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Chironomidae of South India. I. Generic composition, biogeographical relationships and descriptions of two unusual pupal exuviae

(Diptera, Chironomidae)

By **William P. Coffman, L. A. Yurasits, Jr.** and **Carlos de la Rosa**

Abstract

Collections of pupal exuviae were made from 25 sites (lotic, lentic and marine) in the states of Tamil Nadu and Kerala, South India. Species-level taxa belonging to 55 named genera (35 new to India) were encountered – increasing the number of named genera known to occur in India from 38 to 73. An additional 20 possibly "new" genera were also discovered. Descriptions for two of these "new" genera, which are not referable to any known subfamily, are given. Almost all of the named genera collected in S. India are known to occur widely in the Holarctic region, and many are subcosmopolitan. The 20 "new" genera may represent an endemic component in S. India. However, there is some evidence that at least a few of these "new" genera may occur elsewhere in the Oriental region.

Introduction

Sublette & Sublette (1973) list 56 genera of Chironomidae from the Oriental Region. Due to synonymy only 53 of the generic names they give are still considered to be valid (Ashe, 1983). Of these, only 21 had been recorded from India (Table 1). Since 1973 a number of investigators have added to our knowledge of the generic composition of the chironomid fauna of India (Bhattacharya et al., 1985a, 1985b; Chaudhuri & Debnath, 1985; Chaudhuri & Ghosh, 1981, 1982a, 1982b, 1986; Chaudhuri et al., 1984; Chaudhuri et al., 1979; Ghosh & Chaudhuri, 1983; Hirvenoja, 1985; Singh & Kulshresta, 1975; Sinharay & Chaudhuri, 1978, 1984; Sinharay et al., 1978). As a result of these efforts, the number of genera known to occur in India has risen to 38 (Table 1).

Nearly all of the distribution records given for the Chironomidae of India in Sublette & Sublette (1973) and all but one *(Chaetocladius)* of the more recent additions to the Indian fauna have come from Indian states bordering on the Himalayas. In this paper we are presenting the results (at the generic level) of a series of collections of pupal exuviae made in the southern Indian states of Tamil Nadu and Kerala. Broad biogeographical affinities of this fauna are discussed and two unusual pupal exuviae, that cannot be placed in any subfamily, are described. Forthcoming papers will treat the subfamilies Tanypodinae, orthocladiinae and Chironominae.

Material and Methods

All of the specimens utilized in this study were collected using the surface drift pupal exuviae method (Brundin, 1966; Coffman, 1973; Pinder, 1986; Wilson & Bright, 1973). Collections were made with fine mesh drift nets and soil sieves (125 microns) and field preserved in 70% EtOH. Collections were sorted at 12× and series of each species from each sample were slide mounted with Euparal for identification and study. Abbreviations utilized in the descriptions are from Saether (1980).

Table 1. Chironomidae genera reported from India in SUBLETTE & SUBLETTE (1973) and from recent literature sources.

SUBLETTE & SUBLETTE (1973)	Recent Literature
TANYPODINAE	
Ablabesmyia	*Paramerina* (CHAUDHURI & DEBNATH, 1985)
Clinotanypus	
Procladius	
Tanypus	
DIAMESINAE	
Diamesa	
Sympotthastia	
ORTHOCLADIINAE	
Brillia	*Bryophaenocladius* (GHOSH & CHAUDHURI, 1983)
Cricotopus	*Chaetocladius* (CHAUDHURI & GHOSH, 1982a)
Heterotrissocladius	*Eukiefferiella* SHINHARAY et al., 1978)
Parametriocnemus	*Limnophyes* (CHAUDHURI et al., 1979)
	Metriocnemus (SHINHARAY & CHAUDHURI, 1978)
	Nasuticladius (SINHARAY & CHAUDHURI, 1984)
	Orthocladius (CHAUDHURI & GHOSH, 1982b)
	Paracladius (HIRVENOJA, 1985)
	Paratrichocladius (HIRVENOJA, 1985)
	Thienemannia (BHATTACHARYA et al., 1985a)
CHIRONOMINAE	
CHIRONOMINI	
Chironomus	*Beckidia* (BHATTACHARYA et al., 1985b)
Cryptochironomus	*Cladopelma* (BHATTACHARYA et al., 1985b)
Dicrotendipes	*Gillotia* (BHATTACHARYA et al., 1985b)
Glyptotendipes	*Kiefferulus* (CHAUDHURI & GHOSH, 1986)
Harnischia	
Lauterborniella	
Nilodorum	
Paratendipes	
Polypedilum	
Stenochironomus	
TANYTARSINI	
Micropsectra	*Paratanytarsus* (CHAUDHURI et al., 1984)
	Tanytarsus (SINGH & KULSHRESTA, 1975)

