

Morphology and Cytology of Oriental *Chironomus* species

Jon Martin

Department of Genetics, The University of Melbourne, Vic 3010, Australia,

This is a preliminary listing of the species of the genus *Chironomus*, particularly those for which cytological confirmation exists, found in India, South East Asia, China and Japan, i.e. the Oriental region as used here largely corresponds to that defined by Heiser and Schmitt (2013) on the basis of the distribution of Odonata.

I am very much indebted to numerous people who have provided me with material from these areas.

thummi-cytocomplex species

- C. cingulatus* Meigen 1830
- C. (Lobochironomus) dorsalis* Meigen (as *C. longipes* Staeger)
- C. (Austrochironomus) javanus* Kieffer 1924
- C. pulcher* (?) Weidemann 1830
- C. salinarius* Kieffer 1915
- C. sinicus* Kiknadze *et al.* 2005
- C. suwai* Golygina & Martin 2003

pseudothummi-cytocomplex species

- C. acerbiphilus* Tokunaga 1939
- C. apicatus* Johannsen 1932
- C. circumdatus* (Kieffer 1916)
- C. costatus* Johannsen 1932
- C. crassiforceps* Kieffer 1916
- C. flaviplumus* Tokunaga 1940
- C. nr. flaviplumus*
- C. incertipennis* Chaudhuri & Das 1996 (formerly *C. niger* Chaudhuri *et al.* 1992)
- C. kiiensis* Tokunaga 1936. [Sp. incert.](#)
- C. ramosus* Chaudhuri *et al.* 1992
- C. samoensis* Edwards 1928- not Oriental, but included to clarify the difference from the species to which this name has been applied (*C. flaviplumus*, *C. nr. flaviplumus*, and *C. indiaensis*).
- '*C. samoensis*' auct. nec Edwards.
- C. striatipennis* Kieffer 1910
- C. striatipennis* Type 2
- C. yoshimatsui* Martin & Sublette 1972

camptochironomus-cytocomplex

- C. biwaprimus* Sasa & Kawai 1987

Cytology Unknown

- C. atrosignatus* Kieffer 1911
- C. bipunctus* Johannsen 1932
- C. brevistylus* Guha *et al.* 1985

- C. claggi* Tokunaga 1964
C. (?Chaetolabis) echizensis Sasa 1994
C. flavitibia Johannsen 1932
C. formosae Kieffer 1912
C. fortistylus Chaudhuri *et al.* 1992
C. fujisecondus Sasa 1985
C. fujitertius Sasa 1985
C. fusciceps Yamamoto 1990
C. incertus Kieffer 1924, as subgenus *Camptochironomus*. [New name required.](#)
C. indiaensis Martin 2011(formerly *C. samoensis* sensu Chattopadhyay *et al.*)
C. nippodorsalis Sasa 1979
C. nipponensis Tokunaga 1940
C. nudipes Kieffer 1911
C. (Austrochironomus) okinawanus Hasegawa & Sasa 1987
C. palpalis Johansen 1932
C. quadratus Johannsen 1932
C. sp. "shimantoabeus" Sasa, *et al.* 1998
C. simantobeceus Sasa *et al.* 1998
C. sollicitus Hirvenoja 1962
C. sulfurosus Yamamoto 1992
C. tokarabeceus Sasa & Suzuki 1995
C. trinigrivittatus Tokunaga 1940
C. uttarpradeshensis Singh & Kulshretha 1976

There is also a long list of species described as *Chironomus* or *Tendipes* from the Oriental region that were classed as "Unplaced Chironomini" or "Nomina Dubia" by Sublette and Sublette (1973).

Species Descriptions

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

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

S-type: The SV 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 SV 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 SV 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 SV).



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*).

In 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). 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:

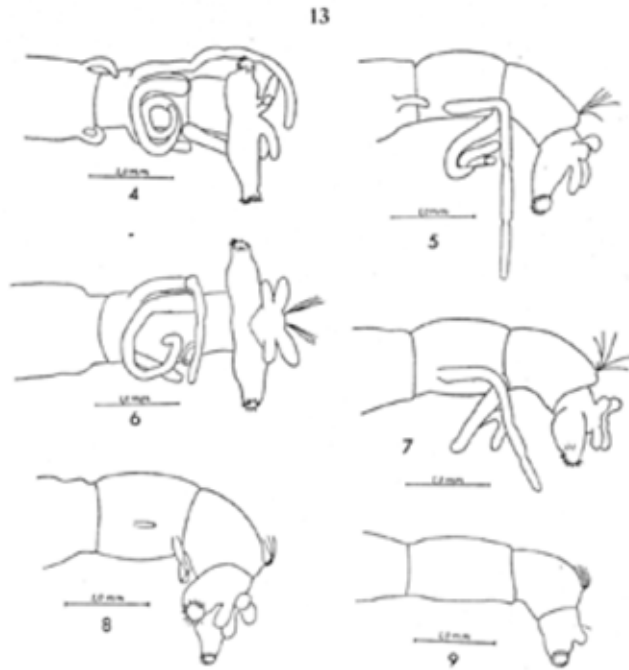
reductus – lacking ventral tubules.

semireductus – short straight or slightly curved VT.

melanotus – moderate to long, essentially straight VT.

plumosus – long, anterior VT with 'elbows', posterior VT coiled.

“short” is generally less than the width of segment 11.



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.

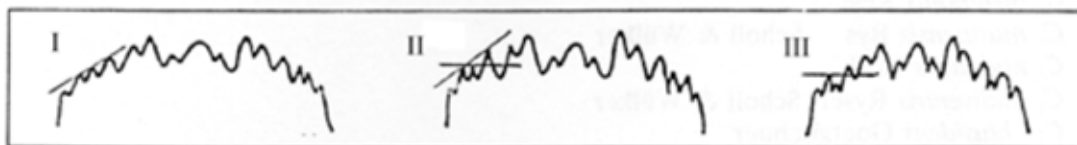
Reference is also made to the mentum and mandible types originally devised by Webb & Scholl (1985), Vallenduuk & Moller Pillot (1997) and Proulx *et al.* (2013). These classifications were made for relatively small numbers of species, but with the much larger number of species they do not cover all the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

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 trifold tooth**:

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

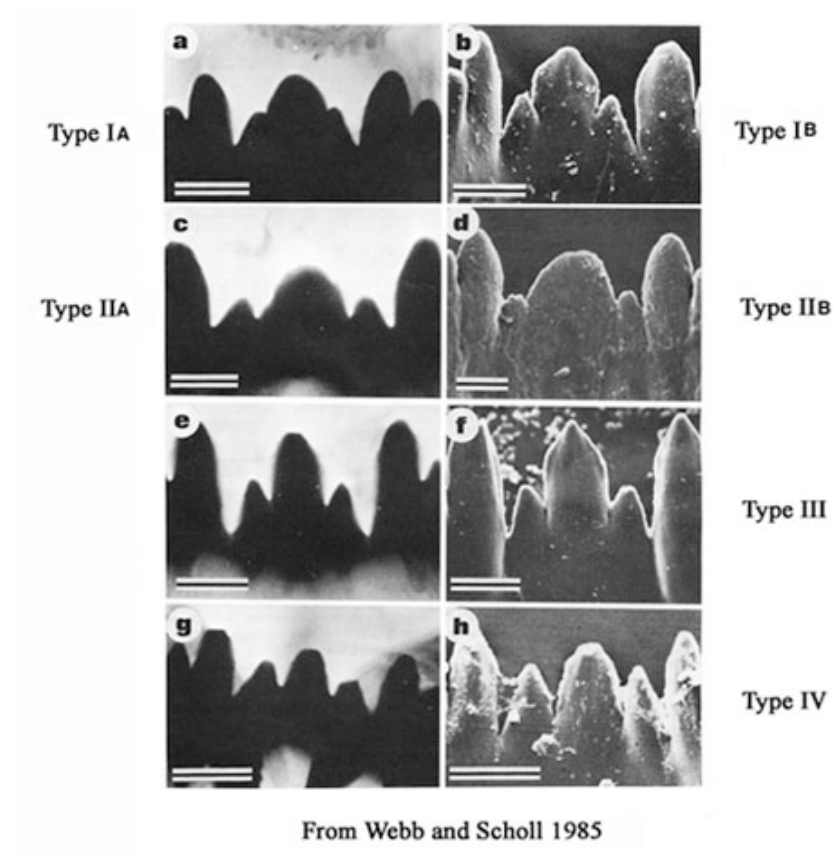
Type IB – c2 teeth slightly more separated (figure b).

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).



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;

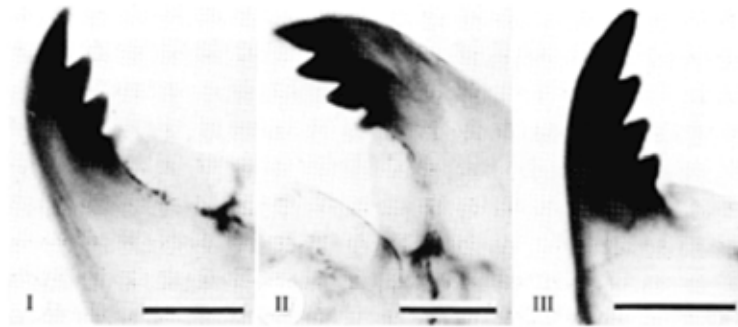
Type III - 3rd tooth completely separate.

Color

Type A – pale

Type B – slightly darkened

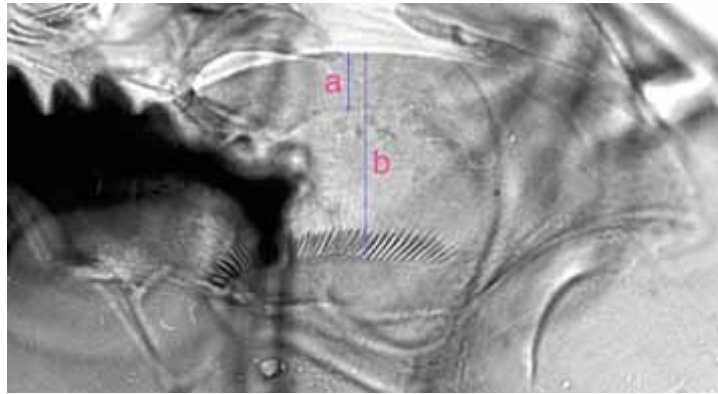
Type C – as dark as other teeth



From Webb and Scholl 1985.

I – type IA; II, type IIB; III – type IIIC

Ventromental plate ratio (VMR) - ratio of the width of the marginal region of ventromentum (usually seen as a granular band under light microscopy) (**a** in figure below) to the distance from the anterior margin to the base of the striae (**b** in figure below).



$$\text{VMR} = a/b$$

Abbreviations:

AT – Anal tubules

BOLD - Barcode of Life Database (http://www.boldsystems.org/views/login_interim.php)

BR - Balbiani Ring

COI - Cytochrome oxidase subunit I

FA - Frontoclypeal apotome (Frontoclypeus)

IV - Inferior volsella

Mt - Mitochondrial

PE - Pecten epipharyngis

PLT - Posterolateral tubules

PM – Premandible

PecM – Pecten premandibularis

SCf - Sensilla campaniformia (on brachiolum)

RO - Ring organ

SV - Superior volsella

VHL - Ventral Head Length

VM – Ventromentum

VMR – Ventromental Plate Ratio

VT - Ventral tubules.

♣ - occurrence not confirmed

***Chironomus acerbiphilus* Tokunaga 1939**

Adult:

Adults of Japanese specimens are entirely black, but those from Europe are paler, suggesting coloration is variable depending upon environmental conditions. Details of adults and pupa drawn from Sasa (1978) and Yamamoto (1986).

Male:

AR 2.50 - 3.33. Wing length 2.9 - 3.2 mm, width 0.9 mm. LR 1.15 - 1.25, BR 2.2.

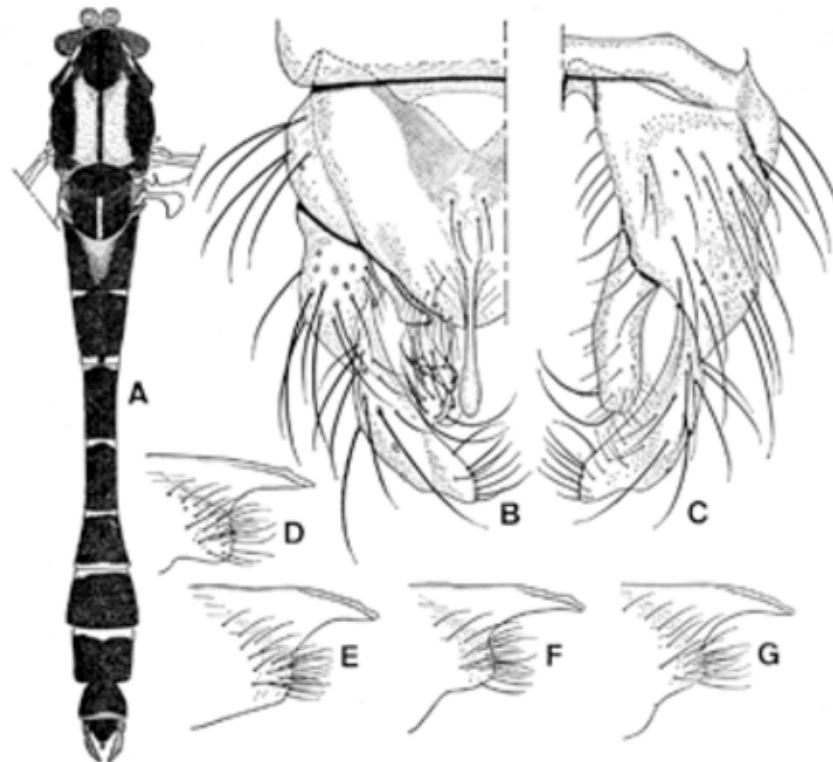


Fig. 1. *Chironomus acerbiphilus*, ♂. A: Dorsal view of the body. B: Genitalia in dorsal view. C: Ditto, ventral view. D-G: anal point in lateral view.

From Yamamoto 1986

Head: Frontal tubercles, 22.5 - 35 μm long, 10 - 17.5 μm wide.

Ratio of palpal segments (μm) 59 : 64 : 203 : 199 : 254. 36 - 48 setae on clypeus.

Thoracic setae: Acrostichals: 8 - 10; dorsocentrals 13 - 23; prealars 6 - 11; supra alar 1; scutellar 22 - 36.

Legs: Note the measurements of Yamamoto (1986) are generally larger than those of Sasa (1978), and show the unusual feature that the antTa1 is shorter or only as long as AntFe, which is not seen in Sasa's measurements.

Proportions (µm):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1400	1220	1480	710	565
PII	1495	1250	675	390	310
PIII	1650	1495	990	560	445
	Ta4	Ta5	LR	F/T	BR
PI	440	270	1.51-1.24	1.10-1.15	2.2
PII	210	185	0.51-0.58	1.10-1.25	-
PIII	265	205	0.65-0.70	1.07-1.13	-

Hypopygium as in figure above. 2 - 5 setae on central field of anal tergite. Anal point narrow and slender, slightly expanded at distal end. SV of figured by Sasa as Strenzke's D-type, and by Yamamoto as S-type. Strenzke (1959) described the German specimens (as *C. crassimanus*) as having a D-type SV.

Female

Wing length 3.3 - 3.5 mm; width 1.1 - 1.2 mm; VR 0.81 - 0.87. LR 1.17 - 1.30.

Colour essentially as in male. Cercus black.

Head: Antennal segments (µm) 148 : 98 : 104 : 104 : 292. Frontal tubercle 15 - 38 µm long, 10 - 24 µm wide.

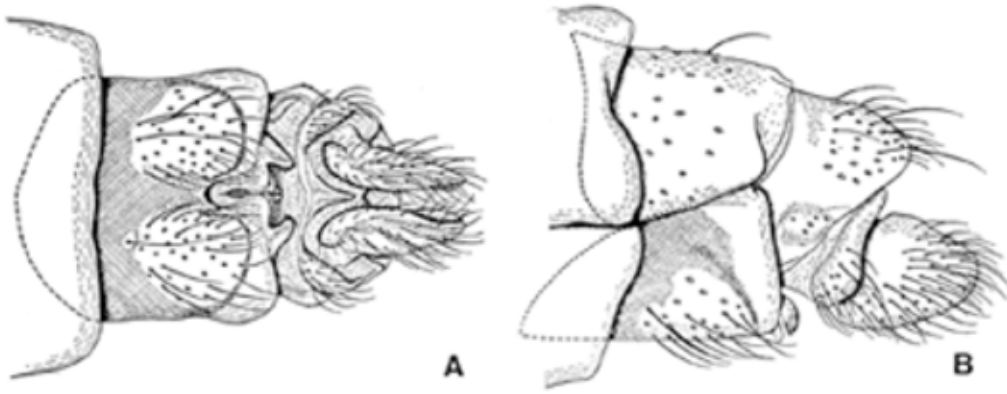
Ratio of palpal segments (µm) 66 : 66 : 202 : 208 : 260. 49 - 57 setae on clypeus.

Thoracic setae: Acrostichals: 10 - 14; dorsocentrals 25 - 28; prealars 8 - 10; supra alar 1 - 2; scutellar 34 - 40.

Wing squama with 27 - 36 setae, bi- or triserial.

Leg proportions (µm):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1600	1300	1630	715	600
PII	1645	1400	705	375	300
PIII	1775	1645	1035	570	480
	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	465	285	1.17-1.30	1.20-1.25	0.21-0.23
PII	220	205	0.49-0.54	1.14-1.21	0.14-0.15
PIII	290	225	0.61-0.67	1.04-1.12	0.13-0.14



Female genitalia of *Chironomus acerbiphilus*. A: Ventral view. B: Lateral view.

From Yamamoto 1986

Genitalia: Apodeme of 8th sternum rounded caudolaterally, not joined mesally. Sternite of segment IX with 3 - 7 setae.

Pupa: (Based on Yamamoto 1986). Length 7.8 - 8.8 mm. Body dark brown. Cephalic tubercle acutely pointed with simple subapical seta. First and ninth terga practically without shagreen. Intersegmental membrane of V-VI segments and VI-Viith segments with very weak centrally place shagreen.

Caudolateral spur of segment VII with 1 - 3 spines, most commonly with 2 (Sasa 1978).

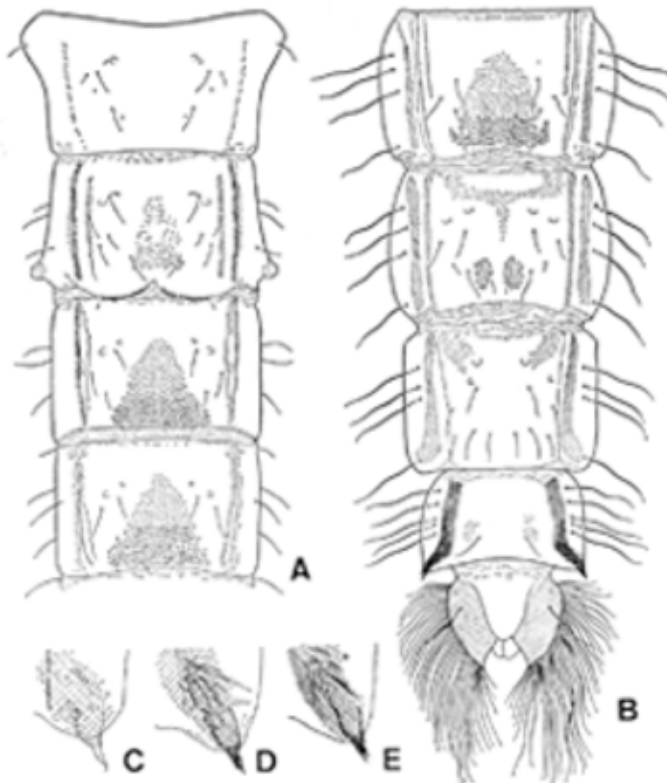


Fig. 5. Pupa of *Chironomus acerbiphilus*. A-D: Dorsum of abdomen. C-E: Postero-lateral spurs of segment VIII.

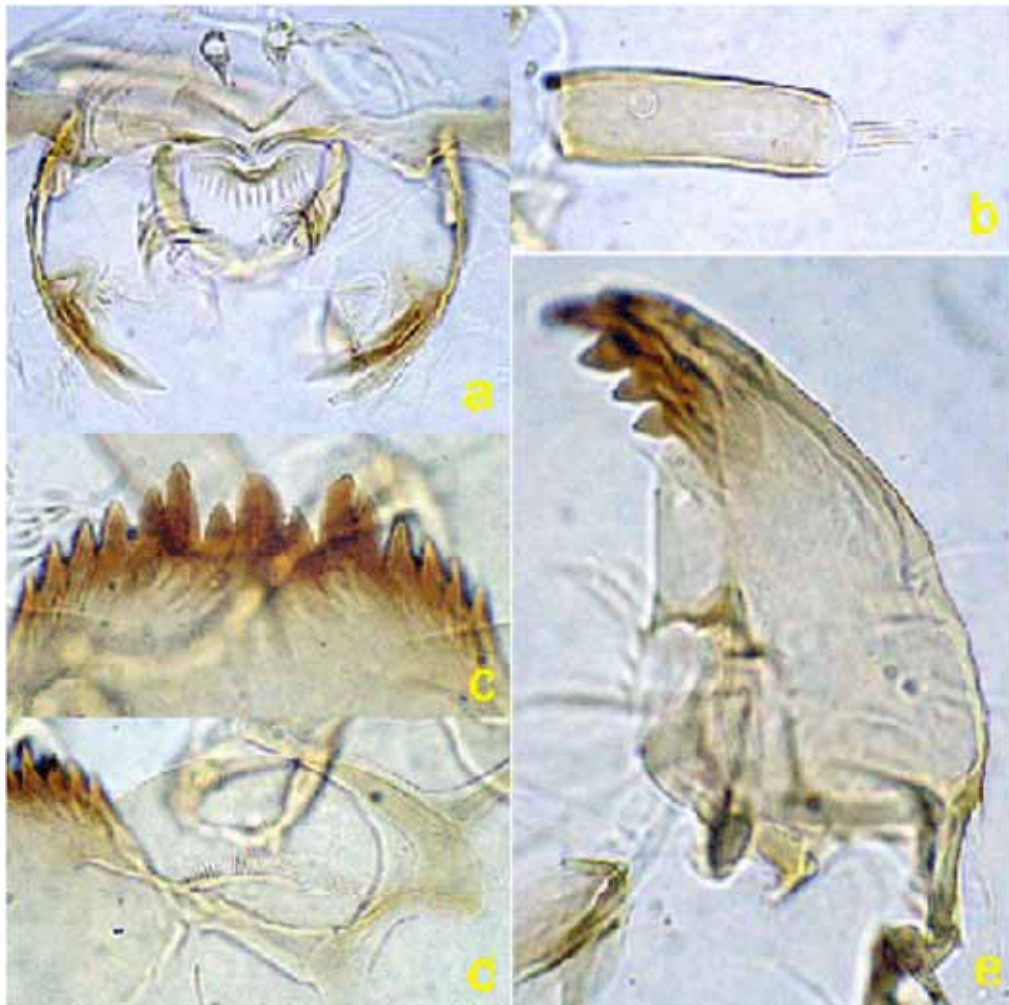
From Yamamoto 1986.

Larva: A small-medium plumosus-type larva, length 12.5 – 14.5 mm. Lateral tubules turn ventrally as described by Sasa (1978) for Japanese specimens. VT well developed. Head capsule generally brownish; gula and FA sometimes darkened. Mentum (c, below) width about half the VHL; C1 teeth relatively broad, with c2 teeth well separate and sharp; lateral teeth sharp, 4th laterals hardly reduced (type I) with 5th laterals slightly above the graduated level of the other lateral teeth. Sasa (1978) shows small notches near the tip of the center tooth, but these will only be seen if the mentum is not worn. Ventromental plates (d, below) separated by about 37 - 40% of mentum width; with about 39 – 40 striae; VMR about 0.28. PE (a, below) with about 17 - 20 sharp graded teeth (although Yamamoto describes them as uneven).

Antenna (b, below) with basal segment relatively long, about 3.4 times longer than wide; RO about 1/3 to 1/2 up from base of segment; AR about 2.22; segment 3 very short, shorter than segment 5; relative length of segments (μm) 129 : 28 : 4 : 11 : 5.

Premandibles (a, below) with the two teeth about equal length, or outer tooth slightly longer; inner tooth about 1.7 times wider than outer tooth.

Mandible (e, below) with 3rd inner tooth defined and darkened (type III), about 12 – 13 furrows on outer surface near the base.



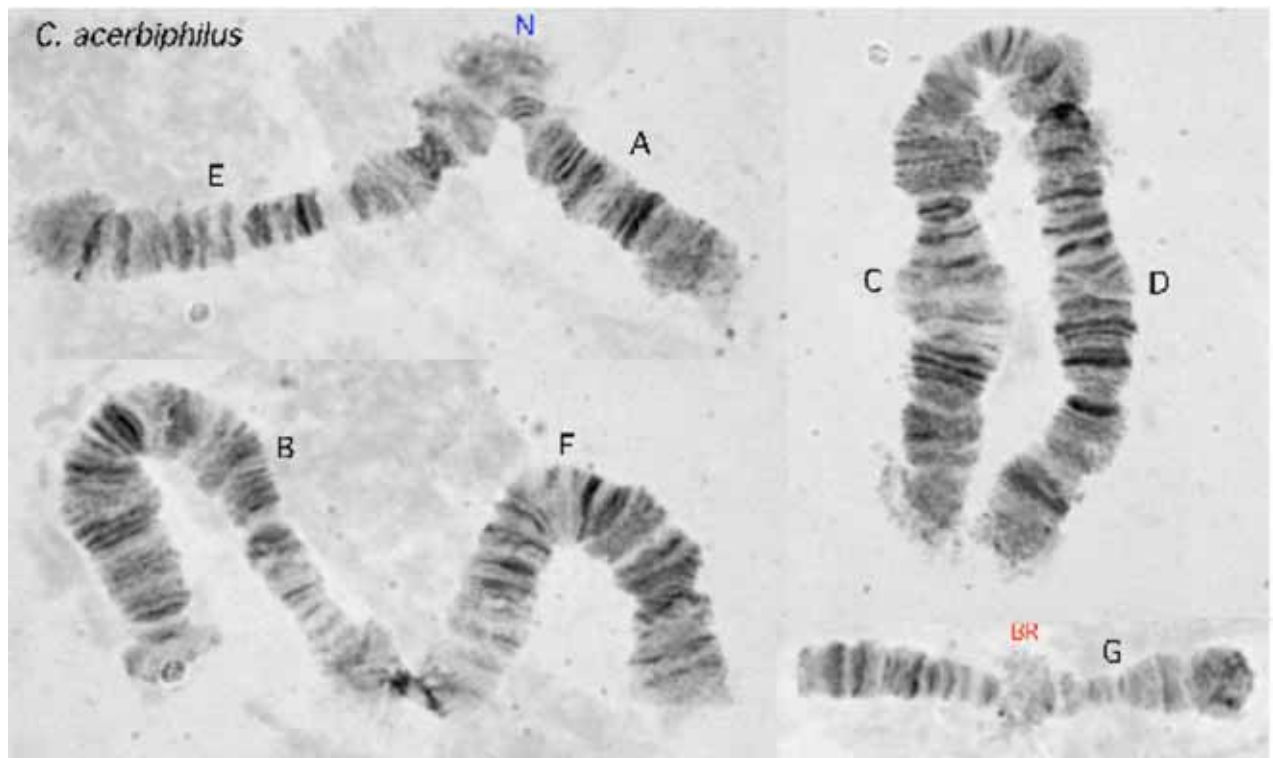
Cytology: 4 polytene chromosomes with the pseudothummi-cytocomplex combination, AE, BF, CD, G. Centromeres strongly heterochromatic and constricted. Pairing may occur between the centromeres of different chromosomes.

