A Key to the Pupal Exuviae of the Midges (Diptera: Chironomidae) of Everglades National Park, Florida

By Richard E. Jacobsen

Version 1.0

Scientific Investigations Report 2008-5082

U.S. Department of the Interior
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Suggested citation:
Jacobsen, R.E., 2008, A Key to the Pupal Exuviae of the Midges (Diptera: Chironomidae) of Everglades National Park, Florida: U.S. Geological Survey Scientific Investigations Report 2008-5082, 119 p.

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Conversion Factors

Multiply	By	To obtain
micrometer (µm)	0.0003937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.1	foot (ft)
kilometer (km)	0.6214	mile (mi)
square kilometer (km^2)	0.3861	square mile (mi^2)

Acronyms

ENP Everglades National Park
FIU Florida International University
WCA Water Conservation Area

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8x°C)+32

A Key to the Pupal Exuviae of the Midges (Diptera: Chironomidae) of Everglades National Park, Florida

By Richard E. Jacobsen

Abstract

A key has been developed for identifying the pupal exuviae of 132 taxa of chironomid midges collected in Everglades National Park, as well as 18 additional species from freshwater habitats adjacent to the Park. Descriptions and illustrations are based upon voucher specimens from extensive collections of chironomid pupal exuviae for faunal surveys and biomonitoring research conducted in Everglades National Park and surrounding freshwater areas from 1998 to 2007. The key includes taxonomic comments for confirming identifications, as well as brief summaries of the distribution and ecology of each species in southern Florida waters. Information is also provided on the morphology of chironomid pupal exuviae, recommended references for identifying pupal exuviae, techniques for making slides, and methods to confirm proper identification.

Introduction

The Chironomidae is a large family of true flies in the suborder Nematocera that are commonly called non-biting midges or midges. The family is more than 120 million years old (Cranston, 1995) and has undergone extensive adaptive radiation to occupy a wider range of microhabitats at present than any other aquatic insect group. Some of the adaptations that have evolved and unusual niches that they can exploit include the following:

- Hemoglobin with a high affinity for oxygen, enabling some species to survive in deep water or organically enriched habitats subject to periodic anoxia. Midges are often the only insects able to survive in highly enriched environments and have been found at depths of 1,700 m in Lake Baikal.
- The ability to survive in a wide variety of aquatic and terrestrial habitats.
- The ability to survive in cold, sub-zero environments.
- Resistance to desiccation, and in one species, even entering a cryptobiotic state upon drying that enables larvae to withstand temperatures from -270 to +102 °C.
- Tolerance of high salinity—Chironomids are one of the few insect families that have adapted to marine environments.
- Diversification of mouthpart morphology to enable feeding on algae, plant tissue, detritus, wood, sponge, food particles in suspension, the hemolymph of other insects, and predation on a variety of animals.
- Evolution of commensalistic and obligate parasitic relationships with other insects, sponges, mussels, turtles, and fishes.

Although many species live in coastal, marine, and terrestrial environments, the Chironomidae are most abundant and diverse in freshwater habitats. Chironomid midges typically represent about one-third of the insect species in most lakes and streams. It is not unusual to find more than 150 species in a stream or 50 species in a marsh or small pond. In Everglades National Park (ENP), more than 70 species have been collected from a single site (fig. 1).

Chironomid midges are excellent indicators of enrichment in lentic environments (Rosenberg, 1993; Lindegaard, 1995; Ruse, 2002), and are increasingly being used to assess other pollutants and environmental factors (Wright and others, 1996). Because of their high species richness, the great diversity of microhabitats that they occupy, and their wide collective tolerances for physical and chemical conditions, studying midges alone can be as effective as using a larger group of invertebrate taxa in bioassessment (Wright and others, 1996; King and Richardson, 2002). In a study of invertebrate communities in

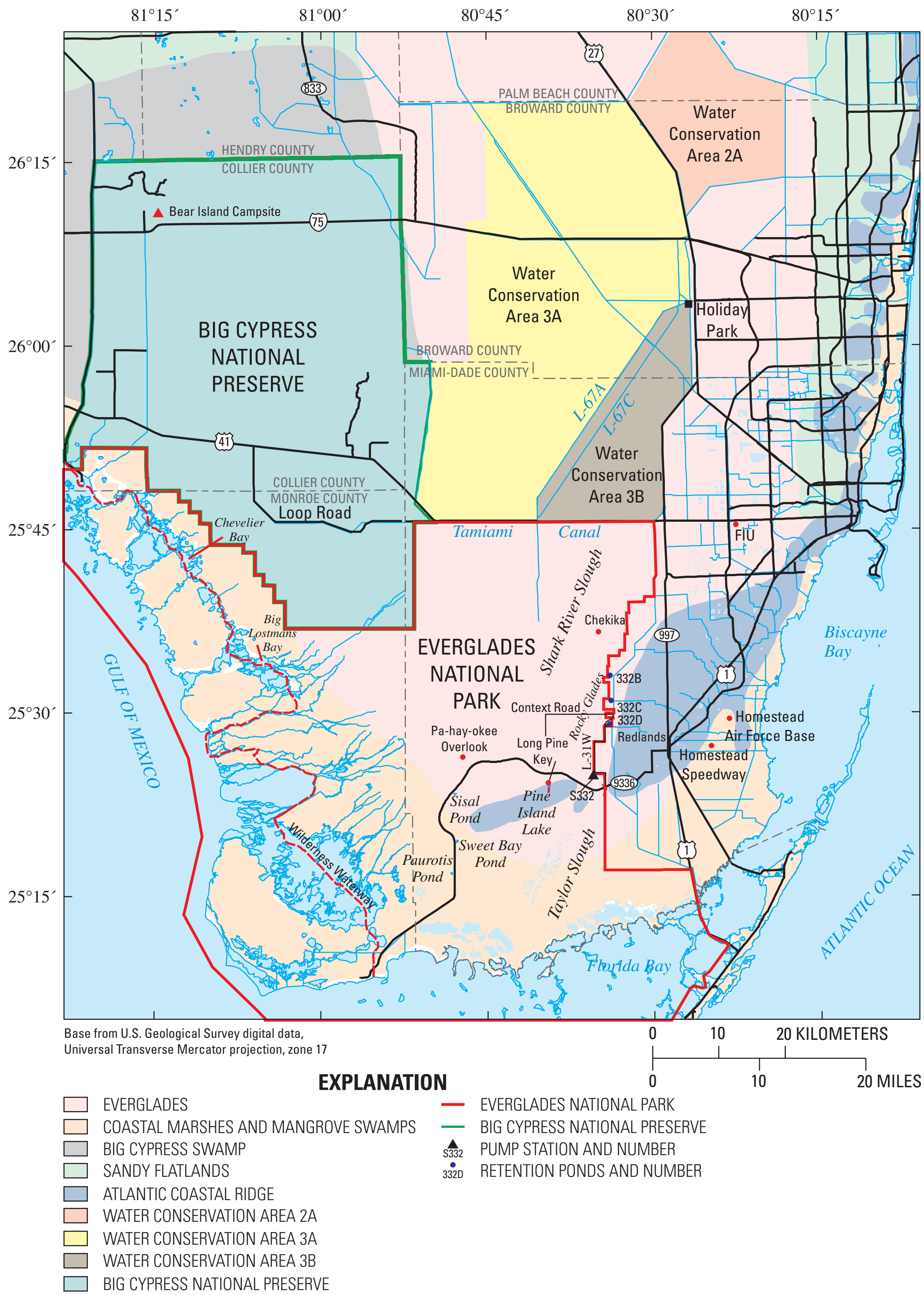


Figure 1. Southern Florida showing relevant landmarks, habitat types, and boundaries of Federal and State lands.

Water Conservation Area 2A (WCA-2A), chironomid midges were the largest single component of the invertebrate community, and were disproportionately more informative than other groups for assessing water quality (King, 2001). However, the difficulty and inefficiency of using conventional sampling techniques to sample and pick midge larvae, and the task of identifying larvae to species, remain an obstacle to their widespread use in biomonitoring programs.

Sampling midges by collecting their floating pupal exuviae is a very thorough, efficient, and relatively unbiased method of acquiring data on midge community composition (Ferrington and others, 1991; Coffman and Ferrington, 1996; Ruse, 2002). Collections of pupal exuviae represent emergence from all microhabitats simultaneously in a given area over a 1- to 2-day period. The process is highly efficient because samples typically yield large numbers of pupal exuviae and are relatively free of organic material, thereby reducing picking time. Pupal exuviae are transparent and can be mounted on slides and identified to species without special preparatory techniques to clear body tissue. An experienced researcher can readily identify many chironomid pupal exuviae to species using only a dissecting microscope. Consequently, a researcher can process and identify substantially more specimens of this insect family to the species level than would be possible by processing and identifying larvae retained in conventional benthos samples.

Pupal exuviae sampling is widely used by benthologists in Europe for studying chironomid distributions in relation to environmental variables and assessing water quality. For example, Great Britain has discontinued the conventional sampling methods previously used in its lakes assessment program in favor of this more efficient technique (Ruse, 2002; G.L. Ruse, Environment Agency, United Kingdom, oral commun., 2003). Biomonitoring programs using midge pupal exuviae sampling are also being implemented in Madiera and other Islands in Macaronesia (Samantha Hughes, Technical University of Lisbon, Portugal, oral commun., 2006). Few North American benthologists, however, are familiar enough with this collection method, or with the Chironomidae in general, to attempt pupal-exuviae-based research on midge populations or communities. A major impediment to pupal exuviae research in North America has been the lack of comprehensive or regional keys to species. The purpose of the current study, conducted by the U.S. Geological Survey, is to develop a reference key for identifying Chironomidae pupal exuviae in ENP and northern Everglades ridge and slough habitats. Hopefully, this key to Everglades Chironomidae pupal exuviae will stimulate greater interest in the family and in using pupal exuviae sampling as a biomonitoring technique.

Purpose and Scope

The purpose of this report is to provide a species-level reference key for identifying Chironomidae pupal exuviae in ENP and the northern Everglades ridge and slough habitats, as well as offer accompanying information useful for working with midge pupal exuviae. This key is based upon specimens obtained from more than 1,200 samples collected over a 9-year period (1998-2007). The key incorporates morphological identification characters for 132 distinct chironomid taxa (representing 136 species) from ENP and an additional 18 species from outside ENP. Further collecting will likely yield more species from the area, particularly in less-collected areas such as the mangrove habitats in the western part of ENP.

The majority of samples were collected from slough, wet-prairie, and karstic marl-prairie habitats (Gunderson and Loftus, 1993) throughout Shark River Slough and Taylor Slough—the major surface-water features within ENP. Additional series of samples were collected from brackish-water ponds and mangrove swamps along the ENP Wilderness Waterway, borrow pits and water held by bromeliads within ENP, and from canals and infiltration basins along the northern and eastern boundaries of the Park. Research conducted in Everglades marshes north of ENP, in Big Cypress slough habitats, and in canals, ditches, and borrow pits from residential areas east of ENP provided additional species that may also be present in ENP. These collections from outside ENP expand the effective spatial coverage of this key to include hard-water Everglades prairie and slough habitats north of ENP, prairie and slough habitats in Big Cypress National Preserve, and ponds, canals, and ditches in southern Miami-Dade County residential areas, as well as aquatic habitats within ENP.

Description of Study Area

The Florida Everglades is an extensive marsh ecosystem formed by the inundation of a shallow limestone depression over the last 5,000 years (Gleason and Stone, 1994). Historically, hydropatterns in the 10,000 km^2 Everglades marsh system were driven by highly seasonal rainfall patterns within the basin, and slow sheetflow from upstream marshes and Lake Okeechobee. The completion of the Central and Southern Florida Project, designed to regulate water levels and control flooding in southern Florida, has compartmentalized the northern Everglades into three large impoundments called Water Conservation Areas, and has enabled extensive agricultural and urban development to occur in northern and eastern parts of the system. The southern Everglades within ENP remains largely free flowing, but its hydrology is highly dependent upon water-management practices elsewhere in the region.

The principal landscape features of ENP include the low-elevation sloughs and sawgrass marshes that carry water southward into Florida Bay and the Gulf of Mexico, marl prairies and rockland pine forests at higher elevations in the Park, extensive mangrove swamps along the coastline, and the Florida Bay estuary. As noted earlier, Shark River Slough in the north, and the smaller Taylor Slough in the southeastern part of the Park, are the main surface-water features in ENP (fig. 1). The lowest-elevation sections of these waterways usually remain wetted throughout the year and support a mosaic of slough habitats composed of submerged (*Utricularia, Potamogeton*), floating (*Nymphaea*), and short emergent (*Eleocharis, Pontedaria, Sagittaria*) macrophyte communities on typically hydric, peaty soils. With increasing elevations and shorter hydroperiods, plant communities change from slough communities to wet-prairie communities (consisting of *Eleocharis, Rhynchospora, Panicum, Paspalidium*, and *Cladium*), to nearly monospecific *Cladium* stands with a 7- to 9-month hydroperiod (Gunderson and Loftus, 1993). Most slough and wet-prairie plant communities allow sufficient light penetration for extensive calcareous periphyton growth to occur; periphyton is usually sparse in *Cladium* stands because of shading.

Natural flow patterns in both Shark River Slough and Taylor Slough have been greatly altered by the Central and Southern Florida Project. Shark River Slough historically flowed southward across a 25-km segment of the Tamiami Trail before turning southwest toward the Gulf of Mexico. Canal and levee construction redirected most water flow into ENP farther to the west, resulting in lower water levels in the former main channel, now called northeast Shark River Slough (Loftus and others, 1990). Prior to drainage and canal construction, Taylor Slough was fed by rainfall, southerly sheetflow from northeast Shark River Slough, and runoff from the coastal ridge. Diminished water levels in northeast Shark River Slough, and canal construction and agricultural development in headwater areas, have reduced natural water delivery into Taylor Slough. Water levels in Taylor Slough are now artificially maintained by a system of canals, pumps, and detention ponds along the eastern edge of ENP.

The highest elevation marl-prairie marshes, also known as the Rocky Glades, have hydroperiods less than 7 months (Loftus and others, 1992) and typically have little hydric soil development. Solution and weathering of the exposed oolitic limestone bedrock have produced an uneven surface topography with shallow, patchy, calcitic soils found primarily in numerous solution holes and depressions. Marl-prairie plant communities are consequently diverse and patchy, with *Cladium jamaicense* Crantz often a co-dominant with *Schoenus nigricans* L., *Panicum tenerum* Beyr., *Spartina bakerii* Merrill, *Schizachyrium rhizomatum* (Swallen), and *Muhlenbergia filipes* M. A. Curtis (Gunderson and Loftus, 1993). During the wet season, bottom substrates and submerged plant stems also develop thick calcareous periphyton growth composed primarily of filamentous blue-green algae (Browder and others, 1994). Bordering the Rocky Glades along a part of the eastern boundary of ENP is a series of newly constructed infiltration basins, called detention ponds. Water is periodically pumped into these basins from the C-111 Canal and allowed to seep through the porous limestone bedrock to raise local ground-water levels. Plant communities differed between basins, and appeared to be undergoing rapid succession during the initial 1 to 2 years of operation.

Rockland pine forests are dominated by south Florida slash pine (*Pinus elliotti* Engelm. var. *densa* Little & Dorman), and support a diverse understory of plant species on patchy soils, including numerous endemic taxa (Gunderson, 1994). As in the marl prairie, hydroperiods are short (less than 5 months), soils are shallow, and dissolution of the limestone bedrock has created numerous karstic depressions and solution holes. Some of these solution holes are deep enough to hold water throughout the year and serve as refugia for fish and invertebrates. Insufficient water delivery has substantially lowered ground-water levels in the pinelands and marl prairies, and has reduced the number of permanently wetted solution holes in ENP (Loftus and others, 1992).

The mangrove forests along the coast represent an ecotonal transition between freshwater sloughs and marine environments. Surface-water sheetflow gradually becomes channelized as it passes through the mangrove zone, first into small streams and then into larger tidally influenced rivers and ponds near the coast. Within the mangrove forests along the southwestern ENP coastline is a 160-km small boat and canoe trail called the Wilderness Waterway. Productivity in the mangrove zone is high due to nutrient flux from both freshwater wetlands, and seasonally and tidally driven movement of marine waters. Furthermore, the physiognomy of mangrove and mangrove forests serves to retain coarse and fine particulate-organic material. Consequently, these forests provide ample organic mud, detritus, and wood substrates for invertebrates such as midges to occupy and feed upon (Nybakken, 1988).

Acknowledgments

This report was made possible through the assistance and support of numerous scientists and field technicians. Sue Perry (National Park Service) recognized the potential of midge pupal exuviae sampling as an effective bioassessment tool for the Everglades. Tom Van Lent (National Park Service), William Loftus (U.S. Geological Survey), and Joel Trexler (Florida International University) are thanked for their sustained support during later stages of midge research in the Everglades. Special appreciation is extended to William Loftus (U.S. Geological Survey) for his technical guidance on this project and for proofing this text. The author thanks Brian Banks (Audubon Society), Evelyn Artis, Teresa Embry, Rhonda Howard, Kimberly Swidarski, and Mike Deacon (U.S. Geological Survey), John Epler, and Broughton Caldwell for proofing earlier versions of the text.

The various landscapes within ENP are some of the most remote and inhospitable landscapes in the eastern United States in which to work. Transport requires either an airboat in slough habitats or a helicopter to access remote sites in the Rocky Glades.

The following people provided transportation for collecting within ENP: Mike Barron (HMC Helicopter Services, Incorporated), Omar Beceiro (National Park Service), William Loftus (U.S. Geological Survey), Eric Nelson (National Park Service), and Christine Taylor and William Van Gelder (Florida International University).

The author thanks the following people for their assistance in collecting chironomid specimens under the often hazardous conditions in the Everglades: Samuel Alvarenga, Carolina Ansani, Brian Banks, Omar Beceiro, Christophe Blanc, M. Cristina Bruno, Fernanda De Souza, Marcos Gomes, Kate Grenouillou, Jeff Kline, Anne Marie Labouche, Dan Levitis, Marcella Lima, Lorena Morales Gopar, Diogo Moreira, Thomas Mueller, Elizabeth Nance, Eric Nelson, Camille Peceaux, Giulia Sagnotti, Florian Veau, and Matthew Williamson. Brian Banks and Matthew Williamson also assisted in processing midge pupal exuviae samples in the laboratory and in data entry. Special thanks to Dan Levitis for collecting phytotelmata from fire-ant-infested bromeliads high in trees. Samples were collected along the Wilderness Waterway within the coastal mangrove zone by Dan Levitis and Thomas Mueller. William Coffman, John Epler, Michael Heyn, and Charles Watson greatly contributed to the accuracy of species determinations by examining pupal specimens.

The author was funded, in part, through Cooperative Agreement No. 5280-8-9015 from ENP to Kelsey Downum, Florida International University. Funding was provided by Critical Ecosystems Science Initiative Grants 5284-3807-388 and 5284-05-0011 of the National Park Service to USGS under management of Mike Zimmerman (National Park Service). Collections were made under Everglades National Park Collecting Permit numbers EVER-2004-SCI-0091, EVER-2005-SCI-0099, and Big Cypress National Preserve Collecting Permit number BICY-2007-SCI-0003.

Collection, Preparation, and Identification of Pupal Exuviae

This section presents techniques and suggestions to help researchers successfully collect, prepare, and identify midges. The first steps are to locate areas in aquatic environments where midge pupal exuviae accumulate, then sample by skimming or dipping. Collected specimens can be mounted on slides using one of several techniques, each of which are described and assessed herein. In most cases, one can use one or more of the taxonomic keys referenced in this section to classify a specimen to genus or species and verify its identification through cross-checking. Because chironomid taxonomy for North America is incomplete, however, suggestions are provided to minimize or eliminate uncertainty in the identification process. The section concludes with suggestions for rearing midges in order to successfully identify morphotypes for different life stages.

Sampling Midge Pupal Exuviae

Chironomid pupal exuviae are collected by repeatedly skimming the water surface with a pot or enamel pan, and pouring the captured exuviae and other flotsam into a fine-mesh sieve (125-µm mesh size) to concentrate the sample (Ferrington and others, 1991). After 5 to 10 minutes of sampling, the retained material in the sieve is transferred into a 500-milliliter container and preserved with 95 percent ethanol. If water bodies lack floating and emergent vegetation such as ponds, borrow pits, canals and stagnant ditches, the wind will push pupal exuviae to the leeward shoreline where they can be collected in large numbers. Repeated dipping along the shoreline, particularly where there is surface foam, film, or an accumulation of flotsam will usually yield large samples representing emergence over a large surface area. In streams and canals where there is a current, exuviae are best collected by skimming along shorelines and eddies, or around surface obstructions such as fallen limbs and boulders. Surface film, foam, or flotsam indicates areas where pupal exuviae are being retained and concentrated. Preliminary sampling is recommended in order to obtain a sense of how much sampling effort is required to collect a suitably sized sample. In water bodies where pupal exuviae are being concentrated by wind or obstructions to current, 5 to 10 minutes of sampling will typically yield sample sizes ranging from several hundred to tens of thousands of midge pupal exuviae.

