

## CHIRONOMIDS OF THE RICE PADDY AREAS OF WEST BENGAL, INDIA (DIPTERA: CHIRONOMIDAE)

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Fiftythree species of Chironomidae are recorded for the first time from rice fields of West Bengal, India; 24 of these, including 5 new species, are new to India. *Cryptochironomus judicious* sp. n. is described from male imago, pupa and larva; *Harnischia tenuitubercula* sp. n., *Paracladopelma aratra* sp. n., *P. sacculifera* sp. n. and *Polypedilum circumum* sp. n. from male imagines. The male imago of *Stenochironomus longipalpis* (Kieffer) and all stages and both sexes of *Stictochironomus obscurus* (Guha & Chaudhuri) comb. n., *Clinotanypus fuscusignatus* (Kieffer), and *Procladius noctivagus* (Kieffer) are redescribed. Keys for the identification of genera and species treated are presented for larvae, pupae and adults. A general account of biology, emergence patterns and sex ratios concludes this paper.

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Key words. – Chironomidae, rice fields, new species, keys, emergence, sex ratio.

Although rice fields have long been recognised as a pre-eminent habitat for chironomids, there are only few works dealing with this habitat. Thienemann (1954) listed the species of midges from rice fields of Southern Sumatra and West Java where the larvae were used as food of carp. The harmful activities of larvae of *Cricotopus trifasciatus* Panzer to the rice seedlings in France were discussed by Risbec (1952). Darby (1962) made a list of 36 species from rice fields and its vicinities of California (U.S.A.) and regarded 30 of them as actually inhabiting the rice paddies. Jones (1968) reported *Chironomus tepperi* Skuse as a pest of rice in Australia. Martin & Porter (1977) presented the biology of this species in the laboratory. Bognár (1958) included chironomids in the arthropod pest group of Hungary. Many chironomid species were reported to injure rice seedlings in Japan (Tokunaga & Kuroda 1935, 1936, Yokogi & Ueno 1971, Ishihara 1972). Hashimoto et al. (1981) gave a brief description of the adult morphology of 32 species of chironomids in the rice fields of Thailand. Sasa & Kikuchi (1986) made an account of 34 species from the rice fields of Japan and stated that at least 40 species of chironomids were found to be breeding in the rice paddy areas of Japan. There has been no previous attempt to give an account of chironomids of rice fields of the Indian subcontinent.

The present paper records 53 chironomid species from the rice paddies of West Bengal, India. Of these, 24 species, including 5 new species, are new

for India. A brief account of the biology, emergence patterns and sex ratios is also presented.

### MATERIAL AND METHODS

Adults were collected by sweeping in the rice fields with a long handled insect net. Larvae were collected from bottom mud in the rice fields with the help of mud scrapers and a scoop sampler. Larvae were reared in petridishes in the laboratory following the procedure given by Chaudhuri et al. (1983). Unless otherwise mentioned, all specimens listed under 'Material examined' were collected in West Bengal by S. Chattopadhyay.

The phenol-balsam technique, as used by Das Gupta & Wirth (1968) was followed for microslide preparation of larvae, pupae and adults. Larval and pupal exuviae were also mounted on microslides in Gum-chloral solution (Sasa 1978) without dehydration. Morphological terminology essentially follows Saether (1980).

Measurements are given in millimeters (mm); the mean value is followed by the range and sample size (n) in parentheses.

The types, paratypes and other specimens of this study are provisionally kept in the insect collection of the Entomology Laboratory, Department of Zoology, University of Burdwan (B.U. Ent.), West Bengal, India, but will be deposited in the National Zoological Collections, Calcutta (NZC); National Pusa Collections, New Delhi; British Museum

(Natural History), London (BMNH); United States National Museum, Washington D.C. (USNM) and Zoologische Staatssammlung, München (FRG) in due course.

LIST OF CHIRONOMID SPECIES TREATED

Subfamily: Chironominae

Tribe: Chironomini

1. *Chironomus circumdatus* (Kieffer)
2. *Chironomus fultarsis* Kieffer
3. *Chironomus javanus* Kieffer
4. *Chironomus nudipes* Kieffer
5. *Chironomus samoensis* Edwards
6. *Chironomus striatipennis* Kieffer
7. *Cryptochironomus fulvus* (Johannsen)
8. *Cryptochironomus judicious* sp. n.
9. *Cryptochironomus rostratus* (Kieffer)
10. *Cryptochironomus subovatus* Freeman
11. *Dicotendipes pelochloris* (Kieffer)
12. *Dicotendipes septemmaculatus* (Becker)
13. *Endochironomus pekanus* (Kieffer)
14. *Harnischia acuta* (Goetghebuer)
15. *Harnischia incidata* Townes
16. *Harnischia tenuitubercula* sp. n.
17. *Harnischia viridula* (Linnaeus)
18. *Kiefferulus barbatitarsis* (Kieffer)
19. *Kiefferulus calligaster* (Kieffer)
20. *Microchironomus fuscitarsus* (Guha & Chaudhuri)
21. *Microchironomus tener* (Kieffer)
22. *Paracladopelma aratra* sp.n.
23. *Paracladopelma sacculifera* sp.n.
24. *Pentapedilum robusticeps* Guha & Chaudhuri
25. *Pentapedilum uncinatum* (Goetghebuer)
26. *Polypedilum aegyptium* Kieffer
27. *Polypedilum annulatus* (Kieffer)
28. *Polypedilum ascium* Chaudhuri, Guha & Das Gupta
29. *Polypedilum chaudhurii* Chaudhuri, Guha & Das Gupta
30. *Polypedilum circulum* sp. n.
31. *Polypedilum lineatum* Chaudhuri, Guha & Das Gupta
32. *Polypedilum nubifer* (Skuse)
33. *Polypedilum medivittatum* Tokunaga
34. *Polypedilum suturalis* (Johannsen)
35. *Polypedilum yapensis* Tokunaga
36. *Stenochironomus bilaris* (Walker)
37. *Stenochironomus longipalpis* (Kieffer)
38. *Stictochironomus affinis* (Johannsen)
39. *Stictochironomus obscurus* (Guha & Chaudhuri) comb.n.
40. *Xenochironomus flaviventris* (Kieffer)

Tribe: Tanytarsini

41. *Cladotanytarsus conversus* (Johannsen)
42. *Cladotanytarsus gloveri* Ghosh & Chaudhuri
43. *Cladotanytarsus multispinulus* Guha, Das, Chaudhuri & Choudhuri
44. *Tanytarsus bifurcus* Freeman
45. *Tanytarsus commoni* Glover
46. *Tanytarsus fuscimarginalis* Chaudhuri, Guha & Ghosh
47. *Tanytarsus vinculus* Chaudhuri, Guha & Ghosh

Subfamily: Tanypodinae

48. *Chinotanypus fuscisignatus* (Kieffer)
49. *Procladius noctivagus* (Kieffer)

50. *Tanypus bilobatus* (Kieffer)
51. *Tanypus grandis* Chaudhuri, Das & Debnath
52. *Tanypus lucidus* Chaudhuri, Das & Debnath
53. *Tanypus tenebrosus* Chaudhuri, Das & Debnath

KEYS TO GENERA AND SPECIES

Larvae

Key 1. Chironomini – genera

1. Antenna 6 segmented ..... *Stictochironomus* Kieffer (key 4)
  - Antenna 5 segmented ..... 2
2. Mentum with broad, pale untoothed central region ..... *Cryptochironomus* Kieffer (species 7-10)
  - Mentum without broad, pale untoothed central region ..... 3
  - Ventral tubules present ..... 4
  - Ventral tubulus absent ..... 5
3. Segment XI with 2 pairs of ventral tubules ..... *Chironomus* Meigen (species 1-6)
  - Segment XI with 1 pair of ventral tubules ..... 6
5. S I blade-like. Mentum with a trifid median tooth and 6 pairs of lateral teeth ..... *Microchironomus* Kieffer (key 3)
  - S I plumose. Mentum with a bifid median tooth and 7 pairs of lateral teeth ..... *Polypedilum* Kieffer (species 26-35)
6. Pecten epipharyngis with 5 teeth ..... *Dicotendipes* Kieffer (species 11, 12)
  - Pecten epipharyngis with 16-19 teeth ..... *Kiefferulus* Goetghebuer (key 2)

Key 2. *Kiefferulus* Goetghebuer

1. S I pectinate. Ventromental plate with wrinkled outer surface. Posterior parapods each with 15-16 well-sclerotised claws ..... 18. *barbatitarsis* (Kieffer)
  - S I plumose. Ventromental plate with smooth outer surface. Posterior parapods each with 13-14 claws ..... 19. *calligaster* (Kieffer)

Key 3. *Microchironomus* Kieffer

1. Mandible with pointed lateral teeth; seta interna with 3 main plumose branches; pecten mandibularis well developed. Ventromental plate wrinkled at its outer margin ..... 20. *fuscitarsus* (Guha & Chaudhuri)
  - Mandible with flat lateral teeth; seta interna with 3-4 filaments; pecten mandibularis absent. Ventromental plate smooth at its outer margin ..... 21. *tener* (Kieffer)

Key 4. *Stictochironomus* Kieffer

1. S I and S II leaf like; pecten epipharyngis comprised of 3 toothed plates, median one with 3 and each lateral one with 8 teeth ..... 38. *obscurus* (Guha & Chaudhuri)
  - S I and S II plumose; pecten epipharyngis comprised of 3 toothed plates, median one with 3-5 and each lateral one with 5 teeth ..... 39. *affinis* (Johannsen)

Key 5. Tanypodinae – genera

1. M appendage without pseudoradula ..... *Tanypus* Meigen (species 50-53)
  - M appendage with pseudoradula ..... 2

2. Dorsomental teeth not located on distinct plate. Mandible strongly hooked with large, pointed basal tooth. Ligula with 6 teeth . . . . .  
     . . . . . *Clinotanypus* Kieffer (species 48)
- Dorsomental teeth located on distinctly defined plate. Mandible not as above. Ligula with 5 teeth . . . . .  
     . . . . . *Procladius* Skuse (species 49)

- Thoracic horn with plastron plate . . . . . 2
2. Plastron plate reduced. Anal fin with a fringe of spines or spinules . . . . .  
     . . . . . *Procladius* Skuse (species 49)
- Plastron plate broad. Anal fin without a fringe of spines or spinules . . . . .  
     . . . . . *Clinotanypus* Kieffer (species 48)

## Pupae

### Key 6. Chironomini – genera

1. Anal segment dorsally with forked, posteromedian process . . . . .  
     . . . . . *Cryptochironomus* Kieffer (species 7-10)
- Anal point without such process . . . . . 2
2. Segment VIII with 2 pair of simple caudolateral spurs, ending in a point . . . . . 3
- Segment VIII with 1 pair of caudolateral spurs, each with more than 1 point . . . . . 4
3. Thoracic horn with a bunch of finely branched filaments . . . . .  
     . . . . . *Dicrotendipes* Kieffer (species 11, 12)
- Thoracic horn with 4 main bunches of finely branched filaments . . . . .  
     . . . . . *Microchironomus* Kieffer (key 8)
4. Segment VI with only 3 pairs of filamentous lateral setae . . . . . 5
- Segment VI with more than 3 pairs of filamentous lateral setae . . . . . 6
5. Frontal setae short and slender . . . . .  
     . . . . . *Polypedilum* Kieffer (species 26-35)
- Frontal setae long, robust and broad . . . . .  
     . . . . . *Stictochironomus* Kieffer (key 9)
6. Tergite VII without median shagreen . . . . .  
     . . . . . *Kiefferulus* Goetghebuer (key 7)
- Tergite VII with median shagreen . . . . .  
     . . . . . *Chironomus* Meigen (species 1-6)

### Key 7. *Kiefferulus* Goetghebuer

1. Thoracic horn with a bunch of fine filaments. Segment I with 1 pair of lateral setae, dorsal setae absent . . . . . 18. *barbatitarsis* (Kieffer)
- Thoracic horn with 2 plumose branches. Segment I without lateral setae, dorsal setae 2 pairs . . . . .  
     . . . . . 19. *calligaster* (Kieffer)

### Key 8. *Microchironomus* Kieffer

1. Frontal seta absent. Tergite VII bare. Segments II-VIII with 1, 2, 2, 3, 4, 4, 2 pairs of dorsal setae. Segments V-VI without filamentous lateral setae . . . . .  
     . . . . . 20. *fuscitarsus* (Guha & Chaudhuri)
- Frontal seta present. Tergite VII with subbasal transverse patches of shagreen. Segments II-VIII with 3, 6, 5, 4, 6, 6, 4 pairs of dorsal setae. Segments V-VI with filamentous lateral setae . . . . .  
     . . . . . 21. *tener* (Kieffer)

### Key 9. *Stictochironomus* Kieffer

1. Thoracic horn with a bunch of finely branched filaments, segment I without dorsal setae . . . . .  
     . . . . . 36. *obscurus* (Guha & Chaudhuri)
- Thoracic horn with 2 main bunches of finely branched filaments, segment I with dorsal setae . . . . .  
     . . . . . 37. *affinis* (Johannsen)

### Key 10. Tanypodinae – genera

1. Thoracic horn without plastron plate . . . . .  
     . . . . . *Tanypus* Meigen (species 50-53)

## Adults

### Key 11. Chironomini – genera

1. Anal point with basolateral setaceous lobe . . . . .  
     . . . . . *Microchironomus* Kieffer (key 17)
- Anal point without basolateral setaceous lobe . . . . . 2
2. Posterior tibia with one spur . . . . . 3
- Posterior tibia with two spurs . . . . . 5
3. Macrotrichia present on wing membrane, wing without spots or markings . . . . .  
     . . . . . *Pentapedilum* Kieffer (key 19)
- Macrotrichia absent on wing membrane, wing with or without spots or markings . . . . . 4
4. Mesonotum with a distinct tubercle at the posterior end of the median vittae. Femora and tibiae usually ringed . . . . .  
     . . . . . *Stictochironomus* Kieffer (key 22)
- Mesonotum without such tubercle at the posterior end of median vittae. Femora and tibiae not distinctly ringed . . . . .  
     . . . . . *Polypedilum* Kieffer (key 20)
5. Inferior volsella reaching well beyond tip of gonocoxite and bearing long curved setae . . . . . 6
- Inferior volsella not reaching beyond tip of gonocoxite and without long curved setae . . . . . 11
6. Inferior volsella extremely broad and bulbous apically . . . . .  
     . . . . . *Kiefferulus* Goetghebuer (key 16)
- Inferior volsella slender, not or scarcely enlarged distally . . . . . 7
7. Inferior volsella strongly bowed dorsoventrally with an expanded clubbed or slightly to deeply bifid to trifid apex bearing many strong setae . . . . .  
     . . . . . *Dicrotendipes* Kieffer (key 14)
- Inferior volsella not as above . . . . . 8
8. Anal point very broad. Superior volsella short, broad and pubescent . . . . .  
     . . . . . *Xenochironomus* Kieffer (species 40)
- Anal point narrow. Superior volsella not as above . . . . . 9
9. Superior volsella strongly chitinized and bare except for a few long basal setae, usually ending a spur or hook . . . . .  
     . . . . . *Chironomus* Meigen (key 127)
- Superior volsella not as above . . . . . 10
10. Anteprepronotum extending to anterior edge of scutum but deeply divided into two anterior lobes. Inferior volsella slender bearing 2 long apical setae and without terminal spine . . . . .  
     . . . . . *Endochironomus* Kieffer (species 13)
- Anteprepronotum not as above. Inferior volsella very long bearing no apical setae but with a well differentiated terminal spine . . . . .  
     . . . . . *Stenochironomus* Kieffer (key 21)
11. Superior volsella short and broad, densely pubescent with a few long setae. Inferior volsella in the form of a small pubescent pad . . . . .  
     . . . . . *Paracladopelma* Harnisch (key 18)
- Both volsellae not as above . . . . . 12

12. Gonostylus short and broad. Superior volsella short, broad and pubescent ..... *Cryptochironomus* Kieffer (key 13)  
 - Gonostylus longer. Superior volsella reduced, occasionally absent ..... *Harnischia* Kieffer (key 15)

**Key 12. *Chironomus* Meigen**

1. Wing with spots or markings ..... 6. *striatipennis* Kieffer  
 - Wing without spots or markings ..... 2  
 2. Anteprenotals 2. Scutellum with 8 setae ..... 3. *javanus* Kieffer  
 - Anteprenotals absent. Scutellum with more than 17 setae ..... 3  
 3. Corona with 2 setae. Gonostylus oblong with blunt apex ..... 4. *nudipes* Kieffer  
 - Corona bare. Gonostylus not as above ..... 4  
 4. Branchiolium with 3 setae. Haltere setose ..... 5. *samoensis* Kieffer  
 - Branchiolium with 2 setae. Haltere bare ..... 5  
 5. Tergites II-V with grey, oval median spots ..... 1. *circumdatus* (Kieffer)  
 - Tergites II-IV with brown, square median spots ..... 2. *filitarsis* Kieffer

**Key 13. *Cryptochironomus* Kieffer (males)**

1. Scutellum with 6-10 setae ..... 2  
 - Scutellum with 17-26 setae ..... 3  
 2. Frontal tubercles prominent and each with an apical knob. Superior volsella more or less globular, inferior volsella small and superposed on superior volsella ..... 7. *fulvus* (Johannsen)  
 - Frontal tubercles small, rounded and each without an apical knob. Superior volsella short, digitiform; inferior volsella absent ..... 10. *subovatus* Freeman  
 3. Haltere light yellow with 11-13 setae. Superior volsella cone shaped bearing 2 setae, inferior volsella absent ..... 8. *judicis* sp. n.  
 - Haltere yellowish green and bare. Superior volsella thumblike bearing 3 apical setae, inferior volsella present ..... 9. *rostratus* (Kieffer)

**Key 14. *Dicrotendipes* Kieffer (males)**

1. Scutellum with 6-8 setae in one transverse row. Wing without spots. Inferior volsella gently bowed ventrally ..... 11. *pelocholoris* (Kieffer)  
 - Scutellum with 12 setae in two transverse rows. Wing with 6 grey spots. Inferior volsella bifurcated into 2 blunt lobes ..... 12. *septemmaculatus* (Becker)

**Key 15. *Harnischia* Kieffer (males)**

1. Male hypopygium without well marked gonocoxite and gonostylus ..... 17. *viridula* (Linnaeus)  
 - Male hypopygium with well marked gonocoxite and gonostylus ..... 2  
 2. Haltere bare ..... 16. *tenuitubercula* sp. n.  
 - Haltere setose ..... 3  
 3. Branchiolium with 2 setae. Superior volsella bearing 3 long apical setae, inferior volsella rudimentary without long setae ..... 14. *acuta* (Goetghebuer)  
 - Branchiolium with 1 seta. Superior volsella bearing 1 apical seta, inferior volsella absent ..... 15. *incidata* Townes

**Key 16. *Kiefferulus* Goetghebuer (males)**

1. Scutellum with 20 setae in two transverse rows. Branchiolium with 4 setae. Anal point well developed, tongue like ..... 18. *barbatitarsis* (Kieffer)  
 - Scutellum with 6 setae in one transverse row. Branchiolium with 2 setae. Anal point dark, more or less peg-like ..... 19. *calligaster* (Kieffer)

**Key 17. *Microchironomus* Kieffer (males)**

1. Anal point with a small setaceous basolateral lobe. Gonostylus with 15-17 setae at its inner margin. Superior volsella little curved with 1 apical seta ..... 20. *fuscitarsus* (Guha & Chaudhuri)  
 - Anal point with a large setaceous basolateral lobe. Gonostylus with 8-10 setae at its inner margin. Superior volsella long and slender with 2-3 apical spine ..... 21. *tener* (Kieffer)

**Key 18. *Paracladopelma* Harnisch (males)**

1. Frontal tubercles absent. Prescutellar present. Spurs of hind tibia equal. Anal point tubular ..... 22. *aratra* sp. n.  
 - Frontal tubercles present. Prescutellar absent. Spurs of hind tibia unequal. Anal point with saccular tip ..... 23. *sacculifera* sp. n.

**Key 19. *Pentapedilum* Kieffer**

1. Scutellum with 26 setae in two transverse rows. Branchiolium with 7 setae. Anal point robust, superior volsella without lateral ..... 24. *robusticeps* Guha & Chaudhuri  
 - Scutellum with 10-11 setae in a transverse row. Branchiolium with 1 seta. Anal point rod like, rather pointed at tip, superior volsella with 1 lateral seta ..... 25. *uncinatum* (Goetghebuer)

**Key 20. *Polypedilum* Kieffer (males)**

1. Wing with spots or markings ..... 2  
 - Wing without spots or markings ..... 6  
 2. AR less than 1 ..... 31. *lineatum* Chaudhuri et al.  
 - AR more than 1 ..... 3  
 3. Frontal tubercles present ..... 32. *nubifer* (Skuse)  
 - Frontal tubercles absent ..... 4  
 4. Anal point narrow with pointed apex ..... 27. *annulatipes* (Kieffer)  
 - Anal point broad without pointed apex ..... 5  
 5. Prealars 3. Scutellum with a row of setae ..... 26. *aegyptium* Kieffer  
 - Prealars 6. Scutellum with 2 rows of setae ..... 29. *chaudhurii* Chaudhuri et al.  
 6. Haltere setose ..... 7  
 - Haltere bare ..... 8  
 7. Superior volsella curved with blunt tip and 1 long lateral seta near the base ..... 30. *circulum* sp. n.  
 - Superior volsella scimitar-like without lateral seta ..... 33. *medi vittatum* Tokunaga  
 8. Superior volsella without lateral seta ..... 28. *ascium* Chaudhuri et al.  
 - Superior volsella with lateral seta ..... 9  
 9. Prescutellar present, scutellum with 6 setae. Tergites I-VII with brown median band ..... 34. *suturalis* (Johannsen)  
 - Prescutellar absent, scutellum with 4 setae. Tergites uniformly brown ..... 35. *yapensis* Tokunaga

**Key 21. *Stenochironomus* Kieffer (males)**

1. Scutellum with 30 setae in two transverse rows. Wing with pale median and apical bands . . . . . 36. *bilalis* (Walker)
- Scutellum with 14 setae in one transverse row. Wing unmarked . . . . . 37. *longipalpis* (Kieffer)

**Key 22. *Stictochironomus* Kieffer (males)**

1. Corona with 4 setae. Anal point with an apical knob . . . . . 39. *obscurus* (Guha & Chaudhuri)
- Corona bare. Anal point without apical knob . . . . . 38. *affinis* (Johannsen)

**Key 23. *Tanytarsini* – genera**

1. Median volsella long and branched . . . . . *Cladotanytarsus* Kieffer (key 24)
- Median volsella short and brush-like . . . . . *Tanytarsus* v. d. Wulp (key 25)

**Key 24. *Cladotanytarsus* Kieffer (males)**

1. Frontal tubercles absent . . . . . 43. *multispinulus* Guha et al.
- Frontal tubercles present . . . . . 2
2. Anal point inverted 'bell-shaped' and with 6-8 punctures . . . . . 42. *gloveri* Ghosh & Chaudhuri
- Anal point short without punctures . . . . . 41. *conversus* (Johannsen)

**Key 25. *Tanytarsus* v. d. Wulp (males)**

1. Anal point bifurcated . . . . . 44. *bifurcus* Freeman
- Anal point simple . . . . . 2
2. Brachiolum with 2 setae . . . . . 46. *fuscimarginalis* Chaudhuri et al.
- Brachiolum with 1 seta . . . . . 3
3. Scutellum with 6 setae. Anal point with 4 lateral setae and a subapical oval lobe . . . . . 45. *commoni* Glover
- Scutellum with 4 setae. Anal point without lateral setae and subapical oval lobe . . . . . 47. *vinculus* Chaudhuri et al.

**Key 26. *Tanypodinae* – genera**

1. Fourth tarsal segment bilobed and shorter than fifth . . . . . *Clintanypus* Kieffer (species 48)
- Fourth tarsal segment cylindrical and not shorter than fifth . . . . . 2
2. Distance between FCu and MCu less than one third the length of Cu<sub>1</sub> . . . . . *Tanypus* Meigen (key 27)
- Distance between FCu and MCu at least half the length of Cu<sub>1</sub> . . . . . *Procladius* Skuse (species 49)

**Key 27. *Tanypus* Meigen (males)**

1. Brachiolum with 1 seta . . . . . 2
- Brachiolum with 2 setae . . . . . 3
2. Scutellum with 10 large setae at the posterior border and 20-22 small setae arranged in the anterior . . . . . region . . . . . 52. *lucidus* Chaudhuri et al.
- Scutellum with 6-10 setae at the posterior region . . . . . 50. *bilobatus* (Kieffer)
3. Tarsomeres I-IV with apical dark brown bands, tarsomere V brown . . . . . 51. *grandis* Chaudhuri et al.
- Tarsomeres uniformly brown . . . . . 53. *tenebrosus* Chaudhuri et al.

## SYSTEMATIC ACCOUNT

1. *Chironomus circumdatus* (Kieffer)

*Tendipes circumdatus* Kieffer, 1916: 110.  
*Chironomus circumdatus*; Hashimoto 1977: 83; Sasa 1978: 11; Hashimoto et al. 1981: 5; Sasa & Hasegawa 1983: 316; Sasa & Kikuchi 1986: 18.

Material examined. – 11 ♂, Howrah, 4 September 1987; 6 ♂, Haldia, 16 October 1987; 4 ♂, Burdwan, 7 September 1987.

