Identification Guide and Key to Chironomid Pupal Exuviae in Mongolian Lakes

R. William Bouchard, Jr.
L.C. Ferrington, Jr.

University of Minnesota
Department of Entomology

Version 1
January 2008

ACKNOWLEDGEMENTS

Many thanks are due to Giana Gelsey who processed and slide mounted the surface floating pupal exuviae samples and provided preliminary identifications. We would also like to thank Moriya Rufer for her original illustrations she made available for use in this guide.

This material is based upon work supported by the National Science Foundation (NSF) under grant DEB-0316503. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.

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CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

CHIRONOMIDAE AND PUPAL EXUVIAE

Flies in the family Chironomidae or non-biting midges are among the most diverse and abundant inhabitants of freshwater aquatic habitats from nearly all regions in the world. The ability to correctly identify these flies is important for a number of reasons including their use in biological monitoring and ecological studies. Unfortunately chironomids are often not identified beyond family or subfamily due to what are considered difficult and time consuming larval identifications. Leaving chironomid identifications at these higher taxonomic levels potentially ignores large amounts of information that can be obtained from these organisms. The use of chironomid surface floating pupal exuviae (SFPE) reduces some of the difficulties associated with the identification of chironomid larvae. These SFPE are easily collected, processed, and identified especially when compared to the larvae (Ferrington *et al.* 1991). In addition to being more easily identified, another advantage of SFPE is they can often be identified to lower taxonomic resolution (species level in many cases) than the larvae. However, there remains a need to generate identification keys to chironomid SFPE to train new researchers and to take advantage of information that can be obtained from identifications beyond the genus level.

In chironomids the process of emergence, and therefore the production of SFPE, appears to be similar for all taxa. The Chironomidae are holometabolous which means they undergo egg, larval, pupal, and adult stages. The larval and adult stages are morphologically very different and they inhabit different habitats with most larvae being aquatic and adults being terrestrial. The pupal stage is the transitional stage between the larva and adult and involves massive tissue reorganization. Once this reorganization is complete and the adult fly has developed, a more or less fully formed adult is present within the pupal skin (pharate adult). This pharate adult swims to the surface of the water and the adult insect emerges from the pupal skin through a dorsal split in the thorax. As the fly exits the pupal skin, the skin fills with air and remains floating on the water's surface. In lentic, or non-flowing waters (e.g., lakes, ponds, wetlands), SFPE accumulate in areas along the lee shore or in areas of emergent vegetation. In lotic, or flowing waters (e.g., streams, rivers), these skins collect in areas behind rocks or snags or in areas were overhanging vegetation contacts the water surface. Regardless of the habitat, these SFPE can easily be collected by skimming the surface of the water with a pan. For methods on collecting and processing chironomid SFPE see Ferrington *et al.* (1991) and Wiederholm (1986).

GUIDE SCOPE

This guide is based on material from 10 lakes in western Mongolia of varying salinity and nutrient levels. From these lakes a total of 58 taxa from 27 genera were identified. Consequently, this identification key is not meant to be a comprehensive key to pupal Chironomidae from lentic habitats in Mongolia. This guide includes subfamily/tribe, genus, and species level keys. The subfamily/tribe and genus keys are modified from Wiederholm (1986) and Ferrington *et al.* (2008). It should function to identify many of the common and some of the less common exuviae from western Mongolian lakes. Due to the great diversity of this family, subsequent studies in Mongolia will undoubtedly document many additional taxa from this country. Future versions of this key will incorporate additional taxa and will possibly also include taxa from different habitats.

Species names or even genus names could not be attached to some taxa although they appear to be distinct taxa. As a result, many taxa are left as morphospecies (e.g. *Ablabesmyia* sp. 1). These designations serve to identify problems in the state of taxonomy for the pupal stage in Chironomidae. There is a great need to establish rearing programs to associate adults with their immature stages and to describe new species. Future research will help to elucidate the identity of many of these taxa.

HOW TO USE THIS GUIDE

This guide consists of a series of keys at the subfamily, genus, and species levels. The keys provided are dichotomous keys which consist of a series of couplets focusing on paired alternative character states. Each couplet presents the user with two different character states and the user must determine which of these character states matches the specimen being identified. To assist with your decision in each of these couplets, photos or illustrations are embedded with the couplets. However, care should be taken as these photos or illustrations may not exactly match your specimen. They are provided to give examples of these structures and they may come from taxa different than your specimen. As you proceed through the key, you will eventually reach a terminal couplet which gives you a taxon name –the identity of your specimen. The subfamily/tribe key will then direct the user to genus level keys for the four subfamilies and tribes included in this guide. Once the genus identity is determined, the user is directed to a page which includes notes on the genus and if there is more than one species known from these lakes, an additional key to the taxa within this genus is provided.

MORPHOLOGY OF CHIRONOMID PUPAE

Identifying chironomid SFPE requires knowledge of their morphology. There are a number of structures and characteristics that are commonly used to separate chironomid taxa. The pupae of many chironomid taxa possess respiratory organs or thoracic horns anteriorly on the thorax (Figures 1.1a & 1.1b). The shape, size, and presence/absence of the thoracic horn can be used to identify some chironomid pupae. The frontal apotome can also possess structures referred to as cephalic tubercles and frontal warts (Figure 1.1b). Cephalic tubercles are present in many taxa and can generally be identified by the presence of frontal setae on these tubercles. Frontal warts are less common and can usually be recognized by the lack of frontal setae originating at the tips.

Spines on the abdomen of SFPE can be used to separate some taxa. The size of the spines, the size or shapes of spine patches, and the location of spine patches are important in separating many taxa (Figure 1.1a). The use of spine patch patterns is particularly important on the abdomen. In many cases, these spine patches are referred to as shagreen. Shagreen is simply patches of small points or spines. In most chironomid taxa a row or rows of recurved hooks is present posteriorly on tergite II. Patterns on the skin including rugosity (areas of wrinkles or creases), granulosity (areas of small granules or bumps), or reticulation (net-like pattern) can also be employed to separate taxa in these keys.

The use of the presence/absence, placement, size, and shape of setae or hairs is also important in the identification of chironomid pupae. Lateral setae (L-setae) on the abdomen are variously developed (Figure 1.1a). Many taxa possess at least some lateral abdominal setae that are flattened or taeniate with the number of these taeniate setae generally increasing posteriorly. Setation on the cephalothorax (head and thorax) is also often important in identifying chironomid pupae.

Dorsocentral setae (not illustrated in Figure 1.1a) are located on the thorax near the ecdysial suture. There are generally four of these setae and they are labeled Dc_1 through Dc_4 from anterior to posterior. The placement, size, and shapes of frontal setae and precorneal setae are also used in the keys provided in this guide.

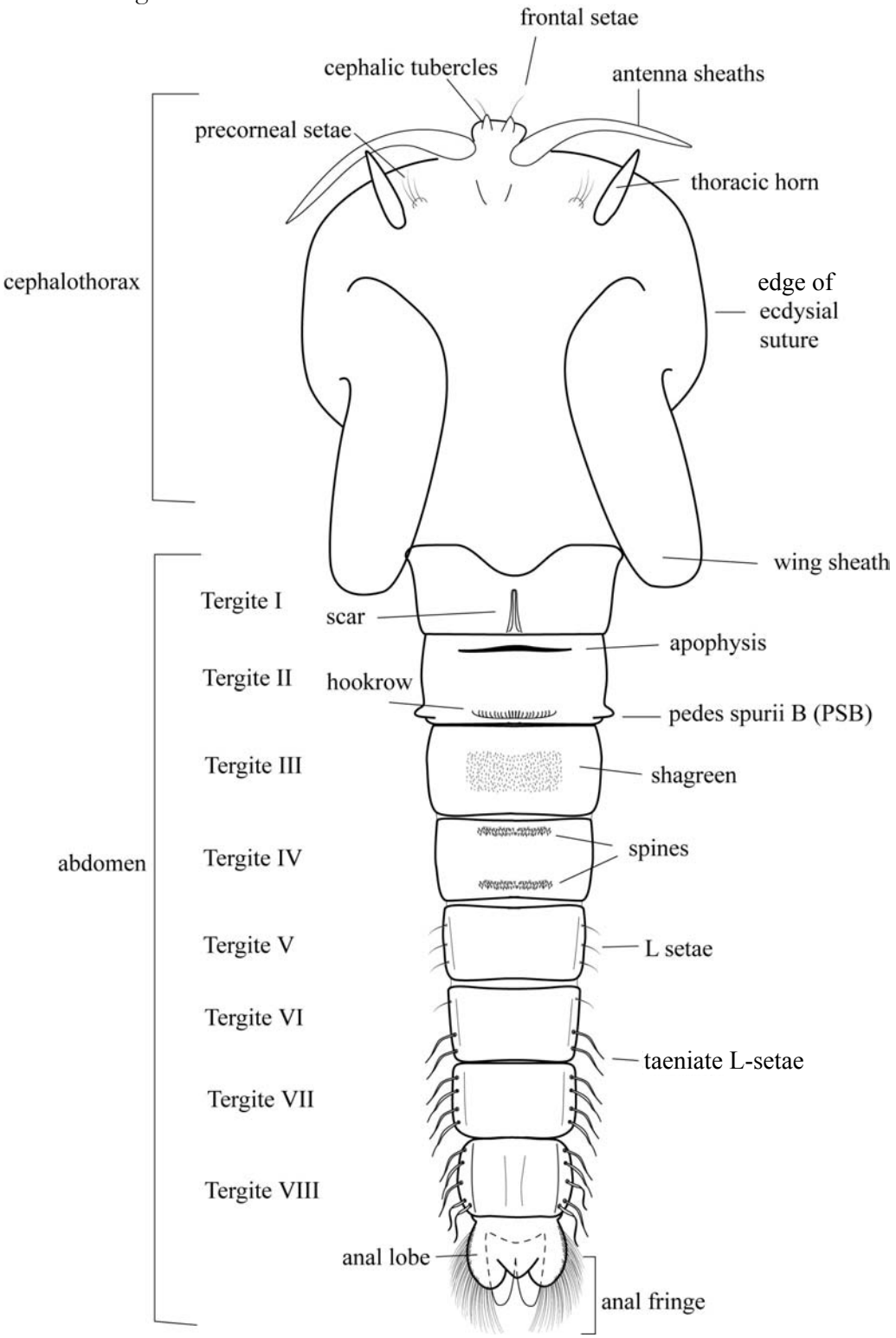


Figure 1.1a: Morphology of the chironomid pupa - dorsal view (Illustration by M.R. Rufer).

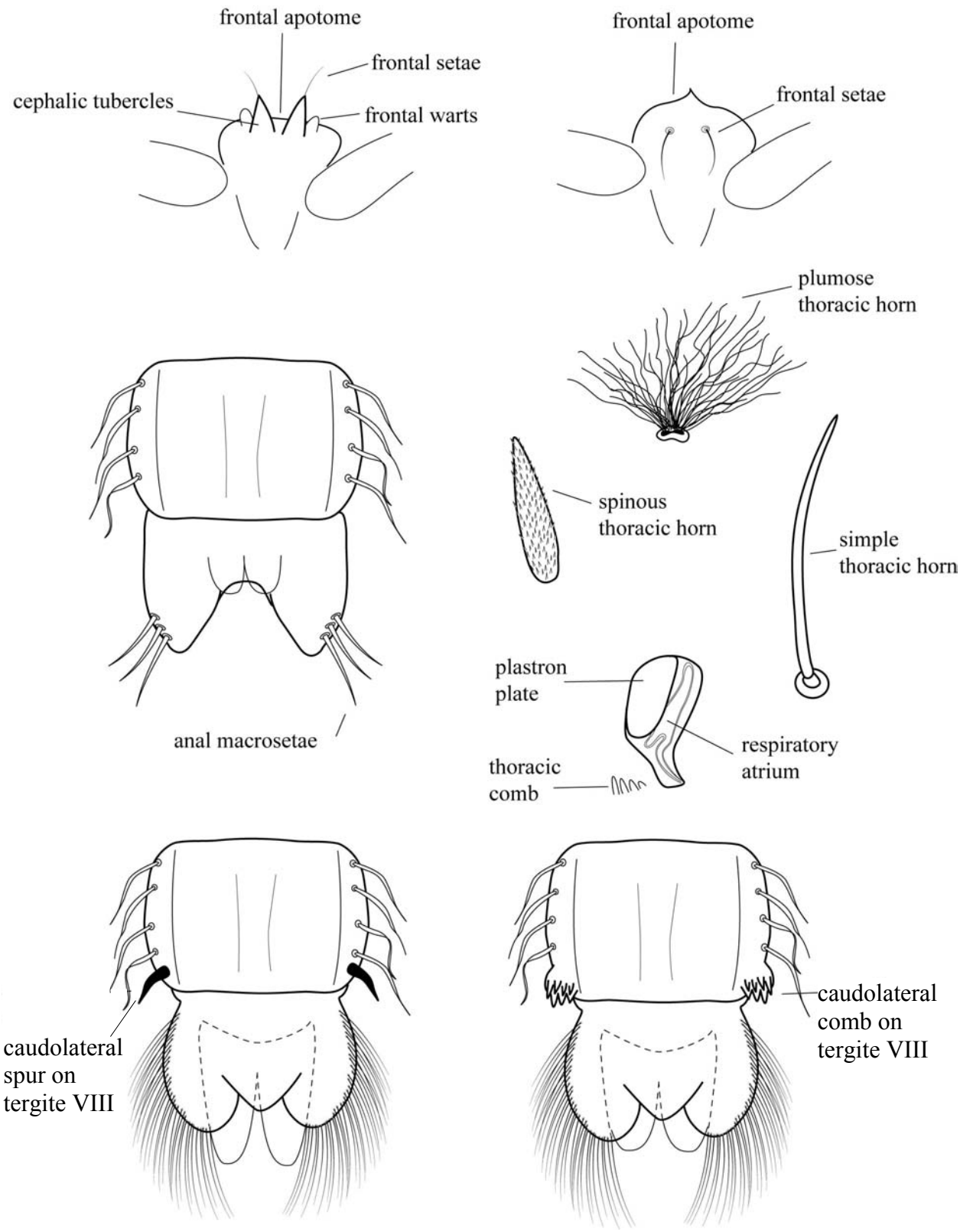


Figure 1.1b: Morphology of the chironomid pupa (Illustrations by M.R. Rufer)

CHAPTER 2

CHIRONOMIDAE:
KEY TO SUBFAMILIES AND TRIBES

KEY TO PUPAE OF THE SUBFAMILIES OF CHIRONOMIDAE

1. Thoracic horn with distinct plastron plate (Fig. 2.1); anal lobes with two lateral taeniate anal macrosetae (Figs. 2.2 & 2.3) ..... **Tanypodinae (in part) - Chapter 3**

Figure 2.1: Thoracic horn of *Procladius* sp. 2

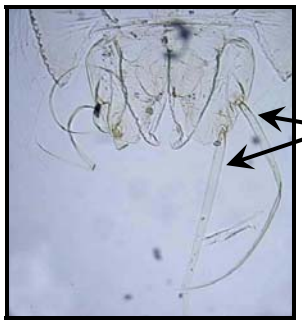


Figure 2.2: Anal lobes of *Tanypus* sp.