Marshes with extensive emergent vegetation inhibit the leeward movement and concentration of exuviae. However, samples are highly representative of emergence in the area sampled, which is useful for assessing midge communities in specific areas of the marsh. In such situations, sampling requires repeated dipping around and against vegetation to dislodge any exuviae adhering to plants. Five to 10 minutes of skimming the surface will typically yield samples containing several hundred to several thousand pupal exuviae. Where vegetation is sufficiently dense to effectively stop wind-generated movement of exuviae, one can take quantitative samples of pupal exuviae using enclosures to calculate numbers per unit surface area. Quantitative sampling can be performed over a large part of the Everglades because emergent vegetation and floating periphyton are sufficiently dense in slough and wet-prairie habitats.

Slide Preparation

The needed equipment and mounting media are described in Epler (2001). Euparal was used in the current study because the resulting slides are permanent. Although temporary mounting media can be convenient for processing samples, the mounts often develop air fingers or turn cloudy. Because pupal exuviae do not require clearing of body tissue, specimens can be placed immediately into 95 to 100 percent ethanol after picking. If euparal is used, specimens must be immersed in 95 to 100 percent ethanol before making slides. Water does not mix with euparal, and excess water will turn specimens cloudy and obscure viewing. In addition, because euparal dries slowly, care is necessary when handling recently prepared slide mountings. To avoid ruining mounted specimens by routine handling, place newly prepared slides in a drying oven at 50 to 60 °C or on a slide warmer for a few days using a low heat setting. Slides should be checked occasionally, and extra euparal added if air fingers begin to develop under the coverslip.

Several techniques are useful for mounting pupal exuviae. The simplest and fastest technique is to mount the entire specimen with its dorsal surface upward. This approach can be problematic, however, because structures on the abdominal segments and on the cephalothorax may be obscured by other overlapping parts of the exuviae. Additionally, the frontal apotome (fig. 2), which is important for identifying many species, does not face upward and is more difficult to view and interpret.

To partially overcome this problem of overlap, spread the thorax by fully opening up the dorsal suture (fig. 2) with fine-tipped forceps or minuten pins and then mount the exuviae ventral surface upward. This method is quick and easy, and the frontal apotome will face upward. However, there often is some overlap of the wing pads on the abdominal segments, and the abdominal segments are mounted ventral side up instead of dorsal side up, which is preferable for observing point and spinule fields (called shagreen, fig. 3B) on the dorsal tergites. This is acceptable if one is experienced working with chironomid pupal exuviae and is only processing samples.

The best technique to expose almost all structures and have them facing upward for viewing is to: (1) separate the cephalothorax from the abdomen, (2) spread the cephalothorax, and (3) mount the cephalothorax with the outer surfaces facing upward and the abdomen with the dorsal surfaces facing upward. Although difficult at first, this method becomes easier with practice. This method is recommended for mounting voucher and other important specimens, and for all but the smallest specimens during sample counts. The detailed procedure is as follows:

- Add an appropriate amount of euparal to the microscope slide and place the pupal exuviae specimen (that has been soaking in 95- to 100-percent ethanol) into the drop of euparal.

- Beneath a quality dissecting microscope, break the adhesions between the wing pads and the first abdominal segment with forceps or fine needles before removing the abdomen from the thorax (fig. 2). This is done by “pulling” the wing pads away from the abdomen on each side of the body. If one tries to remove the abdomen without first breaking these adhesions, either parts of the first abdominal segment break off and remain attached to the wing pads, or the wing pads tear and remain attached to the abdomen.

- Separate the abdomen from the cephalothorax. Lightly press both tips of the forceps on the anterior part of the 1st abdominal segment while holding the cephalothorax with a probe or forceps in the other hand, and pull the abdomen away from the cephalothorax.

- Open up the cephalothorax by sliding a needle or forceps down the dorsal suture, and spread the cephalothorax fully open.

- Turn the cephalothorax over so that the outer surfaces of the cephalothorax are now facing upward. Additionally, turn the abdomen over so that the dorsal surfaces are facing upward.

- Align the cephalothorax 1 or 2 mm below the abdomen so that the two do not overlap.

- Apply a cover slip as follows: (1) take a clean cover slip and dip the lower surface in 95-percent ethanol using forceps; (2) touch the edge of the cover slip quickly on an absorbent surface to remove excess alcohol; (3) lower the cover slip onto the specimen at an angle to prevent trapping bubbles underneath the cover slip; and (4) apply pressure to cover slip if necessary to spread the exuviae or remove any large bubbles that may be trapped under the cover slip. Small bubbles will dissipate over time.

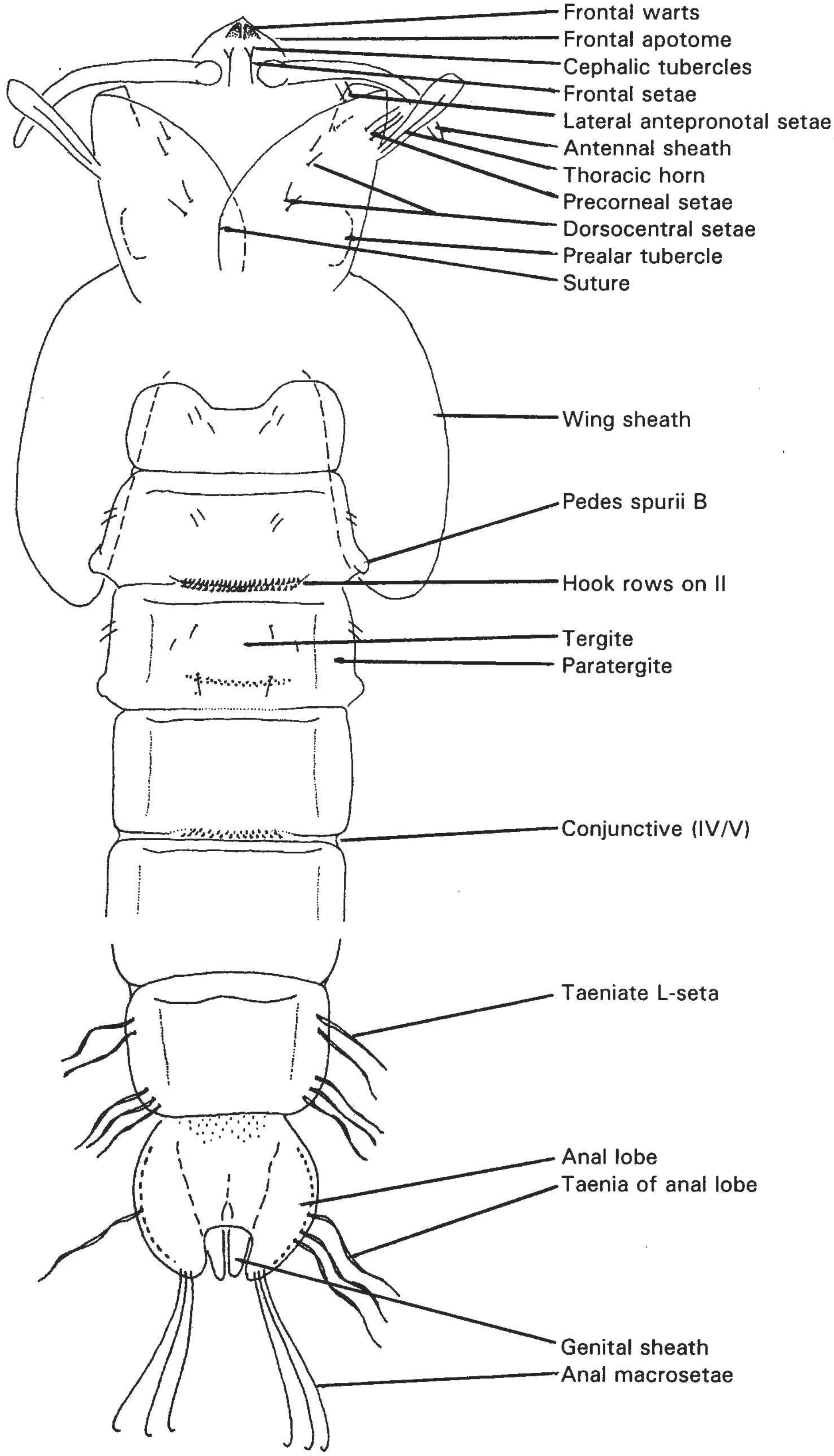


Figure 2. Morphology of Chironomidae pupal exuviae (modified from Langton, 1991).

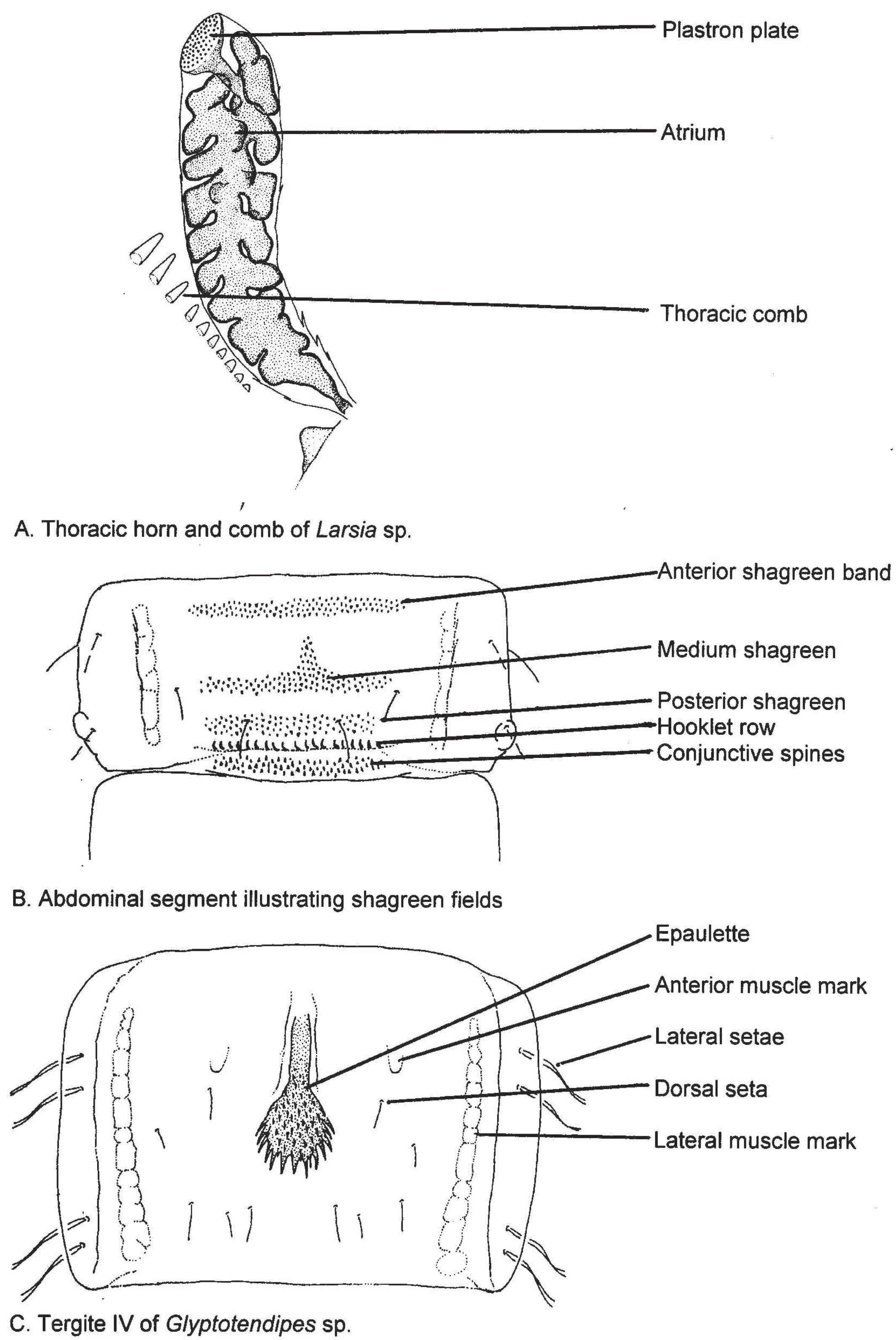


Figure 3. Enlarged views of (A) thoracic horn and comb of *Larsia* sp., (B) abdominal segment illustrating positions of shagreen fields, and (C) tergite IV of *Glyptotendipes* sp.

References for Identifying Pupal Exuviae

A comprehensive introduction to midge identification is provided in "Identification Manual for the Larval Chironomidae of North and South Carolina" (Epler, 2001), which includes a thorough discussion of identification and slide mounting techniques for larvae that is also applicable to making pupal exuviae slides. The guide further describes chironomid nomenclature and how to use keys for those new to identifying midges. Epler (2001) also discusses the "reality" of identifying midges properly, including the importance of obtaining reared or otherwise associated life stages of species, and maintaining a voucher collection that has been verified by experts. Reviewing the introduction to Epler (2001) is a recommended prerequisite to using this manual.

Epler (2001) provides lists of taxonomic references for each genus that can be used to help identify specimens to species. The guide briefly summarizes the taxonomic status of each genus and notes where revisions are needed to incorporate the numerous species that have been collected, but that have not yet been described. Additional information on chironomid taxonomy, including new keys, species descriptions, and corrections to existing keys are available at *http://home.comcast.net/%7Ejohnepler3/index.html* (accessed March 2008).

Other references for identifying chironomid pupal exuviae include Coffman and Ferrington (1996), Wiederholm (1986), and the Tanypodinae series by Roback (1976, 1977, 1978, 1980, 1981, 1985, 1986a, 1986b, 1987). The present report covers a limited geographic area, and taxa not included in this report may be present in Everglades marshes outside of ENP. Therefore, having these references readily available allows for cross-checking and verifying generic identifications. Both Coffman and Ferrington (1996) and Wiederholm (1986) have certain limitations in their coverage of southern Florida fauna. Coffman and Ferrington (1996) is problematic for identifying certain taxa to the genus level, including species in *Apedilum*, *Einfeldia*, *Endotribelos*, *Goeldichironomus*, *Kiefferulus*, *Manoa,* and *Phytotelmatocladius*. Wiederholm (1986) does not include *Apedilum*, *Beardius*, *Denopelopia*, *Manoa,* and *Phytotelmatocladius* because these genera either had not been created yet, or were not known to exist in the Holarctic Region.

Langton and Visser (2003) have written a comprehensive key to the midges of western Europe that is a revision of the Langton (1991) key to European chironomid pupal exuviae. Because many species in North America also occur in Europe and Asia, this reference serves as an informative cross-check for these Holarctic species, as well as a larger reference for showing the breadth of variation within a genus.

Other references include online guides to the midges of Australia and southeast Asia (Cranston, 2000). Although these are not very useful for identifying North American midges, they are useful in showing the types of variation that exist within chironomid genera.

Confirming an Identification

Considerable progress has been made on the taxonomy of Chironomidae in North America during the past few decades. At present, it is possible to identify most midge pupal exuviae to the genus level using Wiederholm (1986), Coffman and Ferrington (1996), and the key in the current report. However, many species remain undiscovered or undescribed, even in Florida, where the fauna is relatively well known. Additionally, the larvae and pupae for many species described as adults are either unknown or unassociated. These gaps in our knowledge create a degree of uncertainty in identifying any particular larval, pupal, or adult specimen to species for someone using any key for North American Chironomidae. Epler (2001) states, "If you start to key something, that something will end up somewhere in the key—but that doesn't mean you've identified it correctly." To minimize or eliminate this uncertainty when identifying midges:

- Check your generic identification with keys in Coffman and Ferrington (1996) and particularly with the keys and diagnoses in Wiederholm (1986). Both keys are useful for verifying most genera, with the exception of a few genera (previously discussed) that are problematic.
- Create a voucher slide or series of slides for every species, or morphospecies encountered.
- When more than one species is acquired for a genus, describe and/or illustrate what differentiates each of the various species collected in that genus.
- Review sample specimens against voucher specimens frequently to ensure sample specimens are correctly identified.
- Rear larvae to acquire associations of larvae, pupae, and adults (or larvae and pupae).
- Prepare slides of associated life stages. Place only the associated life stages of an individual midge on a single slide. Never mount a larval exuviae of one individual with pupal exuviae of another individual on the same slide. This creates the false impression that the two life stages are associated.
- Submit your voucher collection to an experienced Chironomid taxonomist for verification of your identifications.

Rearing Midges

The best way to become familiar with the identity of larval, pupal, or adult morphotypes is to rear larvae to adulthood. The basic methods for rearing larvae are provided in Epler (2001). To select individuals for rearing, look for mature 4th instar larvae with enlarged 1st-3d abdominal segments and developing eyes, indicating that the larva is close to pupating. If only immature 4th instars are present in a sample, some algal or detrital food and some form of aeration may need to be provided to prevent water stagnation and death of larvae. One aeration method is to cut small holes in the side of a small plastic rearing cup, cover the holes with fine screening, and place the rearing cup in an aerated aquarium. To rear small Tanypodinae, it may be necessary to provide small oligochaetes, such as naidid worms, for food. These methods can be modified to suit a particular situation. For example, midges associated with stoneflies must be reared in screened cages placed in moving water to provide sufficient current for survival of the stonefly host.

Rearing midges provides the best opportunity for developing expertise in identifying all life stages. Identification of one life stage can be readily cross-checked by identifying the other associated stages. Many of the identifications in this manual are based on associating the pupal stage with the larval stage or the adult stage, both of which are more often described in the literature, and with greater detail, than the pupal stage. For example, the identity of the pupa *Dicrotendipes* sp. A was determined by collecting a pupal exuviae with an attached larval exuviae. Epler (2001) has illustrated and keyed the larva of this undescribed species in his manual. In rearing larvae of *Labrundinia* sp. 6 (Roback, 1987), the pupa was determined to be the same as Roback's *Labrundinia* sp. 10; that is, *Labrundinia* sp. 6 and sp. 10 were different life stages of the same species. Solving a taxonomic puzzle through rearing can be a rewarding aspect of midge taxonomy. Species encountered in abundance are occasionally determined to be undescribed species, which has been the case for many common Everglades midge species. Through consistent rearing, and slide mounting of reared associations, a valuable taxonomic reference collection can be assembled over time.

Pupal Morphology

The terminology used in this key largely follows Sæther (1980) and Langton (1991; 1995). Terminology in Langton (1991) has been used for specific structures not mentioned in Sæther (1980), and the Langton (1994) suggestion has been followed that the terms "taeniae" and "taeniate" be used instead of "filamentous" in describing the flattened setae common on the anal lobes, abdominal segments, and other areas of the pupa. The following account and figure 2 closely follow Langton's (1991) description of pupal morphology.

Head

At the moment of eclosion, the pharate adult (enclosed in the pupal exuviae) emerges by splitting the cephalothorax along a Y-shaped mid-dorsal <u>suture</u>, thereby releasing a flap of cuticle over the dorsum of the head called the <u>frontal apotome</u> (fig. 2). This cuticle usually falls forward in slide-mounted specimens, and locations of structures on the frontal apotome described herein are in reference to this forward-lying position. The frontal apotome often has a pair of setae called <u>frontal setae</u> located between or just anterior to the bases of the antennal sheaths. The frontal apotome may have one or two pairs of rounded, conical or wart-like tubercles. If only one pair of tubercles is present, they are called <u>cephalic tubercles</u>. In some species, the cephalic tubercles may be partially fused together medially to form a U- or H-shaped ridge. If two pairs of distinct tubercles are present, the posterior pair are the cephalic tubercles and the anterior pair are called <u>frontal warts</u>. The area posterior to the antennal sheath bases is called the <u>praefrons</u>.

Thorax

A pair of respiratory structures (called <u>thoracic horns</u>) is often present along the anterolateral surfaces of the thorax. These structures vary greatly between subfamilies and genera, and even within genera. In the Tanypodinae, each thoracic horn usually has a large dark basal chamber called the <u>respiratory atrium</u> (fig. 3A). Often arising from the respiratory atrium, and usually at the end of slender to stout neck, is a plate with openings called the <u>plastron plate</u> (fig. 3A). Some Tanypodinae have a bulbous atrium that fills each thoracic horn, and instead of having a plastron plate, the thoracic horn ends in a nipple-shaped tubercle. The Orthocladiinae have either a small, simple, round, digitate, digitate-serrated, or pointed thoracic horn, or they may lack a thoracic horn entirely. Tribes within the Chironominae also show considerable variation in thoracic horn structure. Pseudochironomini have either a stout, bulbous or forked thoracic horn, or an enormous elongate thoracic horn with conspicuous tracheal tubes running along its internal surface (*Manoa pahayokeensis*). Tanytarsini typically have a slender, elongate thoracic horn that extends beyond the thoracic suture, often beset with setae or spines. However, two Tanytarsini species have no thoracic horn (*Cladotanytarsus acornutus* and *Paratanytarsus grimmii*), and other species have only a short digitiform or fusciforme thoracic horn. The Chironomini either have a thoracic horn with 2 to 14 branches, a complex branching thoracic horn ending in a plumose mass of fine filaments, or a combination of a simple stout branch and plumose branches.

Near the base of the thoracic horn (fig. 3A) in many Tanypodinae is a row of tubercles or spines called the thoracic comb. The color pattern of the thorax along the dorsal suture is also helpful for separating certain species within the genus *Ablabesmyia*.