Distribution. – Japan, Korea, Taiwan, Thailand and India (present record).

Differential diagnosis. – i) scutellum with 24-26 setae, ii) abdominal tergites I-V each with grey oval median spot, iii) a deep constriction between segments VII and VIII and iv) hypopygium with stout anal point and superior volsella slightly curved.

2. *Chironomus filitarsis* Kieffer

*Chironomus filitarsis* Kieffer, 1911: 160; Chaudhuri & Guha 1987: 27.

Material examined. – 6 ♂, Burdwan, 30 May 1986.

Distribution. – India.

Differential diagnosis. – i) scutellum with 22-24 setae, ii) fore tibial scale blunt, bearing 2 long setae, iii) tergites II-IV each with square shaped dark brown spot and iv) superior volsella bent inward with pointed apex.

3. *Chironomus javanus* Kieffer

*Chironomus javanus* Kieffer, 1924b: 263; Johannsen 1932: 536; Tokunaga 1964: 566; Hashimoto et al. 1981: 7; Sasa & Hasegawa 1983: 317; Sasa & Kikuchi 1986: 18.

Material examined. – 6 ♂, Farakka, 29 September 1986; 9 ♂, Howrah, 4 September 1987.

Distribution. – Caroline Islands, Japan, Java, Marshall Islands, Thailand and India (present record).

Differential diagnosis. – i) antepnotum bearing 2 antepnotals, ii) supraalars absent, iii) fore tibial scale bearing 4 long setae, iv) tarsomeres I-III brown at apex, tarsomeres IV-V dark brown and v) hypopygium with long and tubular anal point, gonostylus with swollen basal half and superior volsella curved.

Remarks. – The specimens collected from the rice fields conform fully with those described by Hashimoto et al. (1981) and Sasa & Hasegawa (1983), except minor morphometrical differences.

#### 4. *Chironomus nudipes* Kieffer

*Chironomus nudipes* Kieffer, 1911: 164; Chaudhuri & Guha 1987: 27.

Material examined. – 6 ♂, Uttarpara, 9 September 1987.

Distribution. – India.

Differential diagnosis. – i) fore tibial scale with 2 long setae, ii) tarsomeres III-V brown, iii) tergites VI-VII each with dark brown median spot and iv) hypopygium with stout, arrow shaped anal point, gonostylus oblong with blunt apex, superior volsella bow-shaped and inferior volsella curved.

#### 5. *Chironomus samoensis* Edwards

*Chironomus samoensis* Edwards, 1928: 67; Tokunaga 1964: 567; Hashimoto 1977: 82; Sasa & Hasegawa 1983: 316; Sasa & Kikuchi 1986: 18.

*Chironomus dorsalis* Tokunaga, 1940a: 220 (see Tokunaga 1964).

*Chironomus eximius* Johannsen, 1946: 193 (see Tokunaga 1964).

*Chironomus flaviplumus* Tokunaga, 1940b: 294; Sasa 1978: 12; Ree & Kim 1981: 136.

Material examined. – 8 larvae, Berhampur, 2 January 1988; 4 larvae, 12 ♂ and 12 ♀ pupae, 5 ♂ and 7 ♀ exuviae, 10 ♂ and 10 ♀, all reared.

Distribution. – Caroline Islands, Japan, Java, Korea, Marshall Islands, Samoa, S. Mariana Islands and India (present record).

Differential diagnosis. – Larva: i) sickle shaped S I, ii) pecten epipharyngis with 14 teeth, iii) premandible with 2 unequal apical teeth, premandibular brush short, iv) mandible with 2 seta externa, v) blade-like anterior chaeta of maxilla and vi) Xth abdominal segment with apically pointed caudolateral processes.

Pupa: i) cephalic tubercles conical, bearing sub-apical setae, ii) thoracic horn with a bunch of finely branched filaments, iii) pedes spurii A present caudolaterally on segment IV-VII, iv) segment I-VIII with 4, 5, 3, 4, 3, 4, 6, 2 pairs of dorsal setae and 1, 3, 3, 3, 4, 4, 5 pairs of lateral setae, v) caudolateral spur on segment VIII with 2-4 unequal points or branches, vi) G/F 0.66 in male and 0.76 in female.

Adult: i) frontal tubercles well developed, ii) prescutellar present, scutellars in two transverse row, iii) brachiolum with 3 setae, iv) RM and FCu almost in the same line, v) colour pattern of legs, vi) tergites II-VI with grey median spots in male, vii) superior volsella of male hypopygium shoe shaped, inferior volsella with 13-15 apically bifid or trifid setae and viii) genitalia of female with prominent apodeme lobe.

#### 6. *Chironomus striatipennis* Kieffer

*Chironomus striatipennis* Kieffer, 1910: 236; Chaudhuri & Guha 1987: 27.

Material examined. – 6 ♂, Palasi, 18 August 1986; 3 ♂, Uttarpara, 24 February 1987; 8 ♂, Burdwan, 6 September 1987.

Distribution. – India and Taiwan.

Differential diagnosis. – i) scutellum with 14-18 setae, ii) markings in wings, iii) tarsomeres I-III dark brown at apices, iv) tergites II-V with brown median spots and v) hypopygium with bent anal point and curved superior volsella.

#### 7. *Cryptochironomus fulvus* (Johannsen)

*Chironomus fulvus* Johannsen, 1905: 224.

*Chironomus* (*Cryptochironomus*) *fulvus*; Johannsen 1937: 39.

*Tendipes* (*Cryptochironomus*) *fulvus*; Darby 1962: 50.

*Cryptochironomus fulvus* (Johannsen); Townes 1945: 98; Hashimoto et al. 1981: 16; Sasa & Hasegawa 1983: 322; Sasa & Kikuchi 1986: 20.

Material examined. – 5 ♂, Berhampur, 17 August, 1986.

Distribution. – Japan, Thailand, U.S.A. and India (present record).

Differential diagnosis. – i) frontal tubercles prominent and each with an apical knob, ii) antepnotum reduced, iii) scutellum with 10 irregular setae, iv) gonocoxite and gonostylus ankylosed, v) superior volsella semiglobular, finely setose and with 3 long setae and vi) inferior volsella small, superposed on superior volsella bearing one apical seta.

#### 8. *Cryptochironomus judicious* sp. n.

Type material. – Holotype ♂, India, West Bengal, Uttarpara, 9 September 1987, leg. S. Chattopadhyay (Type no. 182 B.U. Ent.). Paratypes: 4 ♂, data as holotype; 5 ♂, 8 pupae and 8 exuviae, 6 larvae and 4 exuviae, all reared in laboratory.

Differential diagnosis. – Larva: i) AR 0.96, ii) S I and S II blade like, iii) premandible with 4 unequal apical teeth, premandibular brush dense, short, iv) pecten mandibularis absent, v) each lateral comb of mentum with 7 dark pointed teeth; 7th tooth minute, vi) maxilla with 2 sensilla basiconica and vii) procerus with 8 anal setae.

Pupa: i) cephalic tubercles elevated and bearing subapical setae, ii) thoracic horn with an oval base and finely branched filaments, iii) pedes spurii A caudolateral on segment IV and pedes spurii B basolateral on segment I, iv) tergite I bare, v) lateral setae on segments VI-VIII filamentous and vi) caudolateral spur on segment VIII with 4-5 stout spines.

Adult: i) frontal tubercles very small, ii) scutel-

lum with 26 irregular setae, iii) haltere light yellow with 11-13 setae, iv) fore tibia with a blunt scale bearing 3 long setae, v) colour pattern of tersomeres, vi) pulvilli moderately developed, vii) tergites II-VI with grey caudal spots, viii) gonostylus dark brown and iv) superior volsella cone shaped bearing 2 setae.

Remarks. – The species is named *judicius* for its pointed teeth of the lateral combs of the larval mentum. The present species resembles *C. neonicicola* Kieffer as described by McLachlan (1969) in respect to the larval antennal characteristics. It shares similarities in the mandible with *C. lindneri* Freeman, *C. dicerus* Kieffer and *C. conus* Mason, 1985, in the ventromental plate with *C. ramus* Mason, 1985 and in mentum and maxilla with *C. eminentia* Mason. The pupal respiratory organ of *C. redekei* (Kruseman) appears to be similar to that of the present species. The adults of the new species look like *C. conus* Mason in the shape and structure of the anal point of the male hypopygium.

### Description

Adult. – Male: Body 3.98 (3.91-4.13, n = 9) long, wing 1.47 (1.44-1.48, n = 10) long and 0.46 (0.45-0.48, n = 10) wide.

Head: Brown. Vertex with 8-11 setae (Iv 2-3, OV 5-6, PO 1-2). Corona bare. Clypeus with 23-25 setae, clypeal ratio 1:1. Maxillary palp pale brown, ratio of palpomere length I-V: 9 : 14 : 38 : 33 : 52; L/W. 4.75. Frontal tubercles (fig. 1) small. Antenna brown, ratio of flagellomere length I-XI: 17 : 7 : 8 : 6 : 6 : 6 : 6 : 6 : 5 : 254; AR 3.36; pedicel ratio 0.94. CA 0.57; CP 1.24.

Thorax: Yellow: Anteprepronotum collar-like with slight emargination in the middle, anteprepronotals O. Mesonotum with 3 brown vittae. Acrostichals 24-25 irregularly biserial, dorsocentrals 17 uniserial, humerals 5, prealars 5. Scutellum with 26 irregular setae, postscutellum dark brown and bare. Wing (fig. 2): Hyaline. Brachiolum with 2 setae and 19-21 sensilla campaniformia. R with 24, R<sub>1</sub> with 11-12 and R<sub>4+5</sub> with 26-28 setae; R<sub>2+3</sub> meets C at a distance of 0.14 from R<sub>1</sub>; RM and FCu almost in same line. An ends below FCu. Squama with 12-13 setae. Haltere light yellow with 11-13 setae. CR 0.89; VR 1.12.

Legs: Yellow. Fore tibia with a blunt scale (fig. 3) bearing 3 long setae. Spurs of mid tibia subequal, 0.021 and 0.018 long, ratio of length of spurs to the apical diameter of mid tibia 7 : 15 and 6 : 15; spurs of hind tibia unequal 0.024 and 0.018 long, ratio of length of spurs to the apical diameter of hind tibia 8 : 18 and 6 : 18. Apex of tarsomeres I-III, tarsomeres IV-V of fore leg and tarsomere V of mid and hind legs brown, sensilla chaetica indistinguishable. Pulvilli moderately developed. Proportions and ratios of leg-segments in table 1.

Abdomen: Yellow. Tergites II-VI (fig. 4) with grey caudal spots. Hypopygium (fig. 5) with slender anal point 0.057 long bearing 7-8 basolateral setae. Gonocoxite with 5-6 setae; gonostylus stout, dark and with 8-9 setae at its inner margin and 8-10 setae over it. Superior volsella cone shaped bearing 2 setae; inferior volsella absent. Transverse sternapodeme 0.033, lateral sternapodeme 0.147, coxapodeme 0.057 and phallapodeme 0.12 long. HR 0.39; HV 1.89.

Female. – Unknown.

Pupa. – Reddish brown. Exuviae pale brown. Body 5.19 (5.17-5.24, n = 8) long in male. Female pupa and exuviae unknown.

Cephalothorax: Brown. Frontal apotome (fig. 6) with elevated cephalic tubercles, 0.02 long and 0.048 diameter at base, subapical faint frontal seta 0.027 long. Antennal sheath in ♂ (fig. 7) 0.72 long. Thorax rugose; wing sheath 0.99 long; Thoracic horn (fig. 8) with oval base 0.051 wide and a bunch of finely branched filaments. 2 pairs of precorneal setae.

Abdomen (fig. 9): Pale brown. Pedes spurii A caudolateral on segment IV, pedes spurii B basolateral on segment I. Tergite I bare; tergite II (fig. 10) with median patch of shagreen and with a caudal row of numerous hooklets; tergites III-IV with subbasal transverse patch of shagreen; tergites V-VI with shagreen in the form of inverted 'T'; tergite VII with median longitudinal and tergite VIII with subbasal patch of shagreen. Segments II-VIII with 3, 4, 4, 3, 4, 2 pairs of dorsal setae and segments II-VIII with 2, 2, 2, 4, 4, 4, 5 pairs of lateral setae, on segments VI-VIII filamentous; segment VIII with 1 pair of caudolateral spur 0.024 long, each with 4-5 stout spines. Anal fin (fig. 9) 0.31 long with forked processes and numerous filamentous setae. Genital sac in ♂ (fig. 11) 0.35 long. G/F 1.12 in ♂.

Fourth instar larva. – Colouration red, exuviae white, head capsule, claws of anterior and posterior parapods, and anal setae brown. Body 7.97 (7.64-8.09, n = 10) long.

Head: Brown. Occipital margin light brown. Ventral head capsule (fig. 12) 0.35 long and 0.29 wide. Two eye spots connected to each other. Antenna (fig. 13) five-segmented, basal antennal segment 0.036 long and 0.013 wide, with a ring organ 0.006 in diameter, distance to ring organ from base 0.024; blade of basal antennal segment 0.03 long; accessory blade 0.021 long; blade of antennal segment II 0.013 long; Lauterborn organ small, at apex of antennal segment III; ratio of antennal segment length I-V: 12 : 4.5 : 6 : 1 : 1; AR 0.96. Labral lamella unmarked; SI (fig. 14) blade like 0.093 long, between the bases of two SI 0.018 long; S II blade

Table 1. Proportions and ratios of leg-segments of adult Chironomidae.

	Fe	Ti	ta1	ta2	ta3	ta4	ta5	LR	BV	SV	BR
8. <i>Cryptochironomus judicious</i> sp.n.											
Fore	54	46	71	36	27	21	11	1.54	1.80	1.69	2.14
Mid	49	45	29	14	10	6	5	0.64	3.51	4.48	2.4
Hind	56	57	45	21	19	11	7	0.79	2.72	3.05	2.7
16. <i>Harnischia tenuitubercula</i> sp.n.											
Fore	37	24	49	28	20	14	8	2.04	1.57	1.17	2.80
Mid	33	29	17	11	6	4	3	0.59	3.29	4.77	3.20
Hind	42	44	28	17	15	8	3	0.64	2.53	3.07	4.43
22. <i>Paracladopelma aratra</i> sp.n.											
Fore	31	21	37	19	15	10	6	1.76	1.78	1.68	2.5
Mid	29	23	12	6	4	3	2.5	0.52	4.13	5.47	2.8
Hind	32	31	19	11	10	5	4	0.61	2.56	3.31	3.2
23. <i>Paracladopelma sacculifera</i> sp.n.											
Fore	49	30	67	31	22	17	8	2.33	1.87	1.68	2.28
Mid	44	37	23	11	8	5	4	0.62	3.71	4.76	3.43
Hind	51	49	34	18	16	9	6	0.69	2.73	3.22	4.14
30. <i>Polypedilum circulum</i> sp.n.											
Fore	65	34	73	46	29	23	11	1.15	1.58	1.57	2.83
Mid	58	53	31	15	11	7	5	0.58	3.74	4.83	3.25
Hind	68	58	45	24	22	12	6	0.77	2.67	3.15	3.87
39. <i>Stictochironomus obscurum</i> (Guha & Chaudhuri)											
Fore	43	39	51	30	24	19	11	1.31	1.58	1.52	3.17
Mid	51	45	26	14	11	8	6	0.58	3.13	3.84	3.86
Hind	49	51	40	21	18	11	8	0.78	2.41	2.70	6.14
48. <i>Clinotanytus fuscusignatus</i> (Kieffer)											
Fore	72	85	69	35	22	7	10	0.81	3.05	4.02	2.54
Mid	75	77	53	22	12	5	8	0.69	4.36	6.08	3.30
Hind	68	87	57	28	20	7	9	0.65	3.31	4.30	2.95
49. <i>Procladius noctivagus</i> (Kieffer)											
Fore	40	53	38	18	13	9	7	0.72	2.79	3.21	2.14
Mid	46	45	29	14	10	7	6	0.64	3.24	3.96	3.14
Hind	42	50	34	17	13	8	6	0.68	2.86	3.71	2.87

like; S III simple; S IV 3 segmented; 4 chaetae; 2 spinulae; 3-4 chaetulae laterales; chaetulae basales absent. Pecten epipharyngis comprised of 3 minute toothed plates. Premandible (fig. 15) 0.054 long with 4 unequal teeth, premandibular brush dense and short. Mandible (fig. 16) 0.084 long with 1 apical and 2 lateral teeth, seta subdentalis 0.015 long, seta interna with 4 long and 2 short filaments, 3 seta interna; pecten mandibularis absent; ring organ 0.006 in diameter, distance to ring organ from base 0.009; inner margin smooth. Maxilla with poorly developed lamellae of galea; broad anterior chaeta; leaf like lacinial chaetae; antaxial seta and paraxial seta developed, sensilla basiconica 2; maxillary palp 3 segmented, first segment of maxillary palp 0.021 long, 0.027 wide with ring organ 0.003 in diameter and 2-3 sensilla at its apex; a few chaetulae palpiger, 2 setae maxillaris, SM<sub>1</sub> and SM<sub>2</sub>

close to the palpiger, SM<sub>3</sub> and SM<sub>4</sub> close together on the clerite of carido. Prementohypopharyngeal complex (fig. 17) with prementum 0.018 wide, median lamella distinct, 2 well developed paramedian lamellae, 3 of sensilla and 5 of chaetulae. Mentum (fig. 18) 0.033 long and 0.072 wide with broad, pale untoothed central region, flanked by oblique lateral combs of 7 dark pointed teeth. Ventromental plate (fig. 19) fan-shaped 0.03 wide, outer margin smooth, with faint rays ending before the margin.

Abdomen: Brown. Procercus 0.028 long and 0.014 wide, each with 8 anal setae, 0.055 long and 2 short lateral setae. 2 supraanal setae, 0.18 long; Sa/An 0.33. Anterior parapods with numerous weakly sclerotised claws, posterior parapods (fig. 20) 0.182 long with 12-13 sclerotised, variable claws (fig. 21). Anal tubules (fig. 20) conical 0.098 long.



9. *Cryptochironomus rostratus* (Kieffer)

*Chironomus rostratus* Kieffer, 1911: 164.

*Chironomus (Cryptochironomus) rostratus*; Goetghebuer 1928: 84.

*Chironomus (Chironomus) rostratus*; Edwards 1929: 390.  
*Tendipes (Cryptochironomus) rostratus*; Kruseman 1933: 187.

*Cryptochironomus rostratus*; Pinder 1978: 116; Ree & Kim 1981: 143.

Material examined. – 6 ♂, Howrah, 4 September 1987.

Distribution. – Belgium, The Netherlands, England, Germany, India and Korea.

Differential diagnosis. – i) frontal tubercles small, ii) haltere yellowish green and bare, iii) apical hooks of hind femora pale and inconspicuous, iv) gonostylus short, thick and pointed apex, v) superior volsella thumb-like bearing 3 apical setae and vi) inferior volsella small, lobe-like densely setose.

10. *Cryptochironomus subovatus* Freeman

*Chironomus (Cryptochironomus) subovatus* Freeman, 1954: 20.

*Cryptochironomus subovatus*; Freeman 1955a: 375; Freeman 1957: 390; Freeman & Cranston 1980: 189.

Material examined. – 5 ♂, Berhampur, 17 August 1986; Holotype ♂ (Chir. 437.B), Cape Province Berg R., 27 March 1953 (BMNH).

Distribution. – Cape Province, India, Niger, Nigeria, South Africa, Sudan, Upper Volta, and Zaire.

Differential diagnosis. – i) frontal tubercles small, rounded, ii) supraalar 1, iii) spurs of mid and hind tibia unequal, iv) gonocoxite and gonostylus short and broad and v) superior volsella digitiform with 2 long setae at apex and a few small setae over it.

Remarks. – The specimens collected from the rice fields conform fully with those of Freeman (1954), except minor morphometrics.

11. *Dicotendipes pelochloris* (Kieffer)

*Tendipes pelochloris* Kieffer, 1912: 39; 1916: 113; Sublette & Sublette 1973: 413 (listed in an unplaced series of Chironomini).

*Dicotendipes pelochloris*; Epler 1988: 134.

*Limnochironomus niveicauda* Kieffer, 1921a: 585.

*Chironomus (Limnochironomus) niveicauda*; Johannsen 1932: 528.

*Dicotendipes niveicauda*; Sublette & Sublette 1973: 404; Hashimoto et al. 1981: 13.

*Dicotendipes niveicaudus*; Sasa & Hasegawa 1983: 321; Sasa & Kikuchi 1986: 19.

*Chironomus inferior* Johannsen, 1932: 534.

*Chironomus (Dicotendipes) wirthi* Freeman, 1961a: 692.

*Kimius honsooi* Ree, 1981: 218.

*Xenochironomus loripes* Guha & Chaudhuri, 1981: 163.

*Einfeldia loripes*; Chaudhuri & Guha 1987: 27.

Material examined. – 9 larvae, Burdwan, 7 September 1987; 6 larvae, 7 exuviae, 12 ♂ and 10 ♀ pupae, 8 ♂ and 7 ♀ exuviae, 8 ♂ and 8 ♀, all reared; 2 ♂, Naihati, 16 September 1987.

Distribution. – India, Indonesia, Japan, Korea, Pakistan, Philippines, Taiwan and Thailand.

Differential diagnosis. – Larva: i) plumose S I, ii) pecten epipharyngis a single plate with 5 teeth, iii) premandible with 2 unequal apical teeth, premandibular brush with spines, iv) mandible without pecten mandibularis, inner and outer margin with indentations, v) mentum with dome-shaped median tooth, 5th and 6th lateral teeth appear to be fused and vi) abdominal segment XI with 1 pair short ventral tubules.

Pupa: i) frontal apotome with conical cephalic tubercles, ii) thoracic horn with a bunch of finely branched filaments, iii) tergites V-VIII with median shagreen interrupted in the middle, iv) segment VIII with simple caudolateral spurs ending in a point and v) G/F 0.70 in male and 0.67 in female.

Adult: i) frontal tubercles small, ii) scutellum with 6-8 setae, iii) wing smoky, R<sub>4+5</sub> bare, haltere yellow and bare, iv) fore tibial scale blunt bearing 2 long setae, v) tarsomeres II-V dark brown, vi) hypopygium with gonostylus slightly attenuated at apex; superior volsella well developed with setae arranged throughout the body, inferior volsella gently bowed ventrally and vii) genitalia with broad postgenital plate, seminal capsules approximately equal.

12. *Dicotendipes septemmaculatus* (Becker)

*Chironomus septemmaculatus* Becker, 1908: 77.

*Dicotendipes septemmaculatus*; Cranston & Armitage 1988; Epler 1988: 42.

*Dicotendipes pictipennis* Kieffer, 1913a: 23; Freeman 1955b: 22.

*Dicotendipes pilosimanus* Kieffer, 1914: 262; Freeman 1955a: 372; Sublette & Sublette 1973: 404; Reiss 1977: 93, 1978: 75, 1986; 159; Freeman & Cranston 1980: 190; Contreras-Lichtenberg 1986: 716; Chaudhuri & Guha 1987: 27.

*Chironomus (Dicotendipes) pilosimanus*; Freeman 1954: 19, 1957: 360, 1961b: 247, 1961a: 694.

*Dicotendipes formosanus* Kieffer, 1916: 115; Sublette & Sublette 1973: 403; Hashimoto et al. 1981: 12; Sasa & Hasegawa 1983: 320.

*Dicotendipes formosanus* var. *frontalis* Kieffer, 1916: 116.

*Dicotendipes speciosus* Kieffer, 1924a: 256; Kieffer 1925: 299.

*Dicranotendipes speciosus*; Kruseman 1949: 254 (misspelling).

*Stictochironomus sexnotatus* Goetghebuer, 1930: 95.

*Chironomus hirtitarsis* Johannsen, 1932: 534; Sublette & Sublette 1973: 402.

*Dicotendipes hirtitarsis*; Guha et al. 1982: 30; Chaudhuri & Guha 1987: 27 (Misspelling).

*Polypedilum quatuordecimpunctatum* Goetghebuer, 1936a: 488.

*Dicotendipes quatuordecimpunctatus*; Contreras-Lichtenberg 1986: 710.

*Chironomus (Dicotendipes) pilosimanus* subsp. *guatuordecimpunctatus*; Freeman 1957: 361.  
*Dicotendipes rajasthanii* Singh & Kulshrestha, 1977: 233.

Material examined. – 4 ♂, Burdwan, 6 September 1987; 5 ♂, 9 ♀ Farakka, 29 September 1986.

Distribution. – Algeria, Australia, Bangladesh, Burma, Canary Islands, Egypt, Ethiopia, India, Israel, Japan, Kenya, Lebanon, Malagasy, Malaysia, N. Rhodesia, S. Rhodesia, Spain, Sri Lanka, Sudan, Sumatra, Taiwan, Thailand, Transvaal, Uganda, Yemen and Zaire.

Differential diagnosis. – i) frontal tubercles well developed, ii) scutellum with 12 setae in two rows, iii) wing with 6 grey spots, iv) anal point with broader apex, v) shape of gonostylus, vi) superior volsella bent inward near apex bearing 3-4 apical setae and vii) inferior volsella bifurcated into 2 blunt lobes, larger one with 6-8 and smaller one with 5-6 setae.

### 13. *Endochironomus pekanus* (Kieffer)

*Tendipes pekanus* Kieffer, 1916: 105.  
*Endochironomus pekanus*; Ree & Kim 1981: 146.