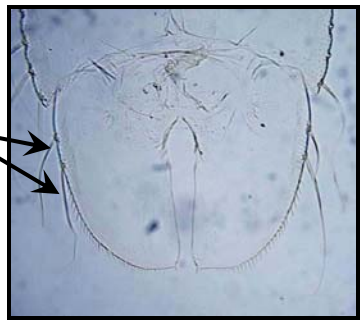


Figure 2.3: Anal lobes of *Procladius* sp. 1

1'. Thoracic horn, if present, lacking a distinct plastron plate (Figs. 2.4, 2.5, 2.6, 2.7, & 2.8); anal macrosetae variable **2**

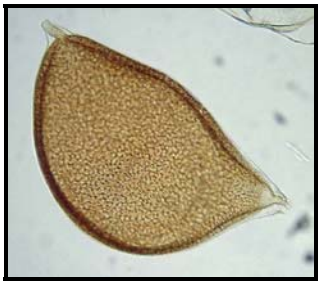
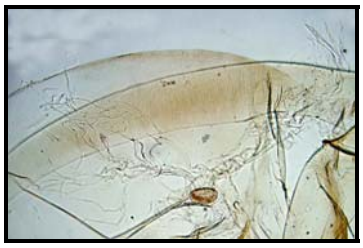


Figure 2.4: Thoracic horn *Tanypus* sp.

Figure 2.5: Thoracic horn *Cricotopus* (*I.*) sp. 1

Figure 2.6: Thoracic horn *Orthocladius* (*O.*) sp. 1

Figure 2.7: Thoracic horn *Endochironomus* sp.



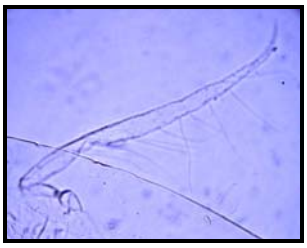


Figure 2.8: Thoracic horn *Cladotanytarsus* sp. 3

2(1'). Thoracic horn large and covered with extensive meshwork (Figs. 2.9 & 2.10); anal lobes with two lateral taeniate anal macrosetae (Figs. 2.2 & 2.3) ..... **Tanypodinae (in part) - Chapter 3**

Figure 2.9: Thoracic horn *Tanypus* sp.

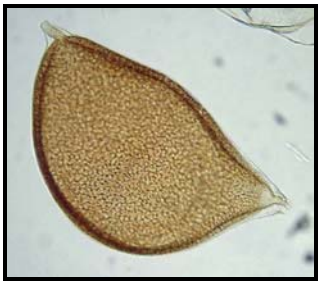


Figure 2.10: Anterior margin of the thoracic horn of *Ablabesmyia* sp.2

2'. Thoracic horn not large and covered with meshwork, sometimes absent (see Figs. 2.5, 2.6, 2.7, & 2.8); anal lobes never with only 2 lateral anal macrosetae **3**

3(2'). Thoracic horn with at least two branches (branches may be difficult to distinguish in slide mounted specimens) (Fig. 2.11)..... **Chironomini - Chapter 5**

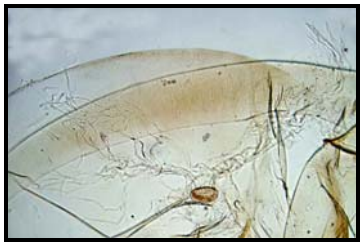


Figure 2.11:
Thoracic horn
***Endochironomus* sp.**

3'. Thoracic horn absent or when present unbranched (Fig. 2.12) many small chaetae may be present (Fig. 2.13) **4**

Figure 2.12:
Thoracic horn
***Orthocladius* (*O.*) sp. 1**

Figure 2.13:
Thoracic horn
***Cladotanytarsus* sp. 1**

4(3'). Caudolateral margin of segment VIII usually with a spine or group of spines (Figs. 2.14 & 2.15); wing sheaths almost always with a nase (Fig. 2.16); anal lobes usually present (sometimes reduced or absent) and lacking anal macrosetae (Fig. 2.14) .... **Tanytarsini - Chapter 6**

Figure 2.14: Segment VII and anal lobes of *Micropsectra* sp.

Figure 2.15: Anal comb of *Tanytarsus* sp. 2

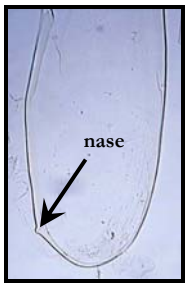


Figure 2.16:
Wing sheath tip of
***Cladotanytarsus* sp. 1**

4'. Caudolateral margin of segment VIII rarely with a spine (Fig.2.17); wing sheaths lacking nase (Fig. 2.18); anal lobes when present with anal macrosetae (Fig. 2.19) although fringe setae may obscure anal macrosetae (Fig. 2.19)..... **Orthocladiinae - Chapter 4**

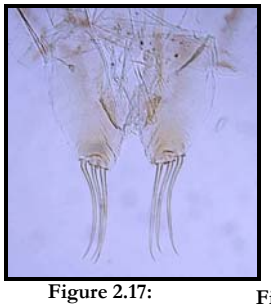


Figure 2.17:
Anal lobes of
***Cricotopus* sp. 1**

Figure 2.18: Wing sheath of *Orthocladius* (*O.*) sp. 2

Figure 2.19:
Anal lobes of
***Corynoneura* sp. 1**

CHAPTER 3

TANYPODINAE:
KEYS TO GENERA AND SPECIES

TANYPODINAE

DIAGNOSIS

EXUVIA: Small to large pupae (2-11 mm). Color variable from clear to dark brown. Many taxa with distinct pigmentation patterns.

CEPHALOTHORAX: Thorax smooth, rugose, or granulose. Thoracic horn present and variable in shape ranging from tubular to globose. Plastron plate often present although it is very reduced or absent in some taxa. Aeropyle sometimes present. Surface of thoracic horn at least partially covered in spines or scale-like spines. Horn sac variable and connected to plastron plate by neck. A row of irregular tubercles (thoracic comb) often present arising from base of thoracic horn and extending toward ecdysial margin. A basal lobe is also commonly present at the base of the thoracic horn. Thoracic setae variable, ranging from simple and pointed to filamentous and distally rounded or pointed.

ABDOMEN: Tergite I with or without a median longitudinal scar. Tergites and sternites variously covered with spinules which may be single or in groups. Spinules variously shaped, usually triangular but sometimes bifid, trifid, or multibranched. Posterior spine rows usually absent. Segments I-VI usually with 2 filamentous lateral setae. A single filamentous lateral seta usually present on segments VII-VIII. Segments I-VI usually without taeniate setae. Segment VII usually with at least some taeniate setae, but this number is variable. Segment VIII usually with 5 taeniate setae although they are sometimes absent. **Segment IX:** Anal lobe well developed or sometimes reduced. Anal lobes variable in shape. Two pairs of anal macrosetae with or without adhesive sheaths. Spines often present on the inner or outer margins of the anal lobes. Male genital sac length variable.

SUBFAMILY COMMENTS

Members of the subfamily Tanypodinae can be separated from other subfamilies and tribes included in this guide by the possession of 2 lateral taeniate anal macrosetae. In addition, the presence of a plastron plate on the thoracic horn will separate this subfamily from other taxa. In tanypod taxa with a thoracic horn which lack a plastron plate, the presence of a large, often globular, thoracic horn covered in reticulation will separate this subfamily from other subfamilies and tribes.

KEY TO GENERA OF TANYPODINAE PUPAE

1. Thoracic horn with distinct plastron plate (Fig. 3.1)..... ***Procladius***

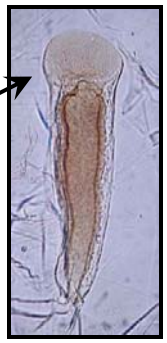


Figure 3.1:
Thoracic horn
***Procladius* sp. 2**

1'. Thoracic horn lacking a distinct plastron plate and either large and covered with meshwork (Fig. 3.2) or slender.....**2**

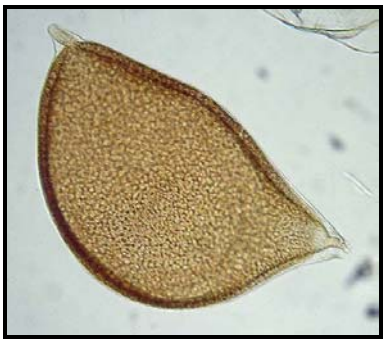


Figure 3.2:
Thoracic horn
***Tanypus* sp.**

2(1'). Segments VII or VIII, or both with 6 or more lateral taeniate setae (Fig. 3.3) ... ***Tanypus***

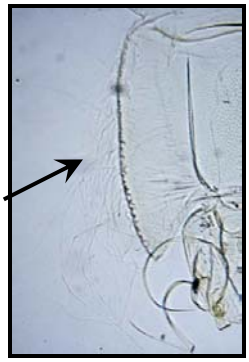


Figure 3.3:
Lateral margin
of segment VIII
in *Tanypus* sp.

2'. Segments VII and VIII fewer than 6 lateral taeniate setae (Fig. 3.4) ..... ***Ablabesmyia***

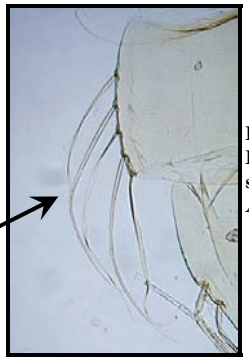


Figure 3.4:
Lateral margin of
segment VIII in
***Ablabesmyia* sp.**

ABLABESMYIA

KEY TO *ABLABESMYIA* SPECIES

1. Wing sheaths with distinct veins (Fig. 3.5); thoracic horn with weak reticulation or meshwork (Fig. 3.6) ..... ***Ablabesmyia* sp. 1**

Figure 3.5:
Wing sheath of *Ablabesmyia* sp. 1

Figure 3.6:
Anterior margin of the thoracic horn of *Ablabesmyia* sp. 1

1'. Wing sheaths s lacking distinct veins (Fig. 3.7); thoracic horn with strong reticulation or meshwork (Fig. 3.8) ..... ***Ablabesmyia* sp. 2**

Figure 3.7:
Wing sheath of *Ablabesmyia* sp. 2

Figure 3.8:
Anterior margin of the thoracic horn of *Ablabesmyia* sp. 2

ADDITIONAL REFERENCES

Roback (1985)

PROCLADIUS

KEY TO *PROCLADIUS* SPECIES

1. Inner corners of anal lobe generally rounded with widely spaced spines (Fig. 3.9); thoracic horn slender, with plastron plate much wider than atrium (Fig. 3.10) .....***Procladius* sp. 2**

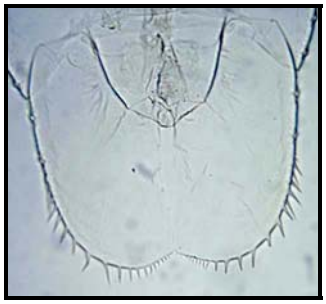


Figure 3.9: Anal lobes of *Procladius* sp. 2

Figure 3.10: Thoracic horn of *Procladius* sp. 2

1'. Inner corners of anal lobe produced or straight (Figs. 3.11 & 3.12); thoracic horn wide, with plastron plate not much wider than atrium (Fig. 3.13) **2**

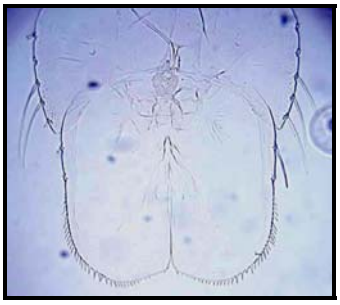


Figure 3.11: Anal lobes of *Procladius* sp. 3

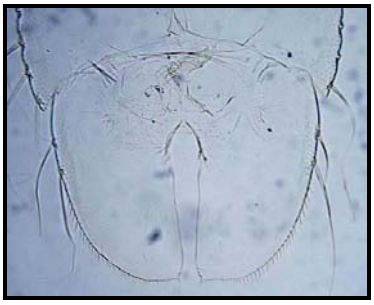


Figure 3.12: Anal lobes of *Procladius* sp. 1

Figure 3.13: Thoracic horn of *Procladius* sp. 1

2(1). Thorax clear and smooth (Fig. 3.14)..... ***Procladius* sp.1**

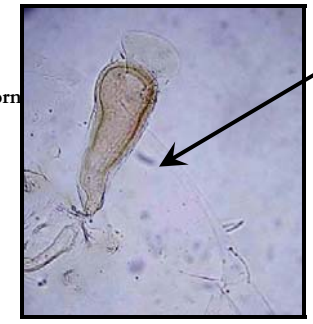


Figure 3.14: Thoracic horn and ecdysial margin of *Procladius* sp. 1

2'. Thorax light brown and rugulose (Fig. 3.15).....***Procladius* sp. 3**

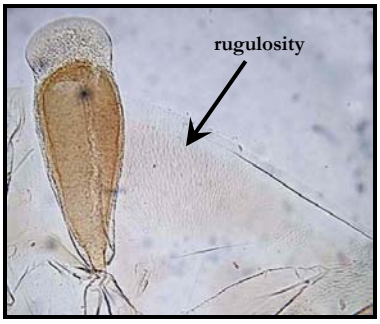


Figure 3.15: Thoracic horn and ecdysial margin of *Procladius* sp. 3

NOTES ON SPECIES

***Procladius* sp. 1:** Subgenus *Procladius*.

***Procladius* sp. 2:** Subgenus *Psilotanypus*.

***Procladius* sp. 3:** Subgenus *Procladius*. This may be the same species as *Procladius* sp.1, but it is larger and darker.

ADDITIONAL REFERENCES

Roback (1980)

TANYPUS

NOTES ON SPECIES

Only one species detected.

CHAPTER 4

ORTHOCLADIINAE:
KEYS TO GENERA AND SPECIES

ORTHOCLADIINAE

DIAGNOSIS

EXUVIA: Small to large pupae (2-11 mm). Color variable from clear to dark brown.

CEPHALOTHORAX: Thorax smooth, rugose, or granulose. Frontal setae present on frontal apotome or prefrons and sometimes borne on cephalic tubercles or absent. Frontal apotome usually without cephalic tubercles or frontal warts. Thoracic horn present or absent. When present variable in shape ranging from elongate to globose. Surface of thoracic horn smooth to covered in spines or scale-like spines. Thoracic horn almost always without chaetae. Plastron plate, aeropyle, and horn sac absent. Thorax with (2)-3 precorneal setae and (3)-4 dorsocentral setae. Thoracic setae variable in size and shape ranging from simple and pointed to taeniate. Wing sheath sometimes with a row or rows of pearls at tip and usually without a nase.

ABDOMEN: Tergite and sternite I often without spines or shagreen. Tergites and sternites II-VIII usually with shagreen, but sometimes absent. Tergites and sternites often possess posterior spine rows or patches and sometimes possess median spine patches. Single or multiple rows of recurved hooks usually present posteriorly on tergite II. Anteriorly directed spines often present on conjunctives III/IV, IV/V, and V/VI. Segments I-III with 1-3 L-setae. Segments II-VII with (1)3-4 L-setae. Segment VIII with 2-5 L-setae. L-setae often taeniate on segments VII-VIII, sometimes also on segment VI and rarely on segment V. Pedes spurii A present or absent on segment IV-VIII although usually absent from segment VIII. Pedes spurii B often present on segment II, sometimes present on segment III, and rarely present on segment I. Apophyses often distinct. Spur on caudolateral margin of segment VIII almost always absent, but sometimes present as an embedded spines. **Segment IX:** Anal lobe usually well developed, but sometimes reduced or absent. Anal lobes variable in shape, but usually rounded. Some taxa with anal lobes drawn out into an apical point. Some Shagreen present or absent. Usually with 1-3 terminal hair-like or spine-like anal macrosetae although up to eight may be present. Rarely 1-2 anal macrosetae located on anal lobe dorsal surface. Spines sometimes present apically or on outer margins of the anal lobes. Male genital sac length reaching beyond tip of anal lobes or not.

