

Some Midge (Diptera:Chironomidae) Larvae
of Boyes Creek, Humboldt County, California

By

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Aquatic macroinvertebrates were sampled in the spring and fall, 1985 from Boyes Creek as part of the U.S. 101 Bypass monitoring program at Redwood National Park. Twenty one larval genera, representing five subfamilies of Chironomidae were identified. Subfamilies, Chironominae tribes and seven genera were positively diagnosed with a dissecting microscope by their gross morphology. Remaining genera required microscope slide mounts of head capsules and the aid of a compound microscope for complete diagnoses. Keys, descriptions and an ecological review of the larvae were developed to facilitate identification of chironomids collected from Boyes Creek.

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(less than 5,000 certain species is described)

INTRODUCTION

The Chironomidae (Diptera) is an important representative of aquatic insects in aquatic ecosystems. The Chironomidae family contains more truly aquatic species than any other order of aquatic insect (McCafferty, 1981). More than 2,000 species reside in the Nearctic Region and as many as 15,000 species occur worldwide. Their distribution extends to the northern and southern limits of land, with some species inhabiting terrestrial and marine environments. Often occurring in high densities and diversity, chironomids are often the most abundant insect group in all types of freshwater habitats (Pinder, 1983; Merritt and Cummins, 1984). Being such a rich and abundant family, chironomidae larvae, pupae and adults are important items in aquatic food webs. The family is also a useful indicator of polluted water conditions (Wiederholm, 1973; Rosenberg and ~~Seins~~^{Waters}, 1976; and Hellawell, 1986).

Most of the attention the family receives is from specialists. The Chironomidae are often ignored in more generalized ecological works. Few general studies describing chironomid faunas of freshwater habitats have produced even a reasonable species list for the family (Pinder, 1983). One reason for this lack of taxonomical understanding is the difficulty in diagnosing the Chironomidae. The larva is the life stage that is most often studied, but collecting, sorting and identifying the larva is often a problem. Identification is difficult because: 1) only a small percentage of Nearctic larval species have been described; 2) some important genera are essentially inseparable; 3) keys will usually not separate early instars; 4) and the extensive process of microscope slide preparation of head capsules is usually required and even then diagnostic features are often difficult to see (Merritt and Cummins, 1984).

Most detailed Chironomidae studies stress the importance of rearing larvae from known adults because most species are described only in the adult stage (Oliver, McClymont, and Roussel 1978; Pinder, 1983). Rearing of specimens was not a part of this project. Larvae used in this study were previously collected from Boyes Creek as part of the bypass monitoring program at Redwood National Park.

On November 26, 1984, Redwood National Park (RNP) and the California Department of Transportation entered into an agreement to monitor biological conditions influenced by the construction of the U.S. 101 Bypass (United States Department of the Interior, 1986). A part of this monitoring program involves aquatic macroinvertebrate inventorying. The aquatic macroinvertebrate program involves a comprehensive sampling procedure in the spring and fall. Once the invertebrates have been determined to the lowest possible taxon, the following information is generated for each sampling location: 1) species list of mean number of observed individuals; 2) mean number of taxa; 3) mean number of individuals; 4) mean biomass; 5) and percent functional group classification as described by Merritt and Cummins (1984) (United States Department of the Interior, 1986).

Chironomids are often prevalent in samples taken to monitor the effects of bypass construction. Because of their numbers, identifying all larvae by slide preparation is undesirable. It is speculated that the Chironomidae fauna inhabiting the streams involved with bypass monitoring is not too diverse and the few species can be identified by their morphology. The objectives of the study are to identify genera using the slide preparation technique, associate known larva with distinctive morphologic characters, and develop a key based on these characters to enable genera to be diagnosed more easily.

A morphologic key could alleviate the problems of identifying chironomids by slide preparation. Such a key could be used to identify Chironomidae larvae collected in the future from Boyes and other creeks associated with the on-going U. S. 101 Bypass monitoring program at Redwood National Park.

STUDY SITE

Boyes Creek is a tributary to Prairie Creek, Humboldt County, California. The Boyes Creek watershed includes 950 acres (385 hectares) (California Department of Transportation, 1984). The headwaters are at Ah Pah peak, at an elevation of 1818 feet (554 m). The confluence of Boyes and Prairie Creek is 154 feet (47 m) above sea level. Old-growth redwood timber harvests occurred near the headwaters as recently as the mid 1970's. Excluding the logged-over areas, the creek flows through old-growth redwood timber stands and is characterized by fairly stable, well-vegetated banks. The fourth order stream includes 3.8 miles (6.2 km) of stream habitat, including north and south forks (Figure A). The aquatic invertebrate fauna is considered diverse and capable of supporting a large fish population (California Department of Transportation, 1984).

Boyes Creek is one of thirteen sampling sites for aquatic macroinvertebrates used in the U.S. 101 Bypass monitoring program. The monitoring involves Prairie Creek, four tributaries and three tributaries to the Klamath River. All being Pacific Coastal streams in the same general area, the streams are considered to have similar macroinvertebrate faunas.

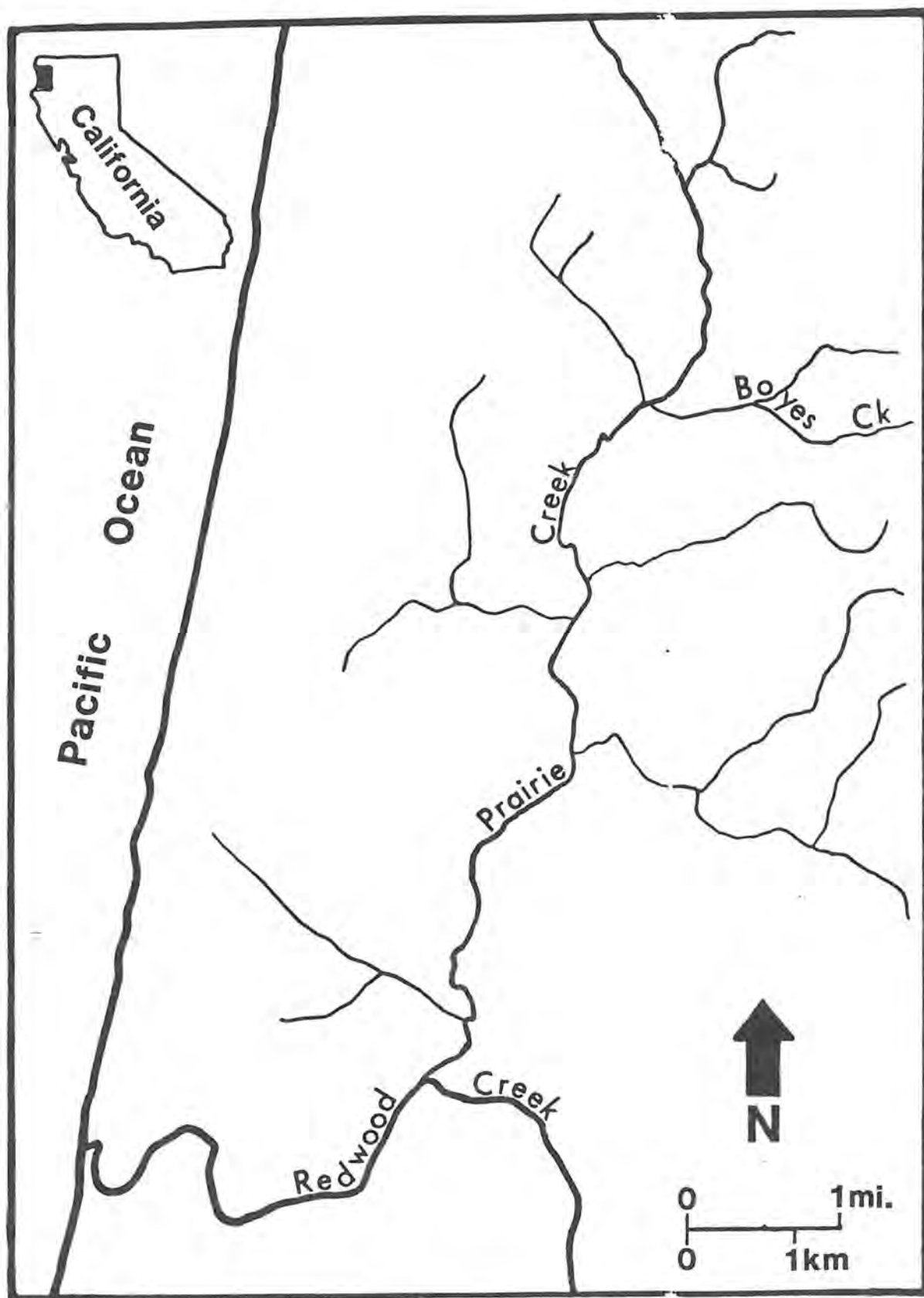


Figure A. Location of Boyes Creek, Humboldt County, California.

METHODS

Boyces Creek was sampled for macroinvertebrates in the spring and fall of 1985 (United States Department of the Interior, 1986). A modified Surber sampler, portable invertebrate box (PIB) sampler with a mesh size of 0.0125 inches (0.32 mm) was used to sample riffle habitat. Five random samples were collected at 1 foot (.3 m) intervals on a transect through the thalweg of all riffles. Samples were removed from the net and placed in 16 ounce jars containing 100 percent denatured alcohol. An Ekman dredge was used to sample pool habitat. Three random samples were taken at 1 foot (.3 m) intervals through the center of each pool, a pool being defined as an area of the stream having a depth of at least 1 foot (.3 m). Organic matter was separated from inorganic matter in pool samples by using a concentrated sugar solution (United States Department of the Interior, 1986). Invertebrates were removed from riffle samples using a Bausch and Lomb dissecting microscope, .8-80X magnification, and forceps. In each sample, chironomid larvae were separated from other groups of insects.

Once the Chironomidae were divided into groups, the general morphology of each group was described. Larvae were measured from the tip of the head capsule to the tip of the abdomen to the nearest 0.04 inch (1 mm). Late instar larvae were preferred for identification, so the largest individuals from each group were used for head mounts. Head capsules were removed from the larvae and placed in a 10 percent sodium hydroxide solution (100 gm. NaOH per 900 ml. water). Heads were soaked for 48 hours to dissolve unsclerotized head parts, facilitating diagnoses. Once soaking was completed, the heads were placed on a microscope slide in a Hoyers mounting solution. Orientating the heads ventral side up, a cover slip was placed over the heads and mounting solution.

Using a Fisher Scientific compound microscope, 4-100X, head capsule features were diagnosed. Larvae were identified to genus using keys from Oliver, McClymont and Roussel (1978); Brundin, (1983); Cranston and Reiss, (1983); Cranston, Oliver and Saether, (1983); Fittkau and Roback, (1983); Pinder and Reiss, (1983); and Merritt and Cummins (1984).

Microphotographs included in this report were taken with an Olympus model BHA compound microscope equipped with an Olympus photomicrographic system model PM-10M camera and model EMM-7 exposure meter. Additional photographs were taken using a Wild Heerbrugg model MPS 20 dissecting microscope combined with a Wild Photoautomat MPS 45 exposure meter and model MPS 11 35 mm camera. Kodak T MAX 400 black and white film was used in the cameras.

The Wild Heerbrugg microscope magnification ranged from 6 to 50X. The Olympus microscope objectives ranged from 4 to 100X magnification. All instruments included eyepieces of 10X power.

RESULTS

Unexpectedly, 21 genera, representing five subfamilies of Chironomidae were identified from Boyes Creek. Some species identification was completed. The subfamilies, Chironominae tribes and eight genera were positively identified by their gross morphology using a dissecting microscope. Remaining genera required microscope slide mounts of head capsules and identification with a compound microscope for complete diagnoses. General larval body and head capsule features are displayed in Figures B-G. Keys, descriptions and reviews of each larva collected in Boyes Creek are included.

KEY TO SUBFAMILIES OF LARVAL CHIRONOMIDAE

1. Antenna retractile into head capsule.
 Prementum with ligula strongly and distinctly developed (Figure 12) Tanypodinae (page 10)

- Antenna not retractile into head capsule.
 Ligula not distinctly developed. Mentum strongly developed (Figure 35) 2

2. Procercus 8-10 times as high as wide (Figure 51). Premandibles absent. Mentum as in Figure 1. Antenna as in Figure 2. Podonominae
Boreochlus

- Procercus rarely more than 4 times as high as wide, usually much less (Figure 3).
 Premandibles present. 3

3. Single eyespot (Figures 4,18,21).
 Ventromental plates not well developed (Figure 33) Orthocladinae (page 9)

- Two eyespots, dorsally and ventrally orientated (Figures 36,37). Ventral part of mentum expanded laterally to form ventromental plates (Figures 42,44) 4

4. Large larva, over 10 mm in length.
 Antenna 4 segmented (Figures 5,5b).
 Ventromental plates strongly expanded with setae present beneath. Mentum distinctive (Figures 6,6b) Prodiamesinae
Monodiamesa

Medium sized larva, no longer than 8 mm in length. Antenna with more than four segments. Ventromental plates usually striated (Figures 42,44). Chironominae (page 8)

KEY TO LARVAL CHIRONOMINAE

1. Antenna at least half the length of head capsule (Figure 36) Tribe Tanytarsini 4
Antenna shorter than half the length of head capsule (Figure 37) Tribe Chironomini 2
2. Mentum with no more than 13 teeth (Figures 47,47b). Anal setae distinctly black and palmate (Figure 39). Tapered, curved case of fine sand grains (Figure 41) Stempellina
Mentum with 16 teeth. Polypedilum . . .3
[scalaenum (or albinodes)]
3. Mentum with 2nd pair of median teeth shorter than 1st pair of median and lateral teeth (Figure 42) Polypedilum species A
(nubeculosum)
All mental teeth decreasing in size laterally (Figure 43) Polypedilum species B
4. Ventromental plates separated by distance less than width of median mental tooth. Plates wider than 3 times their length (Figures 47,47b) 5
Ventromental plates separated by distance greater than width of median mental tooth (Figures 48,48b) Stempellinella
- ✓ 5. Premandible bifid (Figures 45,45b) Microspectra
Premandible with more than two teeth (Figures 47,47b) Tanytarsus

+ Phaenopsectra

KEY TO LARVAL ORTHOCLADINAE

1. One anal seta as long as 1/3 body length
(Figure 17). Krenosmittia
No anal setae as long as 1/3 body length. 2
2. Antennae more than one half the length
of head capsule. 3
Antennae less than one half the length of
head capsule (Figure 4). 5
3. Antennae unicolorous (Figure 24).
Mentum distinctive (Figure 20). Heterotanytarsus
Certain segments of antenna distinctly
darker than other segments (Figure 21).
Mentum not as above. 4
4. Antennae longer than head capsule length.
Antennal segments 2 and 3 darker than
other segments (Figure 24). Antennae 4
segmented (Figure 25). Ventral basal setae
of posterior parapod distinctly plumose
(Figure 28). Corynoneura
Antennae subequal to head capsule length.
Antennae segment 2 darker than other
segments. Antennae 5 segmented (Figures 21,
22). Ventral basal setae of posterior
parapod simple (Figure 27). Thienemanniella
5. Antennal segment 2 divided in basal 1/3 by
a weakly sclerotized area (Figures 29,29b,31). 6
Antennal segment 2 normal (Figures 32,32b). 7
6. Antennal blade extending beyond terminal
antennal segment. Heleniella
Antennal blade not extending beyond
terminal antennal segment (Figures 29,29b). Brillia (redifinis)
7. Antenna 7 segmented. Antennal segment 3
much smaller than segment 4 (Figures 32,
32b). Mentum as in Figure 33. Heterotrissocladius
Antenna 5 segmented. Antennal segment 3
equal or subequal to segment 4 (Figures
34,34b). Mentum as in Figure 35. Parametriocnemus (cf lundbecki)

KEY TO LARVAL TANYPODINAE

1. Dorsomentum with a row of teeth (Figure 8). 2
Dorsomentum without a row of teeth (Figure 7).
. 3
2. Tooth-row of ligula moderately concave.
Pecten hypopharyngis terminating a blunt
point (Figure 9). Brundiniella
Tooth-row of ligula deeply concave. Pecten (not eumorpha)
hypopharyngis terminating a point similar
to other teeth of structure (Figure 10). Apsectrotanypus
3. Inner tooth of ligula shorter than middle
tooth (Figure 11). Nilotanypus
Inner tooth of ligula larger or more or less
equal in length to middle tooth (Figure 12). 4
4. Mandible without large basal tooth (Figure 13).
Annulations apparently present on antennal
segment 2 (Figure 14). Conchapelopia
Mandible with large basal tooth (Figure 15). 5
5. Point of inner tooth of ligula more or less
curved outward (Figure 15). Zavreliomyia
Point of inner tooth of ligula straight
(Figure 16). Natarsia

COMMENTS ON LARVAL CHIRONOMINAE GENERA

Microspectra

Characteristics:

Medium sized larva, found up to 8 mm in length. Antenna long, at least half the length of the head capsule (Figure 36). Lauterborn organs originating from the apex of antenna segment 2 and placed on long pedicels. The pedicels are twice the length of antennal segments 3, 4 and 5. Simple spur at the base of antenna. Mentum with 11 teeth, the median tooth at times trifid. Ventromental plates much wider than their length. Plates at least 3 times as wide as long. The distance between the ventromental plates being less than the width of the median tooth of the mentum (Figure 44). Premandible bifid and with a brush (Figures 45,45b). The larva makes tubes of light to dark brown detrital material (Figure 46).