Taxonomic placement

It has been established that pupal exuviae of most chironomids are easily placed at the generic level. There are, however, a few striking exceptions; for example, *Baetotendipes, Chironomus* and *Einfeldia* species group C (PINDER and REISS, 1986). For this reason, as well as others, the list of chironomid genera given here should be considered to represent a minimum number of genera actually present. A further complication in taxonomic placement was encountered frequently in this material. Many of the species placed in named genera do not conform exactly to all aspects of the pupal diagnoses of genera given in WIEDERHOLM (1986). When the differences were only slight, the species were placed in the

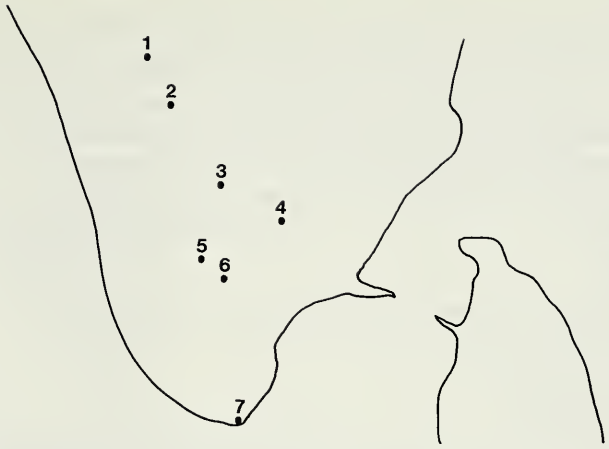


Fig. 1. Map of extreme southern India – numbers indicate areas in which collections were made: 1–2, Ootacamund-Coimbatore Road; 3–4, Kodaikanal-Madurai Road; 5, Periyar; 6, Rajapalaiyam; 7, Cape Cormorin.

appropriate named genera. However, when the differences were considered to have a greater probability of taxonomic significance, the species were either placed in a named genus, with the name given in quotation marks in the list, or the species were considered to be different enough to warrant placement in separate, numbered genera.

Collection sites

Most of the 25 collection sites were first to fourth order streams and were visited only once. however, a few lentic systems (ponds and reservoirs) and one marine locality were also sampled. Two areas were collected relatively extensively: the Palni Hills in the vicinity of Kodaikanal and the Nilgiri Hills in the vicinity of Ootacamund. Additional collections were made from a stream in the vicinity of Rajapalaiyam, Tamil Nadu, a stream near Periyar Lake, Kerala and tidal rock pools at Cape Comorin (Fig. 1).

Results and Discussion

Among the approximately 150 species-level taxa represented in these collections, 55 named genera (including Chironomini Genus D and Genus E of Pinder & Reiss [1986]) were identified (Table 2). All but one of these *(Sublettea)* is known from the Palaearctic, and all but two of the remaining genera *(Paratrissocladius* and *Virgatanytarsus)* are Holarctic in distribution. In addition to the 55 named genera represented in these collections, another 20 "new" genera were recognized. These categories were established for species-level taxa that could not be placed in any of the genera for which diagnoses are given in Wiederholm (1986) or other literature, even when the generic limits were reasonably expanded to allow for some differences (Table 2).

Thirty-five of the named genera represented in the collections from South India are recorded here for the first time from India-bringing the total number of genera with known distributions in India to 73 (Table 2).

Roback & Coffman (in press) found that the fauna of high altitude regions of Nepal, with only four possible endemic genera (all Tanytarsini and based on larvae), was overwhelmingly Holarctic in distribution. The results of other workers in the northern regions of the Indian subcontinent have included

Table 2. Genera of Chironomidae collected as pupal exuviae from South India. *indicates new to India.