SUBFAMILY COMMENTS

The subfamily Orthocladiinae is large and diverse which makes generalizations regarding the morphology difficult. Many taxa in the Orthocladiinae lack a setal fringe on the anal lobe which will separate these taxa from the Chironomini and Tanytarsini. Those Orthocladiinae possessing an anal lobe fringe can be separated from the Chironomini by the lack of a multibranched thoracic horn which is present in the Chironomini. The lack of a caudolateral spur on segment VIII in the Orthocladiinae will separate those taxa with an anal fringe from the Tanytarsini which nearly always possesses a comb or spur in this location. Only some species of *Zalutschia* possess an embedded caudolateral spine on segment VIII (this genus is known from Mongolia [Hayford 2005], but was not collected from the ten lakes and consequently is not included in this key).

KEY TO GENERA OF ORTHOCLADIINAE PUPAE

1. Anal lobe with a fringe of setae (Fig. 4.1) **2**

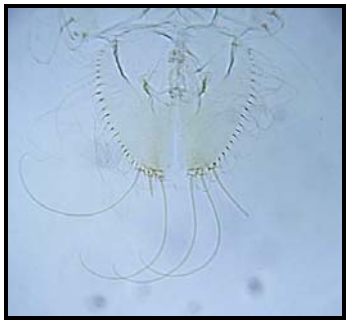


Figure 4.1: Anal lobe of *Psectrocladius* (*P.*) sp. 3

1'. Anal lobe without a fringe of setae (Fig. 4.2)..... **6**

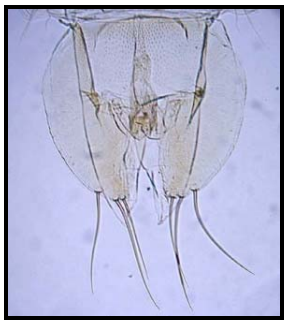


Figure 4.2: Anal lobe of *Orthocladius* (*P.*) sp. 1

2(1). Thoracic horns absent (Fig. 4.3); wing sheath tips with pearl rows (Fig. 4.4) .... ***Corynoneura***

Figure 4.3: Thorax of *Corynoneura* sp. 1

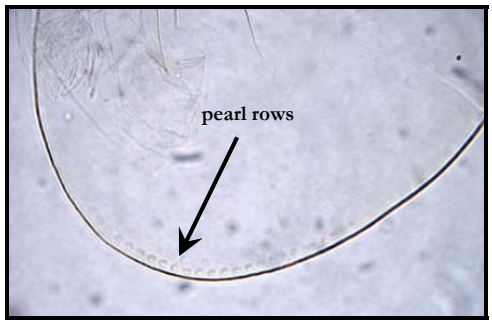


Figure 4.4: Wing sheath tip of *Corynoneura* sp. 1

2'. Thoracic horns present (Figs. 4.5, 4.6, & 4.7) – thoracic horns are sometimes small, clear, or broken off; if thoracic horns are absent then wing sheaths without pearl rows **4**

Figure 4.5: Thoracic horn of *Cricotopus* sp. 4

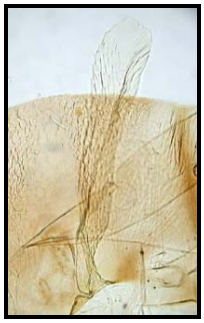


Figure 4.6: Thoracic horn of *Psectrocladius* sp. 4

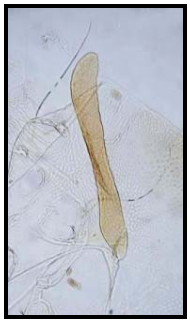


Figure 4.7: Thoracic horn of *Cricotopus* sp. 1

3(2'). Anal lobes with more than or less than 3 anal macrosetae (Fig. 4.8) or with 3 anal macrosetae unevenly or widely spaced (Fig. 4.9) .... ***Psectrocladius*** **(Psectrocladius & *Allopsectrocladius*) (in part)**

Figure 4.8: Anal lobes of *Psectrocladius* (*P.*) sp. 1

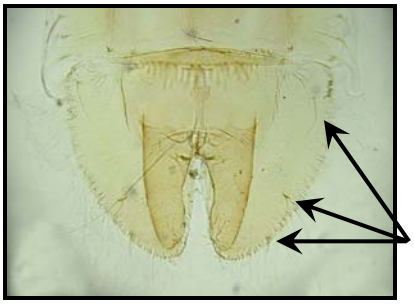


Figure 4.9: Anal lobes of *Psectrocladius* (*A.*) sp. 2

3'. Anal lobes with 3 evenly spaced anal macrosetae on the distal half (Figs. 4.10 & 4.11) **5**

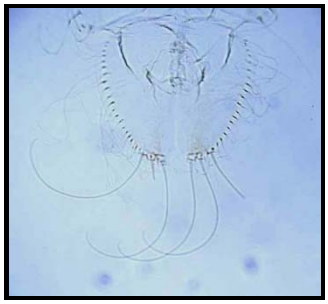


Figure 4.10: Anal lobes of *Psectrocladius* (*P.*) sp. 3

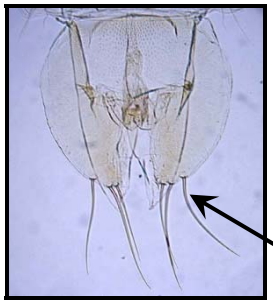


Figure 4.11: Anal lobes of *Orthocladius* (*P.*) sp. 1

4(3'). Two precorneal setae large and one small, all arising from distinct tubercles (Fig. 4.12); pedes spurii B (PSB) on segment II large (Fig. 4.13).....***Nanocladius*** **(in part)**

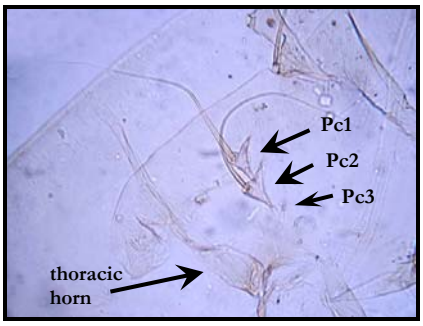


Figure 4.12: Precorneal (Pc) setae and thoracic horn of *Nanocladius* sp. (Pc_3 is small and difficult to see)

Figure 4.13: Abdominal segment II of *Nanocladius* sp.

4'. Precorneal setae usually small, if 2 setae are larger than the other one then not arising from distinct tubercles and/or the setae are shorter or only slightly longer than thoracic horn (Fig. 4.14); pedes spurii B on segment II absent or not as large (Fig. 4.15) **5**

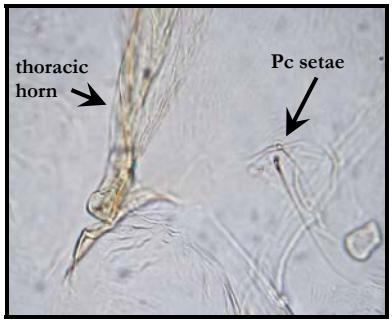


Figure 4.14: Pc setae and base of thoracic horn of *Psectrocladius* (*P.*) sp. 3

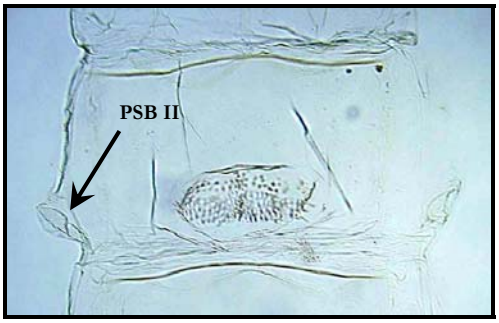


Figure 4.15: Segment II of *Psectrocladius* (*P.*) sp. 3

5(4'). Median spines groups on tergites IV-VI (VII) consisting of strong spines single or paired (Fig. 4.16); frontal warts often present (Figs. 4.17 & 4.18)..... ..... ***Psectrocladius* (*Psectrocladius*) (in part)**

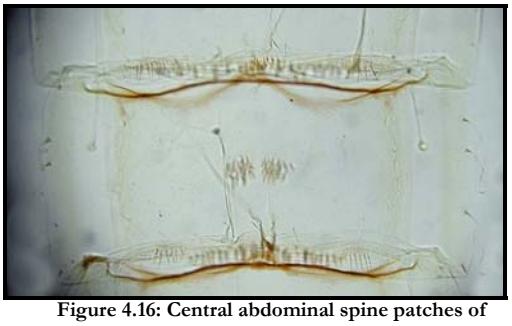


Figure 4.16: Central abdominal spine patches of *Psectrocladius* (*P.*) sp. 1

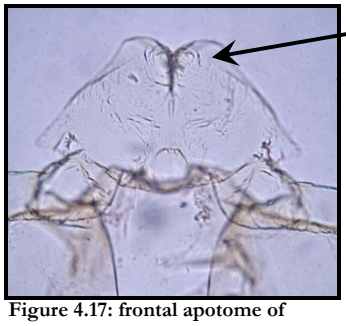


Figure 4.17: frontal apotome of *Psectrocladius* (*P.*) sp. 3

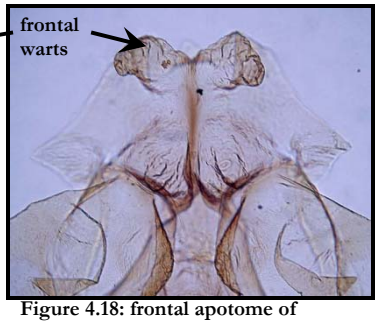
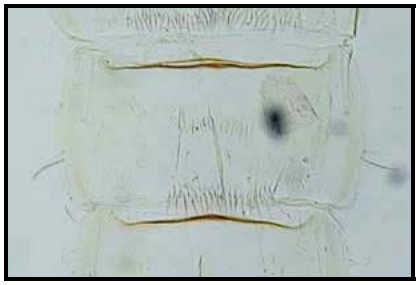


Figure 4.18: frontal apotome of *Psectrocladius* (*P.*) sp. 4

5'. Median spines groups on tergites IV-VI (VII) consisting of weak spines in single groups (Fig. 4.19); frontal warts absent (Fig. 4.20) .....***Nanocladius* (in part)**

Figure 4.19: Central abdominal spine patch of *Nanocladius* sp.



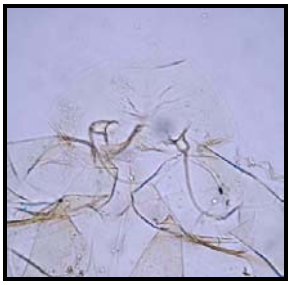


Figure 4.20: Frontal apotome of *Nanocladius* sp.

6(1'). Anal lobe without anal macrosetae (Fig. 4.21) although spines may be present; small, clear exuvia; tergites with coarse shagreen (Fig. 4.22); conjunctives of at least some of the segments III/IV-VII/VIII with groups of spinules (Fig. 4.22)..... ***Pseudosmittia***

Figure 4.21: Posterior abdominal segments of *Pseudosmittia* sp.

Figure 4.22: Abdominal segments of *Pseudosmittia* sp.

6'. Anal lobe with anal macrosetae that may be spine-like, hair-like, or long and slender (Figs. 4.23 & 4.24) **8**

Figure 4.23: Anal lobes of *Orthocladius* (*P.*) sp.1

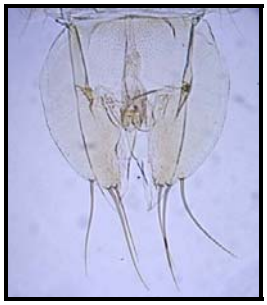


Figure 4.24: Posterior abdominal segments of *Synorthocladius* sp.

7(6'). Anal lobes rounded with 2-3 unequal anal macrosetae (Fig. 4.25) ..... ***Synorthocladius***

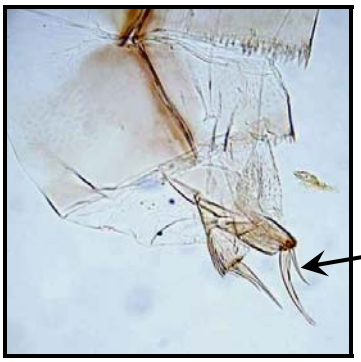


Figure 4.25: Posterior abdominal segments of *Synorthocladius* sp.

7'. Anal lobes with 1 or more long or short hair-like macrosetae (Figs. 4.26 & 4.27) **53**

Figure 4.26: Anal lobes of *Orthocladius* (*O.*) sp.2

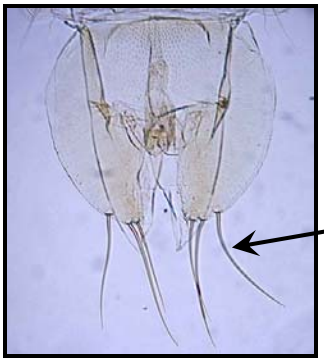


Figure 4.27: Anal lobes of *Orthocladius* (*P.*) sp.1

8(7'). Posterior margins of tergites II-VIII with rows of long, needle-like spines (Fig. 4.28); thoracic horn absent (Fig. 4.29) ..... ***Limnophyes***

Figure 4.28: Abdominal segments of *Limnophyes* sp.

Figure 4.29: Thorax of *Limnophyes* sp.