Remarks:

Microspectra can be separated from other Chironominae by the long antennae. The larva can be distinguished from Stempellinella by the close proximity and style of the ventromental plates. Microspectra can be positively identified from Tanytarsus by the bifid premandible.

Ecology:

According to Pinder and Reiss (1983), Microspectra can be found in muddy deposits in slack regions of running water and in mesotrophic and oligotrophic lakes. The genus contains 80 valid species from the Holarctic region, but very few larval species have been described. The larva was common in Boyes Creek pool and riffle habitat. Microspectra is functionally classified as a collector-gatherer by Merritt and Cummins (1984).

Polypedilum species A

Characteristics:

Medium sized larva reaching 8 mm in length. Antenna short, not more than half the length of the head capsule (Figure 37). Mentum with 16 teeth, including 6 lateral teeth, the 6th being very small. The 2nd pair of median teeth are shorter than the 1st pair of lateral and median teeth. Ventromental plates no wider than 3 times their length. The distance between the plates is greater than the width of the median mental teeth (Figure 42). Premandible bifid with a brush.

Remarks:

Polypedilum species A can be recognized from Stempellina and Polypedilum species B by the characteristic mentum.

Ecology:

Pinder and Reiss (1983) found the larva in virtually all lotic and lentic habitats. Polypedilum encompasses at least 100 species in the Holarctic region. Polypedilum species A was commonly sampled in pools and riffles. Larval species are classified as shredders, collectors and predators (Merritt and Cummins, 1984).

Polypedilum species B

Characteristics:

Small larva up to 3 mm in length. Sharing the same characters as Polypedilum

species A only the teeth of the mentum decrease in size laterally (Figure 43).

Remarks:

Polypedilum species B can easily be distinguished from Stempellina and Polypedilum species A by differences in the mentum.

Ecology:

Polypedilum species B was rarely found in riffle habitat.

Stempellina

Characteristics;

Small larva up to 3 mm in length. Antenna shorter than half the head capsule length and 5 segmented. Lauterborn organs originating from the apex of segment 2. Antennal segment 2 widest at the apex (Figure 40). Palmate spur process at the base of antenna. Mentum with 13 teeth, the median tooth often representing a square in shape. Ventromental plates ovate and separated medially by a distance greater than the width of the median mental tooth (Figures 38,38b). Anal setae distinctly black and often bifid or appearing palmate. The setae are directed posteriorly (Figure 39). Larva with a tapered, curved case of fine sand grains (Figure 41).

Remarks:

Stempellina can be recognized from Polypedilum species by the characteristic anal setae, mentum and transportable case.

Ecology:

An inhabitant of springs, streams, larger rivers, lakes and brackish water, the genus is possibly worldwide in distribution and representative of 14 known species, including unnamed larval types (Pinder and Reiss, 1983). Stempellina was a common inhabitant of pools in Boyes Creek. Merritt and Cummins (1984) classify the larva as a collector-gatherer.

Stempellinella

Characteristics:

Small larva, reaching lengths of 3 mm. Antenna as long as half the length of the head capsule and having 5 segments. Lauterborn organs originating from the apex and base of antennal segment 2 (Figure 49). Mentum having 13 teeth, with the median tooth trifid. Ventromental plates ovate and separated medially by distance greater than the median mental tooth width (Figures 48,48b). Premandible with 3 teeth and brush. Larva having a straight transportable case of fine sand grains (Figure 50).

Remarks:

The long antenna distinguish Stempellinella from the Chironomini of Boyes Creek. The widely separated ventromental plates identify the larva from Microspectra and Tanytarsus.

Ecology:

Found in springs, streams and lakes, the genus is Holarctic in distribution, including seven named species. Most of the species, however, are without definitely associated larva (Pinder and Reiss, 1983). Stempellinella was occasionally sampled in Boyes Creek pools and riffles.

Tanytarsus

Characteristics:

Medium sized larva up to 4 mm in length. Antenna subequal to the head capsule length and with 5 segments. Lauterborn organs placed on long pedicels originating from the apex of antennal segment 2. Mentum with 11 teeth, the median tooth trifid. Ventromental plates almost in contact medially, separated by a distance less than width of median mental tooth. Premandible with 4 teeth and brush (Figures 47,47b).

Remarks:

The elongate antennae separate Tanytarsus from the Chironomini of Boyes Creek. The larva is definitely separated from Microspectra by the 4 teeth of the premandible.

Ecology:

Known to occur in all types of freshwater habitats, with some marine and terrestrial species, the genus contains at least 85 named Holarctic species, the vast majority unknown as larva (Pinder and Reiss, 1983). Tanytarsus occasionally inhabited riffles and pools. Functionally classified as a collector-filterer and gatherer with scraper species.

COMMENTS ON LARVAL ORTHOCLADINAE GENERA

Brillia

Characteristics:

Medium sized larva of 6 mm. Second antennal segment with region of reduced sclerotization in basal 1/3. Antenna with 4 segments. Basal segment of antenna curved and longer than remaining three segments combined. Antennal blade just reaching segment 4 (Figures 29,29b). Mentum with 12 teeth. Median teeth usually paired, but occasionally the teeth fuse, giving appearance of a single, domed median tooth. The 5th and 6th lateral teeth closely oppressed, giving illusion of single, bifid tooth. Fifth lateral tooth sometimes smaller than 6th (Figure 30).

Remarks:

Brillia can be separated from other Orthocladinae by the region of reduced sclerotization on the 2nd antennal segment. The larva can be distinguished from Heleniella by the shorter antennal blade, longer basal antennal segment and by the characteristics of the mentum. Brillia was also found only in riffle areas.

Ecology:

The larva was collected solely in riffles in Boyes Creek, although found to inhabit springs and lakes in addition. Five species are found in the Nearctic region (Cranston, Oliver and Saether, 1983). Using the key by Oliver and Roussel (1983), the larvae in Boyes Creek are most probably B. retifinis. The genus is considered to contain shredder and collector species (Merritt and Cummins, 1984).

Corynoneura

Characteristics:

Small larva up to 3 mm in length. Antennae longer than head capsule length. Antennae 4 segmented, segments 2 and 3 distinctly darker than remaining segments. Antennae segment 3 much longer than segment 2 (Figures 24,25). Mentum with 3 median teeth and 5 laterals. First lateral teeth smaller than second lateral teeth (Figure 26). Ventral basal setae of posterior parapod distinctly plumose (Figure 28). Larval color green.

Remarks:

Corynoneura can be recognized from Thienemanniella by the longer and four segmented antennae, dark antennal segment 3, smaller first lateral teeth, and plumose ventral basal setae of the posterior parapod. Corynoneura larvae are also green compared to the paler Thienemanniella specimens.

Ecology:

Corynoneura larvae are found in many types of lotic and lentic habitats and probably distributed worldwide (Cranston, Oliver and Saether, 1983). The larva was occasionally sampled in Boyes Creek pool and riffle habitat.

Heterotanytarsus

Characteristics:

Medium sized larva up to 4 mm long. Antennae unicolorous and at least half as long as head capsule (Figure 18). Antenna apparently 4 segmented, with

segment 2 longer than segment 1. Lauterborn organs distinct and arising at base and apex of basal 1/3 of segment 2. Simple spur at base of antennae. Premandible with 4 teeth (Figure 19).

Remarks:

Heterotanytarsus is easily diagnosed from other Chironomidae by the single, oval shaped eyespot and long, unicolorous antennae. The mentum is also very distinctive.

Ecology:

Cranston, Oliver and Saether (1983) discovered Heterotanytarsus in ponds, lakes and slower reaches of lotic habitats. In Boyes Creek, the larva was found in riffle and pool habitats. Two species of the genus occur in the Nearctic. Boyes Creek larvae are most likely H. perennis (Saether, 1975).

Heterotrissocladius

Characteristics:

Medium sized larvae up to 6 mm long. Antenna 7 segmented, the 7th segment hair-like and difficult to discern. The 3rd antennal segment is much shorter than segment 4 (Figures 32,32b). Mentum with 2 median and 5 lateral teeth. The median teeth being the longest, remaining teeth decrease in size laterally (Figure 33). A black band is at times apparent on the dorsum of the head capsule.

Remarks:

Heterotrissocladius can be separated from Parametriocnemus by differences in the mentum, the 7 antennal segments and very short 3rd antennal segment.

Ecology:

The genus is found in a variety of habitats from puddles to rivers (Cranston, Oliver and Saether, 1983). Ten larval species are known to occur in the Nearctic (Saether, 1975). The larva was an occasional to common inhabitant of riffles and pools. Functionally classified as a collector-gatherer by Merritt and Cummins (1984).

Heleniella

Characteristics:

Small larva up to 2 mm in length. Mentum consisting of 12 teeth, with additional teeth at the base of the mentum. Notch between the 2 median teeth "U" shaped. Antenna with region of reduced sclerotization near the base of segment 2. First segment of antenna short and squat, shorter than segment 2 (Figure 31). Blade of antenna long, surpassing terminal segment of antenna.

Remarks:

Heleniella can be recognized from Brillia by the shorter basal antennal segment, longer antennal blade and differing mentum characteristics.

Ecology:

Heleniella occurred frequently, but only in pools. More than 100 individuals per sample was common. According to Cranston, Oliver and Saether (1983), only two Nearctic species exist, but no keys were available.

Krenosmittia

Characteristics:

Small larva attaining lengths of 3 mm. Anal setae at least as long as 1/3 the length of the larva (Figure 17). Mentum with a single median tooth and 5 lateral teeth. Premandible with 3 teeth.

Remarks:

Krenosmittia can be easily distinguished from other Chironomidae by the elongated and dorsally directed anal setae.

Ecology:

Recorded from flowing waters (Cranston, Oliver and Saether, 1983), the genus was occasionally found in Boyes Creek riffles and pools. Merritt and Cummins (1984) classified as a collector-gatherer.

Parametriocnemus

Characteristics:

Medium sized larva up to 6 mm long. Antenna 5 segmented, with the 3rd segment equal or subequal to segment 4 (Figures 34,34b). Mentum with 2 median teeth and 5 lateral teeth. Fifth lateral tooth almost as high as 4th and pointed laterally in part (Figure 35).

Remarks:

Parametriocnemus can be distinguished from Heterotrissocladius by the number of antennal segments, size of antennal segment 3 and by the mentum.

Ecology:

Known to occur in springs and in relatively fast flowing and cold streams and rivers, the genus is represented by seven species in the Holarctic (Cranston, Oliver and Saether, 1983). The larva commonly inhabited riffles and pools in Boyes Creek. Merritt and Cummins (1984) classified the larva as a collector-gatherer.

Thienemanniella

Characteristics:

Small larva up to 3 mm in length. Antenna subequal to head capsule length (Figure 21). Antenna with 5 segments, segment 2 distinctly darker than the remaining segments. Antennae segments 4 and 5 minute. Antennal segment 2 subequal in length to segment 3 (Figure 22). Mentum with 3 median teeth and 5 laterals (Figure 23). Ventral basal setae of posterior parapod simple (Figure 27).

Remarks:

The long antennae with the darkened segments is characteristic among the Chironomidae. Thienemanniella can be separated from Corynoneura by differences in the antennae, ventral basal setae of the posterior parapod, and mentum.

Ecology:

Cranston, Oliver and Saether (1983) found the larva in most lotic habitats, from fast mountain streams to slow moving ditches and lowland rivers. Occurring in the interstices of submerged stones, their small size may enable them to resist high water velocities. An undercollected and understudied genus, probably is quite rich in species and worldwide in distribution (Cranston, Oliver and Saether, 1983). Thienemanniella was occasionally found in Boyes Creek pools and riffles.

COMMENTS ON LARVAL PODONOMINAE GENERA

Boreochlus

Characteristics:

Medium sized larva, up to 4 mm in length. Procercus elongate, 8-10 times as high as wide. Posterior half of procercus darkened (Figure 51). Mentum with 15 teeth and premandibles absent (Figure 1). Antenna apparently 5 segmented, with the 3rd segment annulated (Figure 2).

Remarks:

Boreochlus can be identified from other Chironomidae by the elongate, posteriorly darkened procercus.

Ecology:

Brundin (1983) found Boreochlus lived among mosses in cool streams and brooks. Three species are known from North America, but no larva have been described. The larva occurred rarely in riffle samples. Functionally classified as a collector-gatherer by Merritt and Cummins (1984).

COMMENTS ON LARVAL PRODIAMESINAE GENERA

Monodiamesa

Characteristics:

Large larva, found up to 14 mm long. Antenna 4 segmented (Figures 5,5b). Mentum with 13 teeth, the median tooth broad and concave. Ventromental plates distinct, expanding laterally by a distance greater than half the mental width. Ventromental plates with sparse beard beneath (Figures 6,6b).

Remarks:

Monodiamesa has eyespots similar to those of the Chironominae. The large size of the mature larva distinguishes the genus, but slide preparation may be necessary to diagnose early instars.

Ecology:

Saether (1983) believed Monodiamesa to occur in lotic environments. Findings in this report support this assumption. The larva was rarely found in riffle habitat from Boyes Creek. Saether (1973) found the genus contained four Nearctic species. M. prolilobata is the only known occurring western species and possibly represents our Boyes Creek larva.

Monodiamesa prolilobata Saether 1973

(The specimen keys to Monodiamesa sp. (possibly M. prolilobata) in Saether (1973)

COMMENTS ON LARVAL TANYPODINAE GENERA

Apsectrotanypus

Characteristics:

Medium sized larva, up to 6 mm long. Rounded to oval head capsule. Tooth row of ligula deeply concave, the middle tooth being the smallest. Pecten hypopharyngis terminating in an acute tooth, similar to all other teeth of the structure. Dorsomentum with 10 teeth (Figure 10). Small tooth at base of mandible.

Remarks:

Apsectrotanypus can be distinguished from other Tanypodinae of Boyes Creek by the rounded to oval shape of the head capsule. The genus can be separated from Brundiniella by the dorsomental teeth, ligula and the style of the tooth at the apex of the pecten hypopharyngis.

Ecology:

Living in small, cool, lotic habitats, three species of Apsectrotanypus are distributed in the Nearctic region (Fittkau and Roback, 1983). Unfortunately, no species key was available. The larva was a rare inhabitant of pools and riffles. Functionally classified as a predator (Merritt and Cummins, 1984).