Material examined. – 2 ♂, Farakka, 29 September 1986; 5 ♂, Naihati, 16 September 1987.

Distribution. – Korea, Taiwan and India (present record).

Differential diagnosis. – i) frontal tubercles absent, ii) fore tibial scale with a sharp pointed spur and 3 long setae, iii) pulvilli moderately developed, iv) characteristic dark stripes on abdominal tergites, v) superior volsella dark with pallor apex and vi) inferior volsella dark brown with 15-17 branched incurved setae.

Remarks. – The curved setae on the inferior volsella, as reported by Ree & Kim (1981) appear to be branched in the specimens recorded here. Otherwise the specific characters conform with the Korean specimens.

### 14. *Harnischia acuta* (Goetghebuer)

*Chironomus (Harnischia) acutus* Goetghebuer, 1936a: 470.  
*Cryptochironomus acutus*; Freeman 1955b: 17.  
*Chironomus (Cryptochironomus) acutus*; Freeman 1957: 397.  
*Harnischia acuta*; Sasa & Hasegawa 1983: 323.

Material examined. – 1 ♂, Kalyani, 21 August 1986; 4 ♂, Howrah, 4 September 1987; 2 ♂, Burdwan, 6 September 1987; 1 ♂ paratype (B.M. 1957-264). Transvaal, Neispruit, G. H. Frank (BMNH).

Distribution. – Belgian Congo, Cape Province, Japan, New Zealand, Nigeria and India (present record).

Differential diagnosis. – i) eye gothic shaped

without a dorsal extension, ii) fore tibia with a blunt scale bearing 3 long setae, iii) colour pattern of tarsometers of fore, mid and hind legs, iv) anal point slender with rounded apex, v) gonocoxite with a setose lobe and gonostylus with swollen base and vi) superior volsella reduced and inferior volsella rudimentary.

Remarks. – A study of a paratype specimen from BMNH, London, and comparison with collected specimens reveal that the species should be considered as *Harnischia acuta* (Goetghebuer).

### 15. *Harnischia incidata* Townes

*Harnischia incidata* Townes, 1945: 166; Hashimoto et al. 1981: 22.

Material examined. – 5 ♂, Berhampur, 17 August, 1986; 3 ♂, Palasi, 18 August, 1986.

Distribution. – North America, Thailand and India (present record).

Differential diagnosis. – i) frontal tubercles well marked, ii) antepnotum reduced, iii) R<sub>4+5</sub> with 1 apical seta, iv) haltere light yellow with 6-8 setae, v) spurs of mid tibia unequal and spurs of hind tibia equal, vi) pulvilli small, vii) well marked gonocoxite and gonostylus and viii) superior volsella reduced and inferior volsella absent.

Remarks. – The frontal tubercles recorded in Indian specimens were probably overlooked in the specimens from Thailand (Hashimoto et al. 1981).

### 16. *Harnischia tenuitubercula* sp. n.

Type material: Holotype ♂, India, West Bengal, Farakka, 29 September 1986, leg. S. Chattopadhyay (Type no. 183, B.U. Ent.). Paratypes: 3 ♂, data as holotype.

Differential diagnosis. – i) antepnotum well developed with emargination in the middle, ii) prescutellars present, iii) ratio of spurs of mid and hind tibia equal, iv) tongue shaped anal point, v) gonostylus oblong with abruptly pointed apex and vi) superior volsella rudimentary.

Remarks. – The species is named *tenuitubercula* because of its small frontal tubercle. It appears to be close to *H. acuta* (Goetghebuer) in body colouration. In its gonocoxite and gonostylus, this species also resembles *H. argentea* Townes, 1945.

### Description

Adult. – Male: Body 2.27 (2.20-2.35, n = 4) long, wing 1.14 (1.13-1.14, n = 6) long and 0.36 (0.35-0.38, n = 6) wide.

Head: Brown. Vertex with 7-8 setae (IV 2-3, OV 2, PO 3). Corona bare. Clypeus with 10-12 setae, clypeal ratio 0.86. Maxillary palp pale brown, ratio of palpomere length I-V: 5 : 6 : 27 : 22: 23, L/W

3.8. Eyes gothic shaped with a dorsal extension of 0.018 long. Frontal tubercles (fig. 22) small. Antenna brown, ratio of flagellomere length I-XI : 12 : 8 : 6 : 6 : 5 : 5 : 5 : 5 : 5 : 5 : 160; AR 2.58; pedicel ratio 1.09. CA 0.52; CP 1.40.

Thorax: Yellow. Anteprenotum well developed with emargination in the middle, anteprenotals 0. Mesonotum with 3 brown vittae. Acrostichals 10-12 biserial, dorsocentrals 7-8, prealars 3, prescutellars 2. Scutellum with 8 setae in a transverse row, postscutellum dark brown and bare.

Wing (fig. 23): Hyaline. Brachiolum with 2 setae and 8-9 sensilla campaniformia. R with 19-20,  $R_1$  with 12-13 and  $R_{4+5}$  with 17-18 setae.  $R_{2+3}$  meets C at a distance of 0.028 from  $R_1$ ; RM faint and proximal to FCu. An ends proximal to FCu. Squama with 4 setae. Haltere light yellow and bare. CR 0.99; VR 1.12.

Legs: Yellow. Fore tibia with a blunt scale (fig. 24) bearing 2 long setae. Spurs of mid tibia unequal, 0.027 and 0.018 long, ratio of length of spurs to the apical diameter of mid tibia 9 : 11 and 6 : 11; spurs of hind tibia unequal, 0.027 and 0.018 long, ratio of length of spurs to the apical diameter of hind tibia 9 : 13 and 6 : 13. Sensilla chaetica indistinguishable. Pulvilli moderately developed. Proportions and ratios of leg-segments in table 1.

Abdomen: Light yellow. Hypopygium (fig. 25) with tongue-shaped setose anal point 0.042 long and distinctly marked gonocoxite and gonostylus. Gonocoxite with 11 setae; gonostylus oblong with abruptly pointed apex bearing 9 setae at its inner margin and 13-14 setae over it. Superior volsella rudimentary bearing 2 small setae, inferior volsella absent. Transverse sternapodeme 0.06, lateral sternapodeme 0.09, coxapodeme 0.039 and phallapodeme 0.06 long. HR 0.69; HV 1.6.

Female. - Unknown.

Distribution. - India.

### 17. *Harnischia viridula* (Linnaeus)

*Tipula viridula* Linnaeus, 1767: 975.

*Chironomus (Harnischia) viridulus*; Goetghebuer 1928: 86.

*Chironomus (Chironomus) viridulus*; Edwards 1929: 390.

*Cryptocladopelma viridula*; Pinder 1978: 18.

*Harnischia viridula*; Hashimoto et al. 1981: 21; Sasa & Hasegawa 1983: 324; Sasa 1985: 35; Sasa & Kikuchi 1986: 20.

Material examined. - 5 ♂, Burdwan 30 May 1986; 3 ♂, Chinsura, 5 February 1987.

Distribution. - England, Japan, North America, Sweden, Thailand and India (present record).

Differential diagnosis. - i) frontal tubercles well developed, ii) postscutellum bearing 2 setae, iii)  $R_{4+5}$  with 1-2 apical setae, iv) pulvilli well deve-

loped, v) unmarked gonocoxite and gonostylus and vi) superior volsella rudimentary bearing 2 setae.

### 18. *Kiefferulus barbatitarsis* (Kieffer)

*Chironomus barbatitarsis* Kieffer, 1911: 154.

*Kiefferulus barbatitarsis*; Chaudhuri & Ghosh 1986: 277; Chaudhuri & Guha 1987: 28.

Material examined. - 6 larvae, Uttara para, 9 September 1987; 7 larvae, 8 ♂ and 6 ♀ pupae, 4 ♂ and 5 ♀ exuviae, 6 ♂ and 5 ♀ all reared; 5 ♂, Howrah, 4 September 1987; 4 ♂, Kalyani, 10 February 1986; 9 ♂, Hooghly, 4 September 1987.

Distribution. - India.

Differential diagnosis. - Larva: i) S I of labrum densely pectinate, ii) pecten epipharyngis with 18 unequal teeth, iii) ventromental plate with wrinkled outer surface and iv) posterior parapods with 15-16 well-sclerotized claws.

Pupa: i) thoracic horn with a bunch of fine filaments, and ii) segment VIII with 1 pair of caudolateral spurs, each with 4-5 teeth in male and 8-10 in female.

Adult: i) scutellum with 20 setae in two transverse rows, ii) brachiolum with 4 setae and iii) hypopygium with tongue-like anal point, superior volsella bent with subacute apex and bare and inferior volsella curved with blunt apex bearing numerous curved setae.

### 19. *Kiefferulus calligaster* (Kieffer)

*Chironomus calligaster* Kieffer, 1911: 160.

*Kiefferulus calligaster*; Chaudhuri & Ghosh 1986: 285; Chaudhuri & Guha 1987: 28.

Material examined. - 5 larvae, Burdwan, 14 September 1986; 6 larvae, 6 ♂ and 7 ♀ pupae, 5 ♂ and 6 ♀ exuviae, 9 ♂ and 6 ♀ all reared; 2 ♂, Kalyani, 26 October 1986; 5 ♂, Kalna, 4 February 1988.

Distribution. - India.

Differential diagnosis. - Larva: i) S I of labrum plumose, ii) premandible with 5 curved apical teeth and well developed premandibular brush, iii) ventromental plate with smooth outer surface, and iv) posterior parapods long, each with 13-14 claws.

Pupa: i) frontal apotome with 1 pair of funnel-shaped cephalic tubercles, ii) thoracic horn with 2 plumose branches, iii) tergite VII without shagreen and iv) segment VIII with 1 pair blunt, weak caudolateral spurs.

Adult: i) scutellum with 6 setae in a single transverse row, ii) brachiolum with 2 setae, iii) fore femur with apical band, iv) pulvilli large and broad and v) hypopygium with dark peglike anal point, and superior volsella with swollen base bearing 5 setae.

## 20. *Microchironomus fuscitarsus* (Guha & Chaudhuri)

*Cryptochironomus fuscitarsus* Guha & Chaudhuri, 1979: 95.

*Microchironomus fuscitarsus*; Chaudhuri & Chattopadhyay 1988: 175.

Material examined. – 7 larvae, Howrah, 8 March 1987; 3 larvae, 8 ♂ and 8 ♀ pupae, 5 ♂ and 7 ♀, exuviae, 8 ♂ and 8 ♀, all reared; 3 ♂, Burdwan, 6 September 1987.

Distribution. – India.

Differential diagnosis. – Larva: i) blade-like S I and S II, ii) premandible with 2 unequal apical teeth, iii) mandible with well developed pecten mandibularis and iv) fan-shaped ventromental plate with wrinkled outer margin.

Pupa: i) conical cephalic tubercles without frontal seta, ii) thoracic horn with 4 main bunch of finely branched filaments, iii) tergites I, II and VII bare and iv) caudolateral spur on segment VIII simple with sharp point.

Adult: i) anteprenotum with 5 anteprenotals, ii) scutellum with 10 setae, iii) fore tibial scale with 2 long setae and iv) hypopygium with small setaceous lobe basolateral to anal point; superior volsella with 1 apical seta.

## 21. *Microchironomus tener* (Kieffer)

*Chironomus tener* Kieffer, 1918: 48.

*Tendipes* (*Parachironomus*) *tener*; Kruseman 1933: 125, 190-191.

*Leptochironomus tener*; Kugler 1971: 341; Shilova 1976: 118-119; Pinder 1978: 126.

*Microchironomus tener*; Saether 1977: 101; Freeman & Cranston 1980: 193; Moller-Pillot 1984: 244; Chaudhuri & Chattopadhyay 1988: 177.

*Parachironomus tener*; Hashimoto et al. 1981: 19.

*Cryptochironomus aegyptus* Kieffer, 1925: 288.

*Chironomus* (*Cryptochironomus*) *balticus* Pagast, 1931: 218.

*Chironomus forcipatus* Freeman, 1954: 20; 1957: 394; 1961a: 699.

Material examined. – 9 larvae, Kalyani, 17 February 1987; 5 larvae, 6 ♂ and 5 ♀ pupae, 4 ♂ and 5 ♀ exuviae, 6 ♂ and 3 ♀, all reared.

Distribution. – Australia, Chad, Ghana, India, Madagascar, Poland, Rhodesia, South Africa and Zaire.

Differential diagnosis. – Larva: i) pecten epipharyngis indistinct, ii) mandible with 3 flat lateral teeth; seta interna with 3-4 filaments; pecten mandibularis absent, iii) mentum with minute 4th lateral tooth and iv) ventromental plate fan-shaped with faint rays ending before the margin.

Pupa: i) elevated cephalic tubercle with an apical seta, ii) tergites I and II bare, and iii) pattern of shagreen on tergites and lateral setae on segments.

Adult: i) frontal tubercles absent, ii) haltere with

7-10 setae and iii) hypopygium with stout anal point and large setaceous lobe basolaterally; superior volsella long and slender with 2-3 setae at apex.

## 22. *Paracladopelma aratra* sp. n.

Type material. – Holotype ♂, India, West Bengal, Bally, 9 March 1987, leg. S. Chattopadhyay (Type no. 184, B.U. Ent.). Paratypes: 4 ♂, data as holotype.

Differential diagnosis. – i) frontal tubercles absent; ii) prescutellar 1, iii)  $R_{4+5}$  with 2 setae at the apex, iv) spurs of hind tibia equal, v) superior volsella strongly sclerotised appearing as an outgrowth of the gonostylus, inferior volsella plough-like and vi) anal point tubular.

Remarks. – *Paracladopelma aratra* is named *aratra* because of its plough-shaped inferior volsella of the male hypopygium. In the structure of the gonocoxite and gonostylus of the male hypopygium, the present species resembles *P. graminicolor* (Kieffer). The anal point of the male hypopygium shows similarity to that of *P. brincki* (Freeman).

## Description

Adult. – Male: Body 2.09 (2.06-2.11, n = 5) long, wing 0.91 (0.91-0.92, n = 6) long and 0.31 (0.29-0.31, n = 6) wide.

Head: Brown. Vertex with 7-9 setae (IV 2-3, OV 3-4, PO 2). Corona bare. Clypeus with 10-12 setae, clypeal ratio 0.94. Maxillary palp pale brown, ratio of palpomere length I-V: 9 : 6 : 19 : 24 : 33; L/W 3.8. Eyes reniform without a dorsal extension. Frontal tubercles absent. Antenna brown, ratio of flagellomere length I-XI: 12 : 6 : 5 : 5 : 6 : 6 : 7 : 7 : 7 : 102; AR 1.5; pedicel ratio 1.2 CA 0.66; CP 1.23

Thorax: Yellow. Anteprenotum well developed without emargination, anteprenotals O. Mesonotum with 3 brown vittae. Acrostichals 4-6 irregularly biserial, dorsocentrals 5-6 uniserial, prescutellar 1, prealars 3. Scutellum with 4-6 setae, postscutellum dark brown and bare.

Wing (fig. 26): Opaque, veins light brown. Brachiohum with 1 seta and 16-18 sensilla campaniformia. R and  $R_1$  without seta;  $R_{4+5}$  with 2 setae at the apex;  $R_{2+3}$  meets C at distance of 0.981 from  $R_1$ ; RM faint and proximal to FCu. Squama with 5-6 setae. Haltere light yellow with 9-11 setae. CR 0.95; VR 1.23.

Legs: Yellow. Fore tibia with a blunt scale (fig. 27) bearing 2 long setae. Spurs of mid tibia equal 0.018 long, ratio of length of spurs to the apical diameter of mid tibia 6 : 9; spurs of hind tibia equal 0.021 long, ratio of length of spurs to the apical diameter of hind tibia 7 : 11. Femur, tarsomere 1 of fore leg and tarsomere V of mid and hind leg brown. Sensilla chaetica indistinguishable. Pulvilli well developed. Proportions and ratios of leg-segments in table 1.

Abdomen: Yellow. Hypopygium (fig. 28) with tubular anal point 0.036 long and with 3-5 basolateral setae. Gonocoxite with 6-7 gonostylus short and stout bearing 8 setae at its inner margin and 11-12 setae over it. Superior volsella strongly sclerotised appearing as an outgrowth of the gonostylus; inferior volsella more or less plough like having 2 long setae. Transverse sternapodeme 0.033, lateral sternapodeme 0.069, coxapodeme 0.033 and phallopodeme 0.036 long. HR 0.79; HV 2.71.

Female. – Unknown.

Distribution. – India.

### 23. *Paracladopelma sacculifera* sp. n.

Type material. – Holotype ♂, India, West Bengal, Kalyani, 17 February, leg. S. Chattopadhyay (Type no. 185, B.U. Ent.). Paratypes: 5 ♂, data as holotype.

Differential diagnosis. – i) frontal tubercles very small, ii) antepnotum very thin without dorsal emargination, iii) spur of hind tibia unequal, iv) superior volsella short and broad, inferior volsella finger like and each with 1 long seta and v) anal point with saccular tip.

Remarks. – The name of the species is derived from the saccular tip of the anal point of the male hypopygium. The species seems to be nearer to *P. camptobolis* (Kieffer), *P. nais* (Townes) and *P. doris* (Townes) in respect of the anal point, but to *P. undine* (Townes) in view of the gonostylus of the male hypopygium.

### Description

Adult. – Male: Body 2.77 (2.79-2.88, n = 6) long, wing 1.58 (1.58-1.60, n = 6) long and 0.49 (0.48-0.49, n = 6) wide.

Head: Brown. Vertex with 12-13 setae (IV 3-4, OV 5-6, PO 4). Clypeus with 18-19 setae, clypeal ratio 0.92. Maxillary palp pale brown, ratio of palpomere length I-V : 10 : 11 : 34 : 32 : 35; L/W 4.86. Eyes reniform without a dorsal extension. Frontal tubercles (fig. 29) very small. Antenna brown, ratio of flagellomere length I-XI : 12 : 7 : 6 : 6 : 6 : 7 : 7 : 7 : 7 : 137; AR 1.90; pedicel ratio 1.09. CA 0.53; CP 0.92.

Thorax: Yellow. Antepnotum very thin without dorsal emargination, antepnotals O. Mesonotum with 3 brown vittae. Acrostichals 10-11 irregularly biserial, dorsocentrals 7-8 uniserial, prealars 4. Scutellum with 10 setae, postscutellum dark brown and bare.

Wing (fig. 30): Opaque, veins light brown. Brachiolum with 1 seta 10-12 sensilla campaniformia. R with 7-9 setae, R<sub>1</sub> and R<sub>4+5</sub> without seta. R<sub>2+3</sub> meets C at a distance of 0.05 from R<sub>1</sub>; RM faint and proximal to FCu; An ends below FCu. Squama with

5-6 setae. Haltere yellowish green with 6-7 setae. CR 0.92; VR 1.19.

Legs: Yellow. Fore tibia with a blunt scale (fig. 31) bearing 2 long setae. Spurs of mid tibia subequal 0.018 and 0.015 long, ratio of length of spurs to the apical diameter of mid tibia 6 : 13 and 5 : 13; spurs of hind tibia unequal 0.021 and 0.012 long, ratio of length of spurs to the apical diameter of hind tibia 7 : 15 and 4 : 15. Apex of fore tibia and tarsomeres of fore, mid and hind legs brown. Sensilla chaetica indistinguishable. Pulvilli well developed. Proportions and ratios of leg-segments in table 1.

Abdomen: Yellow. Hypopygium (fig. 32) with anal point with sacular apex bearing 8-9 setae at its base. Gonocoxite short with 8-10 setae; gonostylus long and little incurved with 11-13 small setae in its inner margin and 15-17 setae over it. Superior volsella short, broad and pubescent bearing 1 long seta; inferior volsella finger like bearing 1 long and numerous minute setae. Transverse sternapodeme 0.042, lateral sternapodeme 0.087, coxapodeme 0.054 and phallopodeme 0.042 long. HR 0.65; HV 1.98.

Female. – Unknown.

Distribution. – India.

### 24. *Pentapedilum robusticeps* Guha & Chaudhuri

*Pentapedilum robusticeps* Guha & Chaudhuri, 1985: 195.

Material examined. – 4 ♂, Palasi, 18 August 1986; 5 ♂, Uttarpara, 24 February 1987.

Distribution. – India.

Differential diagnosis. – i) scutellum with 26 setae in two transverse rows, ii) brachiolum with 7 setae and iii) hypopygium with robust anal point, stout gonostylus, narrow superior volsella and finger like inferior volsella.

### 25. *Pentapedilum uncinatum* (Goetghebuer)

*Tanytarsus uncinatus* Goetghebuer, 1921: 110.  
*Pentapedilum uncinatum*; Edwards 1929: 376; Pinder 1978: 134; Sasa & Kikuchi 1986: 21.

Material examined: 7 ♂, Kalyani, 17 February 1987; 1 ♂, Spain, Levida, 6 July 1973, Coll. P. S. Cranston (BMNH).

Distribution. – Belgium, England, Germany, Japan, Spain and India (present record).

Differential diagnosis. – i) frontal tubercles absent, ii) fore tibia with a blunt scale bearing 3 setae, iii) length of mid and hind tibia equal, iv) pulvilli moderately developed, v) superior volsella with 1 long lateral seta arising at about the distal 2/3 from the base.

26. *Polypedilum aegyptium* Kieffer

*Polypedilum aegyptium* Kieffer, 1925: 270; Freeman 1958: 281; Guha & Chaudhuri 1983: 635; Chaudhuri & Guha 1987: 28.

*Polypedilum iris* Goetghebuer, 1937: 61.

*Polypedilum airense* Freeman, 1956: 96.

Material examined. – 5 ♂, Chinsura, 6 February 1987.

Distribution. – Africa, Egypt and India.

Differential diagnosis. – i) frontal tubercles absent, ii) thorax dark brown, iii) triangular fore tibial scale having a sharp spine, iv) wing with brown markings and clouds and v) superior volsella more angular.

27. *Polypedilum annulatipes* (Kieffer)

*Chironomus annulatipes* Kieffer, 1910: 234.

*Polypedilum annulatipes*; Kieffer 1921b: 100, 1922: 30; Freeman 1958: 277-278; Sublette & Sublette 1973: 407; Chaudhuri et al. 1981: 115-117; Chaudhuri & Guha 1987: 28.

*Polypedilum octostictum* Kieffer, 1921b: 101, 1922: 39.

*Polypedilum octomaculatum* Goetghebuer, 1934: 195, 1936a: 488.

Material examined. – 6 ♂, Bally, 13 February 1986; 1 ♂, India, Orissa, Barkuda Lake, 1 October 1922, leg. N. Anandale (NZC, Calcutta).

Distribution. – Africa, Egypt, India, Pakistan and Zaire.

Differential diagnosis. – i) presence of single spur in mid and hind tibia, ii) absence of frontal tubercles, iii) anteprepronotum not collar-like and iv) abdominal segment VIII constricted at the base.

Remarks. – From the present study it may be inferred that *P. annulatipes* is a distinct species in the genus *Polypedilum* Kieffer.

28. *Polypedilum ascium* Chaudhuri, Guha & Das Gupta

*Polypedilum ascium* Chaudhuri, Guha & Das Gupta, 1981: 117-119; Chaudhuri & Guha 1987: 28.

Material examined. – 4 ♂, Palasi, 18 August 1986; 1 ♂, Chinsura, 6 February 1987.

Distribution. – Bhutan and India.

Differential diagnosis. – i) mesonotum brown with dark brown patches, ii) anteprepronotum very thin, iii) scutellum with 6 setae, iv) fore tibial scale elongated and blunt and v) inferior volsella axe-shaped.

29. *Polypedilum chaudhurii* Chaudhuri, Guha & Das Gupta

*Polypedilum chaudhurii* Chaudhuri, Guha & Das Gupta, 1981: 119-122; Chaudhuri & Guha 1987: 28.

Material examined. – 16 ♂, Naihati, 16 September 1987.

Distribution. – India.

Differential diagnosis. – i) colour pattern of wing, ii) colour bands of the legs, iii) two rows of scutellar setae, iv) spur of mid tibia bent and v) hypopygium with anal point bearing two projections, superior volsella with uniform width, gently bent at the middle bearing 4 setae and numerous weak setae and elongated, little bowed inferior volsella.

30. *Polypedilum circulum* sp. n.

Type material. – Holotype ♂, India, West Bengal, Kalyani, 25 October 1986, leg. S. Chattopadhyay (Type no. 186, B.U. Ent.). Paratypes: 8 ♂, data as holotype.

Differential diagnosis. – i) frontal tubercles absent, ii) anteprepronotum transparent with some cone shaped apex and emargination in the middle, iii) haltere dark brown with 6-8 setae, iv) spurs of mid and hind tibia equal, v) colour pattern of the abdomen, vi) anal point slender, ending just before tip of appendage 2, vii) gonocoxite short, gonostylus clavate with 6 long setae on its inner margin, viii) superior volsella curved with blunt tip and 1 long lateral seta near the base.

Remarks. – *Polypedilum circulum* is named after the slender appendage 1 of the male hypopygium. The present species resembles *P. nubeculosum* (Meigen) and *P. youngosanensis* Ree & Kim in the gonostylus and *P. angustum* Townes in appendage 1. The anal point of the male hypopygium also shows similarities with that of *P. acutum* Kieffer and *P. angustum* Townes.

## Description

Adult. – Male: Body 3.37 (2.29-3.58, n = 9) long, wing 1.76 (1.75-1.79, n = 10) long and 0.53 (0.52-0.55, n = 10) wide.

