 2.

Shagreen pattern slightly stronger in female than male, particularly in segment VI, where that of male is barely visible. There is strong shagreen on midline of segment II, spreading laterally to segment IV, then reducing again in segment V, and small area of very fine spines in VI. Taeniae of swim fin mostly in a single row, but becoming a double row at posterior end.

Larva: Medium size melanotus-type larva, length about 10.7 (9.7 - 11.3) mm in females; 10.8 (10.2 & 11.3) mm in males. PLT about 300 - 400 micron. Length of ventral tubules about 1.44 - 1.9 mm (anterior) and 1.88 - 2.5 mm (posterior). Anal tubules about 400 - 560 micron in length, about 3 times longer than wide and tending to be constricted near the middle.

Head capsule with posterior third of gula very slightly to slightly darkened, as is FC.

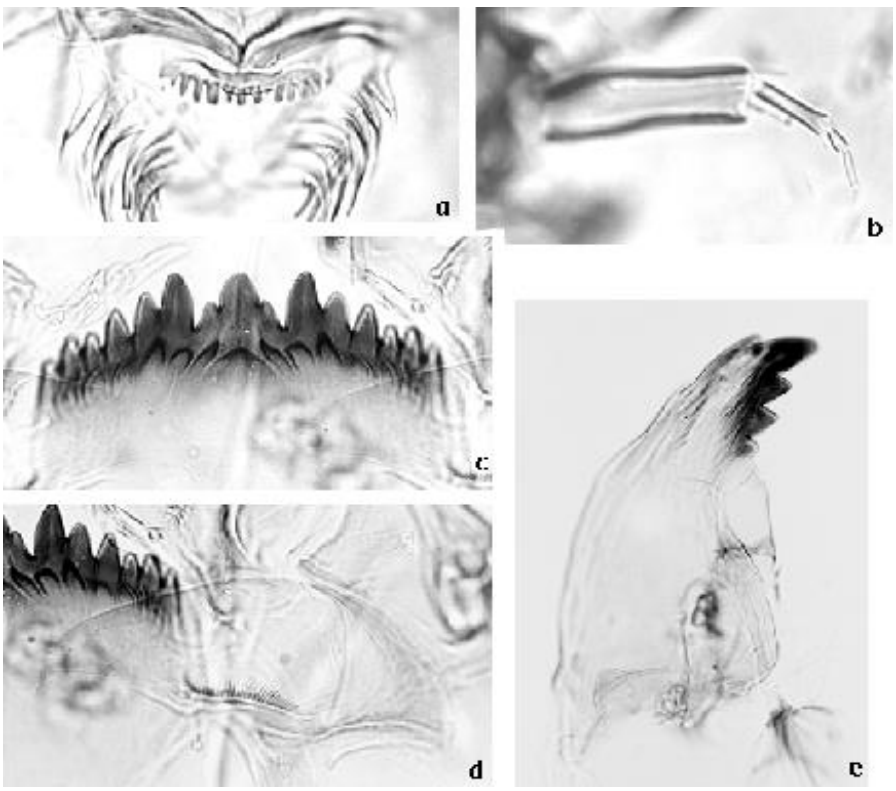
Mentum (c, below) with 4th laterals reduced almost to the level of the 5th lateral (type II), c2 teeth hardly separated from c1 (type IB).

VM (d, below) generally separated by only about 0.17 – 0.28 of the mentum width; with about 37 - 47 striae which reach at least two thirds to the smooth anterior margin; with some obvious lumps at the lateral ends. PE (a, below) with about 13 - 19 somewhat irregular teeth, often with one or more small teeth type D0, as found in European species of *Lobochironomus*.

Prm with teeth about equal in length, inner tooth about 1.8-2.3 times wider than outer tooth.

Basal segment of antenna (b, below) about 3.3 to 4.4 times longer than wide, RO generally between a third and a half way up from base of segment, which does not have an extended foot; AR about 1.5 (1.4 - 1.64); A2/A1 about 0.33 (0.28-0.35); A4/A3 1.48 (1.09-1.73); antennal segment proportions (µm) 106 : 35 : 11 : 16 : 7.

Mandible (e, below) with third inner tooth darkened and at least partially separated (type II-IIIC), about 20 (19 – 23) grooves on outer surface near base; about 12 (10-14) bristles in PMa.



Very similar to the larva of *C*. sp. (bathophilus type) but differing in the presence of PLT and a slightly higher AR and ratio of A4/A3. These two species have lower ARs than other Australian species.

Cytology: 4 polytene chromosomes with the thummi arm combination AB, CD, EF, G (Only other known species possibly of this cytocomplex in Australia is *C. javanus*). Arm G with a subterminal nucleolus and a BR near the middle of the arm. No nucleolus in the long chromosomes. No polymorphism in the known specimens.

qldA1:

qldB1: Large puff (group 7) about one third from distal end, with dark bands (group 8) proximal to it.

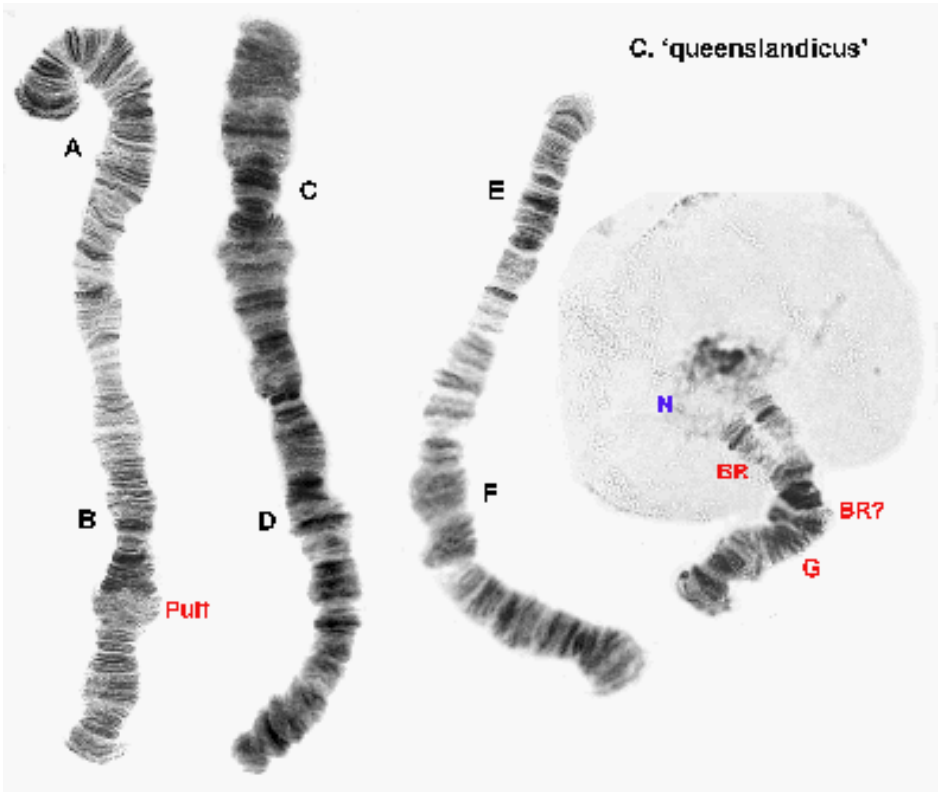
qldC1: Distinctive band groups 3-4 about one third from distal end.

qldD1: 1a - 7, 14 - 19f, 8 - 13, 19g - 23 (preliminary by Kiknadze)

qldE1: 1-3c, 6g - 10b, 3de, 6f - 3f, 10c - 13 (preliminary by Kiknadze)

qldF1: 1 - 10, 17 - 11, 18 - 23 (preliminary by Kiknadze)

qldG1: subterminal nucleolus and probably three BRs evenly spread through rest of arm.



Proposed type series: Holotype male: Queensland, 4 km n. Fernvale (27.43oS, 152.65oE), AQ.19.1, 8.vi.1968 (leg. Jon Martin) reared male with pupal and larval exuvia, slide mounted. Allotype female: same data as Holotype male, reared female 1, with pupal and larval exuvia, slide mounted. Paratypes: reared adult males and females, larval bodies with chromosome spreads, all slide mounted.

Most members of the proposed type series will be lodged in the Australian National Insect Collection.

Found:

New South Wales - Lake Ainsworth.

Queensland - 4 km n. Fernvale, North Stradbroke Island.

***Chironomus* tasmaniensis (manuscript name)**

C. species Bakers Beach - Martin

Adult not known.

Pupa not known.

Larva: a medium sized bathophilus-type. No measurements of body or ventral tubule lengths. Gula and FC pale in the single known specimen. Ventral head length (VHL) 263 micron, width of mentum about 0.7 times the VHL.

Mentum (a, below) very similar to that of other members of the *C. oppositus* group. The teeth are rounded but this may be due to wear; the 4th laterals are slightly reduced, almost to the level of the 5th laterals (type I-II); the c2 teeth are relatively well separated (type IIA), but the division between the c2 and c1 teeth does not reach down to the level of the outer sides of the c2 teeth.

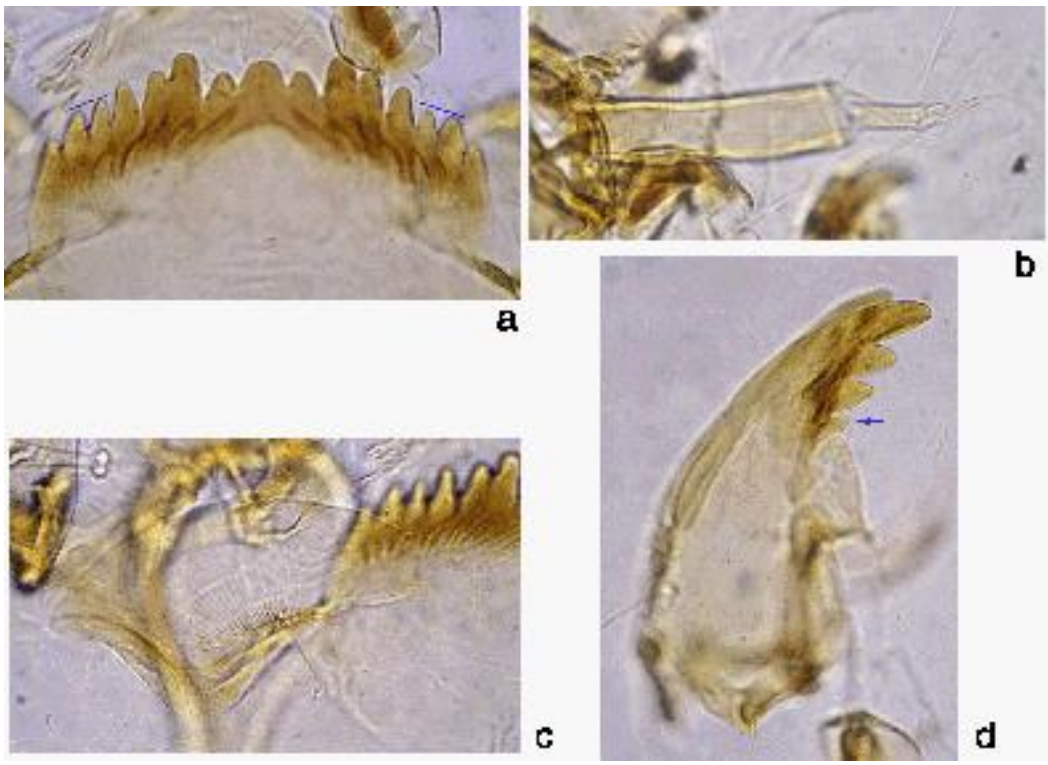
Ventromental plates (c, below) about 0.85-0.9 times the length of the mentum and 3.2 times longer than deep; separated by about a third of the mentum width; separated by about a third of the mentum width; with about 28-30 striae; VMR 0.30-0.35.

PE difficult to see, but appears to have about 9 teeth, possibly type C. Prm with broken teeth, but inner tooth nearly twice as wide as the outer tooth.

Distance between the antennal bases may be slightly greater than that between the S4 setae, which are separated by 0.9 of the FC width at that point.