Brundiniella

Characteristics:

A medium sized larva, found up to 7 mm long. Rounded to oval head capsule. Ligula moderately concave, the inner and middle teeth being equal in size. Pecten hypopharyngis terminating in a large, blunt tooth (Figure 9). Dorsomentum with 14 teeth, the outermost teeth being very small (Figure 8). Small, slender tooth at base of mandible.

Remarks:

Distinctive among other Tanypodinae because of the oval head capsule, Brundiniella can be identified from Apsectrotanypus by the large, blunt, terminating tooth of the pecten hypopharyngis and by ligula and dorsomentum characters.

Ecology:

Previously found in cool brooks and streams, Brundiniella is monotypic in North America and described as B. eumorpha (Fittkau and Roback, 1983). The larva was rarely sampled in riffles and pools in Boyes Creek. Classified as a predator by Merritt and Cummins (1984).

Conchapelopia

Characteristics:

Medium sized larva, up to 7 mm in length. No tooth at the base of the mandible (Figure 13). Teeth of ligula forming straight or slightly concave row. Inner tooth curved slightly outward (Figure 12). Antennal segment 2 appears annulated (Figure 14). Maxillary palp with b seta 3 segmented.

Remarks:

Conchapelopia can be easily separated from other genera of Tanypodinae by the lack of a distinct tooth at the base of the mandible and the annulate 2nd antennal segment.

Ecology:

(This specimen, however, does not seem to belong to B. eumorpha)

Different from B. eumorpha

The larva was commonly found in riffle and pool habitats. Nine Nearctic species have been determined (Fittkau and Roback, 1983). Functional classification a predator (Merritt and Cummins, 1984).

Natarsia

Characteristics:

Medium sized larva up to 5 mm long. Teeth of ligula straight and equal in size. Tooth at base of mandible (Figure 16).

Remarks:

Natarsia can be distinguished from Zavreliomyia by the straight teeth of the ligula.

Ecology:

Known to occur in cool springs, streams and littoral zone of lakes, the genus contains two Nearctic species (Fittkau and Roback, 1983). Natarsia was a rare inhabitant of Boyes Creek pools. Using Fittkau and Roback (1983), Natarsia baltimoreus is likely the larva found in Boyes Creek. Merritt and Cummins (1984) classify the larva as a predator.

Nilotanypus

Characteristics:

Medium sized larva up to 4 mm in length. Head capsule long and narrow. Middle tooth of ligula higher than all other teeth. Points of outer ligulae teeth curved slightly outward. Pecten hypopharyngis with 4 to 5 teeth. Tooth at base of mandible (Figure 11).

Remarks:

Nilotanypus can be easily diagnosed because of the elongated middle tooth of the ligula.

Ecology:

Found to occur in pool habitats of rapidly flowing waters, there are two species of the genus in North America (Fittkau and Roback, 1983). Surprisingly, the larva was found rarely only in riffles.

Zavreliomyia

Characteristics:

Medium sized larva up to 7 mm long. Distinct tooth at base of mandible. Tooth row of ligula straight. Points of inner and outer teeth directed outward (Figure 15).

Remarks:

Zavreliomyia can be distinguished from other Tanypodinae with basal mandibular teeth by the straight tooth row of the ligula and the outwardly curved points of the inner ligulae teeth.

Ecology:

The genus is described as primarily an inhabitant of sandy or detritus rich sediments in lotic habitats close to springs. Three species are found in North America (Fittkau and Roback, 1983), but no species key was obtained. In Boyes Creek, the larva was occasionally sampled in pool and riffle habitat.

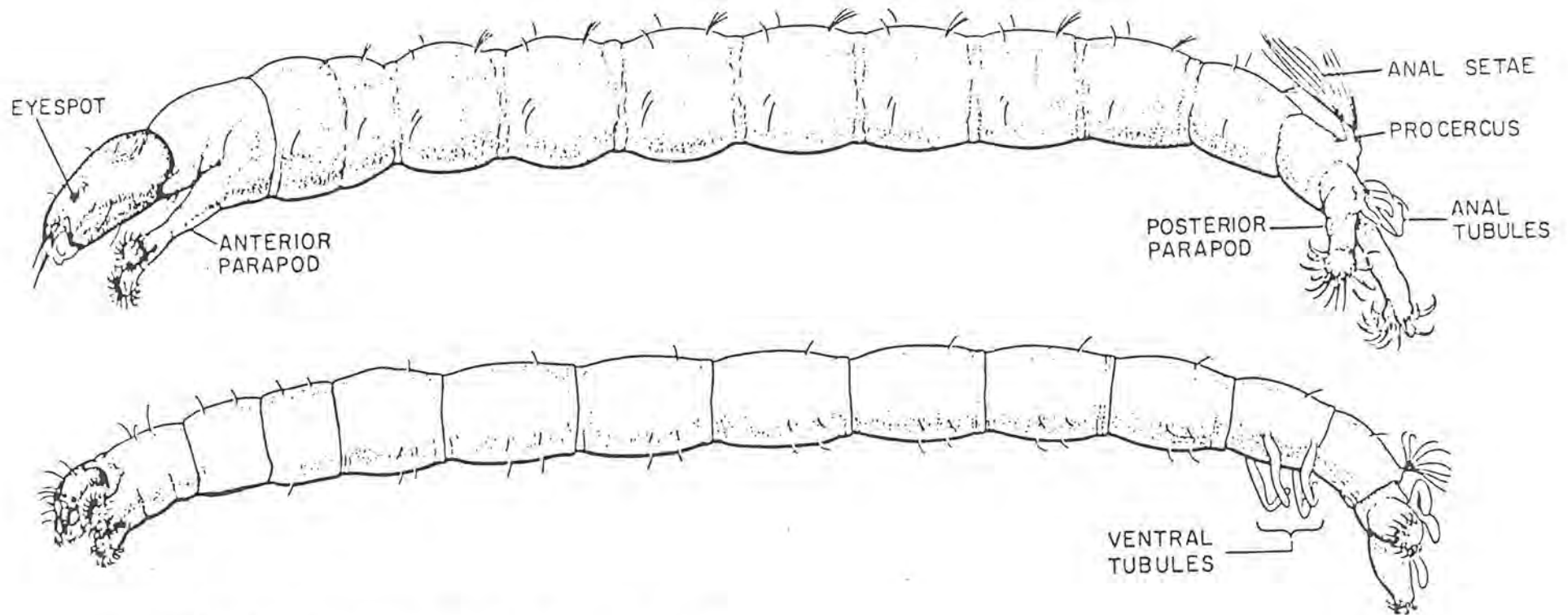


Figure B (top). Tanypodinae larva, lateral view.
Figure C. Chironominae larva, lateral view.

Source: Oliver, McClymont and Roussel (1978)

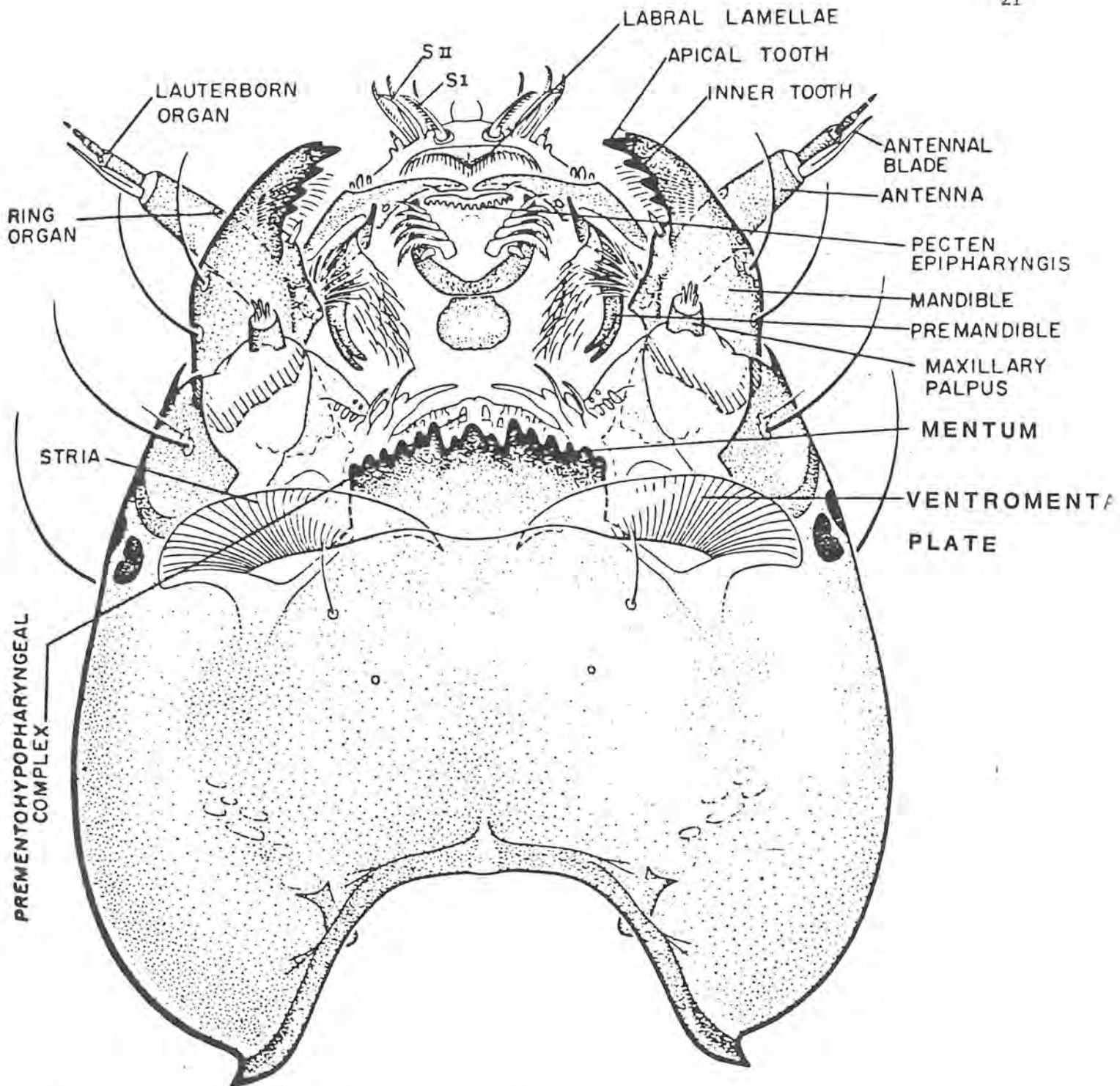


Figure D. Chironominae (Chironomini tribe) head capsule, generalized ventral view.

Source: Oliver, McClymont and Roussel (1978)

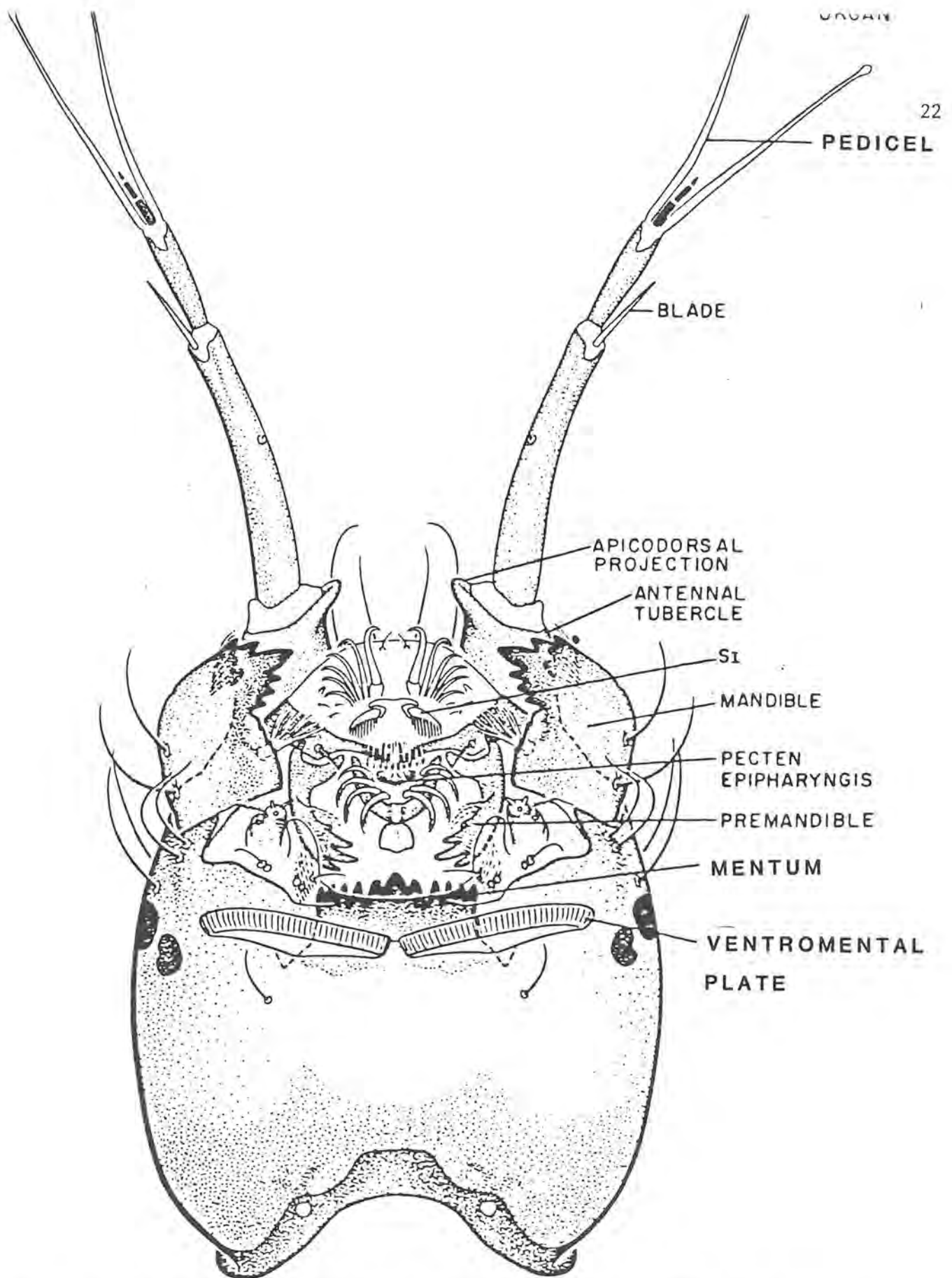


Figure E. Chironominae (Tantarsini tribe) head capsule, generalized ventral view.