Head: Brown. Vertex with 15-17 setae (IV 4-5, OV 7-8, PO 4). Corona bare. Clypeus with 17-19 setae, clypeal ratio 0.85. Maxillary palp pale brown, ratio of palpomere length I-V: 10 : 8 : 19 : 24 : 35; L/W 3.80. Eyes reniform with a dorsal extension of 0.01 long. Frontal tubercles absent. Antenna brown, ratio of flagellomere length I-XIII: 19 : 7 : 8 : 7 : 7 : 7 : 6 : 7 : 7 : 7 : 7 : 194; AR 2.02; pedicel ratio 0.85. CA 0.50; CP 1.55.

Thorax: Brown. Anteprepronotum transparent with cone shaped apex and slight emargination in the middle, anteprepronotals O. Mesonotum brown. Acrostichals 10-11 irregularly biserial, dorsocentrals 8-9 uniserial, prealars 2-3. Scutellum with 6 setae in a transverse row, postscutellum dark brown and bare.

Wing (fig. 33): Hyaline. Brachiolum with 1 seta and 21-23 sensilla campaniformia. R with 17-18,  $R_1$  with 11-12 and  $R_{4+5}$  with 19 setae;  $R_{2+3}$  meets C at a distance of 0.04 from  $R_1$ ; RM pale and proximal to FCu. An ends proximal to FCu. Squama with 8 setae. Haltere dark brown with 6-8 setae. CR 0.98; VR 1.16.

Legs: Yellow. Fore tibia with a triangular scale (fig. 34) bearing a very short apical spine and 2 long setae. Mid tibia with single spur 0.027 long, ratio of length of spur to the apical diameter of mid tibia 9 : 13, hind tibia with single spur 0.027 long, ratio of length of spur to the apical diameter of hind tibia 9 : 15. Basal and apical portion of fore tibia dark brown, tarsomeres uniform in colour; tarsomere V of mid and hind leg yellow to pale brown. Sensilla chaetica indistinguishable. Pulvilli moderately developed. Proportions and ratios of leg-segments in table 1.

Abdomen (fig. 35): Tergites yellowish brown with dark brown band along lateral margin, tergites III and VI with dark brown median patches in addition to the above. Hypopygium (fig. 36) with tubular anal point 0.042 long, subequal to appendage 2 and with 4-5 basolateral setae. Gonocoxite short, stout with 7-9 setae; gonostylus clavate with 1 apical seta, 6 long setae on its inner margin and 12-14 setae over it. Superior volsella slender, bent inward with 3 basal setae and 1 long lateral seta near the base; inferior volsella stout, linear with 11-12 incurved setae besides single long apical seta. Transverse sternapodeme 0.036, lateral sternapodeme 0.066, coxapodeme 0.048 and phallapodeme 0.075 long. HR 0.44; HV 1.27.

### 31. *Polypedilum lineatum* Chaudhuri, Guha & Das Gupta

*Polypedilum lineatum* Chaudhuri, Guha & Das Gupta, 1981: 129-131; Chaudhuri & Guha 1987: 28.

Material examined. - 9 ♂, Haldia, 16 October 1987.

Distribution. - India.

Differential diagnosis. i) corona with setae, ii) frontal tubercles absent, iii) antepnotum dark, very thin without dorsal emargination, and superior volsella well developed, wider at the apex, with numerous small setae.

### 32. *Polypedilum nubifer* (Skuse)

*Chironomus nubifer* Skuse, 1889: 249; Kieffer 1906: 20; 1917: 205.

*Polypedilum (Polypedilum) nubifer*, Freeman 1961a; 707. *Polypedilum nubifer*, Martin 1966: 157; Sublette & Sublette 1973: 408; Porter & Martin 1977: 41; Sasa & Sublette 1980: 33; Hashimoto et al. 1981: 23; Ree & Kim 1981: 158; Sasa & Hasegawa 1983: 327; Sasa & Kikuchi 1986: 26; Chaudhuri & Guha 1987: 28; Chattopadhyay et al. 1988: 29.

*Chironomus triparticus* Kieffer, 1910: 231 (see Freeman 1961).

*Chironomus ceylonicus* Kieffer, 1911: 136 (see Freeman 1961).

*Polypedilum pelostolum* Kieffer, 1912: 41 (see Freeman 1961).

*Polypedilum pharao* Kieffer, 1925: 274 (see Freeman 1961).

*Chironomus (Polypedilum) albiceps* Johannsen, 1932: 515.

*Polypedilum (Polypedilum) albiceps*; Tokunaga 1964: 583.

*Chironomus (Polypedilum) octoguttatus* Tokunaga, 1936: 83.

*Polypedilum octoguttatum*; Sasa 1979: 15.

Material examined. - 5 larvae, Burdwan, 14 September 1986; 8 larvae, 4 ♂ and 5 ♀ pupae, 6 ♂ and 5 ♀ exuviae, 7 ♂ and 7 ♀, all reared; 2 ♂, Kalyani, 10 February 1986; 3 ♂, Chinsura, 6 February 1987; 5 ♂, Hooghly, 4 September 1987; 2 ♂, Uttarpara, 9 September 1987.

Distribution. - Africa, Australia, Egypt, Indonesia, India, Iraq, Japan, Korea, Micronesia, Morocco, Sri Lanka and Taiwan.

Differential diagnosis. - Larva: S I and S II plumose, ii) pecten epipharyngis comprising 3 toothed plates, iii) premandible with 2 unequal apical teeth, iv) seta interna with 3 main plumose branches and v) mentum with short 1st and 7th lateral teeth.

Pupa: i) frontal apotome with elevated cephalic tubercles, ii) thoracic horn with 4 main bunches of finely branched filaments, iii) tergites I and VIII bare, iv) absence of dorsal seta on segment VIII and v) caudolateral spur of segment VIII with 14-24 variable, stout spines.

Adult: i) frontal tubercles small, ii) wing with 10 spots, iii) squama fringed, and iv) hypopygium with slender anal point, gonostylus attenuated with 1 long seta at apex; inferior volsella with 1 long seta at apex.

### 33. *Polypedilum medivittatum* Tokunaga

*Polypedilum (Polypedilum) medivittatum* Tokunaga, 1964: 588; Sasa & Hasegawa 1983: 329.

*Chironomus (Polypedilum) sp. no. 17*, Johannsen 1932: 524.

Material examined. - 6 ♂, Kalyani, 26 October 1986.

Distribution. - Caroline Islands (Palau, Yap and Panope), Japan, S. Mariana Islands (Gham), South Sumatra and India (present record.)

Differential diagnosis. - i) antepnotum narrow without emargination, ii) scutellum with 2-4 setae, iii) haltere yellow with 5 setae, iv) pulvilli well developed, v) tergites I-VI light yellow and tergite VIII brown, vi) superior volsella scimitar like and vii) inferior volsella not beyond tip of anal point.

34. *Polypedilum suturalis* (Johannsen)

*Chironomus (Polypedilum) suturalis* Johannsen, 1932: 522.  
*Polypedilum suturalis*; Sublette & Sublette 1973: 408; Hashimoto et al. 1981: 25.

Material examined. – 6 ♂, Haldia, 16 October 1987.

Distribution. – South Sumatra, Thailand and India (present record).

Differential diagnosis. – i) prescutellar 1, ii) fore tibial scale triangular bearing a short subapical spine and 2 long setae, iii) apical diameter of mid and hind tibiae is lesser than the length of spurs, iv) colour pattern of abdomen, v) anal point long with pointed inwardly bent apex, vi) superior volsella very slender, arcuate with 1 seta on subbasal part and 11-12 minute setae and vii) inferior volsella not reaching tip of the anal point.

35. *Polypedilum yapensis* Tokunaga

*Polypedilum (Polypedilum) yapensis* Tokunaga, 1964: 595; Hashimoto et al. 1981: 25.

Material examined. – 9 ♂, Howrah, 8 March 1987; 3 ♂, Bally, 8 March 1987.

Distribution. – Caroline Islands (Palau, Yap), Thailand and India (present record).

Differential diagnosis. – i) frontal tubercles well developed, setose, ii) scutellum with 4 setae, iii) fore tibia with a blunt scale bearing 2 setae, iv) length of spur of mid and hind tibiae equal, v) superior volsella slender and with 1 long seta behind tip and vi) anal point slender ending before the tip of inferior volsella.

Remarks. – The Indian specimens are slightly different from the Micronesian specimens in body colouration, but the main specific characters seem to be identical. The frontal tubercle, which has been reported to be absent by Hashimoto et al. (1981), has been noted in the present specimens.

36. *Stenochironomus hilaris* (Walker)

*Chironomus hilaris* Walker, 1848: 17.  
*Stenochironomus hilaris*; Townes 1945: 90; Beck & Beck 1970: 33; Gillespie 1974: 238.  
*Stenochironomus (Stenochironomus) hilaris*; Borkent 1984: 69.  
*Chironomus taeniapennis* Coquillett, 1901: 607; Johannsen 1905: 203; Malloch 1915: 430.  
*Chironomus (Stenochironomus) taeniapennis*; Johannsen 1937: 28.  
*Stenochironomus taeniapennis*; Townes 1945: 90 (in part).  
*Chironomus nephopterus* Mitchell, 1908: 7; Johannsen 1908: 280; Malloch 1915: 429.  
*Chironomus nephopterus* [Sic]; Johannsen 1908: 280.  
*Stenochironomus nephopterus*; Townes 1945: 90.  
*Chironomus zonopterus* Mitchell, 1908: 12.  
*Stenochironomus zonopterus*; Townes 1945: 91.

*Chironomus exquisitus* Mitchell, 1908: 11.  
*Chironomus (Stenochironomus) exquisitus*; Johannsen 1937: 28.  
*Stenochironomus exquisitus*; Townes 1945: 91.

Material examined. – 4 ♂, Farakka, 29 September 1986.

Distribution. – Canada, U.S.A. and India (present record).

Differential diagnosis. – i) high value of L/W (7.14), ii) scutellum with 30 setae in two transverse rows, iii) wing with lightly pigmented medial and apical bands, iv) colour pattern of legs, v) fore tibia with a blunt scale bearing 4 long setae, vi) dark anal point with hyaline expanded tip and vii) superior volsella short with 6 setae.

37. *Stenochironomus longipalpis* (Kieffer)

*Tendipes longipalpis* Kieffer, 1913b: 132.  
*Stenochironomus longipalpis*; Sublette & Sublette 1973: 409.

Material examined. – 3 ♂, Palasi, 18 August 1986.

Differential diagnosis. – i) scutellum with 14 setae in a transverse row, ii) wing unmarked, iii) fore tibia with an elongated scale bearing a short spur and 4 long setae, iv) superior volsella short and inconspicuous bearing 5-6 setae and v) inferior volsella with 3 long curved setae on inner apical margin.

Remarks. – As the type is reported to be lost from NZC, Calcutta, the species is here redescribed in order to fix its identity.

## Redescription

Adult. – Male: Body 3.51 (3.43-3.68, n = 3) long, wing 1.48 (1.45-1.50, n = 6) long and 0.38 (0.37-0.39, n = 6) wide.

Head: Brown. Vertex with 12-17 setae (IV 4-6, OV 8-10, PO 0-1). Corona bare. Clypeus with 18-20 setae, clypeal ratio 1.11. Maxillary palp brown, ratio of palpomere length I-V: 10 : 8 : 17 : 40 : 41; L/W 2.42. Eyes reniform without a dorsal extension. Frontal tubercles absent. Antenna brown, ratio of palpomere length I-XIII: 17 : 6 : 7 : 8 : 8.5 : 8.5 : 8.5 : 8.5 : 8.5 : 8.5 : 178; AR 1.68; pedicel ratio 1.18. CA 0.66; CP 2.16.

Thorax: Light brown. Antepre-notum reduced, antepre-notals O. Mesonotum with 4 dark vittae (1 pair dorsomesad, parallel to each other and one each dorsolaterad). Acrostichals 16 irregularly biserial, dorsocentrals 17 uniserial, humeral 0.1, prealars 5-6. Scutellum with 14 setae in a transverse row, postscutellum dark brown and bare.

Wing (fig. 37): Unmarked with pale brown veins. Brachiolium with 2 setae and 14-15 sensilla companiformia. R with 30-34, R<sub>1</sub> with 31-35 and R<sub>4+5</sub> with 64-70 setae; R<sub>2+3</sub> ending close to R<sub>1</sub>; RM brown, thick and proximal to FCu. An ends below



FCu. Squama with 7-8 setae. Haltere yellow with 6-7 setae. CR 0.97; VR 1.11.

Legs: Yellow. Fore tibia with an elongated scale (fig. 38), armed with a short spur, 0.003 long bearing 4 long setae. Spurs of mid tibia subequal 0.027 and 0.024 long, ratio of length of spurs to the apical diameter of hind tibia 9 : 15 and 8 : 15; spurs of hind tibia also subequal 0.024 and 0.021 long, ratio of length of spurs to the apical diameter and hind tibia 8 : 16 and 7 : 16. Apex of fore femur brown, fore tibia dark at base and apex but mid and hind tibiae brown only at base. Tarsomeres broken in all specimens.

Abdomen (fig. 39): Uniformly setaceous with a large number of long setae at each lateral margin. Tergites yellow with brownish tinge except the base of tergites I-IV with dark brown. Hypopygium (fig. 40) with dark, stout anal point, apex broad, rounded bearing 7-8 basolateral setae. Gonocoxite with 7-9 long setae; gonostylus long, slender, evenly curved bearing 1 long apical seta, 3-4 setae on inner margin and 11-13 setae over it. Superior volsella short and inconspicuous bearing 5-6 setae; inferior volsella long, narrow and curved with an articulated spine of 0.015 long at tip and 3 long setae on inner apical margin. Transverse sternapodeme 0.024, lateral sternapodeme 0.06, coxapodeme 0.03, and phallopodeme 0.063, long. HR 0.70, HV 2.09.

Female. – Unknown.

### 38. *Stictochironomus affinis* (Johannsen)

*Chironomus (Stictochironomus) affinis* Johannsen, 1932: 525.

*Stictochironomus affinis*; Ali et al. 1987; Chaudhuri & Guha 1987: 29.

Material examined. – 8 larvae, Katwa, 8 February 1987; 5 larvae, 9 ♂ and 8 ♀ pupae, 5 ♂ and 6 ♀ exuviae, 8 ♂ and 4 ♀, all reared; 6 ♂, Uttarpara, 24 February 1987; 3 ♂, Berhampur, 2 January 1988.

Distribution. – India and Indonesia.

Differential diagnosis. – Larva: i) SI and S II plumose and ii) pecten epipharyngis comprising 3 toothed plates, median with 3-5 and each lateral with 5 teeth.

Pupa: i) tergite I with uniformly distributed spinules, ii) segments II-VIII with 2, 3, 3, 3, 3, 4, 4 pairs of lateral setae and iii) caudolateral spur on segment VIII with 7-8 spines.

Adult: i) corona bare, ii) frontal tubercles present, iii) scutellum with dark posterior border bearing 24 setae, iv) haltere bare and v) hypopygium with curved, pointed superior volsella and slender anal point with subacute apex.

Remarks. – This species was described by Johannsen (1932) from a female, collected on Bali, Indonesia. Ali et al. (1987) confirmed the identity

of this species by comparing reared specimens with the description by Johannsen and by examining the type, received from BMNH, London. They also made a detailed description of the life stages, with a brief account of the general behaviour of larvae and the ovipository behaviour of the female.

### 39. *Stictochironomus obscurus* (Guha & Chaudhuri) comb. n.

*Polypedilum obscurum* Guha & Chaudhuri, 1983: 637.

Material examined. – 6 larvae, Burdwan 30 May 1986; 6 larvae, 8 ♂ and 8 ♀ pupae, 5 ♂ and 5 ♀ exuviae, 10 ♀, all reared; 2 ♂, Bally, 9 March 1987.

Distribution. – India.

Differential diagnosis. – Larva: i) AR 0.74, ii) S I and S II leaf like, iii) pecten epipharyngis comprising 3 toothed plates, median with 3 and each lateral with 8 teeth, iv) premandible with 2 blunt, unequal apical teeth and 1 small inner tooth and v) pecten mandibularis unmarked.

Pupa: i) conical, apically bent cephalic tubercle bearing subapical seta, ii) pedes spurii B caudolateral on segment II and basolateral on segment I, iii) tergite I bare, iv) segments II-VIII with 4, 3, 6, 6, 5, 6, 2 pairs of dorsal setae and 3, 2, 3, 3, 3, 4, 4, pairs of lateral setae, v) caudolateral spur on segment VIII with 9-11 stout spines.

Adult: i) corona with 4 setae, ii) frontal tubercles absent, iii) haltere light brown bearing 4-5 setae, iv) scutellum with 18 irregular setae, v) pattern of wing markings, vi) superior volsella stout, bent bearing 3 basal setae and vii) dark, slender anal point with an apical rounded knob and seminal capsules opening separately into the vagina.

Remarks. – The adult male and female of this species were described from West Bengal and Arunachal Pradesh, India. It requires mentioning here that the structural pattern of the teeth of the larval mentum deviates from that stated by Pinder and Reiss (1983), but other larval and pupal characters clearly support its present recombination with the genus *Stictochironomus* Kieffer.

### Redescription

Adult. – Male: Body 3.93 (3.88-4.04, n = 8) long, wing 1.62 (1.61-1.64, n = 10) long and 0.52 (0.50-0.55, n = 10) wide.

Head: Brown. Vertex with 13-15 setae (IV 5-6, OV 6-7, PO 2). Corona with 4 setae. Clypeus with 24-25 setae, clypeal ratio 0.86. Maxillary palp brown, ratio of palpomere length I-V: 9 : 15 : 36 : 34 : 57; L/W 4.5. Eyes reniform with a dorsal extension of 0.02 long. Frontal tubercles absent. Antenna brown, ratio of flagellomere length I-XI: 15 : 6 : 6 : 6 : 6 : 6 : 6 : 6 : 6 : 6 : 165; AR 2.2; pedicel ratio 1.15. CA 0.62; CP 0.99.

Thorax: Dark brown. Antepronotum collar-like with slight emargination in middle, antepronotals O. Mesonotum brown. Acrostichals 18 irregularly biserial, dorsocentrals 19-21 uniserial, prealars 4-5. Scutellum with 18 irregular setae, postscutellum dark brown and bare.

Wing (fig. 41): Hyaline. Brachiolum with 1 seta and 9-11 sensilla campaniformia. R with 17,  $R_1$  with 8 and  $R_{4+5}$  with 15-16 setae;  $R_{2+3}$  meets C at a distance of 0.108 from  $R_1$ ; RM proximal to FCu. Wing with a few spots, cells  $r_{4+5}$  with 3, cell  $m_{3+4}$  with 1 near the fork and cell an with 1 irregular markings. Squama with 18-19 setae. Haltere light brown with 4-5 setae. CR 0.95; VR 1-07.

Legs: Yellow to pale brown. Fore tibia with a blunt scale (fig. 42) bearing 2 long setae. Mid tibia with single spur 0.021 long, ratio of length of spur to the apical diameter of mid tibia 7 : 13; hind tibia with single spur 0.024 long, ratio of length of spur to the apical diameter of hind tibia 8 : 15. Femur of fore, mid and hind leg brown; tarsomere V of fore leg brown, other yellow. Sensilla chaetica indistinguishable. Pulvilli moderately developed. Proportions and ratio of leg-segments in table 1.

Abdomen: Brown. Hypopygium (fig. 43) with slender apically knobbed anal point 0.036 long with 3-4 basolateral setae. Gonocoxite with 9-10 setae; gonostylus stout with rounded apex bearing 12-13 setae along its inner apical margin and 9-10 setae over it. Superior volsella stout, bent bearing 3 basal setae; inferior volsella well developed bearing 1 long apical seta and 11-12 incurved setae near apex. Transverse sternapodeme 0.054, lateral sternapodeme 0.108, coxapodeme 0.045 and phallapodeme 0.075 long. HV 0.875; HR 3.12.

Female. - Body 3.49 (3.23-3.58,  $n = 11$ ) long, wing 1.62 (1.60-1.65,  $n = 12$ ) long and 0.48 (0.48-0.50,  $n = 12$ ) wide.

Similar to male with usual sex differences. Antenna (fig. 44) yellow, flagellomere V brown, ratio of flagellomere length I-V: 18 : 17 : 20 : 19 : 39, AR 0.53. Genitalia (fig. 45) with notum 0.093 long. Coxosternapodeme short. Gonapophysis VIII (fig. 46) divided into long dorsomesal lobe and stout ventrolateral lobe; apodeme lobe weak. Postgenital plate V-shaped. Cerci well developed and finely setose. Seminal capsules equal, almost rounded 0.042 in diameter, ducts of seminal capsules without any loop, opening separately into the vagina.

Pupa. - Brown. Exuviae pale brown. Body 4.44 (4.34-4.52,  $n = 8$ ) long in male and 3.89 (3.80-3.96,  $n = 8$ ) long in female.

Cephalothorax: Brown. Frontal apotome (fig. 47) with conical, apical bent cephalic tubercles, 0.13 long and 0.10 diameter at base, subapical frontal seta 0.12 long. Antennal sheath in male (fig. 48) 0.91 long, in female (fig. 49) 0.62 long. Thorax

rugose; wing sheath 1.05 long; thoracic horn (fig. 50) with an oval base 0.036 wide and a bunch of finely branched filaments. 2 pairs of precorneal setae.

Abdomen (fig. 51): Brown. Pedes spurii A caudolateral on segment V-VIII, not pronounced in segment VII, pedes spurii B caudolateral on segment II and basolateral on segment I. Tergite I bare, tergite II (fig. 52) with broad median patches of shagreen and a caudal transverse row of 32-41 hooklets; tergites III-IV with a narrow caudal and median irregular patches of shagreen; tergite V with median irregular patches of shagreen; tergite VI with a basal, narrow median and caudal transverse patches of shagreen, tergites VII-IX with 2 basal patches of shagreen. Segments II-VIII with 4, 3, 6, 6, 5, 6, 2 pairs of dorsal setae and segments II-VIII with 3, 2, 3, 3, 3, 4, 4 pairs of lateral setae, on segment V-VIII filamentous; segment VIII with 1 pair of caudolateral spurs (fig. 55) 0.18 long, each with 9-11 stout spines. Anal fin (fig. 51) 0.23 long with numerous filamentous setae. Genital sac in male (fig. 53) 0.20 long, in female (fig. 54) 0.22 long. G/F 0.87 in male and 0.96 in female.

Fourth instar larva. - Colouration dark red. Exuviae pale. Head capsule, claws of anterior and posterior parapods, and anal setae brown. Body 6.41 (6.29-6.55,  $n = 12$ ) long.

Head: Brown. Occipital margin dark brown. Ventral head capsule (fig. 56) 0.27 long and 0.20 wide. Two eye spots, dorsal one slightly larger than ventral. Antenna (fig. 57) six-segmented, basal antennal segment 0.03 long and 0.012 wide, with a ring organ 0.003 in diameter, distance to ring organ from base 0.018 long; blade of basal antennal segment 0.054 long; accessory blade 0.012 long; Lauterborn organ two, first on antennal segment II being 0.012 long and second on segment III being 0.003 long; ratio of antennal segment length I-V: 10 : 3 : 4 : 1.5 : 4 : 1; AR 0.74. Labral lamella rod shaped with median pouch; S I (fig. 58) leaf like with serrated margin 0.021 long, between the bases of two S I 0.016 long; S II also leaf like 0.015 long; S III short with prominent base; S IV simple; S V minute; 4 chaetae; 2 spinulae; 4 chaetulae laterales; chaetulae basales absent. Pecten epipharyngis (fig. 59) comprising 3 toothed plates, median with 3 and each lateral with 8 teeth. Premandible (fig. 60) 0.054 long with 2 unequal, blunt apical teeth and 1 small inner tooth, premandibular brush dense. Mandible (fig. 61) 0.09 long with 1 apical and 3 inner teeth, first one smaller than others; seta subdentales 0.027 long; seta interna with 2 main plumose branches, one longer than the other; 2 seta externa; pecten mandibularis unmarked; ring organ 0.004 in diameter, very close to the base. Maxilla with blade like anterior chaeta; roughly pointed lacinial chaetae; antaxial seta and paraxial seta well

developed; sensillum basiconica 1; pecten galearis distinct; maxillary palp 3 segmented; first segment of maxillary palp 0.014 long, 0.012 wide, ring organ 0.082 in diameter, 4 setae maxillaris, SM<sub>1</sub> and SM<sub>2</sub> close to the palpiger, SM<sub>3</sub> and SM<sub>4</sub> close together on the sclerite of cardo. Premento-hypopharyngeal complex (fig. 62) with prementum 0.021 wide, median lamella distinct, paramedian lamella indistinct, 4 sensilla and 6-7 chaetulae. Mentum (fig. 63) 0.048 long and 0.075 wide with a trifid median tooth 0.018 long and 0.021 wide; 6 pairs of lateral teeth, size gradually decreases from 1st lateral to the 4th, 5th long 6th short. Ventromental plate (fig. 64) fan-shaped 0.057 wide with distinct rays ending before the margin. V/M 2.71.

Abdomen: Dark red. Procercus 0.018 long, 0.027 wide at base, each with 8 anal setae 0.31 long and 2 short lateral setae. 2 supraanal setae, 0.29 long; Sa/An 0.93. Anterior parapods with numerous weakly sclerotised claws. Posterior parapods (fig. 65) 0.09 long with 15-16 well sclerotised variable claws (fig. 66). Anal tubules (fig. 65) conical 0.05 long.