Arm G mostly paired, with BR near middle of arm and no nucleolus. Nucleolus developed in arm A.

A fixed asymmetrical pericentric inversion occurs on chromosome CD, transferring the proximal bands of arm D into arm C (Jablonska-Barna *et al.*), or alternatively it may be related to the duplication of the CD centromere region reported in other pseudothummi-cyctocomplex species such as *C. dorsalis* (= *C. alpestris*) (Kiknadze *et al.* 2008).

No polymorphism in studied North American, European or Japanese populations.

- aceA1: 1a-i, 7 - 9, 2d - 3, 12 - 10, 2c - 1k, 6 - 4, 13 - 19 - with large nucleolus in segment 15
- aceC1: 1 - 2, 10 - 3, 11 - 16, 22, 24 - 21, D(see below) (Jablonska-Barna *et al.* 2010)
- aceD1: 1 - 3, 6 - 4, 7 - 9, 18f-a, 13 - 10, 17 - 14, 18g - 20 (Jablonska-Barna *et al.* 2010)
- aceE1: 1 - 3e, 10b - 3f, 10c - 13 ie. as *halophilus*, etc.
- aceF1: 1, 12p - 11, 2 - 6 14 - 12p, 16 - 17, 10 - 7, 18 - 23 (Wülker, prelim)
- aceF1: (alternate) 1-7, 17-16, 11-14a, 15-14b, 4-6, 9-8, 1-3, 10, 18-20 (clarified from Jablonska-Barna *et al.* 2010)
- aceG1: BR near middle of arm.



Found: Japan - Lake Katanuma, Honshu (Type locality)

California -

Wyoming- Nymph Creek, Yellowstone National Park.

also found in Europe - Reinbeck, Germany (Keyl 1962 as *C. crassimanus*); Łuk Mużakowa Landscape Park, Poland ((Jablonska-Barna *et al.* 2010)

In acidic waters (pH1.4 – 4.3), and also elevated temperatures in North America.

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

***Chironomus apicatus* Johannsen 1932**

Adult:

Male

Length 5 mm.

Very similar to *C. costatus*, but LR about 1.85, the tarsi largely brown, only the two apical segments somewhat paler.

Thoracic vittae are brownish.

Crossvein of wings brown.



Male hypopygium of *C. apicatus* from Johannsen 1932

Additional data on anterior tarsi of type (thanks to Duncan Sivell, Natural History Museum): Ta1 twice the length of Ta2; Ta2-4 subequal, but decreasing in length; Ta5 less than half the length of Ta4.

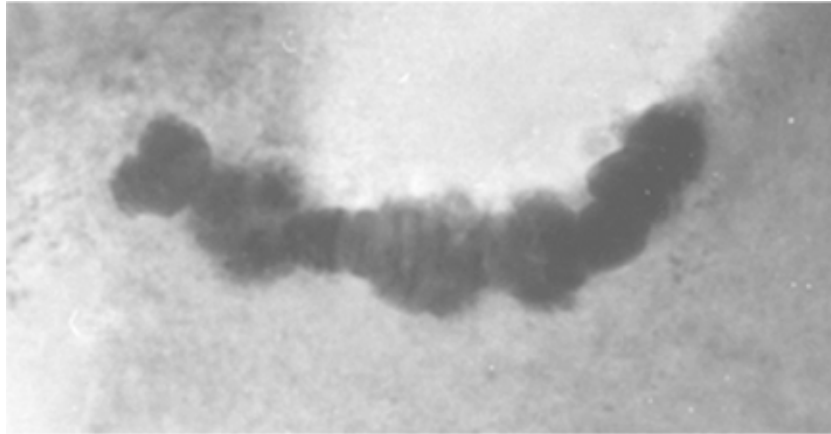
Larva: (based on Singapore specimens) A small plumosus-type, length about 9.0 – 10.5 mm (males). Lateral projections about 170 – 240 μm , posterior pair of VT usually longer (ant. 0.83 – 1.04 mm; post. 0.90 – 1.08 mm). Gular region pale to slightly darkened, FA very slightly dark to dark. Anal tubules long with a constriction near centre.

Mentum with generally sharp teeth, C1 tooth broad, c2 teeth well separated (type II-III), 4th laterals hardly reduced or reduced to about halfway between height of 3rd and 5th laterals (type I-II).

About 13 – 15 teeth in PE. Premandible with inner tooth only about 1/3 wider than outer tooth, and about equal in length.

3rd inner tooth of mandible slightly darkened but with variable separation (type I-IIB).

Cytology: Four polytene chromosomes, probably with the pseudothummi-cytocomplex combination BF, CD, AE, G. Possibly no nucleolus in arm G.



Arm G.

Found: Type locality – Toba Dist., Samosir, Sumatra, INDONESIA.

Also Sigaol, Samosir.

Singapore - this material probably misidentified.

India - Jammu & Kashmir - Farooq Nagar.

In Indonesia found in salt ponds and a pool at 29°C and pH 2.83 (Lenz 1937)

Larva described by Lenz 1937.

Possibly the correct name for the various samples in the Oriental region that have been incorrectly attributed to *C. samoensis* (not Edwards), other than the species renamed as *C. indiaensis* by Martin (2011).

***Chironomus bicoloris* Tokunaga 1964**

***Chironomus bipunctus* Johannsen 1932**

Adult

Male



Male hypopygium of *C. bipunctus* from Johannsen 1932

Found: Type locality – spring pool, Ngadsari, Java, INDONESIA

***Chironomus biwaprimus* Sasa & Kawai 1987**

Adult (from Sasa & Kawai 1987)

Male

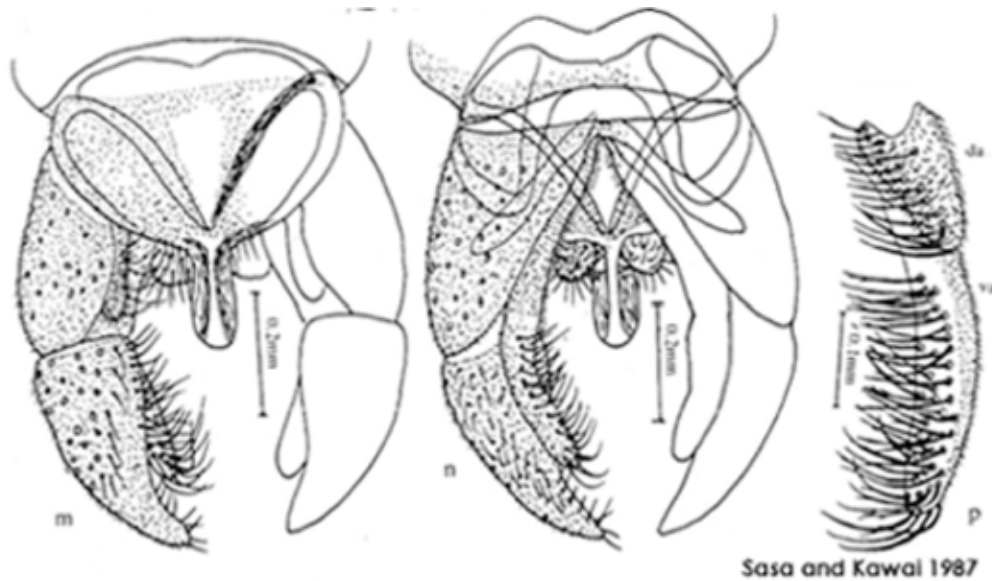
Length 6.96 - 8.11; wing length 3.58 - 4.05; VR 1.02 - 1.06. AR 3.17 - 3.89
LR: Ant. 1.34 - 1.58; mid 0.50 - 0.56; hind 0.58 - 0.64. BR 1.6.

Coloration unusual - antennal shaft brown, hairs brownish yellow; ground color of scutum greenish yellow or pale yellow, vittae dark brown; legs with femur and tibia largely yellow with a narrow apical dark ring; tarsi darkening from brown to dark brown.

Head with relatively small frontal tubercles 22 micron long, 14 micron wide.

Thorax: Anteprenotum united and expanded in the middle, without lateral setae. Setae: Acrostichal 6 - 14; dorsolateral 19 - 36; prealar 6 - 10; scutellar 24 - 36 in a double row.

Legs: Front tibia with 4 subterminal setae arising on a rounded terminal scale.



Hypopygium (above) typical for the subgenus, apparently closest to *C. tentans*.

Larva: A moderate sized plumosus-type larva.

Cytology: Four polytene chromosomes with the *Camptochironomus* cytocomplex combination AB, CF, DE, G. Specimens available did not have particularly good chromosomes, but some banding patterns could be determined. Arm G may have a nucleolus but main nucleolus is in a long chromosome, probably near the centromere of the AB chromosome. One heterozygote, probably in arm B.

biwA1:

biwB1

biwC1

biwD1

biwE1: 1 - 2b, 7h - 10b, 3e - 2c, 7g - 3f, 10c -13 i.e. as *dilutus* E1

biwF1: possibly 1a-d, 12-9b, 2f-3b, 13-14c, 5d-6, 9a-7a, 14d-16, 5c-3c, 1e-2e,.17-23

biwG1:

Found: Type locality - Lake Biwa, Otsu City, Honshu, JAPAN.

***Chironomus cingulatus* Meigen 1830**

Syn: *C. fujitertius* Sasa 1985 – Yamamoto (unpublished).

Adult:

Male

Cytology: (based on European material) Four polytene chromosomes with the thummi-

cytocomplex arm combination AB, CD, EF, G. Centromeres heterochromatic.

Subterminal nucleolus in arm G, with two BR near the other end. Usually closely paired, but may be unpaired at the end distal to the nucleolus. Nucleolus also in arm B.

Polymorphic at least in arm A in Europe.

cinA1: 1 - 2c, 10 - 12a, 3f-a, 2k-h, 4d - 9, 2d-g, 4c-a, 13ab, 3g-I, 12cb, 13c - 19

cinA2: 1, 7b - 4d, 2h-k, 3a-f, 12a - 10, 2c-a, 7c - 9, 2d-g, 4c-a, 13ab, 3g-I, 12cb, 13c - 19

cinB1: Characteristic bands (24 - 27) near, and nucleolus about ¼ away from, centromere.

cinC1:

cinD1:

cinE1: 1 - 3e, 5 - 10b, 4 - 3f, 10c - 13

cinF1: 1 - 2b, 4c - 7e, 17 - 15c, 7f - 8c, 4b - 2c, 8e - 15b, 8d, 18 - 23

cinG1: Nucleolus subterminal to a fanned end

In lakes in Japan.

Found: Type locality – Palaearctic (Type locality not given)

Japan - Lake Kawaguchi & Lake Motosu, Mount Fuji area.

Adult morphology for European specimens redescribed by Strenzke (1959), and Japanese material by Sasa (1985) (as *C. fujitertius*)

Cytology described by Keyl and Keyl (1959), and Keyl (1962).

***Chironomus circumdatus* (Kieffer 1916)**

Syn.: *C. basitibialis* Tokunaga 1936

C. bharati Singh & Kulshretha 1976

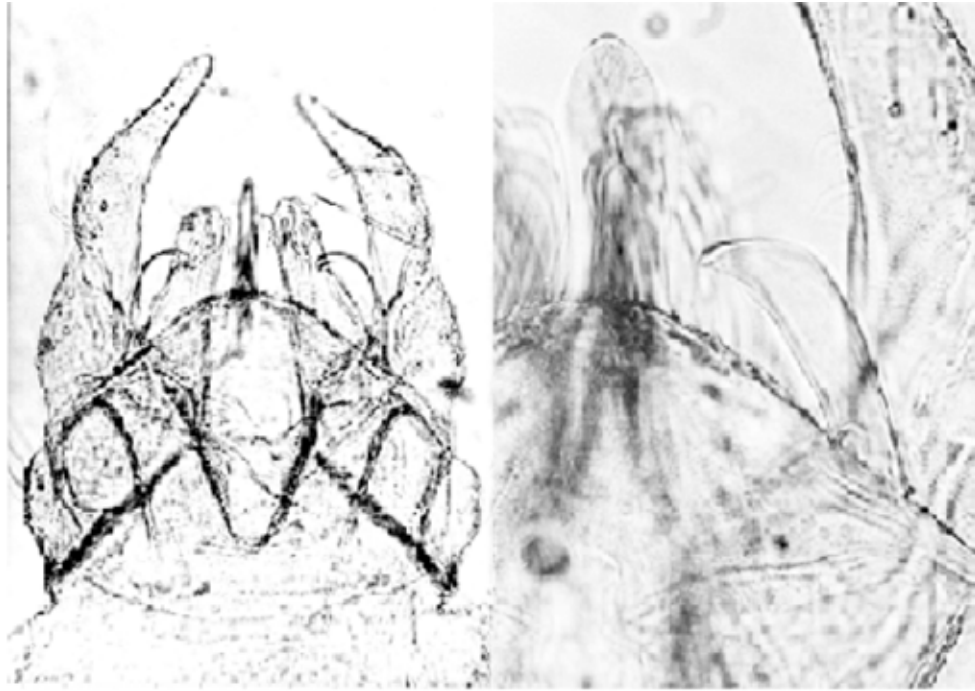
C. costatus sensu Karunakaran 1969 (mtCOI - Wong, unpubl.; cytology - Martin unpubl.)

C. plumatisetigerus Tokunaga, 1945 (Martin & Saxena 2009)

C. setonis Tokunaga 1936 (Yamamoto 2013)

Adult:

Male



Male terminalia of *C. circumdatus*

Anal point relatively narrow, superior volsella D-type curved at the tip.

AR about 3.12 - 3.8. The high value comes from Japanese material (Sasa 1978), Indian specimens are less than 3.5.

Frontal tubercles about 25 - 43 μm long, 10 - 17 μm wide. Palpal proportions (μm) 56 : 54 : 213 : 218 : 334. Clypeal setae - 17 - 34.

Thorax greenish, scutal stripes conspicuous with dark brown margins; scutellum pale yellow, postnotum dark brown. Thoracic setae: acrostichals - 13 - 18; dorsocentrals - 18 - 27; prealar - 5 - 6; scutellar - 8 - 14 in anterior row, 13 - 26 in posterior row (higher numbers have an intermediate row of 11 - 12 setae).

Wing length: 2.72 - 3.04 mm; wing width 0.67 - 0.74 mm. VR about 1.02 - 1.05

Wings without darkening of the crossvein. 25 -27 setae in squamal fringe.

Legs pale, with darkening at distal ends, also on distal half of Ti4 and all of Ta5.

Leg lengths (microns) and proportions as follows:

	Fe	Ti	Ta1	Ta2	Ta3
PI	1145	1060	1610	835	745
PII	1230	1110	705	395	295
PIII	1350	1350	1000	560	475
	Ta4	Ta5	LR	F/T	BR
PI	645	325	1.42-1.67	1.04-1.12	1.64-1.9
PII	165	135	0.62-0.66	1.05-1.13	

PIII	250	170	0.72-0.81	0.97-1.02	
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(i.e. ant Ta5/Ti about 0.31)

Abdominal segments pale, but with increasing central dark oval patch, so that tergites V -

VIII are virtually all dark.

Anal point narrow; 1-16 setae on tergite IX. SV of the D-type, between d and e of Strenzke (1959), but tip may be more bent. Sasa classes Japanese material as E-type, although one illustration looks more like a D-type. Basal setae on IV ramose.

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.

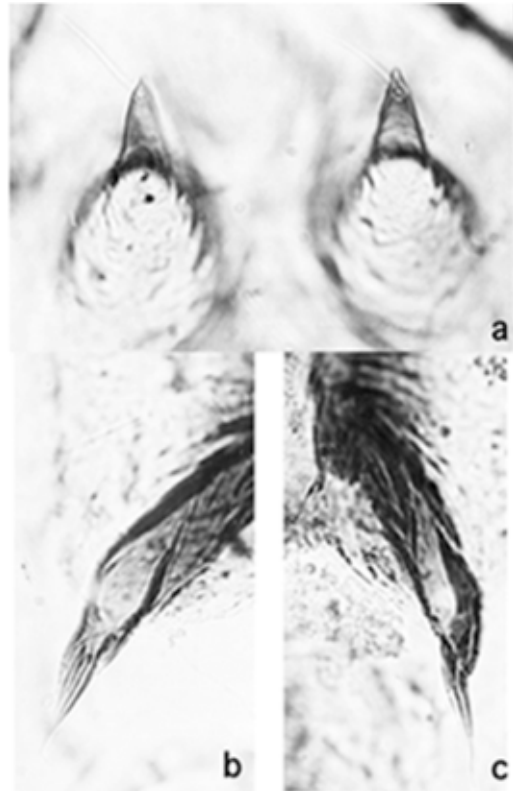
Palpal proportions (segs. 2-5) (mm): 60 : 240 : 250 : 540.

Leg lengths (microns) and proportions as follows:

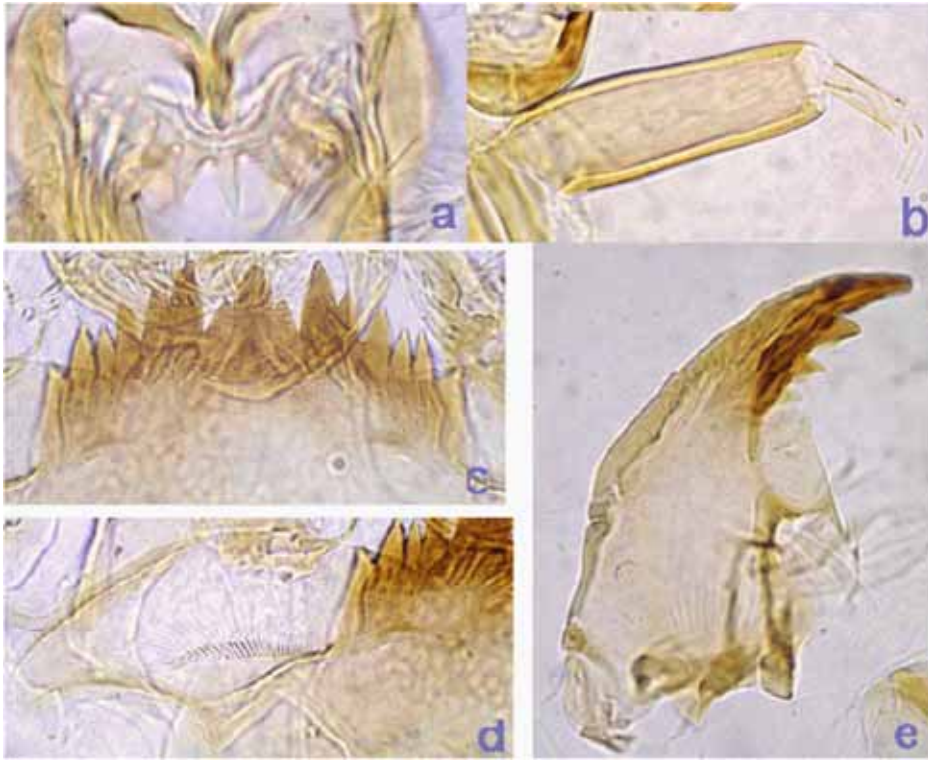
	Fe	Ti	Ta1	Ta2	Ta3
PI	1440	1150	2050	1000	930
PII	1630	1340	810	410	290
PIII	1490	1490	1150	560	460
	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	880	410	1.79	1.25	0.36
PII	180	150	0.60	1.22	0.11
PIII	270	180	0.77	1.00	0.12

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

Pupa: Brown. Exuviae pale brown. Body about 6.6 - 7.7 mm (male) and 6.5 - 7.6 mm (female). Frontal tubercles (a, right) about 70 - 100 μ m, with a subapical seta (40 - 80 μ m). Thorax rugose, with 2 pairs of precorneal setae. Abdominal tergite II with median shagreen and about 52 - 68 hooklets, tergites III-V entirely with shagreen, tergite VI with T-shaped shagreen, tergites VII-VIII with 2 broad patches of shagreen. Caudolateral spur of segment VIII (b & c, right) with about 2 - 4 spines.



Larva: a medium plumosus-type (length 10.6-13.7 mm; females 11.2 - 12.5 mm), lateral tubules well developed (about 480 μ m). Gular region darkened, FA variable from very slightly darkened to dark. Posterior pair of VT generally longer than anterior pair (ant. 1.84; post. 2.48), and coiled. Anal tubules may vary in size in different areas, from about twice as long as wide (Allahabad) to almost three times as long as wide (Jammu), length 290 - 440 μ m, width 165 μ m. 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 central tooth (type III) well separated. VM (d, below) with about 30 - 36 striae. PE (a, below) with about 12 - 15 teeth. Premandible with inner tooth shorter and about twice the width of the outer. Antenna (b, below) with basal segment less than 3.5 times as long as wide; A2/A1 about 0.24; A4/A3 about 2.3 - 2.6. AR about 2-2.3. Mandible (e, below) with third inner tooth slightly darkened and only partly separated (type IIB).

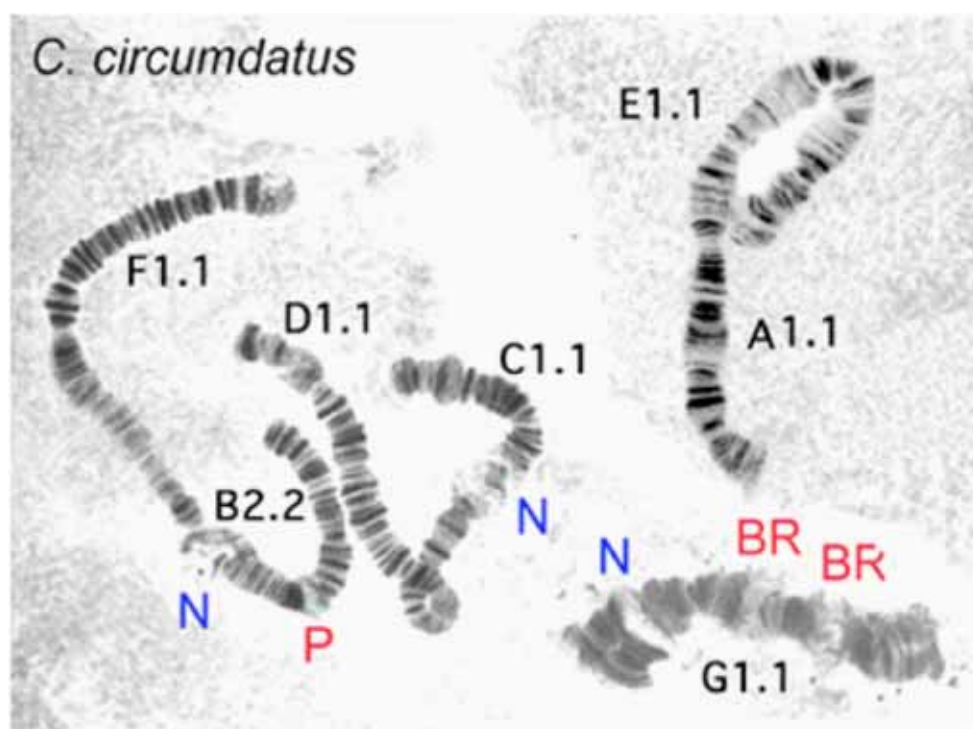


Cytology: Four polytene chromosomes with the pseudothummi-cyto complex combination BF, CD, AE, G. Nucleoli in arm B and C, with a small one also present subterminal in arm G (which is not always present/active). Arm G closely paired with generally 3 obvious BRs from near the nucleolus to the opposite end, depending upon the sequence.

Polymorphism in arms A, B, C, D and G, although Pamual *et al.* report pericentric inversions involving the AE and BF chromosomes. Most polymorphism in arm B.

- cirA1: 1 - 3, 12 - 4, 13 - 19 as *pseudothummi* (widespread)
- cirA2: 1 - 2c, 10 - 12, 3 - 2d, 9 - 4, 13 - 19 as *holomelas*, *incertipenis* (widespread)
- cirA3: approx. 1 - 2d, 11 - 12, 3 - 2e, 10 - 4, 13 - 19 (Thailand)
- cirA-E (called A4): A1-3, 12-5, E11-13, A6-4, 13-19, E 10i-c, 3f, 3a-e, 10ba-4, 2-1 (India and Thailand)
- cirB1: Puff just beyond middle of arm with dark bands distal (gps. 8 - 7) (widespread)
- cirB2: Puff near nucleolus, with dark bands on proximal side (gps. 7 - 8) (widespread)
- cirB3: abt same size as B2, but moved a few bands proximal, ending at nucleolus (India)
- cirB4: small inversion distal to the distal break of B2 (Thailand)
- cirB5: Similar to B2, but about 2-3 bands shorter at each end (Thailand)
- cirB6: Inversion of distal third of arm (Thailand)
- cirB7: Small subterminal inversion (Thailand)
- cirB8: Small inversion of the region of the BRs (northern India)
- cirB-F: involves the characteristic bands (groups 24-26) of arm B, to about F19 (Thailand).
- cirC1: Median nucleolus (widespread)

- cirC2: Inversion of about a third of the arm distal of the nucleolus (widespread)
- cirD1: differs from oppD1 by at least one inversion (widespread)
- cirD2: Inversion of approximately the middle third of the arm (widespread)
- cirD3: noted by Kumar & Gupta, but seems to be in same region as cirD2 (India)
- cirE1: 1 - 2, 4 - 10ab, 3e-a, 3f, 10c - 13 from *aprilinus* by Inv4-3a
- cirF1: 1 - 2a, 10d - 2c, 15c - 11a, 2b, 15d - 23 as *oppositus* F3
- cirG1: Nucleolus near one end, three BRs towards the other end (most distal not always visible) (widespread)
- cirG2: Inversion of over two thirds of the arm, from proximal of the nucleolus to between the two larger BRs (widespread)
- cirG3: Inversion of region around the BRs (India)



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

India to Thailand, to New Guinea, Australia and the Pacific area.