8'. Posterior margins of tergites II-VIII without rows of long, needle-like spines (Fig. 4.30), if spines present then thoracic horn present..... **9**

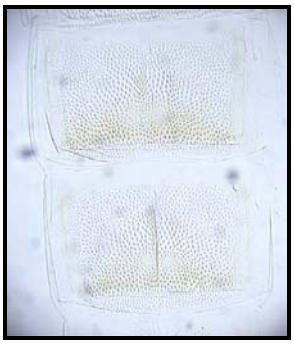


Figure 4.30: Abdominal shagreen of *Cricotopus* (*I.*) sp. 1

9(8'). Recurved hooklets on posterior margin of segment II usually in more than 2 rows (Figs. 4.31 & 4.32); anal lobes often with terminal spines (Fig. 4.33); thoracic horn usually large and strongly pigmented (Figs. 4.34 & 4.35) ..... ***Orthocladius***

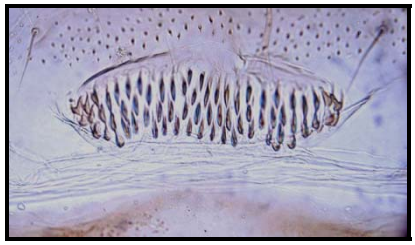


Figure 4.31: Recurved hooks on posterior of tergite II of *Orthocladius* (*O.*) sp. 2

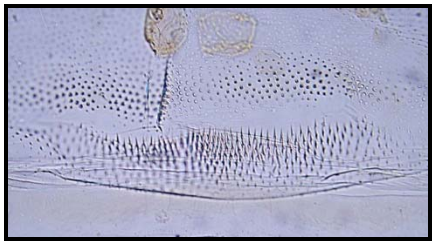


Figure 4.32: Recurved hooks on posterior of segment II horn of *Orthocladius* (*P.*) sp. 1

Figure 4.33: Thoracic horn of *Orthocladius* (*O.*) sp. 2

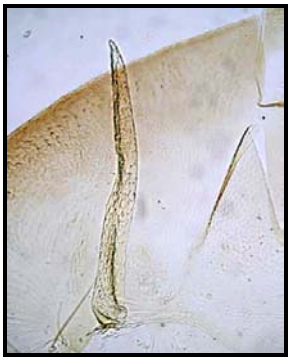


Figure 4.34: Thoracic horn of *Orthocladius* (*O.*) sp. 2

Figure 4.35: Thoracic horn of *Orthocladius* (*P.*) sp. 1

9'. Recurved hooklets on posterior margin of segment II usually in 2 rows (Fig. 4.36); anal lobes with at most tiny spines (Fig. 4.37); thoracic horn usually small and weakly pigmented (Figs. 4.38, 4.39, & 4.40) ..... ***Cricotopus* (in part)**

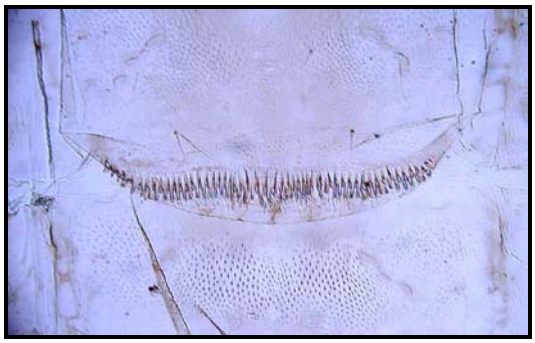


Figure 4.36: Recurved hooks on posterior of tergite II horn of Cricotopus (*I.*) sp. 1

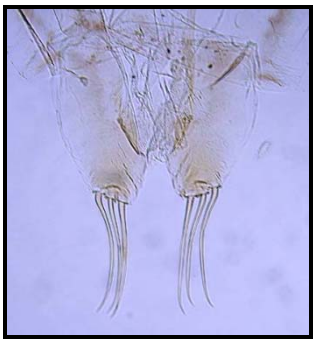


Figure 4.37: Anal lobes of Cricotopus (*I.*) sp. 1

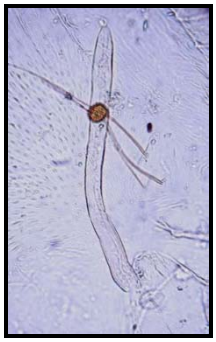


Figure 4.38: Thoracic horn of *Cricotopus* (*I.*) sp. 1

Figure 4.39: Thoracic horn of *Cricotopus* (*I.*) sp. 2

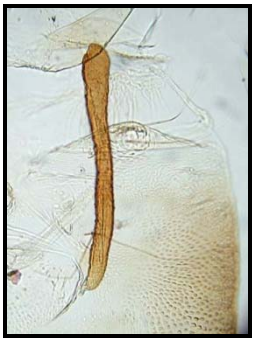


Figure 4.40: Thoracic horn of *Cricotopus* (*I.*) sp. 5

CORYNONEURA

KEY TO *CORYNONEURA* SPECIES

1. Anal lobe fringe complete (Fig. 4.41); tergal shagreen generally similar in size across tergite (Fig. 4.42) ..... ***Corynoneura* sp. 1**

Figure 4.41: Anal lobes of *Corynoneura* sp. 1

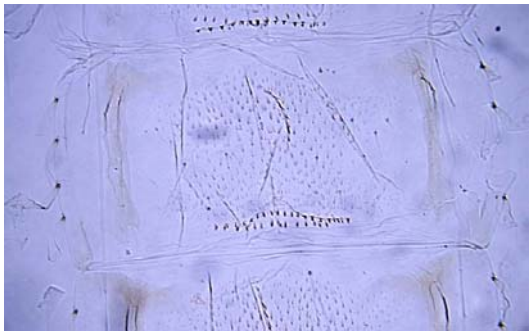


Figure 4.42: Abdominal shagreen of *Corynoneura* sp. 1

1'. Anal lobe fringe incomplete and only occupying the distal 1/2 to 2/3 of the anal lobe (Fig. 4.43); tergal shagreen becoming noticeably stronger posteriorly (Fig. 4.44)..... ..... ***Corynoneura* sp. 2**

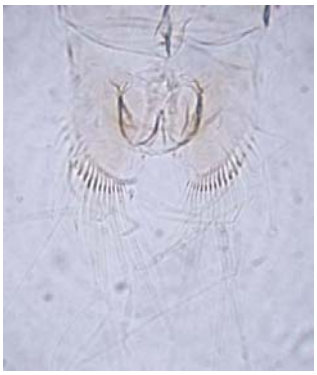


Figure 4.43: Anal lobes of *Corynoneura* sp. 2

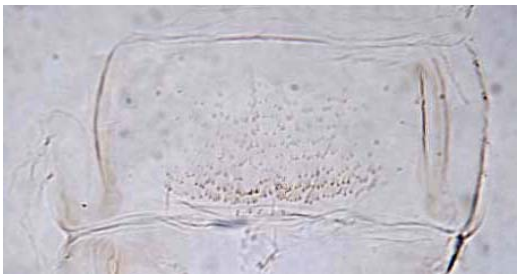


Figure 4.44: Abdominal shagreen of *Corynoneura* sp. 2

Notes on species

***Corynoneura* sp. 1:** This species is relatively common and widespread. Specimens from Zagas Nuur are larger with rugulosity on the ecdysial margin. One specimen from Khar Nuur possesses dark patches on the conjunctives between IV/V, V/VI, and VI/VII.

***Corynoneura* sp. 2:** Only represented by one specimen.

CRICOTOPUS

KEY TO *CRICOTOPUS* SPECIES

1. Tergites II-V with shagreen not covering most of tergite, with anterior and posterior fields of shagreen widely separated – anterior fields of shagreen generally crescent shaped (Figs. 4.45 & 4.46) **(subgenus *Cricotopus*)**.....**2**

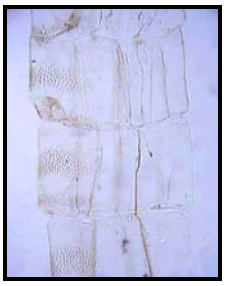


Figure 4.45: Abdominal shagreen of *Cricotopus* (*C.*) sp. 6

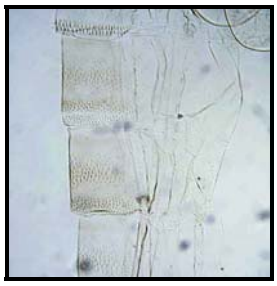


Figure 4.46: Abdominal shagreen of *Cricotopus* (*C.*) sp. 3

1'. Tergites II-V with shagreen covering most of tergites, usually not with distinct anterior and posterior fields (Fig. 4.47) – if fields of shagreen are narrowly separated the anterior fields are generally rectangular (Fig. 4.48) **(subgenus *Isocladius*)**.....**3**

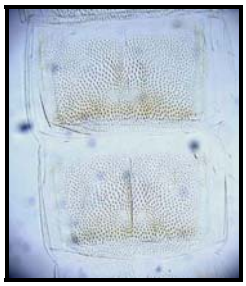


Figure 4.47: Abdominal shagreen of *Cricotopus* (*I.*) sp. 1

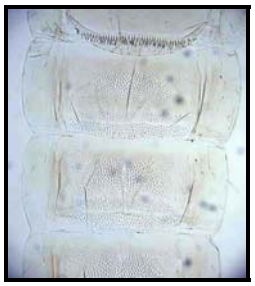


Figure 4.48: Abdominal shagreen of *Cricotopus* (*I.*) sp. 2

2(1). Thoracic horns absent (Fig. 4.49); frontal setae small and located on the prefrons (Fig. 4.50) .....***Cricotopus* (*C.*) sp. 3**

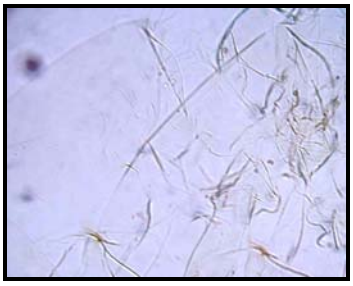


Figure 4.49: Thorax of *Cricotopus* (*C.*) sp. 3

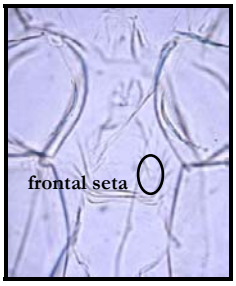


Figure 4.50: Prefrons of *Cricotopus* (*C.*) sp. 3 with frontal seta indicated by circle

2'. Thoracic horns present (Fig. 4.51); frontal setae absent (Fig. 4.52) .....
..... ***Cricotopus* (*C.*) sp. 6**

Figure 4.49: Thoracic horn of *Cricotopus* (*C.*) sp. 3

Figure 4.52: Prefrons and frontal apotome of *Cricotopus* (*C.*) sp. 6

3(1'). Thorax smooth (Fig. 3.53); Dc_2 as close to Dc_3 as Dc_1 (Fig. 3.54) ***Cricotopus* (*I.*) sp. 8**

Figure 4.53: Thorax of *Cricotopus* (*I.*) sp. 8

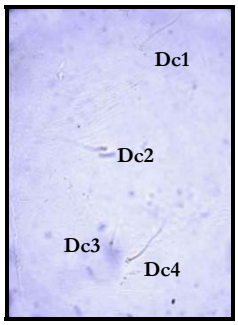


Figure 4.54: Dorsocentral (Dc) setae of *Cricotopus* (*I.*) sp. 8

3'. Thorax rugulose to granulose (Fig. 4.55); Dc_2 closer to Dc_1 than Dc_3 (Fig. 4.55) **4**

Figure 4.55: Thorax of *Cricotopus* (*I.*) sp. 4

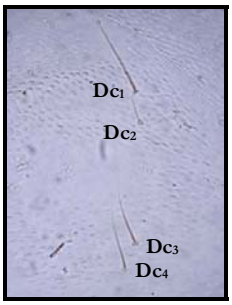


Figure 4.56: Dorsocentral (Dc) setae of *Cricotopus* (*I.*) sp. 1

4(3'). Thoracic horn slender and elongate (>200 μm) (Figs. 4.57 & 4.58); Dc_2 very weak compared to other Dc setae (Fig. 4.59) **5**

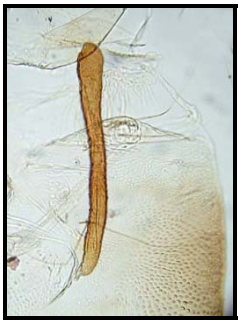


Figure 4.57: Thoracic horn of *Cricotopus* (*I.*) sp. 5

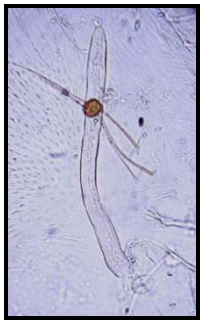


Figure 4.58: Thoracic horn of *Cricotopus* (*I.*) sp. 1

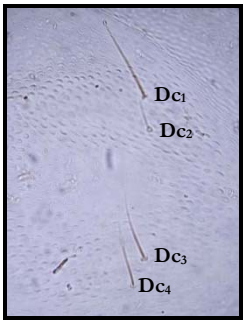


Figure 4.59: Dorsocentral (Dc) setae of *Cricotopus* (*I.*) sp. 1

4'. Thoracic horn short (<200 μm) (Figs. 4.60, 4.61, & 4.62); Dc_2 usually not the smallest Dc seta (Fig. 4.63) **6**

Figure 4.60: Thoracic horn of *Cricotopus* (*I.*) sp. 7

Figure 4.61: Thoracic horn of *Cricotopus* (*I.*) sp. 2

Figure 4.62: Thoracic horn of *Cricotopus* (*I.*) sp. 4

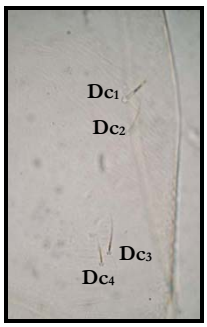


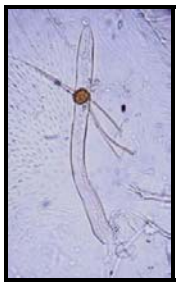
Figure 4.63: Dorsocentral (Dc) setae of *Cricotopus* (*I.*) sp. 4

5(4). Thoracic horn dark brown and covered with small spines (Fig. 4.64) ..... ***Cricotopus* (*I.*) sp. 5**

Figure 4.64: Thoracic horn of *Cricotopus* (*I.*) sp. 5

5'. Thoracic horn clear (sometimes light brown) and usually lacking spines (Figs. 4.65 & 4.66) ..... ***Cricotopus* (*I.*) sp. 1**

Figure 4.65: Thoracic horn of *Cricotopus* (*I.*) sp. 1



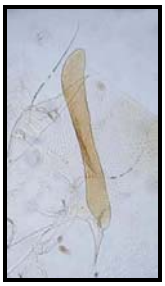


Figure 4.66: Thoracic horn of *Cricotopus* (*I.*) sp. 1

6(4'). Thoracic horn covered with small spines (Fig. 4.67); PSB on II granulose (Fig. 4.68); anterior fields of shagreen separated from posterior fields on tergites III-VI (Fig. 4.69) ..... ***Cricotopus* (*I.*) sp. 2**

Figure 4.67: Thoracic horn of *Cricotopus* (*I.*) sp. 2

Figure 4.68: PSB on segment II of *Cricotopus* (*I.*) sp. 2

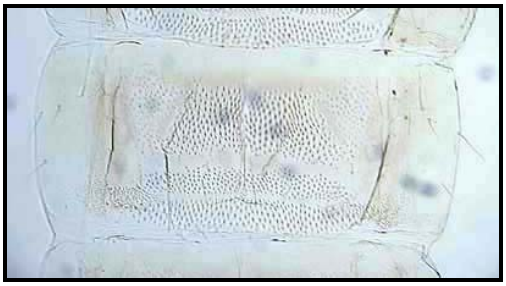


Figure 4.69: Tergal shagreen of *Cricotopus* (*I.*) sp. 2

6'. Thoracic horn bare (Fig. 4.70); PSB on II absent or not granulose (Fig. 4.71); anterior fields of shagreen not or only weakly separated from posterior fields on tergites III-VI (Figs. 4.72) **7**

Figure 4.70: Thoracic horn of *Cricotopus* (*I.*) sp. 7

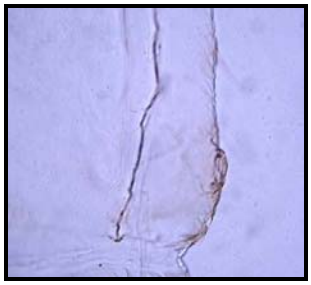


Figure 4.71: PSB on segment II of *Cricotopus* (*I.*) sp. 7

Figure 4.72: Tergal shagreen of *Cricotopus* (*I.*) sp. 4

7(6'). Thoracic horn elongate (Fig. 4.73); PSB present on II (Fig. 4.74); shagreen on tergites II-VI weakly divided into anterior and posterior patches (Fig. 4.75) ..... ***Cricotopus* (*I.*) sp. 7**

Figure 4.73: Thoracic horn of *Cricotopus* (*I.*) sp. 7

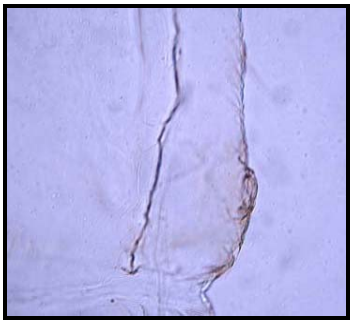


Figure 4.74: PSB on segment II of *Cricotopus* (*I.*) sp. 7

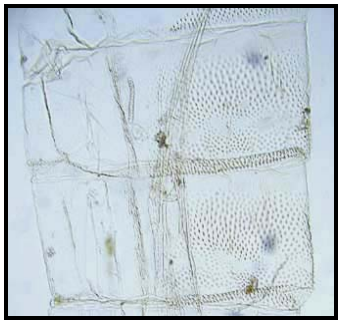


Figure 4.75: Tergal shagreen of *Cricotopus* (*I.*) sp. 7

7'. Thoracic horn very short (Fig. 4.76); PSB absent on II; shagreen on tergites II-VI not divided (Fig. 4.77) ..... ***Cricotopus* (*I.*) sp. 4**

Figure 4.76: Thoracic horn of *Cricotopus* (*I.*) sp. 4

Figure 4.77: Tergal shagreen of *Cricotopus* (*I.*) sp. 4

NOTES ON SPECIES

***Cricotopus* (*I.*) sp. 1:** There is large variability in the size of the frontal setae in this species. In addition the size and color of the thoracic horn is variable. Some thoracic horns are clear or hyaline while others are light brown. Some of the light brown thoracic horns also possess weak spines as in ***Cricotopus* (*I.*) sp. 5**. In some specimens the thoracic horn is shorter than described by Hirvenoja (1973).