#### 40. *Xenochironomus flaviventris* (Kieffer)

*Chironomus flaviventris* Kieffer, 1911: 139.

*Xenochironomus flaviventris* (Kieffer): Chaudhuri & Guha 1987: 29.

Material examined. – 1 ♂, Farakka, 29 September 1986; 1 ♂ Hooghly, 4 September 1987; 4 ♂, 6 ♀, Naihati, 16 September 1987; 1 ♂ paratype (Z.S.I. Regn. No. 9731/19), India, Orissa, Puri, 20-21 January 1908, leg. N. Anandale.

Distribution. – India.

Differential diagnosis. – i) frontal tubercles absent, ii) scutellum with 12-13 setae in a row, iii) brachiolum with 3 setae, iv) colour pattern of leg, v) tergites with dark stripes, vi) anal point short, broad and dark brown, vii) superior volsella lobe like, setose and viii) inferior volsella long and dark brown.

Remarks. – The adult male was described by Kieffer (1911) in the genus *Chironomus* Meigen from Puri, India. On examining a paratype specimen from NZC, Calcutta, Chaudhuri and Guha (1987) placed this species in the genus *Xenochironomus* Kieffer. Reexamination of this paratype and a comparison with specimens from rice fields of Gangatic West Bengal confirm its generic position.

#### 41. *Cladotanytarsus conversus* (Johannsen)

*Tanytarsus conversus* Johannsen, 1932: 543.

*Cladotanytarsus conversus*; Sublette & Sublette 1973: 416.

Material examined. – 8 ♂, Kalyani, 25 October 1986.

Distribution. – South Sumatra and India (present record).

Differential diagnosis. – i) frontal tubercles small, ii) scutellum with 8-10 irregular setae, iii) pulvilli very small, iv) tergites I-VII brown at lateral and caudal margin and v) anal point short without punctures.

#### 42. *Cladotanytarsus gloveri* Ghosh & Chaudhuri

*Cladotanytarsus gloveri* Ghosh & Chaudhuri, 1983: 126.

Material examined. – 4 ♂, Burdwan, 14 September 1986; 3 ♂, Chinsura, 6 February 1987.

Distribution. – India.

Differential diagnosis. – i) frontal tubercles small, ii) scutellum with 6 setae, iii) haltere with 4-7 setae, iv) tergites I-VI brown at their caudal margin and v) anal point with 6-8 punctures.

#### 43. *Cladotanytarsus multispinulus* Guha, Das, Chaudhuri & Choudhuri

*Cladotanytarsus multispinulus* Guha, Das, Chaudhuri & Choudhuri, 1985: 31.

Material examined. – 9 ♂, Kalyani, 17 February 1987; 2 ♂, Uttarpara, 24 February 1987; 3 ♂ Burdwan, 6 September 1987.

Distribution. – India.

Differential diagnosis. – i) frontal tubercles absent, ii) scutellum with 4 setae, iii) tergites I-V whitish with a yellowish apical band, tergites VI-VIII dark yellow and iv) anal point small with numerous spinules.

#### 44. *Tanytarsus bifurcus* Freeman

*Tanytarsus bifurcus* Freeman, 1958: 337; Freeman & Cranston 1980: 221; Chaudhuri et al. 1984: 33; Chaudhuri & Guha 1987: 29.

Material examined. – 5 ♂, Farakka, 29 September, 1986.

Distribution. – Africa (Upper Volta) and India.

Differential diagnosis. – i) corona with setae, ii) scutellum with 6 setae, iii) haltere bare and iv) anal point stout with bifurcated apex.

#### 45. *Tanytarsus commoni* Glover

*Tanytarsus commoni* Glover, 1973: 458.

*Tanytarsus tamakutibasi* Sasa, 1983: 22. Syn. n.

Material examined. – 6 ♂, Kalyani, 25 October 1986; 1 ♂ paratype (Aust. Nat. Ins. Coll., Australia), Clyde Mtn., Eastern foothills, 40 ft. N.S.W., 15 August 1967, leg. Z. Liepa.

Distribution. – Australia, Japan and India (present record).

Differential diagnosis. – i) frontal tubercles oval, ii) prescutellar 1, iii) pulvilli absent, iv) anal point

with 4 lateral setae and a subterminal oval lobe bearing 5 spinulae and v) median volsella small brush like.

Remarks. – A study of a male paratype from ANIC, Australia and a comparison with the present ones from rice fields confirm the conspecificity.

46. *Tanytarus fuscimarginalis* Chaudhuri, Guha & Ghosh

*Tanytarus fuscimarginalis* Chaudhuri, Guha & Ghosh, 1984: 33-34; Chaudhuri & Guha 1987: 30.

Material examined. – 4 ♂, Kalyani, 10 February 1986; 5 ♂, Uttarpara, 24 February 1987.

Distribution. – India.

Differential diagnosis. – i) scutellum with 4 setae, ii) wing white with yellowish tinge, iii) haltere setose, iv) abdominal tergites brown at the caudal and lateral margins and v) hypopygium with anal point bearing 5-7 punctures in a row.

47. *Tanytarus vinculus* Chaudhuri, Guha & Ghosh

*Tanytarus vinculus* Chaudhuri, Guha & Ghosh, 1984: 34; Chaudhuri & Guha 1987: 30.

Material examined. – 7 ♂, Howrah, 4 September 1987.

Distribution. – India.

Differential diagnosis. – i) corona bare, ii) frontal tubercles present, iii) haltere bare, iv) tergite I with a basal brown band, others with similar band at the caudal margin and v) hypopygium with anal point bearing 4 punctures in a row; median volsella brush-like with 8-10 unbranched setae.

48. *Clinotanypus fuscognatus* (Kieffer)

*Procladius fuscognatus* Kieffer, 1910: 218.  
*Clinotanypus fuscognatus*; Sublette & Sublette 1973: 390.

Material examined. – 5 larvae, Howrah, 4 September 1987; 5 larvae, 8 ♂ and 8 ♀ pupae, 6 ♂ and 5 ♀ exuviae, 7 ♂, 10 ♀, all reared; 2 ♂, Bally, 8 March 1987; 1 ♂, Burdwan, 6 September 1987.

Distribution. – Bangladesh and India.

Differential diagnosis. – Larva: i) high value of AR (15.2), ii) chaetulae laterales and chaetulae basales indistinct, iii) middle two teeth of ligula small and equal, iv) paraligula with 3 points on inner side and 2 points on outer side and v) mentum with 14-15 dorsomental teeth on each side in two rows.

Pupa: i) frontal apotome without cephalic tubercles and frontal setae, ii) thoracic horn with short neck and broad plastron plate, iii) segments I-VII with 2, 1, 3, 3, 3, 6 pairs of dorsal setae, iv) lateral setae on segments VII and VIII simple and v) G/F 0.43 in male and 0.39 in female.

Adult: i) corona with 4 setae, ii) frontal tubercles absent, iii) mesonotum with 6 bands, iv) scutellum with 40-42 long setae in two rows and numerous small setae, v) pattern of wing markings, vi) banding pattern of abdomen and vii) tibial spurs with 5 teeth.

Remarks. – The adults of both sexes of *Procladius fuscognatus* were first described by Kieffer (1910) from Calcutta, India. Sublette & Sublette (1973) transferred it to *Clinotanypus* Kieffer. Study of type specimens from NZC, Calcutta and comparison with material reared in the laboratory confirm the validity of the species and the combination suggested by Sublette & Sublette (1973).

Redescription

Adult. – Male: Body 4.07 (3.99-4.14, n = 10) long, wing 2.25 (2.23-2.27, n = 10) long and 0.91 (0.90-0.92, n = 10) wide.

Head: Reddish brown. Vertex with 27-29 setae (IV 3-4, OV 6, PO 18-19). Corona with 4 setae. Clypeus with 14-16 setae, clypeal ratio 1.66. Maxillary palp pale brown, ratio of palpomere length I-V: 6 : 10 : 40 : 5 : 70; L/W 3.07. Eyes reniform with a dorsal extension of 0.08 long. Frontal tubercles absent. Antenna brown, ratio of flagellomere length I-XI: 12 : 9 : 10 : 10 : 9 : 8 : 10 : 8 : 9 : 8 : 8 : 8 : 260 : 50; AR 2.81; pedicel ratio 1.0. CA 0.47; CP 1.11.

Thorax: Shiny light brown. Anteprenotum well developed, anteprenotals 10. Mesonotum with 3 pairs of bands in antero-medial, postero-lateral and prescutellar region. Acrostichals 20-21 irregularly biserial, dorsocentrals 21-23 irregularly biserial, humerals 11, prescutellars 30-32, prealars 23-30 in a staggered row. Scutellum shiny with 40-42 setae in two rows at the posterior margin in addition to numerous irregular small setae, postscutellum dark brown except the upper end bearing 30-32 setae.

Wing (fig. 67): Smoky and distal third hyaline. Brachiolum with 3-4 setae and 26-30 sensilla campaniformia. Costa extended a little being 0.08 long, R<sub>1</sub> shortly bifurcated at the tip; RM thickened, moderately oblique; MCu proximal to RM; RM slightly proximal to FCu. Wing with characteristic bands and spots; dark brown transverse band across distal half from R<sub>1</sub> to twothird of cell m beng interrupted in cell r<sub>4+5</sub>, a large square brown spot over RM. Squama with 29-31 setae, haltere pale with 6-8 setae. CR 0.97; VR 1.07.

Legs: Yellow. Femora of all legs and fore tibia with a basal and apical, mid tibia with only basal and hind tibia with basal and apical dark brown bands. Fore tibia with single spur (fig. 68) 0.054 long having 9-10 small weak lateral teeth, ratio of length of spur to the apical diameter of fore tibia 18 : 25; spurs of mid tibia (fig. 69) unequal, 0.042 and 0.051 long, each having 5 lateral teeth, ratio of length of

spurs to the apical diameter of mid tibia 14 : 24 and 17 : 24; spurs of hind tibia also unequal, 0.048 and 0.081 long, each with 5 lateral teeth, ratio of length of spurs to the apical diameter of hind tibia 16 : 30 and 27 : 30. Hind tibial comb with 13 setae each. Tarsomeres IV-V entirely brown. Proportions and ratios of leg-segments in table 1.

Abdomen (fig. 70): Yellowish brown. Tergites II-VII with transverse brown bands and tergites V and VIII with very narrow transverse brown bands. Tergite IX with 22-23 setae. Hypopygium (fig. 71) with triangular anal point. Gonocoxite 0.24 long, broad proximally and narrow distally; gonostylus (fig. 72) 0.15 long, distal part with 5 setae, curved at right angle to the base and with a subapical tooth. HR 1.6; HV 2.66.

Female. – Body 2.92 (2.65-3.24, n = 4) long, wing 2.19 (2.03-2.37, n = 6) long and 0.86 (0.83-0.98, n = 6) wide.

Similar to male with usual sex differences. Antenna brown with 14 flagellomeres, flagellomere II almost twice as long as broad, flagellomere III-XIV globular, flagellomere XV elongated, somewhat elliptical. Thoracic and leg colouration darker than in male. Genitalia (fig. 73) with notum 0.22 long. Coxosternapodeme curved, thickened and broad proximally. Gonapophysis VIII triangular. Post-genital plate semicircular. Cerci 0.105 long and finely setose. Seminal capsules 3, approximately equal, balloon shaped, ducts of seminal capsules without any loop, opening separately into the vagina.

Pupa. – Brown. Exuviae pale. Body 4.72 (4.66-4.79, n = 8) long in male and 4.97 (4.91-5.07, n = 8) long in female.

Cephalothorax: Dark brown. Frontal apotome (fig. 74) without cephalic tubercles and frontal setae. Antennal sheath in male (fig. 75) 1.09 long, in female (fig. 76) 0.63 long. Thorax rugose; wing sheath 1.69 long; thoracic horn (fig. 77) 0.4 long with short neck and broad plastron plate, having straight basal edge.

Abdomen (fig. 78): Brown. Segments II-VIII with I, 1, 1, 1, 1, 7, 5 pairs of lateral setae and segments I-VII with 2, 1, 3, 3, 3, 3, 6 pairs of dorsal setae; all setae branched except lateral long setae on segments VII and VIII. Anal fin (fig. 78) 0.71 long with 2 pairs of long filamentous setae. Genital sac in male (fig. 79) 0.31 long, in female (fig. 80) 0.28 long; G/F 0.43 in male and 0.39 in female.

Fourth instar larva. – Colouration light brown, exuviae palen. Head capsule, claws of anterior and posterior parapods, and anal setae brown. Body 7.55 (7.32-7.67, n = 10) long.

Head: Brown. Occipital margin pale. Ventral head capsule (fig. 81) 0.67 long. One eye spot, re-

niform. Antenna (fig. 82, 83) four-segmented, basal antennal segment 0.43 long with a ring organ 0.004 in diameter, distance to ring organ from base 0.39; blade of basal antennal segment 0.036 long; accessory blade 0.015 long; blade of antennal segment II 0.021 long; Lauterborn organs 2, very small; ratio of antennal segment length I-IV: 144 : 7 : 1.5 : 1; AR 15.2. S I simple 0.018 long, between the bases of two S I 0.021 long; S II-III simple; S IV indistinct; 2 chaetae; 3-4 spinulae; chaetae laterales and chaetae basales indistinct. Mandible (fig. 83) 0.129 long with expanded base on inner side, apical tooth dark and strongly hooked, lateral teeth 4; first lateral tooth large, pointed apically; others small; seta subdentalis distinct; 3 seta externa; ring organ 0.003 in diameter, distance of ring organ from base 0.006. Maxilla (figs. 85, 86) developed, maxillary palp 3 segmented, first segment of maxillary palp 0.066 long with a ring organ 0.003 in diameter; segment II hyaline and 4-5 sensilla at its apex. Prementohypopharyngeal complex well developed; ligula (fig. 87) with 6 teeth, middle two small and equal; paralingula (fig. 87) with 3 points on inner side and 2 points on outer side. Mentum (fig. 88) with 14-15 light brown dorsomental teeth on each side laterally in double row; M appendage (fig. 88) with distinct, granulose pseudoradula, labial vesicles absent.

Abdomen: Light brown. Procercus 0.165 long and 0.054 wide, each with 15-16 anal setae 0.658 long and 2 small lateral setae. 2 supraanal setae 0.53 long; Sa/An 0.808. Anterior parapods with numerous weakly sclerotised claws. Posterior parapods (fig. 89) 0.434 long with 14-15 sclerotised variable claws (fig. 90). Anal tubules (fig. 89) conical, 0.21 long.

#### 49. *Procladius noctivagus* (Kieffer)

*Tanypus noctivagus* Kieffer, 1919: 222.

*Procladius noctivagus*; Freeman 1955c: 59; Freeman & Cranston 1980: 177; Chaudhuri & Debnath 1983: 121 (as subgenus).

*Trichotanypus niloticus* Kieffer, 1923: 189.

*Trichotanypus nilicola* Kieffer, 1925: 309.

Material examined. – 5 larvae, Kalyani 10 February 1986; 3 larvae, 9 ♂ and 9 ♀ pupae, 4 ♂ and 6 ♀ exuviae, 7 ♂, 8 ♀, all reared; 1 ♂, Burdwan, 29 January 1986.

Distribution. – Chad, Egypt, India, Niger, Nigeria and Sudan.

Differential diagnosis. – Larva: i) AR 4.0, ii) mandible with 2 minute elevations at the inner apical margin, iii) ligula with 5 dark teeth, middle one shortest, iv) paralingula with 4 points on inner side and 7 points on outer side, v) mentum with 8 dorsomental teeth on each side and vi) M appendage with bulb like labial vesicles.

Pupa: i) thoracic horn linear with oval plastron plate, ii) tergites I and III bare, iii) segments I-VIII

with 3, 2, 2, 6, 5, 5, 2 pairs of dorsal setae and iv) G/F 0.44 in male and 0.4 in female.

Adult: i) frontal tubercles absent, ii) scutellum with 20-24 irregular setae, iii) haltere yellow with 6-7 setae, iv) tibial spurs with 4 teeth, v) hind tibial comb with 11 setae, vi) banding patterns of abdomen and vii) gonostylus small, heel prominent and having a sharp tooth.

Remarks. – The analysis of characters of both immatures and adults reconfirm its systematic position.

### Redescription

Adult. – Male: Body 3.61 (3.51-3.68,  $n = 8$ ) long, wing 1.57 (1.55-1.58,  $n = 8$ ) long and 0.53 (0.53-0.55,  $n = 8$ ) wide.

Head: Brown. Vertex with 25-26 setae (IV 3-4, OV 12, PO 10). Corona with 4 setae. Clypeus with 16 setae, clypeal ratio 0.57. Maxillary palp dark brown, ratio of palpomere length I-V: 4 : 5 : 7 : 12 : 20; L/W 2.33. Eyes reniform with dorsal extension of 0.09. Frontal tubercles absent. Antenna brown, ratio of flagellomere length I-XIV: 2 : 3 : 4 : 5 : 5 : 5 : 6 : 6 : 6 : 8 : 8 : 102: 28; AR 2.13; pedicel ratio 1.0. CA 0.24; CP 0.91.

Thorax: Yellowish brown. Anteprenotum with a dorsal emargination in middle, anteprenotals 6. Mesonotum with 3 light brown vittae. Acrostichals 36-40 irregularly biserial and diverging posteriorly, dorsocentrals 15 uniserial, humerals 5, prescutellars 6, prealars 10. Scutellum with 20-24 irregular setae, postscutellum dark brown and bare.

Wing (fig. 91): Wing membrane clothed with macrotrichia. Brachiolum with 2 setae and 19-21 sensilla campaniformia. Costa extended, extension 0.12 long. Wing with spots at the fork of R, cell  $r_{4+5}$ , cell m, cell  $m_{3+4}$  and cell an; RM clouded and base of MCu thickened, RM oblique, MCu below RM. Squama with 23-25 setae. Haltere yellow with 6-7 setae. CR 0.95; VR 1.45.

Legs: Yellowish brown. Femora yellow, apex of tibia dark. Fore tibia with a spur (fig. 92) 0.062 long with 4 lateral teeth, ratio of length of spur to the apical diameter of fore tibia 12 : 14; spurs of mid tibia (fig. 93) subequal, 0.031 and 0.04 long, each with 4 lateral teeth, ratio of length of spurs to the apical diameter of mid tibia 8 : 13 and 10 : 13; spurs of hind tibia unequal, 0.03 and 0.05 long, each with 4 lateral teeth, ratio of length of spurs to the apical diameter of hind tibia 8 : 13 and 10 : 13; spurs of hind tibia unequal, 0.03 and 0.05 long, each with 4 lateral teeth, ratio of length of spurs to the apical diameter of hind tibia 8 : 16 and 15 : 16. Apex of tarsomeres I-III narrowly darkened, tarsomeres IV-V uniformly brown. Mid and hind tarsomeres I-II with single spur 0.031 long. Hind tibia comb (fig. 94) with 11 setae. Pulvilli absent. Proportions and ratios of leg-segments in table 1.

Abdomen (fig. 95): Yellow. Tergites with a basal transverse dark brown band, tergites V-VIII mostly dark with pale caudal area. Hypopygium (fig. 96) with scale like anal point. Gonocoxite stumpy,

broad at the base and narrow distally; gonostylus small, heel prominent and having a sharp tooth. Apodemes well developed. HR 2.44; HV 3.58.

Female. – Body 2.56 (2.51-3.02,  $n = 8$ ) long, wing 1.71 (1.68-1.74,  $n = 8$ ) long and 0.66 (0.62-0.68,  $n = 8$ ) wide.

Similar to male with usual sex differences. Antenna brown, ratio of flagellomere length I-XIII : 6 : 6 : 6 : 6 : 6 : 6 : 6 : 6 : 5 : 5 : 5 : 7 : 26; AR 0.37. Genitalia (fig. 97) with notum 0.18 long. Coxosternapodeme curved. Gonapophysis VIII triangular with a fold. Postgenital plate developed. Cerci finely setose. Seminal capsules 3, approximately equal, ovoid 0.07 long by 0.06 wide; duct of seminal capsules without any loop, opening separately into the vagina.

Pupa. – Brown. Exuviae white. Body 3.19 (3.09-3.26,  $n = 9$ ) long in male and 3.49 (3.39-3.51,  $n = 9$ ) in female.

Cephalothorax: Brown. Frontal apotome (fig. 98) without cephalic tubercles and frontal seta. Antennal sheath in male (fig. 99) 0.74 long, in female (fig. 100) 0.48 long. Thorax rugose; wing sheath 0.89 long; thoracic horn (fig. 101) linear, 0.28 long with oval plastron plate and distinct neck.

Abdomen (fig. 102): Brownish yellow. Tergites I and III bare; tergite II and tergites IV-VIII with median shagreen. Segments I-VIII with 3, 2, 2, 6, 5, 5, 5, 2 pairs of dorsal setae and segments II-VII with 2, 2, 1, 1, 1, 4, 4 lateral setae, on segmentous VII-VIII filamentous. Anal fin (fig. 102) 0.35 long with 2 pairs of filamentous setae. Genital sac in male (fig. 103) 0.15 long, in female (fig. 104) 0.14 long, G/F 0.44 in male and 0.4 in female.

Fourth instar larva. – Brownish yellow. Exuviae white. Head capsule, claws of anterior and posterior parapods and anal setae brown. Body 4.61 (4.54-4.69,  $n = 8$ ) long.

Head: Brown. Occipital margin dark brown. Ventral head capsule (fig. 105) 0.39 long and 0.38 wide. One eye spot, almost reniform. Antenna (fig. 106) four-segmented, basal antennal segment 0.096 long and 0.21 wide at base with a ring organ 0.004 in diameter, distance to ring organ from base 0.069; blade of basal antennal segment 0.018 long; accessory blade 0.004 long; blade of antennal segment II 0.0015 long, 1 pair of minute Lauterborn organ; ratio of antennal segment length I-IV: 32 : 5.5 : 1.5 : 1; AR 4.0. Labral lamella more or less triangular. S I blade like 0.015 long; S II tubular with an apical setae, S III and S IV minute; 1-2 chaetae; 2 spinulae; chaetulae laterales and chaetulae basales absent. Mandible (fig. 107) 0.111 long with 1 dark apical tooth, 1 prominent basal tooth and 1 conical tooth at the base of apical tooth; seta subdentalis 0.015 long; 3 seta externa; inner margin with 2

minute elevations at the apical portion. Maxilla (fig. 108) developed, maxillary palp 3 0.042 long with a ring organ 0.0015 in diameter and 5-6 sensilla at its apex; 2 setae maxillaris; SM<sub>1</sub> and SM<sub>2</sub> close to the stipes.

Prementohypopharyngeal complex well developed; ligula (fig. 109) with 5 dark teeth, middle one shortest; paralogula (fig. 109) with 4 points on inner side and 7 points on outer side. Mentum (fig. 110) with 8 brown dorsomenta teeth on each side, outer one smallest; M appendage (fig. 110) with bulb like labial vesicles, pseudoradula distinct.

Abdomen: Brownish yellow. Procercus 0.14 long and 0.039 wide, each with 14-15 anal setae 0.532 long and 2 small lateral setae. 2 supraanal setae 0.392 long, Sa/An 0.74. Anterior parapods with numerous weekly sclerotised claws, posterior parapods (fig. 111) 0.36 long with 14-15 sclerotised variable claws (fig. 112). Anal tubules (fig. 111) conical 0.25 long.

#### 50. *Tanypus bilobatus* (Kieffer)

*Procladius bilobatus* Kieffer, 1913b: 155.

*Tanypus bilobatus*: Chaudhuri, Nandi & Ghosh 1983: 122-133; Chaudhuri & Guha 1987: 25.

Material examined. - 6 larvae, Burdwan, 30 May 1986; 9 larvae, 6 ♂ and 6 ♀ pupae, 6 ♂ and 5 ♀ exuviae, 5 ♂, 5 ♀, all reared; 3 ♂, Naihati, 16 September 1987; 4 ♂, Hooghly, 4 September 1987.

Distribution. - India.

Differential diagnosis. - i) larval antenna only about one-third of the head length, middle tooth of ligula as long as those of lateral, number of teeth in paralogula and shape of mentum, ii) pupa with biconvex thoracic horn and transparent frontal apotome without cephalic tubercle, frontal setae 1 pair, iii) adult with setose haltere, rounded anal lobe, MCu proximal to FCu distance between MCu and base of FCu less than one-third as long as Cu<sub>1</sub>, tarsomere V uniformly brown and wing with numerous spots or bands.

Remarks. - On examination of the type specimens present at the NZC, Calcutta and correlating them with the collected and reared material, Chaudhuri et al. (1983) recombined this species with the genus *Tanypus*.

#### 51. *Tanypus grandis* Chaudhuri, Das & Debnath

*Tanypus grandis* Chaudhuri, Das & Debnath, 1984: 100; Chaudhuri & Guha 1987: 25.

Material examined. - 10 ♂, Kalyani, 21 August 1986.

Distribution. - India.

Differential diagnosis. - i) large size, ii) linear brown streak near the base of cell r and m, iii) spots near the margin of cell m beyond MCu, cell m<sub>3+4</sub>

with two rounded spots, near its distal margin, iv) tergites with dorsomedian dark patches, v) chaetotaxy of thorax and vi) gonostylus with prominent carina.

#### 52. *Tanypus lucidus* Chaudhuri, Das & Debnath

*Tanypus lucidus* Chaudhuri, Das & Debnath, 1984: 103; Chaudhuri & Guha 1987: 25.