Antenna (b, below) with relatively long, narrow basal segment; A1 4.1 times as long as wide, and about 0.46 of VHL, RO about a third up from the base; AR about 2.04, relative lengths of segments (micron): 120 : 30 : 8 : 14 : 7.

Mandible (d, below) with third inner tooth pigmented and almost fully separated (type II-IIIB); 12 taeniae in the PMa and 16 furrows on outer surface near the base of the mandible.



Cytology: Three polytene chromosomes with the modified pseudothummi-cytocomplex combination:

AEG, BF, CD. Arm G unpaired with a Balbiani ring (BR) near the fusion with arm E and a second about the middle of the arm.

A nucleolus is developed in arm F with the NOR at about group 19.

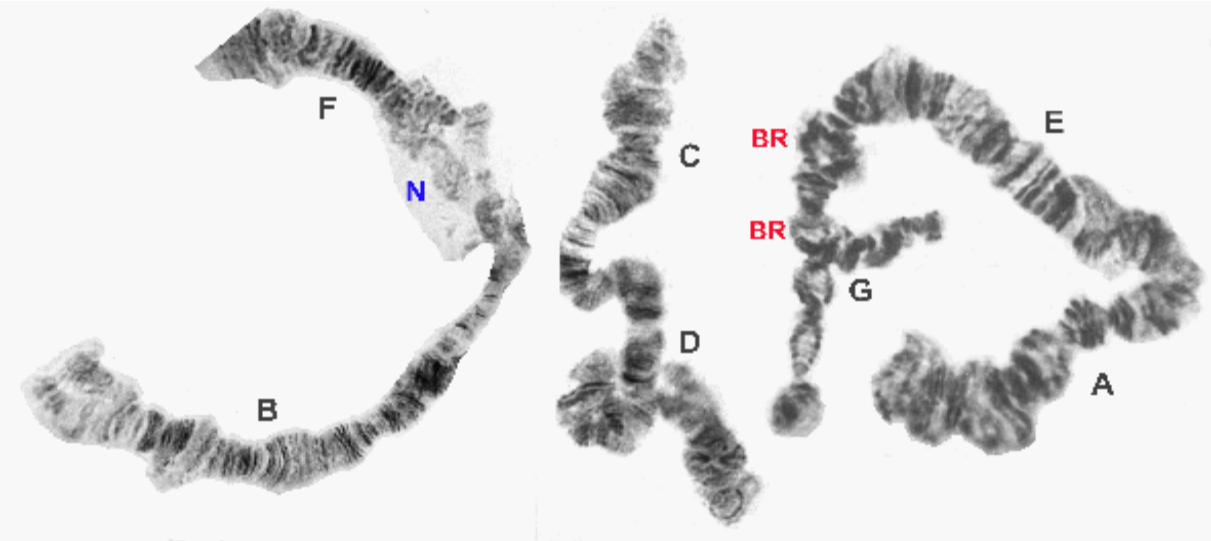
BB A1: 1a-e, 2d - 3e, 1f - 2c, 10a - 11e, 8 - 9, 15 - 13, 7 - 4, 12a-c, 3i-f, 16 - 19 as oppositus A5

BB B1: Large puff (group 7) developed towards the distal end of the arm, with the dark bands (group 8)on the distal side. as oppositus B2

BB C1: Banding pattern not clear.

BB D1: Banding pattern not clear.

BB E1: 1 - 2d, 7g - 10b, 3e - 2e, 7f - 3f, 10c – 13 as oppositus
E2
BB F1: 1 - 2a, 10 - 2b, 11 – 19(NOR) - 23 as oppositus
F1
BB G1: fused to the end of arm E, with two obvious BRs.



Found:
Tasmania – Bakers Beach (41.1oS, 146.6oE), off Highway 9.

This species is known from only a single specimen from Bakers Beach, Tasmania, AT.57.1 5F, (Jon Martin & B.T.O. Lee) 9.xii.1979. The larval morphology and the banding patterns of the polytene chromosomes indicate a relationship to *C. oppositus*. The larval head capsule and the polytene chromosomes are mounted on separate slides.

***Chironomus* species (bathophilus type)**

Adult not known.

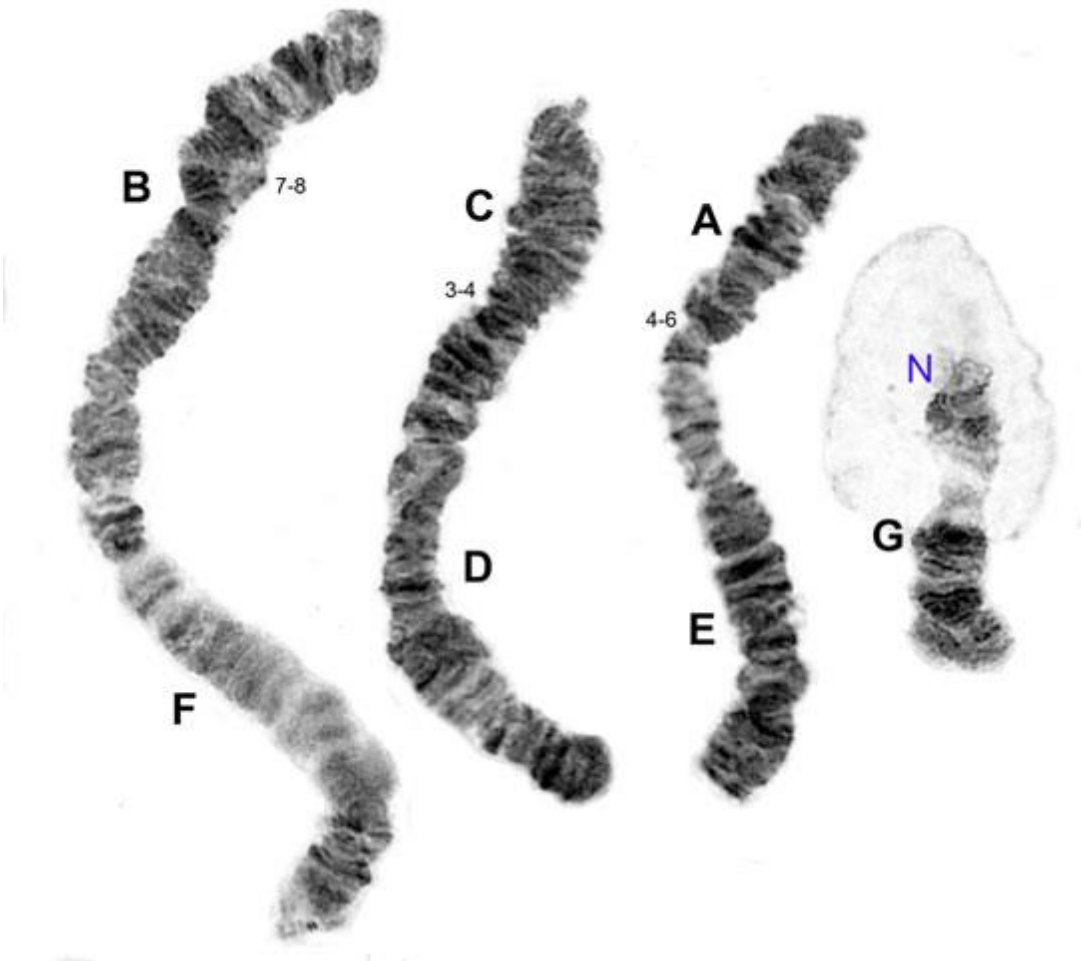
Pupa: A male pupal exuvia collected with the larvae, may belong to this species:
Abdominal tergites with dark shagreen on segments I-VI (appears largely towards edges), but much paler (only narrow bands) on more posterior segments. Pedes spurii B large on segment II, small on segment III; pedes spurii A large on segment IV, just patches of spinules on segments V and VI.

Length 7.9 mm; Cephalic tubercles: 72 x 43 µm, subterminal seta about 38 µm. About 85 hooks in the hook row at posterior of segment II.
Three spines on postero-lateral spur of segment VIII; about 69 taeniae on each side of anal lobe, in a double row at posterior end.

Larva: Medium size bathophilus-type larva. VT of moderate length. Head capsule with pale gula and FC.
Mentum with 4th lateral slightly reduced, almost to the level of the 5th lateral (type I or II), c2 teeth partially separated from c1 (type IIA or worn III).
Ventromentum with about 36 - 37 striae, VMR about 0.26; distance between inner margins only about 0.30 of mentum width. PE with about 17 relatively blunt teeth.
Prm with outer tooth slightly longer, inner tooth at least 2.5x wider.
Basal segment of antenna about 4.2 times longer than wide, RO about 2/5 up from base of the segment; AR about 1.94; A2/A1 about 0.34; A4/A3 about 1.1; proportions of antennal segments (micron) 123 : 35 : 10 : 11 : 6 .
Mandible with third inner tooth moderately darkened and partially separated (type IIB), about 11-12 grooves on outer surface near base, about 11 bristles in PMa.

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G with a subterminal nucleolus. Cytology of available specimens relatively poor.

spb A1: Olive about 1/3 from centromere
spb B1: Puff with proximal dark bands (groups 7-8) about a third from distal end
spb C1: Groups 3-4 about the middle of the arm
spb D1:
spb E1:
spb F1:
spb G1: Relatively short, nucleolus virtually terminal, small BR sometimes visible towards the other end



Very similar to the larva of *C*. 'queenslandicus' but differing in the absence of PLT and a slightly higher AR and lower ratio of A4/A3.

Found:

Queensland - North Stradbroke Island.

***Chironomus* species NI 1**

Adult:

Male:

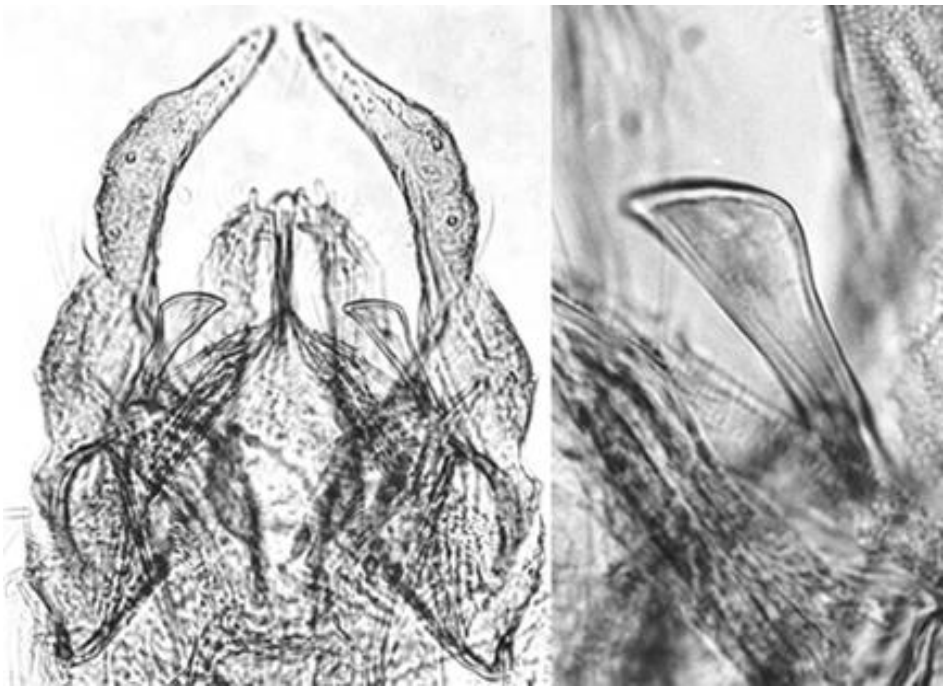
Wing length 3.52 mm, width 0.88 mm, VR 1.10. AR 3.0, LR 1.54.

Frontal tubercles present, length about 29 µm. Setae on clypeus – 16. Palpal segments 2-5 (micron): 46 : 278 : 267 : 418.

Thoracic setae: Acrostichal –at least 12; Dorsolateral – 12 & 13; Prelar – 4; Scutellar in 2 rows, anterior – 6; posterior 10.

Legs: Fore tarsi without beard. Segment lenghts (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1420	1320	2030	1100	1020
PII	1460	1360	880	460	340
PIII	1640	1680	1300	700	540
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	900	420	1.54	1.08	2.23
PII	200	140	0.65	1.07	-
PIII	330	180	0.77	0.98	-



Male terminalia of *Chironomus* sp. NI 1

About 12 setae near centre of 9th tergite.