At the base of the thoracic horn in most Chironominae and Orthocladiinae are three setae called the precorneal setae (fig. 2). Along the anterior margin of the thorax (called the antepronotum) are the antepronotal setae, which are divided into the median antepronotal setae, and the more ventrally positioned lateral antepronotal setae. Ventral to the dorsal suture between the thoracic horn and base of the wing sheath are a set of setae called the dorsocentral setae (Dc). Some species have a small tubercle anterior to the base of the wing sheath called the prealar tubercle (posterior thoracic mound of Langton, 1991). *Cryptochironomis psittacinus* has a prominent pointed tubercle anterior to the prealar tubercle and posteroventral to the base of the thoracic horn that is called the postcorneal tubercle in this report.

The wing sheaths often have a subapical nipple-like protuberance called the nase or nose. Occasionally, a wart-like or nipple-like tubercle is present on the anterior margin of the wing. The apical margin of the wing sheath may have one or two rows of small tubercles called pearl rows. The pattern of pigmentation on the wing sheath is often very helpful in determining species identity.

Abdomen

The abdomen (figs. 2 and 3B-C) of midge pupae is composed of nine visible segments that are referred to in the key with roman numerals (I-IX). On the dorsal surface of segments I-VIII is a median plate called the tergite, and it is bordered laterally by the paratergites. The ventral surfaces of segments I-VIII are likewise comprised of a central sternite and two lateral parasternites. The paratergites and parasternites are joined by the membranous pleuron, which bear the lateral setae, some of which may be flattened or “taeniate.” Abdominal segments are connected by intersegmental membranes called conjunctives that are designated by the segments they connect. For example, conjunctive III/IV is between segments III and IV. Segment IX is comprised dorsally of tergite IX and the flattened peripheral anal lobes. The anal lobes often have a fringe of taeniate setae emanating from their ventrolateral surface, and/or prominent hair-like, taeniate, or spine-like setae on the lateral dorsolateral or posterior surface called the macrosetae. The ventral surface of segment IX lacks a sternite, but instead is comprised of membranes covering the genitalia called the genital sheaths, which in males, may extend beyond the anal lobe.

The surfaces of tergites and sternites are beset with a variety of tubercles, points, teeth, spinules, spines, and shagreen. According to Langton (1991, p. iv), “Tubercles are rounded, teeth and points are conical (or appear conical to flat triangular), spines and spinules are elongate. Teeth are larger than points, spines are longer than spinules.” These terms are relative in that the same sized projection may be a spine on the exuviae of a small species but would be a spinule on a large species. Shagreen is a field of points or spinules. Often within a shagreen field, points, teeth, spinules, and spines will vary in size and grade from one projection type to another. Shagreen points or spinules may be arranged in short rows called group shagreen; when arranged in a crescent, they are called scale shagreen.

In *Glyptotendipes* (fig. 3C), some tergites have anteromedian, mace-like, spiniferous projections termed epaulettes. Other projections on other genera are simply described (for example, spiniferous tubercles).

Each tergite can be divided for descriptive purposes into four fields (or bands in Langton, 1991): the anterior, median, and posterior fields, and a narrow strip along the posterior margin called the “apical band.” The anterior, median, and posterior fields generally have shagreen with points that are posteriorly directed; the apical band has points or hooklets that are anteriorly directed. On tergite II, the apical band is often on a raised pad or ridge-like protuberance and is comprised of a single row, double row, or small transverse field of hooklets. In most species with a single row of hooklets (the hooklet row), these hooklets are arranged in an unbroken row. However, in the *Harnischia* group of genera and an unusual species of *Polypedilum*, this row is on two separate pads and is broken medially. In some genera (*Corynoneura* and *Thienemanniella*), apical bands with hooks are found on other segments besides II. Finally, the conjunctives may also have spinules, or in the Pseudochironomini, small hooklet-like spinules that are anteriorly directed.

On the ventro-lateral surface of segment IV are paired whorls of spinules called pedes spurii A. The posterolateral margin of segment II, and occasionally segments I and III, often have protuberances called pedes spurii B (fig. 2). They are thought to serve as a stabilizing aid for the pupa to enable it to undulate and generate currents through its tube for respiration.

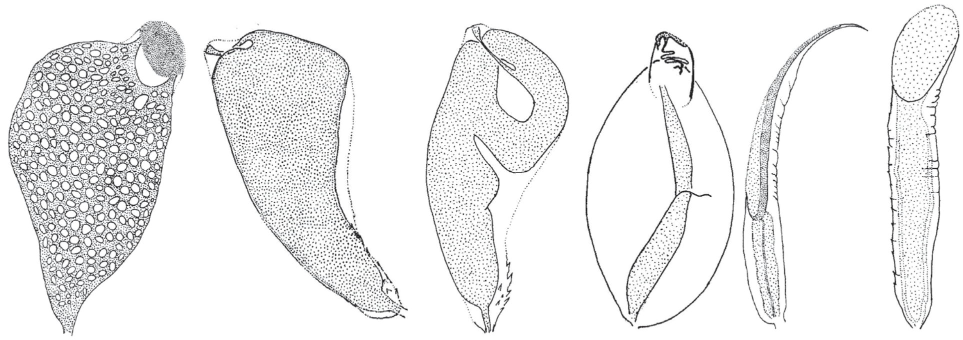
The posterolateral corner of segment VIII is often armed with one or more teeth. There is considerable variation in the size, shape, number of teeth, and arrangement of these teeth on VIII, and they are variously named in the literature as: armament on VIII, anal spur, anal comb, caudolateral spur, and so forth. When this armature is comprised of a single tooth, or a large tooth with accessory spines along its side, it is called a spur. Sometimes there are multiple teeth or a pad of teeth forming a comb.

Key to the Pupal Exuviae of the Midges

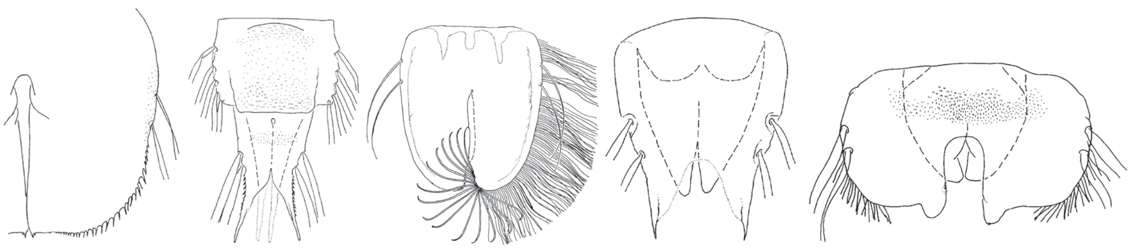
This species-level reference key identifies the pupal exuviae of 132 taxa of chronomid midges collected in ENP, as well as 18 other species from freshwater habitats adjacent to ENP.

Major Taxon Groups and Pseudochironomini

1. Thoracic horn dark, with either a conspicuous plastron plate or large and with a surface meshwork; each anal lobe with 2 large lateral taeniate setae... **Tanypodinae, 24**

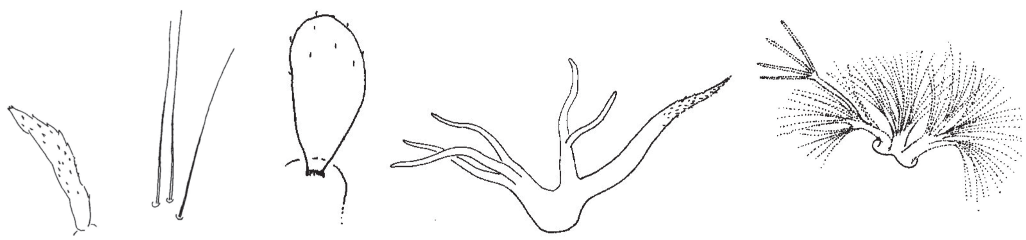


Thoracic horns of various Tanypodinae spp.

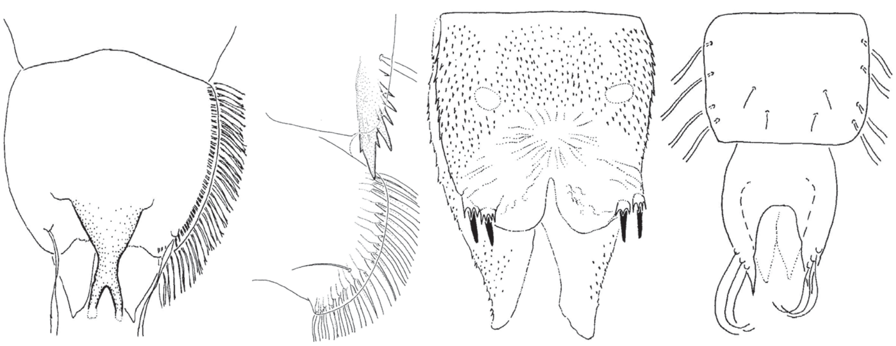


Anal lobes of various Tanypodinae spp.

1'. Thoracic horn may be a variety of shapes or absent, but is not dark; anal lobe variable, but not with 2 large lateral taeniate setae.. **2**



Thoracic horns of Chironomidae other than Tanypodinae



Anal lobes of Chironomidae other than Tanypodinae

2. Posterior margin of tergite II with a distinct <u>single</u> row of closely-spaced hooklets on one or two flap-like prominences. When on one prominence, this row is uninterrupted. When on two prominences, the hooklet row is usually interrupted medially .... **Chironominae (in part), 4**

Note: one rare species has a hooklet row and some scattered additional hooklets behind the principle row, but these additional hooklets do not constitute a complete 2nd row.

Hooklet rows of three different genera of Chironominae

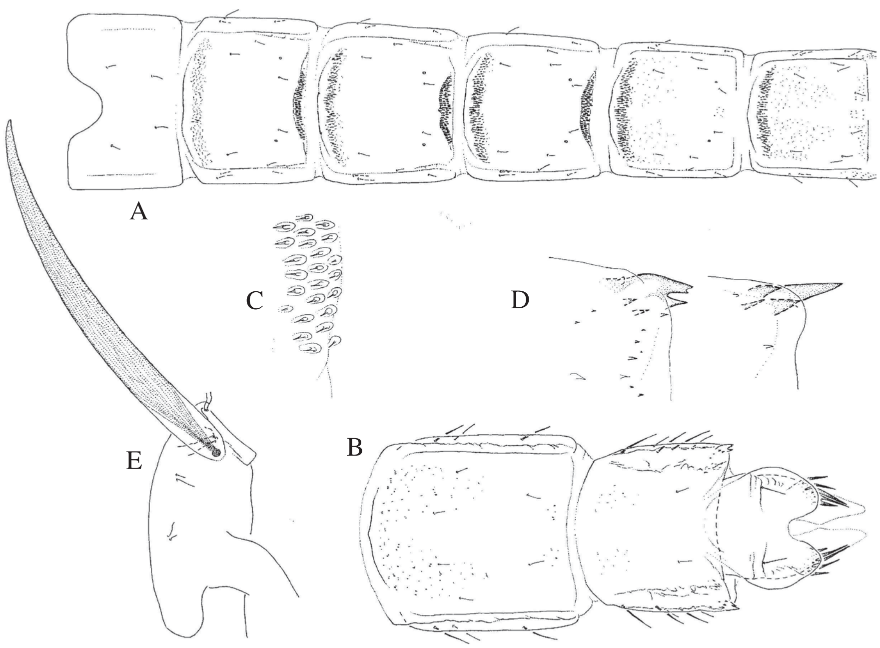
2'. Posterior margin of tergite II without distinct single row of closely-spaced hooklets, either bare, or with a few widely spaced hooklets, or with two or more rows of hooklets **3**

Note: Be careful not to confuse recurved conjunctive spines with hooklet rows. Hooklet rows sit atop a flap-like prominence.

3. Caudolateral corners of segment VIII with a small group of spines; thoracic horn very elongate – about as long as the cephalothorax from the tip of the wing pads to the head .... **Chironominae (in part), Pseudochironomini (in part), *Manoa pahayokeensis***

Exuviae nearly transparent, with distinct conjunctives on II/III to IV/V comprised of 2-4 rows of recurved spines; anal lobes with 3-7 large terminal spines.

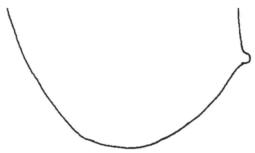
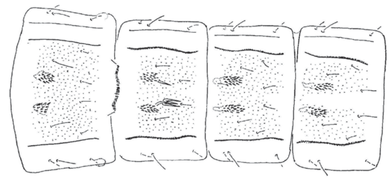
Most often collected along margins of Taylor Slough with shallow water and dense, mixed grass; also collected at the Taylor Slough bridge during low water periods at the onset of the rainy season. Also present at Chekika in shallow ditches near the Homestead Air Reserve base and marshes near Holiday Park in the northern Everglades.



Manoa pahayokeensis: A. abdominal segments I-VI, B. abdominal segments VII-IX and anal lobes, C. spines on conjunctive II/III, D. caudolateral spines on VIII (2 specimens), E. thorax showing thoracic horn.

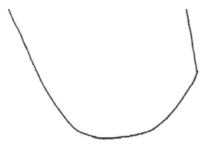
3'. Caudolateral corners of segment VIII without spines .... **Orthocladiinae, 9**

4. Wing sheaths with a subterminal tubercle (“Nose”); some abdominal terga with pairs of conspicuous groups of spines (called spine patches); thoracic horn unbranched or absent…… ....**Tanytarsini, 56**

Tanytarsini: tip of wing sheath with nose abdominal tergites with paired spine patches

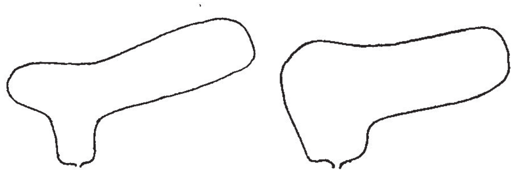
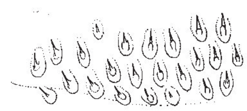
4’. Wing sheaths without a “Nose”; terga usually without pairs of spine patches, when paired spine patches are present, the thoracic horn is branched.. **5**



Wing sheath without nose

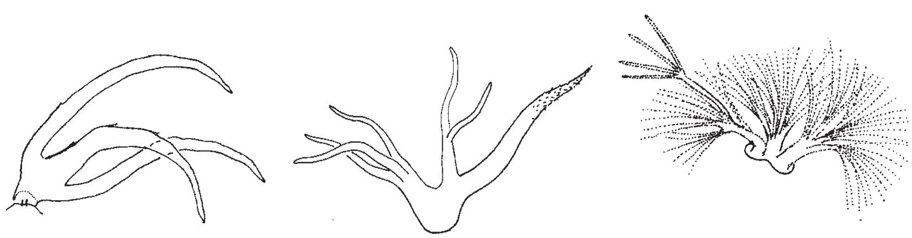
5. Thoracic horn stout, unbranched, or weakly forked and with anterior arm longer than posterior arm; medial part of anterior band of shagreen on V often with circular to diamond-shaped area of lighter pigment and usually smaller spinules .... ……………………..**Pseudochironomini (in part), *Pseudochironomus*, 6**

Note: The thoracic horn in *Pseudochironomus* often breaks off or is difficult to see. The best way to identify this genus is by recognizing the characteristic circular to diamond-shaped pattern of lighter pigmentation on the medial part of the anterior band of shagreen on V. This pattern is due to a reduction of background pigment (pigment between the spines) in this area relative to neighboring areas of shagreen. In some species, this difference in appearance is accentuated by either the spines being smaller or the spines being darker in this central patch than in adjacent areas. Also, the conjunctive spines of all Pseudochironomini (including *Manoa pahayokeensis*) have a distinct base.

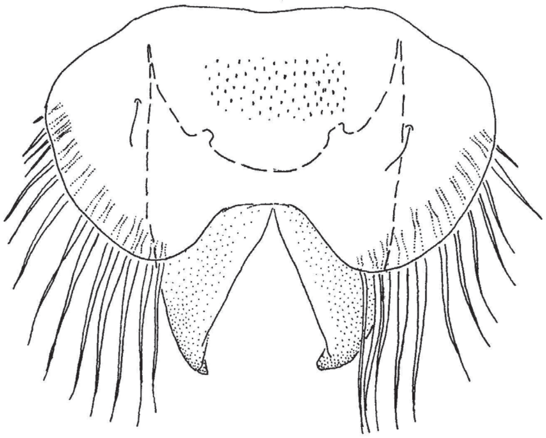
Pseudochironomus sp.: thoracic horn (2 types) conjunctive spines

5’. Thoracic horn with at least 2 branches, often plumose; if anterior band of shagreen is present on VI, it does not have a medial area of lighter pigment.. **Chironomini, 76**



Thoracic horns of various Chironomini

6. Anal lobe with a single row of about 12-24 taeniae **7**



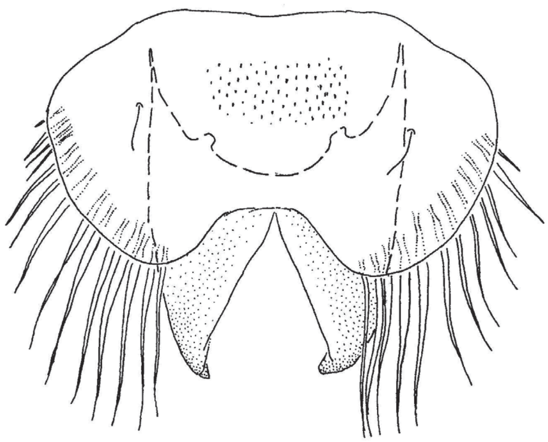
Terminal end of *Pseudochironomus richardsoni*

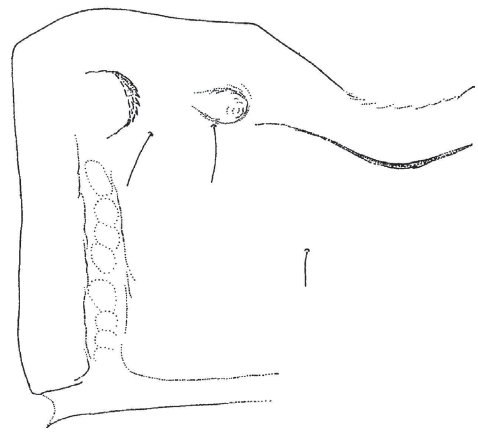
6'. Anal lobe with a double row of more than 30 setae **8**

7. Coloration dark brown; anal lobe with 12-15 taeniae .... ***Pseudochironomus richardsoni***

Tergites V and VI with conspicuous large circular to diamond-shaped median areas; two pairs of knobs on sternite I, only lateral pair with spines. Genital sheaths of male pupal exuviae are pigmented, apically curved, and pointed.

Enriched sites such as in Taylor Slough downstream of S332 pump station, drainage ditches outside ENP, enriched marshes in WCA-2A, near retention ponds 332B and 332C. This is "*Pseudochironomus* sp." of King (2001), and is a strong indicator of nutrient enrichment. This species is rarely collected in nutrient-poor interior waters in ENP.





Pseudochironomus richardsoni: anal lobes and genital sheaths tubercles on sternite I

7'. Coloration pale yellow-orange; anal lobe with 18-24 taeniae .... ***Pseudochironomus* sp. C**

Circular median patches of finer shagreen are present on tergites V and VI, but they are difficult to discern because of the overall weak pigmentation of the pupal exuviae. Both pairs of knobs on sternite I have prominent spines. Posterior margins of sternites have conspicuously darker orange pigmentation. Genital sheaths of males are apically rounded and not pigmented.

Pond on FIU campus. Not found in the Everglades in this study.

8. Tergites V and VI with conspicuous large circular to diamond-shaped median areas; two pairs of spiny knobs on sternite I. Tergite I without spinules on anterolateral margin……………...............................***Pseudochironomus* sp. A**

Anal lobe with 50-60 taeniae.

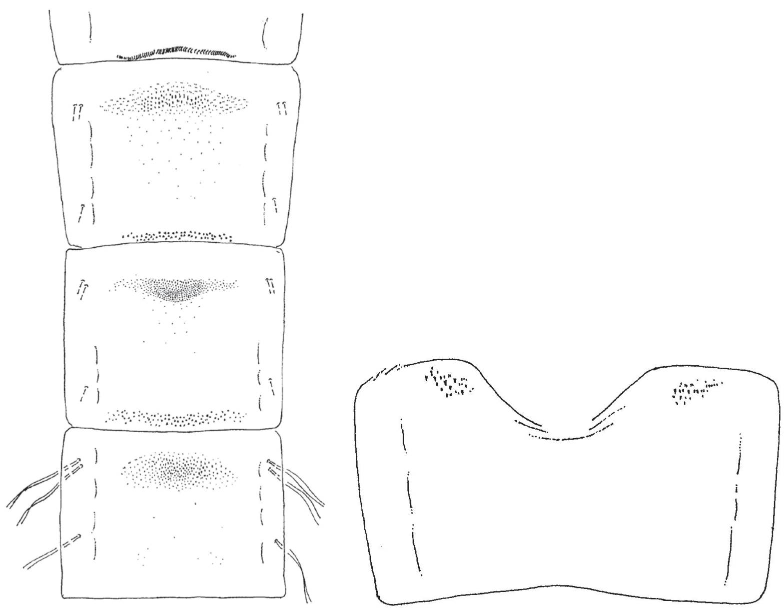
Common in borrow pits such as Sisal Pond and Sweet Bay Pond.