TANYPODINAE
- *Ablabesmyia*
- *Conchapelopia**
- *Hayesomyia**
- *Larsia**
- *Nilotanypus**
- *Paramerina*
- *Procladius*
- *Tanypus*
- *Zavrelimyia**
- Pentaneurini Genera 1–5

ORTHOCLADIINAE
- *Bryophaenocladius*
- *Cardiocladius**
- *Clunio**
- *Corynoneura**
- *Cricotopus*
- *Eukiefferiella*
- *Heleniella**
- *Krenosmittia**
- *Limnophyes*
- *Nanocladius**
- *Paracricotopus**
- *Parakiefferiella*
- *Parametriocnemus**
- *Paratrissocladius**
- *Rheocricotopus**
- *Rheosmittia**
- *Thienemanniella**
- Orthocladiinae Genera 1–4

CHIRONOMINAE

CHIRONOMINI
- *Chironomus*
- *Cladopelma*
- *Cryptochironomus*
- *Cryptotendipes**
- *Dicrotendipes*
- *Glyptotendipes*
- *Harnischia*
- *Microtendipes**
- *Nilodorum*
- *Parachironomus**
- *Paracladopelma**
- *Paralauterborniella**
- *"Paratendipes"*
- *Phaenopsectra**
- *Polypedilum*
- *Robackia**
- *Saetheria**
- *Stenochironomus*
- *"Stictochironomus"**
- Chironomini Genus D* (Pinder & Reiss, 1986)
- Chironomini Genus E* (Pinder & Reiss, 1986)
- Chironomini Genera 1–6

TANYTARSINI
- *Cladotanytarsus**
- *Rheotanytarsus**
- *Stempellinella**
- *Sublettea**
- *Tanytarsus*
- *"Virgatanytarsus"**
- *Zavrelia**
- Tanytarsini Genera 1–3

PSEUDOCHIRONOMINI
- *Pseudochironomus**

UNKNOWN CHIRONOMIDAE
- Taxon 1
- Taxon 2

only two endemic genera *(Asclerina,* Reiss [1968] and *Neopodonomus,* Chaudhuri & Ghosh (1981). *Neopodonomus* has, however, been shown to be a synonym of *Boreoheptagyia* (Roback & Coffman, in press). These results are, perhaps, not surprising since the areas that have been most extensively collected (montane regions) are ecologically more closely related to the Palaearctic than they are to the Oriental Region. The fauna of South India, as revealed by these collections, is clearly dominated by genera that have widespread distributions, but there is also a major component of apparently "endemic" genera. It is not clear whether these genera are limited to South India (perhaps including Sri Lanka) or are more widespread in the Oriental Region. Unfortunately, no comprehensive study of the chironomid fauna of any other part of the Oriental Region has been carried out. The limited data that do exist would seem to indicate that at least some part of this group of "endemic" genera may occur in other parts of the Oriental Region. Thienemann, Johannsen, Zavrel and Lenz found a chironomid

fauna on the Greater Sunda Islands that may be similar to that of South India. The S. Indian species that is here placed in "*Stictochironomus*" bears some resemblance to *Stictotendipes* Lenz (1937) and the *Rheotanytarsus anomalus* group of Zavrel (1934) reported from Sumatra also occurs in the South Indian material. There are other known connections of the South Indian fauna with other parts of the Oriental Region. The species of *Sublettea* from South India is very similar (perhaps identical) to that found by Fittkau in SW China and reported by Pinder & Reiss (1986). Chironomidae Genus 2 (described below), or something very similar, has recently been found in China and in collections from Burma (E. J. Fittkau, personal communication).

Descriptions of pupae of two unusual taxa

Taxon 1

Pupa (Figs. 2–8):

Size demonstrating strong sexual dimorphism, total length of females 7.0 mm – 8.3 mm, $\bar{x}$ = 7.6 mm, n = 4; total length of males 5.3 mm – 6.5 mm, $\bar{x}$ = 5.4 mm, n = 6.