Source: Oliver, McClymont and Roussel (1978)

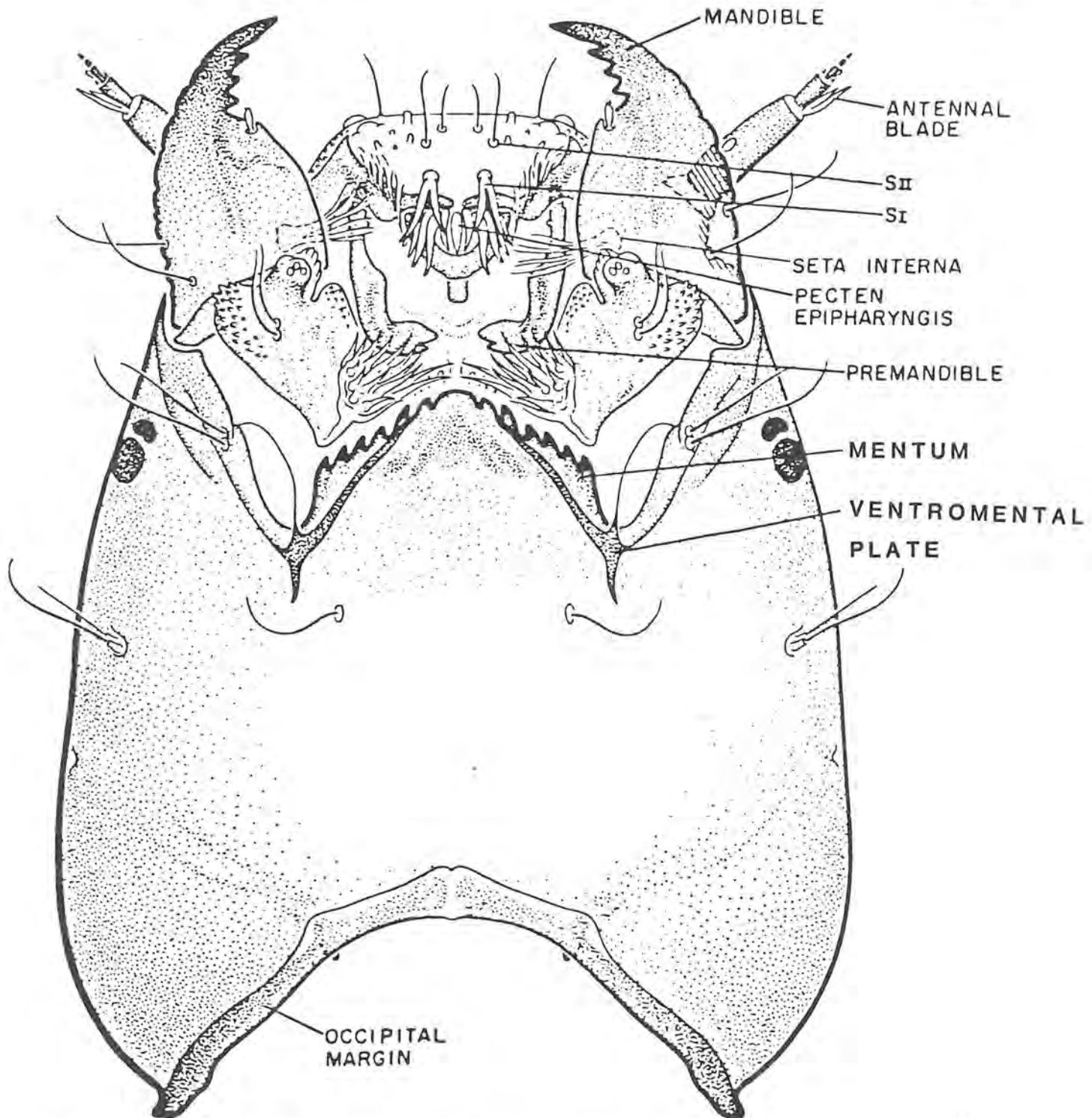


Figure F. Orthocladinae head capsule, generalized ventral view.

Source: Oliver, McClymont and Roussel (1978)

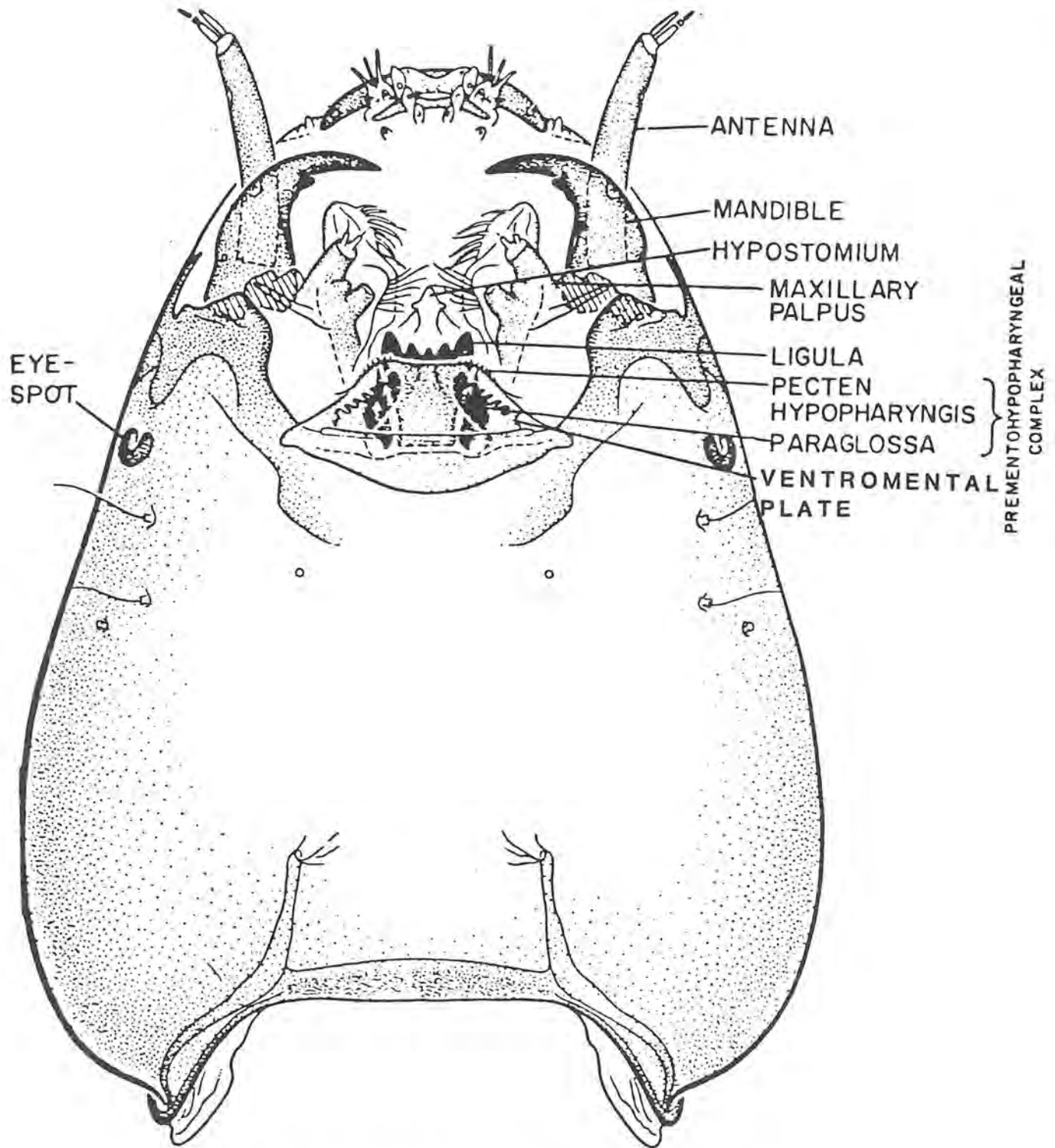
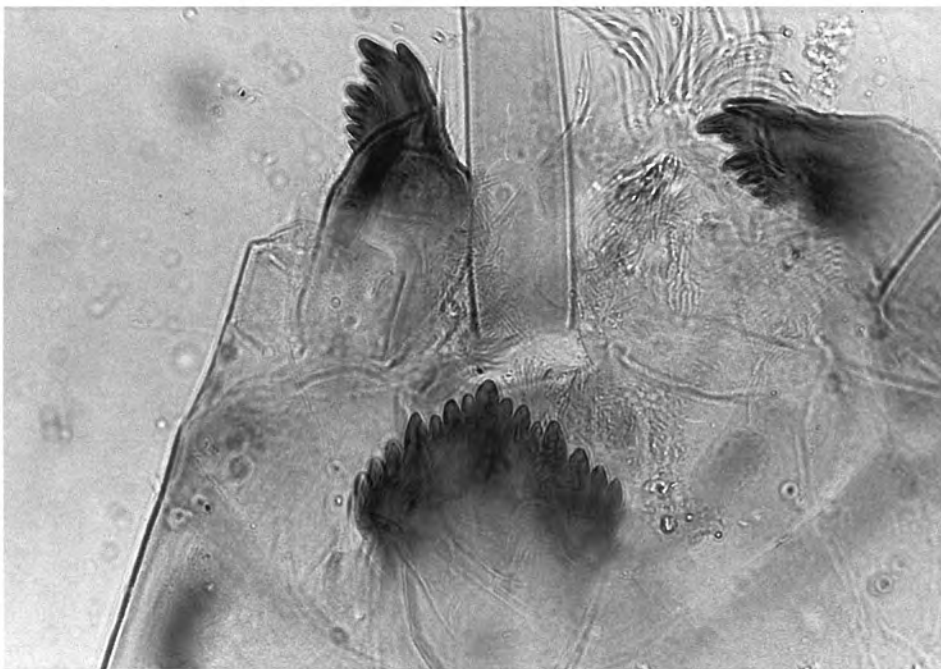
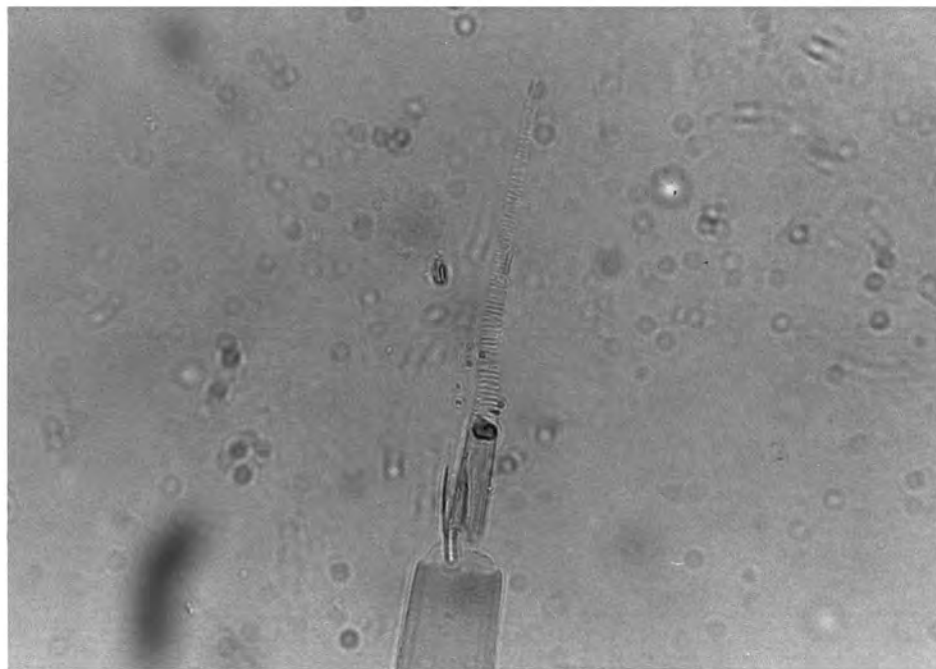


Figure G. Tanypodinae head capsule, generalized ventral view.

Source: Oliver, McClymont and Roussel (1978)



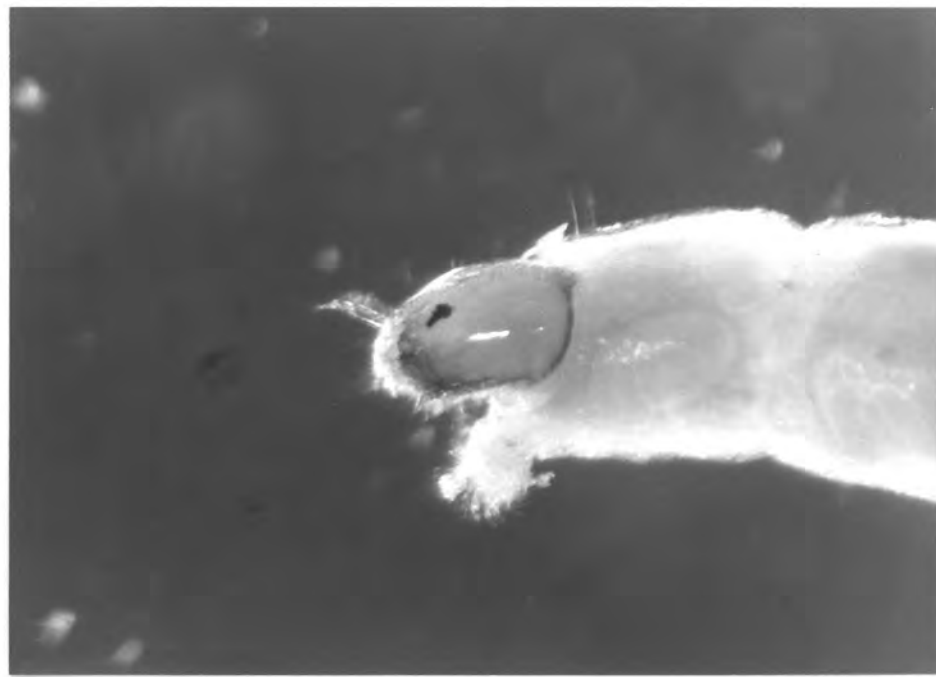
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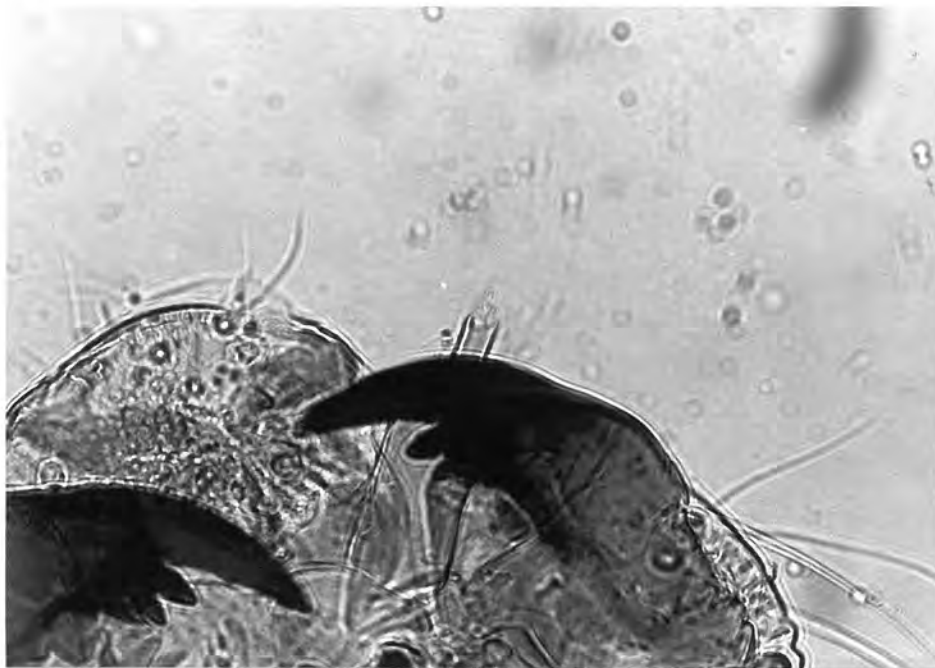
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Figure 1. Mentum of Boreochlus.

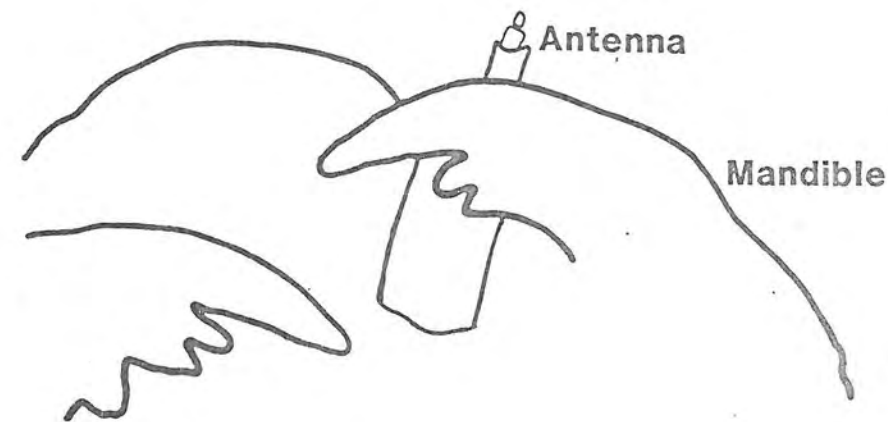
Figure 3. Procercus of Conchapelopia.