Superior volsella between Strenzke's S- and D-types, as in many specimens of *C. samoensis.*

Female, pupa, and larva not known.

Found: Norfolk Island - Bridle Track (72-806).

Known only from a single male adult, 72-806 male 1. The hypopyium, particularly the superior volsella, suggests that it may be related to *Chironomus samoensis,* and the AR, LR, etc., are similar to those of that species.

This specimen is in the Australian National Insect Collection

A female and some larvae were also collected, but their association to the males is not certain:

Female: (72-806 Female 1)

Wing length about 3.35 mm; wing width 0.92 mm; VR 1.10. Scf on brachiolum 2.

Head: Frontal tubercles present, about 26 µm in length. Antennal proportions (µm): 186 : 139 : 151 : 145 : 186; AR 0.30; A5/A1 1.0. Palpal proportions segments 2-5 (µm): 58 : 232 : 278 : 429. 26 clypeal setae.

Thoracic setae: Acrostichal 16; Dorsolaterals 16 - 19; Prealars 4 - 5; setae of Scutellum in approximately two rows, about 6 in anterior row, about 11 in posterior row.

Leg lengths (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1420	1260	2080	1100	1040
PII	1460	1380	880	460	320
PIII	1600	1660	1200	670	530
	Ta4	**Ta5**	**LR**	**F/T**	**Ta4/Ti**
PI	1070	480	1.65	1.13	0.85
PII	200	140	0.64	1.06	-
PIII	320	170	0.72	0.96	-

BR about 0.91

Larvae:

The cytology of Norfolk Island specimens appeared to be similar to that of *C. 'februarius'*, although the banding patterns of some arms (B, C and D) were not all that clear. The puff (group 7) of arm B does not appear to be developed.

On the other hand, the sequence of mt*COI* appears relatively different (abt. 11% difference). This suggests it has been isolated for a long time. Further material, including other life stages, is needed to clarify the situation.

A medium sized (len. 12.2–14.2 mm) plumosus-type; VT well developed, posterior pair longer (Ant. 1.20–1.48; Post. 1.32–1.92 mm). PLT moderately developed (120–280 µm). Anal tubules with dorsal pair usually longer than ventral pair (dors. 270-360, vent. 230-320 µm) and about 2.6-3.4 times longer than wide.

Gular region pale or very slightly darkened, FC pale or with slight darkening of FC and surrounding area. Mentum of type II, and c2 teeth well separated from c1 tooth (i.e. type IV). Ventromentum with about 41 striae. PE with about 12 teeth.

Basal segment of antenna relatively long and narrow, about 3.7 times as long as wide; A2/A1 about 0.18-3.50.21; A3 shorter than A4, and about same length as A5.

Mandible of type IIB, with about 17 grooves on the outer surface near the base.

Chironomus species NI 2

Adult:

A reared male, with associated pupal exuviae (72-824 reared male 1), is known.

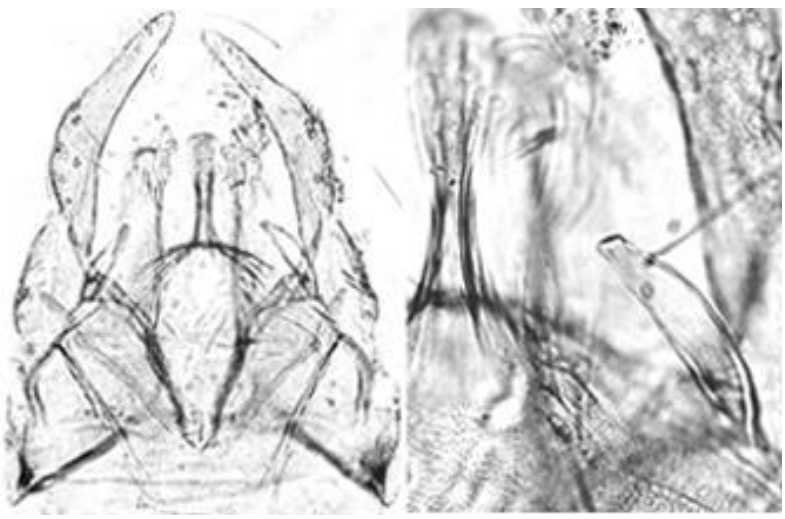
Wing length 3.44 mm, width 0.82 mm, VR 1.06. AR not known. LR 1.74.

Frontal tubercles present, length about 15 µm. Setae on clypeus – 25. Palpal segments 2-5 (micron): 58 : - : 278 : 452.

Thoracic setae: Acrostichal – at least 12; Dorsolateral – 7 & 9, Prealar – 4; Scutellar in two rows, anterior – 4, posterior – 12.

Legs: Fore tarsi without beard. Segment lengths (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1580	1240	2160	-	-
PII	1580	-	-	-	-
PIII	1760	1760	-	-	-
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	-	-	1.74	1.27	2.5
PII	-	-	-	-	
PIII	-	-	-	1.00	

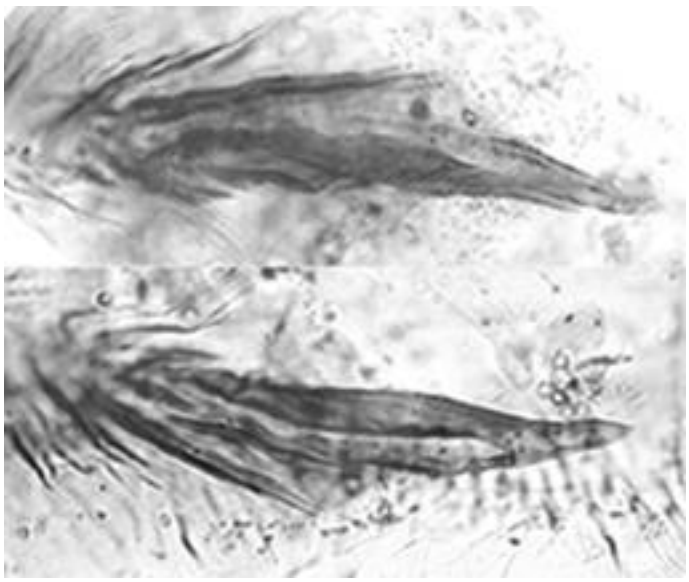


Male terminalia of *C.*species NI 2 (left) and superior volsella (right).

Hypopygium with relatively narrow anal point, 17 setae near centre of 9th tergite.
Superior volsella essentially of the D-type of Strenzke, closest to his figure f, but with end squared off. IVo setae may not be forked.

Female: Not known

Pupa: The caudolateral spur of segment VIII has 1 - 3 spines, but appears to have a broadened base. No other information available.



Pupal spurs of *C.*species NI 2. Note the lateral broadening near base of spines.

Larva: No larvae definitely associated with this species are known.

Found: Norfolk Island - Bridle Track.
This reared male is in the Australian National Insect Collection.

Chironomus tepperi Skuse, 1889

Adult

CHIRONOMUS (CHIRONOMUS) TEPPERI Skuse

Chironomus tepperi Skuse, 1889, p. 244. Kieffer, 1906, p. 22.

Medium-sized dark species with dull grey pruinosity; antennae short, A.R. about 2, pits of dorsocentral bristles dark and distinct; legs short, posterior basitarsus less than half as long as tibia, male hypopygium with appendage 2 greatly enlarged and styles short and oval.

This is a distinctive species with an unusual male hypopygium, probably most closely related to species of the subgenus *Camptochironomus*. On account of the presence of appendage 1 and absence of lateral lobes on 9th tergite, together with reduction of styles, I prefer to leave it in a rather indefinite position in the typical subgenus.

Wing length.—2·8–4·0 mm.

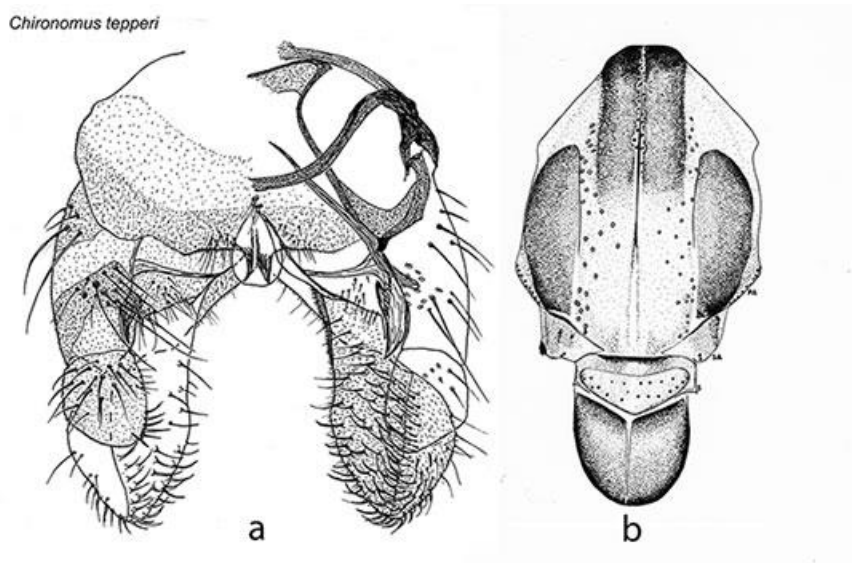
Male.—*Head*, mouthparts, and antennae yellowish brown or grey; palpi well developed, frontal tubercles small, antennal plumes whitish, antennae rather short, A.R. about 2. *Thorax* dark and thickly clothed with dull grey pruinosity through which stripes and other dark areas can be seen; scutellum pale; dorsocentral hairs irregularly biserial, yellow but arising from distinct dark pits. *Legs* yellow, darkened at knees, widely so on front pair, and at tips of tibiae and of tarsal segments; anterior tarsi not bearded, L.R. about 1·75; posterior tarsi shorter and thicker than usual, basitarsus less than half as long as tibia, whole tarsus often hardly longer than tibia. *Wings* with normal venation, crossvein slightly darkened. *Abdomen* dark and pruinose, each segment paler apically. Hypopygium (Fig. 19, *c*) highly characteristic; anal point deep in lateral aspect, laterally flanged as in *Camptochironomus tentans* F. (Palaearctic region); appendage 1 straight and pointed, appendage 2 greatly enlarged, rounded in lateral aspect, densely hairy on inner surface; styles short and oval, small in comparison with appendage 2.

Female.—Resembles male but is usually darker.

Types.—The type series consists of two much damaged females in the South Australian Museum (not seen by author). It seems clear from the description that this is the species Skuse had before him. Type localities Mt. Lofty and Adelaide, S. Aust.

Redescription of *C. tepperi* adults

From Freeman 1961



a. Male hypopygium of *C. tepperi* (Martin, unpubl.); b. thorax showing setae (Porter 1974)

Male (additional data):

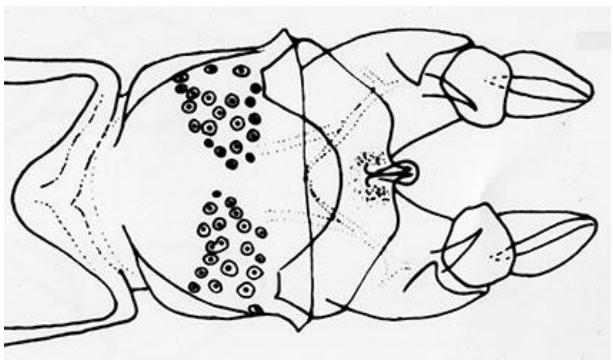
Wing length up to 5.0 mm, width abt 1.14 mm., VR abt 1.13, abt 15-20 setae in squamal fringe.

Head: Frontal tubercles about 11 µm long and 11 µm across base. Palp segments (µm): 65 : 80 : 233 : 256 : 290. Clypeal setae very variable – 18-42.

Thoracic setae very variable: Acrostichal - abt 11-12; Dorsolateral - abt 28-31; Prealar - 9-17; Supra-alar abt 2; Scutellar 10-28.