India - University of Jammu & Kashmir, Jammu (32.73°, 74.87°); Bishnah wetland 32.70°, 75.00° Jammu & Kashmir; Madurai, Tamil Nadu (9.91°, 78.00°); Varanasi, Banaras, Uttar Pradesh (25.20°, 83.03°)

Indonesia - Kampung Damai, Balikpapan (-1.25°, 116.82°), Kalimantan.

Malaysia - Langat River, Selangor.

Singapore - Sungei Api Api (as *C. costatus*)

Thailand - Ban Bangkanark, Chachoengsao Province (Hashimoto *et al.* 1981); Bangkok area; Ban Don Chi, Amphoe Phibun Mangsahan, Ubol Ratchathani Province (Hashimoto *et al.* 1981), Ban Haet; Ban Phai; Ban Thung Ka La, Amphoe Chiang Dao, Chiang Mai Province (Hashimoto *et al.* 1981); Borabue; Changan; Chiang Khwan; Chiang yuen; Kamalasai; Kantharavichai; Kham Ta Kla; Meuang Kalasin; Meuang Khon Kean; Meuang Nakhon

Phanom; Meuang Roi Et; Na Kae; Phang Khon, Pra Yuen; Renu Nakhon; Rong Kham; Sawang Daen Din; Si Somdet; That Phanom; Yang Talat; Wanon Niwat (mostly from Pramual *et al.* 2008)

The morphology was redescribed by Sasa (1978) and Chaudhuri *et al.* (1992). Chaudhuri *et al.* claim the larval VT are not coiled.

Chromosomes described by Kumar & Gupta (1990) and Pramual *et al.* (2008) as *C. circumdatus*, by Kuvangkadilok (1985) from Thailand, and for arms A, E and F (with some errors) by Saxena (1995) as *C. plumatisetigerus*.

The species can be bred in the laboratory (Kuvangkadilok 1994).

DNA Sequence:

mtCOI: sequence is in GenBank for Malaysia(acc. no. JQ287751), Thailand (acc. nos. KT212956 - 977, JQ287747-51), Singapore (acc. no. KJ530968).

***Chironomus claggi* Tokunaga 1964**

Type localities: Futami-ko; Camp Beach, Omura; Gen's beach, Minato-ko, Yatsue Region; all Chichi Jima, Micronesia
Japan - Tokyo Metropolitan

The *mtcox1* sequence for Japan in GenBank is AB740233.

***Chironomus costatus* Johannsen 1932**

This species as recognized by Karunakaran (1969) is almost certainly a synonym of *Chironomus circumdatus* Kieffer 1916 – but see notes under “Larva”.

Adult:

Compiled from description of Johannsen (1932)

Male: Body length 4.5 mm. AR greater than 3. LR about 1.73.

Head pale yellow, including proboscis and palpi; scape deeper yellow, flagellum brownish; eyes deeply emarginate, narrowly separated on the front; frontal tubercles well developed; twelfth antennal segment over three times as long as segments 2-11 combined.

Thorax pale yellow; mesonotum with three deep yellow vittae each margined on both sides with brown, making it appear as if there were six short narrow brown vittae, the lateral pairs connected on the front margin; metanotum deep yellow with two closely approximated brown spots; pleura with a brown spot below wing; sternum deeper yellow; scutellum pale. Abdomen pale yellow, perhaps greenish in life; each tergite with a large, brown, transverse, oval spot which does not touch the incisures.

Abdominal tergites with a large brown transverse oval spot, which does not touch the incisures.

Legs yellow; extreme tips of fore femora, immediate bases of fore tibiae, and the extreme tips of tarsal segments 1 - 4 and whole of 5 of mid and hind legs, brown.

Anterior leg proportions: 45 : 37 : 64 : 33 : 30 : 26 : 13 (i.e. Ta5/Ti abt 0.20); fore tibia with rounded scale; middle and hind tibiae each with two spurs on the usual combs; empodium long, pulvilli large; fore tarsi not bearded.

Wings hyaline, veins pale, crossvein faintly tinged with brown; costa not produced, ending slightly farther in front of wing tip than the media does behind it; cubitus forks under the crossvein. Squama fringed. Halteres pale.



Male hypopygium of *C. costatus* from Johannsen 1932.

Hypopygium yellow, gonostylus slender, gradually tapering, with some short stiff, inwardly directed bristles near apex; inferior appendages with the usual curved bristles; superior appendages bare, curved, pointed, reaching the base of the spur of the ninth tergite, the spur extending almost as far caudad as the tip of the inferior appendage. Apparently without setae at the base of the anal point. Superior appendage difficult to interpret from illustration, but possibly narrow and reaching to end of the gonocoxite.

Female: In coloring resembling the male but with the darker marks on the mesonotum nearly black and rather broader thus nearly obliterating the yellow on the lateral vittae. Abdominal tergites with brown transverse fasciae which do not reach incisures.

Basal third of fore tibiae and tips of all femora dark brown.

Antennae six-segmented, second compound; sixth segment brown, twice as long as the fifth, intermediate segments flask-shape, the neck about as long as the bulbous part.

Similar to male, but body stouter, markings darker and abdominal fasciae very broad covering almost the entire tergites.

Johannsen also notes considerable variation in the extent of the brown on the thorax and legs, In the palest specimens the legs and thorax show only traces of brown. In the darkest females the vittae of the mesonotum are almost wholly dark brown and the leg markings are sharply defined.

Pupa: Lenz (1937) describes it as “thummi-type”

Larva: There is no larval description from the type locality (see below), so this description relates to Singapore specimens, which are probably *C. circumdatus*.

A small to moderate plumosus-type, length about 11.8 – 14.3 mm (female) 11.0 – 12.0 mm (male). Lateral projections about 220 – 400 μ m, posterior pair of VT usually longer (ant. 1.36 – 2.48 mm; post 1.52 – 2.76 mm). Anal tubules about 2-3 times longer than wide, ventral pair may be longer and thinner (3.5-4.3 times longer than wide).

Head width about 420 μ m. Gular region darkened on posterior half, FA very slightly dark to dark, sometimes with very pale markings along outside edge of clypeus.

Mentum with generally rounded teeth, c2 teeth well separated (type II), 4th laterals reduced to level of 5th laterals or below (type II-III). About 12 – 13 teeth in PE.
Third inner tooth of mandible dark but only partially separated (type IIC).
Karunakaran also describes the first - third larval instars.

Cytology: (from unillustrated description by Alfred & Michael, 1990):

Four polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G.

No mention of nucleoli. Polymorphic in arms (from unillustrated description by [Alfred & Michael, 1990](#)):

Four polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. No mention of nucleoli. Polymorphic in A and G, both for small terminal inversions.

This description is insufficient to distinguish these chromosomes from those of *C. circumdatus* A and G, both for small terminal inversions.

This description is insufficient to distinguish these chromosomes from those of *C. circumdatus*.

Found: Type locality - Buitenzorg, BOGOR, INDONESIA.

Also Malang and Ngebel,

India - Madurai University, Madurai (Alfred 2006); Shillong, Meghalaya (Alfred & Michael 1990)

Malaysia - Selangor, (Habib *et al.* 1997)

In pools and ditches and in running water

Lenz (1937) describes six immature types for this species:

1. A small plumosus-type, length about 10-12 mm, ventral tubules long, anal tubules long.
2. A plumosus-type, length 12-13 mm.
3. A plumosus-type, about 12 mm long, ventral tubules not very long.
4. **A pupal type from the type locality, larva not known .**
5. A thummi-type larva, with long ventral tubules, moderately long anal tubules, the hind tubuli swollen at the base.
6. from a pupal type, larva not known.

Since Johannsen notes variation in coloration of the adults and Lenz ascribes a number of different larval types to this species, it raises the possibility that more than one species is included under this name. In the absence of a good adult description of material from other countries, it remains uncertain whether these reports relate to the same species, and whether *C. costatus* or one of the variants is the synonym of *C. circumdatus*.

***Chironomus crassiforceps* Kieffer 1916**

Synonyms

Chironomus esakai Tokunaga 1940

Chironomus insolens Johannsen 1946 - synonymised with *C. esakai* by Hardy (1960).

Yaesecundus iriobeceus Sasa *et* Suzuki, 2000

Chironomus daitoabeus Sasa *et* Suzuki 2001

Daitoyusurika daitofecea Sasa *et* Suzuki, 2001,

Possible synonym – *C. nudipes* Kieffer 1911 – i.e. this could be the senior synonym for this species.

Adult:

Kieffer description - Annales Musei Nationalis Hungaricis **14**: 111-112 (1916)

10. *T. crassiforceps* n. sp.

Male: Fawn colour. Frons with two small white lobes. Palps of a dark brown. Antennae of 12 segments, brownish, with fawn variegation, transverse segments 3-11 twice as wide as long, the 12th twice as long as previous ten together. Mesonotum frosted white, with 3 reddish bands, short, dull, whitish; scutellum, metanotum and pleura reddish or fawn. Halteres white, extremity of club brown. Wings subhyaline, crossvein black, second longitudinal vein close to radius, cubitus more than half as long as the radius, posterior fork a little distal to the crossvein. Legs yellowish, the last two tarsal segments and the extremity of the third darker, anterior tarsus not bearded, long anterior tibia, hardly shorter than the unmarked femur, metatarsus at least longer by half than the tibia, segments 2-4 gradually and slightly shortened, the fourth not distinctly shorter than the third one, more than twice as large as the 5th, large pulvillus, shorter than empodium. Abdomen linear, of a brownish white, lateral edges black, the last two tergites and claspers a little duller than the other tergites. Large claspers, very large terminal segments, longer and larger than the basal segments, straight, slightly thinner and rounder at the edge, except the distal quarter which possesses, as well as the extremity, short hairs, erect and quite dense, the setae of the lateral part are relatively shorter than usual, shorter than the width of the segment; coxite appendages in a short point; superior appendages extend out a little past the basal segments, flat, linear, curved; inferior appendages very long, nearly reaching the extremity of the terminal segments, more than twice as large as the superior appendages, but not half as big as the terminal segments, slightly swollen before the extremity which is thinner, pubescent, dorsal surface armed, on the distal third, with long hairs, rigid and strongly curved.-- L. 4.5 mm. (i.e. AR about 1.5, LR about 1.5)



Fig. 19.
Tendipes crassiforceps n. sp.
Half of claspers of the male
viewed from above

Male

Wing length 2.70 - 3.4 mm.; AR 1.55 - 1.75; VR abt. 1.14.

Head: Palp proportions segs. 2 - 5 (microns): 56 : 170 : 195 : 260. Clypeal setae 28 - 37.

Thoracic setae: dorsolateral abt. 12; dorsocentral 14 - 24; prealar 5 - 7; supra alar 1; scutellar in approx. 2 rows ant. 5 - 10. post. 9 - 13.

Leg proportions and ratios (microns)

	Fe	Ti	Ta1	Ta2	Ta3
PI	1430	1245	1820	875	775
PII	1450	1400	650	385	300
PIII	1635	1600	910	530	460
	Ta4	Ta5	LR	F/T	BR
PI	740	370	1.45-1.70	1.13-1.20	1.44
PII	215	190	0.43-0.49	1.03-1.05	-
PIII	265	215	0.55-0.62	0.98-1.10	-

Hypopygium: Anal point stout, gonostylus large and oval in lateral aspect, dorsal volsella long and slender, IV slightly curved and almost as long as the gonostylus. No setae centrally on 9th tergite.

Female

Wing length 2.08 - 2.77.

Head: Antennal proportions 40 ; 78 : 64 : 66 : 56 : 122. Palpal proportions 28 : 30 : 78 : 95 : 144.

Leg proportions and ratios

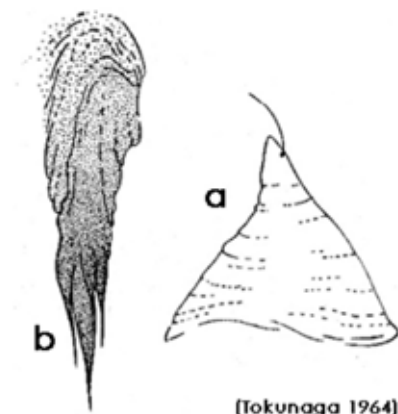
	Fe	Ti	Ta1	Ta2	Ta3
PI	1120	880	1400	680	560
PII	1120	1140	520	280	240
PIII	1300	1280	800	440	400
	Ta4	Ta5	LR	F/T	BR
PI	520	280	1.59	1.27	-
PII	180	140	0.46	0.98	-
PIII	210	180	0.63	1.02	-

Abdomen largely yellow or yellowish-brown, darker at posterior.

Pupa (from Tokunaga 1964) Body length 5 - 6 mm.

Frontal tubercles triangular, as long as the basal length, with small apical seta.

Abdominal tergite II with a caudal ridge of 77 hooklets; caudolateral spur of segment VIII with 3 or 4 spines.



Larva a medium sized plumosus-type larva. Length (females) about 7 - 12 mm. Anterior ventral tubules slightly longer than the posterior pair.

Gular region at least slightly darkened on posterior half, FA also darkened, and slight darkening elsewhere on dorsal surface.

Mentum with 4th laterals only slightly reduced (essentially type I), and c2 teeth partly separated from c1 (type II).

Ventromentum with about 32 - 47 striae. PE with about 15 - 19 teeth. Premandible with outer tooth as long as inner tooth, and slightly narrower.

Antenna with relatively long basal segment, over 3.2 - 4.2 times as long as wide; AR about 1.70 - 2.23, segment lengths (micron) 129 : 25 : 9 : 11 : 7 .

Mandible with 3rd inner teeth showing some colour and separate (type III); about 13-19 furrows on outer surface near the base.

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Nucleolus in arm F at about group 19, and a small nucleolus sometimes developed in arm

G. No known inversion polymorphism. Differs from *C. magnivalva* by fixed inversions in arms C, E and G.

craA1: 1-2c, 3-2d, 10-12, 14-13, 4-9, 15-19

as magnivalva A1

craB1: Large puff with distal dark bands (groups 7-8) near distal end of arm as magnivalva

craC1: the distinctive groups 3-4 are about one quarter of the arm length from the centromere

craD1: as arm D of magnivalva

craE1 1-3a, 10g-c, 3f-4, 10b-5, 3e-b, 4-3f, 11-13 from cingulatus/magnivalva by Inv10g-3b

craF1: 1-2a, 10d-a, 2b-9, 11-23

as magnivalva F1

craG1: Nucleolus sometimes subterminal, with BR immediately next to it, and two other BRs spread along the arm



Arm G of *C. crassiforceps*

Found: Type locality – Tainan, Taiwan, (Republic of China). Types were in the Natural History Museum in Budapest, and so are lost. Type localities of the synonyms are not in Asia.

Japan - Miyako Island, Okinawa Prefecture, Ryukyu.

Philippines - Sozan, Taihoku.

?Micronesia: S. Mariana Island, Palau, Yap, Caroline Atolls, Ponape, Kusaie, Marshall Is., Gilbert Is.

?Hawaii - Oahu; Molokai.

Some specimens were obtained from a hot spring at temperature 38°C

?Thailand - Ban Bu, Amphoe Muang, Nakhon Ratchasima Province; Ban Kud Khaee Khon Kaen Province; San Pa Tong Rice Experimental Station. Amphoe San Pa Tong, and Doi Inthanon, Amphoe Hang Dong, both Chiang Mai Province; (all Hashimoto *et al.* 1981);

? - the identity of these specimens is uncertain in the absence of cytological or DNA data.

All life stages were redescribed by Tokunaga (1939, 1964). *C. nudipes* was redescribed by Chaudhuri *et al.* (1992).

This species is very closely related to *Chironomus magnivalva* Kieffer which occurs in northern Australia and the Pacific Islands, and to the Indian species *C. nudipes* Kieffer.

***Chironomus (Lobochironomus) dorsalis* (Meigen 1818)**

Described from Japan as *C. longipes* Staeger, which is currently considered to be a synonym of *C. dorsalis*. However it remains to be clarified whether all specimens do belong to a single species.

Larva a medium semi-thummi-type, i.e. small lateral projections and well developed VT. PE with some thinner teeth interspersed between the normal teeth.

Cytology: (based on North American material) 4 polytene chromosomes with the thummi-cytocomplex combination AB, CD, EF, G. Arm G with a subterminal nucleolus, a large BR just proximal to it and another BR near other end of chromosome. Other nucleoli on arms B and D.

Arm A:

Arm E: possibly 1-3c, 9-10a, 8i-a, 3ed, 10b, 5-7, 4-3f, 10c-13.

Arm F:

Found: Type locality - not given

***Chironomus flaviplumus* Tokunaga 1940**

Syn: *Einfeldia okisiroia* Sasa 1993

Was placed as a synonym of *Chironomus samoensis* Edwards by Hashimoto (1977), but this synonymy is considered doubtful (Sasa 1978).

Important features are the LR of about 1.6 – 1.8 and the relatively long anterior Ta5, which is about 0.35 - 0.4 length of anterior Ti.

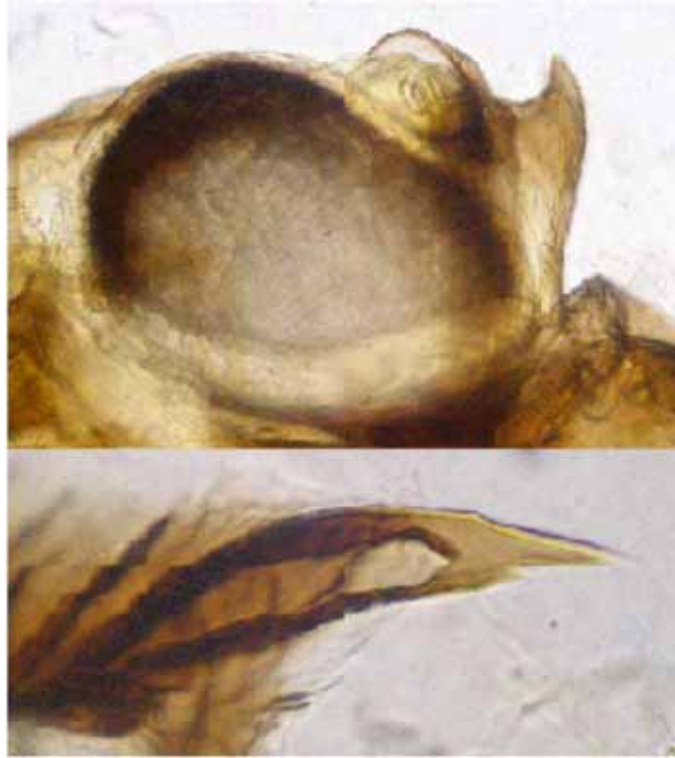
In a later paper, Sasa and Hasegawa (1983) give a much broader range of values (including Ta5/Ti values of only 0.25) which could suggest that they had material of more than one species.

The major reason for doubting the synonymy of *C. flaviplumus* with *C. samoensis* is the higher AR (abt 3.5 - 4) (Sasa 1978), and the difference in the anterior fore leg ratios of the female.

There is also a difference in the distribution of *C. flaviplumus* and the Japanese *C. samoensis*, in that *C. flaviplumus* has a more northerly, cooler, distribution.

However the “*C. samoensis*” used as a laboratory organism and from which the cytology of Japanese specimens is obtained (see below) is probably one of the *C. flaviplumus* types.

Pupa: Exuvia length about 7.8 mm (female), 7.0 - 7.5 mm (male). Caudolateral spur of segment VIII commonly with 3 spines, but range from 1 - 4 (Sasa 1978), often with one longer, stronger spine.



Pupa of *C. flavipumus*.

Larva: a medium sized plumosus-type larva (length about 14.8 mm.). Anterior VT (1.20 mm.) shorter than posterior pair (1.52 mm.). Gula pale or very slightly darkened on posterior third; FA pale. Anal tubules long and cylindrical, as long as the posterior pseudopods, about 5-6 times longer than wide.

Mentum (Fig. b, below) with square sharp teeth, c2 teeth of central trifold tooth well separated from c1 tooth (type II), 4th laterals slightly reduced (type I).

PE (Fig. a, below) with about 16 - 21 variable but sharp teeth. Ventromentum (Fig. c, below) with about 29 - 34 striae.

Antenna (Fig. d, below) with a moderately long basal segment, which is about 4 - 4.5 times as long as wide; AR about 1.75 - 1.96. Antennal proportions: 122 : 31 : 10 : 13 : 6.

Mandible (Fig. e, below) with third inner tooth only slightly darkened (Type I), and with about 12 - 14 furrows on outer surface at the base.

Found: Type locality - Saga, Kyoto, JAPAN.

Also found **Japan:** Kyushuu - Nabikimatsu, Koge-Machi, Chikujyo-gun, Fukuoka Prefecture, Ohta River, Hiroshima Prefecture.

China – Yangtze River basin

But see below.

Four species have been found described under this name based on the available BARCODE sequences, two in Japan, one in China and the Korean material of Ree & Kim (1981), which is actually *C. yoshimatsui*.

Specimens found in Northern Australia are probably a closely related species.

The three types of *C. flaviplumus* are here referred to as Type A, type B, and type C.

Molecular Sequence:

COI The barcode sequence of this species is in Genbank from Japan (2 species) and China (another species, accession numbers KP902730 - 731), and there are also sequences in the Japanese Chironomid DNA Barcode database. The Korean samples in GenBank (accession numbers JF412075 - 077) are misidentified and are actually *C. yoshimatsui*.

If correctly identified, this species can be bred in the laboratory, as Japanese specimens have been maintained in a laboratory culture (Kuhn *et al.* 1987).

***Chironomus flaviplumus* type A.**

This variant was described by Sasa (1968)

Adult

Male: AR about 3.5 - 4.0.

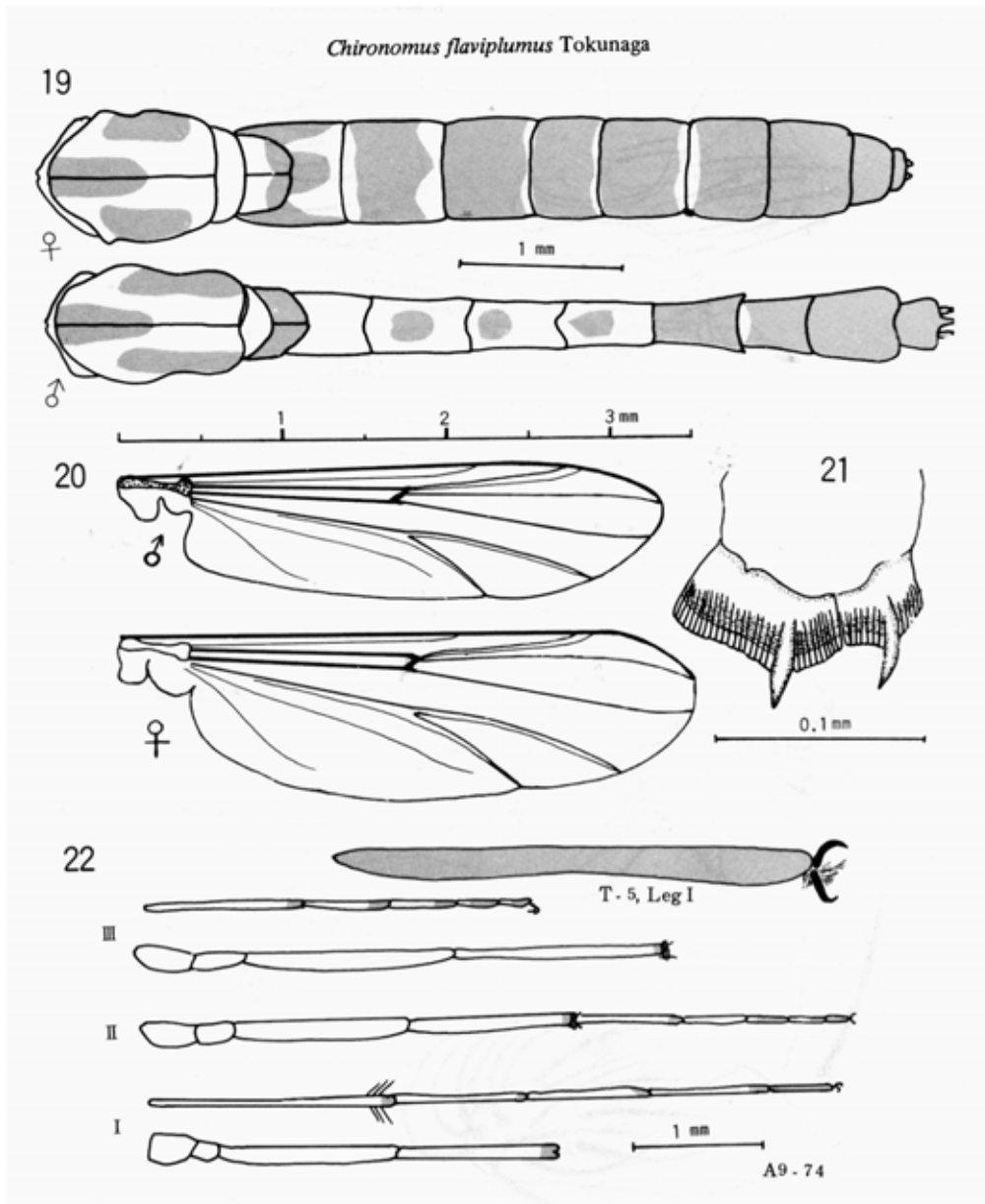
Head: Frontal tubercles about 20 - 39 µm long and 13 µm wide. Palp proportions: 44 : 53 : 189 : 222 : 315.