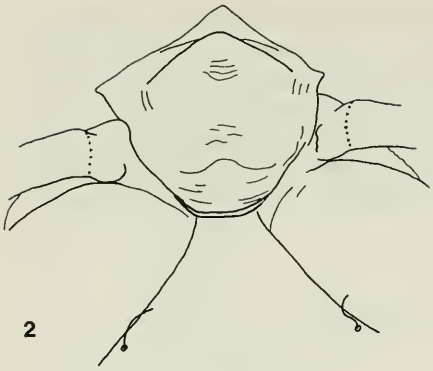
Cephalothorax: antepronotum, ventral structures of thorax, cephalic region and leg sheaths yellow; dorsal parts of thorax and wing sheaths yellow-brown; Cephalic area (Fig. 2): frontal apotome strongly sclerotized; frontal setae absent; frontal apotome without tubercles or warts; ocular field with one postorbital seta; Thorax (Fig. 3): antero-dorsal region of mesonotum with a field of very strong spine-like processes; fields of rugulosity dorsal of the dorsocentral setae, on the prealar lobe and on a lobe-like process posterior to the precorneal setae – the latter somewhat stronger than the other two fields; all leg sheaths recurved under wing sheaths; wing sheaths without pearl rows or terminal protuberance; thoracic horn absent; Chaetotaxy of thorax: two narrowly separated MAps; one LAps located on a low protuberance; four Dc setae, Dc2 (apparently) located much ventral of Dc1, Dc3 and Dc4 forming a posterior pair; three Pc setae of variable lengths, but Pc1 is usually shorter than the other two; no Pa or Mn setae present.

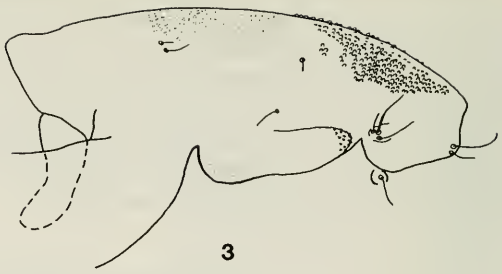
Abdominal segments I–VIII (Figs. 4–8): mostly yellow-brown, but armature and adjacent areas reddish-brown to black.

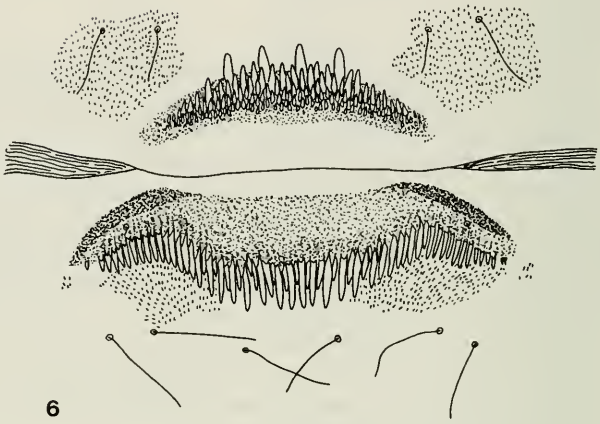
Shagreenation – tergites: tergite I without, tergites II and III with extensive fields of dense fine shagreen, slightly larger toward the posterior margins (Figs. 4–5), tergite IV with a narrow transverse anterior band and posterolateral areas of dense fine shagreen (Figs. 4 and 6), tergite V with two narrowly separated anterior groups and a transverse posterior band of fine dense shagreen (Figs. 4 and 6), tergite VI with most of the central area covered by fine, but less dense, shagreen, expanded laterally along the posterior margin (Figs. 4 and 7), tergite VII with central area covered with weak shagreen (Fig. 4), tergite VIII with a weak transverse anterior band or without shagreen (Figs. 4 and 8).
pleurites: pleurite I without, pleurites II and III with small anterior areas of fine shagreen, usually much weaker on III (Figs. 4–5), pleurites IV and V with extremely fine shagreen on posterior halves (Fig. 4), pleurites VI–VIII with extremely fine shagreen over much of surface, sometimes absent on VII and much of VIII.