***Cricotopus* (*I.*) sp. 4:** This species is represented by a single specimen and it is not clear if the thoracic horn in this specimen is malformed.

***Cricotopus* (*I.*) sp. 5:** This may be a larger, darker version of ***Cricotopus* (*I.*) sp. 1**.

***Cricotopus* (*I.*) sp. 7:** One specimen from Achit Nuur may be a different species – shagreen is different and thoracic horn longer than in other taxa.

***Cricotopus* (*I.*) sp. 8:** This taxon is represented by a single, badly damaged specimen where many characteristics are not discernable. More specimens should be examined to determine the validity of this taxon.

ADDITIONAL REFERENCES

Hirvenoja (1973)
Simpson *et al.* (1983) – an English translation of the keys from Hirvenoja (1973)

LIMNOPHYES

NOTES ON SPECIES

Only one species detected.

ADDITIONAL REFERENCES

Sæther (1990)

NANOCLADIUS

NOTES ON SPECIES

Only one species detected.

ADDITIONAL REFERENCES

Sæther (1977)

ORTHOCLADIUS

KEY TO *ORTHOCLADIUS* SPECIES

1. Tergites III-VII with paired median spine patches (Fig. 4.78); thoracic horn oval and robust (Fig. 4.79) **(subgenus *Pogonocladius*)** ..... ***Orthocladius* (*P.*) sp. 1**

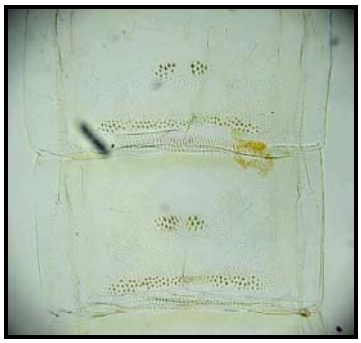


Figure 4.78: Tergal shagreen of *Orthocladius* (*P.*) sp. 1

Figure 4.79: Thoracic horn of *Orthocladius* (*P.*) sp. 1

1'. Tergites III-VII without paired median spine patches (Fig. 4.80); thoracic horn long and slender (Fig. 4.81) **(subgenus *Orthocladius*)**..... ***Orthocladius* (*O.*) sp. 2**

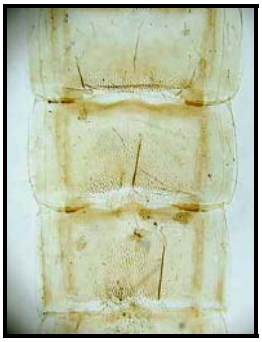


Figure 4.80: Tergal shagreen of *Orthocladius* (*O.*) sp. 2

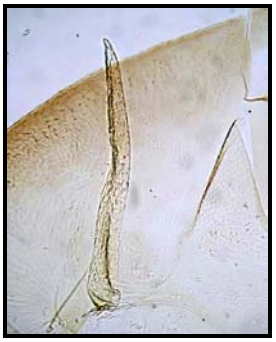


Figure 4.81: Thoracic horn of *Orthocladius* (*O.*) sp. 2

ADDITIONAL REFERENCES

Soponis (1977)

PSECTROCLADIUS

KEY TO *PSECTROCLADIUS* SPECIES

1. Anal lobe with 3 small anal macrosetae – 1 anterior and 2 posteromedian (Fig. 4.82) **(subgenus *Allopsectrocladius*)** ..... ***Psectrocladius* (*A.*) sp. 2**

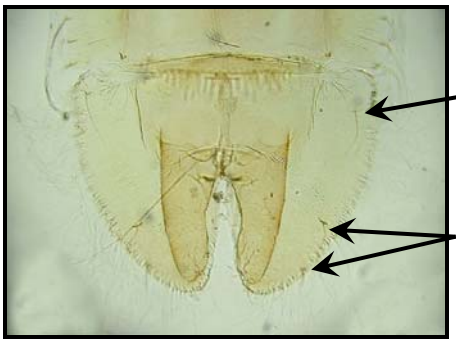


Figure 4.82: Anal lobe of *Psectrocladius* (*A.*) sp. 2

1'. Anal lobe with 3-8 strong anal macrosetae located posteriorly (Fig. 4.83) **(subgenus *Psectrocladius*)** **2**

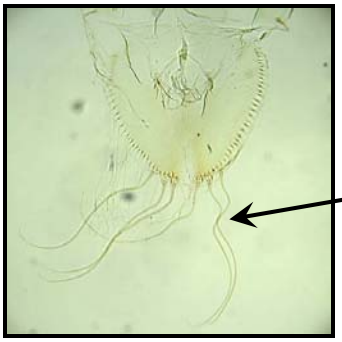


Figure 4.83: Anal lobe of *Psectrocladius* (*P.*) sp. 3

2(1'). Anal lobe with 5-8 anal macrosetae (Fig. 4.84) ..... ***Psectrocladius* (*P.*) sp. 1**

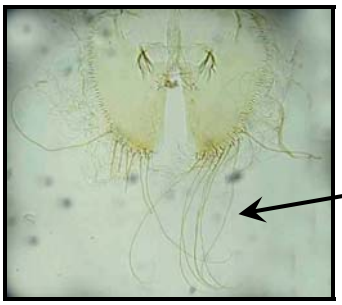


Figure 4.84: Anal lobe of *Psectrocladius* (*P.*) sp. 1

2'. Anal lobe with 3 anal macrosetae (Fig. 4.85) **3**

Figure 4.85: Anal lobe of *Psectrocladius* (*P.*) sp. 3

3(2'). Single patches of median spines present on tergites IV-VI (Fig. 4.86); thoracic horn pointed at tip (Fig. 4.87)..... ***Psectrocladius* (*P.*) sp. 3**

Figure 4.86: Abdominal tergites of *Psectrocladius* (*P.*) sp. 3

Figure 4.87: Thoracic horn of *Psectrocladius* (*P.*) sp. 3

3'. Paired patches of median spines present on tergites IV-VI (Fig. 4.88); thoracic horn large, and apically blunt (Fig. 4.89) ..... ***Psectrocladius* (*P.*) sp. 4**

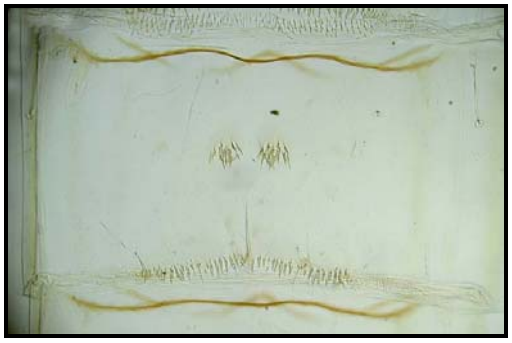


Figure 4.88: Abdominal tergite of *Psectrocladius* (*P.*) sp. 4

Figure 4.89: Thoracic horn of *Psectrocladius* (*P.*) sp. 4

NOTES ON SPECIES

***Psectrocladius* (*P.*) sp. 1:** There is variation in the number of anal macrosetae present. Many specimens posses only 5 anal macrosetae while another group possess 7-8 anal macrosetae. These possibly represent two different taxa.

PSEUDOSMITTIA

NOTES ON SPECIES

Only one species detected.

SYNORTHOCLADIUS

NOTES ON SPECIES

Only one species detected.

CHAPTER 5

CHIRONOMINI:
KEYS TO GENERA AND SPECIES

CHIRONOMINI

DIAGNOSIS

EXUVIA: Small to very large pupae. Color variable from clear to dark brown.

CEPHALOTHORAX: Thorax smooth, rugose, or granulose. Frontal setae present or rarely absent, usually small and hair-like. Cephalic tubercles usually present bearing frontal setae apically or subapically. Size and shapes of cephalic tubercles variable ranging from low mounds to large forked processes. Frontal setae sometimes arising directly from the frontal apotome. Frontal apotome sometimes also possessing frontal warts. Thoracic horn present and consisting of two to many branches or filaments. Plastron plate, aeropyle, and horn sac absent. Thorax with (0)2-3 precorneal setae and 4-(5) dorsocentral setae. Thoracic setae variable in size and shape ranging from simple and pointed to taeniate. Wing sheaths never with a row of pearls at tip and usually without a nase.

ABDOMEN: Tergite I with without patches of fine shagreen. Tergal shagreen variable often with anterior and posterior spine bands. Some taxa possess shagreen covering much of the tergite (variously shaped and possessing gaps) and some taxa possess distinct spine patches or spinose processes. Row of recurved hooks usually present posteriorly on tergite II and sometime medially divided. Anterior sternites sometimes with rows of long needle-like spines. Some taxa with tubercles that are often spinose on sternite I. Anteriorly directed spines on conjunctives absent or present on III/IV and IV/V and sometimes on V/VI and VI/VIII. Pedes spurii A usually present on segment IV (sometimes also on V and VI). Pedes spurii B often present on segment II and on segment I. Apophyses usually indistinct. Caudolateral margin of segment VIII usually with a spur or comb. **Segment IX:** Anal lobe usually well developed with a complete fringe of taeniate setae. Fringe of setae sometimes reduced. Anal macrosetae lacking. Male genital sac length usually reaching beyond tip of anal lobes.

SUBFAMILY COMMENTS

The tribe Chironomini can be separated from all other chironomids (with the exception of the Pseudochironomini, which is not included in this guide) by the possession two or more branches in the thoracic horn. This tribe can also be separated from other subfamilies and tribes by the possession of an anal lobe setal fringe coupled with the lack of apical anal macrosetae.

KEY TO GENERA OF CHIRONOMINI PUPAE

1. Row of hooklets on posterior margin of tergite II distinctly interrupted (Fig. 5.1) or less commonly absent with only spines present (Fig. 5.2) **2**

Figure 5.1: Recurved hook row on the posterior margin of tergite II in *Cladopelma* sp.

Figure 5.2: Spine row on the posterior margin of tergite II in *Cryptotendipes* sp.

1'. Row of hooklets on posterior margin of tergite II always present and not interrupted or only interrupted by a few missing hooklets (Figs. 5.3, 5.4, & 5.5) **4**

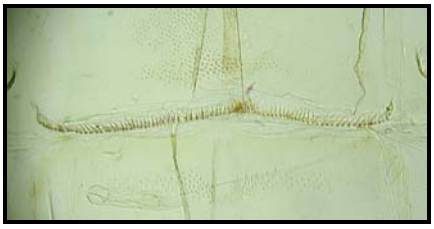


Figure 5.3: Recurved hook row on the posterior margin of tergite II in *Stictochironomus* sp.

Figure 5.4: Recurved hook row on the posterior margin of tergite II in *Dicrotendipes* sp. 1

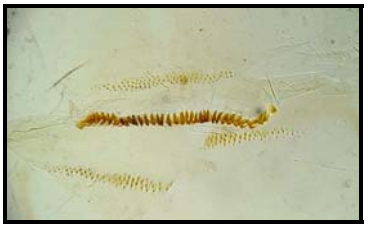


Figure 5.5: Recurved hook row on the posterior margin of tergite II in *Endochironomus* sp.

2(1). Thoracic horn very long, more than ¼ length of exuvia (Fig. 5.6)..... ***Cryptotendipes***

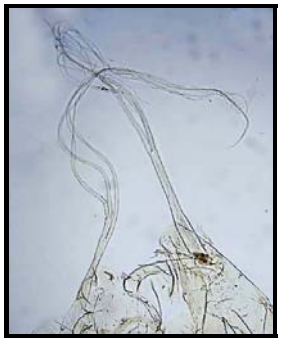


Figure 5.6: Thoracic horns of *Cryptotendipes* sp.

2'. Thoracic horn not as long as above and consisting of fine filaments (Figs. 5.7, 5.8, & 5.9) **2**

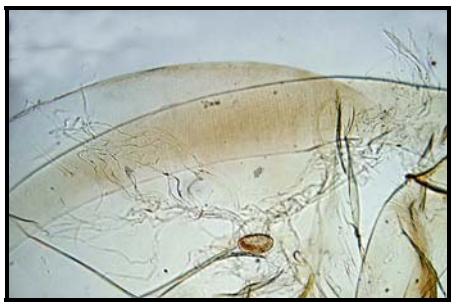


Figure 5.7: Thoracic horn of *Endochironomus* sp.

Figure 5.8: Thoracic horn of *Glyptotendipes* sp. 1

Figure 5.9: Thoracic horn of *Polypedilum* sp. 1

3'. Caudolateral margin of segment VIII with a spine (Fig. 5.10); anal segment without a paired posteromedian projection (Fig. 5.11) ..... ***Cladopelma***

Figure 5.10: Anal spur on caudolateral margin of segment VIII in *Cladopelma* sp.

Figure 5.11: Anal lobes of *Cladopelma* sp.

3'. Caudolateral margin of segment VIII lacking a spine (Fig. 5.12); anal segment with paired posteromedian projection (Fig 5.13) ..... ***Cryptochironomus***

Figure 5.12: Caudolateral margin of segment VIII in *Cryptochironomus* sp. 3

Figure 5.13: Anal lobes of *Cryptochironomus* sp. 3

4(1'). Caudolateral margin of segment VIII with a spine or group of spines (Figs. 5.14, 5.15, 5.16, & 5.17).....**5**

Figure 5.14: Anal comb of *Polypedilum* sp. 1

Figure 5.15: Anal comb of *Chironomus* sp. 2

Figure 5.16: Anal spur of *Dicrotendipes* sp. 1

Figure 5.17: Anal comb of *Endochironomus* sp.