Figure 2. Antenna of Boreochlus.

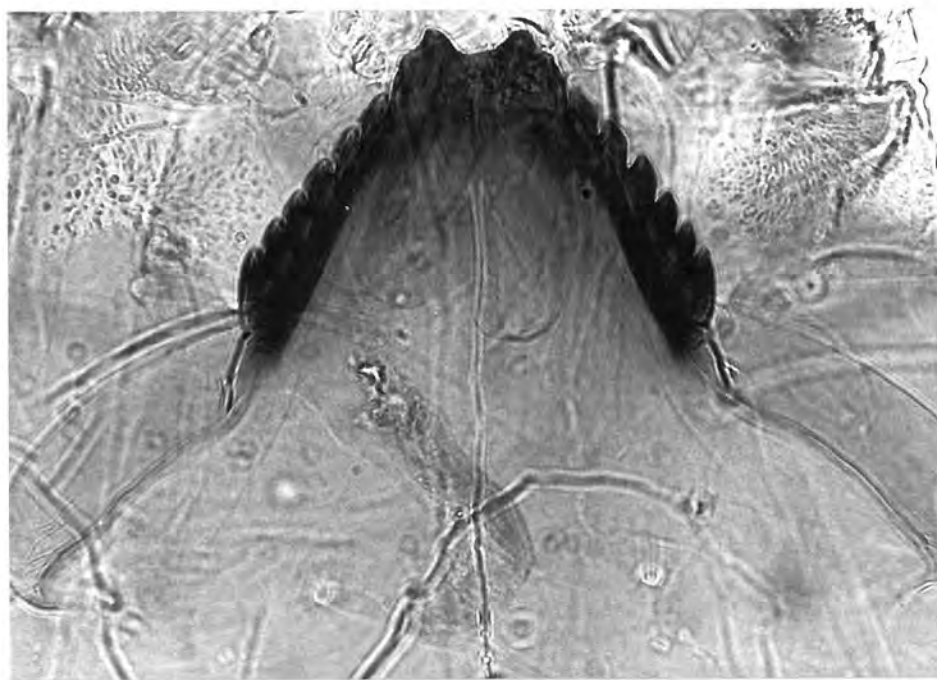
Figure 4. Head capsule of Orthocladinae.



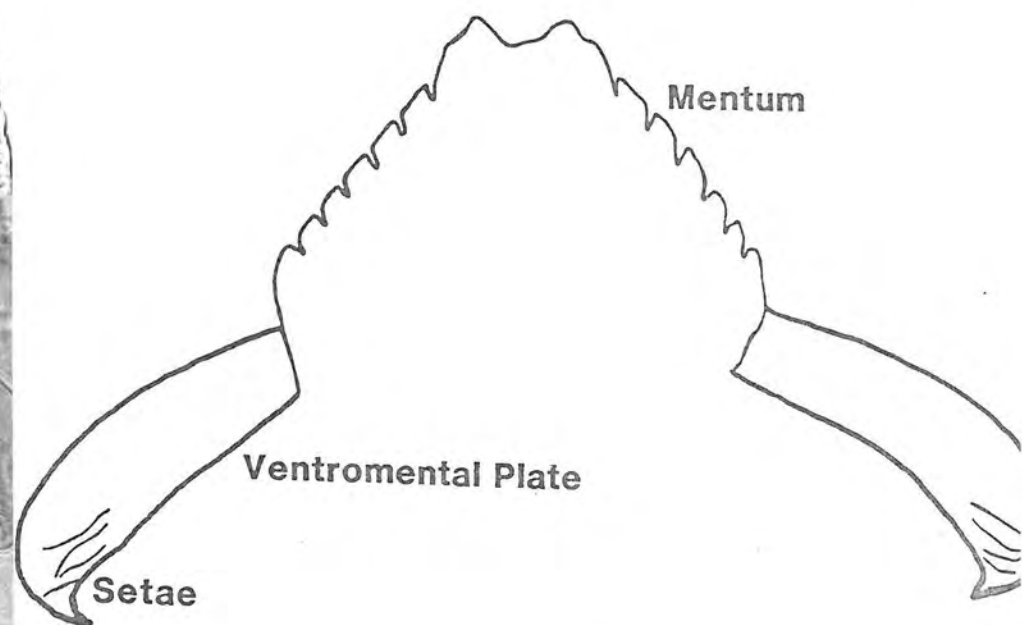
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5b



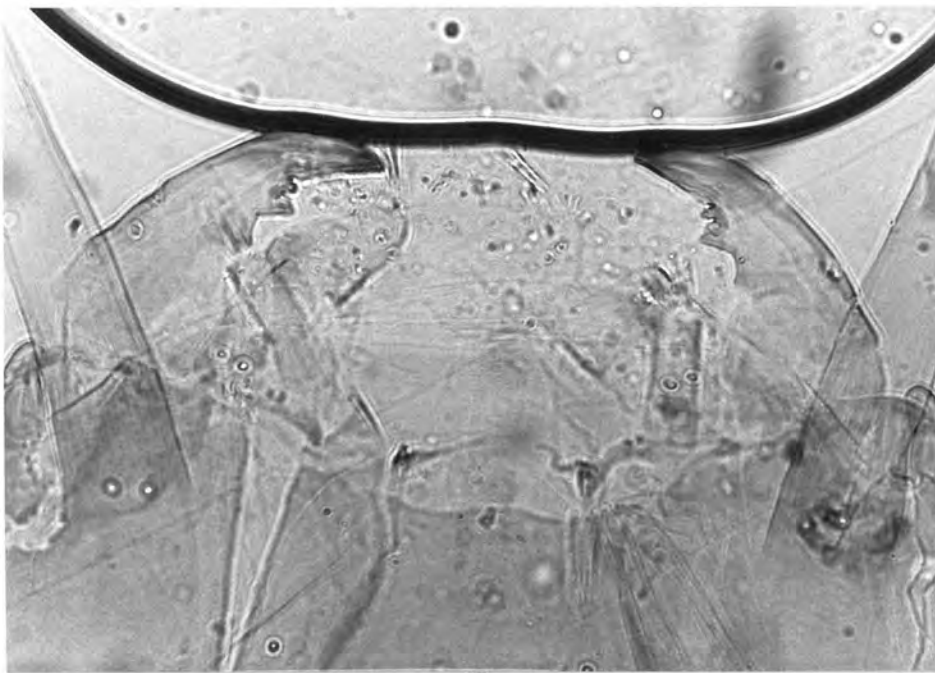
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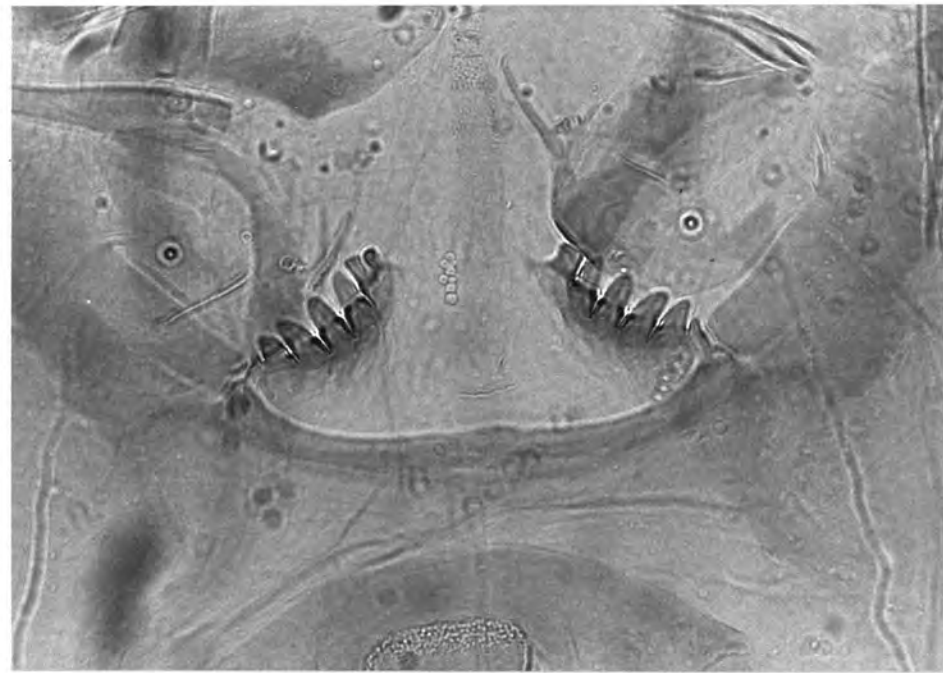
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Figure 5. Antenna of Monodiamesa.
 Figure 6. Mentum, ventromental plates and setae
 of Monodiamesa.

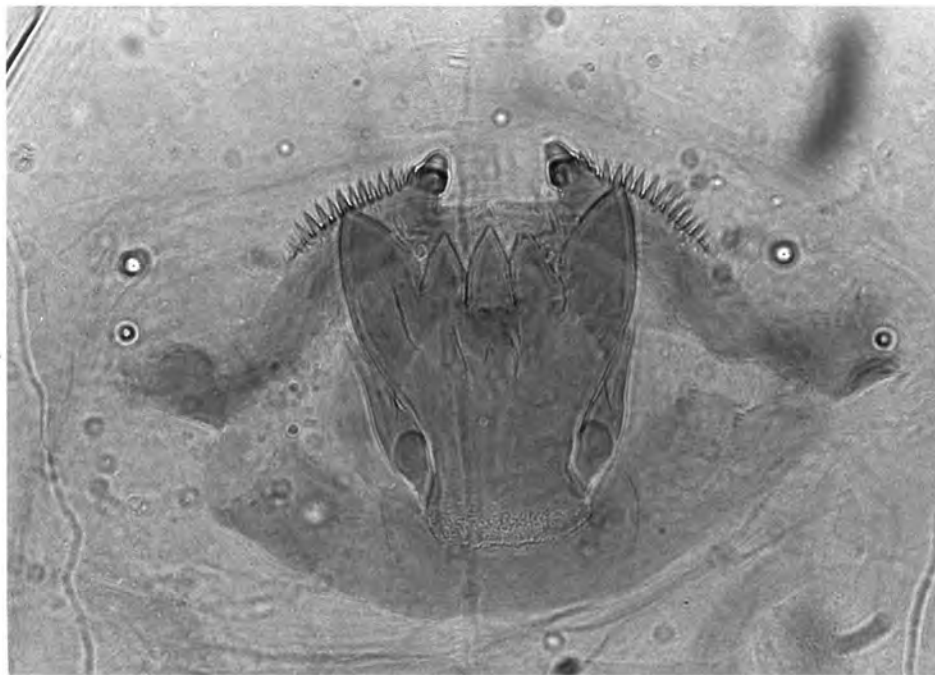
Figure 5b. Antenna and mandible of Monodiamesa.
 Figure 6b. Mentum, ventromental plates and setae
 of Monodiamesa.



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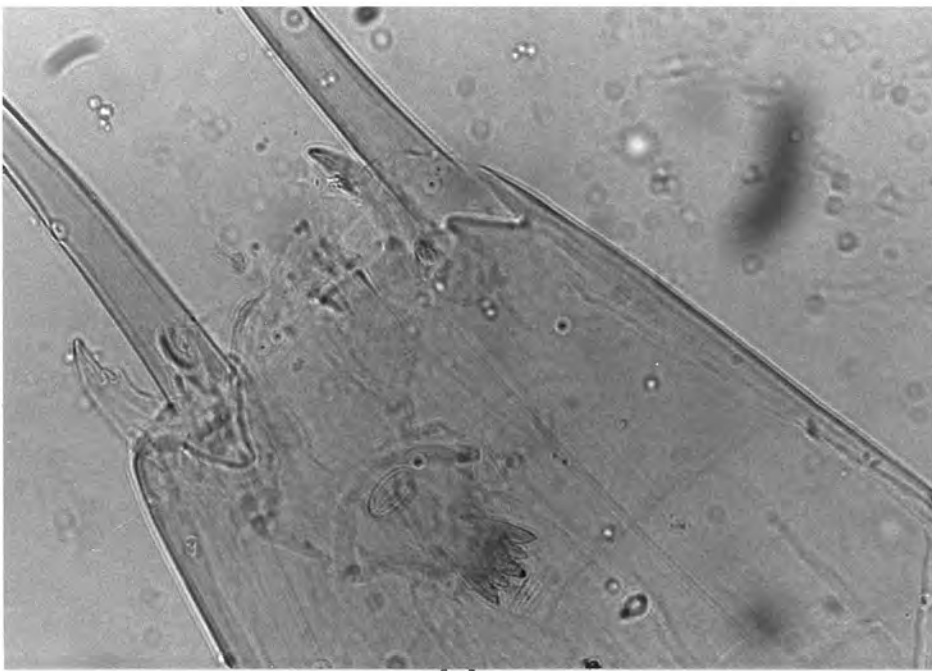
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Figure 7. Dorsomentum and mandible of *Natarsia*.

Figure 9. Ligula and pecten hypopharyngis of *Brundiniella*.

Figure 8. Dorsomentum of *Brundiniella*.

Figure 10. Dorsomentum, ligula, and pecten hypopharyngis of *Apsectrotanypus*.



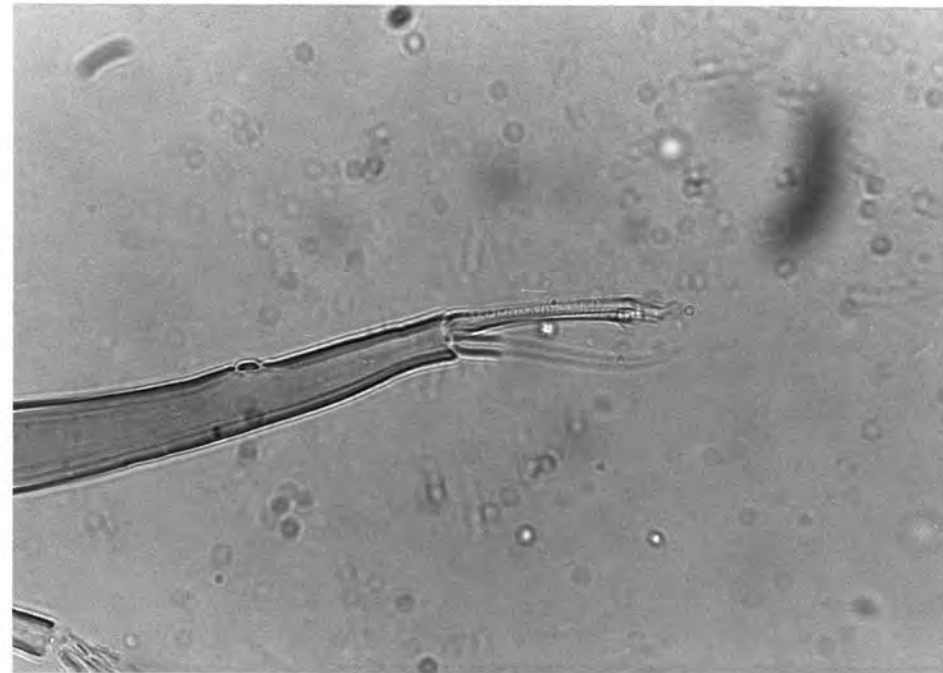
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Figure 11. Dorsomentum, ligula, and mandibles of Nilotanypus.