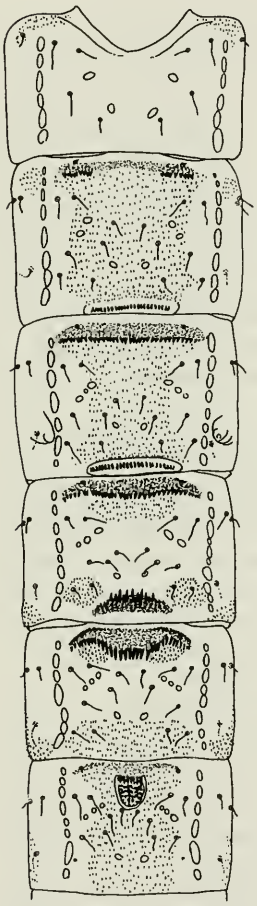
Sternites: sternites I–VI with at most very fine and very sparse shagreen spinules, sternite VII with a weak anteromedian group of shagreen spinules, sternite VIII without shagreen.

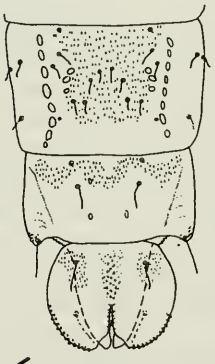
Armature and other structures of abdomen: rows of approximately 50–60 Hl on posterior margins of tergites II and III (Figs. 4–5); tergites III (II)–IV with transverse anterior rows of sharp dark posteriorly directed spines (Figs. 4–5), tergite IV with a posteromedian transverse group of sharp, dark, anteriorly directed spines of varying lengths (Figs. 4 and 6); tergite V with a sinuous row of large, dark, posteriorly directed spines (Figs. 4–6); tergite VI with a dense, anteromedian, semicircular patch of spines (Figs. 4 and 7); tergites VII and VIII without armature; PSB absent on II, but a PSB-like structure present on segment III (Figs. 4–5); PSA absent on all segments.