4'. Caudolateral margin of segment VIII lacking a spine or group of spines (Fig. 5.18) **16**

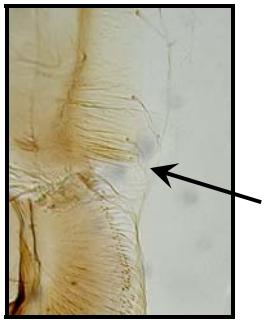


Figure 5.18: Caudolateral margin of segment VII in *Glyptotendipes* sp. 3

5(4). Cephalic tubercles present (Figs. 5.19, 5.20, & 5.21) **9**

Figure 5.19:
Frontal apotome of *Parachironomus* sp. 1

Figure 5.20:
Frontal apotome of *Chironomus* sp. 2

Figure 5.21:
Frontal apotome of *Glyptotendipes* sp. 1

5'. Cephalic tubercles absent (Figs. 5.22, 5.23, & 5.24) **15**

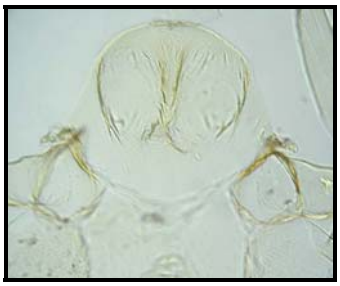


Figure 5.22:
Frontal apotome of *Parachironomus* sp. 2

Figure 5.23:
Frontal apotome of *Polypedilum* sp. 2

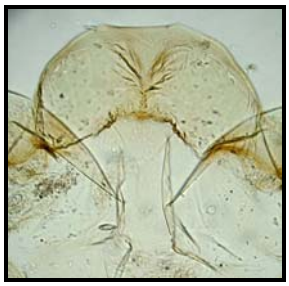


Figure 5.24:
Frontal apotome of *Endochironomus* sp.

6(5). Tergites II-VI or III-VI with unpaired spiniferous processes (Figs. 5.25, 5.26, & 5.27)..... ..... ***Glyptotendipes***

Figure 5.25:
Median spiniferous process on tergite VI in *Glyptotendipes* sp. 2

Figure 5.26:
Median spiniferous process on tergite VI in *Glyptotendipes* sp. 4

Figure 5.27:
Median spiniferous process on tergite VI in *Glyptotendipes* sp. 1

6'. Tergites without such spines or processes (Fig. 5.28).....**7**

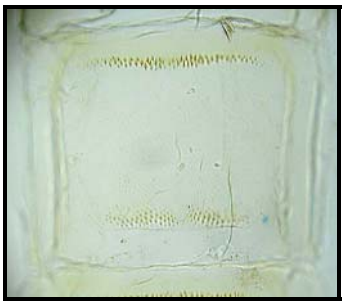


Figure 5.28:
Tergite VI in *Endochironomus* sp.

7(6'). Long needle-like spines on sternite II (Fig. 5.29) and spines on caudolateral margin of segment VIII strong (Figs. 5.30 & 5.31) ..... ***Dicrotendipes* (in part)**

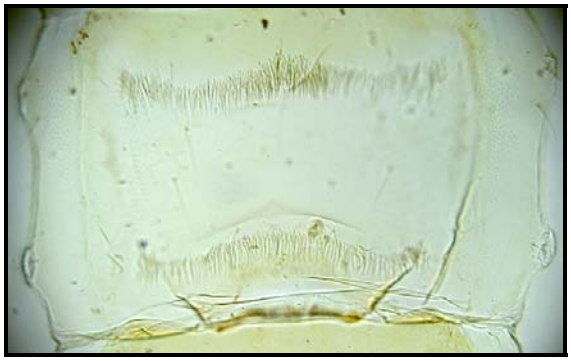


Figure 5.29: Sternite II of *Dicrotendipes* sp. 2

Figure 5.30: Anal spur of *Dicrotendipes* sp. 1

Figure 5.31: Anal spurs of *Dicrotendipes* sp. 2

7'. Long needle-like spines on sternite II absent; if long needle-like spines on sternite II are present then spines caudolateral margin of segment VIII are weak or absent **8**

8(7'). Spines on caudolateral margin of segment VIII consisting of single or double usually sinuate spine (Figs. 5.32 & 5.33) ..... ***Dicrotendipes* (in part)**

Figure 5.32: Anal spur of *Dicrotendipes* sp. 1

Figure 5.33: Anal spurs of *Dicrotendipes* sp. 2

8'. Spines on caudolateral margin of segment VIII consisting of comb of weak to strong spines or a compound spur (Figs. 5.34, 5.35, & 5.36) **9**

Figure 5.34: Anal spurs of *Chironomus* sp. 3

Figure 5.35: Anal comb of *Glyptotendipes* sp. 1

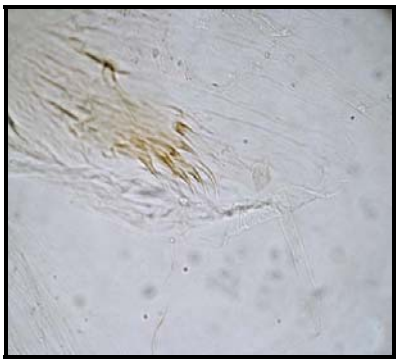


Figure 5.36: Anal comb of *Parachironomus* sp. 2

9(8'). Tergite VI with posterior spines stronger than on other tergites and often borne on a flap or lobe (Fig. 5.37) ..... ***Parachironomus* (in part)**

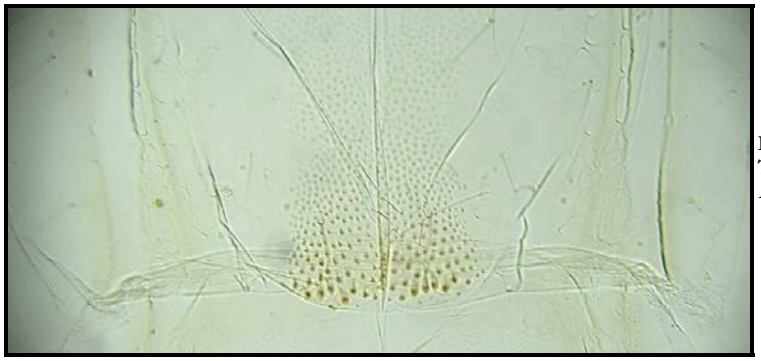
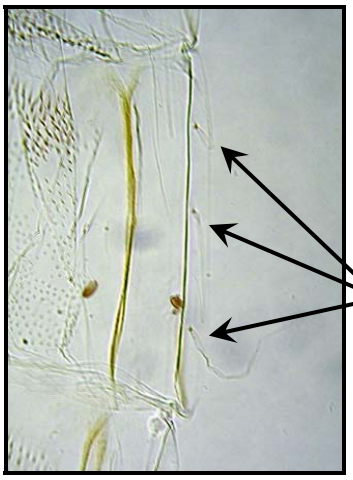


Figure 5.37: Tergite VI of *Parachironomus* sp. 2

9'. Posterior spines on tergite VI absent, or not strongest, or borne on a flap..... **10**

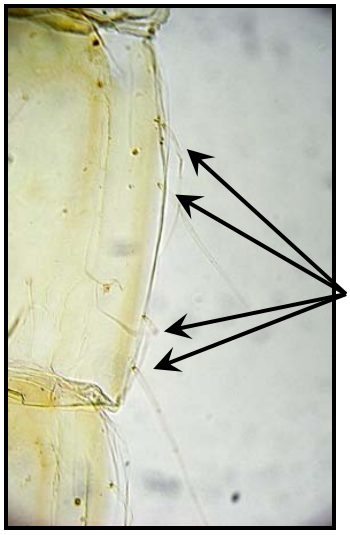
10(9'). Segment V with 1-3 taeniate lateral setae (Fig. 5.38).....**11**

Figure 5.38: Lateral edge of segment V of *Polypedilum* sp. 1



10'. Segment V with 4-5 taeniate lateral setae (Fig. 5.39)..... **13**

Figure 5.39: Lateral edge of segment V of *Dicrotendipes* sp. 2



11(10). Segment VI with 4 taeniate L-setae (Fig. 5.40); spines on caudolateral margin of segment VIII fused at base and appearing as a compound spur (Figs. 5.41 & 5.42); frontal setae present and cephalic tubercles usually well developed (Fig. 5.43) ..... ***Chironomus* (in part)**

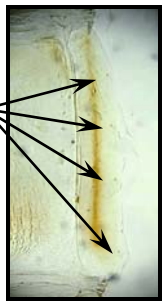


Figure 5.40: Lateral edge of segment VI of *Chironomus* sp. 3

Figure 5.41: Anal spurs of *Chironomus* sp. 3

Figure 5.42: Anal spurs of *Chironomus* sp. 1

Figure 5.43: Frontal apotome of *Chironomus* sp. 2

11'. Segment VI with 3 taeniate L-setae (Fig. 5.44); spines on caudolateral margin of segment VIII not fused at bases and appearing as a compound spur (Figs. 5.45 & 5.46); cephalic tubercles present or absent, sometimes well developed..... **12**

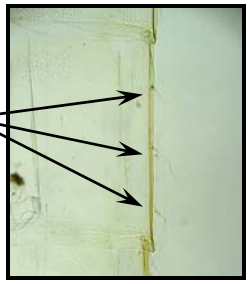


Figure 5.44: Lateral edge of segment VI of *Stictochironomus* sp.

Figure 5.45: Anal comb of *Polypedilum* sp. 1

Figure 5.46: Anal comb of *Stictochironomus* sp.

12(11'). Fringe of setae on anal lobes uniserial (Fig. 5.47) ..... ***Polypedilum* (in part)**

Figure 5.47: Anal lobe of *Polypedilum* sp. 1

12'. Fringe of setae on anal lobes at least partly multiserial (Fig. 5.48)..... ***Stictochironomus***

Figure 5.48: Anal lobe of *Stictochironomus* sp.

13(10'). Caudolateral armature on segment VIII consisting of a single or double spur (Figs. 5.49 & 5.50) ..... ***Dicrotendipes* (in part)**

Figure 5.49: Anal spur of *Dicrotendipes* sp. 1

Figure 5.50: Anal spurs of *Dicrotendipes* sp. 2

13'. Caudolateral armature on segment VIII consisting of three or more short spines (Figs. 5.51, 5.52, & 5.53) **14**

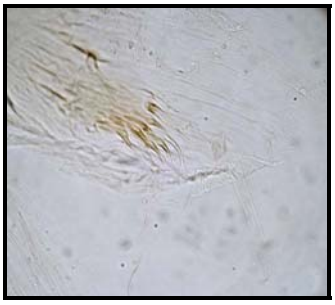


Figure 5.51: Anal comb of *Parachironomus* sp. 2

Figure 5.52: Anal spurs of *Chironomus* sp. 1

Figure 5.53: Anal spurs of *Chironomus* sp. 3

14(13'). Spines on caudolateral margin of segment VIII consisting of a compound spur (Figs 5.54 & 5.55) ..... ***Chironomus* (in part)**

Figure 5.54: Anal spurs of *Chironomus* sp. 1

Figure 5.55: Anal spurs of *Chironomus* sp. 3

14'. Spines on caudolateral margin of segment VIII not as above (Fig. 5.56)..... ..... ***Parachironomus* (in part)**

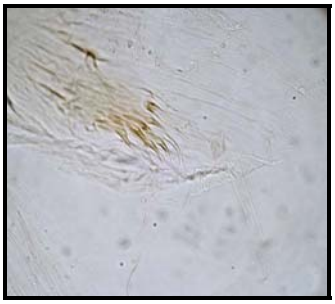


Figure 5.56: Anal spurs of *Parachironomus* sp. 2

15(5'). Segment V with no taeniate L-setae (Fig. 5.57) ..... ***Endochironomus***

Figure 5.57:
Lateral margin of segment in V of *Endochironomus* sp.

15'. Segment V with 3-4 taeniate L-setae (Fig. 5.58) ..... ***Polypedilum* (in part)**

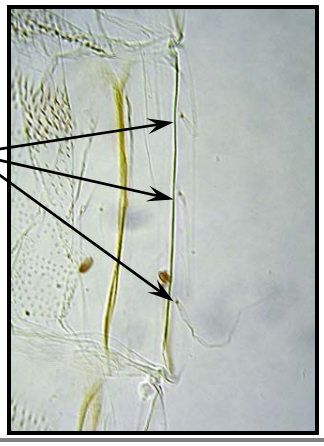


Figure 5.58:
Lateral margin of segment in V of *Polypedilum* sp. 1

16(4'). Cephalic tubercles present (Figs. 5.59 & 5.60) **17**

Figure 5.59:
Frontal apotome of *Parachironomus* sp. 1

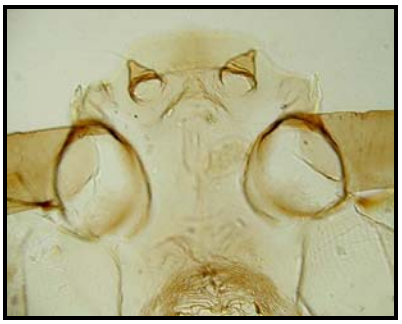


Figure 5.60:
Frontal apotome of *Glyptotendipes* sp. 3

16'. Cephalic tubercles absent (Fig. 5.61) ..... ***Parachironomus* (in part)**

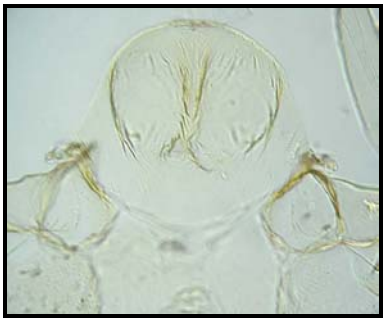


Figure 5.61:
Frontal apotome of *Parachironomus* sp. 2

17(16). Tergites II-VI with unpaired spiniferous processes (Fig. 5.62, 5.63, & 5.64) .... ***Glyptotendipes*** **(in part)**

Figure 5.62: Median spiniferous process on tergite VI in *Glyptotendipes* sp. 2

Figure 5.63: Median spiniferous process on tergite VI in *Glyptotendipes* sp. 4

Figure 5.64: Median spiniferous process on tergite VI in *Glyptotendipes* sp. 1

17'. Tergites without such processes ..... ***Parachironomus*** **(in part)**

CHIRONOMUS

KEY TO *CHIRONOMUS* SPECIES

1. Anal spur with spines drawn out into a point (Fig. 5.65)..... ***Chironomus* sp. 3**

Figure 5.65:
Anal spurs of
***Chironomus* sp. 3**

1'. Anal spur not drawn out into a point (Figs. 5.66 & 5.67).....**2**

Figure 5.66:
Anal spurs of
***Chironomus* sp. 1**

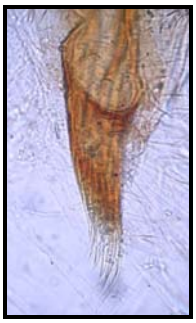


Figure 5.67:
Anal spurs of
***Chironomus* sp. 2**

2(1'). Anal spur weak, consisting of only several short spurs (Fig. 5.68)..... ***Chironomus* sp. 1**

Figure 5.68:
Anal spurs of
***Chironomus* sp. 1**

2'. Anal spur strong, consisting of long spines (Fig. 5.69) ..... ***Chironomus* sp. 2**

Figure 5.69:
Anal spurs of
***Chironomus* sp. 2**

CLADOPELMA

NOTES ON SPECIES

Only one species detected.