Legs, quite short, relative proportions (micron):

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1920	1480	2320	1160	1000
PII	1680	1760	760	440	360
PIII	2140	2100	930	600	445
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	880	390	1.57-1.75	1.30	1.5
PII	190	138	0.43	0.95	-
PIII	273	173	0.44	1.02	-



Patches of setae on tergite VIII

(from D.L. Porter, Ph.D. thesis 1974)

Abdomen: Two large patches of setae on tergite VIII, but none on tergite IX. SVof the D(f)-type of Strenzke (1959). Setae of IVo simple.

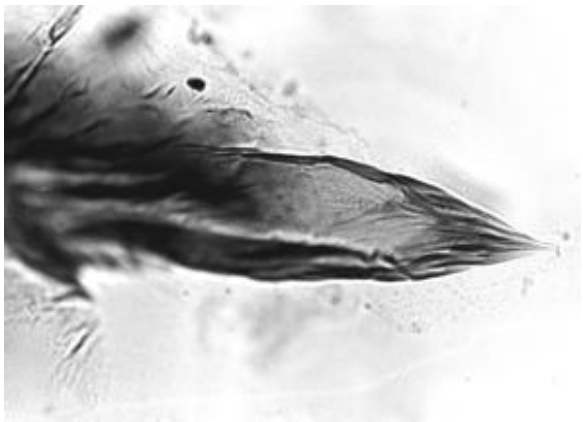
Female:

Head: Clypeal setae very variable – 10-51

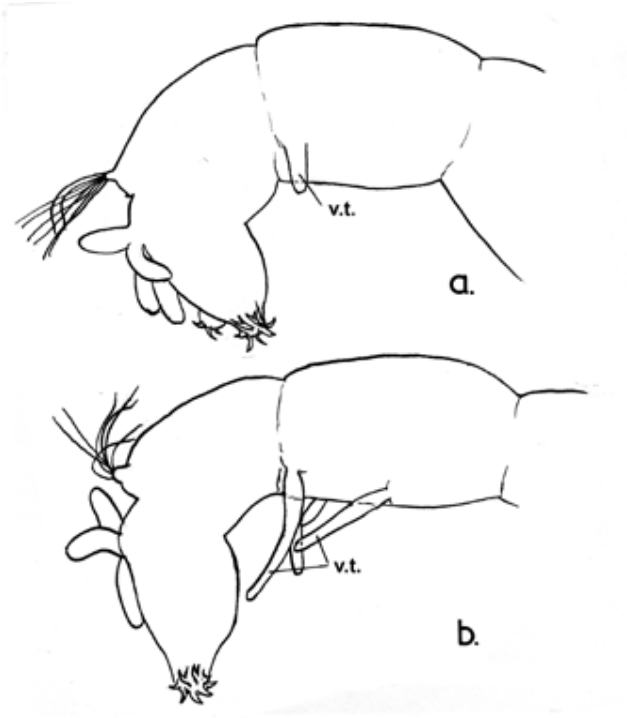
Thoracic setae very variable: Prealar -9-21; Scutellar 18-36.

Pupa: Exuviae pale, length about 8.9 mm (6.6 - 9.3 in females, 6.7 - 10.6 in males). Cephalic tubercles 65 - 70 µm long, width at base 40 - 58 µm, subapical seta about 50 µm.
Large pedes spurii B on segment II, that on segment III a relatively large patch of spines. Large pedes spurii A on segment IV, with smaller patches of spines on segments V and VI.
About 60 - 77 recurved hooks on segment 2; about 78 - 120 taeniae along the edge of the swim fin, mean number higher in females (abt 103 cf. 93 in males).

Caudolateral spur with about 6 spines (3 – 8), closely applied.



Larva: a medium sized (9.8 – 14.8 mm) halophilus/bathophilus, variable; VT sometimes moderately developed (bathophilus) (ant. 0.33 – 0.83 mm; post 0.67 – 1.17 mm), but sometimes only posterior pair present (halophilus) (see below). posterior pair longer. Gular region pale, FC usually not darkened, but occasional very slight darkening. Hind prolegs reduced quite suddenly near the tips (see below).



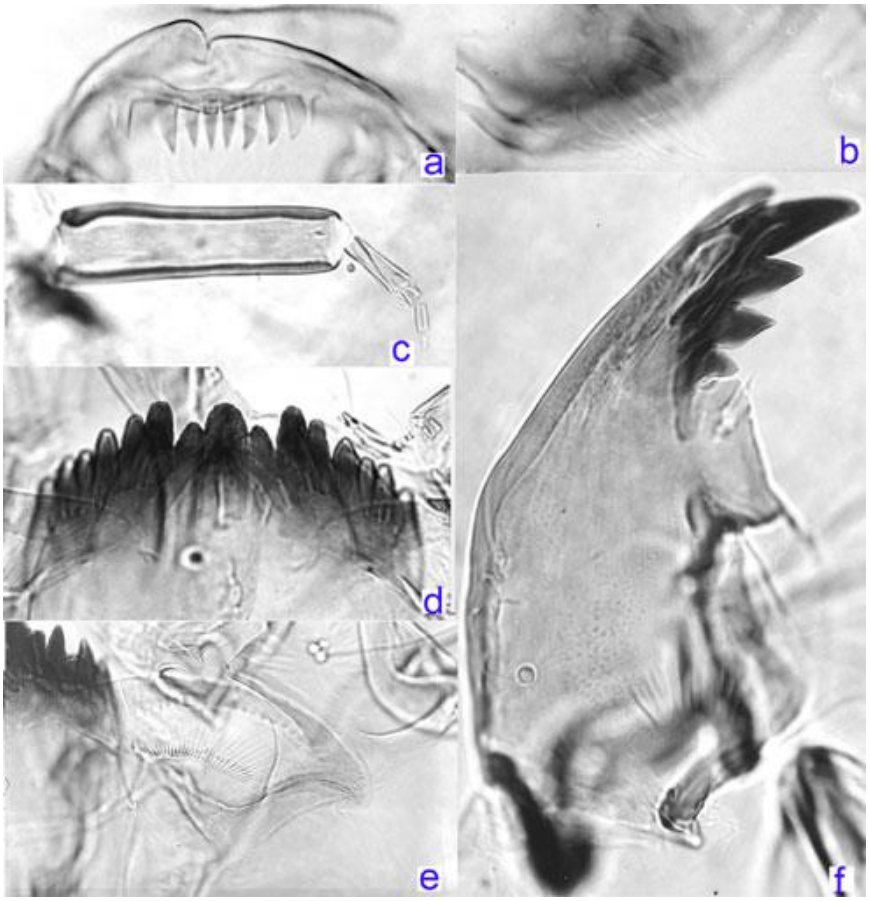
Mentum (Fig. d, below) with 4th lateral reduced slightly, sometimes to about the level of the 5th lateral (type I-II), and c2 teeth notches on the c1 tooth (type I, sometimes tending towards type IV).

Ventromental plates (Fig. c, below) well separated (76-96 µm) by about 44 - 46% of mentum width, with about 26-32 striae. PE (Fig. a, below) with about 12-17 teeth.

Prm (Fig. b, below) with inner tooth about 1.75-2x wider than outer tooth.

Basal segment of antenna (Fig. c, below) relatively long and narrow, about 3.7 - 5 times longer than wide; RO about one third from base of A1; AR about 2.59 (2.43 - 2.74); A2/A1 about 0.21 (0.20-0.21); antennal proportions (µm) 137 : 28 : 8 : 10 : 7 .

Mandible (Fig. f, below) with third inner tooth completely formed (type III), with about 12-16 furrows on outer surface near the base.



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

Arm G polymorphic for a subterminal nucleolus, although it is not certain whether it is polymorphic for the NOR (i.e. whether the nucleolus is absent because there is no NOR, or whether the NOR is simply inactive), also with 2 BRs. Nucleolus in arm F, with NOR at about group 19. No inversion polymorphism known. Irradiation experiments have revealed that the male sex determiner is located in the proximal region of arm A, between 3f and 19e (Martin, 1981).

tepA1: 1a-e, 11 - 10, 2c - 1f, 3e - 2d, 8 - 9, 3f-i, 12c-a, 4 - 7, 13 - 19 as oppA4

tepB1: Bulb and distal dark bands (groups 7 & 8) about 1/4 from end of arm. as oppB2

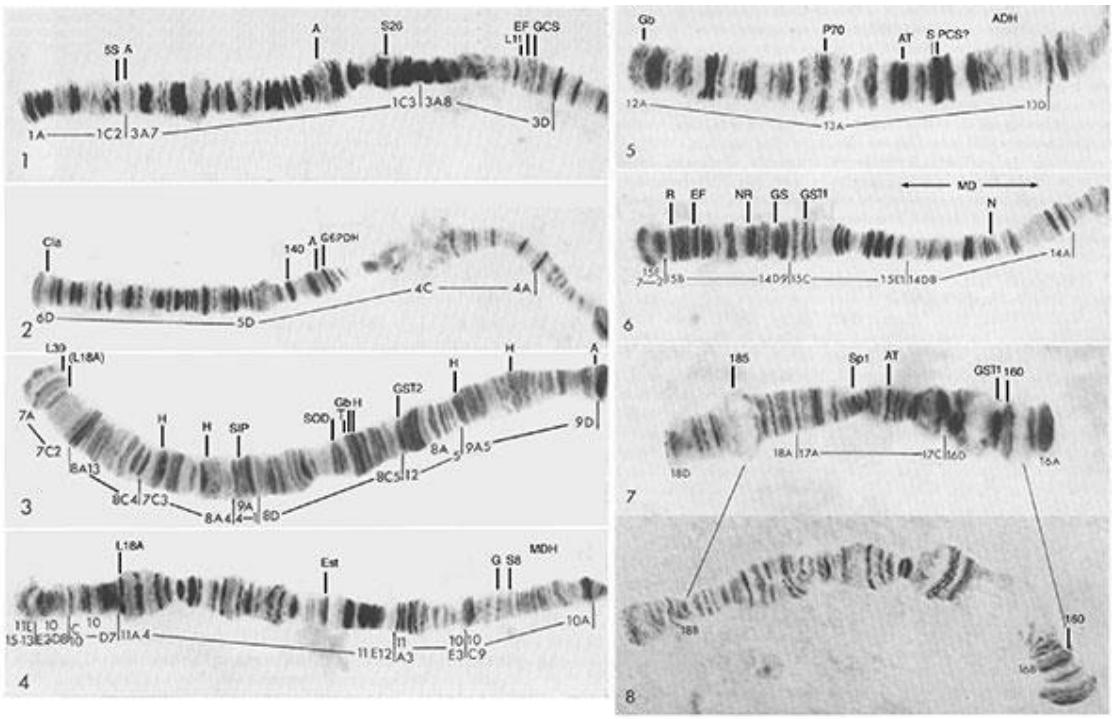
tepC1: Characteristic band groups 3-4, with 5 distal, near distal end as psoC1

tepD1: 1-2f, 9b-e, 3d-a, 10d-12, 18g-a, 2g-i, 16-14h, 19c-a, 8-3e, 10a-c, 17a-f, 9a, 13-14g, 19d-24

tepE1: 1 - 3e, 10b - 3f, 10c - 13 as oppE1, etc.