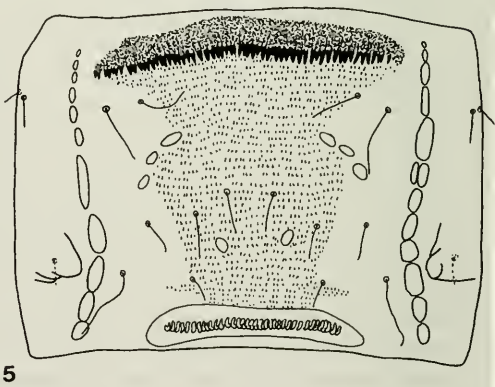




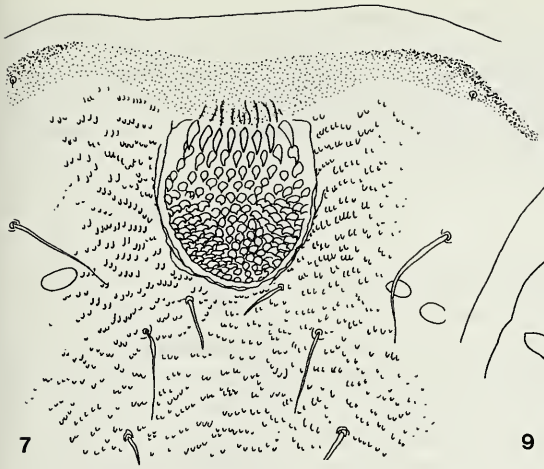


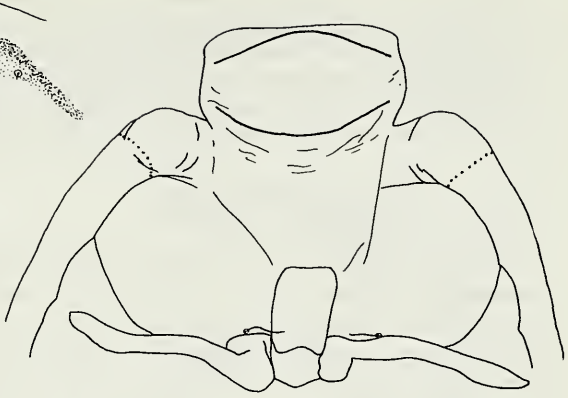


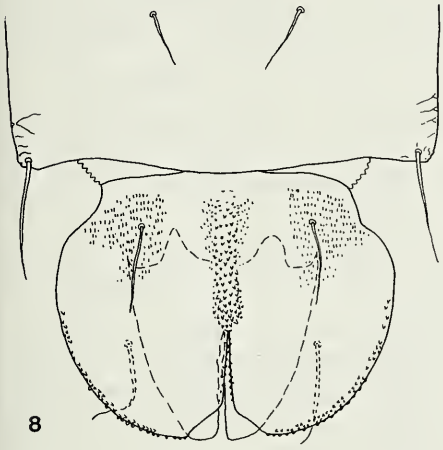


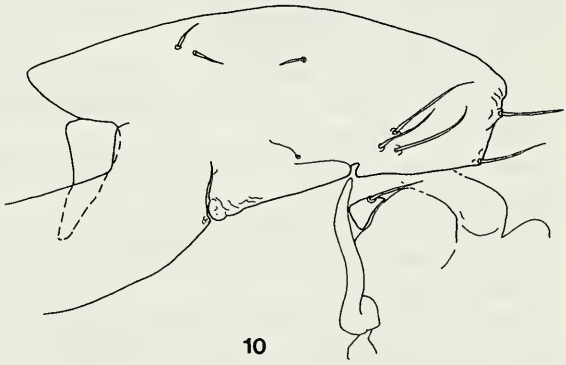


Figs. 2–6. Taxon 1, pupa, – 2. cephalic region, – 3. thorax, lateral, – 4. abdomen, dorsal, – 5. segment 3, dorsal, – 6. posterior armature of tergite 4 and anterior armature of tergite 5.









Figs. 7–10. Taxon 1, pupa. – 7. Anteromedian armature of tergite 6, – 8. posterior margin of segment 8 and anal lobes, dorsal; Taxon 2, pupa. – 9. cephalic area, – 10. thorax and adjacent structures of cephalic region, lateral.

Chaetotaxy – tergites (Figs. 4–5 and 8): tergite I with 4 D setae; tergites II–V with 7 D setae; tergites VI and VII apparently with 6 D setae; tergite VIII with 1 D seta.

Pleurites: pleurite I with 1 L seta; pleurites II–VII with 3 L setae; pleurite VIII with one relatively large posterior L seta (Figs. 4–5 and 8).

Sternites: sternite I with V setae apparently absent; sternites II–VII with 4 V setae; sternite VIII with 2 V setae.

Anal lobes and segment IX (Figs. 4 and 8): tergite IX with lateral and median fields of shagreen; AL without marginal fringe of setae, but with several rows of small spine-like protuberances; each AL with a dorsal and ventral seta on the disc; inner margins of AL with small groups of weak spinules; genital sheaths of male extend to tip of AL.

Specimens examined:

Kodaikanal area, Palni Hills, Tamil Nadu, South India – small stream along Madurai – Kodaikanal Road, at milepost 36, 1 female pupal exuviae, 18 Mar. 1978; 3rd order stream along Madurai – Kodaikanal Road, about

4 km east of Kodaikanal, Tiger Forest stream, 2 female pupal exuviae, 20 Mar. 1978; 2nd order stream along Madurai – Kodaikanal Road, between mileposts 17/5 and 17/6, 1 male and 1 female pupal exuviae, 18 Mar. 1978; Ootacamund area, Nilgiri Hills, Tamil Nadu, South India – Vellappalam stream (2nd or 3rd order) along Coimbatore – Ootacamund Road, 1 male pupal exuviae (fragment), 5 May 1979; 2nd order stream along Coimbatore – Ootacamund Road, 3 male pupal exuviae, 8 May 1979; Kallar River (4th order stream) at base of Nilgiri Hills along Coimbatore – Ootacamund Road, 2 male pupal exuviae, 8 May 1979.

Taxon 2

Pupa (Figs. 9–15):

Moderate sexual dimorphism in size, total length of females 3.0 mm – 3.5 mm, $\bar{x}$ = 3.2 mm, n = 6: total length of males 2.5 mm – 3.25 mm, $\bar{x}$ = 2.9 mm, n = 12.