Material examined. - 4 ♂, Bally, 13 February 1986; 8 ♂, Burdwan 7 September 1987.

Distribution. - India.

Differential diagnosis. - i) scutellum with 30-32 setae, ii) brachiolum with 1 seta, iii) squama with 31 setae, iv) tibia uniformly brown and hypopygium without anal point or with membranous structure, v) hind tibial comb with 5 setae and vi) cell r without any markings.

#### 53. *Tanypus tenebrosus* Chaudhuri, Das & Debnath

*Tanypus tenebrosus* Chaudhuri, Das & Debnath, 1984: 105; Chaudhuri & Guha 1987: 25.

Material examined. - 5 ♂, Naihati, 16 September 1987.

Distribution. - India.

Differential diagnosis. - i) brachiolum with 2 setae, ii) haltere brown with 4 setae, iii) tarsomeres uniformly brown, iv) hind tibial comb with 9 setae, v) tergites I-V with mid lateral stripe, tergites VI-VIII with only middle stripe and vi) gonostylus small, bent ending in an apical tooth.

### BIOLOGY

Almost all the rice fields of West Bengal are polluted. Chironomid larvae accumulate either by eggs deposited there or are carried to the field with incoming water from various sources. At the beginning of the rice season, the fields are muddy and studded with larval tubes of chironomids belonging to the genus *Chironomus*. In the middle of the season larvae of *Chironomus* were seen to live there in association with algal mats. All the species of chironomid larvae, except for the predaceous forms belonging to the genera *Clinotanypus*, *Tanypus* and *Procladius*, constructed tubular houses. The tubes were mostly 'U'-shaped or 'S'-shaped in *Chironomus* and *Kiefferulus* and sometimes tunnel-like in the mud. The houses of *Polypedilum* and *Stictochironomus* were usually slender and 'U'-shaped, but conical tubes appeared at lower depths than in *Chironomus*. The nests of *Dicrotendipes* were smaller than those of *Chironomus*. The tubes built by the larvae of *Tanytarsus* were distinguished into two types, long cylindrical, or upright tubes over or just beneath the mud surface in winter and branched in

Table 2. Duration of life history stages in summer ( $32 \pm 2.5$  °C) and winter ( $24 \pm 2.5$  °C); a = summer, b = winter.

Species		Egg (hrs)	Larval duration (days)	Pupa (hrs)	Adult (days)	Total (days)
<i>Chironomus samoensis</i>	a	34-50	16-25	24-28	2-3.5	20.42-31.75
	b	52-74	24-36	27-38	3-4.5	30.29-45.17
<i>Dicrotendipes pelochloris</i>	a	30-54	20-29	24-48	2-4	24.25-37.25
	b	36-71	25-40	34-56	3-4	30.92-49.29
<i>Stictochironomus obscurus</i>	a	30-42	20-26	21-29	2-3	24.12-31.96
	b	46-73	21-28	26-36	3-4	27.00-36.54
<i>Clinotanypus fuscusignatus</i>	a	-	-	-	-	-
	b	59-90	64-72	51-65	3-4	71.58-82.46
<i>Procladius noctivagus</i>	a	52-84	45-50	46-56	1-3	50.08-59.25
	b	64-88	55-68	59-75	2-3	62.12-77.79

the summer and remaining in the deeper layer of substrates.

It was observed that the larvae of *Chironomus samoensis* and *Kiefferulus barbatitarsis* prefer to remain in clumped conditions in association with the roots of the rice plants. It seems interesting that the larvae of *Cryptochironomus judicious* made their abodes on the side walls of the rice fields, whereas there was no trace of the larvae within the rice fields. It may be thought that *Tanypus* larvae were dominant in the early crop season whereas the larvae of *Clinotanypus* dominated in the late season. In contrast to the observations of Ping (1917) and Darby (1962), larvae of *K. barbatitarsis* survived in most cases for almost one month out of water, but the remaining larvae died after four to five days under such conditions.

The present study details the life history of 5 species: *Chironomus samoensis* Edwards, *Dicrotendipes pelochloris* (Kieffer), *Stictochironomus obscurus* (Guha & Chaudhuri), *Clinotanypus fuscusignatus* (Kieffer) and *Procladius noctivagus* (Kieffer). The duration of egg, larva, pupa and imago in both summer ( $32 \pm 2.5$  °C temperature and 51-76% humidity) and winter ( $24.5 \pm 2.5$  °C temperature and 20-48% humidity) are shown in table 2.

#### EMERGENCE AND SEX RATIO

Emergence of adult chironomids was studied in the laboratory in both summer ( $32 \pm 2.5$  °C) and winter ( $24.5 \pm 2.5$  °C). The emergence period appeared to be related to the duration of the larval period. *Chironomus samoensis* emerged in the evening hours, i.e. at dusk. The emergence period in winter was 1-2 hours earlier than in summer, which might be due to the change in the time of sunset. *Dicrotendipes pelochloris* and *Stictochironomus obscurus* emerged mostly throughout the day i.e.

dawn and dusk in summer. In winter maximum emergence occurred during the mid day except for *D. pelochloris* where it also continued in the afternoon, up to the early hours of darkness during several days of observations. *Procladius noctivagus* exhibited a bimodal pattern in summer, emerging in dawn and dusk with a few hours (1-2) earlier in winter. In winter, the emergence of *Clinotanypus fuscusignatus* began 2-3 hours prior to dawn and dusk with a peak of 1-1.5 hours after sunset.

It is evident here that the adult emergence of most chironomids showed an approximately diel periodicity and maximum emergence occurred mainly between late afternoon and early hours of darkness. The emergence pulse tended to be higher near the middle of the total emergence period.

#### Sex ratio in laboratory emergences (table 3)

The sex ratio of adults reared from egg masses in the laboratory was expressed in percentages of males, or females. The percentage of males was higher in *Chironomus samoensis* and *Stictochironomus obscurus*. On the other hand, females predominated in *Dicrotendipes pelochloris*, *Clinotanypus fuscusignatus* and *Procladius noctivagus*. Of the five species of chironomids studied here, the highest percentage of males was observed in *Stictochironomus obscurus* (65.55%) and of females in *Clinotanypus fuscusignatus* (67.07%).

#### DISCUSSION

Investigations represented in this paper comprise morphological diagnoses of 53 species of chironomids found in the rice paddies of West Bengal, India. Of these, 40 species are recorded as adults only and 13 including immature stages. Prior to this work, most of these were recorded from various places in India other than rice paddies. Further 10



Table 3. Numbers of larvae, pupae and adults reared from egg masses and sex ratios of emerged adults.

Species	No. of egg masses	No. of eggs	Larvae hatched	Percentage of eggs hatched	Pupae obtained	Percentage of larvae pupated	Adults emerged		Percentage of pupae hatched	Sex ratios of adults (♂: ♀)
							Male	Female		
<i>Chironomus samoensis</i>	5	1024	799	78.03	293	36.67	109	61	58.02	64.12:35.88
<i>Dicrotendipes pelochloris</i>	4	682	374	54.84	168	44.92	49	68	69.64	41.88:58.12
<i>Stictochironomus obscurum</i>	5	1665	1199	72.01	423	35.28	177	93	63.83	65.56:34.44
<i>Clinotanypus fuscicornis</i>	5	651	377	57.91	103	27.32	27	55	79.61	32.93:67.07
<i>Procladius noctivagus</i>	5	901	602	66.81	225	37.37	54	76	57.78	41.54:58.46

species were previously reported from Thailand (Hashimoto et al. 1981), six from Japan (Sasa & Kikuchi 1986) and one from North America (Darby 1962).

The life cycles of chironomids described here, present interesting features of the biology of the midges. The present work is the first attempt to study the life cycle of the following five oriental species from rice paddies: *Chironomus samoensis* Edwards, *Dicrotendipes pelochloris* Kieffer, *Stictochironomus obscurus* (Guha & Chaudhuri), *Clinotanypus fuscicornis* (Kieffer) and *Procladius noctivagus* Kieffer. The duration of each stage was generally neglected in earlier works. It can only be conveniently determined in the laboratory, as did Hilsenhoff (1966). Grodhaus (1963) reported the life cycle of *Chironomus tentans* Fabricius on the basis of information from Sadler (1935). The duration of each stage is temperature-dependent and related to the overall length of the life cycle (Oliver 1971). The time required for hatching of eggs was recorded as 2.5 days at 24 °C in *Chironomus atrella* (Townes) by Anderson & Hitchcock (1968), 4 days at 20 °C in *C. zealandicus* Hudson by Forsyth (1971) and 4-5 days at 18 °C in some other species (Mundie 1956). Similarly the duration was recorded to be 3-4 days at 18 °C in *Einfeldia synchrona* Oliver (Danks 1971) and 2-2.5 days and 3-3.5 days at 32 ± 2.5 °C and 24.5 ± 3 °C respectively in *Tanytus bilobatus* (Kieffer) by Chaudhuri et al. (1983). Recently, Chaudhuri & Ghosh (1986) reported that the duration of egg stage required 40-60 hours and 48-72 hours in *Kiefferulus barbatitaris* and 24-36 hours and 48-69 hours in *K. calligaster* at temperatures of 32 ± 2.5 °C and 24.5 ± 3 °C respectively. Chattopadhyay et al. (1988) stated the duration in the case of *Polypedilum nubilifer* to be 28-40 hours in summer (32 ± 2.5 °C) and 42-72 hours in winter (24 ± 2.5 °C). It may therefore be inferred that the hatching period varies with temperature, being shorter with the rise of temperature in summer and longer with the fall of temperature in winter.

The duration of the larval stages of four species, both in summer and winter and one species in winter only are presented in table 2. The larval stage of the members of Chironominae required 16-29 days and 20-40 days in summer and winter respectively, whereas tanytopid species needed 45-50 days and 55-72 days respectively. Oliver (1971) stated that changes in the duration of the larval period occur over a wide range of latitudes. With increasing latitude, the duration of the larval period became longer. Temperature was one of the main factors responsible for this increase. According to Jónasson (1965), *Chironomus anthracinus* Zetterstedt, was recorded to have a two year life cycle, although some emerged after one year and growth was reduced both in summer (related to low oxygen concentration) and in winter (related to low temperature). The 2-year life cycle in other species was also reported by Hamilton (1965) and Saether (1968). Butler (1982) reported a 7-year life cycle for two *Chironomus* species in arctic Alaskan tundra ponds. The processes involved in slowing down or cessation of growth and development have not received due attention. Developmental arrests with a cessation of feeding in both summer and winter were found by Hilsenhoff (1966), Jónasson & Kristiansen (1967) & Armitage (1970). From these studies, it became evident that temperature itself was not the factor which controlled larval life, it rather played a key role in determining the length of larval life, but other factors, particularly the availability of food, were also important (Jónasson 1965; Forsyth 1971).

The pupal stage had not been seriously investigated except for its taxonomic importance. As compared to the larval stage, the duration of the pupal stage is very brief, ranging from a few hours to a few days (Forsyth 1971, Oliver 1971, Chaudhuri et al., 1983, Chaudhuri & Ghosh 1986, Chattopadhyay et al. 1988) and temperature dependent (Mundie 1956; Hilsenhoff 1966), which is also confirmed by this investigation (table 2). The pupal life varied between 21-48 hours and 26-56 hours in Chirono-

minae and between 46-66 and 51-75 hours in Tany-podinae in summer and winter respectively.

The life span of adult chironomids lasts for a few days (Table 2), supporting Forsyth (1971) and Hein & Schmulbach (1972). The duration of adult life of one week (Mundie 1956) or several weeks (Oliver 1971) is more unusual.

The emergence period is related to the duration of the larval period (Chaudhuri et al. 1983). The adults are able to fly immediately after emergence as shown by Mundie (1956), Hilsenhoff (1956), Brundin (1966), Forsyth (1971) and Hein & Schmulbach (1972). The investigations revealed that the rate of emergence was highest during the middle of the total emergence period conforming the findings of Chaudhuri et al. (1983) & Chattopadhyay et al. (1988). According to Ali (1980), the periodicity is caused by a complex interaction of various environmental stimuli and endogenous rhythms. The phenomenon appears to be typically regulated and maintained by an internal clock (the endogenous rhythms) which is said to be influenced by external stimuli or exogenous factors (Corbet 1964). Temperature is regarded as the more important factor determining diel emergence periodicities in high arctic chironomids (Oliver 1968; Danks & Oliver 1972). Similar observations are reported for mosquitoes by Corbet (1966). In contrast, intensity of light appears as the factor controlling the diel emergence pattern of chironomids in the temperate zones. This study revealed that *Chironomus samoensis* emerged at dusk in summer (see also Morgan & Weddell 1961), while a few emerged at dawn.

*Dicrotendipes pelochloris* and *Stictochironomus obscurus* do not show a distinct periodicity in emergence, occurring mostly throughout the day (Singh and Harrison 1982). A bimodal pattern was also found by Ali & Mulla (1979) & Ali (1980). However, a deviation was noticed in the peak of emergence related to the earlier onset of sunset in *Clinotanypus fuscusignatus* as stated above. Light intensity may probably be the inducing agent in the emergence of *D. pelochloris* and *S. obscurus* as shown by Oliver (1968). Since these two environmental clues were immediately linked together, their combined effects require further investigation.

There are several reports on sex-ratios deviating from the normal 1 : 1. According to Palmén (1962) and Lindeberg (1971) males emerge in lower numbers than females. This investigation revealed a higher percentage of females in the case of *Dicrotendipes pelochloris*, *Clinotanypus fuscusignatus* and *Procladius noctivagus* reared from egg masses (Table 3), as also was notified by Palmén (1962) and by Singh & Harrison (1982), but the reverse situation with a preponderance of males occurred in *Chironomus samoensis* and *Stictochironomus obscurus*, as was also found by Hein & Schmulbach

(1972), Chaudhuri et al. (1983) and Chattopadhyay et al. (1988). A rhythm in emergence starting with an excess of males and ending with female predominance was recorded in most of the chironomids in question, as shown by Miall & Hammond (1900) and Downes (1969), but no such rhythm was observed in *Stictochironomus obscurus* in the present study.

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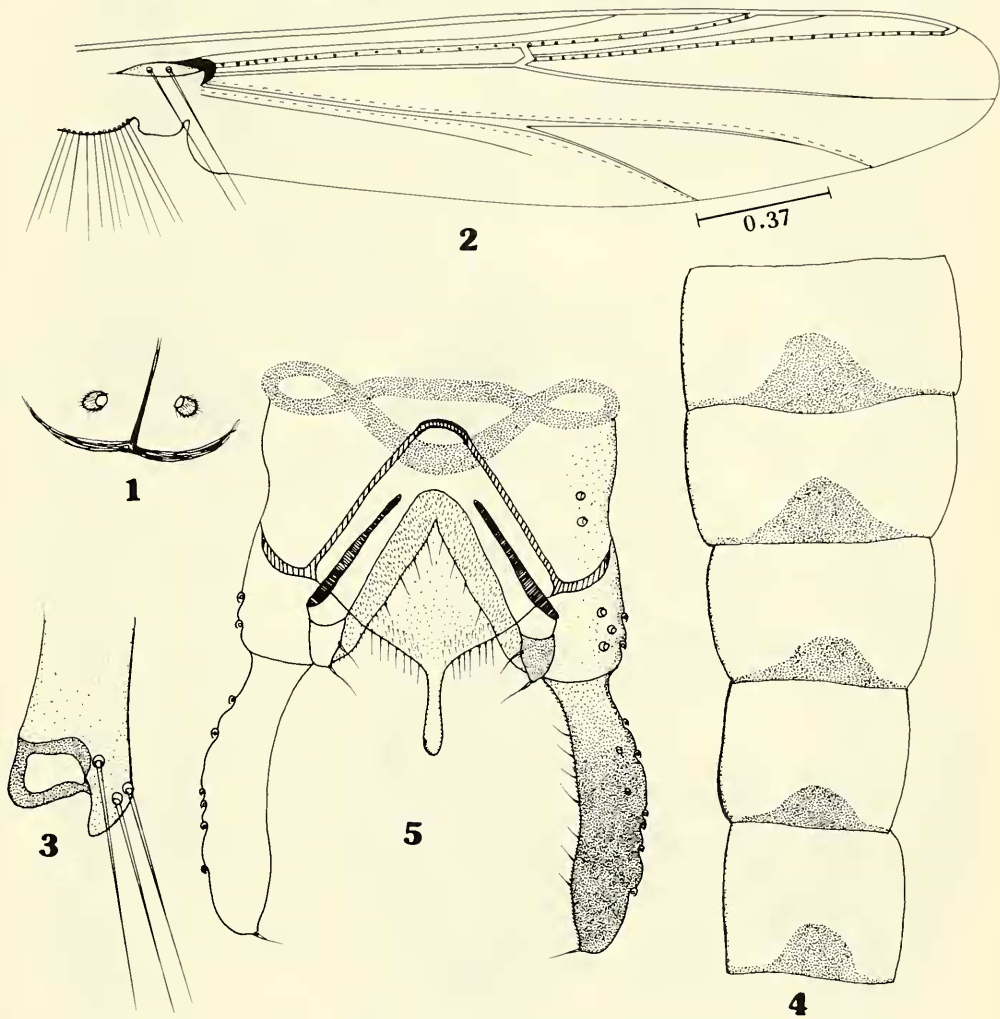
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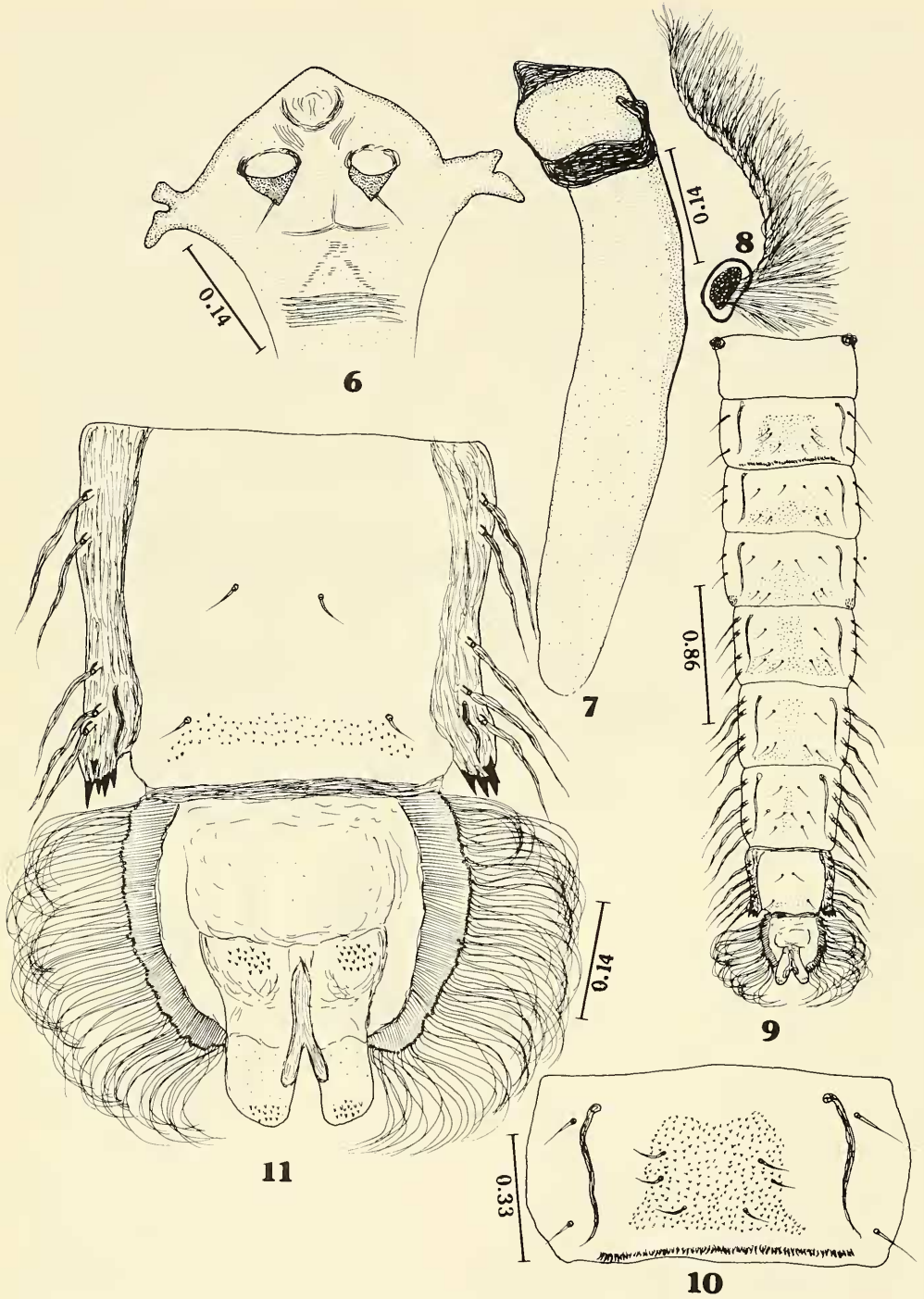
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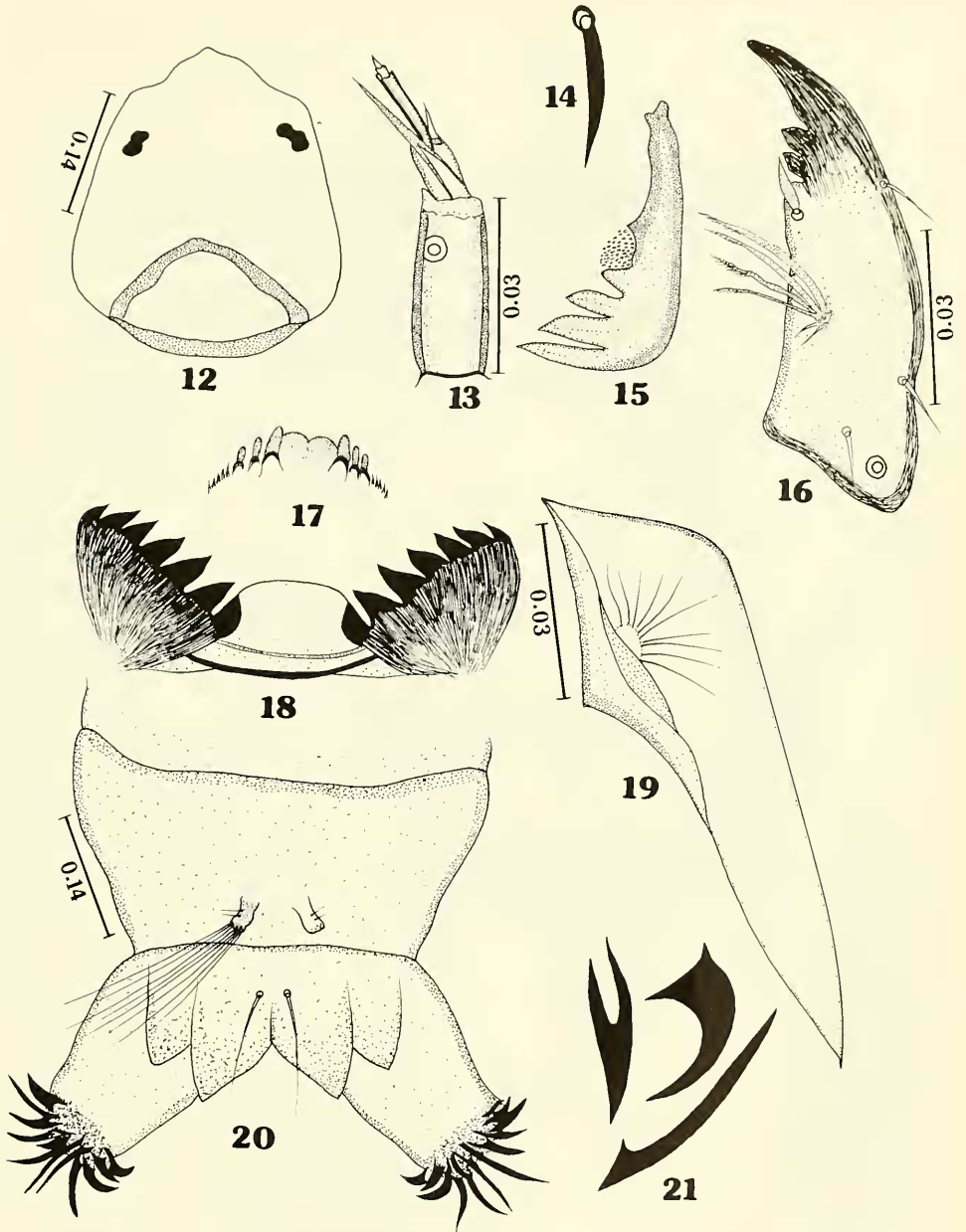


Figs. 1-5. Adults of *Cryptochironomus judicious* sp. n. 1, Frontal tubercles; 2, wing; 3, fore tibial scale; 4, tergites II-VI; 5, male hypopygium.