CRYPTOCHIRONOMUS

KEY TO *CRYPTOCHIRONOMUS* SPECIES

1. Abdomen without reticulation (Fig. 5.70) ..... ***Cryptochironomus* sp. 1**

Figure 5.70: Tergite of *Cryptochironomus* sp. 1

1'. Abdomen with reticulation or wrinkles (Figs. 5.71 & 5.72) **2**

Figure 5.71: Tergite of *Cryptochironomus* sp. 3

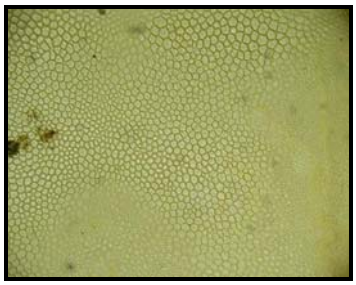


Figure 5.72: Tergite of *Cryptochironomus* sp. 2

2(1'). Abdomen with strong reticulation (Fig. 5.73) ..... ***Cryptochironomus* sp. 2**

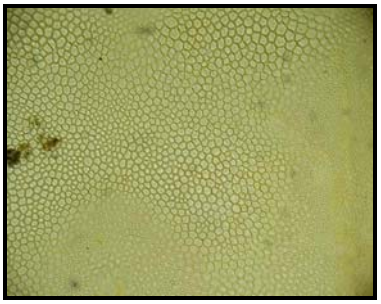


Figure 5.73: Tergite of *Cryptochironomus* sp. 2

2'. Abdomen wrinkled (Fig. 5.74) ..... ***Cryptochironomus* sp. 3**

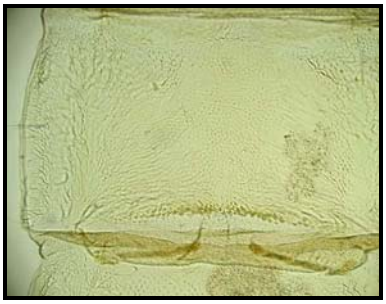


Figure 5.74: Tergite of *Cryptochironomus* sp. 3

NOTES ON SPECIES

All three *Cryptochironomus* taxa possess simple, very elongate cephalic tubercles without fused bases.

ADDITIONAL REFERENCES

Curry (1958)
Mason (1986)

CRYPTOTENDIPES

NOTES ON SPECIES

Only one species detected. Hook rows absent in the species from these lakes.

DICROTENDIPES

KEY TO *DICROTENDIPES* SPECIES

1. Sternal spine patch on I-III strong (Fig. 5.75); tergal shagreen weakest anteriorly (Fig. 5.76); 5 taeniate lateral setae on VIII ..... ***Dicrotendipes* sp. 1**

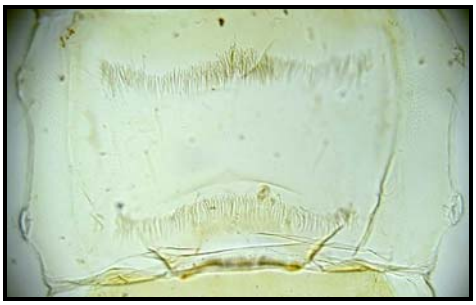


Figure 5.75: Sternite II of *Dicrotendipes* sp. 1

Figure 5.76: Tergal shagreen of *Dicrotendipes* sp. 1

1'. Sternal spine patch on I-III weak (Fig. 5.77); tergal shagreen weakest medially (Fig. 5.78); 4 taeniate lateral setae on VIII ..... ***Dicrotendipes* sp. 2**

Figure 5.77: Sternite II of *Dicrotendipes* sp. 2

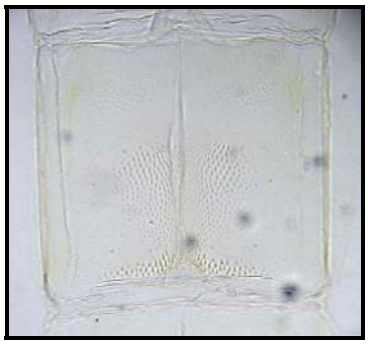


Figure 5.78: Tergal shagreen of *Dicrotendipes* sp. 2

ADDITIONAL REFERENCES

Epler (1987)
Epler (1988)

ENDOCHIRONOMUS

NOTES ON SPECIES

Only one species detected.

ADDITIONAL REFERENCES

Grodhaus (1987)

GLYPTOTENDIPES

KEY TO *GLYPTOTENDIPES* SPECIES

1. Unpaired median spiniferous process on tergite II absent (Fig. 5.79) ..... ***Glyptotendipes* sp. 4**

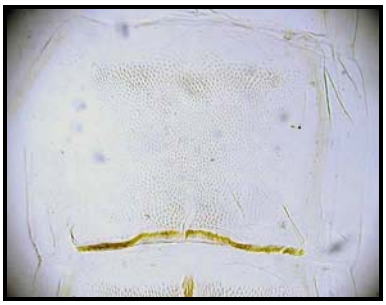


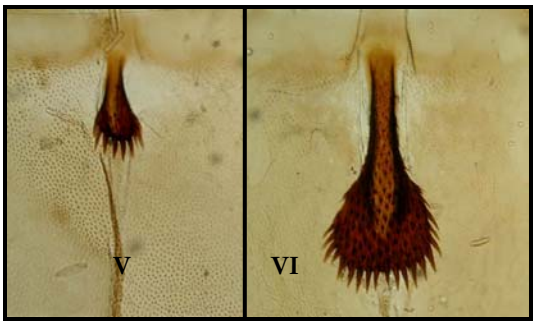
Figure 5.79: Tergite II of *Glyptotendipes* sp. 4

1'. Unpaired median spiniferous process on tergite II present (Fig. 5.80) **2**

Figure 5.80: Tergite II of *Glyptotendipes* sp. 3

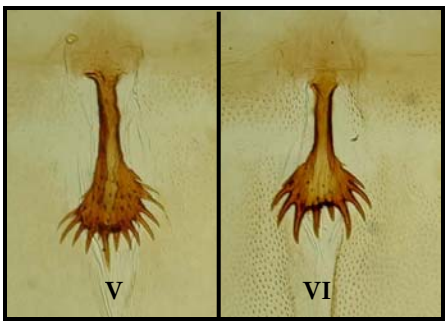
2(1'). Unpaired median spiniferous process on tergite VI distinctly larger than tergite V plate (Figs. 5.81); unpaired median spiniferous process dark brown..... ***Glyptotendipes* sp. 2**

Figure 5.81: Unpaired median spiniferous processes on tergites V and VI of *Glyptotendipes* sp. 2



2'. Unpaired median spiniferous process on tergite VI similar in size or only slightly larger than tergite V plate (Fig. 5.82); unpaired median spiniferous process golden brown **3**

Figure 5.82: Unpaired median spiniferous processes on tergites V and VI of *Glyptotendipes* sp. 1



3(2'). Unpaired median spiniferous process on VI much larger than unpaired median spiniferous process on II (Figs. 5.83 & 5.84); cephalic tubercles large (Fig. 5.85) .... ***Glyptotendipes* sp. 1**

Figure 5.83: Unpaired median spiniferous process on tergite II of *Glyptotendipes* sp. 1

Figure 5.84: Unpaired median spiniferous process on tergite VI of *Glyptotendipes* sp. 1

Figure 5.85: Frontal apotome of *Glyptotendipes* sp. 1

3'. Unpaired median spiniferous process on VI only slightly larger than unpaired median spiniferous process on II (Figs. 5.86 & 5.87); cephalic tubercles moderately developed (Fig. 5.88) ..... ***Glyptotendipes* sp. 3**

Figure 5.86: Unpaired median spiniferous process on tergite II of *Glyptotendipes* sp. 3

Figure 5.87: Unpaired median spiniferous process on tergite VI of *Glyptotendipes* sp. 3

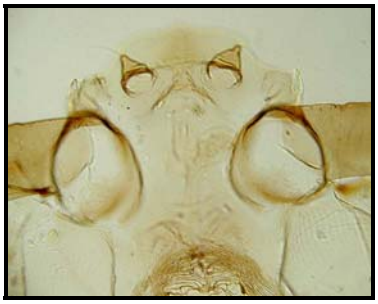


Figure 5.88: Frontal apotome of *Glyptotendipes* sp. 3

PARACHIRONOMUS

KEY TO *PARACHIRONOMUS* SPECIES

1. Long spines present on sternite II (Fig. 5.89); prealar tubercle bilobed (Fig. 5.90) ....***Parachironomus* sp. 1**

Figure 5.89: Sternite II of *Parachironomus* sp. 1

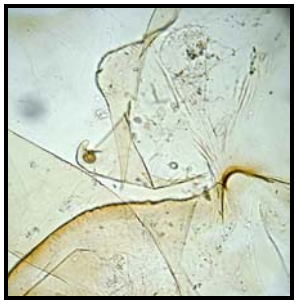


Figure 5.90: Wing sheath base and prealar tubercle of *Parachironomus* sp. 1

1'. Weak spines present on sternite II (Fig. 5.91); prealar tubercle not bilobed (Fig. 5.92) .... ***Parachironomus* sp. 2**

Figure 5.91: Sternite II of *Parachironomus* sp. 2

Figure 5.92: Wing sheath base and prealar tubercle of *Parachironomus* sp. 2

POLYPEDILUM

KEY TO *POLYPEDILUM* SPECIES

1. Anal spurs with several lateral spines (Fig. 5.93)..... ***Polypedilum* sp. 1**

Figure 5.93:
Anal spur of
***Polypedilum* sp. 1**

1'. Anal spurs with only 1-2 lateral spines (Fig. 5.94) ..... ***Polypedilum* sp. 2**

Figure 5.94:
Anal spur of
***Polypedilum* sp. 2**

ADDITIONAL REFERENCES

Maschwitz & Cook (2000)

STICTOCHIRONOMUS

NOTES ON SPECIES

Only one species detected.

CHAPTER 6

TANYTARSINI:
KEYS TO GENERA AND SPECIES

TANYTARSINI

DIAGNOSIS

EXUVIA: Small to medium sized pupae. Color variable from clear to dark brown.

CEPHALOTHORAX: Thorax smooth, rugose, or granulose. Frontal setae present or rarely absent, when present usually small and hair-like, but sometimes spine-like. Frontal setae often borne apically or subapically on cephalic tubercles or arising directly from the frontal apotome. Cephalic tubercles ranging from low mounds to large conical or finger-like projections. Frontal apotome usually without frontal warts. Thoracic horn usually present and simple sometimes covered in chaetae or spines. Plastron plate, aeropyle, and horn sac absent. Thorax with (0)2-3 precorneal setae and 4-(5) dorsocentral setae. Thoracic setae variable in size and shape ranging from simple and pointed to taeniate. Wing sheaths sometimes with a row of pearls at tip and usually with a nase.

ABDOMEN: Tergite I with or without patches of fine shagreen. Tergites and sternites II-VIII usually with shagreen, but sometimes absent. Tergites often with paired point or spine patches. Row of recurved hooks usually present posteriorly on tergite II. Conjunctives usually bare. Pedes spurii A usually present on segment IV (sometimes also on V and VI). Pedes spurii B often present on segment II. Apophyses usually indistinct. Caudolateral margin of segment VIII almost always with a spur or comb. **Segment IX:** Anal lobe usually well developed with a complete fringe of taeniate setae. Fringe of setae sometimes reduced. Anal macrosetae lacking. Male genital sac length usually reaching beyond tip of anal lobes.

SUBFAMILY COMMENTS

The tribe Tanytarsini can be separated from other tribes and subfamilies by the possession of a simple thoracic horn coupled with a fringe of anal lobe setae, no apical anal macrosetae, and usually the presence of an anal comb or spur on the caudolateral margin of segment VIII. Many Tanytarsini also possess a nase on the wing sheath and paired spines patches on several abdominal tergites.

KEY TO GENERA OF TANYTARSINI PUPAE

1. Tergite IV (and sometimes III and V) with long-needle-like spines (Figs. 6.1 & 6.2).....**2**

Figure 6.1: Tergal spines on segment IV of *Tanytarsus* sp. 2

Figure 6.2: Tergal spines on segment IV of *Paratanytarsus* sp. 4

1'. Tergites IV and V (and sometimes III and V) without long needle-like spines (Fig. 6.3) although short spines may be present (Fig. 5.4) or a few long spines (Fig. 6.5).....**3**

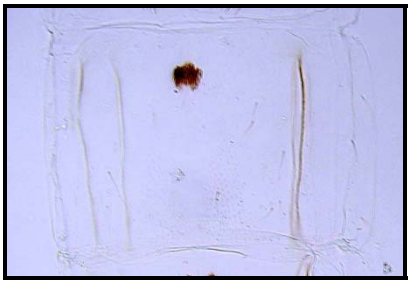


Figure 6.3: Tergal armature on segment IV of *Paratanytarsus* sp. 2

Figure 6.4: Tergal armature on segment IV of *Tanytarsus* sp. 1

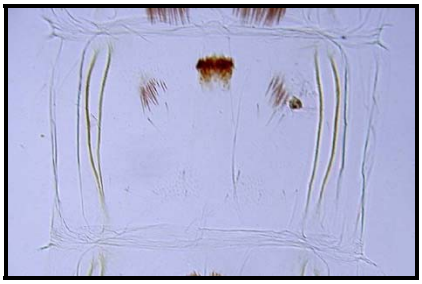


Figure 6.5: Tergal armature on segment IV of *Paratanytarsus* sp. 1

2(1). Tergite IV with 2 longitudinal rows of long needle-like spines and 1-2 anterior median patches of spines (Fig. 6.6); wing sheaths with or without pearl rows (Fig. 6.7)..... ..... ***Paratanytarsus* (in part)**

Figure 6.6: Tergal spines and median spines patches on segment IV of *Paratanytarsus* sp. 4

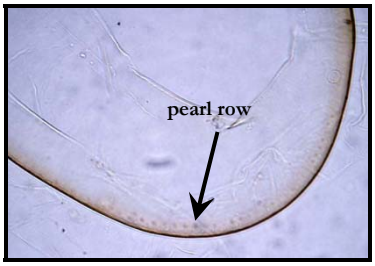


Figure 6.7: Wing sheath tip of *Paratanytarsus* sp. 4

2'. Tergite IV without anterior median patches of spines (Fig. 6.8) although longitudinal rows of needle-like spines may be present; wing sheaths without pearl rows (Fig. 6.9) .... ***Tanytarsus* (in part)**

Figure 6.8: Tergal spines on segment IV of *Tanytarsus* sp. 2

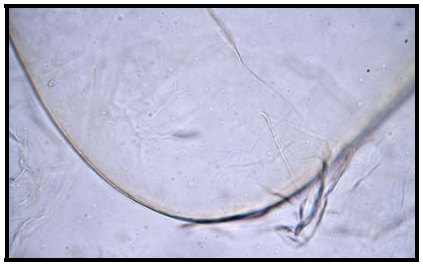


Figure 6.9: Wing sheath tip of *Tanytarsus* sp. 1

3(1'). Tergite IV with a single median group of short spines (Figs. 6.10 & 6.11).....**4**

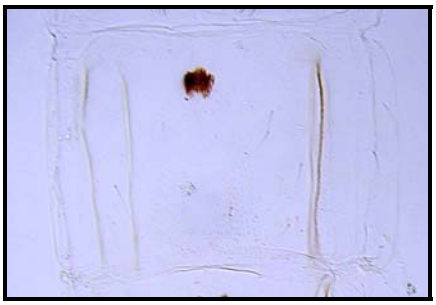


Figure 6.10: Median spine patch on tergite IV of *Tanytarsus* sp. 2

Figure 6.11: Median spine patch on tergite IV of Tanytarsini Genus 1 sp.

3'. Tergite IV with paired median patches of spines (Figs. 6.12 & 6.13) **5**

Figure 6.12: Median spine patches on tergite IV of *Micropsectra* sp.