Pseudochironomus sp. A: anal lobe, tubercles on sternite I, tergite IV

8'. Tergites V and VI without circular to diamond-shaped median areas. Tergite I with patch of spinules on anterolateral margin...***Pseudochironomus* cf. *articaudus***

Anal lobe with 37-42 taeniae. Adult males and larvae closely resemble *Pseudochironomus articaudus* Sæther (1977). However, the pupal exuviae of ENP specimens are pigmented and have caudolateral spines on VIII, whereas *P. articaudus* specimens from Manitoba are reported to be pale and lacking spines on VIII. Most likely, these differences represent geographic variation within a single species.

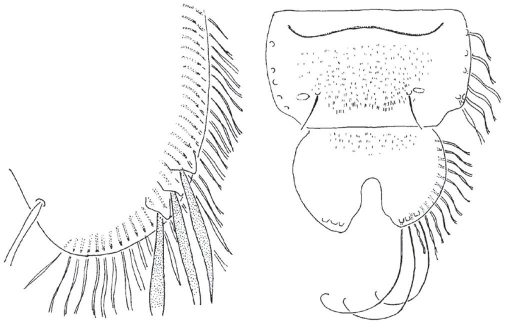
Abundant at marl-prairie sites. Though very common in ENP, it has not been collected in WCA-2A at unenriched marsh sites. This species is an indicator of excellent water quality.



Pseudochironomus cf. *articaudus*: tergites III-V tergite I showing anterior shagreen

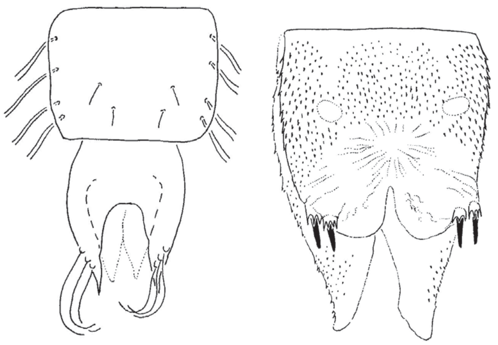
Orthocladiinae

9. Anal lobe with a fringe of taeniae **10**



Anal lobes with a fringe of taeniae.

9’. Anal lobe without a fringe of taeniae **17**



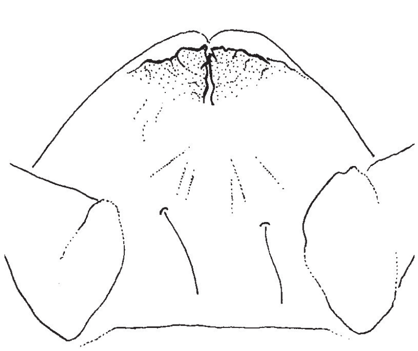
Anal lobes without a fringe of taeniae.

10. Thoracic horn present; tergites often brown **11**

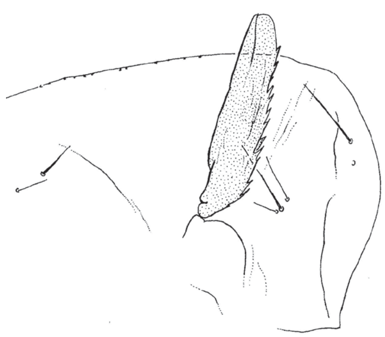
10’. Thoracic horn absent; tergites generally clear though paratergites may be brown **14**

11. Frontal apotome with frontal warts; precorneal setae less than half the length of the thoracic horn; abdominal tergites pale .... ***Psectrocladius* sp.**

332D Retention Pond, pond on Florida International University campus. So far, not collected in ENP.



Psectrocladius sp.: frontal apotome with frontal warts



thoracic horn

11'. Frontal apotome without frontal warts; 2 precorneal setae and at least one antepronotal setae arising from distinct tubercles and about as long as thoracic horn or longer; most or all of abdominal segments brown......... ***Nanocladius,* 12**

12. Thoracic horn oval, < 2.0X as long as wide .... ***Nanocladius* cf. *balticus***

Only tergites VI-VII with small median spine patches; segment VIII with 5 taeniate lateral setae.

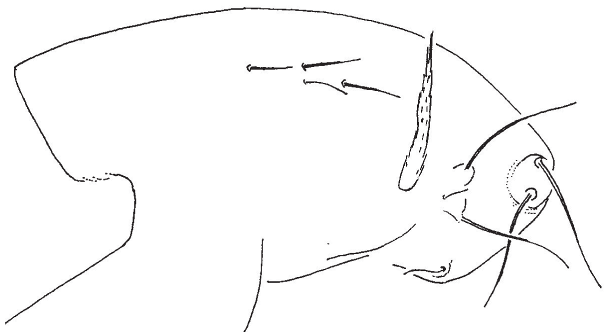
Found at Chekika marsh sites close to the SW 237th Ave. canal. Also common in borrow pits like Sisal Pond and Sweet Bay Pond.

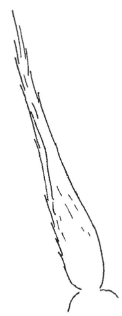
12'. Thoracic horn elongate, digitiform or pointed, >5X as long as wide.. **13**

13. All tergites dark brown, tergites VII and VIII without shagreen; thoracic horn pointed and with long apical spines.……………………. .... ***Nanocladius distinctus***

Antepronotal setae and 2 of 3 precorneal setae on prominent tubercles. VI with 4 non-taeniate lateral setae.

Found only at enriched sites with current (Taylor Slough near S332 pumping station when pumps were operating prior to 2001).





Nanocladius distinctus: thorax thoracic horn

13'. Tergites VII and VIII with faint pigmentation and with distinct shagreen; apex of thoracic horn rounded……….......... ....***Nanocladius alternantherae***

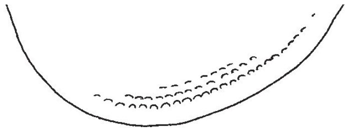
Found at long hydroperiod sites, solution holes, and in borrow pits.

King (2001) found this species to be indicative of high water quality in WCA-2A. It is relatively rare in ENP marshes compared to what has been observed in the Water Conservation Areas.

Nanocladius alternantherae, thorax

14. Apex of wing sheath with “pearl row”; anterior cephalothorax near median suture smooth.................. ***Corynoneura*, 16**

Note: *Corynoneura* need to be slide-mounted and examined under a compound microscope to see the pearl rows on the wind sheath tips.

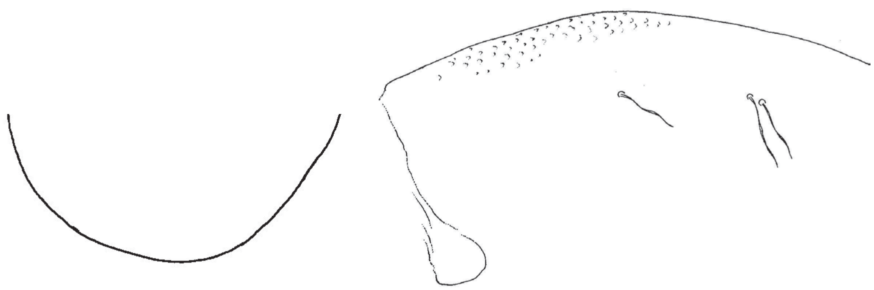


Corynoneura sp. B, tip of wing sheath

14’. Apex of wing sheath without pearl row; anterior thorax near median suture with group of point .... ***Thienemanniella*, 15**

Note: *Thienemanniella* spp. are difficult to separate from the similarly colored *Corynoneura* sp. A under a dissecting scope because the points on the anterior cephalothorax are difficult to see. Even if one becomes proficient at identifying pupal exuviae with a dissecting microscope, it is probably best to slide mount darker-colored Corynoneurini to observe the wing sheath tips. Nearctic *Thienemanniella* were recently revised by Hestenes and Sæther (2000).

Generally found at longer hydroperiod sites.



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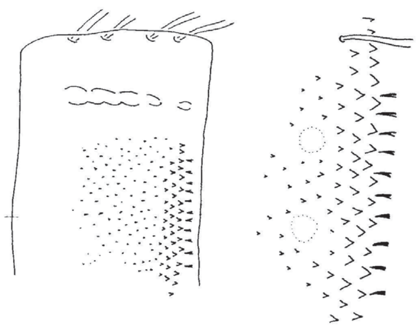
Thienemanniella sp.: tip of wing sheath anterior thorax

15. Shagreen on tergites II-VIII with 2-3 rows of distinctly broader-points along posterior margin... ***Thienemanniella* cf. *taurocapita***

Sternite II has bundles of needle-like spinules.

Present in upper Taylor Slough near the L-31W canal.

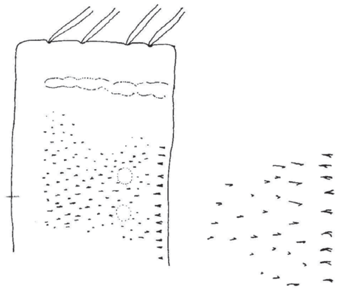


Thienemanniella cf. *taurocapita*, shagreen pattern on TVI

15'. Shagreen points on tergites all generally narrow and uniformly sized.......................... ***Thienemanniella* cf. *lobapodema***

Tergite I lacks caudal hooklets; segment III has 3 taeniate lateral setae

Present in upper Taylor Slough and in a borrow pit in the Chekika area



Thienemanniella cf. *lobapodema*, shagreen pattern on TVI

16. Anal macrosetae the same color (clear) as taeniae on anal lobe; thorax with dark, uniform coloration, paratergites also darkly pigmented.. ***Corynoneura* sp. A**

This species is difficult to separate from *Thienemanniella* under a dissecting microscope because one cannot see the pearl rows on the wing tips, and the small field of points on the anterior dorsal cephalothorax of *Thienemanniella* is difficult to see. All darkly pigmented Corynoneurini should be slide mounted and examined under a compound microscope.

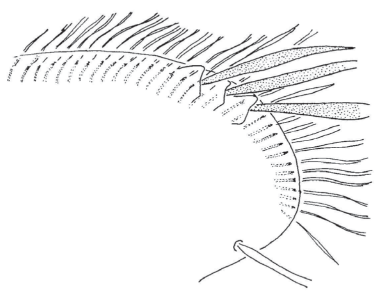
More common in peaty, long-hydroperiod sites.

Corynoneura sp. A, anal lobe

16'. Anal macrosetae darker than taeniae, thorax with light, uneven color pattern..................................... ***Corynoneura* sp. B**

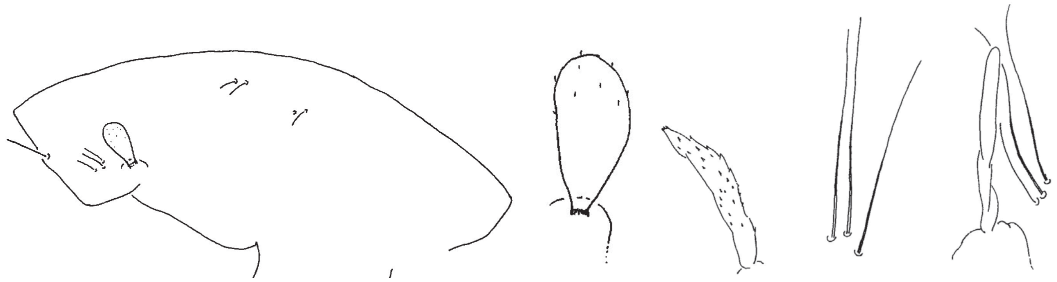
The notably darker macrosetae and overall lighter color enables easy identification under a dissecting microscope.

Widespread, most abundant at marl-prairie sites. King (2001) found this species to be indicative of high water quality. Collections for this manual suggest this species is not a reliable indicator of enrichment.



Corynoneura sp. B, anal lobe

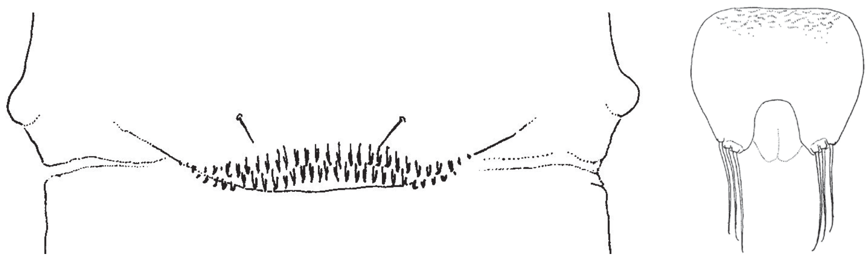
17. Thoracic horn present **18**



Examples of thoracic horns on Everglades Orthocladiinae (last 2 with adjacent precorneal setae)

17'. Thoracic horn absent **21**

18. Posterior margin of tergite II with 2 rows of recurved hooklets; anal lobes rounded, with anal macrosetae terminally inserted; body pale to darkly pigmented, length > 3 mm; thoracic horn not spherical .... ***Cricotopus,* 19**

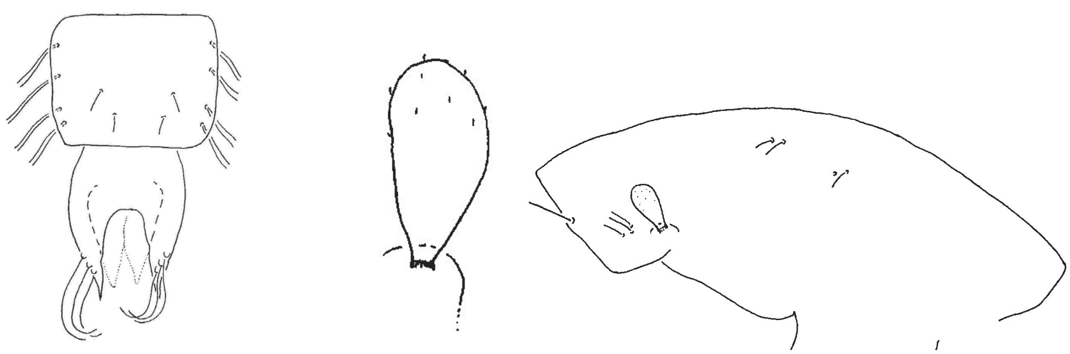


Cricotopus bicinctus, hooklet rows on tergite II, anal lobes

18'. Tergite II without 2 rows of recurved hooklets; anal lobes pointed, with anal macrosetae subterminally inserted; body darkly pigmented, almost black, length 2-3 mm; thoracic horn ovoid....................................... ***Parakiefferiella coronata***

Segments VII-VIII with 4 taeniate L-setae. The anal lobes are often retracted into the abdominal segments during eclosion so they may be difficult to see under a dissecting microscope. Florida DEP personnel claim that at least one other *Parakiefferiella* species is present in the northern Everglades based upon collections of larvae. I have not noticed other pupal forms. It is perhaps best to call all *Parakiefferiella* pupae encountered as *Parakiefferiella* sp.

Ubiquitous and extremely abundant where there is abundant calcareous periphyton. This species is an indicator of high water quality.

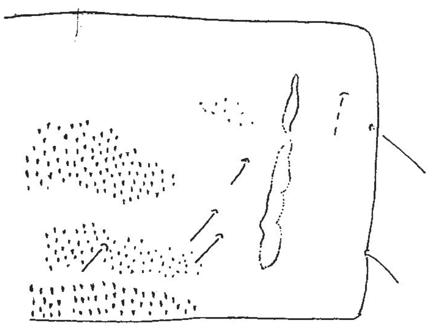


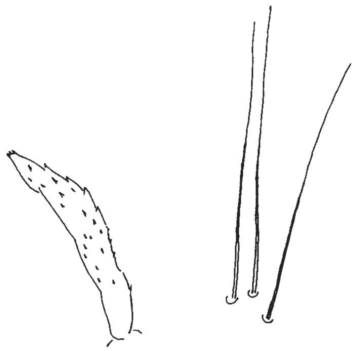
Parakiefferiella coronata: anal lobe thoracic horn thorax

19. Shagreen on abdominal tergites divided into anterior and posterior fields ....***Cricotopus (Cricotopus) bicinctus***

Coloration ranges from light brown to dark brown.

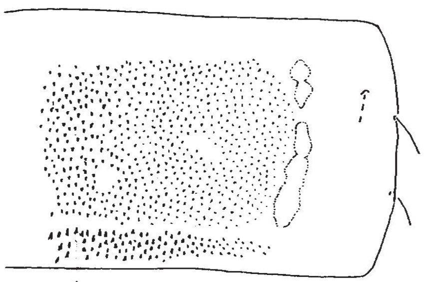
Taylor Slough downstream of pumping station, also in outlet of pond at Chekika. Appears to prefer current; notorious for being tolerant to, and becoming abundant in, polluted rivers and streams. Really not useful as an indicator in the Everglades because it is not found in most slow current environments in the Everglades.





Cricotopus bicinctus: tergite V shagreen pattern thoracic horn and precorneal setae

19'. Shagreen on abdominal tergites undivided...***Cricotopus (Isocladius)*, 20**

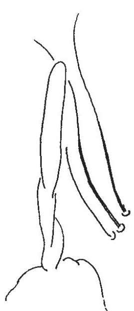


Cricotopus sylvestris, tergite V shagreen pattern

20. Thoracic horn elongate, digitiform, with rounded tip ....***Cricotopus (Isocladius) sylvestris***

Exuviae pale to light tan in color

Taylor Slough downstream of S332 pumping station, outflow from Chekika spring-fed pond, 332 retention ponds, occasionally in solution holes near retention ponds. Also in eutrophic ditches around Homestead.

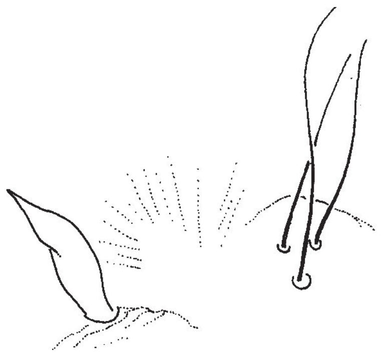


Cricotopus sylvestris, thoracic horn and precorneal setae

20’. Thoracic horn short, with pointed tip ....***Cricotopus (Isocladius)* sp. A**

Pigmentation of tergites II-VI is darker near posterior margin to give a banded appearance under low magnification. This species is likely to be *C. lebetis* (Epler and others, 2000).

Eutrophic ditches with *Hydrilla* along 6 Mile Road between Homestead Air Base and Homestead Speedway.

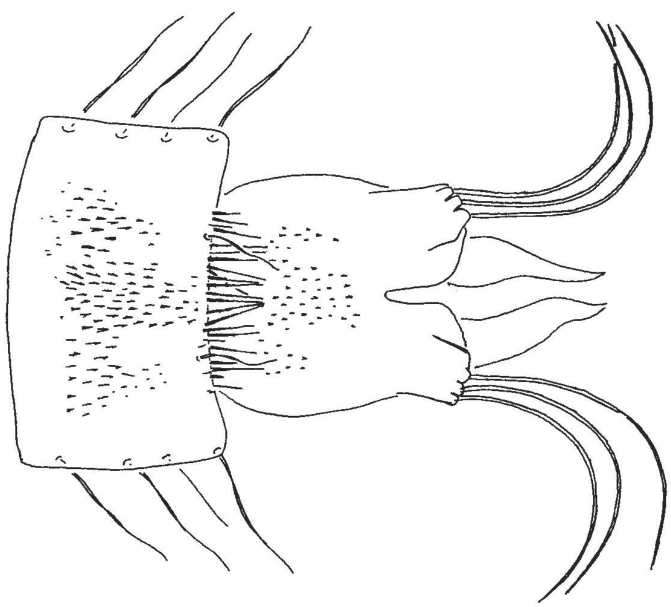


Cricotopus (I.) sp. A: thoracic horn precorneal setae

21. Tergites II-VIII with posterior row of long spines; anal macrosetae subequal in length to anal lobes ......***Limnophyes* sp.**

Pupal exuviae almost colorless. Easily recognized by the distinctive anal macrosetae and long L-setae (lateral setae) on the abdominal segments

Rare at Taylor Slough and Chekika marl-prairie sites.