Wing length: 2.85 - 3.15 mm; wing width 0.30 - 0.67 mm. VR about 1.0

Leg lengths (microns) and proportions as follows:

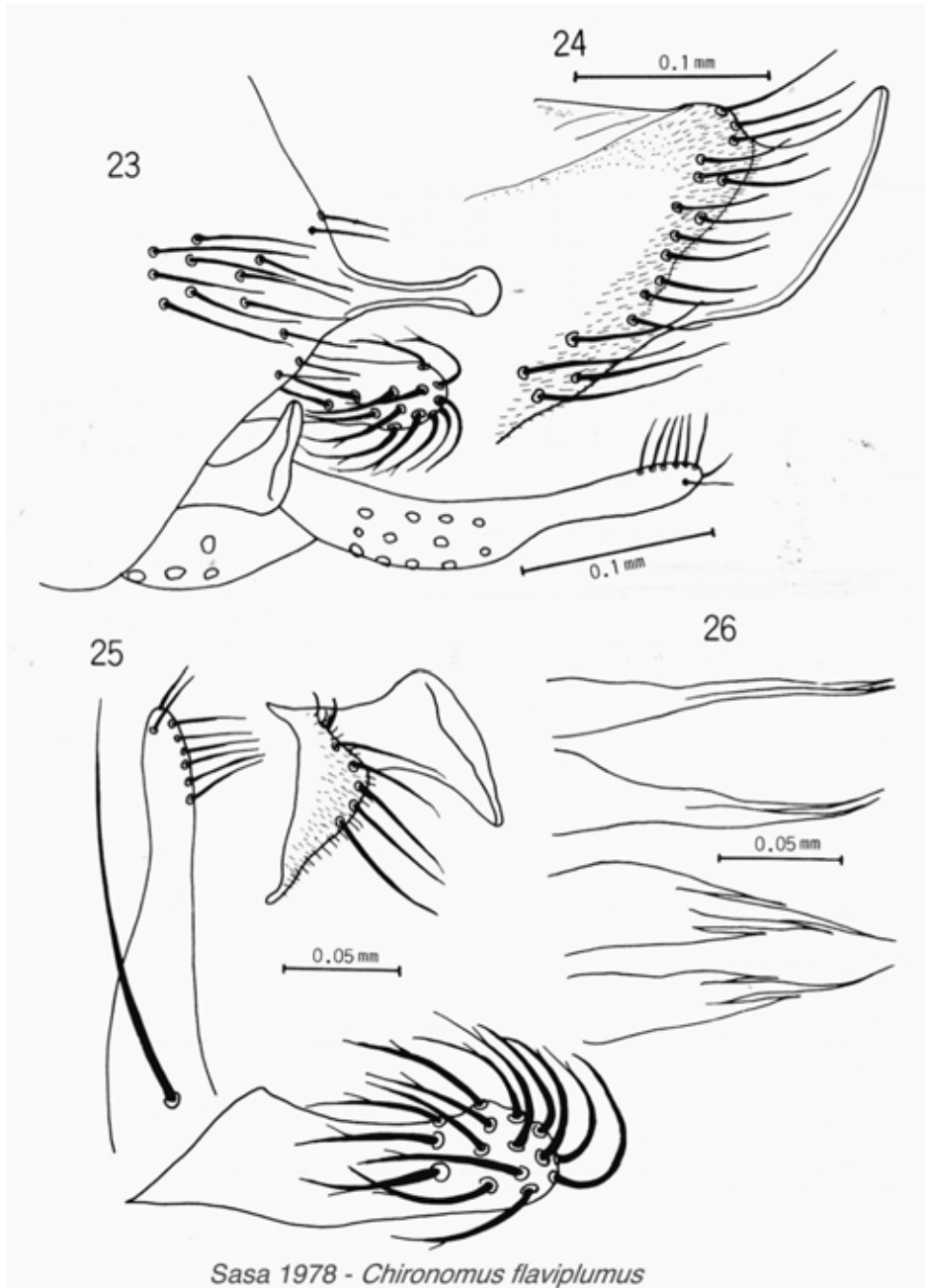
	Fe	Ti	Ta1	Ta2	Ta3
PI	1390	1240	2030	1020	930
PII	1460	1290	810	460	340
PIII	1660	1660	1240	660	490
	Ta4	Ta5	LR	F/T	BR
PI	880	500	1.63	1.12	2.1
PII	190	130	0.62	1.31	
PIII	280	175	0.75	1.00	

Ant Ta5/Ti – 0.40.



Sasa's (1978) illustrations of morphology of *C. flaviplumus*.

Abdominal tergites II-IV with a dark central oval spot, tergites V-VIII almost uniformly dark brown.



Sasa's (1978) illustrations of *C. flaviplumus*: Male hypopygium (top) and superior appendage (right) (note boot shape – S-type). Also Gc (left) and IV (below)

Setae on 9th tergite: 9 - 12. SV “beaked”.

Female

Head: Antennal proportions (micron): 180 : 130 : 140 : 140 : 250.

Frontal tubercles about 26 µm long and 12 µm wide.

Palp proportions (micron): - : 60 : 250 : 250 : 370.

Thorax coloration as in males.

Wing length: 3.5 mm; wing width 1.1.

Leg lengths (microns) and proportions as follows:

	Fe	Ti	Ta1	Ta2	Ta3
PI	1510	1220	2150	1170	1100

PII	1540	1370	830	440	340
PIII	1660	1610	1220	660	500
	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	1100	510	1.76	1.24	0.42
PII	200	140	0.61	1.12	0.10
PIII	290	200	0.76	1.03	0.12

Found Japan: Ohta River, Hiroshima Prefecture.

Molecular Sequence:

MtCOI: Sequence for these specimens is in GenBank (accession numbers AB740235 – 9) and the Japanese Chironomid Barcode Database.

***Chironomus flaviplumus* Type B**

This type was identified as *C. flaviplumus* by H. Yamamoto. BLAST comparisons of available sequences in GenBank or the BOLD Database reveals that the species is widely distributed from Japan, northern Australia, Thailand, India and Afghanistan (as *C. incertipennis*).

This description is based on specimens from India

Adult:

Male: (based on one specimen):

AR about 3, LR not known. Wing length about 3.4 mm; width about 0.73 mm; VR about 1.05.

Frontal tubercles relatively small, 18x13 µm;

Palp proportions (µm) 48: 60 : 240 : 225 : (shrivelled). Clypeal setae about 24.

Thoracic setae: acrostichals - abt 14; dorsocentrals - 14-15; prealar - 6; scutellar - 8 in anterior row, abt. 29 in posterior row (of which 14 are in an intermediate row).

Wing with 2 setae on brachiolum and about 17 on the anal fringe.

Leg lengths (microns) and proportions as follows:

	Fe	Ti	Ta1	Ta2	Ta3
PI	1240	1189	-	-	-
PII	1365	1250	720	415	305
PIII	1520	1505	1105	610	480
	Ta4	Ta5	LR	F/T	BR
PI	-	-	-	1.04	-
PII	210	160	0.58	1.09	
PIII	290	190	0.74	1.01	

Sensilla chaetica: Mid Ta1 - 9,10; Hind Ta1 - 6,6.

SVbeaked, of D-type, between d and e of Strenzke (1959). Setae of IV forked. About 19 setae on tergite IX.

Pupa:

Not known

Larva: a medium length (female abt 12.2 mm) plumosus-type. Anterior VT shorter (abt 2.44 mm) than the posterior pair (abt 2.64 mm); PLT well developed (abt 400 µm). Gular slightly

darkened, FA dark, particular at posterior of head. Mentum with 4th laterals reduced almost to height of 5th laterals (type II), 6th laterals originating slightly below the level of other teeth; teeth relatively sharp; centre trifold tooth with c2 teeth well separated, tending to type IV. VM plates separated by about 30% of the mentum width, with about 42 - 44 striae. PE with about 16 sharp teeth.

Premandible relatively broad and blunt, teeth about equal in length, inner tooth about 1.5 - 2 times the width of the outer tooth.

Antenna with a moderately long basal segment, which is about 4 times as long as wide; AR about 2.06; RO just under half way up from base. Antennal proportions: 130 : 29 : 8 : 13 : 6. Mandible with 3rd inner tooth well developed (type III), about 14 - 15 furrows on inner margin at base.

Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Does not appear to be a nucleolus in arm G, but a large medial BR. Nucleolus in arm F probably at about group 19.

Polymorphism at least in arms D and G.

Arm A2: 1 - 2c, 10 - 12, 3, 14c - 13, 4 - 9, 2ed, 14d - 19 (India)

Arm B2: Puff (group 7) about one third from distal end, with dark bands (group 8) distal to it. possibly as cirB1

Arm C1:

Arm D1:

Arm D2: Small simple inversion near the middle of the arm

Arm E1: 1 - 2c, 5 - 10b, 3e - 2d, 4 - 3f, 10c - 13 (India)

Arm F1: possibly 1 - 2a, 10d-a, 15 - 11, ??, 19-23

Arm G1:

Arm G2: possibly a complex inversion (or 2 simple inversions) involving most of the arm. (A2 and B2 are relative to *C. nr. samoensis* (see below))

India - Jammu & Kashmir: Bishnah wetlands; Deoli Village; Farooq Nagar; Gadhighargh; Sangrampur Village.

Thailand -

Australia - Twin Falls, Kakadu Natl. Park, Northern Territory. **Adult:**

Male:

Larva: a medium length (female abt ??? mm) plumosus-type.

Found **Japan:** Kyushu - Nabikimatsu, Koge-Machi, Chikujyo-gun, Fukuoka Prefecture.
India: Jammu & Kashmir - Bishnah wetland; Deoli Village; Farooq Nagar; Univ. Jammu & Kashmir, Jammu.
Singapore: Bedok Canal

Molecular Sequence:

MtCOI: A sequence from Japan and several from India are in the data of J. Martin.

Indian specimens differ by less than 1% from that of *C. incertipenis*, but are two apparently consistent base differences

It includes some of those Indian samples (besides *C. indiaensis*) that have been classed as “*C. samoensis*” or “*C. nr. samoensis*”.

This may well be *C. incertipennis* (see above) but there is some doubt that it has the dark anal point characteristic of that species.

***Chironomus flaviplumus* Type C**

This type was identified as *C. flaviplumus* from the Yangtze River basin in China, for which only the DNA BARCODE sequence is available. Limited information on the larva was available from Thailand.

Larva: The larvae of this species are a plumosus-type larva, very similar to those of *C. striatipennis*,

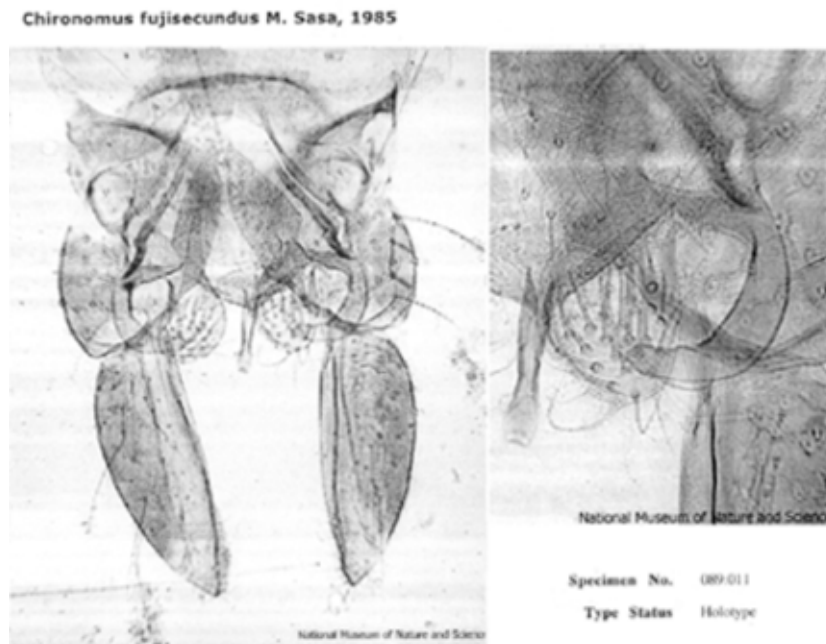
Molecular Sequence:

COI – GenBank accession nos. for Chinese specimens are KP902730 &31. and for Thailand KT213029- 038. In BOLD they have 99.5% similarity to an early release sequence named as ChironomidaeGC sp. 7 from Queensland, Australia.

Found: **China** – Yangtze River basin
 Thailand - Maha Sarakham; Buriram.

***Chironomus fujisecondus* Sasa 1985**

Adult:



***Chironomus fusciceps* Yamamoto 1990**

as new name for *Chironomus lugubris* sensu Tokunaga 1938, and Sasa & Yamamoto (1977) .

Also called *Chironomus thmini* (misspelling of thummi?) Tokunaga 1940 and *Chironomus riparius* Sasa & Yamamoto 1977.

Adult:

Information from Yamamoto 1990.

Male:

AR 2.15-2.67. Frontal tubercle about 12.5-30 µm long, 10-15 µm wide.

Wing length 1.8- 2.6 mm, width 0.6-0.8 mm. VR 0.88-0.93. Squama with 10-20 setae.

Thoracic setae:

Pupa: Postero-lateral spurs of segment VIII with 1 - 2 spines

Larva: A small (length - 10 mm) thummi-type larvae. Anal tubules well developed, dorsal pair shorter than the ventral pair. Head uniformly dark brown.

Found: Type locality – Mount Unzen, Nagasaki Prefecture, JAPAN.

Also found **Japan:** - Tarutama, Kumamoto Prefecture.

Found in sulphur-containing water.

***Chironomus incertipenis* Chaudhuri & Das**

Chironomus species 1 Sharma *et al.* 1990

Chironomus niger Chaudhuri, Das & Sublette 1992: 21 (Name preoccupied by Wiedemann)

Chironomus plumosus form A Tripathi *et al.* 2002 (probable synonymy)

Chironomus plumosus form B Sharma *et al.* 2004

Adult:

Male

Wing length 2.34 (1.96-2.40) mm. Wing width 0.78 (0.68-0.82) mm. VR 1.01 (1.00-1.03).

Head:

Abdomen yellowish, with brown oval median spot. Anal point dark brown and pointed.

About 8-14 setae on tergite IX. SV appears to be a D-type, but may have a beak like some members of the *C. samoensis* group.

Larva: A small to medium plumosus-type (length 6.25-12.6 mm). Gular region and FA apparently not darkened. Anterior VT longer than posterior pair. Anal tubules about 300 µm long. Mentum with c2 teeth of central trifold tooth of well separated (type II), 4th laterals slightly reduced (type I-II).

PE with 15 teeth. Premandible with outer tooth longer and sharp, inner tooth blunt.

Antenna with basal segment three times as long as wide, RO about one third up from base; AR 1.74 - 1.79; segments in ratio 22 : 6 : 2 : 3 : 2.

Mandible with 3rd inner tooth developed.

Cytology: Four polytene chromosomes with the pseudothummi-cytochrome combination BF, CD, AE, G.

Nucleolus in arm F. Arm G partly unpaired at one end, with prominent BR about one third from the other end.

Polymorphism in arms B, C, and F: incC1 occurs in Varanasi while incC2 has been found at Jammu, with no heterozygotes presently known.

incA1:	1 - 2, 10 - 12, 3, 9 - 4, 13 - 19	as <i>circumdatus</i> A2, <i>holomelas</i> , <i>ramosus</i>
incB1:	Puff near centre of the arm with dark bands proximal (gps 7 - 8)	as nr. <i>samoensis</i> B1
incC1:		
incC2	Inversion of about two thirds of the arm	as <i>ramosus</i>
incD1:		
incE1:	1 - 2b, 5 - 10b, 3e - 2c, 4 - 3f, 10c - 13	as <i>ramosus</i>
incF1:	1 - 2a, 10 - 3d, 14c - 11, 2b - 3c, 14d - 23	Nucleolus in region 20. as <i>flaviplumus</i> (<i>samoensis</i> sensu Wülker <i>et al.</i> 1989)

Found: Type locality - Barasat, West Bengal, INDIA.

Other Indian localities: Varanasi - Banaras Hindu University.
Singapore, and Japan

All life stages described by Chaudhuri *et al.* (1992) as *C. niger*. Chromosomes described by De & Gupta (1994), as *C. niger*, and as *Chironomus* species 1 by Sharma *et al.* (1990). Sharma *et al.* (2004) published the chromosomes of this species as *Chironomus plumosus* form B (although it has no relationship whatever to *C. plumosus*) and incorrectly placed it in the thummi-cytocomplex. The similarly incorrect form A is very likely also this species. The original Chaudhuri *et al.* (1992) name related to the dark anal point.

***Chironomus incertus* Kieffer 1924**

Junior homonym of *C. incertus* Walker 1856. Therefore new name required.

Placed in subgenus *Camptochironomus*.

Known only from the adult

Male:

Description of Kieffer, largely from translation by Johannsen 1932.

Yellowish. Eyes separated by their greatest width, thin part longer than wide. Palps long, 1st segment not much longer than high, 2nd and 3rd subequal, 4th little longer than the third (current 2nd-5th segments). Scape kidney shaped, antenna broken

Thorax shining, three vittae on mesonotum and mesosternum tawny, metanotum black, halteres white. Wing hyaline, lobed, finely stippled, the cubitus forks distad of the crossvein. Legs bright (or pale) yellow, extremity of femur black, fore tibia black with a dark yellow preapical band, last two or three segments of the mid a hind tarsi dark, middle and hind tibiae each with two spurs, the one on the small combs as long as the one on the large combs. Pulvilli also as long as the empodium, a little shorter than the claws, with numerous median branches. Tergites with a large dark spot.

Hypopygium dark brown, formed as in *Camptochironomus*, except the ninth tergite; terminal segments curved on the outside, free to the medial side whose distal third has fine hairs; SV yellowish, curved, glabrous barely exceeding the gonocoxite, most of the distal two thirds is very slender and ending in a point, proximal third more than twice as wide and bearing on medial side five long aligned bristles; IV linear, with just over half the width of the terminal segment, then reach the final third their surface pubescent, the distal half has large dorsal setae, long and curved; ninth tergite yellow, formed as in *Chironomus*, the point black, reflexed at tip. L. 5 mm.

Found: Type locality – Buitenzorg, Java, INDONESIA

***Chironomus indiaensis* Martin 2011**

New name for *Chironomus samoensis sensu* Chattopadhyay *et al.* 1991

Description and metrics based on Chattopadhyay *et al.* (1991)

Adult:

Male: Wing length 2.53 - 2.58 mm, wing width 0.73-0.76, VR 1.02. AR 2.99.

LR 1.41

Brownish species; yellow thorax with brown vittae, abdomen light brown to brown with median grey spots on segments II-VI. Legs yellow.

Head: Frontal tubercles present, abt 180 µm; abt 23 - 25 clypeal setae

Palpal proportions (arbitrary units): 10 : 12 : 59 : 61 : 81.

Thorax: Setae - Achrostical 14; dorsolateral 11 - 12; prealar 6; scutellar in two or three rows, ant. row 9 - 10 small setae, post. rows 10 - 12 long setae.

Leg proportions (arbitrary units):

	Fe	Ti	Ta1	Ta2	Ta3
PI	42	39	55	30	26
PII	45	38	24	13	8
PIII	49	50	35	20	15
	Ta4	Ta5	LR	F/T	BR
PI	23	11	1.41	1.08	2.44
PII	6	4	0.63	1.18	
PIII	9	5	0.70	0.98	

AntTa5 about 0.28 of Ti.

Hypopygium with stout anal point, 5-6 basal setae, about 13 setae on tergite 9. SV a boot or shoe shape (S-type of Strenzke); IV with 13-15 bifid or trifid setae.

Differs from *C. samoensis* where the frontal tubercles are longer (33-38 micron); the LR is greater (1.82 - 1.96); and the fore Ta5 is relatively longer (0.35 - 0.4 of the length of fore. Ti).

Female:

Wing length about 2.79 - 2.83 mm, wing width 0.76-0.77. AR 0.39.

Antennal proportions: 13 : 9 : 8 : 8 : 15.

The description of the female of this species does not mention the unusually long foreTa4 noted by Tokunaga (1964), which appears to be characteristic of *C. samoensis*.

Pupa: Length 6.51 (5.99 - 6.61) mm in males, 7.21 (7.01 - 7.53) in females. Colour brown, but pupal exuviae pale brown. Frontal tubercles 75 µm long and 57 µm wide at base, subapical seta 39 µm long.

Thorax rugose, wing sheath 1.69 mm long.

About 84 - 96 hooklets on tergite II, tergites II-VII with median shagreen, tergite VIII with 2 median patches of shagreen. Pedes spurii A caudolateral on segments IV-Vii, pedes spurii B caudolateral on segment II. Tergite I bare, tergite II-VII with median shagreen, tergite VIII with 2 median patches of shagreen.

Caudolateral spurs of segment VIII with 2 - 4 spines.

Larva: a small to medium plumosus type (8.41 - 9.83 mm), with anterior VT shorter than posterior pair; anal tubules tubular, about 340µm long.

Head capsule described as brown, but only mention of darkening is on the occipital margin. Antenna with basal segment about 2.7 times longer than wide, RO only about a quarter up from base; AR 1.86; blade 390 µm, accessory blade 150 µm long; ratio of antennal segments (micron): 80 : 25 : 9 : 6 : 3.

Mentum shown as type I-II, i.e. 4th laterals appear slightly reduced, but laterals noted as gradually reducing in size.

PE with 14 teeth. Premandible with outer tooth longer.

Mandible shown with 3rd inner tooth only partially separated and pigmented.

The most obvious difference from the larva of *C. samoensis* is that antennal segment A4 of that species is longer than A3, while the relative lengths are reversed in this species.

Cytology: - not known.

Found: West Bengal – Berhampur, Farakka, Burdwan,
No type has been designated, but the specimens are stated to be in the National Zoological Survey of India, Calcutta; the British Museum (Natural History), London; and the United States National Museum, Washington, D.C.

***Chironomus javanus* Kieffer 1924**

Syn.: *Chironomus daitocedeus* Sasa et Suzuki, 2001 (Yamamoto, unpubl.)

Chironomus prasinellus - Tokunaga 1940 (misidentified)

Chironomus vitellinus Freeman 1961 (Chaudhuri *et al.* 1992)

Yamamoto (2002) has suggested that this species should be in a separate subgenus *Austrochironomus*, as type of the subgenus. There is some doubt as to whether this publication meets the requirements for a valid description.

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 1/2 : 2 : 3/4 [i.e. LR = 1.80], the 4th segment is longer than 3rd, the four hind tibiae 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 curved setae. Anal point long and thin. L. 4.5 mm.

Male:

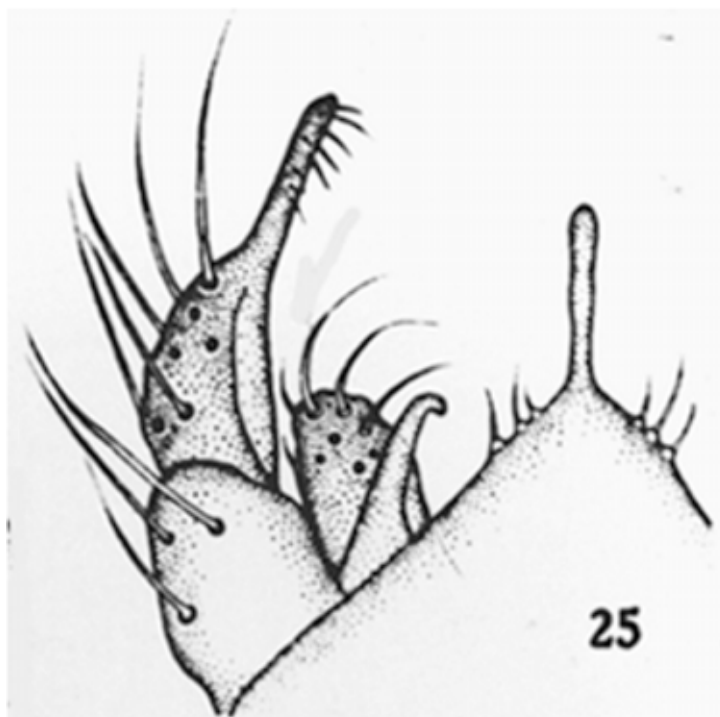


Illustration of the hypopygium of *C. javanus*

From Johannsen (1932)

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

Thorax yolky colour, dull with practically no pruinosity. Abdomen without dark markings but with strong pruinosity at the incisures and on segments 5 and 7. 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)).

Wing length 2.07 - 3.0 (2.75) mm, width 0.56 - 0.73 (0.62) mm; VR 1.05 - 1.08.

Head Frontal tubercles about 30 μ m; about 17-21 clypeal setae;

Palpal proportions (segs. 1 - 5) (μ m): 60 : 60 : 185 : 220 : 330

Thoracic setae: acrostichals abt 10, but often not evident; 6 - 14 dorsolaterals; 2 - 4 prealars; scutellars abt 8, often not evident.

Wing Hyaline, brachiolum with 2 SCf; squama with 8 setae.

Leg proportions and ratios (microns):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1215	1050	1120	955	840
PII	1305	1120	725	375	280
PIII	1445	1445	1120	605	470
	Ta4	Ta5	LR	F/T	BR
PI	770	350	1.6-1.8	1.15	2.1-2.5
PII	185	140	0.60-0.64	1.16	-
PIII	300	160	0.70-0.77	1.00	-

Hypopygium with long tubular anal point, SV well developed and curved, IV with 12 -14 incurved setae.