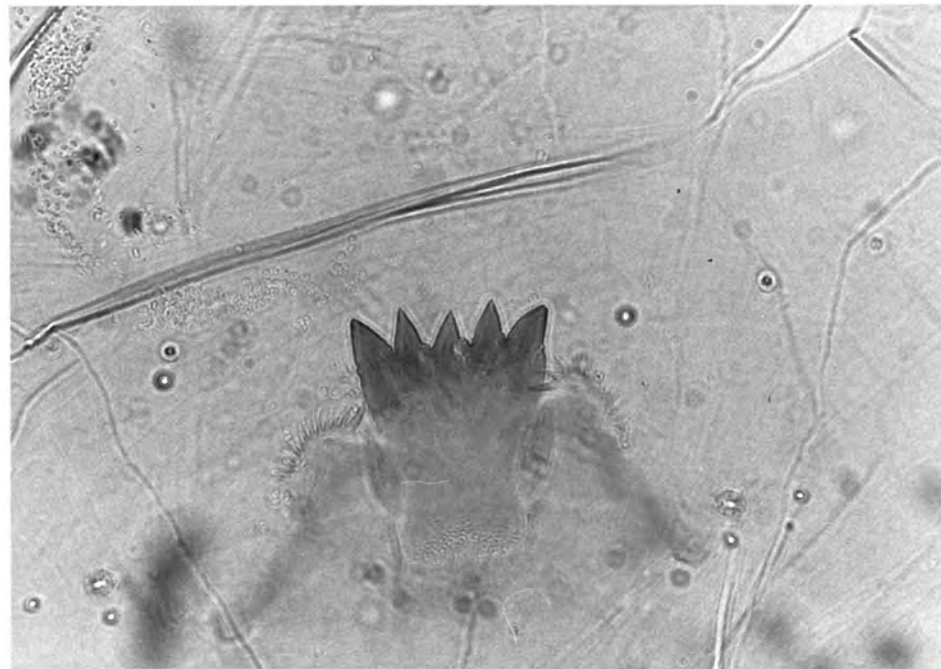
Figure 13. Mandible of Conchapelopia.

Figure 12. Ligula of Conchapelopia.

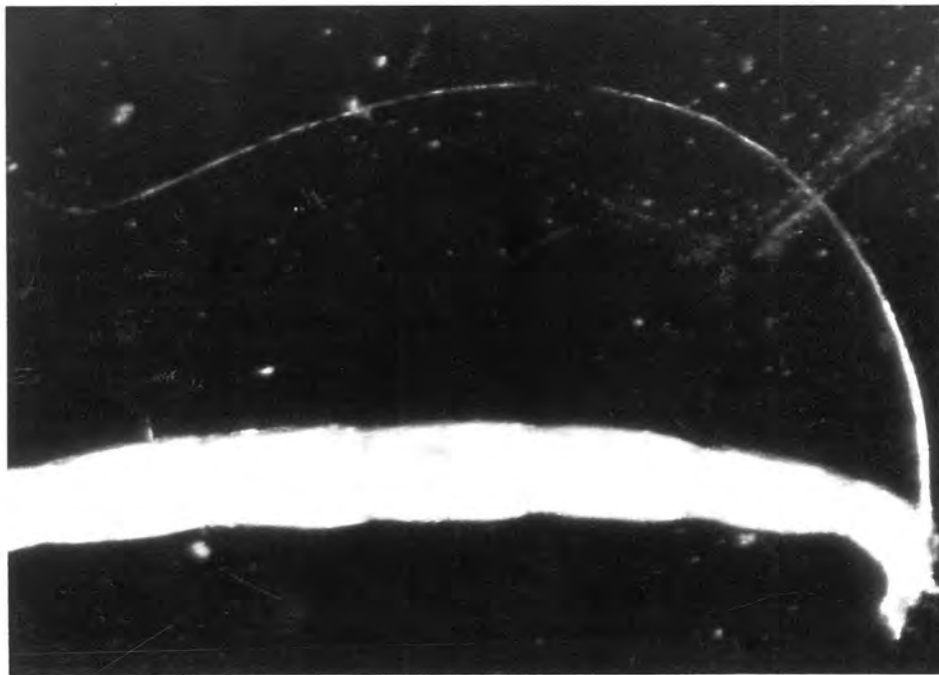
Figure 14. Annulate 2nd antennal segment of Conchapelopia.



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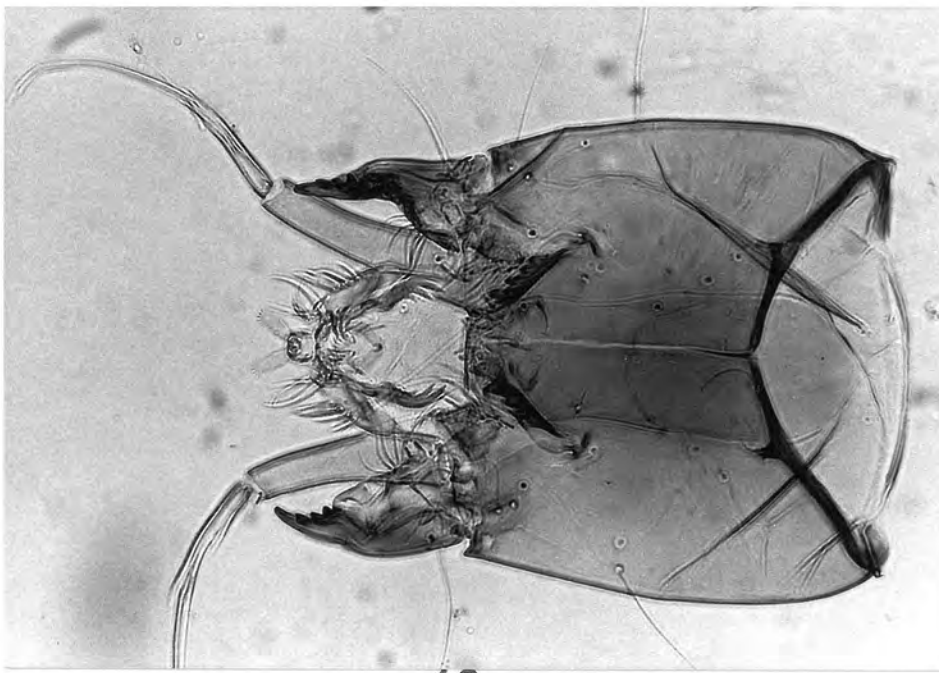
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Figure 15. Ligula and mandibles of Zavreliomyia.
 Figure 17. Anal setae of Krenosmittia.

Figure 16. Ligula of Natarsia.
 Figure 18. Antennae of Heterotanytarsus.



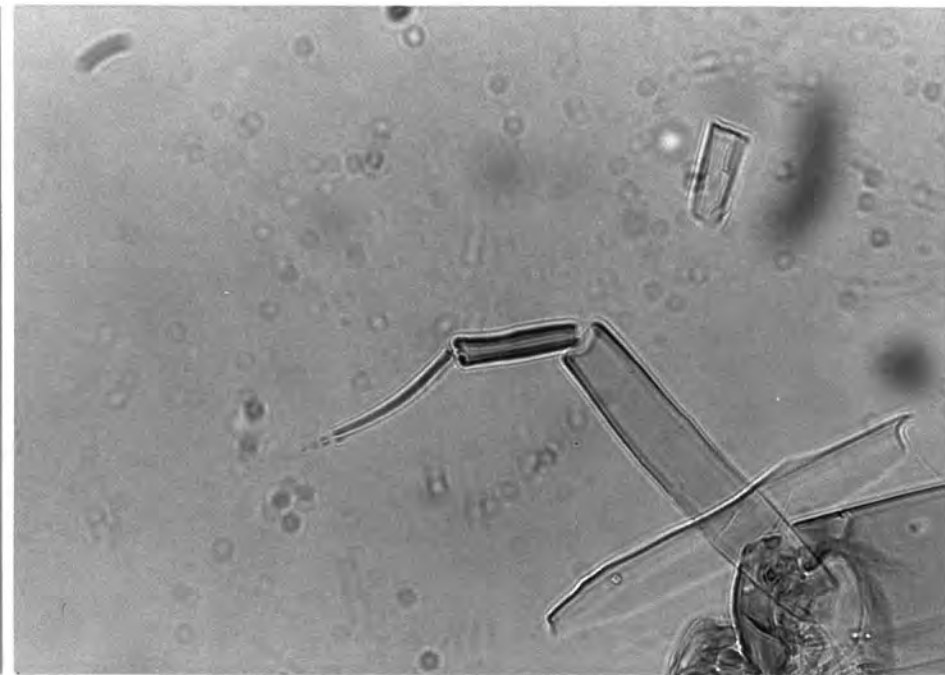
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Figure 19. Head capsule features of Heterotanytarsus.

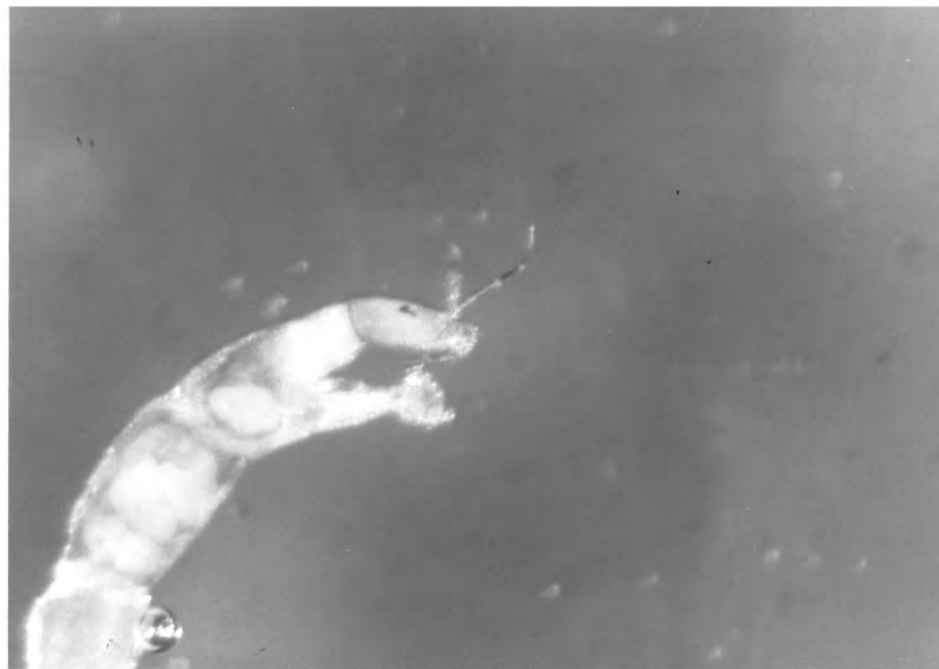
Figure 21. Antennae of Thienemanniella.

Figure 20. Mentum of Heterotanytarsus.

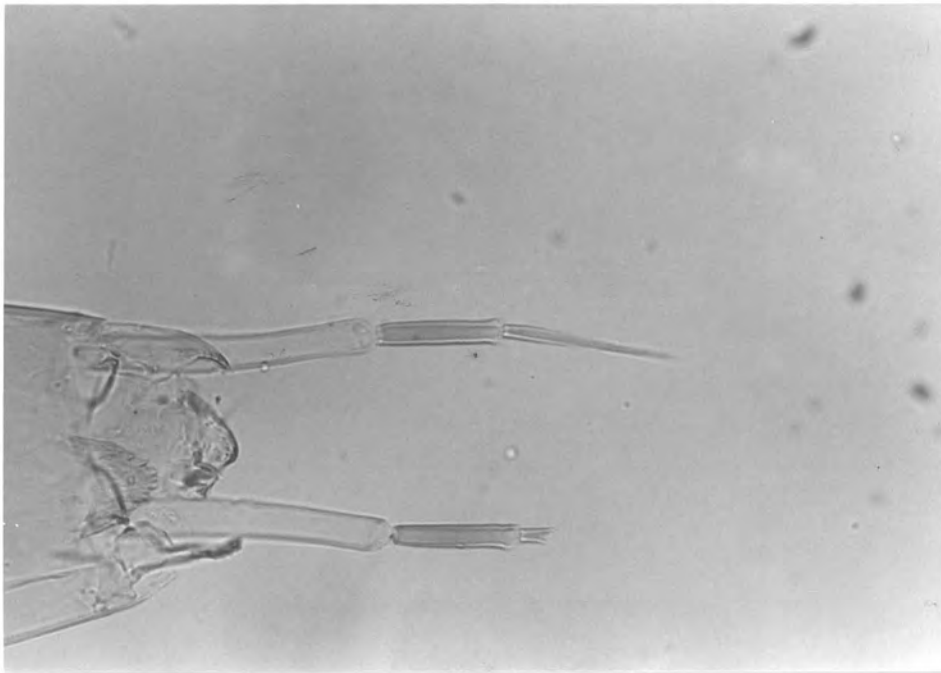
Figure 22. Antennal segments of Thienemanniella.



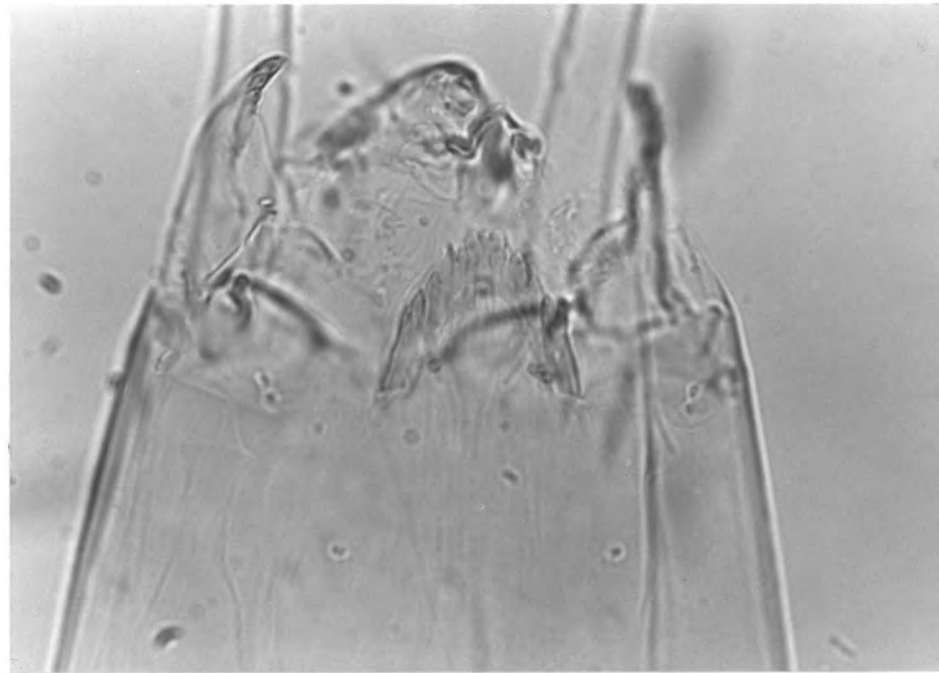
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Figure 23. Mentum of Thienemanniella.
 Figure 25. Antennal segments of Corynoneura.