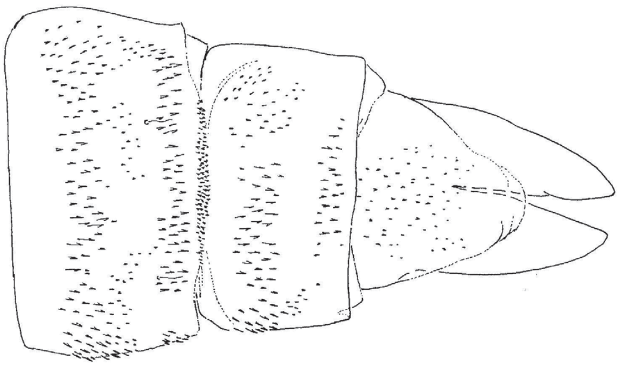


Limnophyes sp., tergite VIII-IX and anal lobe

21’. Tergites II-VIII with, at most, rows of short spines; anal macrosetae at most 1/3rd length of anal lobe or absent........... **22**

22. Anal macrosetae absent……………………………...***Pseudosmittia* spp.**

At least 3 species of *Pseudosmittia* are present in ENP: *P. digitata*, *P. forcipata*, and *P*. sp. A. Though abundant associated material of *P*. sp. A has been collected, these species cannot be distinguished in the pupal stage at the present time. Adults of *P. digitata* have been collected from terrestrial habitats such as ENP lawns. Adult male *P. forcipata* have been collected in solution holes and are likely to be primarily terrestrial. The third species, tentatively identified as *P*. sp. A, appears to be common in shallow and recently wetted marl-prairie sites. Almost all male *Pseudosmittia* collected when *Pseudosmittia* pupal exuviae are abundant in samples are this species.



Pseudosmittia sp., segments VII-IX

22'. Anal macrosetae present...**22**

Note: Pupae that key to here are mostly taxa that live in terrestrial or otherwise atypical habitats. There are several such genera that lack a thoracic horn and fringe of taeniate setae that are not included in this key but may turn up in south Florida. One should consult Coffman and Ferrington (1996) or Coffman and others (1986) for determining the generic identification of these pupae.

23. Restricted to phytotelmata (plant-held water); anal macrosetae of normal width.........................***Phytotelmatocladius* sp.**

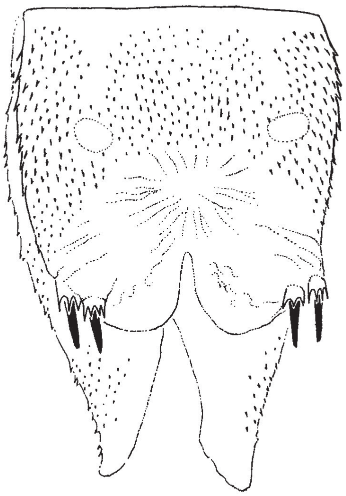
No pupae have been collected to date. All larvae collected appear to be Epler's "Orthocladiinae genus H (Epler, 2001: 7.163), which Epler called *Metriocnemus* sp. B. in his 1995 key to Florida chironomid larvae (Epler, 1995). Epler has since designated this species as the type species for a new genus, *Phytotelmatocladius*, but the paper has not been published yet. Most likely, the species that we have found in plant-held water in ENP is the same as his yet to be published *Phytotelmatocladius delarosai*.

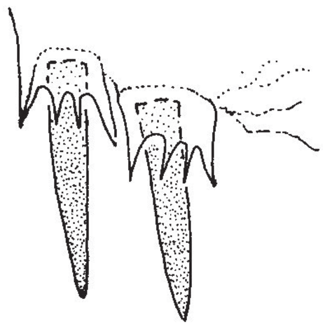
Epler (2003) describes the pupa of *Phytotelmatocladius* as follows: "The pupa lacks a thoracic horn and pedes spurii A and B, has tergites II-VII and anal lobe mostly covered with shagreen spines, with well developed spinules on the conjunctiva between most tergites and sternites, and has only two macrosetae on each of its truncated anal lobes" (Epler, 2003, p. 24).

23'. Not found in phytotelmata; anal macrosetae stout, spinelike .... **cf. *Antillocladius* sp.**

Anal lobe each with 2 spine-like setae, each arising from a coronate socket.

A single pupal exuviae was found in Taylor Slough below the S332 pumping station when it was operating. The larvae are probably semiaquatic.





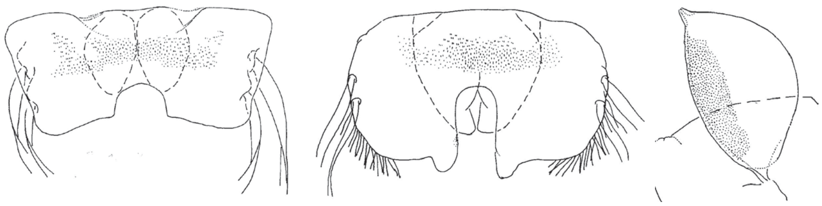
cf. *Antillocladius* sp.: tergite IX and anal lobes

anal macrosetae

Tanypodinae

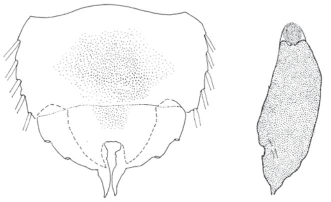
24. Choose the type of anal lobe that best matches your specimen:

A. Anal lobes quadrate; combined, about twice as wide as long; thoracic horn bulbous and with a nipple-like apical projection .... ***Tanypus,* 25**

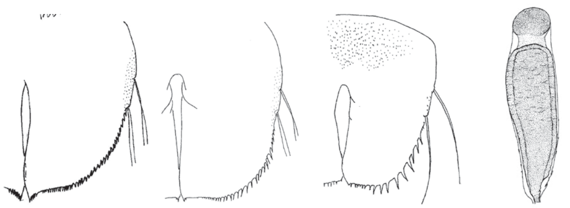


B. Anal lobes combined are semicircular, about twice as wide as long; appear to be fused with VIII; thoracic horn oblong and flattened .... ***Djalmabatista pulchra***

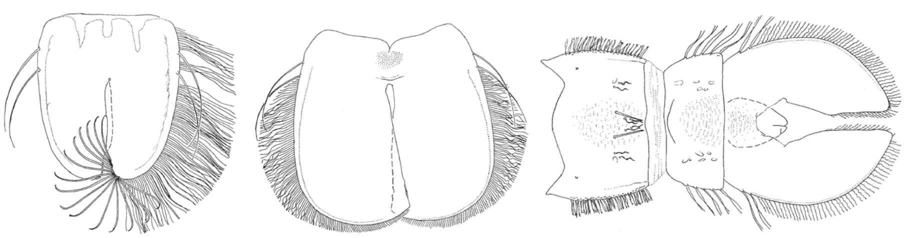
Present in retention ponds; rare in nearby ENP marshes. Probably an indicator of enrichment, but it is not found in typical Everglades habitats.



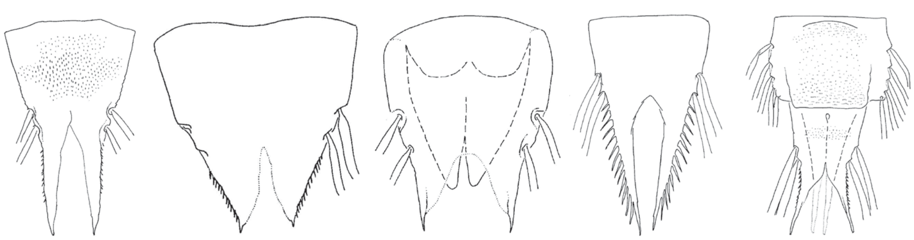
C. Anal lobe with straight inner margin and broadly rounded, serrated outer margin, and small apical cusp; thoracic horn amphora-shaped .... ***Procladius,* 29**



D. Anal lobe paddle-shaped, with fringe of setae .... ***Clinotanypus, Coelotanypus, Fittkauimyia,* 31**



E. Anal lobe triangular and/or elongate **33**



25. Taeniate L-setae on segments II or III-VIII **26**

25'. Taeniate L-setae only on segments VII-VIII **27**

26. Exuviae almost completely pigment free .... ***Tanypus* probably *clavatus***

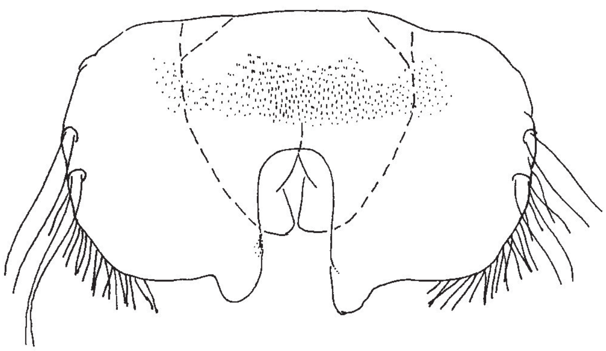
Lateral margins of abdominal segments III-VII with dense fields of taeniate setae that are too numerous to count (estimated 500-1000 on V-VII). This unassociated and currently undetermined species was collected at the Chevelier Bay outlet along the Wilderness Waterway and is tolerant to salinity. *Tanypus clavatus* is also tolerant of salinity but the pupa is currently unknown.

26'. Exuviae distinctly pigmented .... ***Tanypus* cf. *neopunctipennis***

Lateral margins of abdominal segments with numerous setae, though setae are countable. Found in both freshwater and brackish water. Tentatively identified as *T. neopunctipennis* but an adult male keys out to one of the western U.S. species.

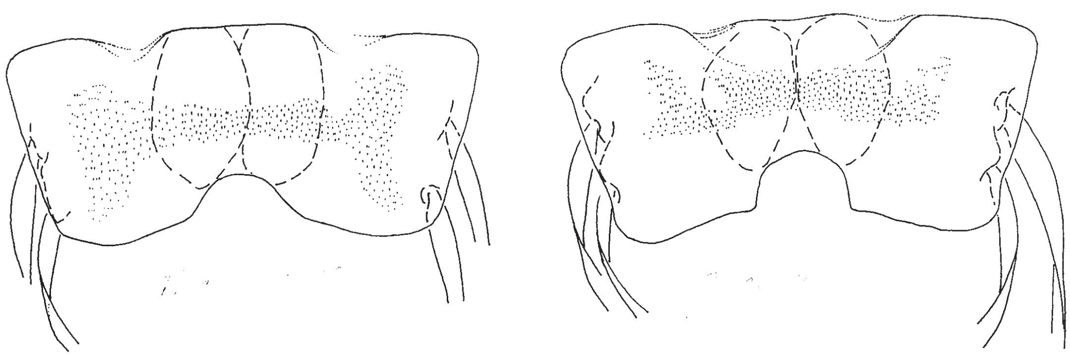
27. Anal lobe with caudomesal projection and lateral fringe of fine hairs .... ***Tanypus stellatus***

Present in Taylor Slough below 332 pumping station.



Tanypus stellatus, anal lobes

27'. Anal lobe without caudomesal projection and lateral fringe of fine hairs **28**

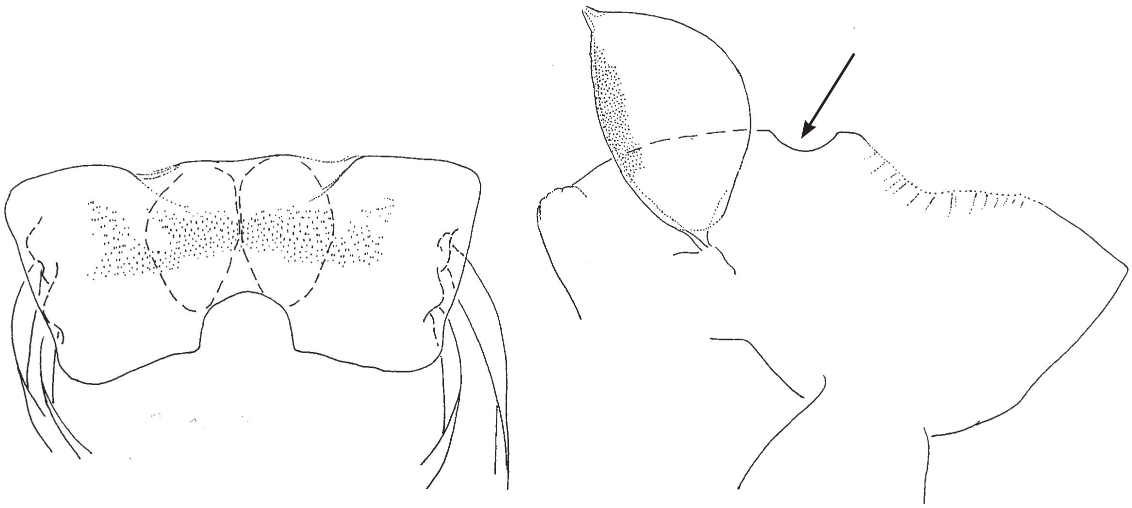


Tanypus spp., anal lobes

28. Inner corner of anal lobe nearly square or produced; median suture of cephalothorax with a small medial notch about 3 times longer than deep... ***Tanypus* cf. *vilipennis***

T. vilipennis has not been reported yet from Florida. This species may be *T. vilipennis* or it may be a new species. It appears to be common in southern Florida. It is often found together with *T. carinatus* and always the exuviae are darker than that of *T. carinatu*s.

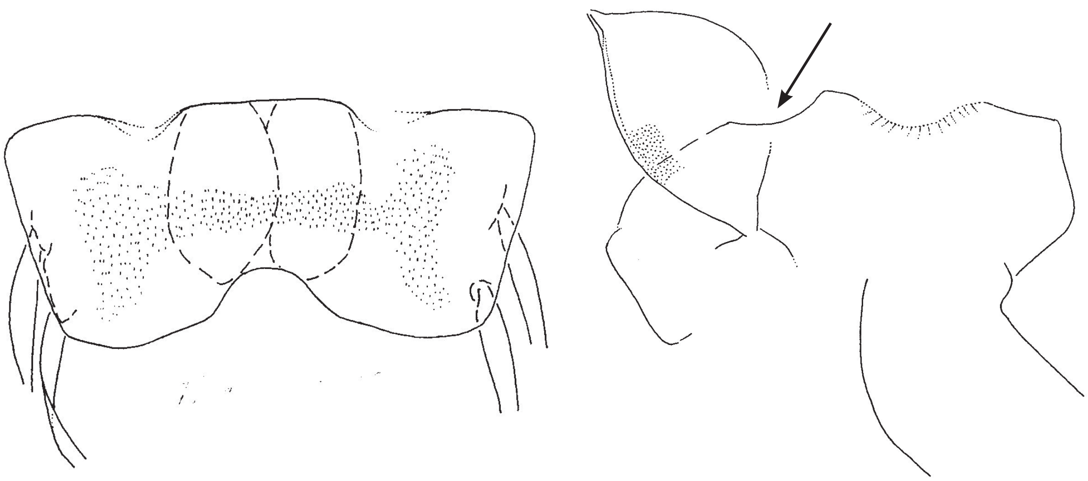
In ENP, specimens have been collected from solution holes along Context Road and from gator holes in Taylor Slough.



Tanypus cf. *vilipennis*: anal lobes lateral view of thorax showing medial notch (arrow)

28'. Inner corner of anal lobe not strongly angled in shape; median suture of cephalothorax with a relatively wider medial notch (about 5 times longer than deep) ....***Tanypus carinatus***

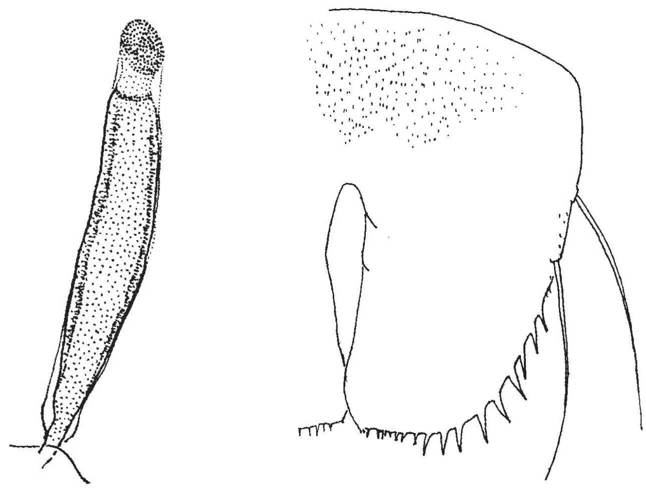
From sites with soft peaty sediments: gator holes in Taylor Slough, Context Road solution holes.



Tanypus carinatus: anal lobes lateral view of thorax showing medial notch (arrow)

29. Exuviae colorless; thoracic horn slender, about 7 times longer than width ....***Procladius (Psilocladius) bellus***

Borrow pits, for example, Sisal Pond.



Procladius sp. A: thoracic horn anal lobe

29’. Exuviae pigmented; thoracic horn about 3-4 times longer than width................................***Procladius (Holotanypus)*, 30**

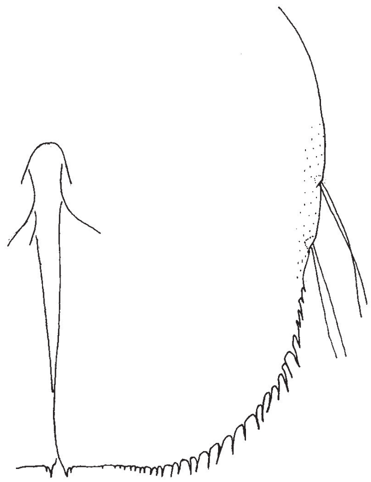
Species within the subgenus *Holotanypus* are very difficult to identify consistently in the pupal stage because there is considerable variability within species and overlap in the expression of characters between species. Usually two very distinct, easily separable species of *Holotanypus* are collected in the Everglades. However, pupal exuviae that appear to be somewhat intermediate and more difficult to assign to species are also encountered. Charles Watson examined pupal exuviae of the two taxa, including some specimens that were less obvious as to their identity, and concluded that there were at least two species, most likely *P. freemani* and *P. sublettei*. However, Watson believed that they cannot be consistently separated on the basis of tergite color pattern and anal lobe characters, and he proposed that other species may be present in the Everglades as well.

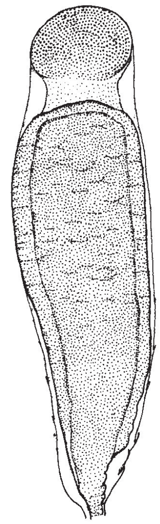
What follows is a couplet for distinguishing the two pupal types of *Holotanypus* that are typically encountered in ENP. Specimens that don’t easily fit or seem to be intermediate between the two choices should probably be identified as *Procladius (Holotanypus)* sp.

30. Anal lobes with about 20-30 distinctly spaced spines; apex of anal lobe with a small simple or 2-3 spined cusp............. ....***Procladius (H.)* cf. *sublettei***

Atrium of thoracic horn usually with a reticulate pattern. Note that the apex of the anal lobe forms a right angle with the inner margin. On *P.* cf. *freemani*, the apex of the anal lobe forms an acute angle with the inner margin.

Common at long hydroperiod marshes in Shark and Taylor Slough; also in peaty solution holes and borrow pits.



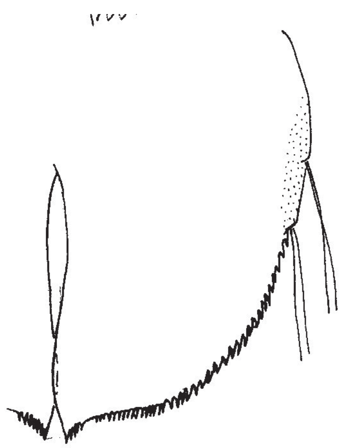


Procladius cf. *sublettei*: anal lobe thoracic horn

30'. Anal lobes with about 55 closely spaced spines; apex of anal lobe with a larger, 5-10 spined cusp ....***Procladius (H.)* cf. *freemani***

Atrium of thoracic horn without a reticulate pattern. Note that the apex of the anal lobe forms an acute angle with the inner margin. Tergites strongly patterned.

Common in Rocky Glades solution holes, occasionally found in long-hydroperiod marshes.

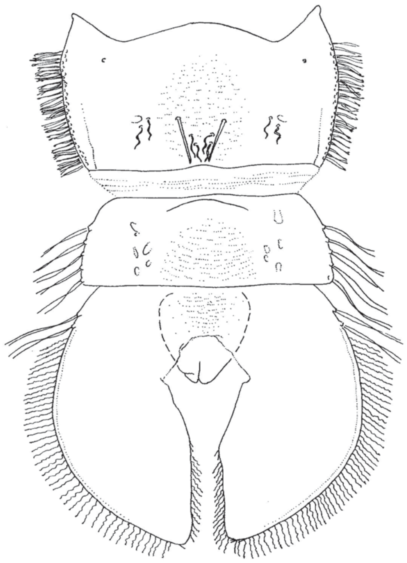


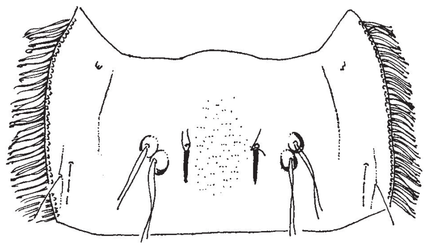
Procladius cf. *freemani*, anal lobe

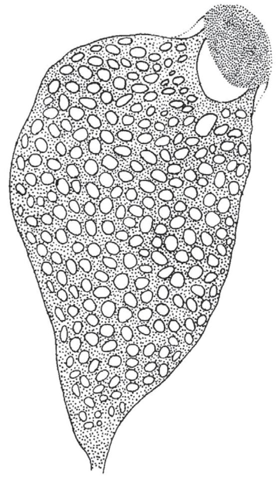
31. Segment VII with many more than 8 setae, setae hairlike; thoracic horn atrium flattened and perforate... ***Fittkauimyia* sp.**

This species is most likely *F. serta*, the only species recorded for the SE USA. Apparently the pupal exuviae disintegrates easily because usually only the thorax or a few abdominal segments are encountered in samples.