Female

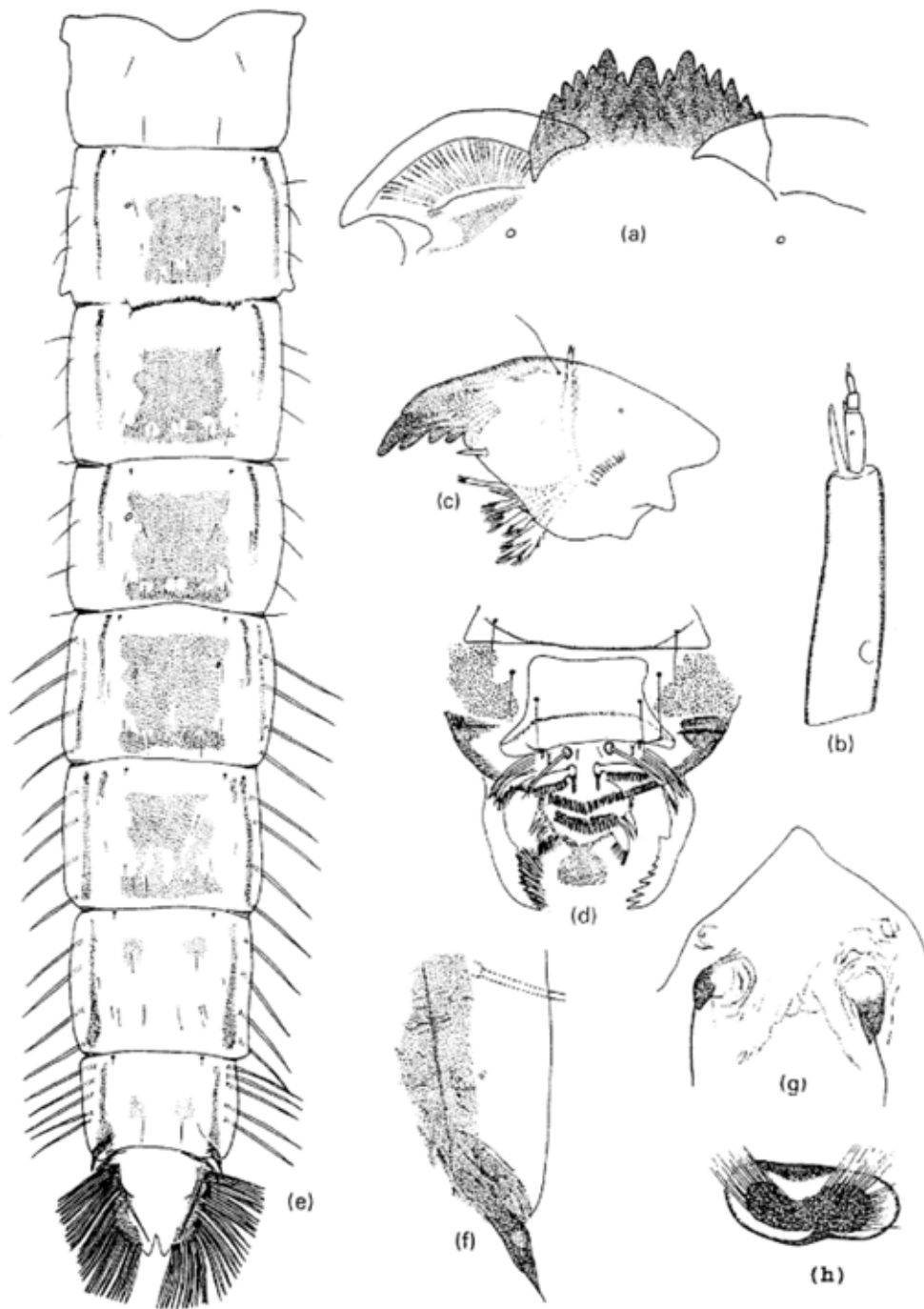
Body length 3.57 - 3.89 (3.69) mm. Wing length 2.08 - 2.93 (2.57) mm; width 0.66 - 0.96 (0.83) mm.

Thoracic setae: acrostichals 20-26.

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.



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)

Larva: Medium sized plumosus-type larva (length fem. 9.3-13.7 mm (11), male 13.0 mm (1)), although PLT (about 380 micron long) are more ventrally placed than in other

species. Chaudhuri et al. (1992) show the VT arising very close together, but this is not normal in this species from other countries. Anal tubules variable across distribution from about 220-425 microns long, and 3-3.6 times longer than wide with median constriction.

Gula pale or slightly darkened on posterior third; frontoclypeus generally not darkened.

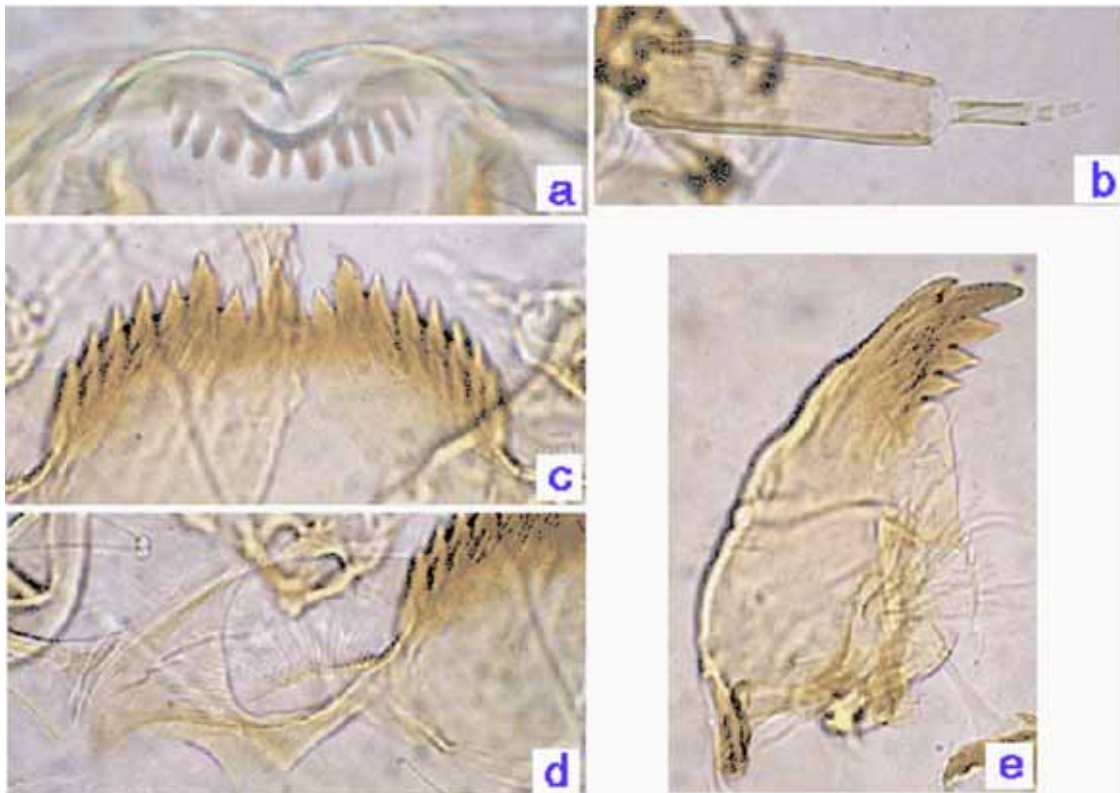
Mentum (c, below) with the central trifid tooth set below the 1st laterals, and the c2 teeth markedly separated from c1 tooth (type III) and pointed towards it; 4th laterals at most slightly reduced (type I).

PE (a, below) with about 12 - 13 often irregular teeth. 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 striae at the base.



The larva is most readily recognized by the unusual premandible, which has 6 (as illustrated

by Chaudhuri *et al.* (1992) for Indian specimens) or 7 (as illustrated below) teeth rather than the usual two. However, specimens have been described from Malaysia and Singapore (e.g. Kuvangkadilok 1969) where the premandible has a normal premandible with only two teeth.



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

Cytology: Four polytene chromosomes with the thummi-cytocomplex combination, AB, CD, EF, G. Subterminal nucleolus in arm G, with prominent BR about one third from the other end. Dr. Midya has an alternative species from India identified as *C. javanus*.

javA1:

javB1: Puff (gp. 7) about one third from distal end of the arm with dark bands distal.

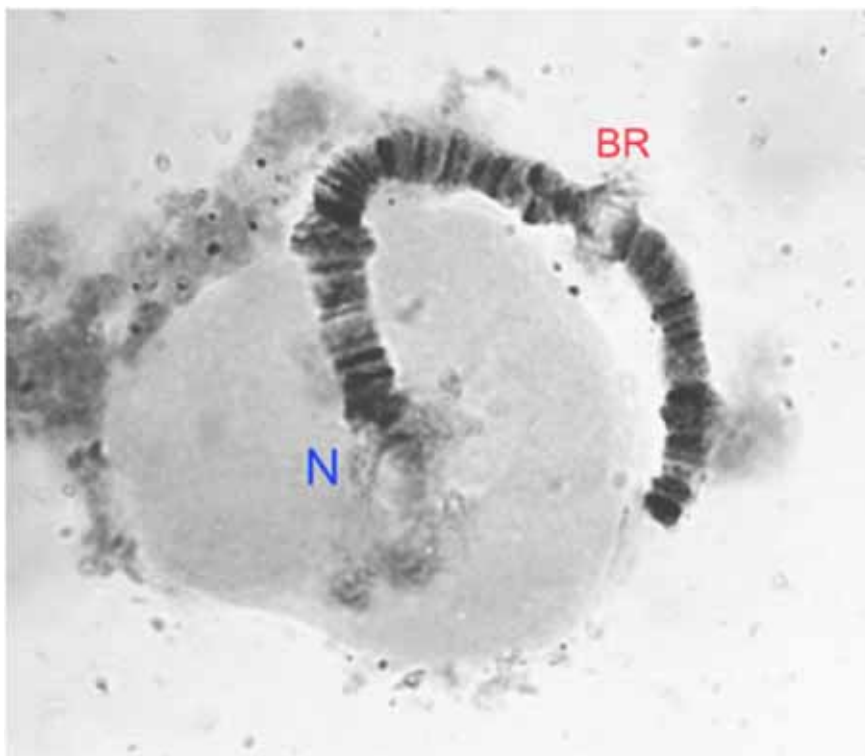
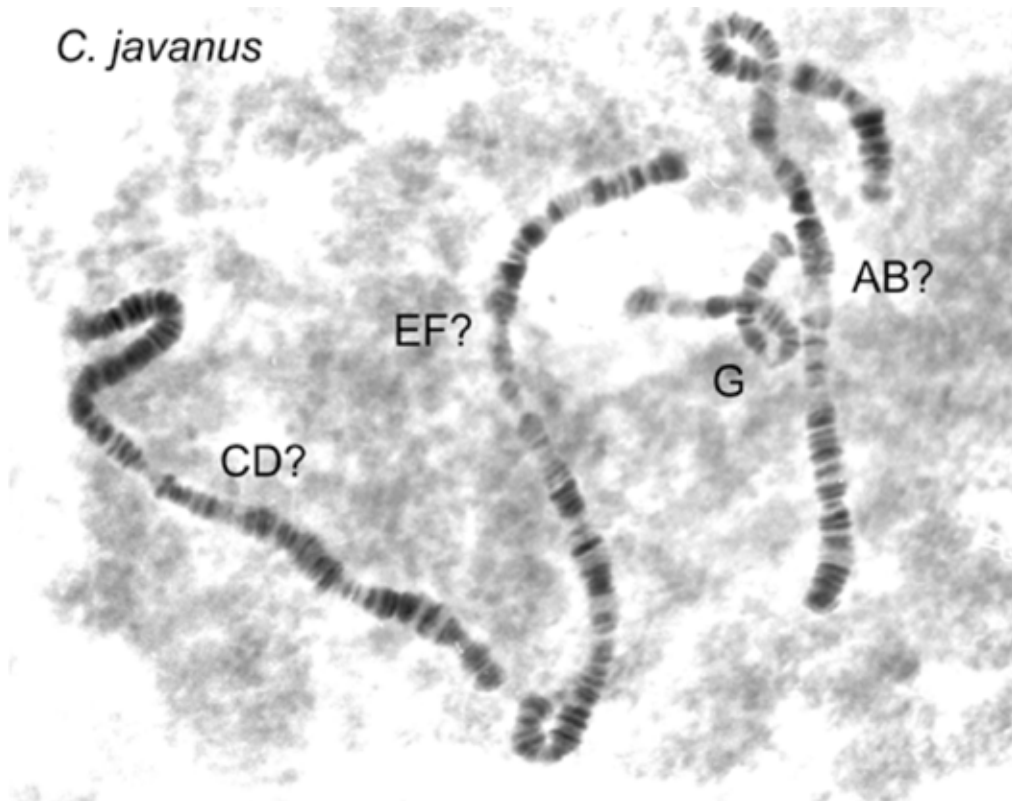
javC1:

javD1:

javE1:

javF1:

javG1: Nucleolus subterminal, BR about one third from other end; closely paired.



Molecular: The mitochondrial cox1 barcode sequence is available in GenBank (Accession number DQ648203) for a specimen from Japan.

Found: Type locality - **Buitenzorg, Java, INDONESIA**. also ; Sumatra (Johannsen 1932).

India - Jammu & Kashmir: University of Jammu Campus (32.73; 74.87).

Japan - Shizuoka, Shizuoka Prefecture, Honshu (34.989; 138.38).

Malaysia - Minden (5.13; 100.13) and Bukit Merah Rice Res. Stn, Permatang Pauh, Penang; Tregganu.

Thailand - Ban Bangkanark, Chachoengsao Province; San Pa Tong Rice Experimental Station, Amphoe San Pa Tong, Chiang Mai Province; Ban Mae Kachiang, Amphoe Wiang Pa Pao, Chiang Rai Province (Hashimoto *et al.* 1981)

Other regions:

Fiji - Viti Levu

Melanesia - Caroline Islands and Marshall Islands.

Central Africa - Blantyre, Malawi.

Australia - Manning River, Kundibakh, New South Wales; Darwin, Northern Territory (type locality of *C. vitellinus*); Mareeba; Sarina; and 3 km w. Sarina Beach, Queensland.

Papua New Guinea - Mafulu (1200 m), Lae-Goroka Road, Eastern Highlands Province; Sogeri, Central Province

Broadly distributed through India, south east Asia, the Pacific regions and Africa, in rice paddies and small temporary water bodies, even sewage works.

The adult male was described from Thailand by Hashimoto *et al.* (1981), and all stages for India by Chaudhuri, Das & Sublette (1992). The cytological description given here is based on Australian, Papua New Guinea and Japanese specimens. Includes species PK3.

***Chironomus javanus* (sensu T. Midya)**

Larva: Not seen. This may be the larva with a standard *Chironomus* premandible (e.g. Kuvangkadilok 1969)

Cytology: Four polytene chromosomes with the pseudothummi-cytochrome combination BF, CD, AE, G. Nucleoli in arms C (or D?) and A. Arm G subacrocentric and closely paired, with a BR near the centre of the chromosome and another near the distal end. No reported polymorphism.

Found: India: Calcutta area.

***Chironomus kiiensis* Tokunaga 1936**

As currently used, this name is a junior synonym of *C. striatipennis* Kieffer 1910 (Pramual, Simwisat & Martin 2015, in press, see under that species). The location of type material is not recorded, so it is not certain whether the original specimens are identical to those currently recognized, since morphological and DNA data from Japan and Korea does indicate the presence of a second species with similarly patterned wings.

However, considering the extensive use of the name for specimens of *C. striatipennis*, it is recommended that the name NOT BE USED, as its application to a different taxon would only cause further confusion.

Several names have been synonymised with *C. kiiensis*, but these are either synonyms of *C. striatipennis* or distinct species:

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

C. pallidinubeculosus Tokunaga 1964 - incorrect synonymy by Hashimoto *et al.* 1981, as this is a distinct species with similarly patterned wings.

Tokunaga's original description of the male is given here for information:

Adult.

Male

CHIRONOMUS (CHIRONOMUS) KIIENSIS sp. nov.

This species is commonly found at Seto and females are often captured at light ashore in summer.

Male.—Body slender, ground color yellow, about 5 mm long.

Frontal tubercles present, small; antennae 12-segmented, brown; second antennal segment yellow, but its distal end brown; antennal ratio about 3.2 to 3.3; maxillary palpi distinctly 4-segmented (3 : 7 : 7 : 11); last maxillary palpal segment yellow; frontoclypeus with many long brown setae.

Scutum with distinct reddish brown vittae; median vitta with a longitudinal, pale, median line; pale posterior region of the scutum with a fine, dark, median line; scutellum yellow, setigerous, its lateral margins brown; sternal side of the mesosternepisternum reddish brown; mesonotepisternum, mesonotepimeron, and mesosternepimeron each with a reddish brown spot near base of wing articulation; supra-alar setal group represented by five to seven small setae.

Abdomen slender, yellowish; first tergum with two pairs of brown stripes: mesal pair small and lateral pair long and oblique; second to fourth terga each with a median I-shaped brown stripe; following three terga entirely brown, stripes being obscure, each with a brown V-shaped chitinization on its meson. Hypopygium (Plate 3, fig. 23) brown, setigerous; ultimate tergum with a small, oval, setigerous plate and V-shaped chitinization on meson; its caudal setae near basis of anal point slender; anal point strongly chitinized, bare, curved ventrad, not trilobed apically; coxites slightly constricted, each with five slender setae on its ventromesal ridge; styles distinctly narrowed on apical one-third, each provided with six, small, strong setae on apex and about thirteen, small, slender setae on ventral ridge of style; dorsal appendages large and slender, not extending to tip of anal point, bare, strongly curved ventrad, each with a few setae on its basal pubescent area; ventral appendages large and straight, extending far beyond middle of styles, provided with many, strong, recurved setae and a few slender setae on apical one-third.

Legs yellow in ground color; coxae and trochanters brown; femora each with a distinct brown ring just before distal tip; two distal segments and distal ends of three proximal segments of each tarsus reddish brown; forelegs without tibial spurs; each tibia of the middle and hind legs provided with two basally fused combs, which occupy about three-fourths the circumference of tibial end; two tibial combs each provided with a small spur; fore tarsal segments have the following proportional lengths: 80 : 45 : 30 : 24 : 12; leg ratio 1.7 to 1.8; claws simple; empodium slender, setigerous; pulvilli large, padlike, setigerous, extended distad far beyond middle of claws.

Wings slightly clouded; two elongated nebulae in cell R₁, a narrow nebula in cell M₂ along vein M_{1,2}, narrow nebulae along veins M_{3,4}, Cu₁, 1A, and 2A; r-m distinctly darkened; fCu beyond the crossvein; R_{2,3} extended closely along R₁, ending slightly distad of the end of R₁; Cu₁ and 1A slightly sinuous on distal parts; R, R₁, and R_{3,4} brown, setigerous. Halteres yellow.



Original description of *C. kiiensis* male from Tokunaga 1936

Tokunaga's illustration suggests the SV is similar to that of the other members of this group, i.e. an E-type, perhaps closest to fig. h of Strenke (1959), but end more sharply curved.

Molecular:

MtCOI: Barcode sequence attributed to this species exists for a number of specimens from a number of areas, and falls into 3 groups. The majority of sequences refer to *C. striatipennis*, but there are four sequences in GenBank that differ from them by about 9%. These may be *C. kiiensis*, but note caution above.

The GenBank accession numbers are: JQ350720 (Korea), AB740240 (Ibaraki, Miho, Yogoiri headrace), AB838642 (Japan), AB838644 (Japan).

Found: JAPAN - Seto, Wakayama Prefecture (Type locality)

Chironomus nippodorsalis

Molecular:

MtcoxI sequence in GenBank suggests that this species may be a junior synonym of *Chironomus alpestris* Wuelker & Kloetzli.

Chironomus nipponensis

Molecular:

MtcoxI sequence in GenBank shows some differentiation between high and low altitude populations, consistent with the view of Yamamoto (2010) that there were morphological differences between these habitats.

***Chironomus nudipes* Kieffer 1911**

Redescribed by Chaudhuri *et al.* (1992)

May be senior synonym for *C. crassiforceps*

Adult:

KIEFFER, J. J. - Records of the Indian Museum **6**(3): 164 (1911)

Male. Head, palps, scape and thorax reddish, antenna brown; mesonotum whitish yellow and lustrous, with three furruginous bands, of which the median is gradually becoming thinner into a line percurrent to the rear, the laterals foreshortened at the front; halteres white, legs yellow, the two or three last segments of tarsi becoming darker; anterior half of abdomen green, posterior half brown like the claspers. Eyes separated by the distance of their own width. Segments 3 - 13 of the antennae a little transverse(?), 14th half as long again as the 12 previous segments together, plumes brown. Wings hyaline, veins pale, radius equally distant from the point of the wing as the anterior branch, very near to the 2nd longitudinal; cubitus not extending beyond the costal, more distant from the point of the discoidal; crossvein oblique, situated above the bifurcation of the posticale. Anterior metatarsus nearly double the tibia, which is a little shorter than the femur, 4th segment longer than the 3rd, more than twice as long as the 5th, the latter 8 times as long as wide(?); claws without long hairs, subglabrous.

Lamellae of the claspers with a prolongation to a point, terminal segment a little longer than the basal, slightly thinner at its rear, lobe extending notably to the middle of the terminal segment.

Length 4.5 mm.

Calcutta, 10-viii-1907 (N. Annandale).

Additional data from Chaudhuri *et al.* (1992):

AR 2.03 - 2.09; Clypeal setae 22- 24; relative lengths of palp segments 12 : 11 : 38 : 40 : 56.

Wing length 1.50 - 1.61 mm, width 0.48 - 0.57 mm; VR 1.00 - 1.10.

Leg proportions and ratios (units not stated):

	Fe	Ti	Ta1	Ta2	Ta3
PI	60	52	85	43	37
PII	64	63	30	18	15
PIII	54	72	45	25	22
	Ta4	Ta5	LR	F/T	BR
PI	36	19	1.5-1.63	1.15	No beard
PII	12	9	0.47	1.02	-
PIII	13	9	0.62	0.75	-

Fore tibial scale with 2 long setae.

Abdomen brown, tergites VI-VIII with dark brown oval/round median spot. SV bowshaped, IV long, curved, expanded at the end with 12 - 20 incurved setae along the inner margin.

Female: Unknown.

Pupa:

Larva: a small plumosus-type, length about 6.53 – 9.38 mm.

Mentum with 4th laterals reduced (type II), central tooth of type III.

Ventromentum with striae almost to anterior margin.

PE with 17 teeth. Premandible with two unequal teeth, outer longer.

Antenna with basal segment about 2.8 – 2.9 times longer than wide; AR about 1.6 – 1.9; segments proportions (µm) 90 : 21 : 8 : 11 : 7 .

This species could be the senior synonym of *C. crassiforceps*, but this requires a detailed comparison of the two species. Chaudhuri *et al.* (1992) state the long setae on the scale of the fore tibia is distinctive, but this character needs further investigation since the limit of other bristles of the tibia is not shown. In some other species, including the probably closely related *C. crassiforceps* and *C. magnivalva*, there are long setae at the base of the scale, one of which may be moved into the basal third. However the relatively short posterior tibia (only three quarters of the length of the femur), may be distinctive.

The synonym listed by Chaudhuri, *C. sp. Ikwma(sic)* from Ikema Island, Japan, is almost certainly *C. crassiforceps*.

***C. okinawanus* Hasegawa & Sasa 1987**

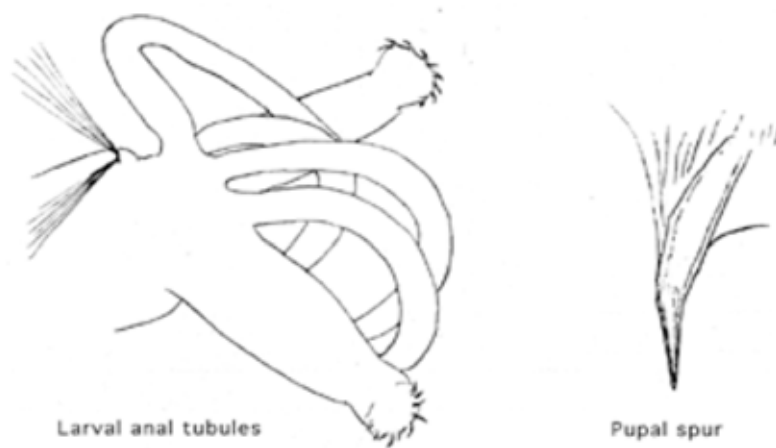
Yamamoto (2002) has suggested that this species should be in a separate subgenus

Austrochironomus.

Found: Type locality - Okinawa, Japan.

***Chironomus palpalis* Johannsen 1932**

Adult:



Illustrations of parts of the immatures of *C. palpalis* by Lenz 1937.

Pupa: Integument moderately pale, length about 7-8 mm. Caudolateral spur of segment VIII with only a single spine (see figure above).

Larva: A small to moderate plumosus-type larva, about 13 mm long; long ventral tubules and long lateral tubule on segment 10; very long anal tubules (see figure above).

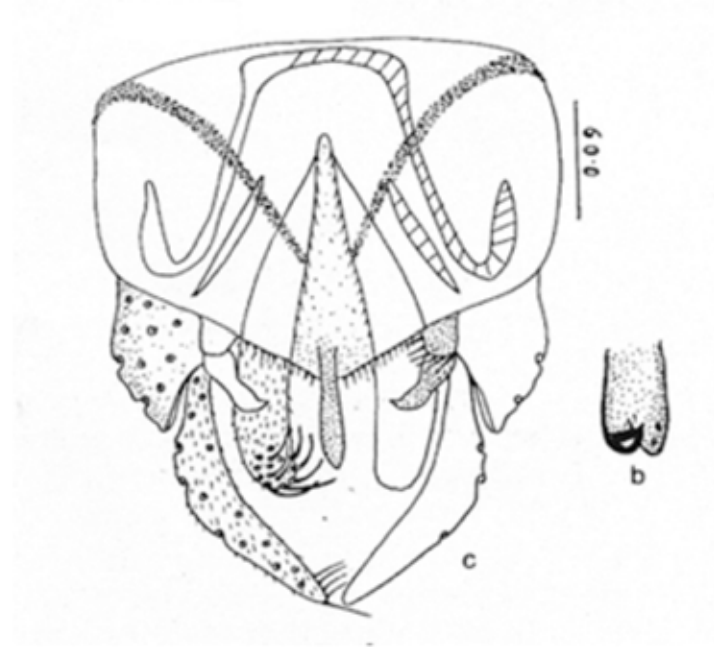
Found: Type locality – Tjurup and L. Ranua, Sumatra.

In lake at depth of 45 m.

Larva and pupa described by Lenz 1937 from material collected by Johannsen.

***Chironomus pulcher* Wiedermann 1830**

Adult: (based on description of Indian specimens by Chaudhuri *et al.* (1992).



Male: Body length 4.78 - 4.85 mm; wing 3.19 mm long, 0.58 mm wide; VR abt 1.04. AR abt 3.43.

Head: Yellowish brown, antennae and palps brown; frontal tubercles present; clypeus with 18 - 20 setae. Ratio of maxillary palp segments: 8 : 12: 42 : 40 : 60.

Thorax: Greenish yellow, mesoscutum with 3 dark yellow vittae.

Setae: Achrostichals 16, dorsocentrals 14 - 15, humerals 2, prealars 4, scutellar 12.

Legs: Yellowish green, tarsal segments slightly darker at apices.

Fore tibia with blunt scale (see b above) with 2 long setae.

Anterior LR abt 1.54; mid LR abt 0.63, hind LR abt 0.69.

Abdomen: Tergites greenish yellow with slightly darker markings on the middorsal line.

Hypopygium as illustrated above, anal point narrow, slightly expanded subapically; SV of D-type.

Larva: A plumosus-type larva.