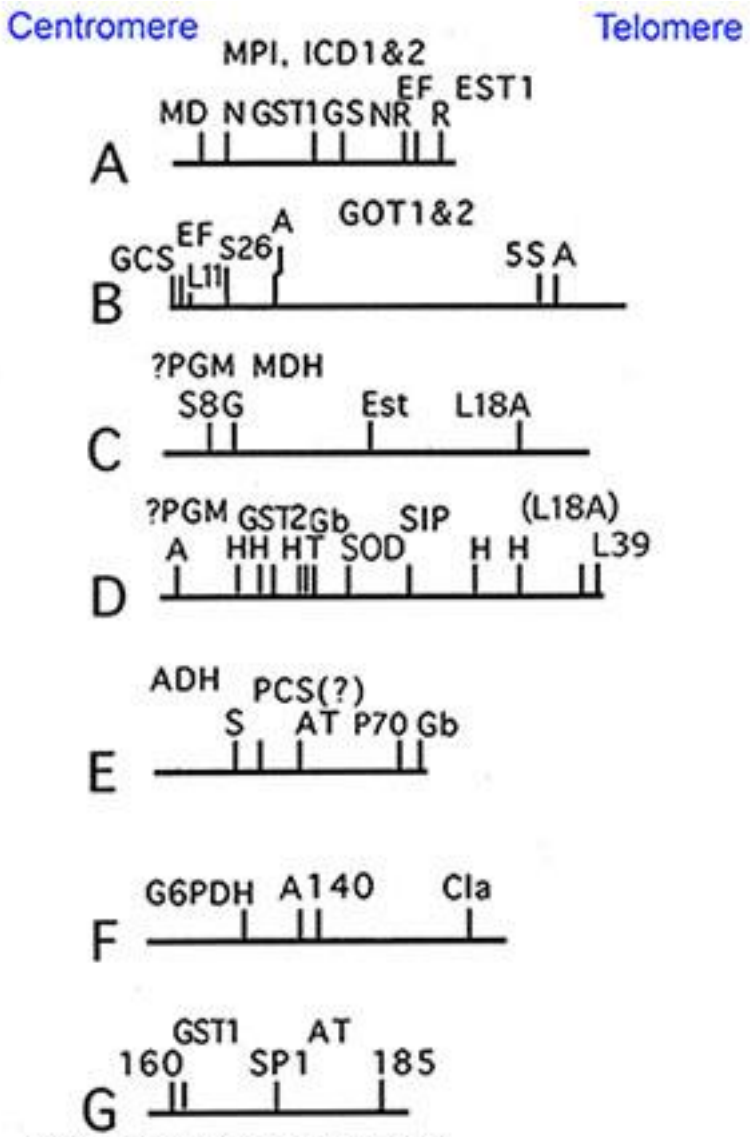
tepF1: 1 - 2a, 10 - 2b, 11 – 19(NOR) – 23 as oppF1, etc.

tepG1: NOR near centromere end, BR near NOR and another towards distal end.

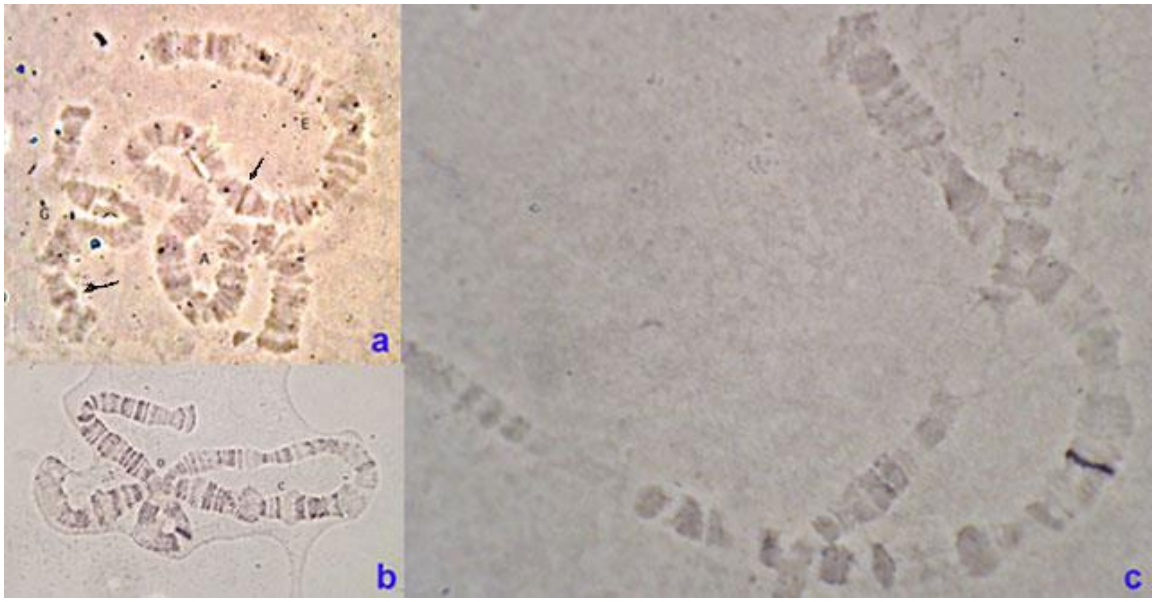


The 4 polytene chromosomes of Chironomus tepperi: BF (1 & 2); DC (3 & 4); EA (5 & 6); and G (7 & 8 showing differential development of nucleolus and BRs).
Sp1, 140, 160, 185 - silk protein genes; 5S - 5sRNA; A - Actin; ADH - Alcohol dehydrogenase; AT - alpha Tubulin; Cla - unique region amongst Cla elements. EF - Elongation factor 1alpha; Est - Esterase; G - Gart; Gb - Globins; GCS - Glutamyl-cysteine synthase; GS - Glutathione synthase; H - Histones; MD - male determiner; N - Nanos; NR - NADH-ubiquitinone reductase; P70 - heat shock protein 70; PCS - Phytochelatin synthase; R - Retinal generation gene; S - Shibire; SIP - Sex influenced protein; T - Trp-like.

In-situ hybridization has been used to produce preliminary physical maps for the genome. The sites of hybridization are shown above the chromosomes (above), and as a physical map (below).



Genetic map of the 7 arms of C. tepperi.
Sp1, 140, 160, 185 - silk protein genes; 5S - SsRNA; A - Actin, ADH - Alcohol dehydrogense; AT - alpha-Tubulin; Cla - region of 'Cla' element; EF - Elongation factor 1 alpha; Est, Est1 - Esterases;G - Gart; Gb - Globins; GCS - Glutamyl-cysteine synthase; GOT - Glutamate oxaloacetate transaminase; GS - Glutathione synthase; H - Histones; ICD1&2 - Isocitrate dehydrogenases; MD - male determiner; MDH - Malatee dehydrogenase; MPI - Mannose phosphate isomerase; N - Nanos, NR - NADH-ubiquitinone reductase; P70 - Heat shock protein 70; PCS - Phytochelatin Synthase; PGM - Phosphoglucomutase; R - Retinal degeneration gene; S - Shibire; SIP - Sex influenced protein; T - Trp-like channel. L11, L18A, S8, S26 - Ribosomal proteins. GST1 & 2 - Glutathione synthase transferases 1 & 2.



Photographs showing the sites of hybridization of probes for the genes: a. GST-1 (2 sites, on arms A and G, arrowed); b. SOD on arm D; and c. HSP-70 on arm E.

The salivary gland chromosomes were described by Martin (1974); the nucleoli and location of C-bands by Lentzios & Stocker (1979) and Lentzios *et al*. (1980). Kalisch (1981); Kalisch & Hä;gele (1981, 1982) and Schmitz (1982) produced photographic maps of the polytene chromosomes based on surface-spread chromosomes.

Molecular data

Mt*COI*: There are a number of sequences in GenBank, incl. AF192211, KC750328-36.

Found:

Australian Capitol Territory - Black Mountain, Canberra (both Freeman, 1961); Lake Burley Griffen.

New South Wales - Belaringa, Griffith, Hornsby, Lake Illawarra, Nyngan, Sydney, Trangie, Yass (all Freeman, 1961); Arrawarra (30.06oS, 153.19oE); Corowa (36.08oS; 146.39oE); Forbes (33.38oS, 148.01oE); Marom Creek (28.88oS, 153.37oE); Boggy Swamp Creek, abt 20 Km n. Putty; nr Rutheford Creek, about 35 Km ne. White Cliffs; 7 Km e. Wyalong; West Wyalong; Yanco (34.60oS, 146.42oE).

Northern Territory - Nourlangie Rock Road, Kakadu N.P.; Ross River, East Macdonell Ranges.

Queensland - Burpengary, Eidsvold, Innisfail (21.13oS, 149.18oE), Townsville, Watten (all Freeman, 1961); Somerset Dam; Woodridge.

South Australia – Mt Lofty (34.97oS, 138.70oE) & Adelaide (34.56oS, 138.30oE) (Type localities), Didicoolum, Mt. Eyre (all Freeman, 1961); Lock (33.57oS, 135.76oE), Paringa (34.16oS, 140.78oE), Renmark (34.17oS, 140.73oE), Victor Harbour (38.35oS, 138.37oE).

Tasmania - Bellerive(42.83oS, 147.33oE).

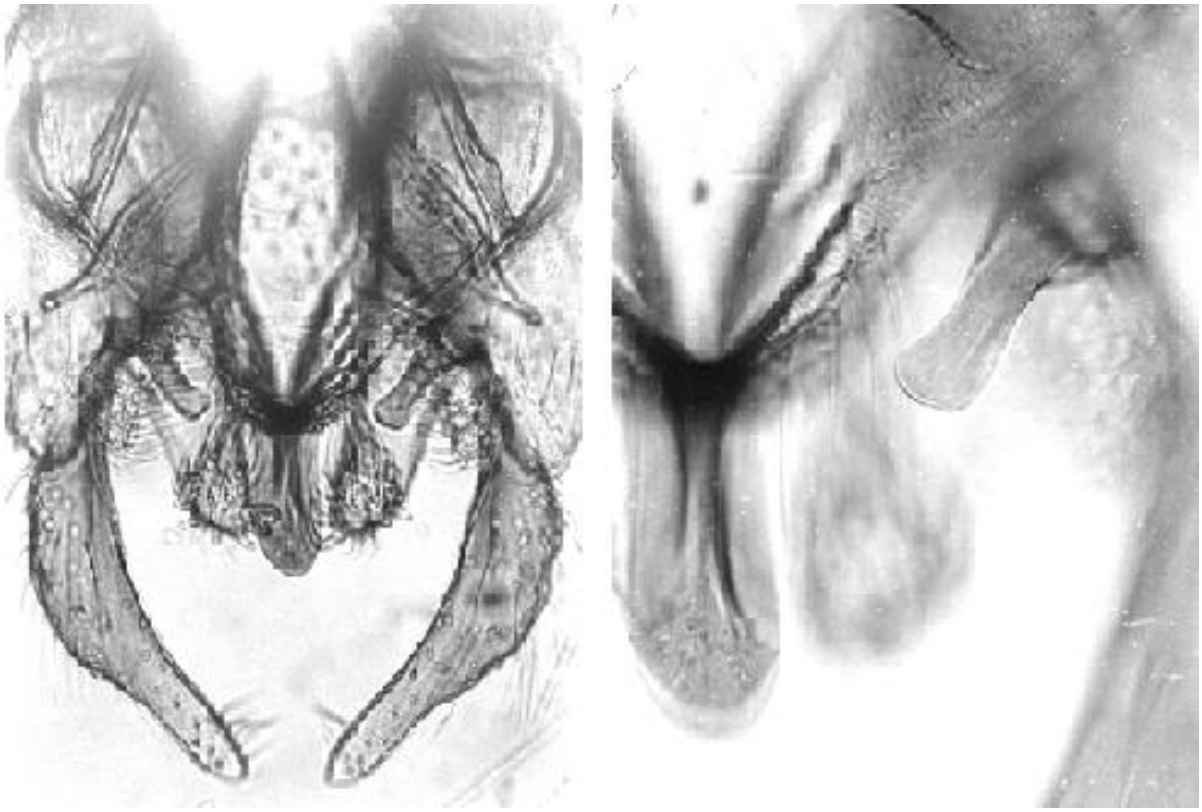
Victoria - Chiltern, Melbourne, Pianglo, Sandringham, Sealake (all Freeman, 1961); Albert Park; Box Hill North; Carrum; Alistair Knox Park, Eltham (Carew *et al*. 2013); Woodland Park, Essendon (Carew *et al*. 2013); Harrow; Lynbrook (Carew *et al*. 2013); Mapley Farm (Carew *et al*. 2013); Mt. Waverley; Albert Park Lake, South Melbourne; Parkville; Taylors Lakes (Carew *et al*. 2013); 7 Km s. Wangaratta; Melbourne Water Metropolitan Farm, Werribee; Woohlpooer.

Western Australia - Esperance, Lake Grace, Leederville, Millstream Station, and Perth (all Freeman, 1961); Kalgoorlie.

***Chironomus* 'timmsi'** (Manuscript name).

A blackish species.

Male:



Face dark green, base of antenna black, antennae blackish brown. AR = 3.08 - 3.63. Frontal tubercles present, length about 20 microns. Palpal proportions (segs. 2-5, micron): 70 : 245 : 253 : 345. Clypeal setae - 37-46.