Widespread but uncommon.





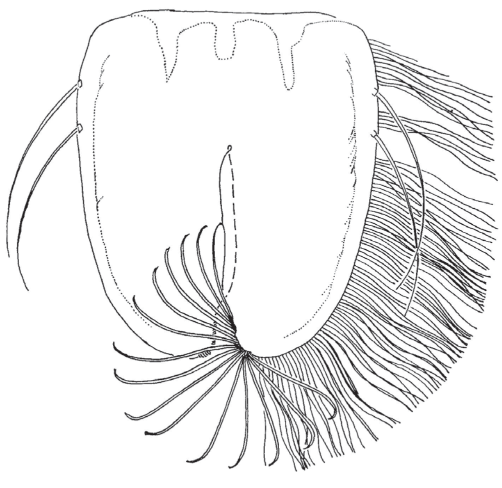


Fittkauimyia: TVII-anal lobes tergite thoracic horn

31'. Segment VII with 8 or fewer strong lateral setae; thoracic horn atrium not perforate.. **32**

32. Anal lobes with medial setiferous projections; usually 6-7 lateral setae on segment VII; anal lobe fringe setae about as long as width of lobe .... ***Clinotanypus* sp.**

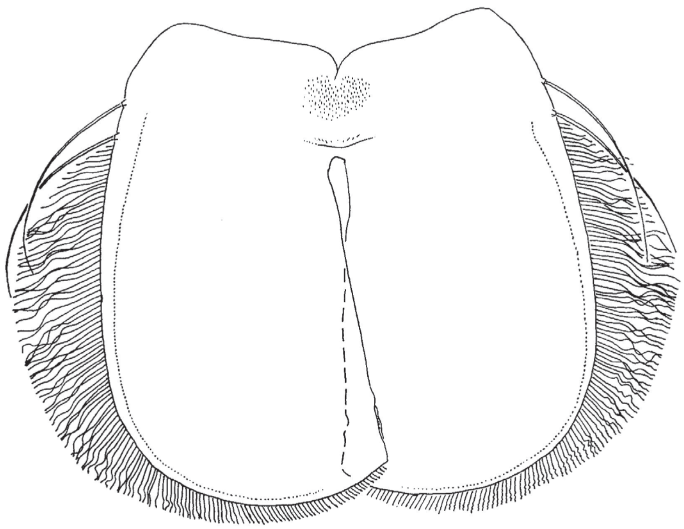
Most commonly found at deeper sites with peaty substrates. Also present in Rocky Glades solution holes.



Clinotanypus sp., anal lobes

32'. Anal lobes rounded uniformly; usually 8 lateral setae on segment VII; anal lobe fringe setae much shorter than width of one lobe ....***Coelotanypus* sp**.

Collected along the Wilderness Waterway.



Coelotanypus sp., anal lobes

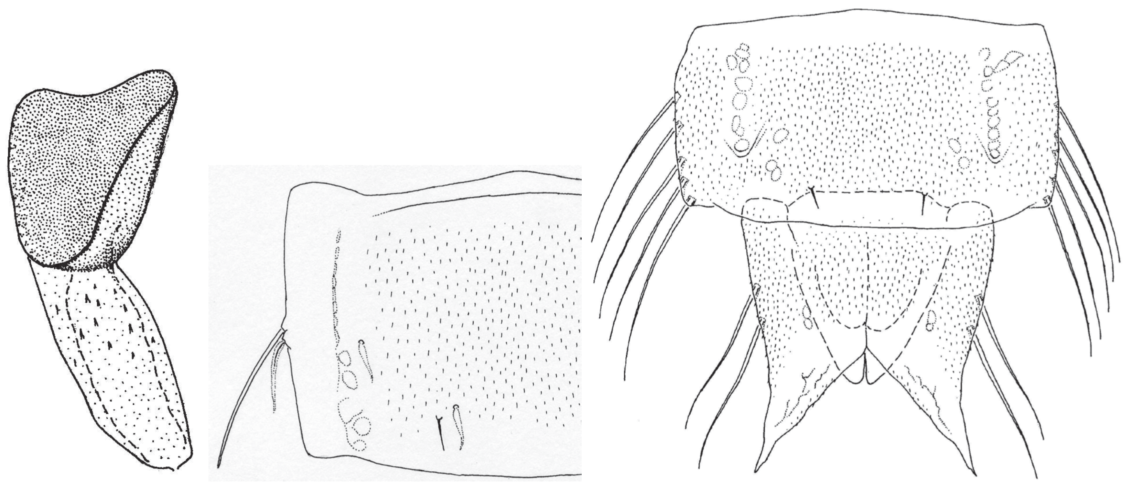
33. Thoracic comb absent..**34**

33'. Thoracic comb present **37**

34. Abdominal segment VII with one strong and one weak seta ....***Natarsia* sp.**

This distinctive species is also identified by the apically-expanded, notched thoracic horn. The lateral setae on segment VIII and the anal lobes are more hair-like than taeniform.

One specimen was collected in WCA-3B near the Tamiami Canal.

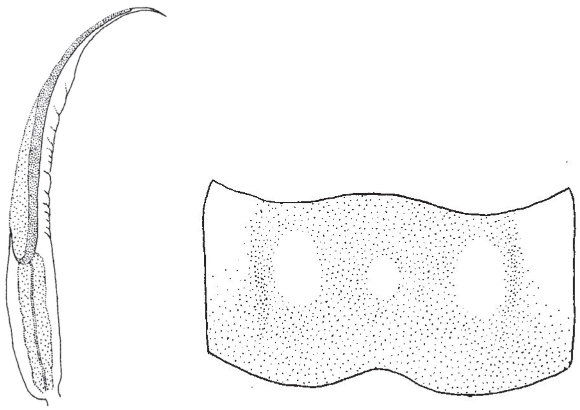


Natarsia sp.: thoracic horn segment VI segment VIII and anal lobe

34'. Abdominal segment VII with at least 3 taeniate setae...**35**

35. Thoracic horn arcuate, with clear terminal spine; abdominal tergites each with 3 white spots ....***Monopelopia boliekae***

Common in enriched ditches outside ENP, also present in ENP near 332 retention ponds. This species is a strong indicator of nutrient enrichment.

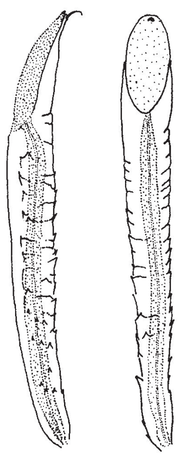


Monopelopia boliekae: thoracic horn tergite IV

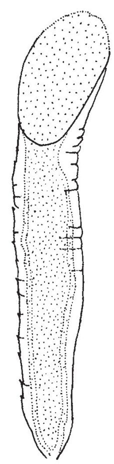
35'. Thoracic horn not arcuate, if spine is present, it is subterminal; abdominal segments brown with no distinct pattern of spots **36**

36. Thoracic horn with small, subterminal spine ....***Monopelopia* cf. *caraguata***

Present in Long Pine Key solution holes and short hydroperiod marl-prairie sites shortly after rewetting, uncommon. This is very likely to be the same species Mendes and others (2003) described from bromeliad phytotelmata in southern Brazil as *M. caraguata.*



Monopelopia cf. *caraguata*, thoracic horn



Cantopelopia gesta, thoracic horn

36'. Thoracic horn without spine (see above)..***Cantopelopia gesta***

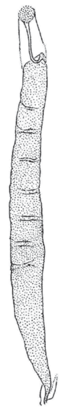
The posterolateral margin of VIII is produced into a posteriorly projecting lobe.

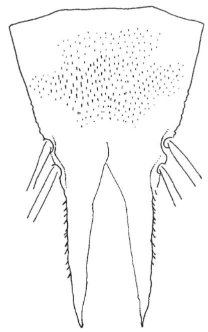
Solution hole along Context Road, rare. More common in highly enriched ditches in south Miami-Dade County.

37. Thoracic horn bean-shaped, about 10 times longer than width; wing pads with uniform brown coloration .... ***Denopelopia atria***

Sternite II with conspicuous shagreen consisting of rows of spinules. Bases of spinules in each row become fused to look like sets of eyelashes in posterior part of sternite. The anal lobes are elongate and narrow, their maximum combined width is slightly more than half the width of segment VIII.

Short-hydroperiod, marl-prairie sites; rare.





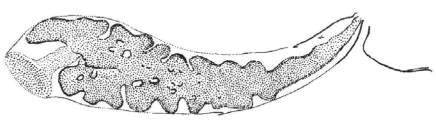
Denopelopia atria: thoracic horn anal lobes

37'. Thoracic horn shaped otherwise; wing pads usually patterned - with 1-2 clear spots on a brown wing or with pigmentation over the developing wing veins **38**

38. Wing pad brown with 1-2 pale spots **39**

38'. Wing pad with a venation-like pattern or entirely brown **42**

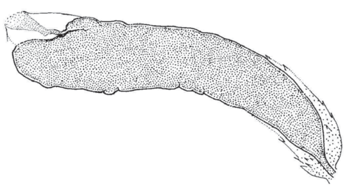
39. Atrium of thoracic horn alveolar .... ***Larsia*, 40**



Larsia decolorata, thoracic horn

39'. Atrium of thoracic horn tubular, not alveolar .... ***Paramerina* sp.**

Widespread and common.

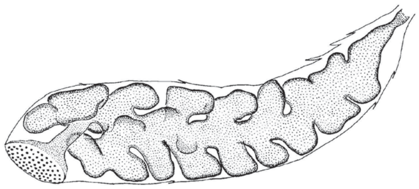


Paramerina sp., thoracic horn

40. Abdominal tergites II-VII pale and lacking darker median pigmentation.. ***Larsia berneri***

Atrium of thoracic horn convoluted but lacks holes. *Larsia decolorata* can also be very pale, therefore, one must examine the thoracic horn to make sure there are no perforations to be certain that pale colored specimens are truly *L. berneri*.

Present in borrow pits near the Visitors Center.



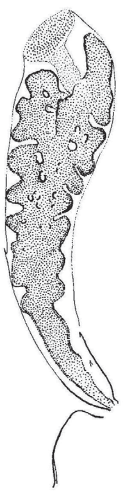
Larsia berneri, thoracic horn

40'. Abdominal tergites II-VII dark or with distinct median pigmentation... **41**

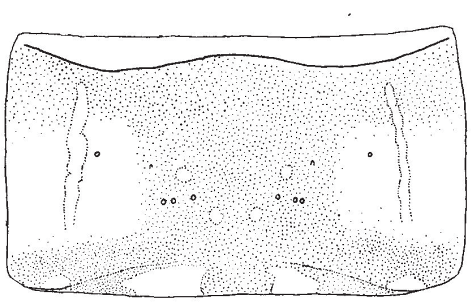
41. Wingpad with 2 clear spots..***Larsia decolorata***

Atrium of thoracic horn highly convoluted and usually with perforations. Tergites usually with distinct medial pigmentation. This pigmentation can vary considerably in darkness between different specimens. Adult males and larvae collected so far all key to *L. decolorata*. However, there appears to be considerable variation in color between exuviae, with some specimens very pale with no apparent median pigmentation. Some specimens may be difficult to separate from *L. berneri*.

Common at a wide variety of sites. This species tends to increase in abundance with enrichment and was found to be an indicator of enrichment in WCA-2A by McCormick and others (2004), but it is so widespread and common that is of limited value as an indicator of enrichment.



Larsia decolorata, thoracic horn



tergite IV

41'. Wingpad with only one clear spot ....***Larsia* sp. B**

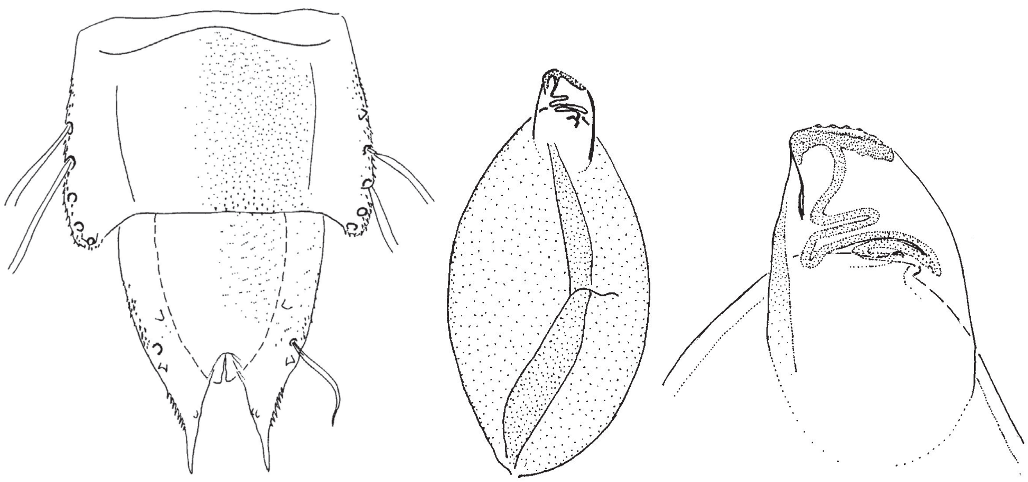
Abdomen is darkly pigmented. This may or may not be Epler's *Larsia* sp. B, i.e., the two taxa have not been associated.

Collected at Taylor Slough marl-prairie sites immediately after rewetting; rare.

42. Posterior margin of segment VIII produced laterally as lobe-like projections; bulbous thoracic horn, with a prominent lobe near the base .... ***Guttipelopia guttipennis***

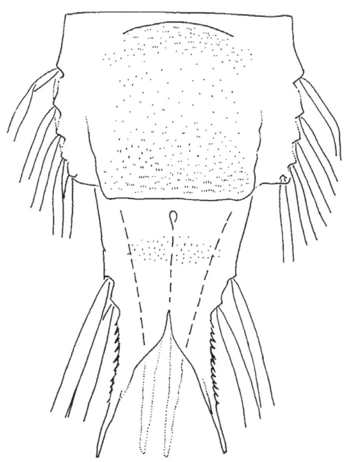
The only other Tanypodinae in the Everglades with a somewhat similar lobelike posterolateral margin on segment VIII is *Cantopelopia gesta*, but that species lacks a thoracic comb and has uniform wing pad coloration. *Guttipelopia guttipennis* wing pads have “wing venation” pigmentation. The thoracic horn has a plastron plate that is set on a small, prominent, and somewhat flattened, clear tubercle and that is connected to the horn sac by a narrow sinuous neck.

Rare; collected at small pool near Chekika entrance and from the pond at the Chekika Ranger station.



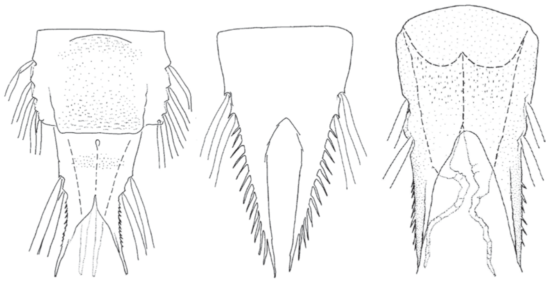
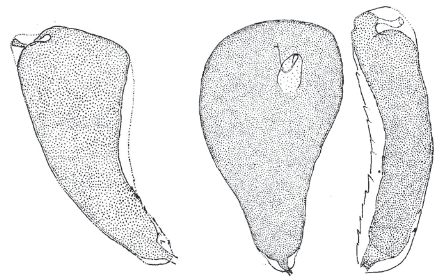
Guttipelopia guttipennis: TVIII & anal lobe thoracic horn apex of thoracic horn

42’. Posterior margin of segment VIII not produced laterally as a lobe-like projection **43**



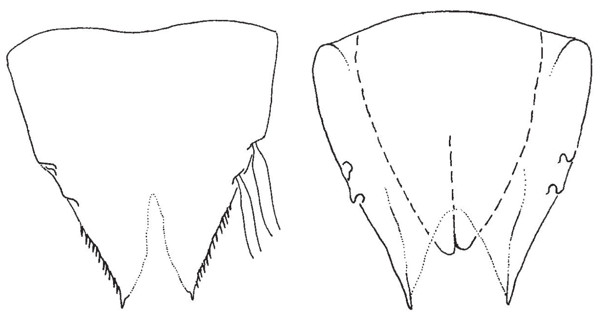
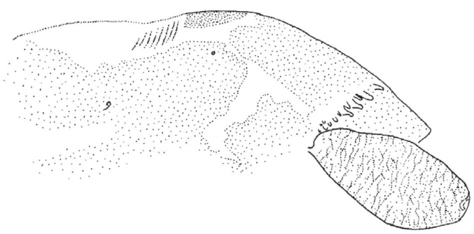
Labrundinia sp., segment VIII and anal lobes

43. Small pupae, 2-3 mm long; anal lobes long and narrow; meshwork of thoracic horn usually fine ....***Labrundinia*, 44** (key modified from Roback, 1987)

Labrundinia spp.: anal lobes (3 spp.) thoracic horns (3 spp.)

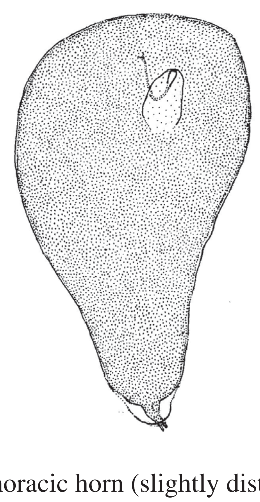
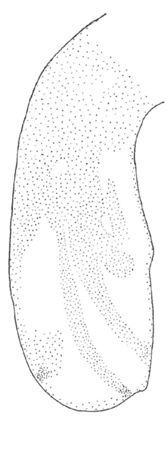
43'. Larger pupae, 5-7 mm long; anal lobes relatively short and broad; meshwork of thoracic horn coarse..***Ablabesmyia*, 50**

Ablabesmyia spp.: anal lobes (2 spp) thorax with thoracic horn

44. Thoracic horn appears radially symmetrical, lightbulb-shaped......................................***Labrundinia* sp. B (Epler, 1995)**

This unnamed and partially described species has been collected from herbaceous solution holes at Long Pine Key and along Context Road. Also found in upper Taylor Slough near L-31W. This is the pupa of Epler's (1995) larval type called *L.* sp. B.

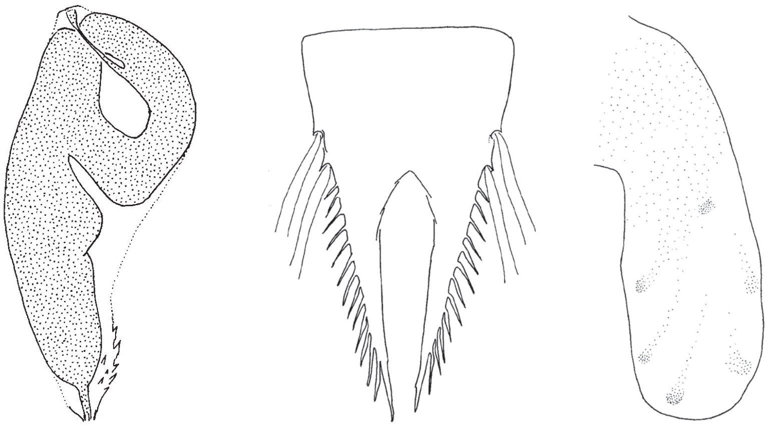
Labrundinia sp. B: thoracic horn (slightly distorted) wing pad coloration

44’. Thoracic horn not radially symmetrical **45**

45. Preapical groove (arrow below) elongate and expands into a large open area so that the respiratory atrium is 9-shaped... .... ***Labrundinia*** **sp. 3 nr.** ***virescens*** **(Roback, 1987)**

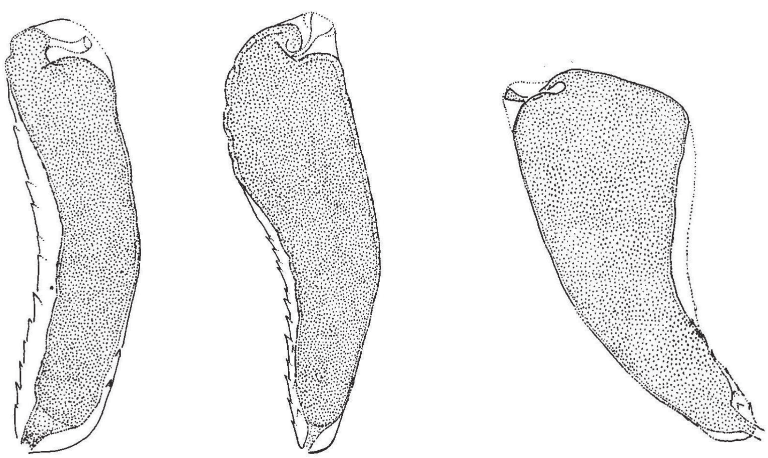
This species is also recognizable by the relatively elongate spines on the anal lobes. This is the same species as “*L.* sp. (from Florida)” in Wiederholm (1986)

This partially described but unnamed species is uncommon from marl- and wet-prairie habitats in Taylor Slough. It is very abundant in a small borrow pit along Pine Island Road near the Main entrance to ENP. It is also abundant outside Everglades National Park in ditches along SW 266th St E of SW 112th Ave.