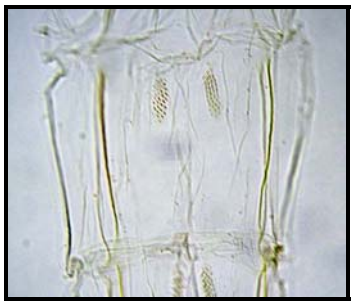


Figure 6.13: Median spine patches on tergite IV of *Cladotanytarsus* sp. 2

4(3). Tergite III with paired patches of long spines (Fig. 6.14); tergite IV with single median patch and tergite V with a single patch or paired median patches (Fig. 6.15); tergites VI-VII bare (Fig. 6.16) ..... ***Paratanytarsus* (in part)**

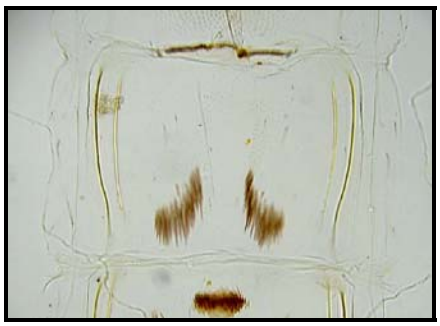


Figure 6.14: Tergite III of *Paratanytarsus* sp. 1

Figure 6.15: Tergites IV-V of *Paratanytarsus* sp. 1

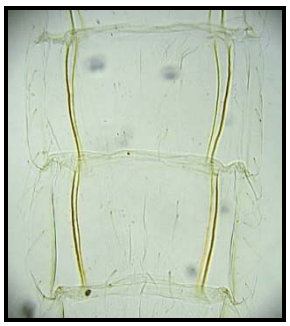


Figure 6.16: Tergites VI-VII of *Paratanytarsus* sp. 1

4'. Tergite III with paired patches of short spines (Fig. 6.17); single median paired patches present on tergites IV-VII (Fig. 6.18) ..... **Tanytarsini Genus 1**

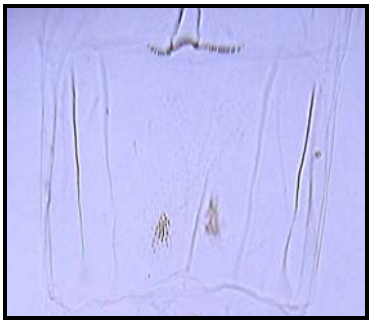


Figure 6.17: Tergite III of Tanytarsini Genus 1 sp.

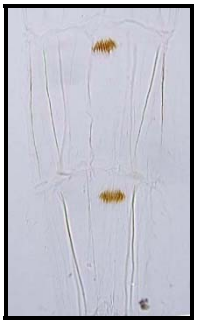


Figure 6.18: Tergites IV-V of Tanytarsini Genus 1 sp.

5(3'). Tergites V and VI with large oval groups of small spines (Fig. 6.19); fringe of setae on anal lobes limited to distal ends (Fig. 6.20) ..... ***Neozavrelia***

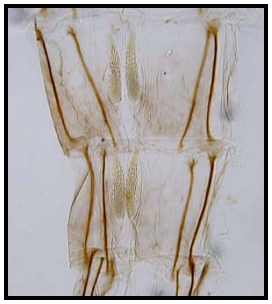


Figure 6.19: Tergites on segments V and VI of *Neozavrelia* sp.

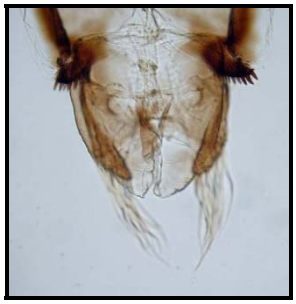


Figure 6.20: Anal lobes of *Neozavrelia* sp.

5'. Tergites V and/or VI without spine patches (Fig. 6.21) or smaller patches may be present (Fig. 6.22); anal lobes usually with a complete fringe of setae (Fig. 6.23) or at least with fringe setae on proximal edge (Fig. 6.24) **6**

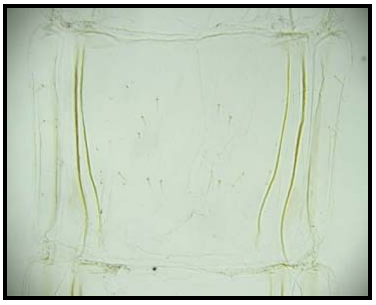


Figure 6.21: Tergite VI of *Micropsectra* sp.

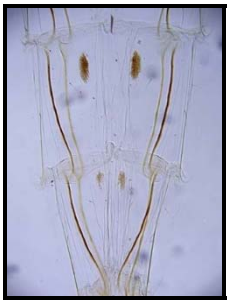


Figure 6.22: Tergites V and VI of *Tanytarsus* sp. 2

Figure 6.23: Anal lobes of *Micropsectra* sp.

Figure 6.24: Anal lobes of *Tanytarsus* sp. 2

6(5'). Each anal lobe with 1 dorsal seta (Fig. 6.25).....***Micropsectra* (in part)**

Figure 6.25: Anal lobe of *Micropsectra* sp.

6'. Each anal lobe with 2 dorsal setae (Fig. 6.26).....**7**

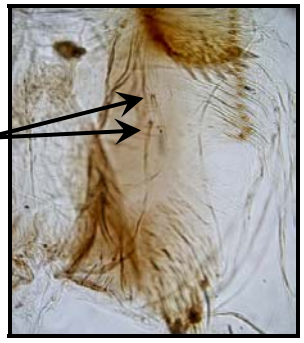


Figure 6.26: Anal lobe of *Tanytarsus* sp. 2

7(6'). Combs on caudolateral margin of segment VIII broad (Fig. 6.27); precorneal setae taeniate and inserted on a mound (Fig. 6.28) however, this mound is sometimes indistinct (Fig. 6.29) ..... ***Cladotanytarsus***

Figure 6.27: Anal comb of *Cladotanytarsus* sp. 1

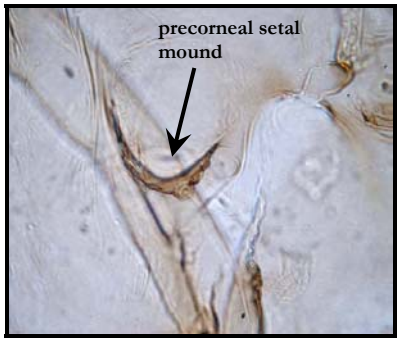


Figure 6.28: Bases of precorneal setae with mound of *Cladotanytarsus* sp. 1

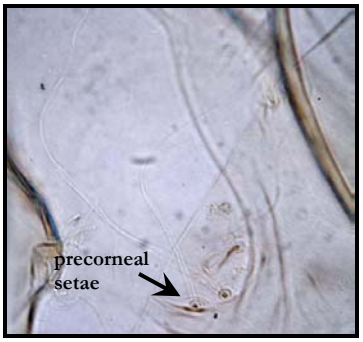


Figure 6.29: Precorneal setae of *Cladotanytarsus* sp. 2

7'. Combs on caudolateral margin of segment VIII usually less broad (Fig. 6.30); precorneal setae not taeniate or inserted on a mound (Fig. 6.31) ..... ***Tanytarsus* (in part)**

Figure 6.30: Anal comb of T*anytarsus* sp. 2

Figure 6.31: Precorneal setae of *Tanytarsus* sp. 1

CLADOTANYTARSUS

KEY TO *CLADOTANYTARSUS* SPECIES

1. Frontal apotome granulose (Fig. 6.32); thoracic horn long and tapering with a fringe of long chaetae (Fig. 6.33) ..... ***Cladotanytarsus* sp. 1**

Figure 6.32: Frontal apotome of *Cladotanytarsus* sp. 1

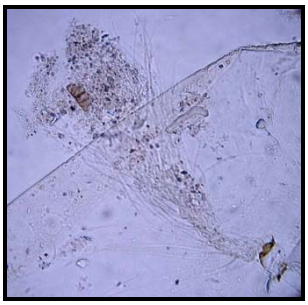


Figure 6.33: Thoracic horn of *Cladotanytarsus* sp. 1

1'. Frontal apotome smooth or slightly rugulose (Fig. 6.34); thoracic horn variable, but generally with fewer chaetae (Fig. 6.35) **2**

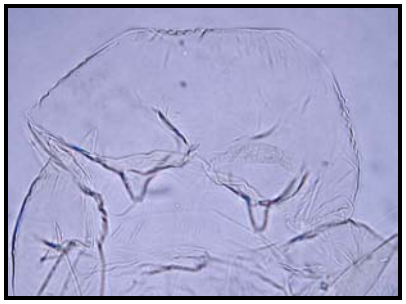


Figure 6.34: Frontal apotome of *Cladotanytarsus* sp. 2

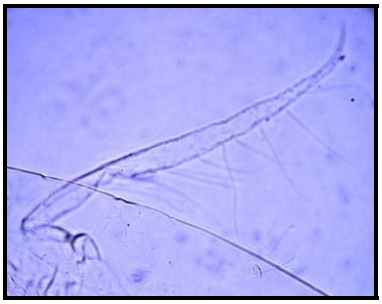


Figure 6.35: Thoracic horn of *Cladotanytarsus* sp. 2

2(1'). Thoracic horn with scattered long chaetae (Fig. 6.36); cephalic tubercles low cones (Figs. 6.37 & 6.38) ..... ***Cladotanytarsus* sp. 2**

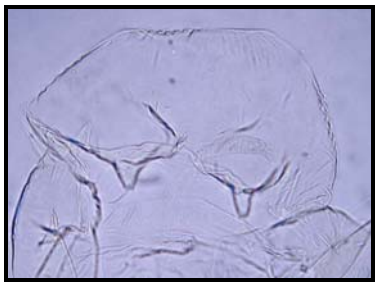


Figure 6.36: Frontal apotome of *Cladotanytarsus* sp. 2

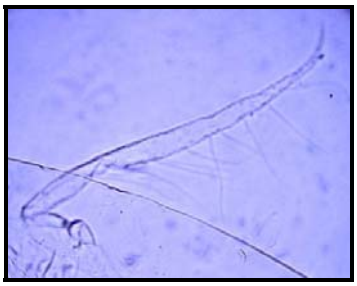


Figure 6.37: Thoracic horn of *Cladotanytarsus* sp. 2

Figure 6.38: Thoracic horn of *Cladotanytarsus* sp. 2

2'. Thoracic horn with no or only a few chaetae (Fig. 6.39); cephalic tubercles absent (Fig. 6.40) ..... ***Cladotanytarsus* sp. 3**

Figure 6.39: Thoracic horn of *Cladotanytarsus* sp. 3

Figure 6.40: Frontal apotome of *Cladotanytarsus* sp. 3

NOTES ON SPECIES

***Cladotanytarsus* sp. 2:** This is a variable taxon and there are potentially 2-3 species encompassed by this taxon.

ADDITIONAL REFERENCES

Bilyj & Davies (1989)

MICROPSECTRA

NOTES ON SPECIES

Only one species detected.

ADDITIONAL REFERENCES

Oliver & Dillon (1994)

NEOZAVRELIA

NOTES ON SPECIES

Only one species detected.

PARATANYTARSUS

KEY TO *PARATANYTARSUS* SPECIES

1. Paired anterior patches on tergites IV-VI (Fig. 6.41) ..... ***Paratanytarsus* sp. 4**

Figure 6.41: Tergites IV-V of *Paratanytarsus* sp. 4

1'. Paired anterior patches not on tergites IV-VI although they may be present and paired on other segments (Figs. 6.42 & 6.43) **2**

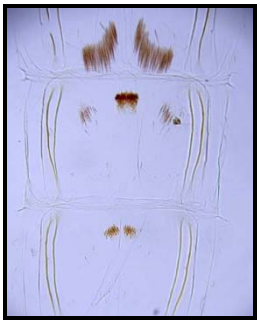


Figure 6.41: Tergites IV-V of *Paratanytarsus* sp. 1

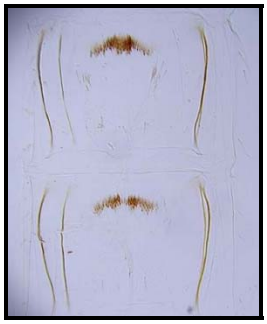


Figure 6.41: Tergites IV-V of *Paratanytarsus* sp. 3

2(1'). Anterior patches on tergite V wide and single although this patch may be weaker in the middle (Fig. 6.42) ..... ***Paratanytarsus* sp. 3**

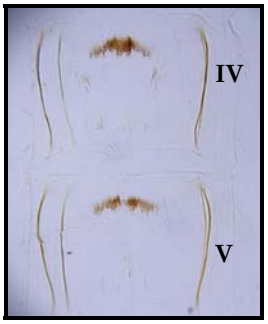


Figure 6.42: Tergites IV-V of *Paratanytarsus* sp. 3

2'. Anterior patches on tergite V double (Fig. 6.43) **3**

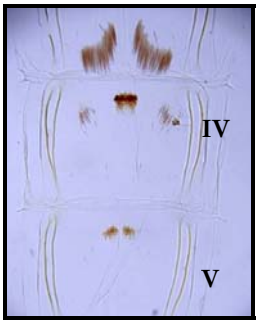


Figure 6.43: Tergites IV-V of *Paratanytarsus* sp. 1

3(2'). Conical prealar tubercle present (Fig. 6.44) ..... ***Paratanytarsus* sp. 1**

Figure 6.44: Wing base and prealar tubercle of *Paratanytarsus* sp. 1

3'. Conical prealar tubercle absent (Fig. 6.45) ..... ***Paratanytarsus* sp. 2**

Figure 6.45: Wing base and prealar tubercle of *Paratanytarsus* sp. 2

NOTES ON SPECIES

***Paratanytarsus* sp. 1:** Belongs to *inopertus* group.
***Paratanytarsus* sp. 2:** Belongs to *inopertus* group.
***Paratanytarsus* sp. 4:** Belongs to *penicillatus* group.

ADDITIONAL REFERENCES

Reiss & Säwedal (1981)

TANYTARSUS

KEY TO *TANYTARSUS* SPECIES

1. Tergites III-VI with longitudinal spine patches consisting of short spines (Fig. 6.46); anal lobe with complete fringe of setae (Fig. 6.47) ..... ***Tanytarsus* sp. 1**

Figure 6.46: Tergite IV of *Tanytarsus* sp. 1

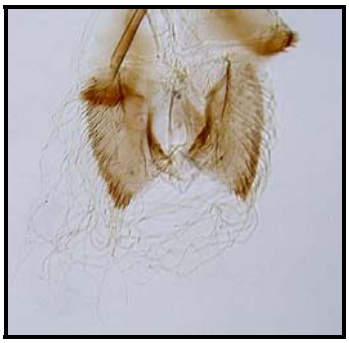


Figure 6.47: Anal lobe of *Tanytarsus* sp. 1

1'. Tergites III-IV with longitudinal spine patches consisting of long spines (Fig. 6.48); tergites V-VI with elongate oval anterior patches of short spines (Fig. 6.49); anal lobe with fringe of setae absent medially (Fig. 6.50) ..... ***Tanytarsus* sp. 2**

Figure 6.48: Tergites III-IV of *Tanytarsus* sp. 2

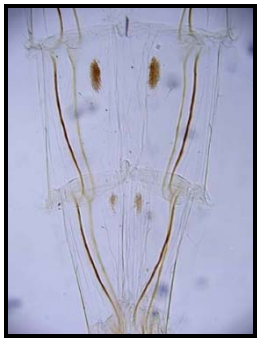


Figure 6.49: Tergites V-VI of *Tanytarsus* sp. 2

Figure 6.50: Anal lobe of *Tanytarsus* sp. 2

ADDITIONAL REFERENCES

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TANYTARSINI GENUS 1

NOTES ON SPECIES

Only one species detected.

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