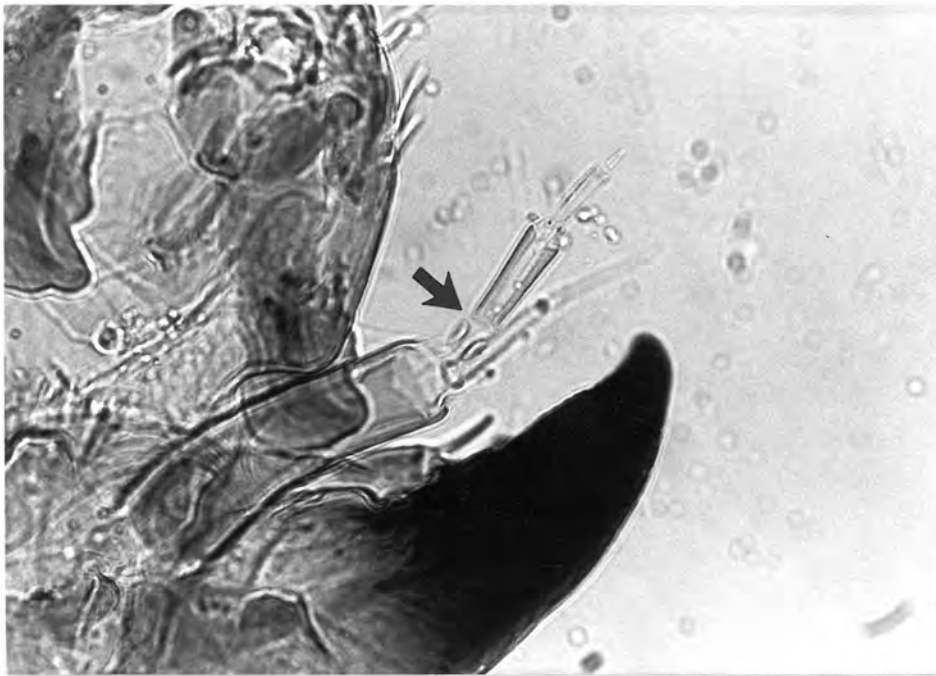
Figure 24. Antennae of Corynoneura.
 Figure 26. Mentum of Corynoneura.



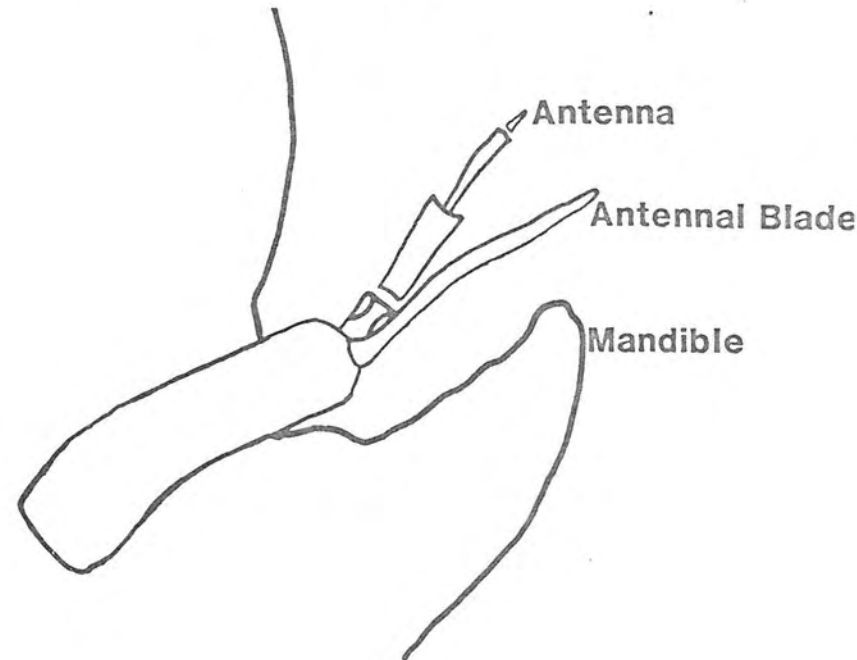
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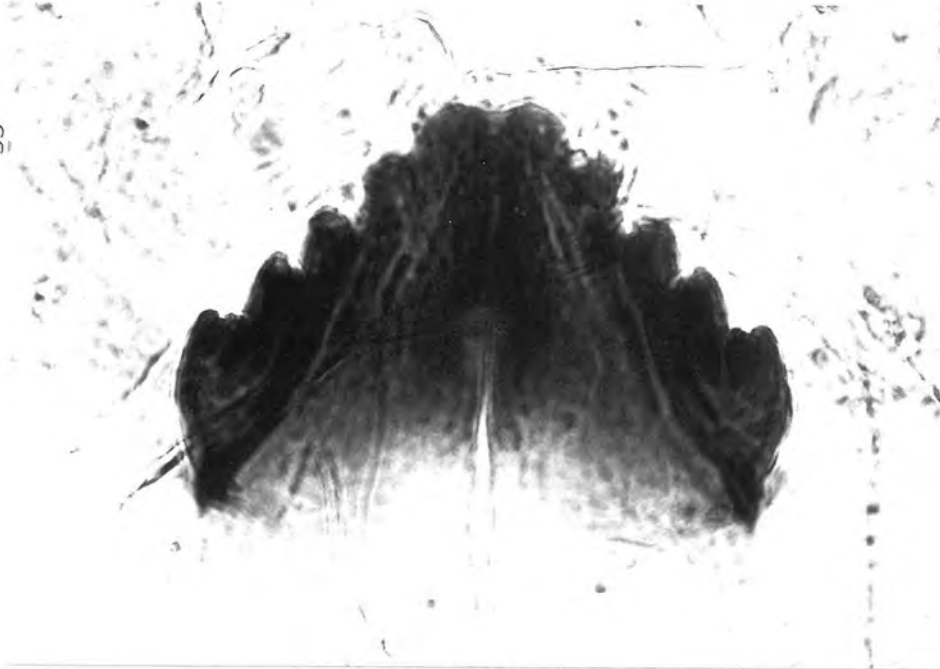
29b

Figure 27. Posterior parapod ventral basal spine of Thienemanniella.

Figure 29. Antenna and antennal blade of Brillia.

Figure 28. Posterior parapod ventral basal spine of Corynoneura.

Figure 29b. Antenna, blade and mandibles of Brillia.



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31



32



32b

Figure 30. Mentum of Brillia.Figure 32. Antenna of Heterotrissocladius.Figure 31. Antennae and mentum of Heleniella.Figure 32b. Antenna and mandible of Heterotrissocladius.

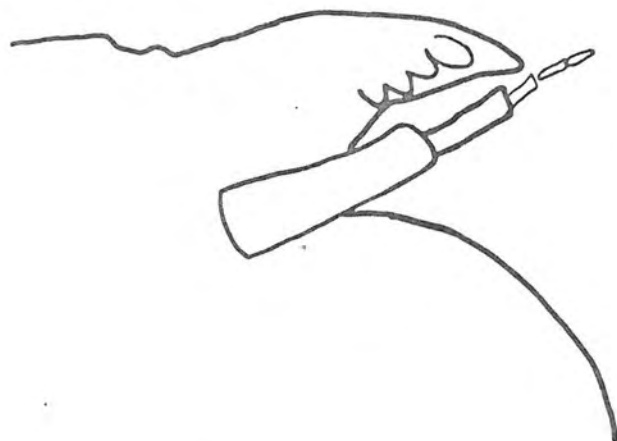
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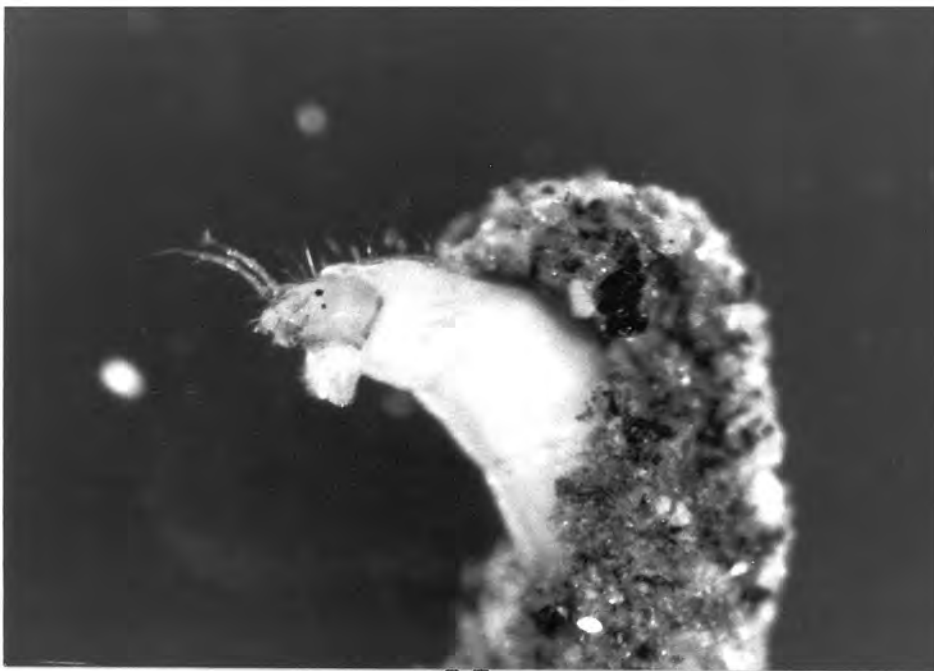
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Figure 33. Mentum of Heterotrissocladius.
Figure 34b. Antenna and mandible of Parametriocnemus.

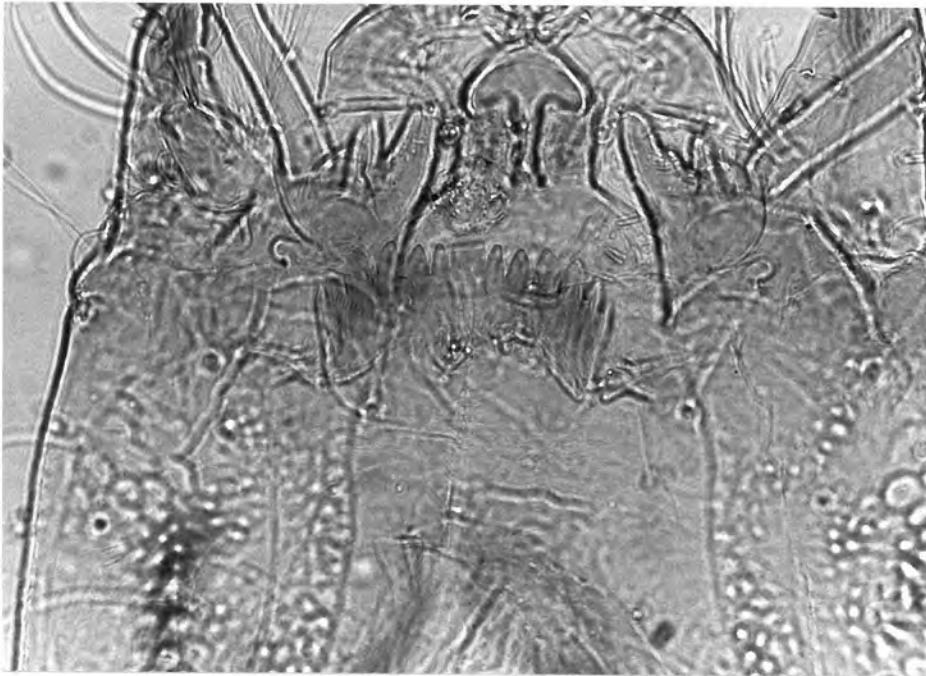
Figure 34. Antenna of Parametriocnemus.
Figure 35. Mentum of Parametriocnemus.



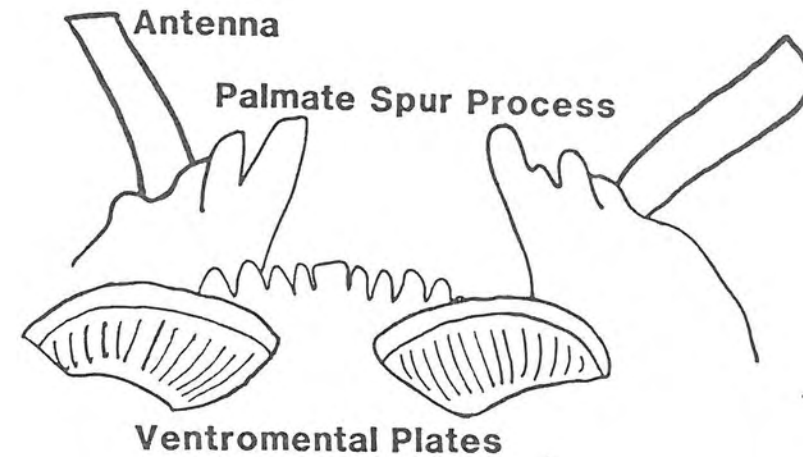
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38b

Figure 36. Antennae of Microspectra.
 Figure 38. Mentum and antennal palmate spur
 process of Stempellina.

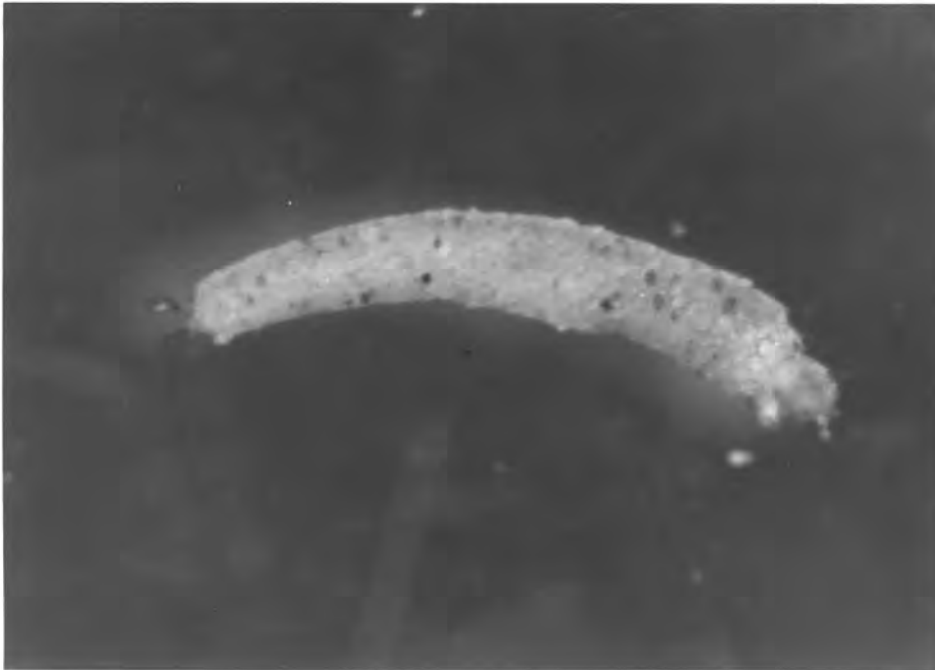
Figure 37. Antennae of Polypedilum.
 Figure 38b. Antennae, palmate process, and ventromental
 plates of Stempellina.



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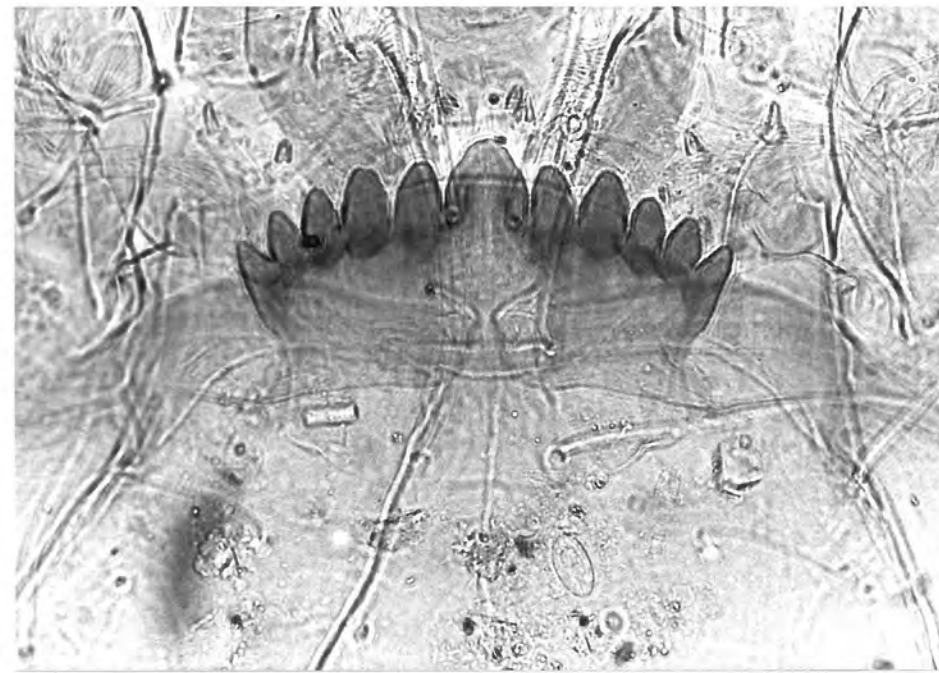
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Figure 39. Anal setae of Stempellina.
 Figure 41. Case of Stempellina.