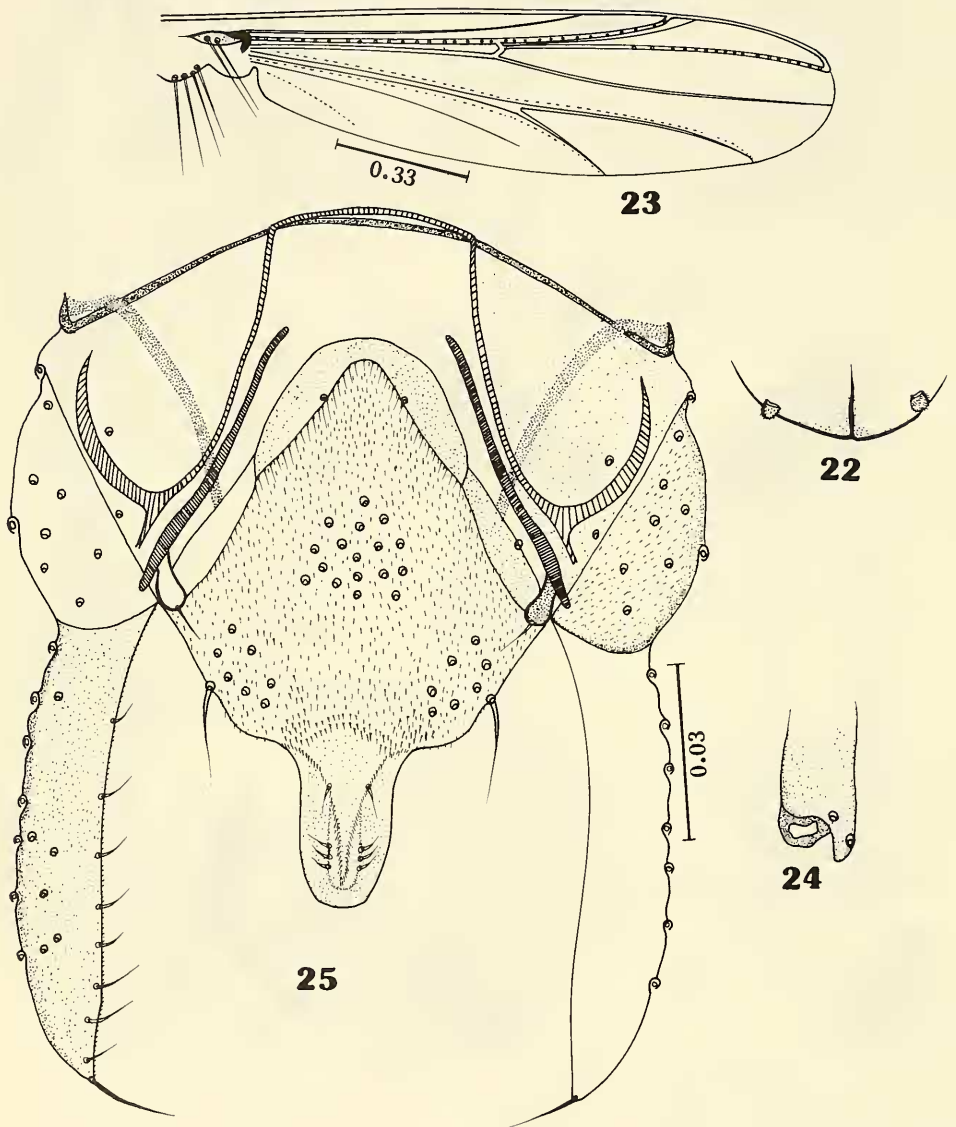


Figs. 6-11. Pupa of *Cryptochironomus judicious* sp. n. 6, Frontal apotome; 7, antennal sheath of male; 8, thoracic horn; 9, abdomen; 10, tergite II; 11, anal fin and genital sac of male.

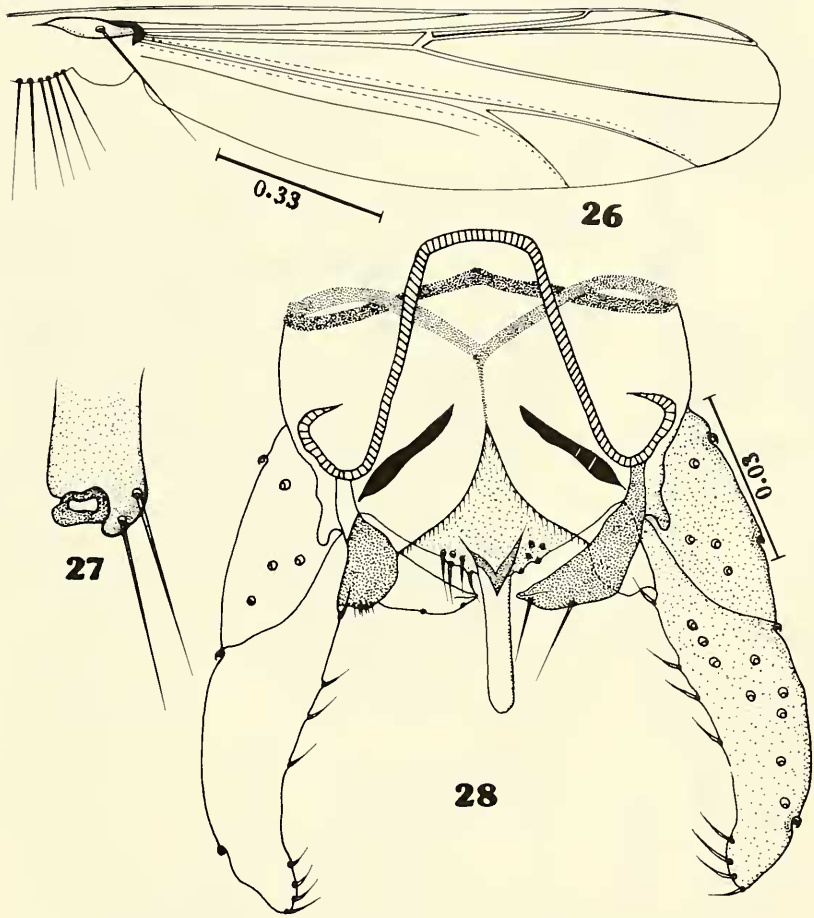




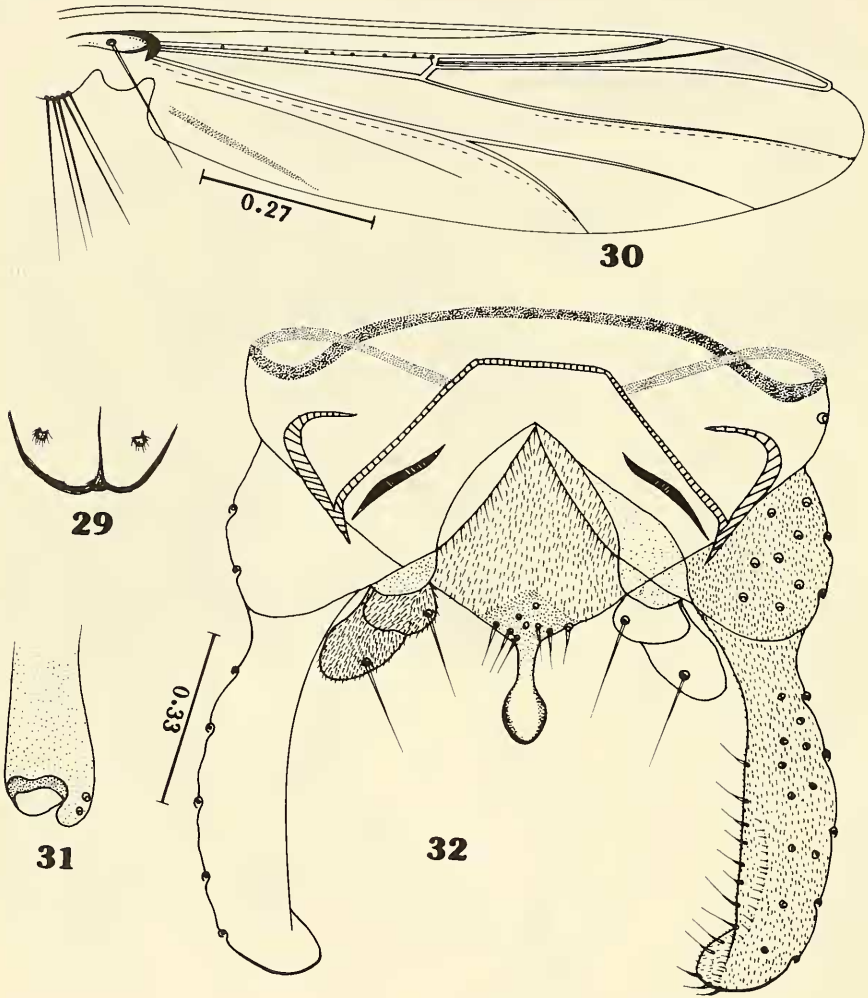
Figs. 12-21. Larva of *Cryptochironomus judicious* sp. n. 12, Head capsule; 13, antenna; 14, S I; 15, premandible; 16, mandible; 17, premento-hypopharyngeal complex; 18, mentum; 19, ventromental plate; 20, posterior abdominal segments; 21, claws of posterior parapods.



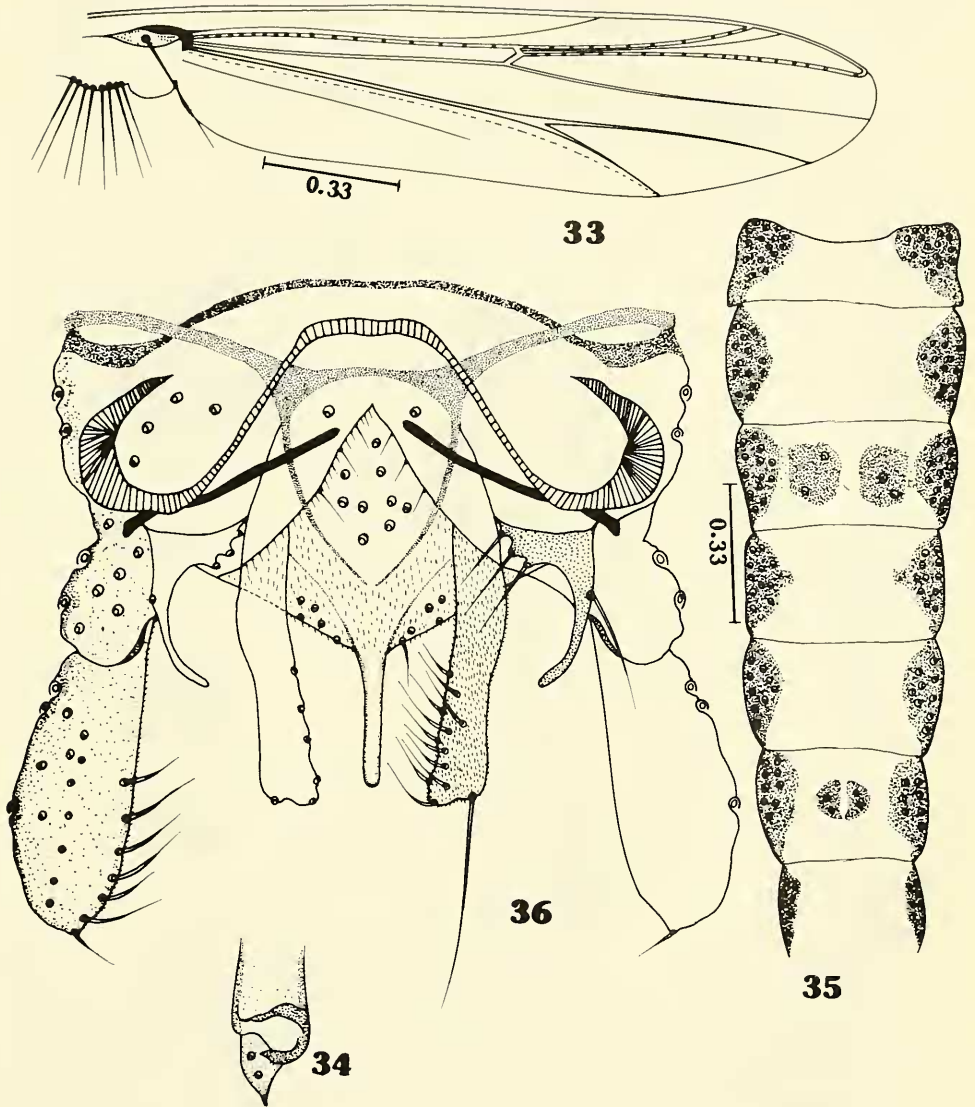
Figs. 22-25. Adult of *Harnischia tenuitubercula* sp. n. 22, Frontal tubercles; 23, wing; 24, fore tibial scale; 25, male hypopygium.



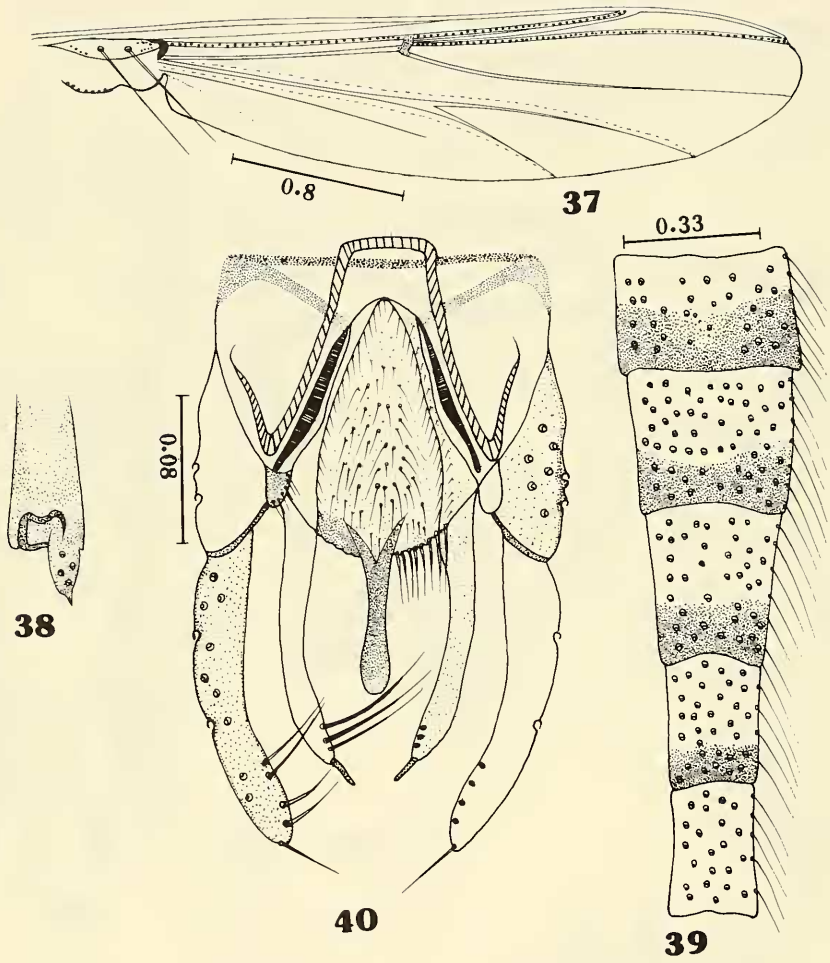
Figs. 26-28. Adult of *Paracladopelma aratra* sp. n. 26, Wing; 27, fore tibial scale; 28, male hypopygium.



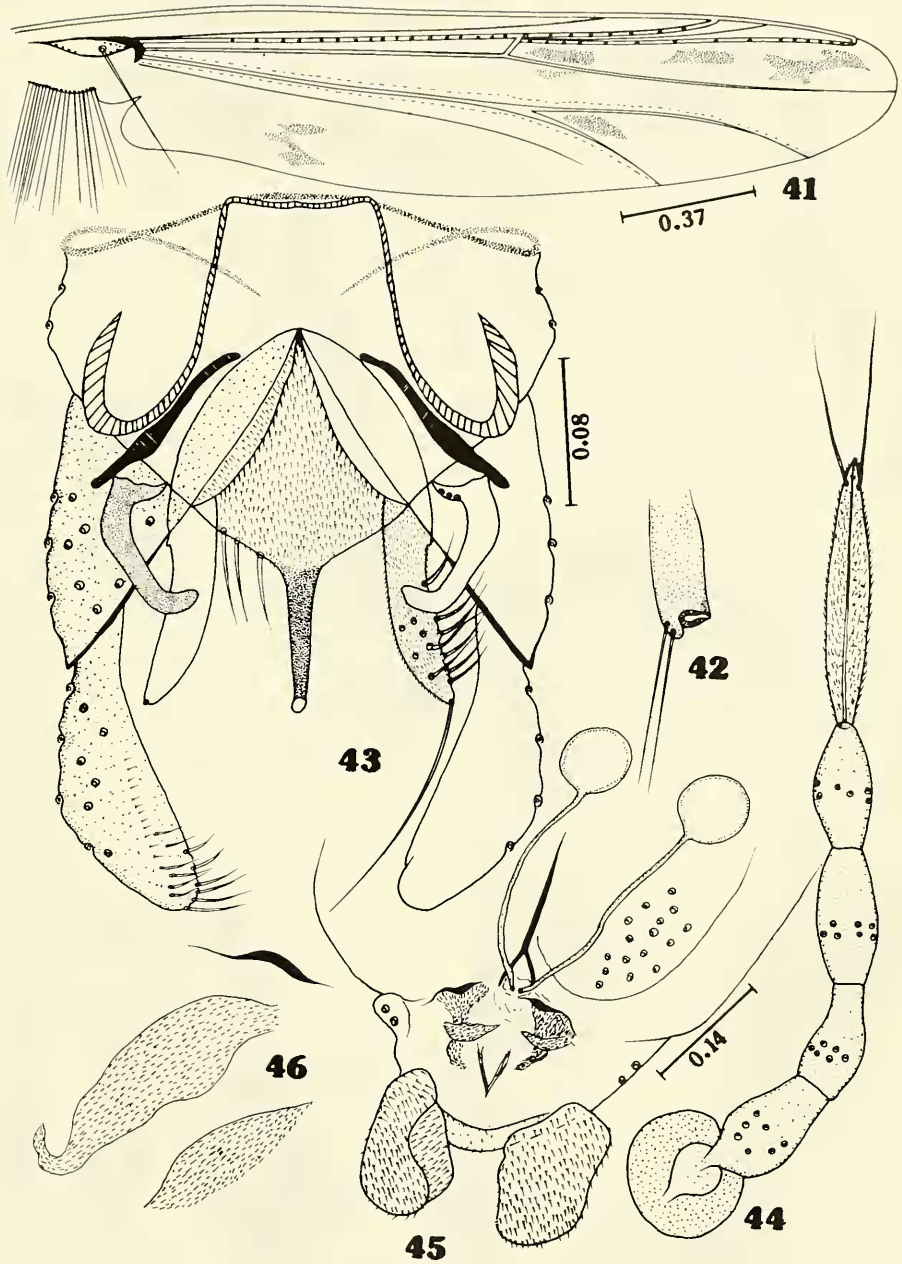
Figs. 29-32. Adult of *Paracladopelma sacculifera* sp. n. 29, Frontal tubercles; 30, wing; 31 fore tibial scale; 32, male hypopygium.



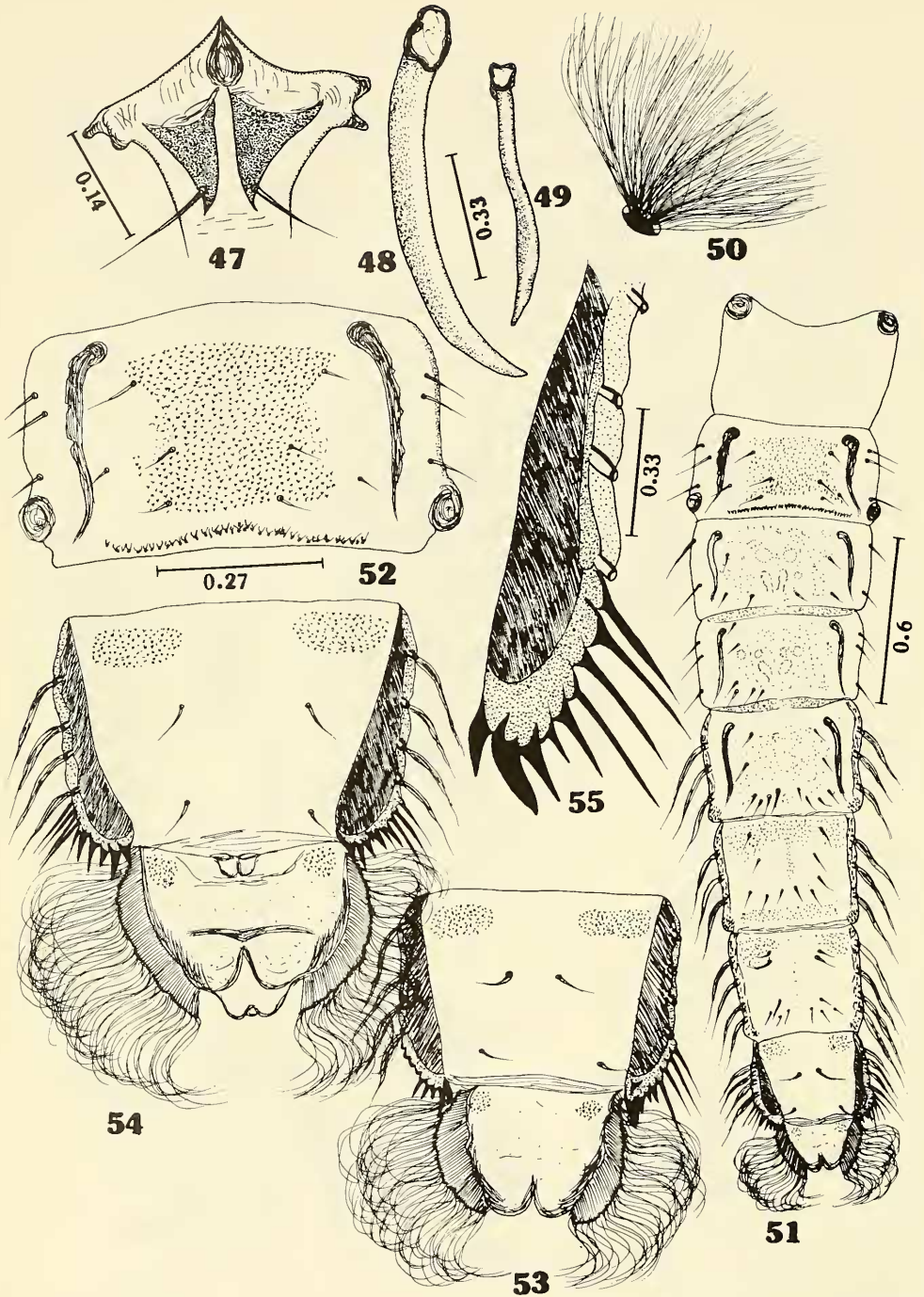
Figs. 33-36. Adult of *Polypedilum circulum* sp. n. 33, Wing; 34, fore tibial scale; 35, abdomen; 36, male hypopygium.



Figs. 37-40. Adult of *Stenochironomus longipalpis* (Kieffer). 37, Wing; 38, fore tibial scale; 39, abdomen; 40, male hypopygium.

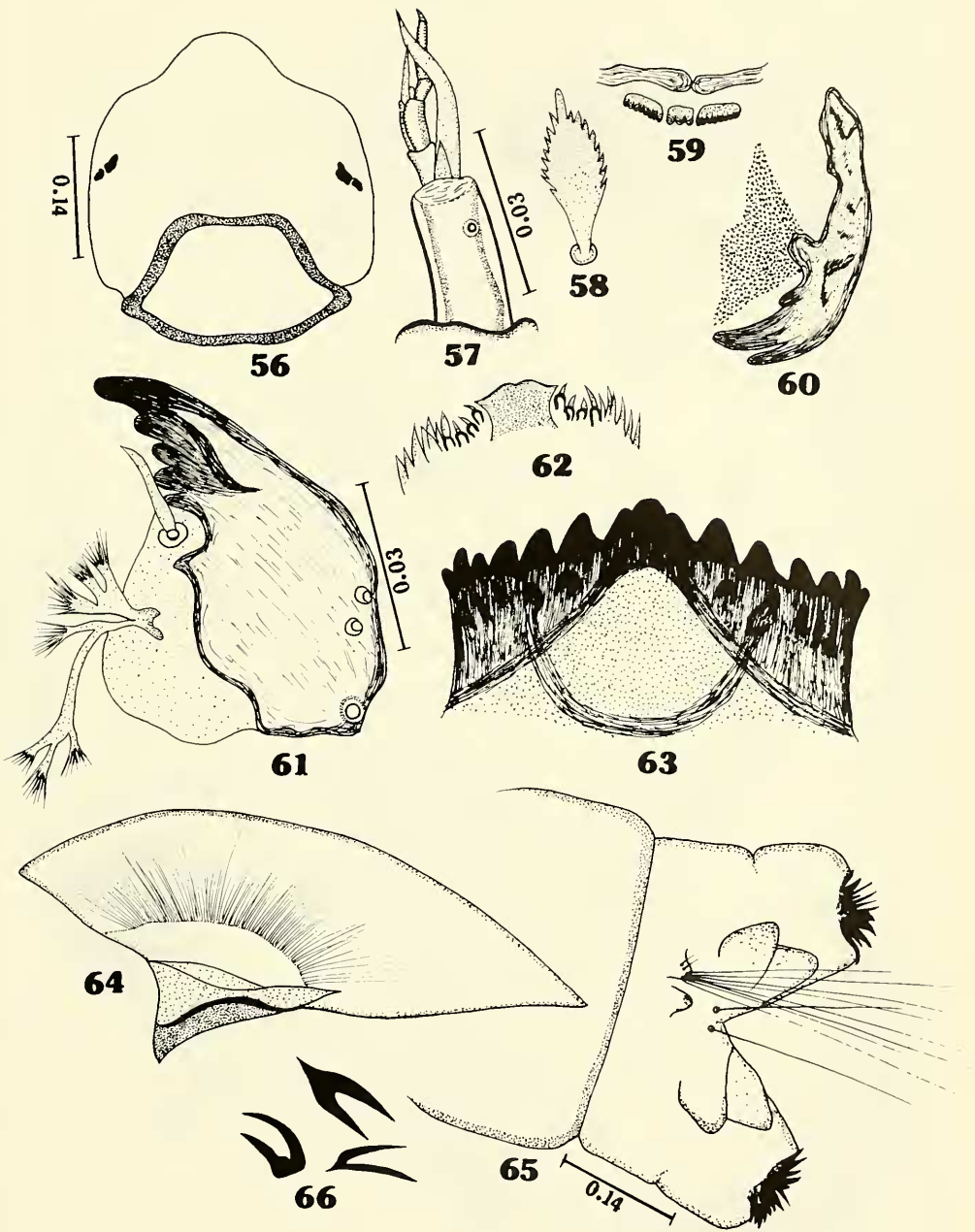


Figs. 41-46. Adult of *Stictochironomus obscurus* (Guha & Chaudhuri) comb.n. 41, Wing; 42, fore tibial scale; 43, male hypopygium; 44, female antenna; 45, female genitalia; 46, dorsomesal, ventrolateral and apodeme lobes of gonapophysis VIII.