Thorax greenish black, with black stripes, postnotum and sternopleuron. Setae – 19-22 Dorsocentral, Prealar – 8, Scutellar in two rows 15-23 ant, 14-16 post.

Wing length about 4.26- 4.5 mm, width about 0.91-0.92. 4-7 SCf on branchiolum.

Legs brown, darkened at knees, last tarsal segments black. Anterior basitarsus bearded. Ant LR = 1.35.

Leg proportions (microns):

Male	**Fe**	**Ti**	**Ta1**	**Ta2**	**Ta3**	**Ta4**	**Ta5**	**LR**	**F/T**	**BR**
PI	1475	1385	1920	1065	820	870	405	1.36-1.41	1.06-1.07	3.8-4.9
PII	1575	1525	930	550	420	270	205	0.59-0.63	1.01-1.05	-
PIII	1845	1915	1335	805	785	395	245	0.70	0.96-0.97	-

Male terminalia distinctive due to essentially spatula-like SVo, unlike any of the Strenzke types, perhaps closest to his S-type. IVo with unforked setae. About 13-14 setae near centre of tergite IX. Gonostylus tapers over posterior third.

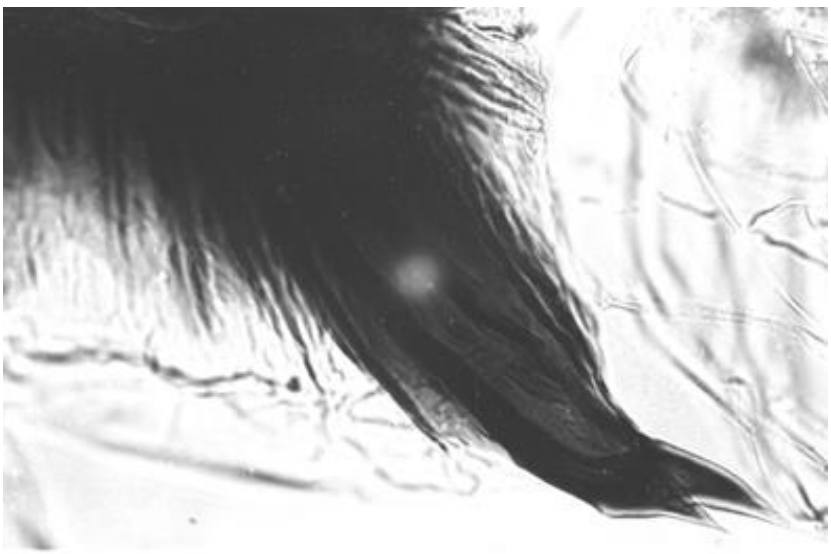
Female:

Pupa: Exuviae relatively pale, brownish; length about 10.6 mm (female), 10.3 mm (male); length of inner margin of wing case 2.1 mm (female), 2.2 mm (male).

Many characters are summarised in the Table below, with additional information here:

Cephalic tubercles about twice as long as wide. Respiratory base about 142-164 µm long, with the tracheal patch markedly narrowing in the centre. Anterior to the base there is a patch containing 2 or 3 loops and 2-3 setae.

Hook row on posterior margin of tergite II occupying about 55-60% of the segment width Pedes spurii B well developed laterally on segment II, smaller on segment III; pedes spurii A well developed on segment IV, but small and distinct on V and VI. L-setae present at the junction of segments III/IV and IV/V, arising from the posterior margin of the anterior segment, the setae are difficult to measure but generally seem to be about 100 µm long, possibly longer at the IV/V junction.



Caudolateral spur of tergite VIII with one or two spines.

	Females (1)		Males (4)	
	Mean	Range	Mean	Range
Length (mm)	10.6	10.6	10.25	10.0 – 10.7
Inner margin wing case (mm)	2.09	2.09	2.18	2.15 – 2.20
Cephalic tubercles (µm)	60	58 - 61	72.8	63 - 86
Cephalic bristles (µm)	55.5	53 - 58	55.8	50 - 60
HR	2.3	2.2 - 2.5	2.6	2.0 - 3.0

Hooks on abd. segment II	89	89	97	90 - 106
Len. Ped.sp.A of seg.IV (µm)	220	218 - 220	218	185 - 240
Swim fin taeniae (one side)	123	123	115	107 - 121

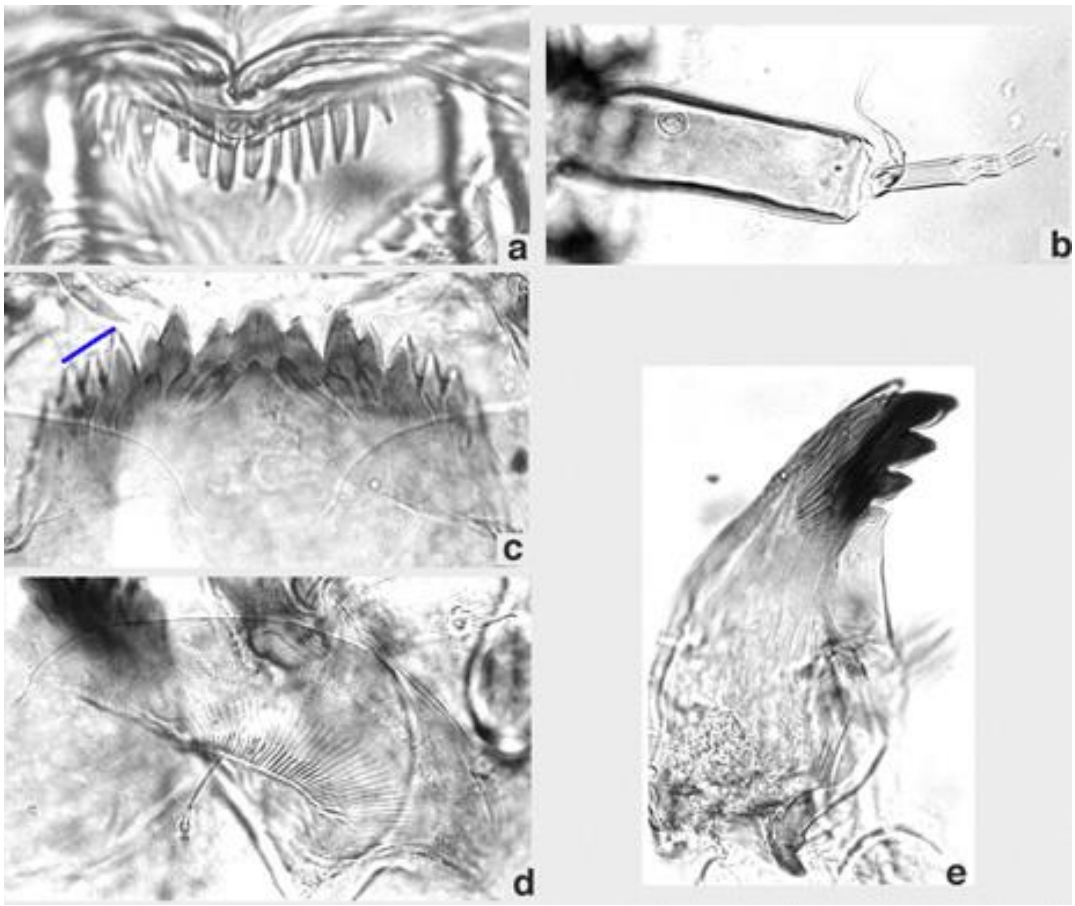
Larva: a medium sized bathophilus-type (abt 18.19 mm); VT well developed, anterior pair longer (0,94 to 0.88 mm).; Gula and FC pale. AT about 400 µm long and about 3 times longer than wide. Mentum (c, below) with fourth laterals slightly reduced (type I-II); c2 teeth of centre trifid tooth well separated (type IIA). PE (a, below) with about 15 (11 – 18) sharp pointed teeth. Ventromental plates (d, below) separated by about one third of the mentum width, each with about 35 - 45 striae, VMR about 0.3-0.33.

Prm with teeth about equal length, inner tooth about 2.1-2.75x wider than outer tooth.

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

Antenna (b, below) relatively short, RO about 0.35 – 0.46 up from base of A1, which is about 3 - 3.6 times as long as wide; AR about 2.28 (2.15-2.45); A2/A1 about 0.25 (0.22-0.27); antennal proportions (microns) 146 : 36 : 9 : 13 : 7.

Mandible (e, below) with third inner tooth only slightly darkened and not completely separated (type IIB), about 13 - 17 furrows on the outer surface near the base; aabout 13 (10-15) bristles in PMa.



Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Centromeres somewhat heterochromatic and vacuolated on the AE and CD chromosomes. These vacuolated centromeres sometimes form loose connections with those of other chromosomes through diffused heterochromatin (see bottom left of chromosome figure). Banding patterns of arms B, C, and D quite difficult to recognize.

Arm G paired, with an essentially terminal nucleolus with a heterochromatic cap, probably with a BR close by, and a BR just before the middle of the arm.

No polymorphism in the two specimens available.

timA1: 1a-e, 9 - 8, 2d - 3e, 1f - 2c, 10 - 11, 3f-i, 12c-a, 4 - 7, 13 – 19

timB1: Puff with dark bands proximal (groups 7-8), about one third from distal end of the arm.

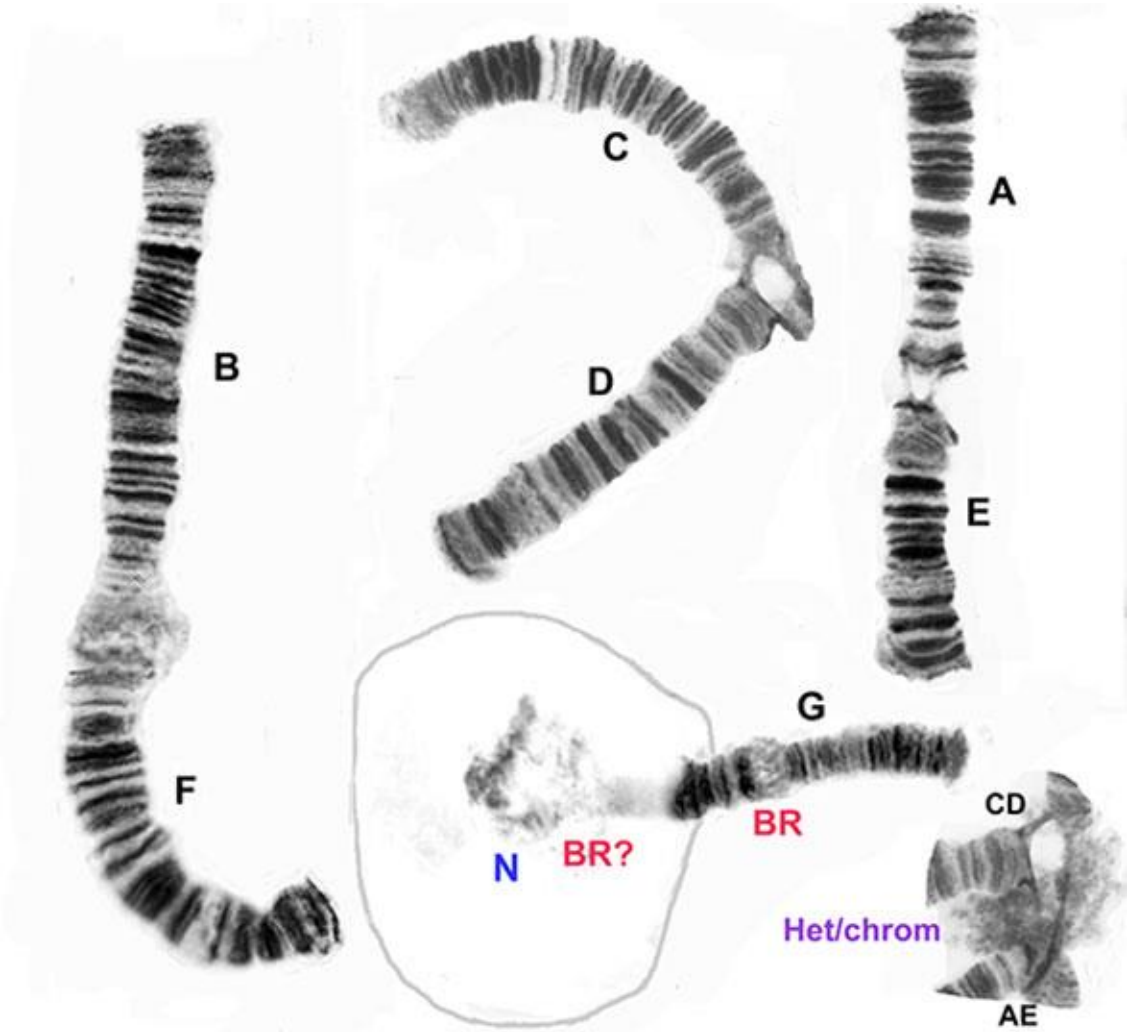
timC1: Characteristic bands (groups 3-4) about a third from distal end.

timD1:

timE1: 1 - 3e, 10b - 3f, 10c - 13 as *oppositus* E1

timF1: 1 - 2a, 10 - 6, 13c - 11, 2b - 5, 13d – 23

timG1: Essentially terminal nucleolus with just a heterochromatic cap., and a BR near middle of the arm.