Figure 40. Antenna of Stempellina.
 Figure 42. Mentum of Polypedilum species A.



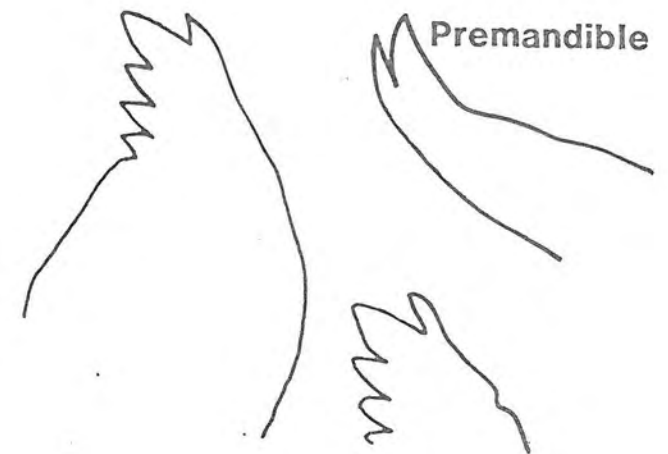
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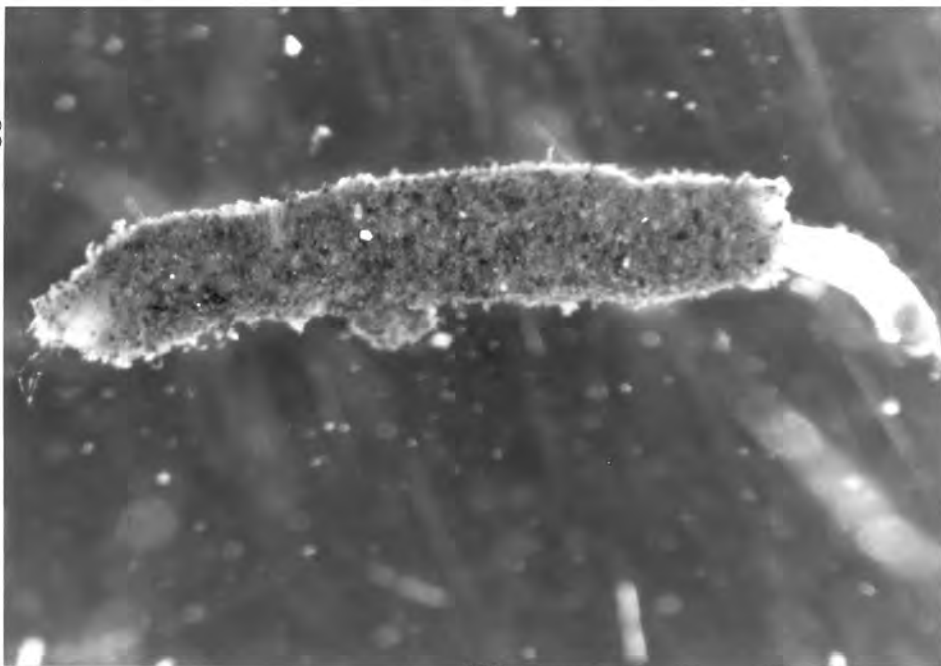
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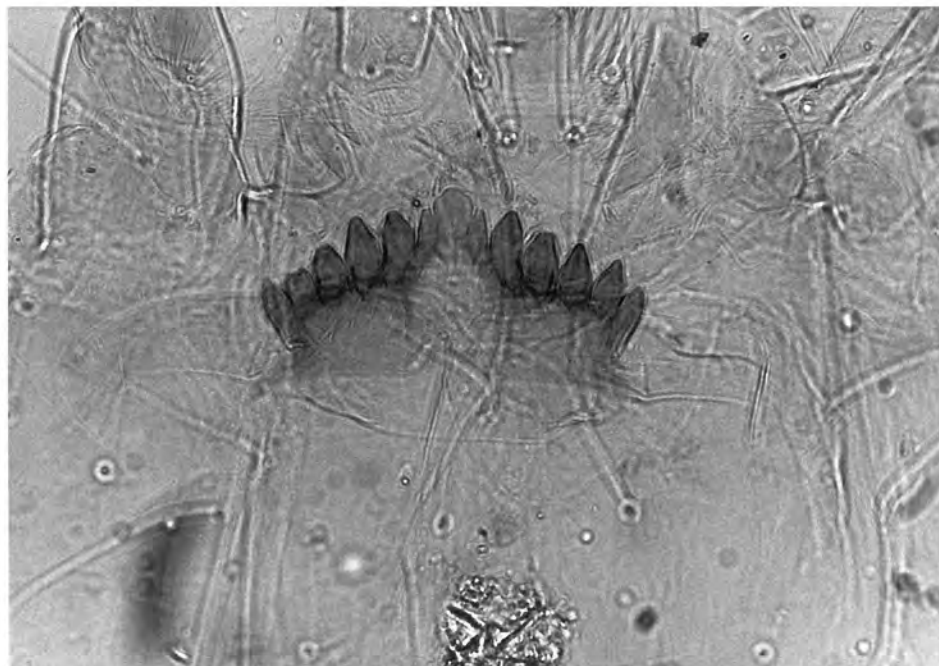
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Figure 43. Mentum of Polypedilum species B.
Figure 45. Premandible of Microspectra.

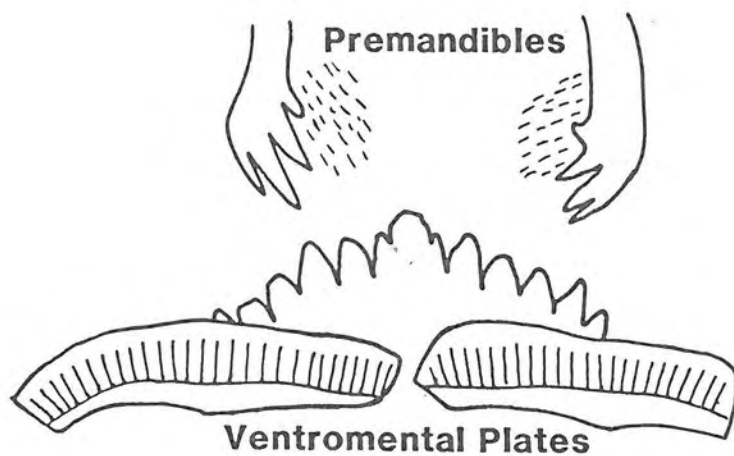
Figure 44. Mentum and ventromental plates of Microspectra.
Figure 45b. Mandible and premandible of Microspectra.



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47b



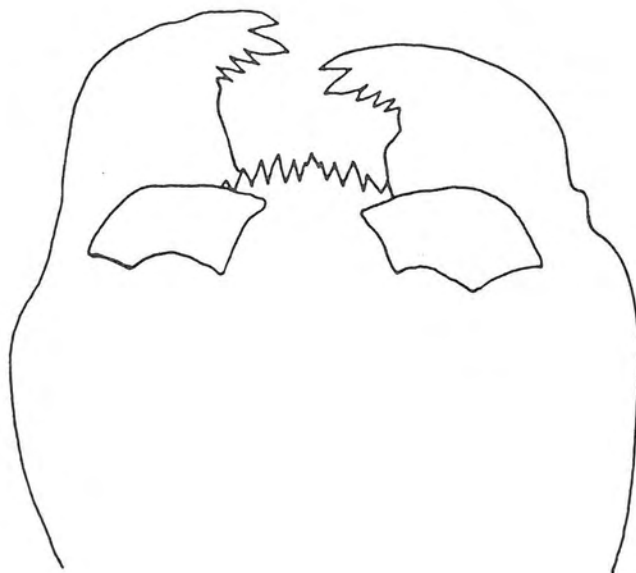
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Figure 46. Case of Tanytarsini.

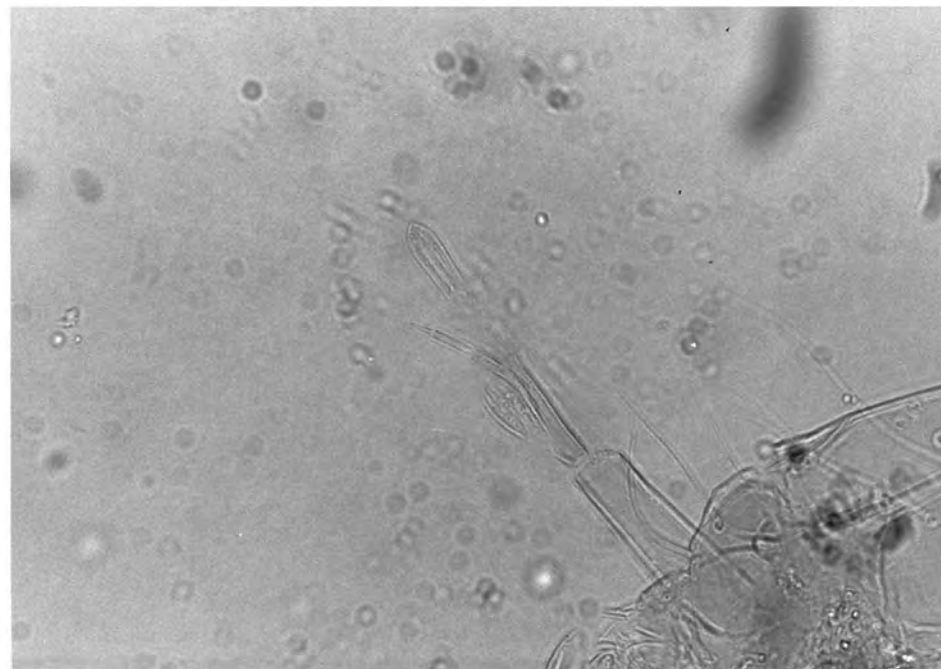
Figure 47b. Mentum, premandible, and ventromental plates of Tanytarsus.

Figure 47. Mentum, premandible, and ventromental plates of Tanytarsus.

Figure 48. Mentum and ventromental plates of Stempellinella.



48b



49



50



51

Figure 48b. Mandibles, mentum, and ventromental plates of Stempellinella.

Figure 50. Case of Stempellinella.

Figure 49. Antenna of Stempellinella.

Figure 51. Procercus of Boreochlus.

DISCUSSION

After examining the larval Chironomidae fauna of Boyes Creek, it is concluded that identification by gross morphology is not possible for all genera. Because of the great diversity, some chironomid genera inhabiting Boyes Creek have no characteristics that can easily and positively distinguish them from other members of the family. Subfamilies, Chironominae tribes and eight genera can be identified with few problems.

The Chironominae can be recognized by their two dorsal-ventral eyespots. The Tanytarsini tribe can be identified by their elongate antennae. The Chironomini tribe have shorter antennae and the eyespots are in closer proximity. Orthocladinae have a single eyespot or at times double posterior-anterior eyespots and short or long antennae. The Tanypodinae are diagnosed by their distinctive head capsule and retractile antennae. Boreochlus larva are easily recognized by the elongate, posteriorly darkened procercus, characteristic of the Podonominae.

In some instances, problems exist in separating subfamilies. The single Prodiamesinae representative, Monodiamesa has eyespots and antennae similar to the Chironomini tribe. The large size of the Monodiamesa larva, however, may be distinguishable. Early instars always pose a problem in invertebrate identification, since keys describe final instars. Young Chironominae often have "fused" eyespots, which render them very similar to the Orthocladinae. A certain amount of experience is valuable in diagnosing these early life stages.

Particular genera can be positively identified because of definitive characters, regardless of the stage of development. Among the Chironomini, Polypedilum can be recognized by the short antennae and simple anal setae. The black, palmate anal setae of Stempellina distinguish it from all other Chironomidae of Boyes Creek. The remaining genera of the Chironominae-Microspectra, Stempellinella and Tanytarsus are all Tanytarsini. Stempellinella may be recognized if found within the straight, fine grain sand case it inhabits.

Within the Orthocladinae, Krenosmittia can be easily identified by the long, dorsally directed anal setae. Heterotanytarsus is positively diagnosed by the long, unicolorous antennae. Thienemanniella and Corynoneura are distinctive among the Chironomidae because of the elongate antennae with darkened antennal segments. Heterotrissocladius may be recognized by a dark band on the dorsum of the head capsule, but this character seems to appear only in later instars.

The most difficult subfamily to morphologically separate into genera is the Tanypodinae. Apsectrotanypus and Brundiniella can be recognized by the more rounded head capsules.

The Chironomidae diversity demonstrated in Boyes Creek points to the probability that other genera reside in the stream that have not been previously collected. A light survey of other waters associated with the bypass monitoring project found a number of other chironomid genera that

were not described in this report. Eukiefferiella, Lopescladius, and Symbiocladius of the Orthocladinae and Microtendipes and Rheotanytarsus of the Chironominae were sampled in neighboring streams, but were not collected in Boyes Creek. Thus, chironomid faunas of neighboring creeks may vary enough that the Boyes Creek key could not positively identify larvae collected from other creeks. This key should therefore be used cautiously, and only to identify larvae collected from Boyes Creek. If a larva does not fit into the key properly, it is possible that the larva has not been described. It is recommended that such an individual be identified using previously mentioned references, then included in the Boyes Creek key.

Late instar larvae were desired for development of the key, but the exact stage of development of specimens was uncertain. The largest of the individuals were used for head capsule mounts. References to generic lengths in the text are sizes of chironomid larvae at periods of macroinvertebrate sampling in the spring and fall.

Species identification was uncertain and difficult. Rearing of larva was not a part of this study, so identification had to be completed with keys which may have described different species. It is also remotely possible that some chironomid species of Boyes Creek have never been described. Species literature was also difficult to obtain.

One reason for the lack of species knowledge is because the North American Chironomidae fauna includes many undescribed and undercollected species. In addition, some genera are being revised and redescribed (Saether, 1973; Saether 1975b; Oliver, 1981; Oliver, 1982; and Oliver and Roussel, 1983). Merritt and Cummins (1984) conclude that new taxa are to be expected from areas of North America that have been poorly collected.

Conchapelopia may represent an undescribed specimen. No chironomid key used in this report described a Tanypodinae genus as having annulations on the 2nd antennal segment. In describing most of the North American species of Conchapelopia, related subgenera and genera, Roback (1981) described similar striations, but on the blade of antennal segment 1. The distinct annulations on the 2nd antennal segment of this Boyes Creek specimen may distinguish it among other Conchapelopia species or from other Tanypodinae genera.

Identifying chironomids by head capsule mounts is an extensive process. Especially when coupled with the already comprehensive collecting, sorting and identifying of other aquatic macroinvertebrates involved with monitoring programs similar to the 101 bypass project. According to Hellawell (1986), family diagnoses is the limit of practical Chironomidae identification.

Using this key to morphologically identify subfamilies and certain distinctive genera of chironomids may allow for decreased diversities when conclusions are made concerning bypass macroinvertebrate faunas. The time saved, however, by using this key instead of identifying chironomids exclusively by head capsule mounts would be valuable and beneficial. Percent functional group classification should remain relatively unchanged. The Chironominae, Orthocladinae, Podonominae and Prodiamesinae are generally

classified by Merritt and Cummins (1984) as collectors, while the Tanypodinae are considered predators.

Although not able to identify all genera by their morphology, the key is valuable for larval taxonomy and most closely represents the Chironomidae of Boyes Creek. In addition, the report includes important and useful information on descriptions, distributions and the ecology of genera in this understudied family of aquatic insects.

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