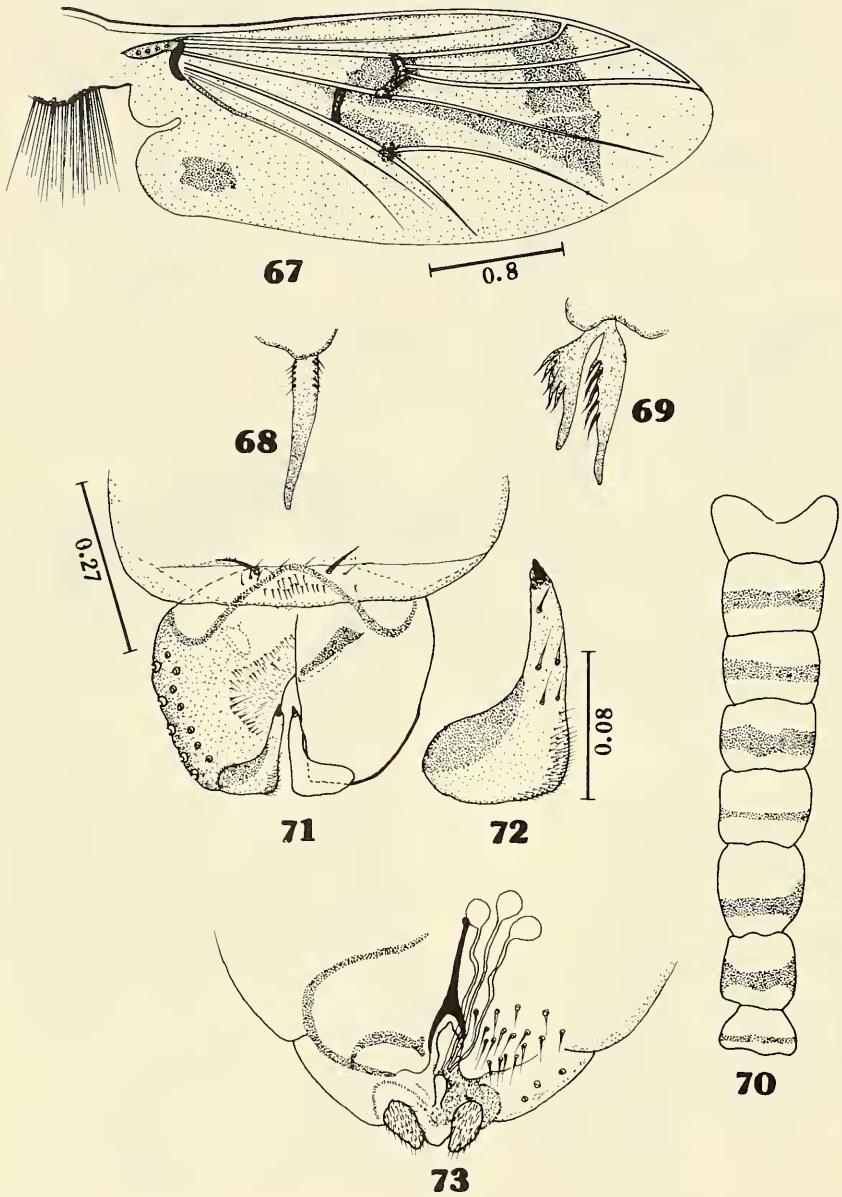


Figs. 47-55. Pupa of *Stictochironomus obscurus* (Guha & Chaudhuri) comb.n. 47, Frontal apotome; 48, antennal sheath of male; 49, antennal sheath of female; 50, thoracic horn; 51, abdomen; 52, tergite II; 53 anal fin and genital sac of male; 54, anal fin and genital sac of female; 55, caudolateral spur of segment VIII.

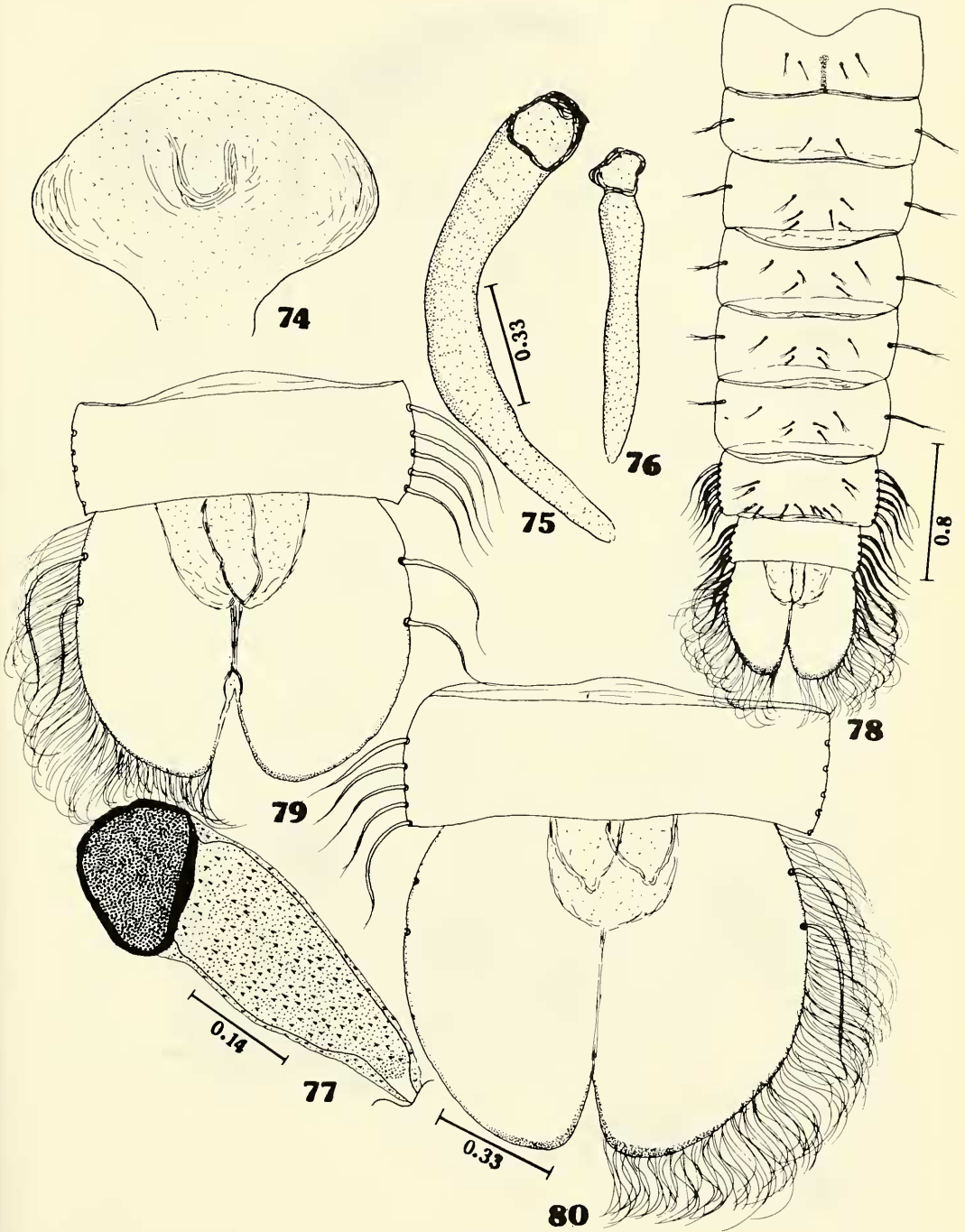




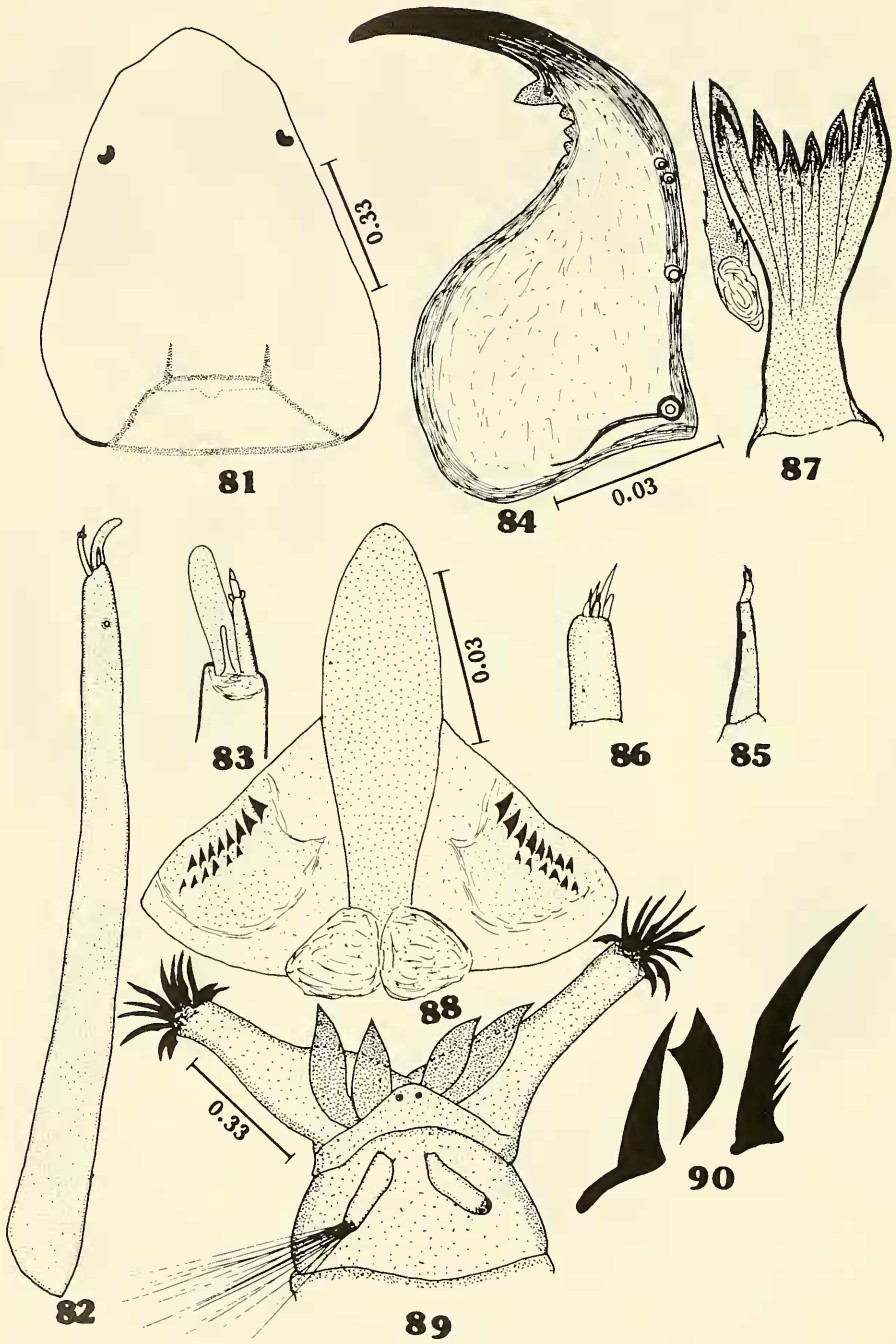
Figs. 56-66. Larva of *Stictochironomus obscurus* (Guha & Chaudhuri) comb.n. 56, Head capsule; 57, antenna; 58, S I; 59, pecten epipharyngis; 60, premandible; 61, mandible; 62, premento-hypopharyngeal complex; 63, mentum; 64, ventromental plate; 65, posterior abdominal segments; 66, claws of posterior parapods.



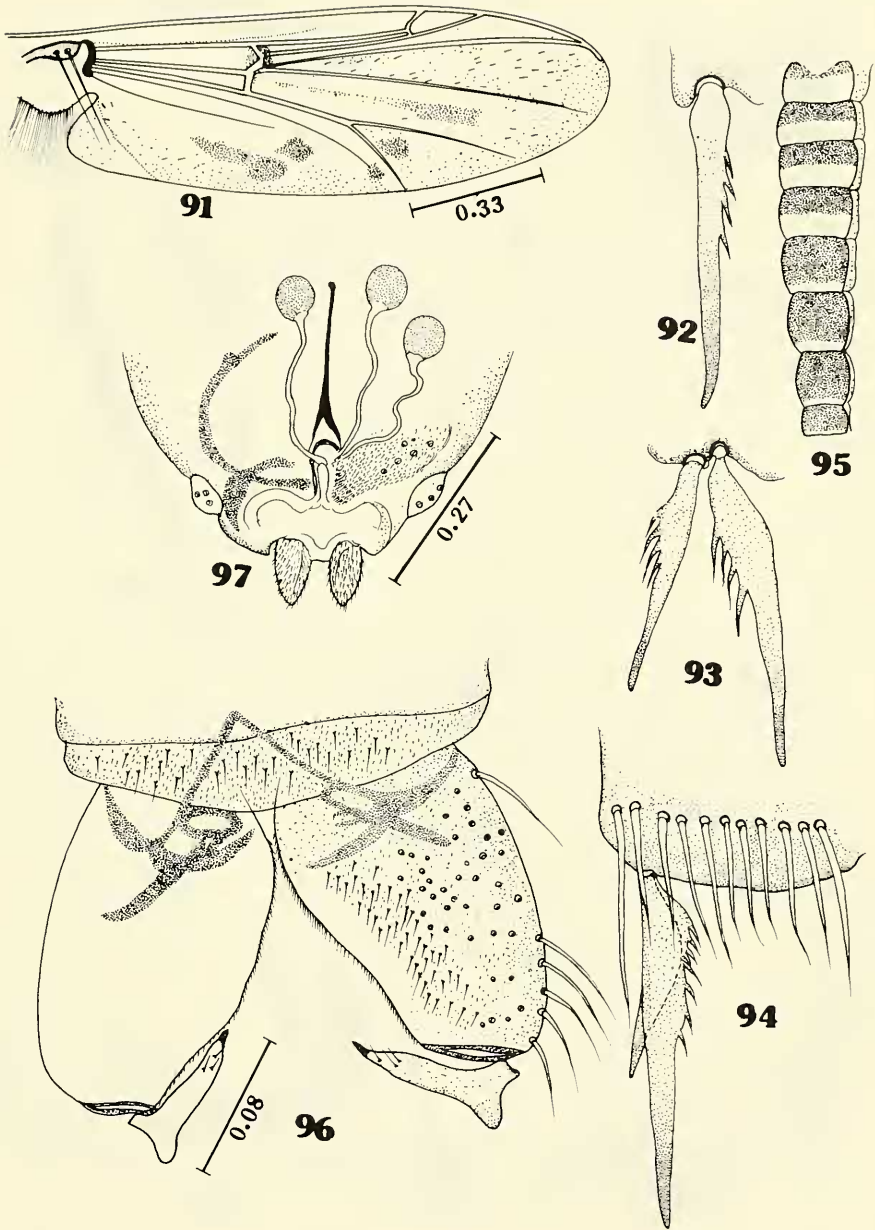
Figs. 67-73. Adult of *Clinotanypus fuscicornis* (Kieffer). 67, Wing; 68, fore tibial spur; 69, mid tibial spur; 70, abdomen; 71, male hypopygium; 72, gonostylus of male; hypopygium; 73, female genitalia.



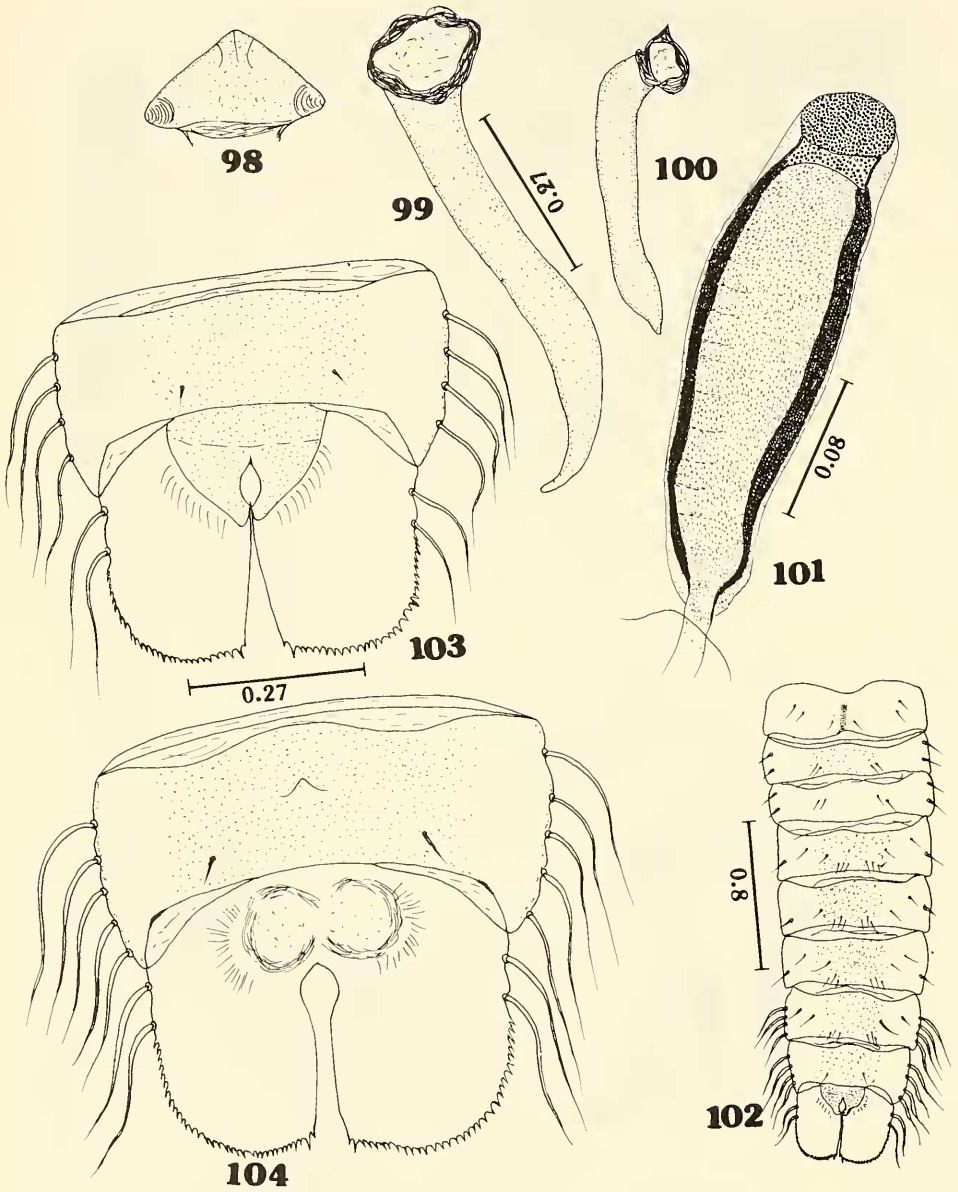
Figs. 74-80. Pupa of *Clinotanypus fuscognatus* (Kieffer). 74, Frontal apotome; 75, antennal sheath of male; 76, antennal sheath of female; 77, thoracic horn; 78, abdomen; 79, anal fin and genital sac of male; 80, anal fin and genital sac of female.



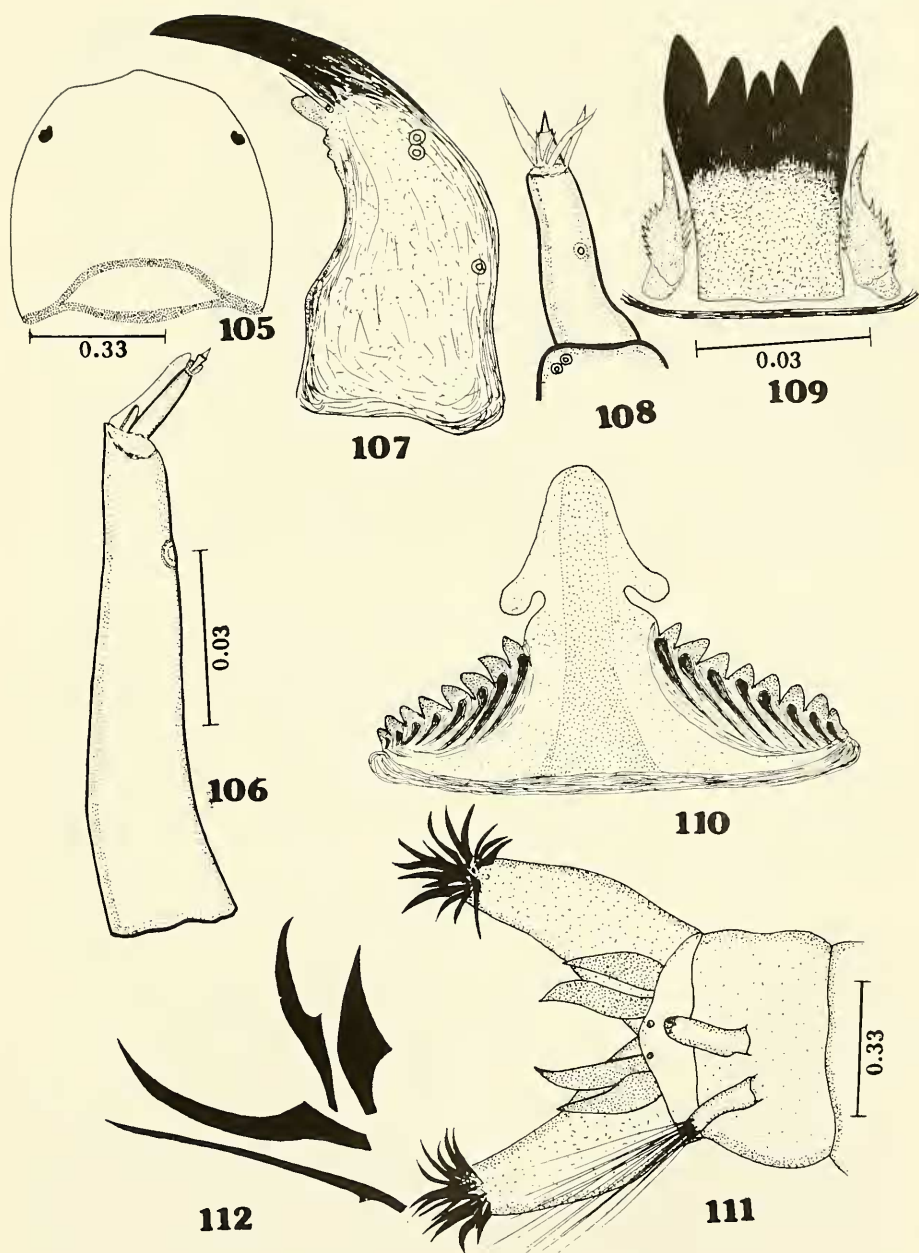
Figs. 81-90. Larva of *Clinotanypus fuscusignatus* (Kieffer). 81, Head capsule; 82, antenna; 83, apex of antenna; 84, mandible; 85, maxilla; 86, apex of maxilla; 87, ligula and paralingula; 88, mentum and M appendage; 89, posterior abdominal segments; 90, claws of posterior parapods.



Figs. 91-97. Adult of *Procladius noctivagus* (Kieffer). 91, Wing; 92, fore tibial spur; 93, mid tibial spur; 94, hind tibial comb; 95, abdomen; 96, male hypopygium; 97, female genitalia.



Figs. 98-104. Pupa of *Procladius noctivagus* (Kieffer). 98, Frontal apotome; 99, antennal sheath of male; 100, antennal sheath of female; 101, thoracic horn; 102, abdomen; 103, anal fin and genital sac in male; 104, anal fin and genital sac in female.



Figs. 105-112. Larva of *Procladius noctivagus* (Kieffer). 105, Head capsule; 106, antenna; 107, mandible; 108, maxilla; 109, ligula and paraligula; 110, mentum and M appendage; 111, posterior abdominal segments; 112, claws of posterior parapods.