Polytene chromosomes of *C*, 'timmsi'. Note the vacuolated centromeres of chromosomes CD and AE, which can form loose connections as seem at bottom left.

Types: Holotype male: Lake Edward (-37.63, 140.58), ASA.36.3, 30.viii.1973, (leg. Jon & C.J. Martin) reared adult with pupal and larval exuviae (m3), slide mounted. Allotype female: Lake Edward, ASA.36.5, 19.viii.1975 (leg. Jon Martin & W. Canning) reared adult with pupal and larval exuviae (f1), slide mounted. Paratypes: 1 reared male, 3 larvae, 1 with polytene chromosomes, all slide mounted, same data as Holotype male.

Holotype, allotype and paratypes will be lodged in the Australian National Insect Collection.

Found:

South Australia - Lake Edward, w. Kalangadoo (37.63oS,140.58oE).

Chironomus tyleri

formerly *Chironomus oppositus* f. *tyleri* Martin & Lee (1984)

The adults are very similar to those of *C. oppositus*, anterior tarsi without a strong beard.

In BOLD Bin: BOLD:AAF3284
(along with the other forms of *C. oppositus*, and *C.* 'jacksoni')

Males: Head, antennae and mouth parts brown. Frontal tubercles present, length about 14 - 28 micron.

AR about 2.9 - 3.2. Frontal tubercles about 40 - 48 µm.

Palp segments 2 - 5 (micron): 63 : 230 : 238 : 370.

Thorax generally greenish with brown stripes; thorax pruinose, postnotum and sternopleuron yellowish brown.

Setae: clypeal - 23-33; acrostichals - 18; dorsocentrals - 13-16; prealar - 6; scutellar - 10 in anterior row, 13-15 in posterior row.

Wings with anterior veins hardly darker than posterior, crossvein slightly darkened.

Wing length 4.3 - 4.4 mm; width 0.9 - 1.0 mm. VR: 0.99 - 1.04. SCf on branchiolum 3

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**
PI	1545	1405	2215	1110	920
PII	1660	1565	940	495	380
PIII	1895	1975	1405	775	615
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	760	335	1.53-1.66	1.08-1.19	1.78-1.91
PII	250	185	0.59-0.61	1.04-1.08	
PIII	375	225	0.71	0.95-0.97	

Abdomen generally greenish with narrow to broader saddle markings on the anterior segments, gradually extending in length from about tergum 5 to occupy most of the tergum by segment 8.

Male terminalia of *C.* 'tyleri' (above); SVo (below left); ramose bristles on IVo (below right).

Hypopygium similar to those of other members of the *C. oppositus* group; 6 setae medially on 9th tergum; Superior volsella of D-type, about as e of Strenzke (1959); setae near tip of inferior volsella ramose.

Females:

Antennal segments (micron): 215 : 135 : 146 : 128 : 215.

Cephalic tubercles present, about 20 - 50 µm.

Palp segments 2 - 5 (micron): 63 : 215 : 265 : 434.

Setae: clypeal - 25-35; acrostichals - 13-15+; dorsocentrals - 22-34; prealar - 6; scutellar - 6-10 in anterior row, 14-16 in posterior row.

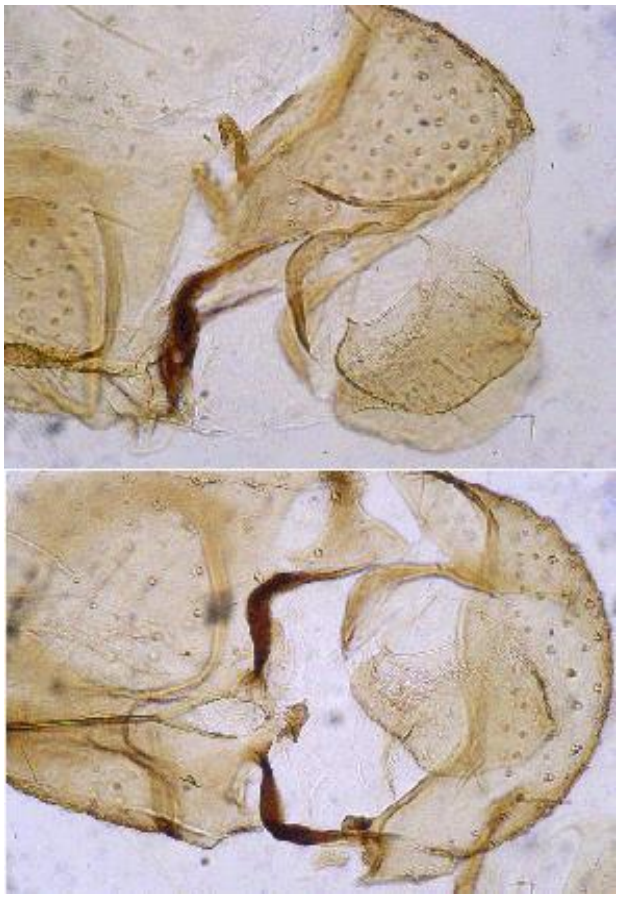
Wing length 4.0 - 4.6 mm; width 1.10 - 1.16 mm; VR: 1.02 - 1.09. 3-5 SCf on branchiolum.

Leg lengths (microns) and proportions as follows:

	Fe	**Ti**	**Ta1**	**Ta2**	**Ta3**

PI	1673	1393	2258	1062	897
PII	1737	1617	953	503	363
PIII	1902	2003	1410	757	598
	Ta4	**Ta5**	**LR**	**F/T**	**BR**
PI	803	347	1.56-1.69	1.19-1.22	1.13-1.75
PII	243	183	0.57-0.61	1.07-1.08	
PIII	362	217	0.69-0.71	0.93-0.96	

93 - 104 SCh on hind tibia.



Female terminalia of *C.* 'tyleri' - dorsal view (above); ventral view (below).

Genitalia: 6 setae on Gp VIII.

Larva: medium sized larvae (female 13.8 - 16.2; male 11.2 - 16.5 mm), generally of bathophilus-type, but showing some degree of development of the lateral projections (less than 200 µm). Anterior VT with an 'elbow bend', sometimes slightly longer than the slightly curved posterior pair, but in general about the same length (ant. 0.56 - 2.97; post. 0.58 - 2.97 mm).

Anal tubules about equal in length, from 230-480 µm long and generally 2-3.5 times longer than wide. Longer hooks of anterior parapods without hooks.
Gular region slightly darkened to dark over about posterior half, some degree of darkening of the FC.
Mentum with 4th laterals slightly reduced (type I-II), c2 teeth usually well developed, c1 relatively narrow (type (I)-III).
Ventromental plates separated by about a quarter to a third of the mentum width, with about 36-46 striae; VMR about 0.32-0.33. PE with about 11-17 teeth.
PrM with teeth about equal in length, inner tooth at least 1.5 (up to 2.3)times as wide as the outer tooth.
Basal segment of antenna about 3.0 - 3.7 times as long as wide, RO from about a quarter to half way up the segment; AR about 2.34 (2.04-2.69); A2/A1 about 0.18-0.25; .relative length of the segments (µm) 148 : 34 : 10 : 13 : 7.
Distance between the antennal bases greater than that between the S4 setae, which are just before the widest part of the FA.
Mandible 251-280 µm in length (tip to heel), with third inner tooth only partly separated and coloured (type IIB). About 12-17 furrows on outer surface near the base; about 13 bristles in PMa.

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Arm G with subterminal nucleolus, and generally unpaired at the distal end. Nucleolus in arm F with NOR at about group 19. Basic sequences similar to those seen in other members of the *C. oppositus*-group, but has some unique sequences polymorphic in some arms. Polymorphic in all arms; that in arm G often sex-linked. Rare sequences, particularly E2, probably resulting from hybridization with forms of *C. oppositus*.

tylA1:	1a-e, 7 - 4, 12a-c, 3i-f, 9 - 8, 11 - 10, 2c - 1f, 3e - 2d, 13 - 19		as oppA1
tylA2:	1a-e, 7 - 4, 12a-c, 3i-f, 9 - 8, 2d - 3e, 1f - 2c, 10 - 11, 13 - 19		as oppA2
tylB1:			as oppB1
tylB2:	less common		as oppB2
tylB3:	derived from B1 with distal break closer to end of arm than B2	rare	
tylC1:	Typical groups, 3-4, about one third from distal end.		as oppC1
tylC2:	Inversion of most of the arm, taking groups 3-4 to a proximal location	(occasional)	as oppC2

tylC3: A small distal inversion of C1, with one break in groups 3-4. as oppC3

tylD1: 1 - 2, 16 - 13, 9a-e, 3d-a, 10d - 12, 18 - 17,10c-a, 3e - 8, 19 - 24 (occasional) as oppD1

tylD2: 1 - 2, 16 - 14h, 19c-a, 8 - 3e, 10a-c, 17 - 18, 12 - 10d, 3a-d, 9e-a, 13 - 14g, 19d - 24
as oppD4

tylD3: 1 - 2, 18e - 17, 10c-a, 3e - 8, 19a-c, 14h - 16, 18fg, 12 - 10d, 3a-d, 9e-a, 13 - 14g, 19d - 24
(occasional) (was oppD5)

or 1 - 2f, 17f-a, 10c-a, 3e - 8, 19a-c, 14h - 16, 2i-g, 18a-g, 12 - 10d, 3a-d, 9e-a, 13 - 14g, 19d - 24
(ie. intermediate to tepD1)

tylE1: 1 - 3e, 10b - 3f, 10c - 13 as halophilus, oppE1,
etc.

tylE2: 1 - 2d, 7g - 10b, 3e -2e, 7f - 3f, 10c - 13 (occasional) as oppE2

tylF1: 1 - 2a, 10 - 2b, 11 – 19(NOR) - 23 as oppF1

tylF2: 1 - 2a, 10 - 6c, 15g-11, 2b - 6b, 15d - 23 as oppF2

tylG1: as oppG1

tylG2: (often sex-linked) as oppG2

Molecular Data:

mt*COI* - see BOLD and Martin (2011a). These sequences are shared with the forms of *C. oppositus*, presumably due to ongoing low levels of hybridization.

ITS-2 - see Martin (2011a)

Found:

New South Wales - Lake Eucumbene; Kiandra; Thredbo Village.

South Australia - Lake Edward and Lake Leake, via Kalangadoo.

Tasmania – Arthur River; Bellerive (42.87ºS, 147.37ºE); Blackmans Lagoon; Cambridge; Campbelltown; Lake Dulverton (42.28ºS, 147.35ºE); Little Swanport; Longford; 16 Km e. Marrawah (40.93ºS, 145ºE); 15 Km nw Queenstown; Strahan; Whites Lagoon, Tunbridge. Flinders Island – Babel Farm, Lackrana; Kronstadt Farm, Emita; Ranga: King Island – Mt. Stanley area; 3-tree Lagoon; Pearshape Lagoon.

Victoria - Anglesea; Botanical Gardens, Melbourne; Exhibition Gardens, Carlton; Footscray Park; Horden Vale; Manns Beach; Mitcham; Moggs Creek; Monteith Flat; Wallington, nr. Ocean Grove; Squeaky Beach and Derby River, Wilsons Promontory.