Cytology: Wülker et al. (2011) have given a description of the banding sequences of specimens tentatively described as *C. pulcher* from Kenya in Africa. Three polytene chromosomes with the modified thummi cytochrome complex arm combination AE, CD, FEG. Centromeric bands not heterochromatic, nucleolus terminal in arm F, but nucleolus-like bodies at the ends of arms A, B, and G.

pulA1: 1 - 3, 8 - 6, 16d - 17, 11e - 9, 4ab, 5 - 4c, 16c - 12, 18 - 19

pulB1: Characteristic bands near centromere, puff developed about 1/3 from distal end.

pulC1:

pucC2: Inversion of most of the arm.

pulD1: 1 - 3, 11 - 12, 10e-a, 13 - 19b, 4 - 9, 19c - 24

pulE1: 1 - 2, 6e - 4, 13 - 12, 3f-a, 6f - 11, 13

pulF1: 1 - 10, 19 - 11, 20 - 23

pulG1: Large BR near site of fusion, small BR or puff in center of the arm, with a possible small nucleolus at the telomeric end.

Found: Type locality "Cape", South Africa.
India:

***Chironomus ramosus* Chaudhuri et al. 1992**

Adult: Wing length 2.33 (2.27-2.40), wing width 0.72 (0.70-0.76). VR 1.01 (1.00-1.03).

Head: AR 3.86 (3.72-3.94) Ratio of palp segments: 14 : 11 : 47 : 48 : 66. Clypeal setae 20 (18-20).

Mesonotum with 4 brown vittae; fore tibial scale with 4 long setae; tarsomeres of foreleg dark brown,

Abdomen: Greenish yellow, tergites I-VI with brown oval spot medially; curved anal point, beak-like SV (as in *C. samoensis*, *C. flaviplumus*, etc.); setae of IV finely branched.

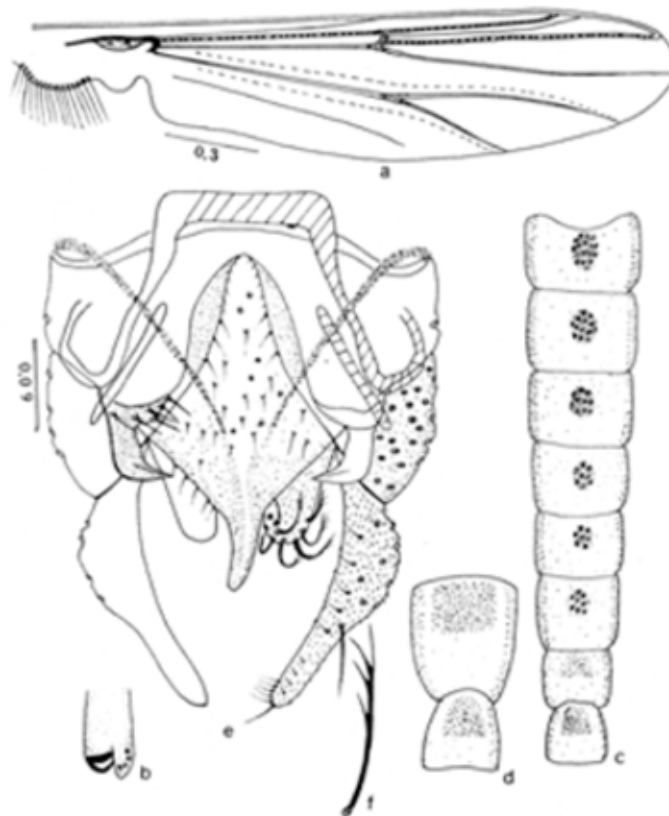


Fig. 20

Adult male of *C. ramosus* (Chaudhuri, Das and Sublette 1992)

Larva: a small to medium plumosus-type (length 8-13.2 mm). Anterior pair of VT shorter than posterior pair. Gula and FA apparently not darkened.

Mentum with c2 teeth well separated and c1 broad (type IIA), 4th laterals slightly reduced. PE with about 20 teeth. Premandible with two equal teeth.

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G.

Nucleolus in arm B (at 11B)(as in map of Nath and Godbole 1997), but may be developed in arm F (at 10D - abt. groups 22-23). Two BRs, about equally distant from each end, are on arm G.

No reported polymorphism.

Some points can be made by reference to the map of Nath & Godbole (1997):

- ramA1: 1 - 2c, 10 - 12, 3- 2d, 9 - 4, 13 - 19 as *circumdatatus* A2, *holomelas*, etc.
 ramB1: Characteristic bands at 10F. Generally a nucleolus at 11B, as in *C circumdatatus*.
 ramC1: Developmentally stage specific puff at 6B. as C2 of *incertipenis*?
 ramD1:
 ramE1: 1a-i, 5 - 10b, 3e - 2, 4 - 3f, 10c - 13 i.e Inv2-5 from *aprilinus*, as *incertipenis*
 ramF1: 1 - 2a, 10 - 3d, 14c - 11, 2b - 3c, 14d - 23 as flaF1
 Nucleolus sometimes about region 22-23, so distinctive bands not visible.
 ram G1: BRs at 18C and 19C

Found: Type locality - Satgachhia, West Bengal, INDIA.

Other Indian localities: Hooghly, West Bengal; Pune; Cachar Hills, Assam.

Larva, pupa and adult described by Chaudhuri, Das & Sublette (1992). Chromosomes described by Nath & Godbole (1997). In their map, chromosome I is comprised of arms D and C, chromosome II of arms F and B; chromosome III of arms A and E, and chromosome IV is arm G. As noted, the nucleolus in the map is at 11B in arm B, but in other specimens, the nucleolus is in arm F at 10D. Since the available specimens have all come from an inbred laboratory stock, it is not clear what the situation is in natural populations.

Morphologically close to the *C. samoensis* group; cytologically close to *C. incertipenis*.

***Chironomus samoensis* Edwards 1928**

Although not found in Asia, this description is given here so that the differences of the Asian species can be understood

Original Description: Insects of Samoa Part VI. Fasc. 2, Nematocera.

59. *Chironomus* (s. str.) *samoensis*, sp. n.

Head ochreous, palpi and antennal flagellum rather darker; plumes of antennae pale. Frontal tubercles present, of moderate size. Last segment of antennae quite three times as long as 2-11 together. *Thorax* greenish; scutum with three reddish-orange stripes, the areas between the stripes dusted with silvery-grey. Postnotum not darker than the scutal stripes. Pronotum slightly emarginate in middle. *Abdomen* of (when not discoloured) green, tergites 2-4 each with a more or less diamond-shaped brown spot near base, 5 brownish, 6-8 darker brown, hypopygium pale. Seen very obliquely from in from the segments are rather distinctly silvery-grey at the base; seen obliquely from behind the silvery dusting is on the posterior margins of 2-5 and nearly the whole of 6-7. Hypopygium with anal point moderately long and slender; claspers

slender, not much enlarged at base; upper basal appendage rather small with a downward curved point; the structure almost as figured by Kieffer for *Ch. imberbis*. *Abdomen* of without distinct markings. *Legs* greenish-yellow; tarsi a little darker, first two segments narrowly and rather indistinctly brown at tip. No darkening on femora, nor on front tibiae. First segment of front tarsi about 1.8 times as long as tibiae. No tarsal beard. *Wings* hyaline; *r-m* slightly darkened; venation as in other members of the *dorsalis* group. Halteres pale.

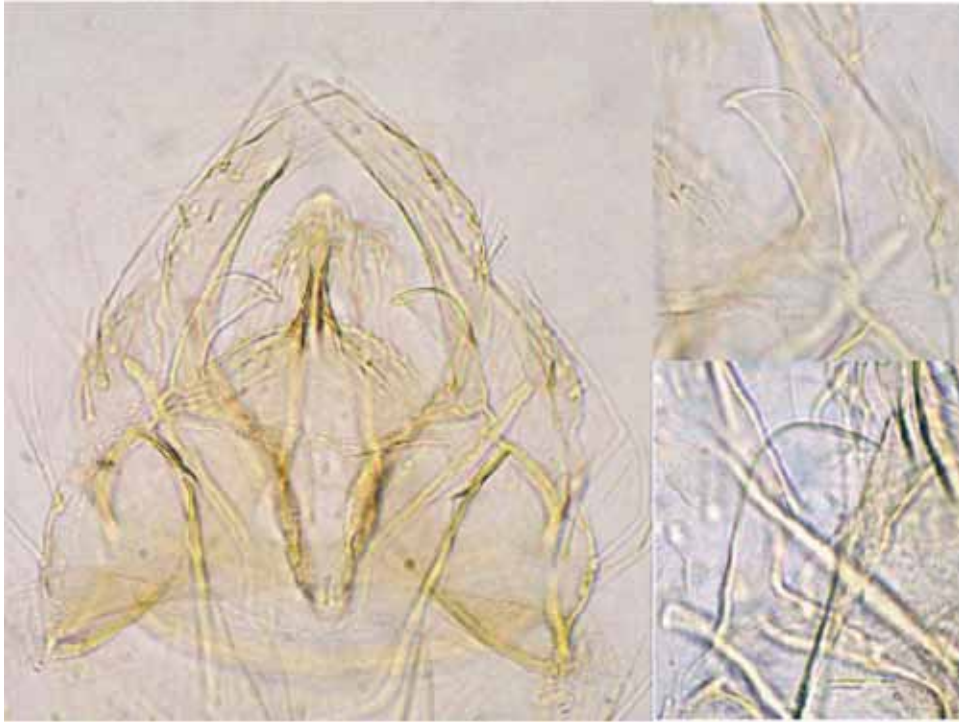
Length of body () 4.5-5 mm.; wing 3-3.5 mm.

Chironomus samoensis is very closely related to a number of described Australasian species, such as *C. subdolos* Skuse and *C. imberbis* Kieff, of the cosmopolitan *dorsalis* group. It does not quite agree with specimens of *C. subdolos* in the British Museum, and is not represented in the collections from the Society Is. and Fiji. From *C. hawaiiensis* Grim, it differs chiefly in the absence of dark preapical rings on the femora.

The description of the upper basal appendage (SV), and the list of species to which this species is compared, is important here - all of these species have a D type SV. Tokunaga (1964) notes the hypopygium is of the *dorsalis* type but illustrates it with a triangular apex which can be misinterpreted as an S-type. The specimens described by Tokunaga from Micronesia are probably *C. samoensis*, and the illustration is presumably intended to depict the somewhat beaked SV seen in some specimens. The misinterpretation of this illustration may be partly responsible for the identification of *C. samoensis* in other locations, which have an S type SV. However, they also differ in other characters and are mis-identifications. While the females are largely dismissed as “like the male apart from the usual sexual differences”, the relative lengths of the fore leg segments appear to be useful in separating the species of this group.

Tokunaga makes the important point that the fore tarsus has Ta4 far longer than Ta3, and slightly longer than Ta2, although examination of a pharate female from Tutuila, American Samoa, suggests that Ta2 and Ta4 can be about equal in length.

Additional data from specimens from Tutuila, Pago Pago, American Samoa:



Male hypopygium of *Chironomus samoensis* (left), superior volsella (right)
 Note the appearance of a beak in the lower figure.

Male

Head: AR - 2.94 (2.51 - 3.23, 4); frontal tubercles 33 µm (29-38,4) long and 15µm (14-17,3) wide; palpal proportions (micron) - 46 : 46 : 193 : 234 : 354; clypeal setae 17-23.

Thoracic setae: Acrostichal - at least 14 or 15; dorsolateral - 17-21; prealar - 4-5; scutellar in two rough rows, ant. 5-12, post. 12-15.

Wing length 2.58 mm (2.40-2.68, 4), width 0.63 mm (0.60-0.66, 4), VR 1.03 (1.02-1.04, 4).

Legs, pale, tarsi slightly darker. Relative length of leg segments (micron) (4)

	Fe	Ti	Ta1	Ta2	Ta3
PI	1107	1000	1507	810	750
PII	1170	1040	675	365	245
PIII	1290	1245	1185	513	385
	Ta4	Ta5	LR	F/T	BR
PI	670	330	1.50-1.52	1.08-1.12	1.54-1.75
PII	160	115	0.62-0.67	1.07-1.17	
PIII	233	153	0.78-0.82	1.03-1.05	

Abdomen pale, with darkening as described by Edward. Hypopygium (above) similar to that of *C. dorsalis*, with the SV of the D type, similar to fig. e of Strenzke (1959), but sometimes with the development of a beak. The IV has mainly simple, curved setae, but a small number appear to have a small simple fork near the tip. About 4-6 setae on the 9th tergite near the base of the anal point.

Female:

No females are available amongst the material, but some characters could be obtained from a pupa with a pharate female. An important character is the relative proportions of the fore leg,

particularly the tarsi, as Tokunaga (1964) notes that the Ta4 of specimens he assigned to *C. samoensis* was unusually long. The approximate lengths of these segments were measured (in micron) as: Fe 900 ; Ti 750 ; Ta1 1020 ; Ta2 620 : Ta3 470 : Ta4 610 : Ta5 340; Ta4 about same length as Ta2, and about one third longer than Ta3.

Other characters:

Head - frontal tubercles - length 23µm, width 13 µm. Antennal segments (µm) 144 : 109 : 116 : 106 : 215. About 24 clypeal setae.

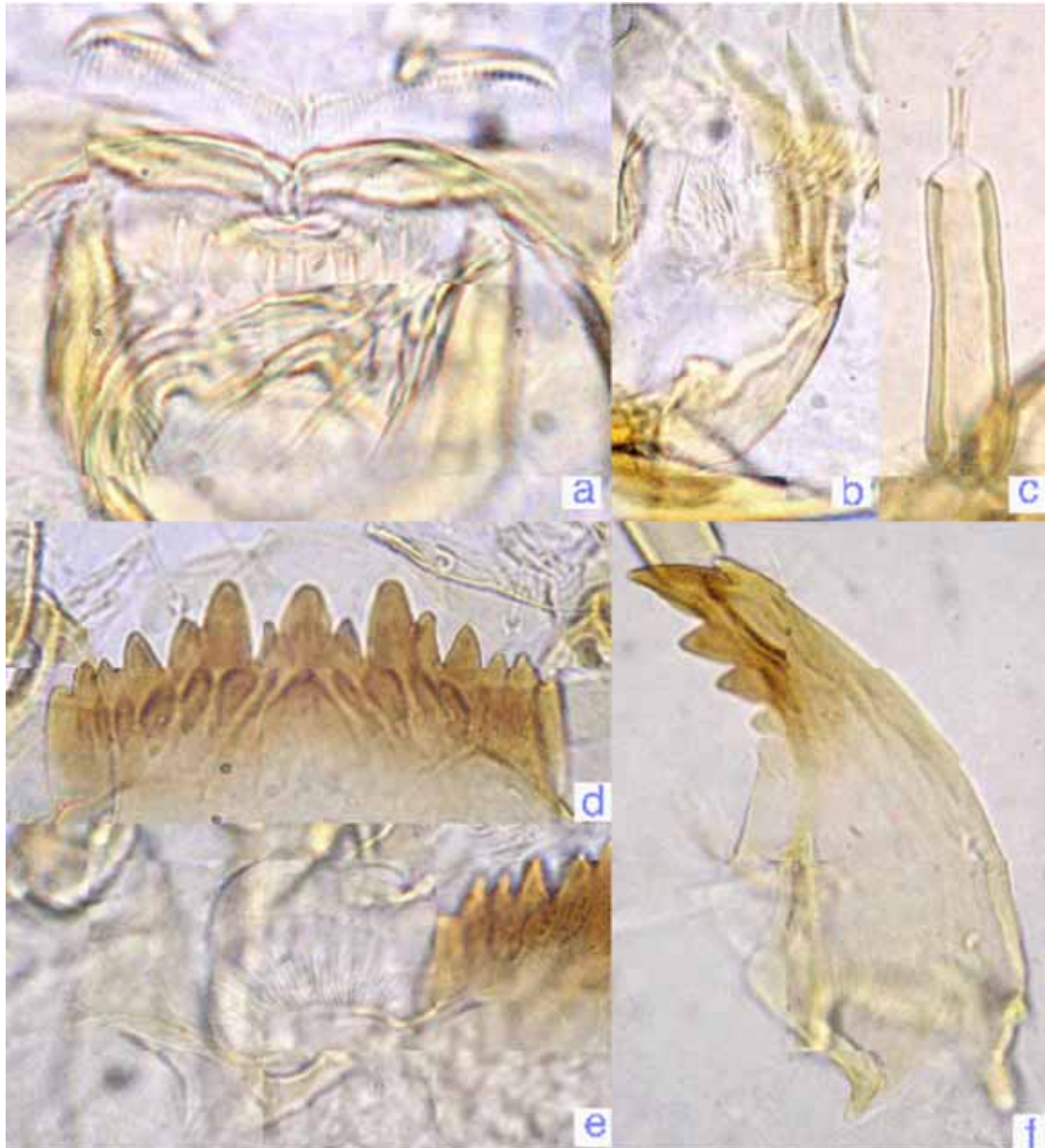
Thoracic setae: Acrostichal 14, dorsolateral 31, prealar 5, scutellar in two rows, ant. 14, post. 14.

Pupa:

Exuviae length 6.8 (6.5-7.0, 3) mm (male), inner margin of wing case about 1.34 (1.27-1.42, 3) mm (male). Pale, with darkened caudolateral spurs. Cephalic tubules 93 (76-115, 4) µm long and 78 (56-94, 4) µm across the base, subterminal bristle about 68-80 µm in length. Basal ring about 142 (129-164,5) by 68 (54-85,5) µm. About 67-77 hooks in row on segment II. Slight development of Pedes spurii B on segment II, progressive development of Pedes spurii A from segments IV to VI. Caudolateral spur of segment VIII with 1 to 3 spines. 78-88 taeniae on each side of the anal lobe of male.

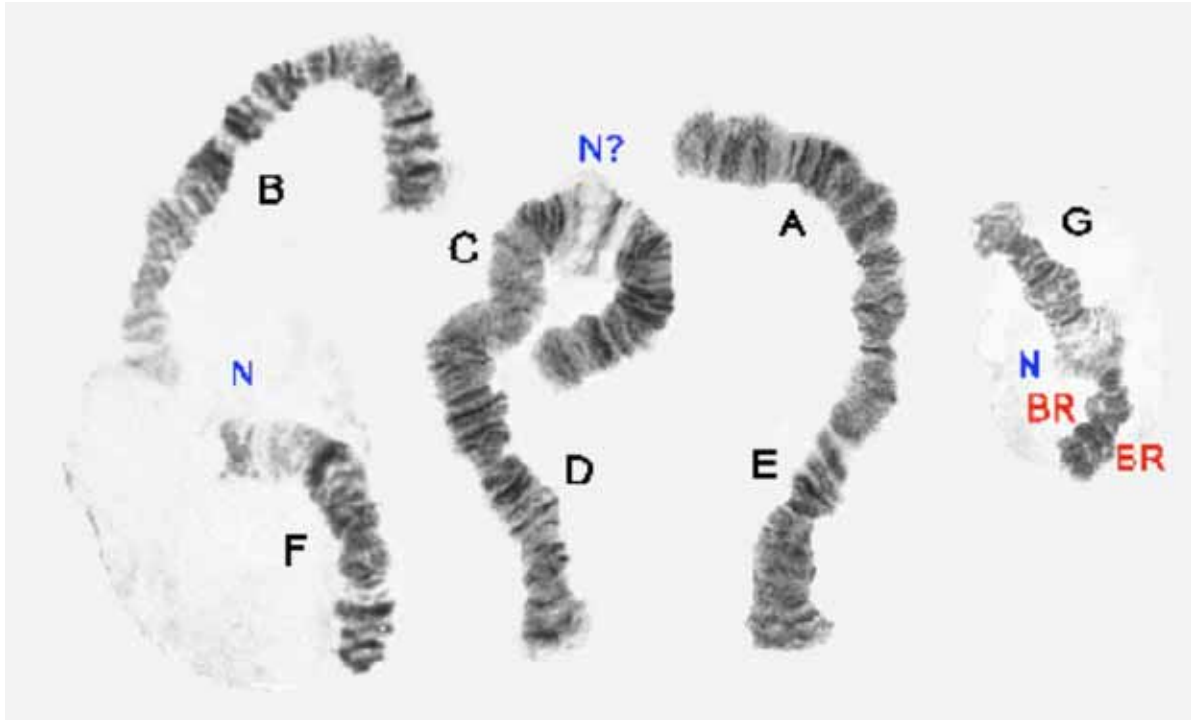
Larva: (Fig. 3)

A medium sized plumosus-type; length about 12.5-12.7 mm (female) and 10.8-11.8 mm (male); PLT about 280-360 µm; VT relatively long (anterior 1.76-2.16 mm; posterior 1.80-2.68 mm), posterior pair longer and coiled; anal tubules moderately long (about 1.6-2.6 times longer than wide), dorsal pair (240-410 µm) slightly longer than ventral pair (215-370 µm). Head capsule pale with darkening of the posterior half of the gula, frontal apotome sometimes pale but mostly with slight darkening, ventral head length 261-318 µm. Distance between antennal bases greater than the distance between the S4 setae. Mentum wider than usual, about 0.6 of ventral head length; centre trifid teeth with c2 teeth well developed (essentially type IV); 4th laterals reduced to about the level of 5th laterals (type II), 6th lateral variable, sometimes arising at same level as other laterals but generally appearing to be at a slightly lower level, apparently due to wear. Ventromental plates separated by about 35-41% of the width of the mentum; each with about 32-35 striae. Pecten epipharyngis with about 13 (10-16, 8) sharp pointed teeth. Premandible with sharp teeth, outer tooth shorter than inner tooth, which is about twice as wide as the outer tooth. Mandible about 208-228 mm long, with 3rd inner tooth relatively pale and only partly separated (type II), about 13 (12-14,8) furrows on outer surface at base, pecten mandibularis sparse, with about 8 (7-10,5) setae. Antenna five segmented, with A1 almost 4 times longer than wide, RO between 0.4 and 0.5 up from the base of the segment; relative length of antennal segments (micron) 110 : 24 : 6 : 11 : 7 ; AR 2.03-2.30.



Larval head capsule characters of *C. samoensis*

Cytology: The polytene chromosomes of *C. samoensis* also differ from those described for the others species in the group. The arm combinatiion is pseudothummi-cytocomplex, as in the other species, but the most obvious difference is that the nucleolus in arm G is near the middle of the arm, rather than almost terminal. There is a second nucleolus in near the diagnostic bands of arm F, and generally a large puff, which may be a nucleolus, near the middle of arm C.



Polytene chromosome complement of *C. samoensis*

Based on these descriptions, diagnostic features of the species are: Frontal tubercles relatively long; LR about 1.50 -1.52, fore Ta5 about one third of the length of the fore tibia, SV of the D-type, or “beaked”; in female fore Ta4 longer than Ta3 and about the same length as Ta2. In larva, antennal segment 3 relatively short, usually shorter than A5. In the polytene chromosomes, the nucleolus in arm G is median, and there is a further nucleolus about region 20 of arm F and usually a large puff in arm C.

“*Chironomus samoensis*” (Japan)

A stock obtained from Dr. Hideo Yajima, Ibaraki University, Mito, Japan and called *C. samoensis* was studied genetically by Kuhn *et al.* (1987), Elbetieha and Kalthoff (1988) and for the polytene chromosome patterns by Wuelker *et al.* (1989).

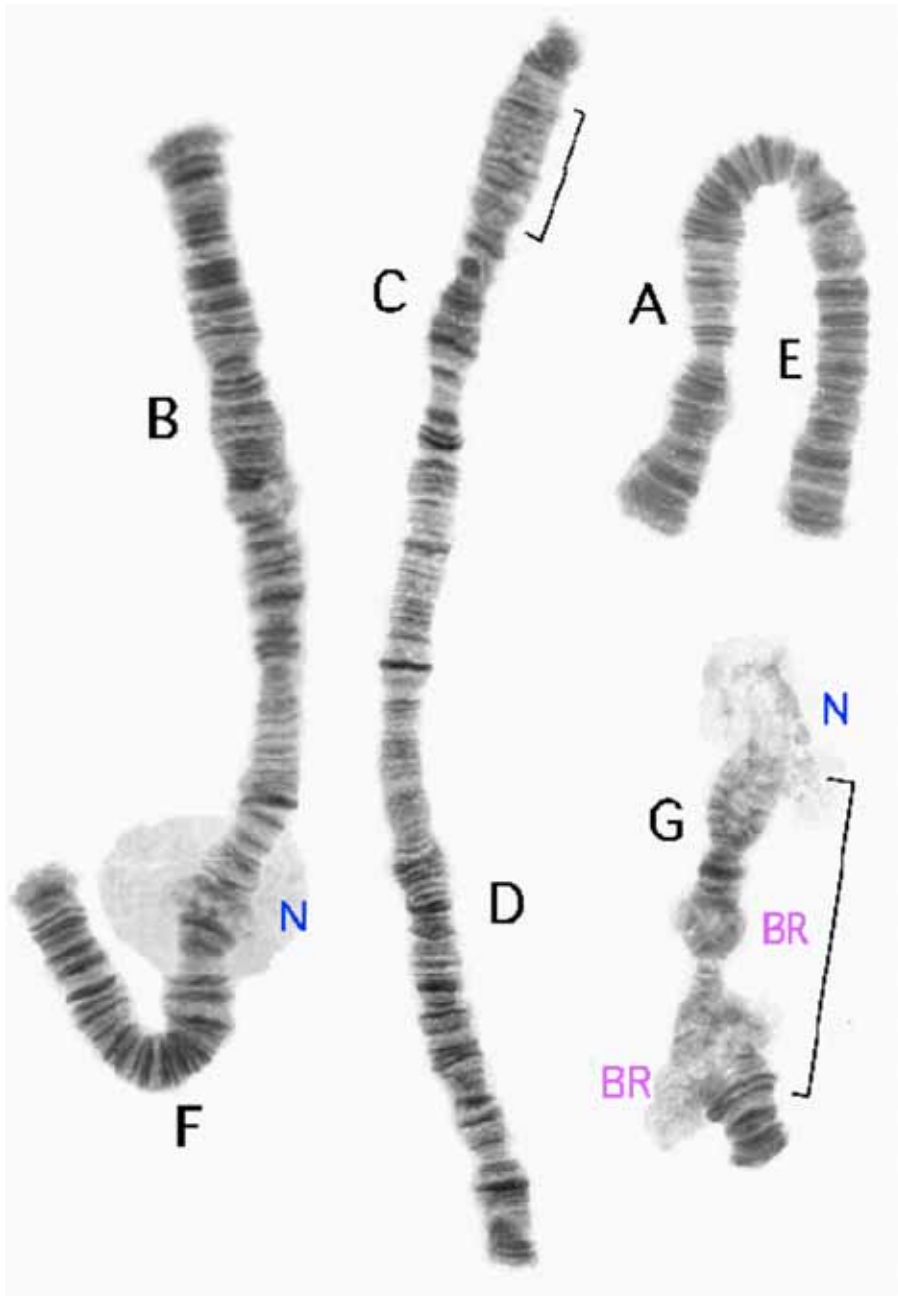
Cytology: 4 polytene chromosomes with the pseudothummi arm combination AE, BF, CD, G. Nucleolus virtually terminal in arm G, but may not always be visible, or may be broken off; well developed BR about one third from the other end, and a smaller BR close to this other end; closely paired. Nucleolus near the characteristic bands of arm F in Japanese specimens. Arm A of Australian “*C. samoensis*” differs from that of these Japanese specimens by a complex inversion, and arm F by possibly a simple inversion.