Labrundinia sp. 3: thoracic horn anal lobes wing pad pigmentation

45’. Preapical groove, when present, at most only slightly expanding.. **46**

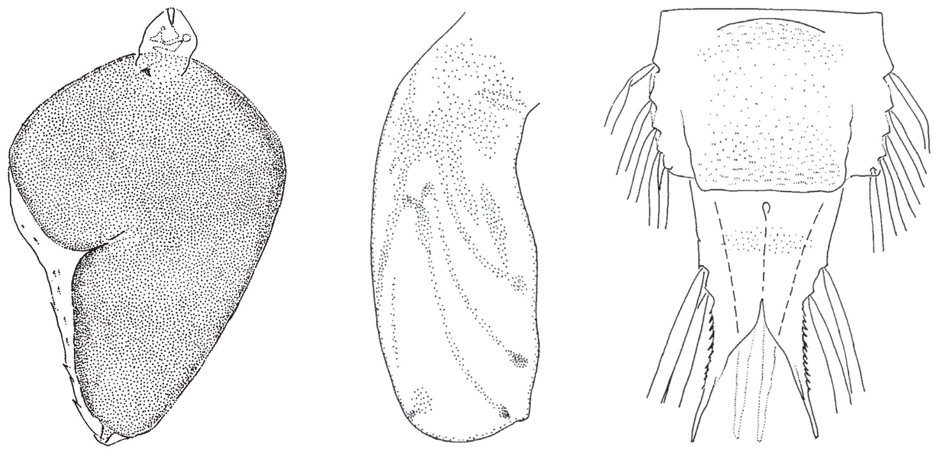


Labrundinia spp. thoracic horns with small preapical grooves

46. Thoracic horn ovoid, robust, > 370 µm; aeropyle tube elongate, sinuate ....***Labrundinia* sp. 10 (=*Labrundinia* sp. 6)**

Roback (1987) described the larvae as *L.* sp. 6 and the pupae as *L.* sp. 10, descriptions of the adults are forthcoming.

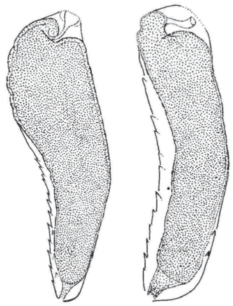
Most often found in herbaceous solution holes, long hydroperiod sites with peat bottom substrates, and upper Taylor Slough near L-31W.



Labrundinia sp. 10: thoracic horn wing pad coloration TVIII and anal lobes

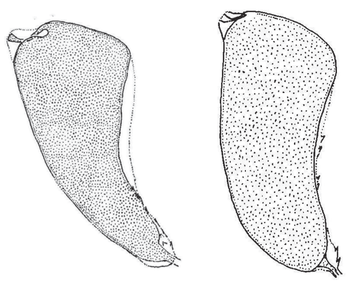
46'. Thoracic horn wrench-, club- or wedge-shaped, < 300 µm; aeropyle tube not sinuate **47**

47. Preapical groove prominent, thereby imparting a wrench-like appearance to the thoracic horn, aeropyle tube inserted into upper margin of groove **48**



Thoracic horns of *Labrundinia* spp. with a prominent apical groove.

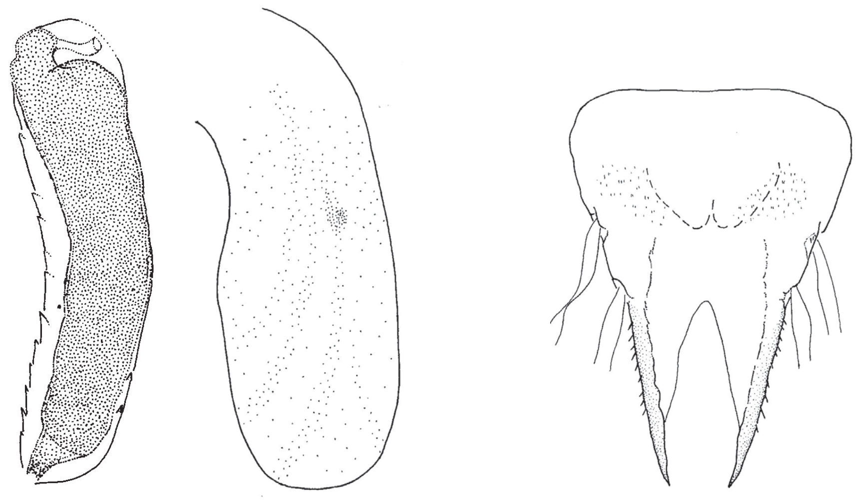
47'. Preapical groove shallow or not present **49**



Thoracic horns of *Labrundinia* spp. with a shallow apical groove or without an apical groove

48. Wing pad with a dark spot near crossvein r-m; tergites generally light in color.............................. ***Labrundinia pilosella***

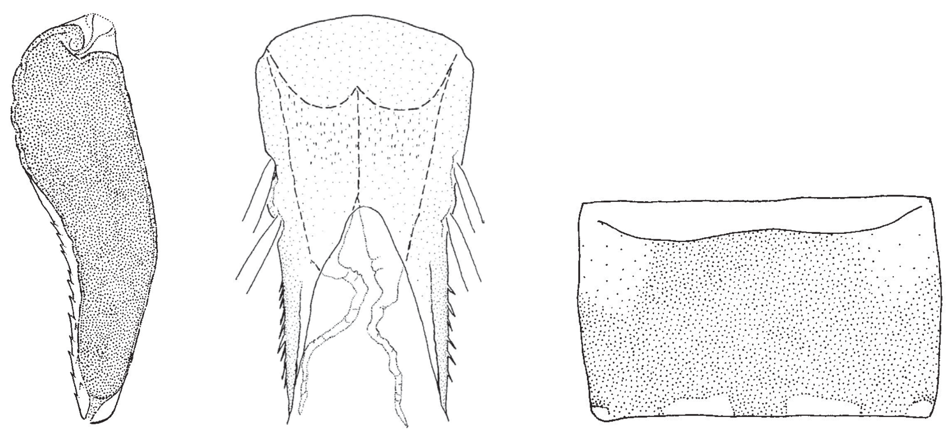
Common in upper Taylor Slough.



Labrundinia pilosella: thoracic horn wing pad tergite IX and anal lobes

48’. Wing pad without dark spot on wing pad; tergites with median and posterior areas brown..................***Labrundinia becki***

Upper Taylor Slough.



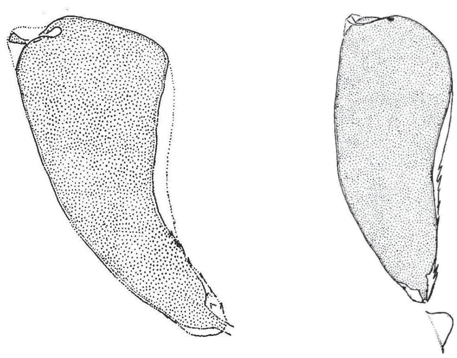
Labrundinia becki: thoracic horn T IX and anal lobes tergite IV

49. Aeropyle tube about 1/3 to one-half the width of the thoracic horn..***Labrundinia neopilosella*** **group**, (***Labrundinia neopilosella and L. johannseni)***

Reliable characters for separating these two species have not been found so far. This key deviates from Roback's (1987) key because specimens of both species have been reared that have long aeropyle tubes at least 1/3 the width of the thoracic horn. *Labrundinia neopilosella* appear to have a narrower thoracic horn than *L. johannseni*. Further rearing is needed to reliably separate these species. However, *Labrundinia neopilosella* appears to be far more common than *L. johannseni* based upon larvae encountered in samples (*L. johannseni* larvae have a pigment band across the head capsule that is very distinctive. *L. johannseni* larvae have not been found in samples from ENP for several years).

Pupal exuviae of this taxon group are recognized by the uniform light brown coloration of the abdominal segments, and the basally tapered thoracic horn with a long aeropyle tube. *Labrundinia maculata* are paler in color, have a noticeably fatter thoracic horn, and a short aeropyle tube.

Labrundinia neopilosella is widespread and abundant throughout ENP. Based upon slide records, *L. johannseni* has been collected from an herbaceous solution hole in Long Pine Key. A larval exuviae was also collected in northeast Shark River Slough. This species is not rare in south Florida, so it cannot be assumed that all exuviae from the Everglades that key here are simply *L. neopilosella*.

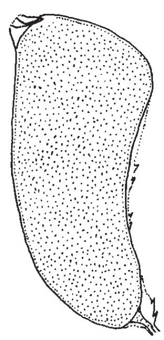


Thoracic horns of *Labrundinia* spp.: *L. neopilosella* *L. johannseni*

49'. Aeropyle tube about 1/4th the width of the thoracic horn or smaller..***Labrundinia maculata***

The fat thoracic horn of this species becomes easy to recognize with experience. Also, the overall color is lighter than *L. neopilosella*, and abdominal segments are pale with a faint median U-shaped pattern.

This species is most commonly encountered in short-hydroperiod (<6 months), marl-prairie habitats.



Labrundinia maculata: thoracic horn

50. Apical nipple of thoracic horn elongate, with sinuate aeropyle tube; abdomen very pale yellow, with no distinct color pattern .... ***Ablabesmyia peleensis***

Second (medial) spot of pigment along thoracic suture absent; wing pad has veins of pigment that extend to margin and blotching between veins, and has conspicuously darkened spot near crossvein r-m. This is Roback's (1987) *A. peleensis* type I

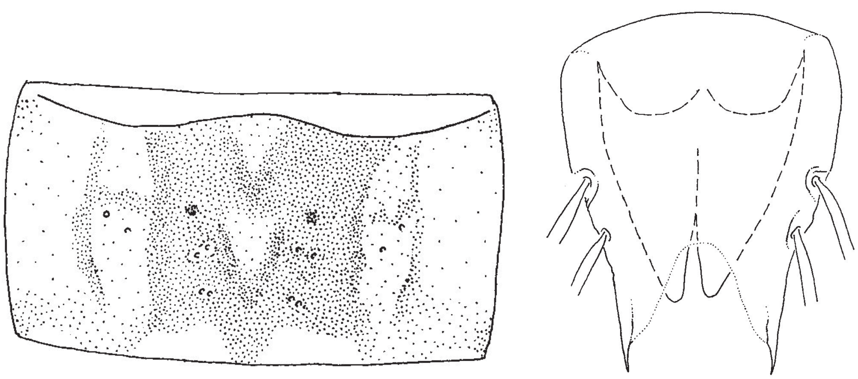
Rare; collected in Shark Slough at Pa-hay-okee, Chekika slough habitats, and Taylor Slough near the S.R. 9336 bridge.

Ablabesmyia peleensis: thoracic coloration wing pad pigmentation thoracic horn

50'. Apical nipple of thoracic horn short; abdomen usually light brown, brown, or orange–brown and often with color pattern.. **51**

51. Abdominal tergites each with 3-4 yellow spots against orange-brown background .... ***Ablabesmyia mallochi***

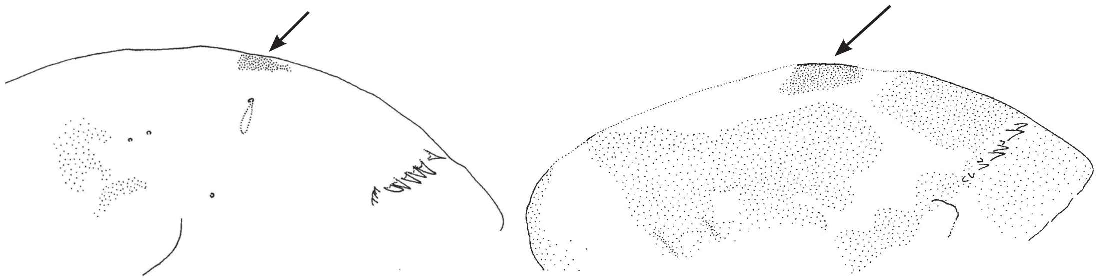
Most commonly collected at Taylor Slough sites near the pump station but also present at the FL S.R. 9336 bridge and near Royal Palm. According to Epler (2001: 4.25), *A. mallochi* is usually found in lotic environments. Apparently, the increased current near the pump station and near the bridge is sufficient for their survival. The population in upper Taylor Slough is still present even though the 332 pumps have not operated since 2000.



Ablabesmyia mallochi: tergite color pattern anal lobes

51'. Abdominal tergites without multiple spotted pattern **52**

52. Thorax with distinct small spot of pigment midway along dorsal suture, this medial spot is either alone or separated from a larger anterior spot **53**



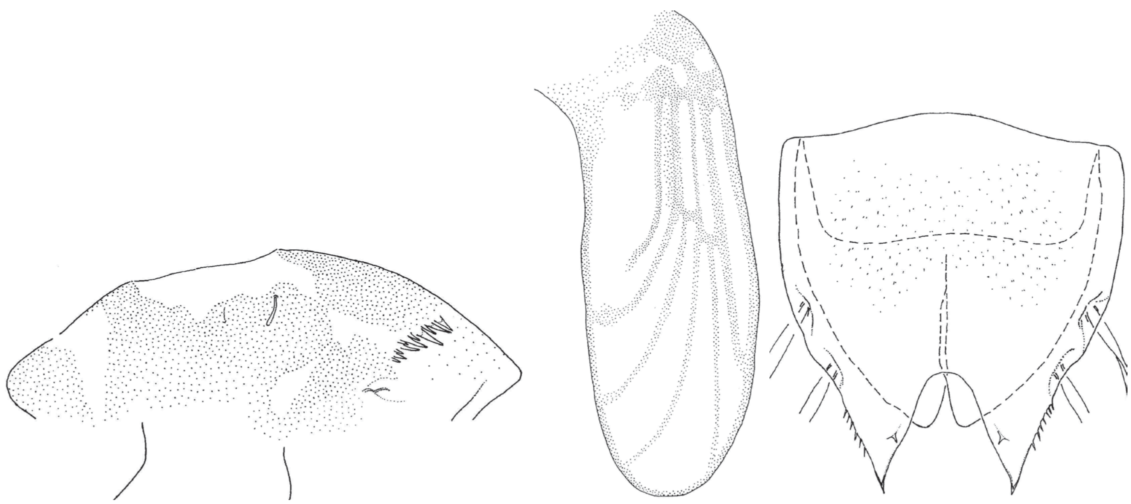
Ablabesmyia spp., thorax with pigment spot (arrow) midway along dorsal suture

52'. Thorax without a small, distinctly separate spot of pigment midway along dorsal suture; instead, this spot is contiguous with large anterior spot of pigment..***Ablabesmyia* sp. F**

Wing pads with veins of pigment extending to wingpad margin. Leg sheaths with conspicuous bands of pigment. Anal lobe with 6-8 lateral spines and one distinct medial spine.

This species is very similar to *A. peleensis* in lacking a distinct medial pigment spot along the dorsal suture. It can be separated from *A. peleensis* by the lack of spots between the pigment veins on the wingpads, and the thoracic horn with only a short apical nipple. This species appears to belong in the subgenus *Karelia* and may be the same species as Epler's (2001) *A.* sp. A

Borrow pits such as Sweet Bay Pond.



Ablabesmyia sp. F: thorax (without thoracic horn) wingpad anal lobes

53. Wing pads with veins of pigment that do not extend to the wing margins.. **54**

53'. Wing pads with veins of pigment that extend to the wing margins.. **55**

54. Thorax with only one small medial spot along dorsal suture; wing sheath without crossvein pigmentation .... ***Ablabesmyia* sp. E**

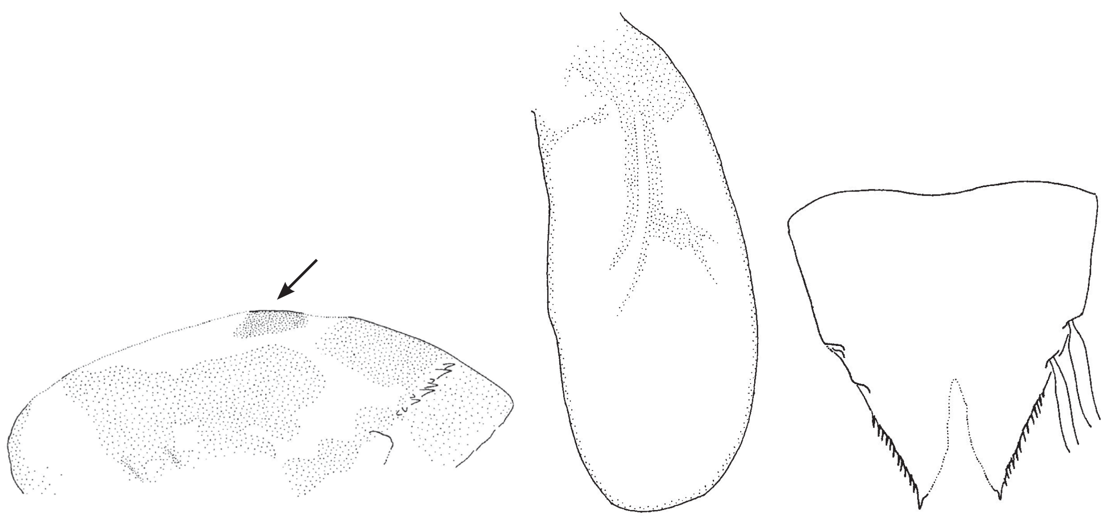
This pale species is found in Pine Island Lake, Everglades National Park, and in other oligotrophic borrow pits in south Miami-Dade County.

Ablabesmyia sp. E: thorax (thoracic horn omitted) wing sheath

54'. Thorax with large anterior spot, and smaller, darker medial spot along dorsal suture; wing sheaths with crossvein pigmentation .... ***Ablabesmyia* sp. A**

Anal lobes each with 9-10 strong spines. Thoracic comb with sharp teeth; medial spot along thoracic suture (arrow below) somewhat rounded, slightly darker than first spot. The tergites are generally more darkly pigmented than the paratergites. This species is best separated from *A*. sp. B by the reduced wingpad pigmentation that doesn't extend to the wingpad margins and the prominent spines on the anal lobes.

This is probably *A. parajanta*. It is the most common and widespread species of *Ablabesmyia* in ENP. It is an indicator of high water quality.

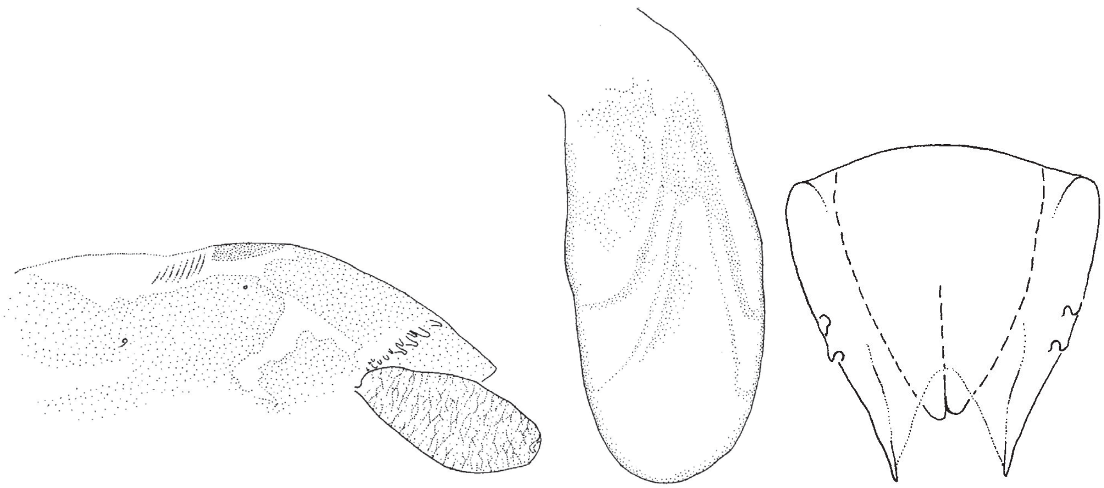


Ablabesmyia sp. A: thoracic pigmentation wing pad pigmentation anal lobes

55. Anal lobe with 3-7 thin, weak spines and with a short tip .... ***Ablabesmyia* sp. B**

The anal lobe spines are fine and somewhat difficult to see; they are not shown in the figure below to illustrate the overall appearance of the anal lobes under a dissecting scope at 40X. Overall color is slightly darker than *A*. sp. A

Common at a variety of sites, often with *Ablabesmyia* sp. A. This species is an indicator of high water quality.