Cephalothorax: All thoracic structures yellow to yellow-brown; Cephalic area (Fig. 9); frontal apotome strongly sclerotized; frontal setae absent; frontal apotome without tubercles or warts; ocular field with one postorbital seta; Thorax (Fig. 10): dorsal surface of thorax not rugulose, but with very weak sculpturing; all leg sheaths recurved under wing sheaths; wing sheaths without pearl rows or terminal protuberance, but with an angular process on the inner margin near the base, adjacent to and fitting closely against the prealar lobe; thoracic horn absent; Chaetotaxy of thorax: two widely separated MAps; one LAps located on a low protuberance; four Dc setae, Dc2 or Dc1 located more ventrally than others, Dc3 and Dc4 forming a posterior pair; three relatively strong Pc setae of approximately equal size; no Pa or Mn setae present.

Abdominal segments I–VIII (Figs. 11–15): tergites light reddish-brown, armature of tergites dark reddish-brown; tergites II–VII with lateral, longitudinal dark brown lines; pleurites and sternites with little or no pigmentation.

Shagreenation – tergites: tergites II–VIII with lateral and/or anterior groups of very weak shagreen spinules (Figs. 11–15).

Pleurites: all pleurites without shagreen.

Sternites: sternites II–VIII with lateral, moderately dense groups of very fine shagreen spinules in irregular arching rows.

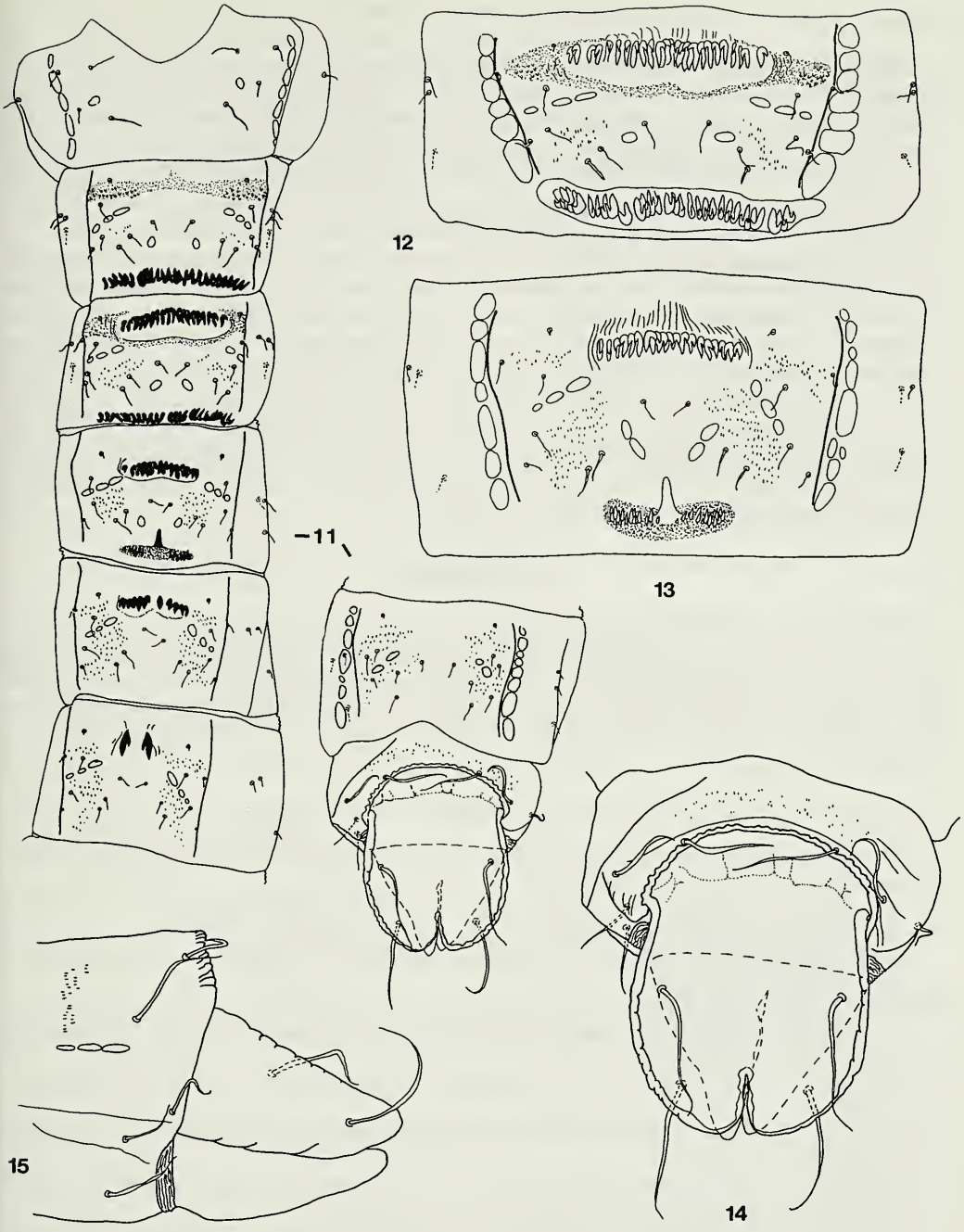
Armature and other structures of abdomen: posterior margins of tergites II and III with rows of about 25–30 strong Hl (Figs. 11–12); tergites III–V with anterior rows of strong Hl, 25–30 on tergite III, about 18 on tergite IV and about 12 on tergite V (Figs. 11–13); tergite IV with a posterior median group of anteriorly directed spines, the median spine in this group much larger than the others (Figs. 11 and 13); tergite VI with a pair of very large anteromedian Hl (Fig. 11); tergites VII and VIII without armature; PSB and PSA absent on all segments.