ArmA1: 1a-i, 2k-d, 9 - 4, 13 - 14, 3h-i, 12 - 10, 2c - 1k, 3a-g, 15 - 19 complex
inv from *holomelas*, etc.

ArmB1: Puff near the middle of the arm with distal dark bands (gps. 8 - 7)

ArmC1:

- ArmC2: Differs by a small terminal inversion, distal of characteristic band groups 3-4.
- ArmD1:
- ArmE1: 1 - 3e, 10b - 3f, 10c - 13 as *aprilinus*, etc.
- ArmF1: 1 - 2a, 10d-a, 15 - 11, 2b - 9, 16 - (nucleolus) 23
- ArmG1:
- ArmG2: Inversion of central half of the arm from just distal of the nucleolus to just distal of the second BR.



Possible polytene chromosomes of "*C. samoensis*" (courtesy of W. Wuelker)
 The brackets indicate the approximate limits of known polymorphic inversions.

BR - Balbiani ring; N - Nucleolus

The sequences of this Japanese species differ in the sequences of arms A and F from Australian specimens, although the relationship between specimens from the two regions has not yet been confirmed.

Specimens identified as “*C. samoensis*” from Jammu and Kashmir:

Adult:

Male: Wing length 3.39 - 3.57 mm, width 0.73 - 0.88 mm. AR 2.85 - 3.05.

LR - 1.4; the fore Ta4 about 0.28 of the length of Ti.

Head: Frontal tubercles present, abt 18 - 28 µm; abt 23 - 25 clypeal setae.

Palpal proportions (micron): 49 : 53 : 218 : 230 : 370

Thorax: Setae - Achrostichal 14 - 16; dorsolateral 11 - 19; prealar 5 - 6; scutellars in two or three rows, ant. row 6 - 10, posterior rows 14, and/ or 11 - 15.

Legs: Proportions (microns)

	Fe	Ti	Ta1	Ta2	Ta3
PI	1255	1198	1895	1035	760
PII	1390	1263	750	412	305
PIII	1570	1553	1148	620	484
	Ta4	Ta5	LR	F/T	BR
PI	680	400	1.59	1.02-1.10	4.3
PII	203	158	0.58-0.62	1.09-1.12	-
PIII	303	185	0.64-0.78	1.00-1.01	-

About 9 - 10 sensilla chaetica on midTa1 and about 5 - 9 on Hind Ta1



The SV is D-type, with an extended 'beak' (above); IV with some forked setae; and tergite 9 has 12-19 setae (c.f. sp 5), gonostylus moderately swollen and narrowing from about half way.

Pupa: Not known.

Larva: larva a small to medium plumosus-type. Posterior third of gula dark, FA very dark. Anal tubules long, cylindrical, about 340 µm in length. Antenna with basal segment about 2.7 times longer than wide; AR 1.86; ratio of antennal segments (µm) 80 : 25 : 9 : 6 : 3.

Cytology: Four polytene chromosomes with the pseudothummi-cytochrome combination BF, CD, AE, G. Nucleolus subterminal in arm G and also in arm F, a nucleolus sometimes developed in arm D.. Nucleolus in arm G may only appear as a large puff. Polymorphism in arm C, D and G. Although no polymorphism has been observed in arms A or B, two different homozygous sequences have been observed (associated) in different populations.

- “sam”A1: 1 - 2c, 10 - 12, 3 - 2d, 9 - 4, 13 - 19 as *circumdatatus* A2, *holomelas*, etc.
- “sam”A2: 1 - 2c, 10 - 12, 3, 14c-13, 4 - 9, 2ed, 14d-19 (in2d-14c c.f *incertipennis* & “sam”A1) – probably *C. nr. flaviplumus*
- “sam”B1: Puff (gp 7) medial, with dark bands (gp 8) proximal.
- “sam”B2: Puff (gp 7) more distal, with dark bands (gp 8) distal.
- “sam”C1: Typical constriction (gp 3-4) proximal.
- “sam”D1:
- “sam”D2: Small inversion at distal end of arm.
- “sam”E1: 1-2c, 5-10b, 3e-2d, 4-3f, 10c-13 as *incertipennis*
- “sam”F1: 1a - 2a, 10d-a, 15 - 11, 2b - 9, 16 - 23 (not proven) as *flaviplumus*
- “sam”G1: two dark bands immediately distal to nucleolus.
- “sam”G2: inversion of middle third of arm.

Found: India - Bishnah wetland (A2,B2) Deoli Village (A2,B2); Gadigagh; Sangrampur village (A1,B1), Jammu region. Berhampore, Farakka, and Burdwan, West Bengal. Not identical to material from Japan, Korea, Java, Australia, Samoa & other Pacific Islands. Cytology differs most notably from *C. samoensis* by the position of the nucleolus in arm G, which is medial in *C. samoensis*. Some polytene chromosome sequences, are similar to those of *C. flaviplumus* from Japan, while the mtCOI sequences also indicate relationship.

It is likely that this species is a complex of closely related forms. The included specimens have very similar mitochondrial COI sequence (result of hybridization?), but the cytology differs (as noted above). All examined larvae have a darkened gula and FA.

***Chironomus simantobeeceus* Sasa, Suzuki and Sakai 1998**

Adult

Male: Length 7.12 mm. Wing length 3.04 mm, width 0.88 mm.
 AR 3.11. Frontal tubercles prominent, 48 µm long, 12 µm wide.
 Clypeal setae 26.
 Thoracic setae: 17dorsocentral, 21 acrostichials; 7 prealars, 34 scutellars.

Found: Type locality – Shimanto River, Shikoku Island, JAPAN

***Chironomus sinicus* Kiknadze et al. 2005.**

Adult

Male: Length 8.64 – 9.67 mm.
 Wing length 4.43 – 5.03 mm; VR 1.03 – 1.06. Squama with 13 – 21 setae.
 AR 4.79 – 5.31. Frontal tubercles well developed, 52 – 83 µm long.
 Relative length of palps (in µm) 66 : 82 : 244 : 232 : 298. Clypeus with 31 – 39 setae.
 Thoracic setae: 16 – 19 dorsocentral, 9 – 14 acrostichials; 6 – 7 prealars, 35 – 42 scutellars.
 Legs: Front tarsi bearded, BR 5.95 – 6.23. Leg ratios omitted from published description, but inserted below:
 Lengths (in mm) and proportions of legs:

	fe	ti	ta ₁	ta ₂
p ₁	1.67-1.92, 1.81	1.70-1.94, 1.79	2.27-2.46, 2.32	1.40-1.51, 1.44
p ₂	1.84-2.08, 1.95	1.84-2.00, 1.92	1.03-1.11, 1.08	0.65-0.73, 0.68
p ₃	2.24-2.43, 2.33	2.35-2.51, 2.42	1.62-1.81, 1.70	1.00-1.11, 1.05
	ta ₃	ta ₄	ta ₅	LR
p ₁	0.86-0.95, 0.91	0.76-0.81, 0.78	0.34-0.41, 0.37	1.17-1.36, 1.30
p ₂	0.46-0.51, 0.48	0.30-0.35, 0.32	0.24-0.27, 0.26	0.55-0.58, 0.56
p ₃	0.76-0.84, 0.79	0.43-0.49, 0.47	0.27-0.30, 0.29	0.68-0.72, 0.70

Pupa:

Length 12.0 – 12.5 mm, wing sheath length 2.8 – 3.0 mm. Cephalic tubercles 220 - 250 µm high and 120 – 150 µm wide. Thoracic granulation well developed anteriorly. Pleura of segment IV smooth. Hook row of tergite II with 90 – 125 hooks and occupying 0.59 – 0.63 of total segment width. Caudolateral spur of segment VIII with 10 – 14 spines. Shagreen present on sternites III and IV and forms a longitudinal band on each side.

Larva of the melanotus (semireductus)-type, length 17 – 22 mm. VT 0.82 – 1.25 mm (ant) and 0.75 – 0.98 mm (post), posterior pair curved anteriorly PLT about 160 – 238 µm long. Ventromentum with about 79 – 83 striae. PE with about 12 – 17 teeth. AR 1.55 – 2.28; antennal proportions (µm) 144 : 34 : 15 : 16 : 10 ; basal segment about 2.9 – 3.2 times as long as wide. Mandible about 310 – 350 µm, third inner tooth apparently darkened and well developed. Anal tubules about 440 – 530 µm long and 140 – 250 µm wide.

Cytology: Four polytene chromosomes with the thummi-cytocomplex combination: AB, CD, EF, G. Only nucleolus subterminal on arm G. Polymorphism in arms C and G. Additional B-chromosomes present in over a third of larvae examined.

sinA1: 1a – 2c, 10 – 12, 3 – 2h, 4d – 9, 2d-g, 4c-a, 13 – 19 as plumosus A1

sinB1: Puff towards the distal end of the arm

sinC1: 1a-c, 12 -11d, 6gh, 17a-16, 7d-a, 6f-c, 2c-1d, 13-15, 8-11c, 6b-2d, 17b-22

sinC2: 1a-c, 12 -11d, 6gh, 17a-16, 7d-a, 6f-c, 2c-1d, 13-15, 8-11c, 6b-4g, 18d-17b, 2d-4f,
18e-22

sinD1: 1 - 2g, 13a, 10a-8, 18d-a, 7-4, 10e-b, 13b-14, 3-2h, 12 - 11, 15 - 17, 18e-24

sinE1: 1 – 3e, 5 – 10b, 4 – 3f, 10c – 13 as plumosus E1

alternative E1; 1 – 3a, 4c-10b, 3e-b, 4b – 3f, 10c - 13

sinF1: 1a-d, 6e – 5d, 10d – 7a, 5c – 1e, 14f – 17, 14e – 11, 18 – 23

sinG1 and sinG2 differ by a small inversion near the distal BR.

Found: Type locality – Nankai University campus, Tianjin City, CHINA.

Cytology described by Kiknadze *et al.* (2005) as part of the original description.

***Chironomus striatipennis* Kieffer 1910**

- as *Chironomus* (*Prochironomus*), on basis of adult female
- *Chironomus calipterus* – misidentification by Saxena (1995)

Kieffer 1910, description of *Chironomus* (*Prochironomus*) *striatipennis*, sp. nov.
(there are no figures)

Female. Brun; tête et antennes roussâtres, nodosités des antennes noirâtres; mesonotum d'un gris blanchâtre, avec 4 bandes d'un brun roux, les deux médianes séparées par une ligne et raccourcies en arrière, les deux latérales raccourcies en avant; scutellum d'un gris blanchâtre; balanciers blancs; pattes blanchâtres, extrémité des 3 ou 4 premiers articles tarsaux et le dernier ou les deux derniers en entier d'un brun noir. Antennes de 5 articles, dont le 2^e est rétréci au milieu; 3-5 ellipsoïdaux, plus longs que leur col, sauf le 5', dont l'appendice terminal est de moitié plus long que la nodosité; verticilles 2-3 fois aussi longs que l'épaisseur des articles. Ailes blanchâtres, avec des stries enfumées le long de la partie distale de la discoïdale, de la posticale et de ses deux rameaux, de l'anale et le long du bord du lobe anal; en outre, deux bandes longitudinales et étroites sont situées l'une distalement de l'autre, entre le cubitus et la discoïdale; nervures jaunâtres; transversale, base du cubitus et de la partie distale de la discoïdale noires et bordées de noirâtre; extrémité du radius également distante de l'extrémité des deux rameaux de la posticale; cubitus à peine arqué, non dépasse par la costale, distant du bord, aussi rapproché de la pointe alaire que la discoïdale; transversale oblique, située un peu en avant de la bifurcation de la posticale. Tibia antérieur égalant les trois quarts du fémur; métatarse double du tibia; 4' article tarsal plus de deux fois le 5', celui-ci six fois aussi long que gros; aux pattes postérieures, le 4^e article est de moitié plus long que le 5^e, qui est 3-4 fois aussi long que gros. Abdomen presque deux fois aussi long que le reste du corps. Taill 4.5 mm.

Female. Brown, reddish head and antennae, nodules of antennae blackish; mesonotum a whitish gray, with four bands of reddish brown, the median two separated by a line and shortened at the back, the two sides shortened at the front; scutellum of a whitish gray, white balancers, legs whitish, extremities of 3 or 4 first tarsal segments and the whole of the last of the two of a black brown. Antennae of 5 segments, including the second is narrowed in the middle; 3-5 ellipsoidal, longer than their collar, except the 5th, which is the terminal appendage which is half as long as the knot; whorls 2-3 times as long as the thickness of the segments. Wings whitish, with smoky streaks along the distal portion of the discoidal, the posticale and its two branches, the anal and along the edge of the anal lobe, in addition, two longitudinal and narrow strips are located distally from one another, between the ulna and discoidal; veins yellowish; transversal, base of the ulna and the distal part of the discoidal black and borders of blackish; distal extremity of the radius also distant from extremity of the two branches the posticale; cubitus barely arched not exceeding the costal, distant from the edge, as close to the wing tip as the discoidal, transversal oblique, located just in front of the bifurcation of the posticale. Anterior tibia matching three-quarters of the femur; metatarsal twice the tibia; 4th tarsal segment more than twice the 5th, which is six times as long as wide; for the posterior legs, the 4th segment is half longer than the 5th, which is 3-4 times as long as wide. Abdomen almost twice as long as rest of the body. Length 4.5 mm.
i.e. for anterior legs LR = 2, F/T = 1.3

In Kieffer's key the defining character is two transverse dark bands on the wings. The type in the Indian Museum was re-examined by Chaudhuri and Guha, but they did not redescribe it, while Chaudhuri *et al.* (1992) refer to a paratype male in the ZSI (Reg.no.980/15) but its relation to the type is not clear since Kieffer did not describe the male.

Diagnosis: According to Chaudhuri *et al.* (1992):

Adult - scutellum with 14-18 setae; wing markings; tarsomeres I-III dark brown at apices; tergites II-V with brown median spot; hypopygium with bent anal point and curved SV; and equal spheroidal seminal capsules.

Pupa - Frontal plate with triangular frontal tubercles; respiratory organ with a bunch of profusely branched filaments; tergite II with median shagreen and caudal row of 62-72 hooklets; tergite VIII with basal transverse patch of shagreen, caudolateral spur with 2 unequal points; G/F 1.05-1.08 in male and 0.69-0.82 in female.

Larva - AR 1.6-2.0, triangular labral lamella; 2 pairs of chaetulae basales; PE a single plate with 16 teeth; premandible with subequal apical teeth and short premandibular brush; mandible with well developed pecten mandibularis; maxilla with 4 sensilla basiconica; mentum with short 4th and 6th lateral teeth; segment XI with 2 pairs of coiled ventral tubules; procercus with 8 anal setae.

Adult: Incorporating description of Chaudhuri *et al.* (1992):

Male:

Wing length = 1.98-2.84 mm.; width = 0.53-0.70) mm. VR = 1.04-1.08.

LR = 1.49-1.82;

Face yellowish brown, antennae and palps brown. AR about 2.47 – 2.97. Frontal tubercles about 41 (35 - 49) µm long and 14 (10-20) µm wide. Palpal proportions (micron) 45 : 44 : 161 : 164 : 240. Clypeal setae - abt 16 - 22.

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

Setae: acrostichals - abt 17 (13 - 23); dorsocentrals - 19 (16 - 26); prealar - 5 (3-5); scutellar - 2 - 4 in anterior row, 8 - 14 in posterior row.

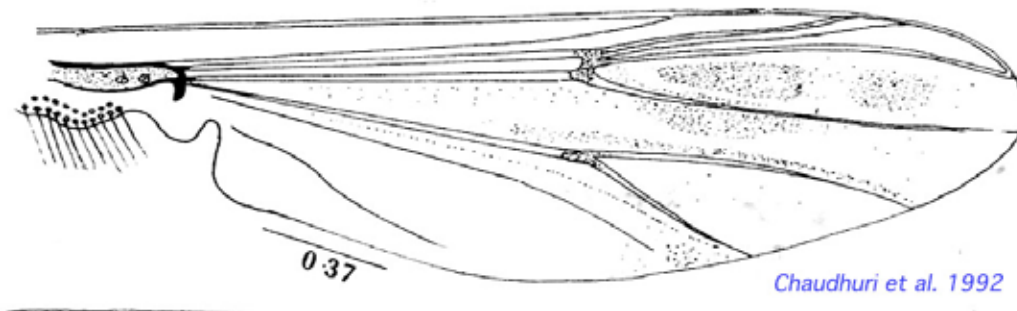
Wings with dark spot over the crossvein and with obvious dark clouds and seams, particularly in cell R5. 2 setae on brachiolum, abt 12-20 setae in squamal fringe. Haltere pale.

Relative lengths of leg segments (μm):

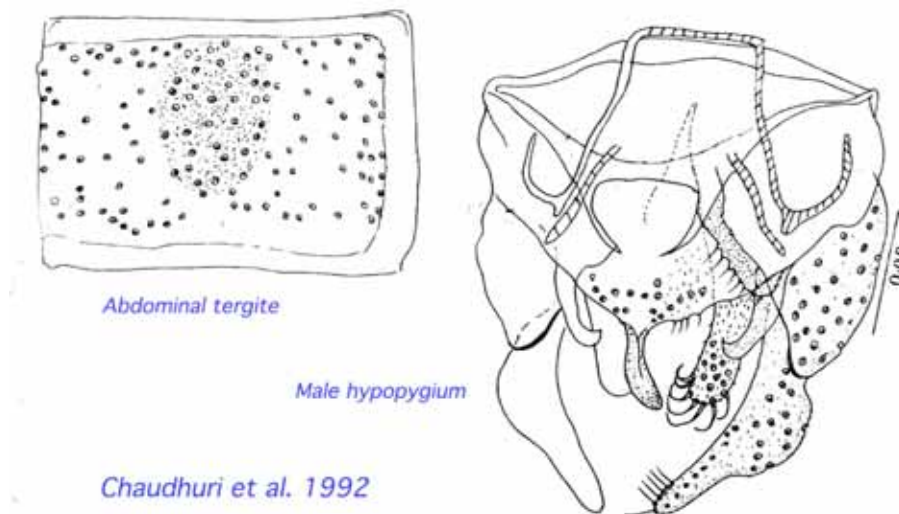
	Fe	Ti	Ta1	Ta2	Ta3
PI	1088	994	1569	854	608
PII	1139	1100	640	408	297
PIII	1279	1343	1012	604	455
	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	487	256	1.49-1.82	1.08-1.23	0.25-0.32
PII	200	139	0.55-0.62	1.00-1.04	
PIII	272	173	0.72-0.80	0.93-0.99	

Ant. BR 4.5-4.7 Sensilla chaetica: Mid 5-7; Hind 7-8

Wings with dark clouds



Abdominal tergites mostly dark, with a pale basal band on the anterior segments, paler in Japanese specimens. About 7-10 setae near middle of tergite IX. SV of E type clost to fig. h of Strenzke (1959). Setae of IV simple.



Female (based on Sasa 1978 and Chaudhuri et al. 1992):

Wing length 1.68- 2.8 mm. VR about 1.06. Cloudy patches as in male.

Antennal proportions (micron) 80, 147, 102, 105, 98, 170. AR 0.37-0.38

Frontal tubercles 43 µm long, 22 µm wide.

Palps (segs 2-5): 40, 130, 100, 230.

Leg lengths (microns) and proportions as follows:

	Fe	Ti	Ta1	Ta2	Ta3
PI	1170	980	1610	880	710
PII	1200	1170	660	380	270
PIII	1370	1440	1100	660	540
	Ta4	Ta5	LR	F/T	Ta5/Ti
PI	660	320	1.65	1.19	0.33
PII	200	150	0.56	1.03	0.13
PIII	320	200	0.76	0.95	0.14

Pupa: Length 5.4- 6.8 mm (male) 4.8-5.8 (female), posterior margin of wing case about 1.1 mm.

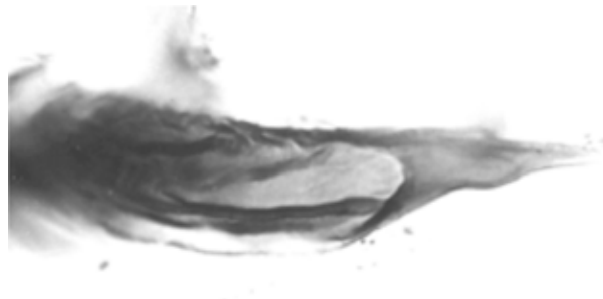
Head: Cephalic tubercles about 53 µm long and about 40 µm wide at the base, with a subterminal seta about 57 µm long.

Thorax: Prealar tubercle present, not simple, but small, about 25 µm long and 6 µm wide.

Basal ring of respiratory horn with edge thicker at the anterior end, and pinched at the centre, about 126 µm long and 60 µm wide. There are about 3 rough short spines immediately anterior to the basal ring, and a large, possibly muscle scar just posterior to it.

Abdomen: About 62-72 recurved hooks on posterior margin of segment II, the hook row covering about 54% of the width of the segment. Pedes spurii B on segment II, and pedes spurii A on segment IV, while those of segment V and VI are small and mainly identifiable by the spinules. Caudolateral spur of segment VIII generally with 1 main spine (see below), but occasionally with 1 or 2 subsidiary ones.

Anal lobe with about 53 taeniae on each side, mostly in a single row.



Larva: a small plumosus-type (length 7 - 12.3 mm (fem. 10.5-12.3 mm)). Anterior VT bent and posterior VT coiled and about equal length or anterior longer (ant 0.96-1.56 mm, post 0.96-1.48 mm).

Gula from pale to dark, which may extend over posterior 2/3; and FA also from pale to dark. Distance between antennal bases generally greater than the distance between the S4 setae.

Mentum (c, below) with c2 teeth of central tooth separated and sharp (type 3), 4th lateral reduced, sometimes only slightly, or down to level of 4th lateral. Pecten epipharyngis (a, below) with 12-18 teeth.

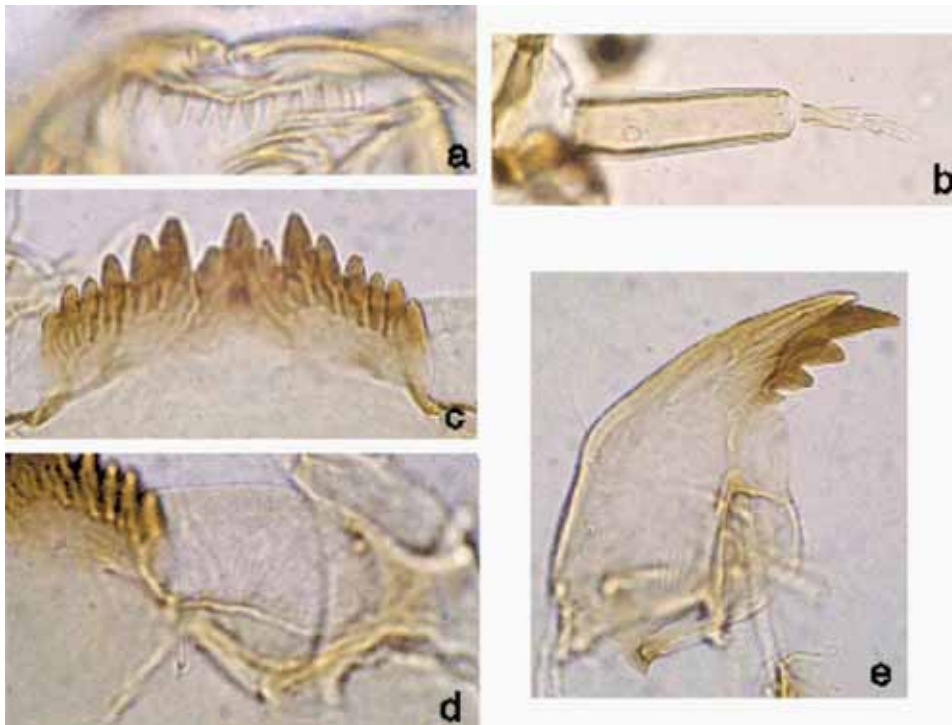
Ventromental plates (d, below) separated by 0.25-0.4 of the mentum width, about 19-46 striae reaching at least halfway to anterior margin.

Premandibles with outer tooth slightly longer, but wear may make them equal or even leave the inner tooth slightly longer; inner tooth at least 1.5 and up to 2.5 times wider than the outer tooth.

Mandible (e, below) with third inner tooth partially or completely separated, and partially pigmented (i.e. type IIB or IIIB), with 12-20 furrows.

Antenna (b, below) with basal segment relatively long, 3.2-3.9 times longer than wide; RO from about 0.32-0.53 up from base of segment; AR about 1.63-2.14; proportions (μm) 113 : 27 : 8 : 11 : 6.

Much of the variability in these larval characters comes from the different Indian samples.



(Currently also includes striatipennis type 2)

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Centromeres with some degree of heterochromatinization. Nucleolus essentially terminal on arm G, no nucleoli on long arms. End of arm G bearing nucleolus is typically unpaired, with BR near other end. Polymorphism in A, B, C, D, E, and F.

stpA1: 1 - 2c, 11 - 7, 4 - 6, 2d - 3, 12 - 19

stpA2:

stpB1: Puff virtually terminal with only the dark bands distal.

stpB2:

stpC1:

stpC2:

stpD1:

stpD2:

stpE1: 1 - 13 ie. as *piger*

stpE2: probably 1 - 3e, 10b - 3f, 10c - 13 i.e. as *holomelas*

stpF1: 1 - 2a, 15 - 11, 2b - 10, 16 - 23

stpF2: 1a, 21c - 16, 10 - 2b, 11 - 15, 2a - 1b, 21d - 23 (from Saxena)

stpF3: 1 - 2a, 15 - 14, 18 - 16, 10 - 2b, 11 - 13, 19 - 23 (from Saxena)

stpF4: 1 - 2a, 15 - 14, 16f-a, 10 - 2b, 11 - 13, 16g - 23 (from Saxena)

stpG1: nucleolus essentially terminal (see below)



Found: India - Type localities - Bhim tal, Kumaon, Uttar Pradesh.