Types: Holotype male: Bellerive (49.87$_o$S, 147.37$_o$E), Tasmania, AT.9.12, from Egg mass #25 (coll. (M2).

Allotype female: Data as holotype male (F4).

Paratypes: Larva and associated polytene chromosomes (on separate slides), 1 km n. Arthur River, Tasmania (43.05$_o$S, 144.65$_o$E) AT.41.1, from egg mass #1, sl. 201F.

13 Males, 4 females, same data as holotype and allotype; 1 adult male Anglesea (38.38$_o$S, 144.18$_o$E), Victoria, AV.106.

Type material currently in collection of Jon Martin, but will eventually be distributed to the ANIC and other institutions.

Often found in slightly deeper, more permanent waters and in cooler areas (Kuvangkadilok 1982)

Einfeldia australiensis (Freeman 1961)

As *Xenochironomus australiensis*

According to Cranston (Cranston *et al*. 2016) the type series is mixed. The Holotype is *Einfeldia*, but two of the paratypes are an undescribed species of *Xenochironomus*.

Adult:

The adult male was redescribed by Cranston (Cranston *et al*. 2016), but the female is still unknown.

Male

Wing length about 2.75-3.5 mm, VR 1.07; AR about 2.7; LR_1 1.57-1.65; LR_2 0.46-0.48; LR_3 0.55-0.60. Fore tarsal beard sparse, BR 5.0.

Colour greenish; thorax yellow-brown with vittae scarcely darker; legs green, forelegs with darker tibia and tarsomeres, mid and hind legs with dark tarsomeres; abdomen light green becoming darker posteriorly. Freeman classed the thorax as green with yellowish-red thoracic vittae.

Frontal tubercles present (Freeman stated they were absent) globular, about 5-7 µm across.

Palpal proportions (segs. 2-5) 50-65 : 120-175 : 150-200 : 210-320. 15-18 clypeal setae.

Thorax with antepronotal lobes narrow dorsally and fused at shallow notch, slight indication of a scutal tubercle. Setae – 19-21 acrostichals in irregular biserial row, 6-11 dorsocentrals, 5-6 prealars, about 16 scutellars in two rows.

Dorsomedial setae of TIX in pair of clusters, about 11-20 in each cluster. Anal point thick and heavily downturned. Gonostylus slightly widened in midsection, tapering slightly at tip.

Pupa: (described by Cranston): Length about 7 mm, medium brown, with weak abdominal apophyses. Cephalic tubercle roughly conical, abt 70 µm long and with short (about 20 µm) pale seta.

Hook row on TII undivided, with 55-60 uniserial hooks, covering about 50% of segment width. No setae in conjunctives. Posterolateral spur of segment VIII with about 5-7 brownish, basally separated, tapering spines about 80-110 µm long. Anal lobe with dense, uniserial fringe of 70-80 taeniae, with single dorsal seta inserted quite anterolaterally. Pedes spurii A strongly developed on SIV, pedes spurii B well developed on II, absent on III.

Larva: Rather like a Kiefferulus larva in gross morphology. Length about 7-12.5 mm, no lateral tubules, one pair of ventral tubules about 1.08-1.16 mm in length; anal tubules about 260-360 µm long and about twice as long as wide.

Head capsule generally pale, but posterior third of the gula may be darkened. Dorsal surface with fused frontoclypeus, with large ovoid to heart shaped fenestra between the S4 setae.

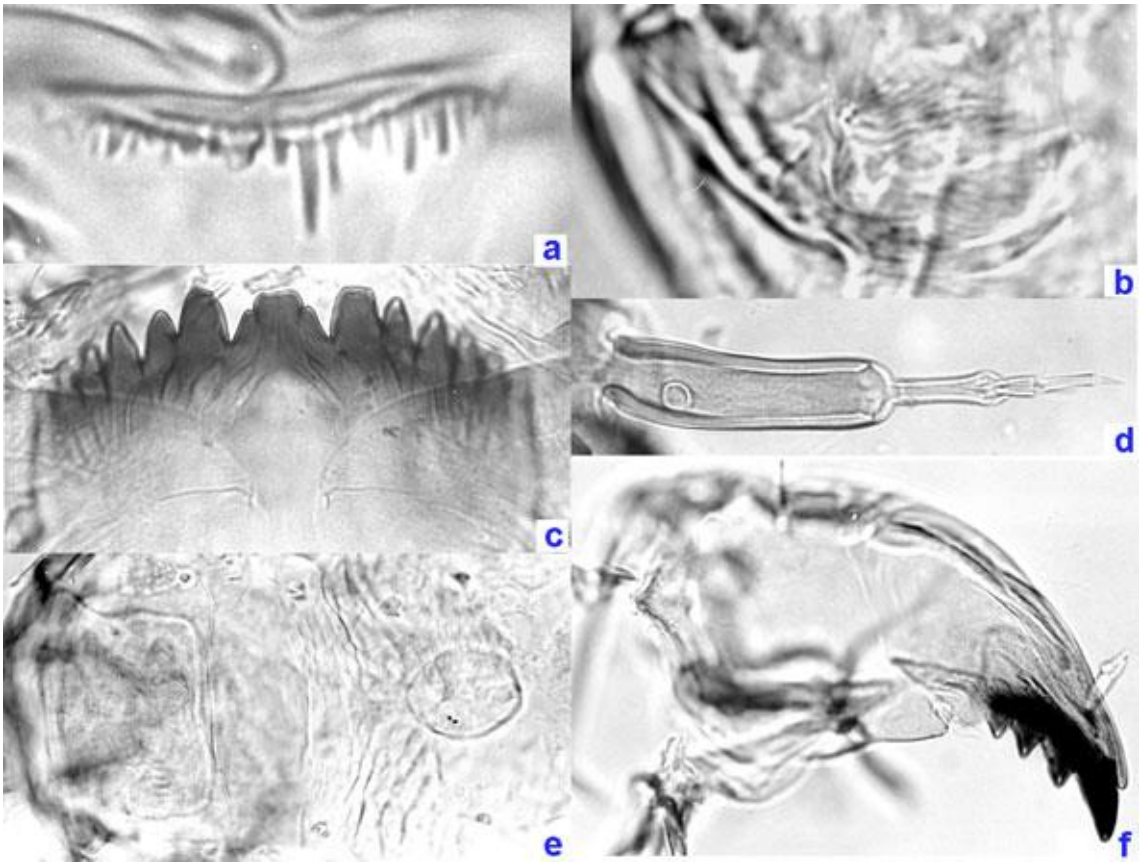
Mentum with 15 teeth, c1 tooth domed, c2 teeth variably visible depending on wear. Laterals decrease evenly (i.e. type I). Ventromental plates separated by about 13-15% of mentum width, with about 43-55 striae, which extend almost to margin, terminating in 1-2 spinules, VMR about 0.37-0.38.

PE with three scales (but see note under Molecular Data, below), each with about 4-8 variably shaped teeth.

Premandible with two teeth of approximately equal length, inner tooth about 2-2.4 times the width of the outer tooth.

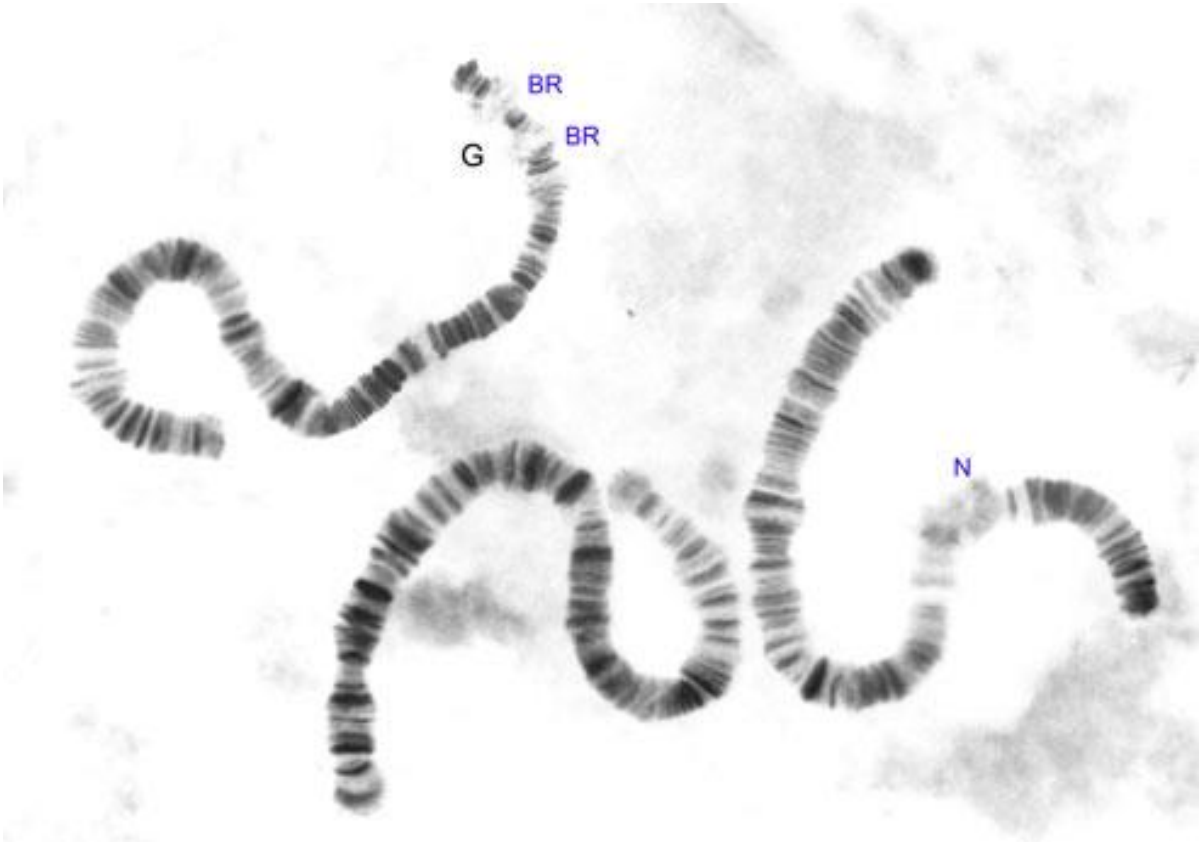
Antenna with basal segment about 3.6-5.0 times longer than wide, RO in basal third. Antennal proportions 88-93 : 25-28 : 12-15 : 12-15 : 7. AR 1.33-1.56.

Mandible with small accessory dorsal tooth outer tooth; no furrows near the base. Fourth inner tooth separated and darkened (type IIIC); PMa with about 12-13 bristles.



Cytology: 3 polytene chromosomes with little evidence of the Keyl arms. However the arm corresponding to arm G is fused to one arm, possibly arm E, of a previously metacentric chromosome (confirmed by presence of 4 polytene chromosomes in other *Einfeldia* species). The fused arm G has two BRs but no nucleolus. The nucleolus is developed near the middle of an arm of another chromosome. The two metacentric chromosomes have heterochromatic bands which probably represent the centromeres. Unfortunately the cytology of most specimens is unclear due to being too young or less than ideal original fixation, but one other larva lacked the second BR of the presumed arm G.

No polymorphism in the studied specimens.



Molecular Data:

mt*COI* – Sequence now available suggests that there may be two forms (species?) included under this name. The sequences are from larvae, with no associated adults. The larval head capsules are very similar, but there are a couple of possible differences – notably that Cranston (in Cranston *et al.* 2016) illustrates the PE comprising three scales, whereas in some larvae there is one, or perhaps two scales. Further data, particularly from adults, are needed to resolve the situation.

Found:

Australian Capital Territory – Lake McKenzie, Jervis Bay (35.06°S, 150.68°E).

New South Wales – Blue Lagoon dune lake; Pond #3, Botany wetlands, Sydney (33.935°S, 151.208°E); Oxford Falls (type locality -types in BNHM, London).

Queensland - Ocean Lake, Fraser Island (24.925°S, 153.273°E),

South Australia – Lake Edward, nr. Kalangadoo (37.63°S, 140.58°E); Valley Lake, Mt. Gambier (37.50°S, 140.75°E).

Victoria – Lake Little Beatle (37.79°S, 148.42°E); Swan Lake (38.20°S, 141.32°E).

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