Chaetotaxy – tergites (Figs. 11–13): tergite I with 4 D setae; tergites II–VII with 7 D setae; tergite VIII with 2 D setae.
pleurites: pleurite I with 1 L seta; pleurites II–VII with 3 L setae; tergite VIII with 1–2 L seta.
sternites: sternite I without V setae; sternites II–VII with 4 V setae; sternite VIII with 1–2 V setae.

Anal lobes and segment IX (Figs. 11, 14 and 15): tergite IX without shagreen; AL without marginal fringe, but margin weakly crenulate; each AL with a dorsal and ventral seta on the disc; AL and segment IX forming a Telmatogetoninae-like concave, oval plate; the posterior margin of tergite VIII heavily sclerotized and crenulate, forming an arching ridge above the AL.

Specimens examined:

Ootacamund area, Nilgiri Hills, Tamil Nadu, South India – Kallar River (4th order), at base of Nilgiri Hills along Coimbatore – Ootacamund Road, 16 male and 10 female pupal exuviae, 8 May 1979.



Figs. 11–15. Taxon 2, pupa. – 11. abdomen, dorsal, – 12. segment 3, dorsal, – 13. segment 4, dorsal, – 14. segment 8 and anal lobes, dorsal, – 15. posterior margin of segment 8 and anal lobes, lateral.

Comments on taxa 1 and 2

Although the pupal exuviae of these unusual taxa differ from each other in size and many structural features, they have a number of basic similarities that, most probably, indicate a close relationship. Among these features are: 1). the absence of a TH; 2). the absence of FS; 3). the ventral position of one of the anterior Dc setae; 4). the unusual position of the LAps on a low protuberance; 5). the absence of LS on all abdominal segments; 6). the presence of only one L seta on segment VIII; 7). the presence of seven D setae on most tergites; 8). the absence of an AL fringe; 9). the presence of dorsal and ventral setae on the disc of the AL; and 10). the presence of unusual armature on the abdominal tergites.

Each of these taxa undoubtedly represents a new genus and, since the combination of characters that they possess is not consistent with any described subfamily, they most likely represent a new higher taxon as well, perhaps a new subfamily. The number and distribution of the thoracic setae of these taxa would seem to indicate a relationship with Orthocladiinae. However, the abdomen of Taxon 1 shows a number of relationships with *Pseudochironomus,* e. g., the shape of the AL and the presence of a nearly circular patch of spines on tergite VI. Some species of *Pseudochironomus* also have no fringe on the AL. The abdomen of Taxon 2 does not, however, show this possible relationship. Instead, the unusual arrangement of segment VIII and IX, with the AL, appears to represent a remarkable convergence with Telmatogetoninae. Clarification of the taxonomic position and phylogenetic relationships of these taxa must await discovery of the larvae and/or adults.

Acknowledgements

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Dr. William P. Coffman,
L. A. Yurasits, Jr.
Dr. Carlos de la Rosa,
Department of Biological Sciences,
University of Pittsburgh
Pittsburgh, PA 15260, USA