Other localities: Burdwan; Delhi - Lodi Gardens (28.53, 77.27); Yamuna River, Okhla (28.58, 77.22). Uttar Pradesh - Varanasi, Banaras (25.20, 83.10). Jammu & Kashmir - Bishnah Wetlands (abt. 32.70, 75.00).

Japan - Otsu City, Honshu (35.00, 135.88).

Korea

Malaysia - Kuala Terengganu, Terengganu (5.33, 103.15).

Singapore - Bedok Canal (1.28, 103.83).

Thailand - Pattani, Pattani Province (6.87, 101.25); Maha Sarakham.

Adult redescribed and immatures described by Chaudhuri, Das & Sublette (1992) for Indian material, while Sasa (1978) and Sasa & Hasegawa (1983) redescribed Japanese material as *C. kiiensis*. Nath & Lakhotia (1989) and Gupta & Kumar (1991) both describe the chromosomes, but it appears they reverse chromosomes I and II. A, E and F were described by Saxena (1995) as *C. calipterus* and she also provided some other unpublished sequences.

DNA sequence:

Mt *COI* barcode sequence exists for some Indian specimens, and is similar to sequences from Japan, Korea, Singapore, Malaysia, Thailand but with an apparent cline of difference from west to east.

GenBank accession numbers: AB740241, AB838643, AB838645, AB838646, JF412086, JF412087, JF412088, JF412089, JQ350720, KT212990-994

BOLD numbers: COTW008, COTW009, COTW010, COTW011, COTW012

Many of these sequences are under the name *Chironomus kiiensis*.

***Chironomus striatipennis* Type 2**

Adult:

Male: The abdomen of the molecular Type 2 (see below) appears to have an abdomen similar to that of the Japanese Type 1 material.

Wing length about 2.62-2.64 mm, width 0.56-0.66 mm. VR - 1.08-1.13

AR about 2.2. Cephalic tubercles developed, about 35-46 μm long and 18-22 μm wide. 17-18 setae on clypeus; palpal proportions (μm) 50 : 38 : 152 : 157 : 240.

Thoracic seta: acrostichal - 10-13; dorsocentral - 15-18; prealar - 5; scutellar in two rows, anterior - 4-5, posterior - 9-11.

Wings with dark spot over the crossvein and with obvious dark clouds and seams, particularly in cell R5; abt 6-14 SCf on brachiolum in two clusters, abt 18 setae in squamal fringe.

Leg lengths (μm) and proportions:

	Fe	Ti	Ta1	Ta2	Ta3
PI	1031	938	1390	760	613
PII	1092	1048	735	366	266
PIII	1224	1270	987	557	430
	Ta4	Ta5	LR	F/T	BR
PI	413	249	1.32-164	1.10-1.11	2.3-3.5
PII	175	136	0.60-0.82	1.01-1.07	
PIII	256	170	0.78	0.96	

Female:

Larva: a small plumosus-type (length fem. abt 9.2 mm). Anterior VT bent and posterior VT coiled and posterior longer (ant 0.74 mm, post 0.781 mm).

Gula from pale to dark, which may extend over posterior 2/3; and FA also from pale to dark. Distance between antennal bases generally greater than the distance between the S4 setae.

Mentum with c2 teeth of central tooth separated and sharp (type 3), 4th lateral possibly slightly reduced, but broken on available specimen (type 1?). Pecten epipharyngis with 14 teeth.

Ventromental plates separated by about 0.28 of the mentum width, about 38 -40 striae reaching at least halfway to anterior margin.

Premandibles with teeth approximately equal in length; inner tooth about 2x wider than the outer tooth.

Mandible with third inner tooth partially separated, and pale (i.e. type IIA), with 17-19 furrows.

Antenna with basal segment relatively long, 3.2 times longer than wide; RO from about 0.37-0.42 up from base of segment; AR about 1.8; proportions (μm) 102 : 23 : 9 : 11 : 8.

Cytology: Centromeres only slightly heterochromatic in Malaysian specimen.

Found: Malaysia - Minden, Penang (5.13, 100.13).
Singapore – Bedok Canal (1.367, 103.939).

The redescription of *C. kiiensis* by Al-Shami *et al.* (2012) probably refers to this material.

Molecular: The mitochondrial *cox1* differs from that of Type 1, and this sequence is found in Japan and SE Asia, but has not been found in India.

BOLD accession numbers: COTW009, COTW010, COTW013

Chironomus sulfurosus Yamamoto, 1990

(based on Yamamoto 1990)

Adult:

Male

Leg proportions (micron):

	Fe	Ti	Ta1	Ta2	Ta3
PI	1270	1020	1500	750	630
PII	1300	1110	620	350	270
PIII	1450	1310	880	500	400
	Ta4	Ta5	LR	F/T	Ta4/Ta3
PI	480	270	1.32-1.52	1.25	0.73-0.77
PII	190	150	0.53-0.58	1.17	
PIII	250	100	0.66-0.70	1.11	

Larva: A small (length 8 - 12 mm) essentially melanotus-type larva, but sometimes posterior pair of VT tending to curl up. PLT short and slender. Anal setae of procerus fused into a single stout bristle. AT relatively stout, ventral pair longer than the dorsal pair. Head capsule orange-yellow, gula not pigmented.

Mentum of type I, center tooth of type IIA. PE with about 20 uneven teeth

Premandibles stout, outer tooth longer than the inner, which is about 1.7 times broader than the outer tooth.

Basal segment of antenna about 4 times longer than wide; RO about a quarter up from base; AR about 1.9; relative proportions of segments 42 : 11 : 2 : 4 : 2.

Distance between antennal bases less than that between the S4 setae

Mandible with 3rd inner tooth apparently well developed and darkened (type IIIC); PecM with 12 setae; no information on basal furrows.

Cytology: no information.

In highly acidic waters.

Found: Japan - Kurinodake, Onsen, Kagoshima Pref. (**Type locality**), Kyushu.

DNA sequence: It appears the mtCOI sequence in GenBank (accession number AB704937) is misidentified and is actually for a species of *Kiefferulus*.

***Chironomus suwai* Golygina & Martin 2003**

Larva a plumosus-type. length about 20 - 28 mm, VT from 0.5 - 3.0 mm. Gula darkened. AR about 2.13 (1.81 - 2.36). About 79 - 107 striae on ventromental plate.

Cytology: Four polytene chromosomes with the thummi-cytocomplex combination: AB, CD, EF, G. Only nucleolus subterminal on arm G. Polymorphism in arms A, B and E. A B-chromosome is sometimes present.

suwA1: 1 - 2c, 10 - 12a, 13ba, 4a-c, 2g-d, 9 - 4d, 2h - 3, 12cb, 13c - 19

suwA2: from suwA1 by complex inversion.

suwB1: as B1 of borokensis

suwB2: as B2 of plumosus and borokensis

suwC1: 1-2c, 6c-7, 16-17a 6hg, 11d-12, 4-6b, 11c-8, 15-13, 3-2d, 17b-22

suwD1: 1-3, 10b-e, 4-7, 18a-d, 8-10a, 13a-11, 13b-17, 18e-24 as D2 of plumosus and borokensis

suwE1: 1 - 3a, 4c - 10b, 3e-b, 4b - 3f, 10c - 13 as E1 of plumosus and borokensis

suwE2: 1 - 3a, 4c - 10b, 3e-b, 4ba, 10e-c, 3f, 10f - 13

suwE3: 1 - 3a, 4c - 6d, 7c - 6e, 7d - 10b, 3e-b, 4b - 3f, 10c - 13

suwF1: 1 - 6, 7 - 10ab, 18, 11 - 17, 10dc, 19 - 23 as F2 of borokensis

suwG1: as G2 of borokensis

Found: **Type locality - Lake Suwa, Honshu, JAPAN.**

Japan - Tsukuba.

The adults and pupae were described by Sasa (1978) as *C. plumosus*.

***Chironomus yoshimatsui* Martin & Sublette 1972**

Synonyms: *C. daitoefeus* Sasa et Suzuki, 2001 (Yamamoto, unpubl.)

C. echizensis Sasa, 1994 (Yamamoto, unpubl.)

Adult:

Male

AR 2.85 (2.58 – 3.88) ;Wing length 3.44 (2.97-3.88) mm, VR 1.04 (1.00-1.07); LR 1.65 (1.57-1.85).

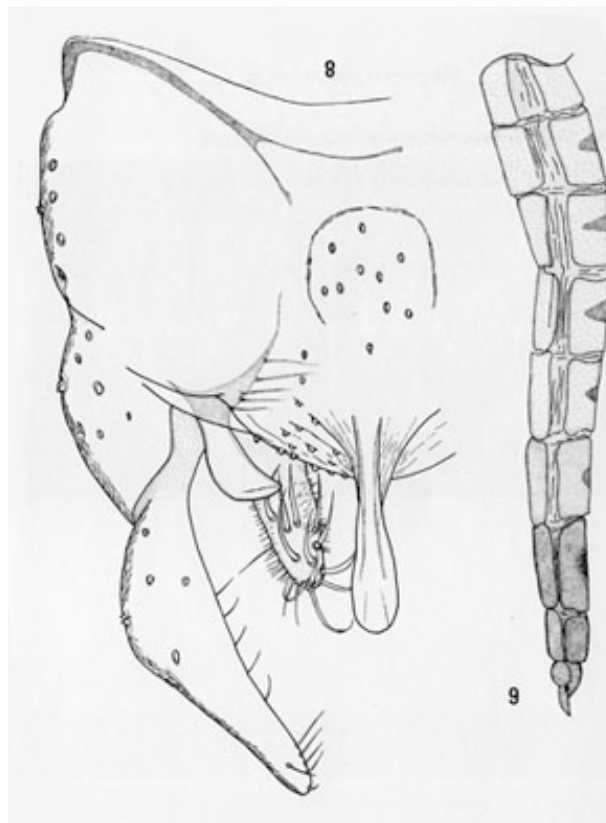
Head: Frontal tubercles 25 x 9 µm, palpal proportions (segments 2-5, units) 5 : 30 : 29 : 40. Clypeus as wide as the antennal pedicel, with 19 setae.

Thorax with vittae most of postnotum, and mesosternum yellowish brown, dark central spot on postnotum. Thoracic setae: acrostichal in one staggered row; dorsolateral about 24 in one to three rows; supra-alar 2; scutellar anterior row of 10 smaller setae, posterior row of 13 larger setae.

Wing with r-m slightly darkened, squama with 17 fringe setae in a partial double row. Legs yellowish, becoming darker on the tarsi, tarsal joints one to three infuscate with a narrow apical dark band, segments four and five almost completely dark. Foretarsus without a beard.

Leg proportions (units):

	Fe	Ti	Ta1	Ta2	Ta3
PI	88	75	120	60	52
PII	89	82	49	26	19
PIII	100	100	73	40	30
	Ta4	Ta5	LR	F/T	Ta5/TI
PI	45	19	1.57-1.85	1.17	0.25
PII	17	10	0.57-0.64	1.08	
PIII	250	100	0.63-0.75	1.00	



From Holotype male (Martin & Sublette 1972)

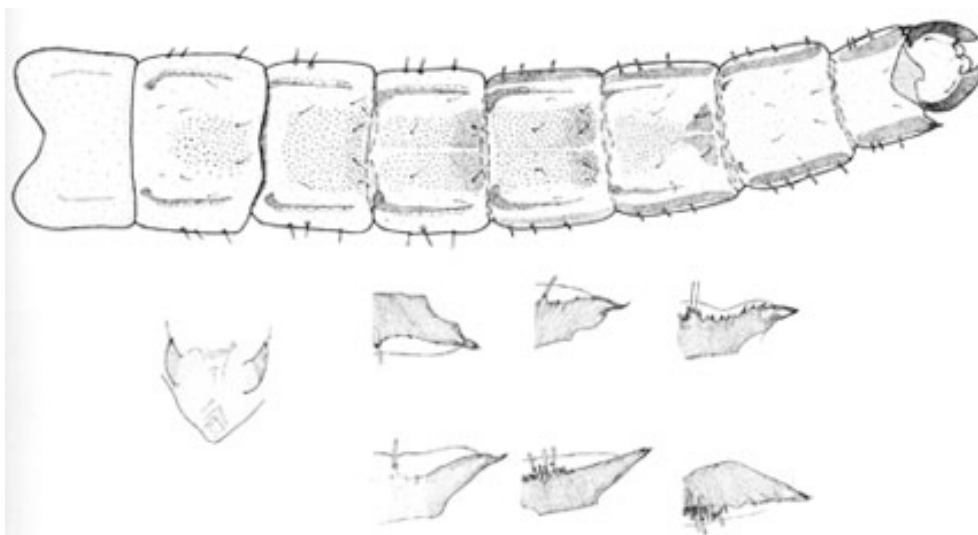
Abdominal tergites II-VI with a transversely elongated central spot, that of VII merges into background.



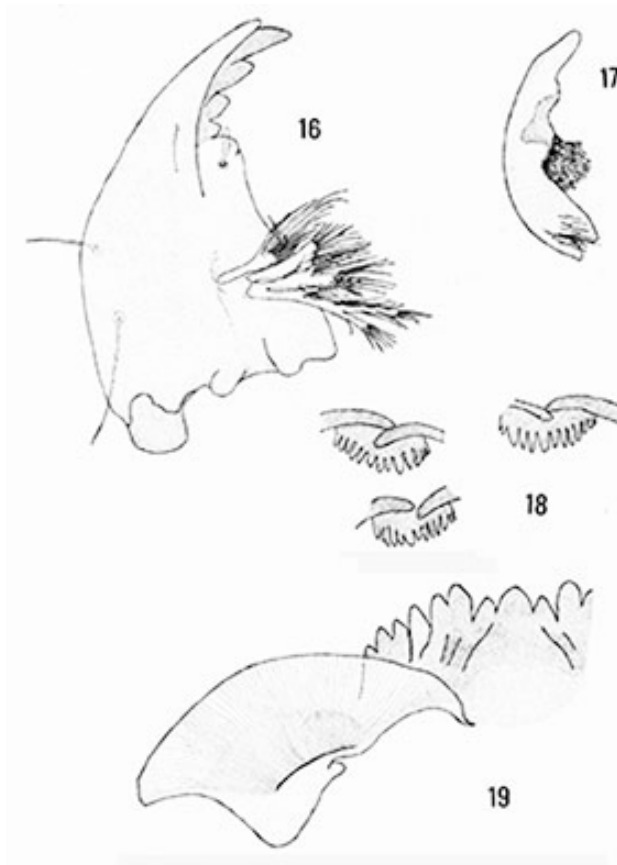
Style reduces gradually from about half way. SV of type D(d-e) of Strenzke. IV with simple setae.

Pupa:

Total length females 7.90-9.99 mm; males 7.99-8.66 mm. Coloration generally darkish
 Frontal tubercles (below) small and conical, with a subapical seta.
 Base of respiratory organ 0.20 x 0.10 mm; above this base is a elongate, narrow, rugose patch; anterior to the base is a smaller rugose patch. Two *Oth* setae near the anterior rugose patch, four *Mth* setae in a longitudinal line parallel to and below the median raphe.
 Recurved hooks on tergite II varying in number from 26-117 (mean abt 94). Posterolateral spur of segment VIII usually with a single spine, but varying up to four.
 Swim fin with one dorsal and 61- 97 (mean abt 82) lateral bristles.



Larva: A medium sized (len. 9.8 – 15.3 mm, females (mean 12.68 mm) generally longer than males (mean 11.43 mm)) bathophilus-type. VT relatively short, posterior pair generally longer (Ant.: 0.30-1.16 (0.72) mm; Post. 0.48-1.36 (0.94) mm.). Anal tubules fingerlike. Gula and FA darkened; FA generally darker along the edges and the posterior end.



From Martin & Sublette (1972)

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Nucleolus terminal in arm G, and in groups 18-19 in arm F. Polymorphic in all arms.

- yosA1: 1 - 2c, 10 - 12, 3 - 2d, 9 - 4, 13 - 19 as holomelas A1
- yosA2: 1a-k, 2k-d, 9 - 4, 13a-f, 3d-i 12 - 10, 2c-a, 3a-c, 14 - 19 from holomelas A2
- yosA3: 1a-k, 11d - 12, 3i-d, 13f-a, 4 - 9, 2d-k, 11c - 10, 2c-a, 3a-c, 14 - 19
- yosB1: Puff near center of arm with distal dark bands (groups 8-7)
- yosB2: Puff near center of arm with proximal dark bands (groups 7-8)
- yosB3: Small inversion of the region of the puff.
- yosC1: 1 - 2g, 13e - 11d, 6e-h, 6d - 2h, 11c - 8a, 15 - 13f, 17a - 16a, 7d-a, 17b - 22
- yosC2:
- yosC3: 1a-e, 5d-6d, 6h-e, 11d-13e, 2g-1f, 5c-2h, 11c-8a, 15-13f, 17a-16a, 7d-a, 17b-22
- yosD1: 1 - 6c, 13g-a, 6d - 12, 14 - 24 2 inv from ST
- yosD2:
- yosE1: 1 - 3e, 10b - 3f, 10c - 13
- yosE2: 1 - 2, 12c - 10c, 3f - 10b, 3e-a, 12d - 13
- yosF1: 1 - 2d, 9 - 2e, 10 - 23
- yosF2: 1 - 2d, 16e - 10, 2e - 9, 16f, - 23

yosG1: Virtually terminal nucleolus.

yosG2:

yosG3:

Molecular Data:

mtCOI: Japanese specimen (AB740260), and Japanese Chironomid Barcode Database. There are sequences for Korean specimens under the name *C. flaviplumus* (accession numbers JF412075 - 077). These are very similar to those of *C. sp. PK6* (see below).

Found: **Type locality - Yamaguchi; Hokkaido, JAPAN** (Holotype male in U.S. National Museum Collection, No. 71268, March 1970, H. Yoshimatsu)

Also Honshu (possibly Otsu City), Japan

Korea - Shilim-dond, Kwanak-gu, Seoul and numerous other localities (as *C. flaviplumus*. Ree & Kim 1981).

Russia: Sakhalin Island; nr. Vladivostok (Kiknadze *et al.* 2003).

Adults redescribed by Ree & Kim (1981) under the name *C. flaviplumus*. Karyotype redescribed by Kiknadze *et al.* (2003).

***Chironomus* species SS**

Larva:

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Nucleolus terminal in arm G, which has two well developed BRs near the middle of the arm. Arm G closely paired.

Arm A:	1 - 2c, 11 - 7, 12, 3 - 2d, 6 - 4, 13 - 19	Inv4-12 from <i>kiiensiss</i>
Arm B:	Puff in arm B about one third from centromere with dark bands distal.	
Arm C:	as species PK6	
Arm D:	Differs by simple inversion from species PK6	
Arm E:	1 - 3e, 10b - 3f, 10c - 13	as <i>luridus</i> , etc.
Arm F:	1 - 2a, 15 - 11, 7 - 2b, 8 - 10, 16 - 23	Inv2b-7 from <i>kiiensiss</i>

Found: Delhi area.

Arms A, E and F described, with some errors, by Saxena (1995)

***Chironomus* species R&S**

Larva:

Cytology: No nucleolus in arm G, but possibly a nucleolus in both chromosomes I (on arm C) and II. The photographs are very poor but consistent with this being *C. circumdatus*.

Found: India - vicinity of Ujjain (or Gwailor).

Various papers by H.S Rathore and H. Swarup from 1980-1982, which refer to a chromosome map in a Ph.D. thesis of 1979.

Chironomus species PK4

(based on Kabeer Colony IN.6.1 photos from P. K.)

Adult: Not currently known

Larva: Morphology not known

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Arm G with three obvious BRs, one near distal end not always developed, but no obvious nucleolus. Nucleolus possibly on arm F, but this is not clear. Polymorphism in arms A, and C.

Arm A1:

A2:

Arm B1: Puff (gp 7) slightly proximal of centre of arm with dark bands (gp 8) distal

Arm C1: Inverted near distal end compared to *striatipennis*

C2: Inversion of about distal two thirds of the arm

Arm D:

Arm E:

Arm F: Bands 7,8,9 near distal end. Could be nucleolus in group 20.

Arm G1: may be similar to *C. incertipennis*.

Found: Jammu & Kashmir: Kabeer colony, Jammu.

Probably equivalent to *C. sp.* PK2 (and *C. incertipennis?*),

Chironomus species PK5

A member of the *Chironomus dorsalis* group. Related to, perhaps conspecific with, *C. alpestris*.

Adult:

Male: Wing length 3.60 mm, width, 0.82 mm. VR 1.08. AR 2.96.

Head: Frontal tubercles small, abt 18 µm. 26 clypeal setae.

Palps (microns) 55 ; 53 : 215 : 230 : 275.

Thoracic setae: Achrostichal - at least 9; Dorsolateral - 21 - 22; Prealar 8;

Supra-alar - 1; Scutellar in two rows - anterior 8, posterior 14.

Legs with dark knees, tibia and tarsi; no beard.

Proportions (micron)

	Fe	Ti	Ta1	Ta2	Ta3
PI	1330	1140	1860	900	790
PII	1410	1285	780	420	300
PIII	1570	1570	1050	600	440
	Ta4	Ta5	LR	F/T	BR
PI	650	280	1.63	1.17	3.2
PII	190	145	0.65	1.10	-
PIII	280	160	0.67	1.00	-

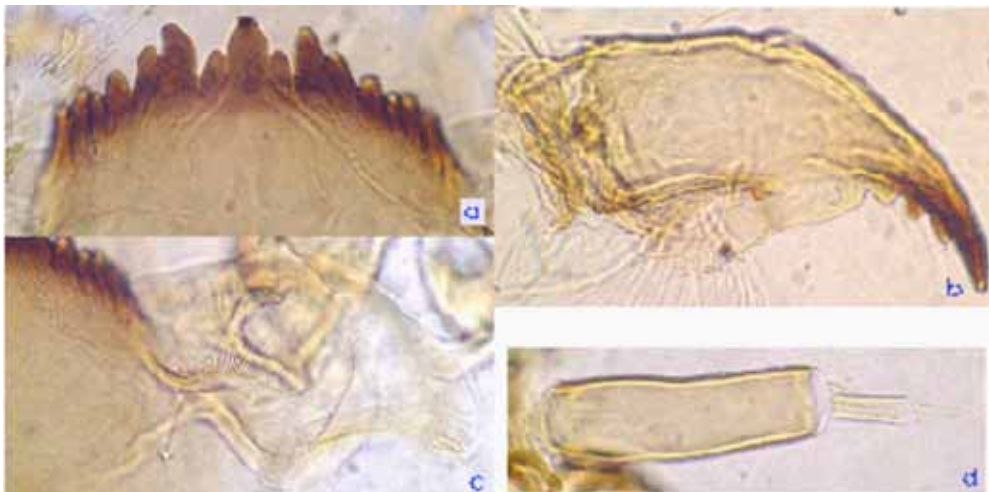
About 10 fine hooked setae on mid tibia and at least 5 on the hind tibia.



Note the S-type superior volsella

The SV (above) is a little 'beak-like' (S-type of Strenzke 1959), but beak is quite short; about 5 setae on tergite 9. Gc moderately expanded c.f. Gs, which narrows relatively slowly from about half way.

Larva: a medium plumosus type. Gular region darkened over posterior 2/3, FA dark, also darkened outside clypeus. VT relatively long, anterior with elbows, posterior pair coiled. Head capsule relatively long and narrow, mentum relatively narrow, mentum width/VHL about 0.49 - 0.52. Mentum (a, below) with 4th laterals reduced to about the level of 5th laterals (type II), 1st laterals tending to curve outwards; centre trifid tooth with c2 teeth well separated (type II, towards type III). Ventromental plates (c, below) separated by about 0.40 of the mentum width. Premandible with sharp teeth, the outer tooth longer; inner tooth about 1.5 to 2 times wider than outer tooth. PE with about 12 - 14 teeth. Mandible (b, below) with 3rd inner tooth well developed (type III); about 18 - 20 furrows on the outer surface at the base. Antenna (d, below) with basal segment about 3.7 times longer than wide, ring organ about half way up from base; AR about 2 - 2.14, A3 quite short; segment proportions (microns) 123 : 30 : 7 : 11 : 6.



Mouthparts of *C. sp*PK5. Note outward curving 1st lateral of mentum.

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Large almost terminal nucleolus in arm G, with a large BR about 1/3 from the other end of the arm. No nucleolus in the long chromosomes. No polymorphism in 5 specimens examined.

Arm A1: 1 - 2c, 4 - 9, 2d - 3, 12- 10, 13 - 19 as *dorsalis*

Arm B1: Puff distal of centre of arm with some dark bands distal.

Arm C1: Large puff about the middle of the arm.

Arm D1:

Arm E1: 1 - 2c, 8b - 6, 3 - 2d, 8 - 9, 4 - 5, 12a - 10, 12b - 13

i.e. In5-9 and In9-3 from *dorsalis*

Arm F1: possibly 1 - 10, 15 - 11, 16 - 23 as *halophilus*

Found: **India** - Jammu & Kashmir: Kabeer colony, Jammu; Deoli Village; University of Jammu & Kashmir, Jammu.

Israel - Mt. Hermon.

DNA sequence

Mitochondrial COI sequence indicates this species is related to *C. alpestris*.

Chironomus species PK6

Related to *C. yoshimatsui*.

Adult not currently known.

Larva: a small-medium plumosus-type. Head capsule with gular region and FA pale.

Cytology: Four polytene chromosomes with the pseudothummi-cytocomplex combination BF, CD, AE, G. Nucleolus terminal on arm G, which may be unpaired in this region. Arm G also with two well developed BRs. Polymorphic in arms A and C.

Arm A1: 1 - 2c, 11 - 7, 12, 3 - 2d, 6 - 4, 13 - 19 as A1 of species SS?

A2:

Arm B1: Puff about 1/3 from centromere, with dark bands distal (as sp.SS)

Arm C1: As species SS

C2:

Arm D1: Differs by simple inversion from species SS

Arm E1: 1 - 3c, 12b - 10c, 3f - 10b, 3ed, 12c - 13 inv3d-12b from *luridus*, etc.

Arm F1: Inv. cf. species SS?

Found: India: Jammu & Kashmir - Deoli village; Kabeer colony; Jammu,;

This species is close to, but not identical with *Chironomus* species (*C. sp. SS*, above) of Sumitra Saxena (1995).

Molecular sequence:

DNA BARCODE close to *C. yoshimatsui*.

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