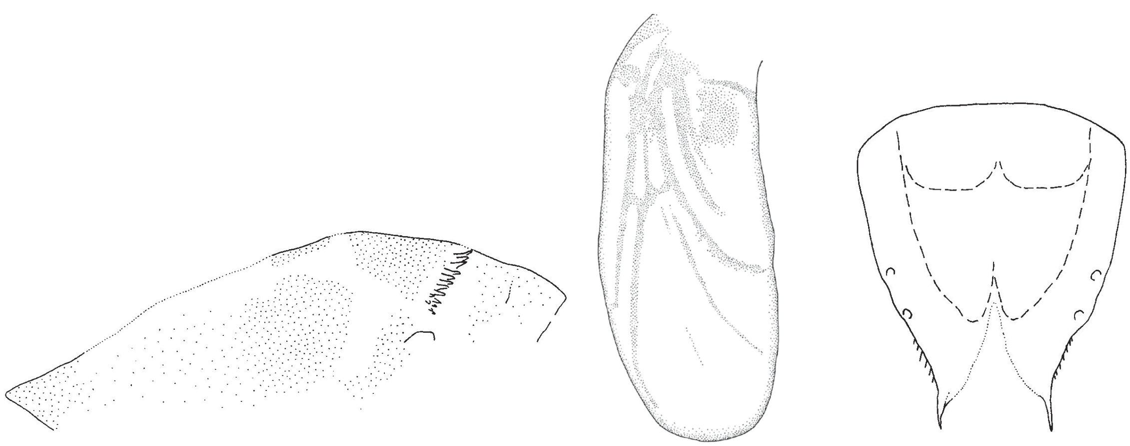


Ablabesmyia sp. B: thoracic pigmentation wing pad pigmentation anal lobes

55'. Anal lobe with about 10 strong spines and with a distinct elongated tip .... ***Ablabesmyia* sp. C**

This species can potentially be confused with *A*. sp. A. However, aside from the characters in the key, the medial spot along the cephalothoracic suture is narrow or occasionally absent and not notably darker than first spot. Also, the thoracic comb has long blunt teeth.

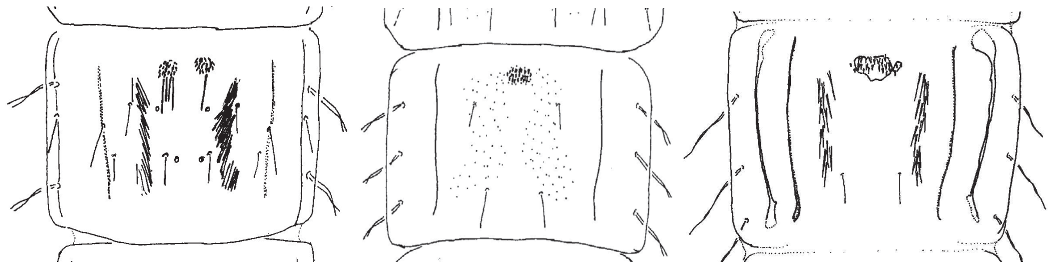
This species is most common in upper Taylor Slough sites near the L-31W canal. It is also present near retention pond 332C. This species may be associated with canals.



Ablabesmyia sp. C: thoracic pigmentation wing pad pigmentation anal lobes

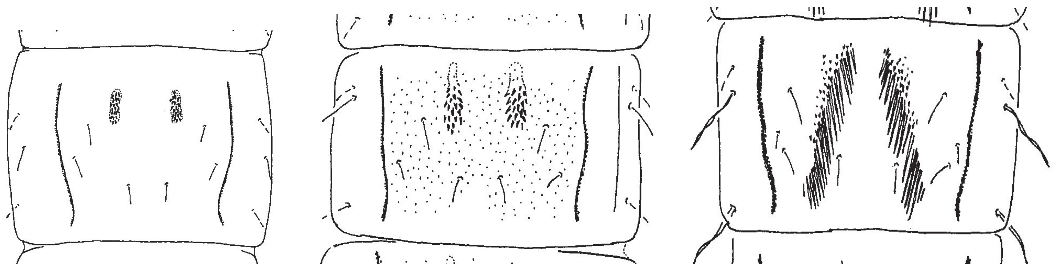
Tanytarsini

56. Tergite IV with either 1, 3, or 4 well separated spine patches .... ***Paratanytarsus*, 57**



Tergite IV of *Paratanytarsus* spp.

56'. Tergite IV with 2 spine patches (though sometimes a spine patch may be composed of spines with distinctly different lengths) **59**

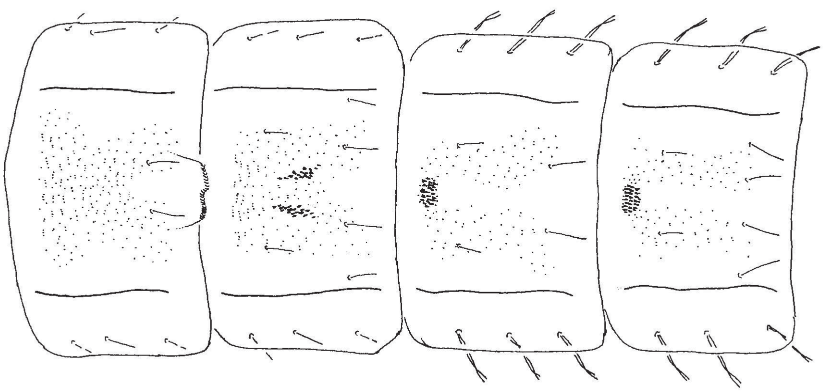


Tergite IV of Tanytarsini other than *Paratanytarsus* spp.

57. Tergite IV without lateral, longitudinal patches of long spinules... ***Paratanytarsus* sp. B**

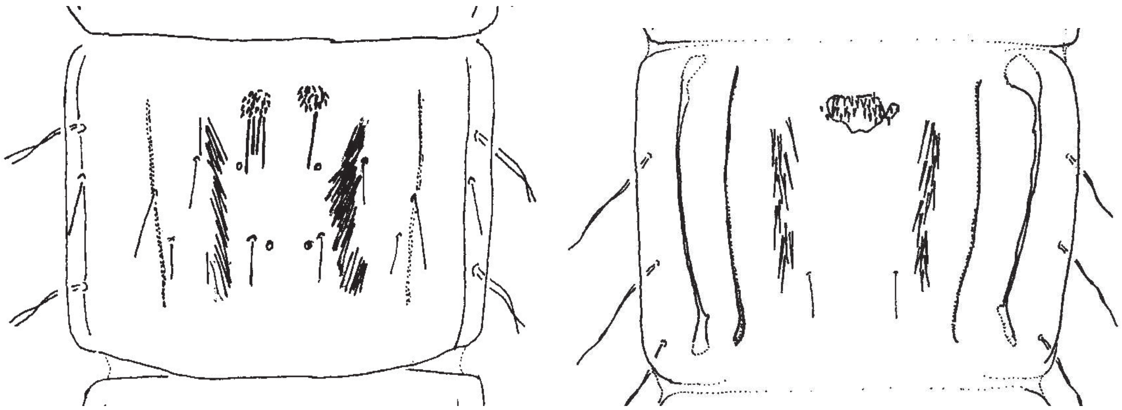
Tergite IV with a single anteromedian patch of points. Base of antennal sheath conspicuously darkened.

Widespread and common at slough and marl-prairie habitats with longer hydroperiods. King (2001) found this species to be an indicator of high water quality. Data from Everglades National Park strongly agrees with this conclusion.



Paratanytarsus sp. B, tergites II-V

57'. Tergite IV with lateral, longitudinal rows of long spinules **58**

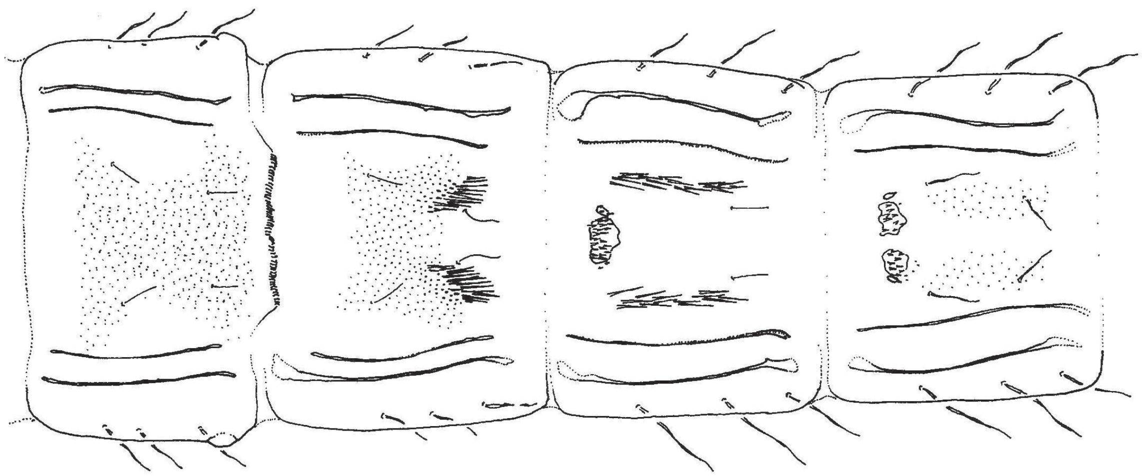


Paratanytarsus spp., tergite IV showing lateral rows of long spinules

58. Tergite V without lateral, longitudinal rows of long spinules .... ***Paratanytarsus grimmii***

Tergite IV with anteromedian patch of short spinules or points and a pair of lateral rows of long spinules. Tergite V with only an anteromedian pair of patches of short spinules. Thoracic horn is absent. *P. grimmi* is a parthenogenetic species with a worldwide distribution that can become a pest in water supply systems.

Small, enriched ditch near Homestead Speedway. Though this species was not collected in Everglades National Park in this study, it may be present in enriched areas of the Everglades.

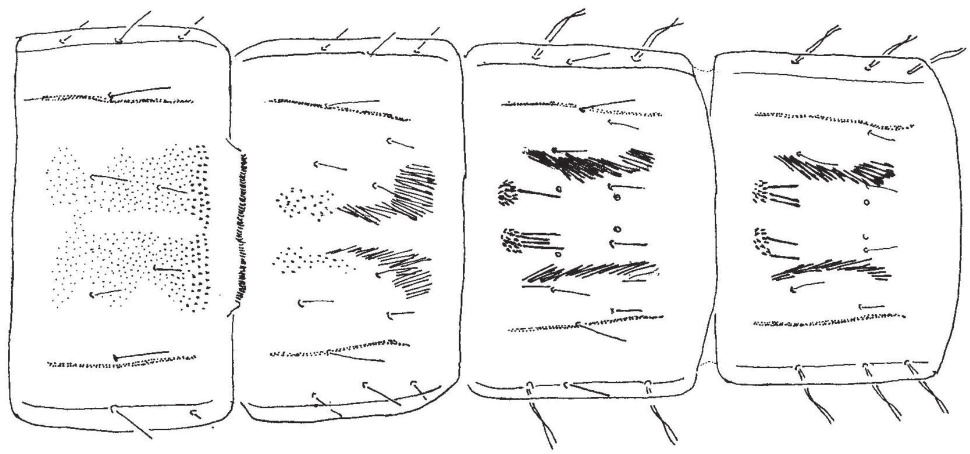


Paratanytarsus grimmii, abdominal segments II-V.

58'. Tergite V with lateral rows of long spinules..***Paratanytarsus* sp. A**

Tergite IV with two lateral patches of long spines and two small anteromedian patches of both short and long spines.

Common in Paurotis Pond, rare in Taylor Slough basin.



Paratanytarsus sp. A, tergites II-V.

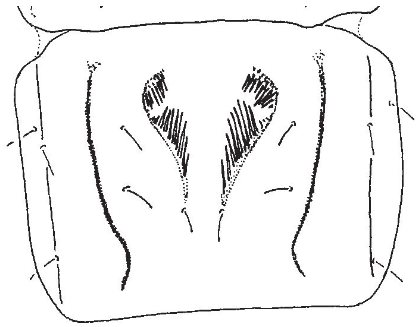
59. Tergite III spine patches with at least some long spines...***Tanytarsus* (in part), 60**

Tanytarsus spp., all with long spines in spine patches on tergite III.

59'. Spine patches on all tergites comprised of only short spines **69**

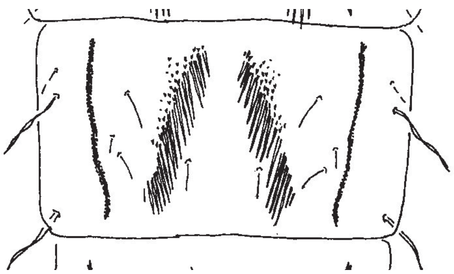
60. Longitudinal spine rows of tergite IV are sinuate, with posterior spines directed anteromedially; anal comb (on caudolateral corners of segment VIII) very broad.. ***Tanytarsus* "Nimbocera-group", 61**

This group of species is called the "Nimbocera-group" because the pupae of these species, including *Tanytarsus limneticus*, all share sinuate spine rows on tergite IV. Larvae of *Tanytarsus limneticus* were mistakenly described as belonging to the genus *Nimbocera* by Steiner and Hulbert (1982).



Tergite IV of *Tanytarsus* "Nimbocera-group" sp. showing sinuate longitudinal spine rows.

60'. Spine groups on IV not sinuate; anal comb much less broad... **64**

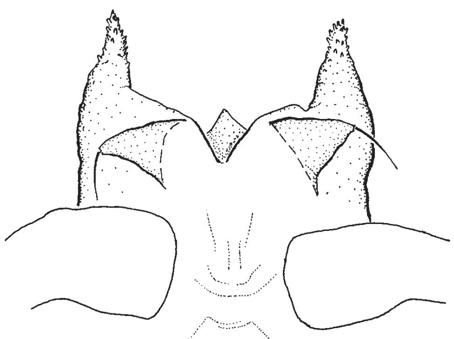


Tergite IV of a *Tanytarsus* sp. showing straight longitudinal spine rows

61. Frontal apotome with large, spiny frontal warts.. ***Tanytarsus* cf. *epleri***

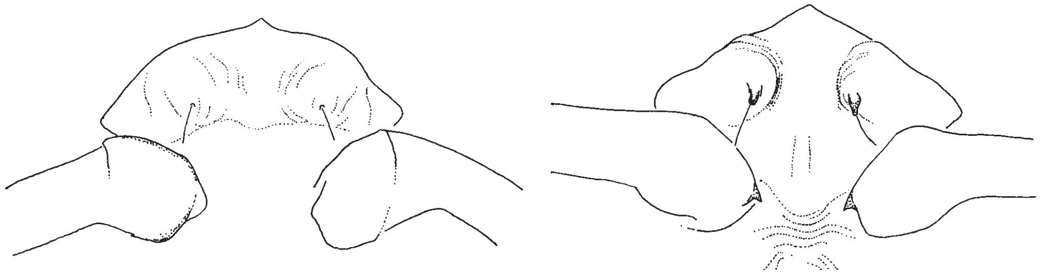
Cephalic tubercles large.

Present in upper Taylor Slough near the 332 pump station when pumps were operating and extended downstream at least to the FL S.R. 9336 bridge. It has not been collected since pumping was stopped in 2000.



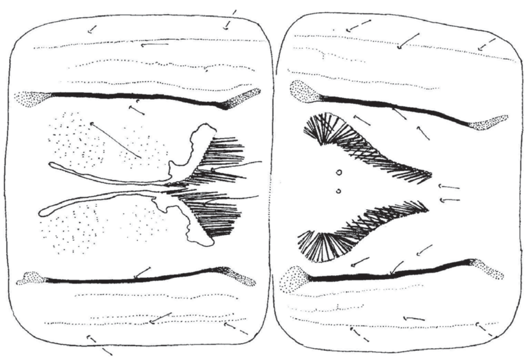
Tanytarsus cf. *epleri,* frontal apotome

61'. Frontal apotome without frontal warts **62**



Tanytarsus spp. without frontal warts

62. Spine patches on III with narrow, sclerotized, spineless anterior extensions; posteromedially directed anterior spines on tergite IV not markedly smaller than posterior spines.. **63**

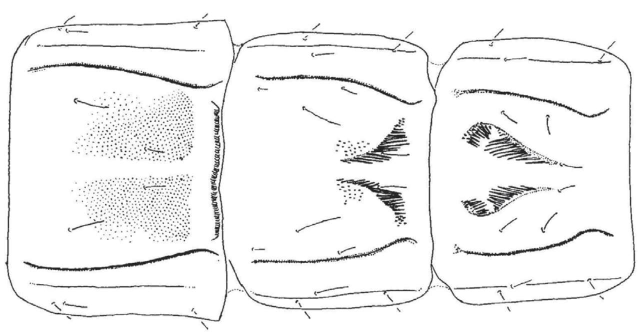


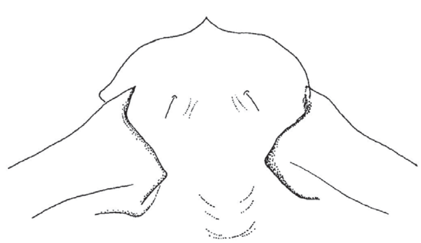
Tanytarsus sp. NA, tergites III-IV (arrow points to sclerotized anterior extension of spine patch on tergite III).

62'. Spine patches on III without sclerotized anterior extension; anterior spines on tergite IV markedly smaller than posterior spines... ***Tanytarsus limneticus***

The larva of this species was described as *Nimbocera pinderi* by Steiner and Hulbert (1982). By obtaining reared associations, Epler (1995) was able to show that this species was actually the larva of *Tanytarsus limneticus.*

Widespread and common. This species is common in eutrophic waters, but also in a wide variety of relatively unenriched habitats such as gator holes, solution holes, and borrow ponds. Therefore, it is not a reliable indicator of nutrient enrichment.



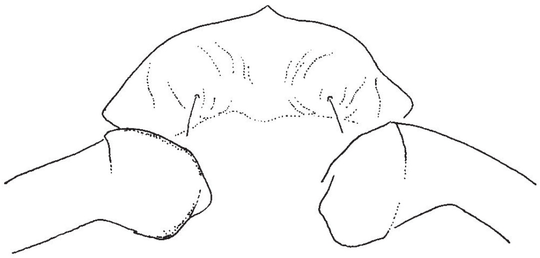


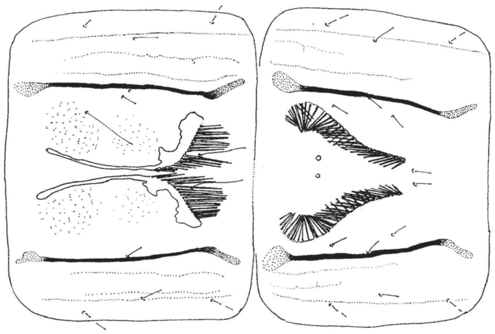
Tanytarsus limneticus: tergites II-IV frontal apotome

63. No distinct cephalic tubercle; anal lobes with more than 20 taeniae ....*Tanytarsus* **sp. NA**

Base of antennal sheath without distinct pointed spur.

Widespread and common, though conspicuously absent in areas of Taylor Slough near the L-31W canal. Common in interior marshes but rare near the 332 retention ponds. Also absent in Shark Slough P-dosing flumes that received the highest (30 ppb) doses of phosphate. Distribution records suggest that this species is a good indicator of high water quality.



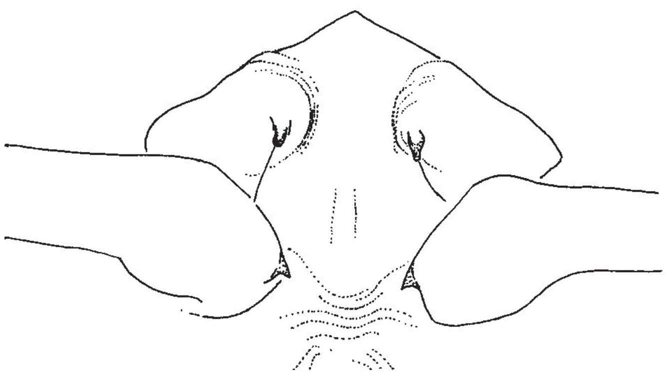


Tanytarsus sp. NA: frontal apotome segments III-IV

63'. With small cephalic tubercles; anal lobes with less than 20 taeniae ....*Tanytarsus* **sp. ND**

Very similar to *T*. sp. NA and almost seems to grade into this species, particularly in the numbers of setae on the anal lobe. Extensive reared series of both species are needed to determine if *T*. sp. NA and *T*. sp. ND are distinct species or are a single species with morphological variability. They are considered to be different species in this key, with *T*. sp. ND being quite variable in the number of taeniae on the anal lobe and in cephalic tubercle development.

Common near the retention ponds and in ditches and canals outside ENP.



Tanytarsus sp. ND, frontal apotome

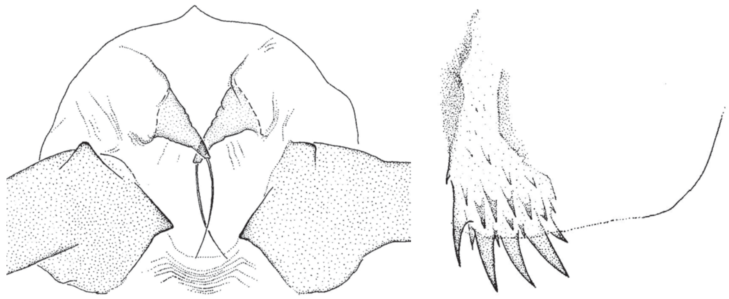
64. Small spine patches absent on tergite VI.. **65**

64'. Small spine patches present on tergite VI **66**

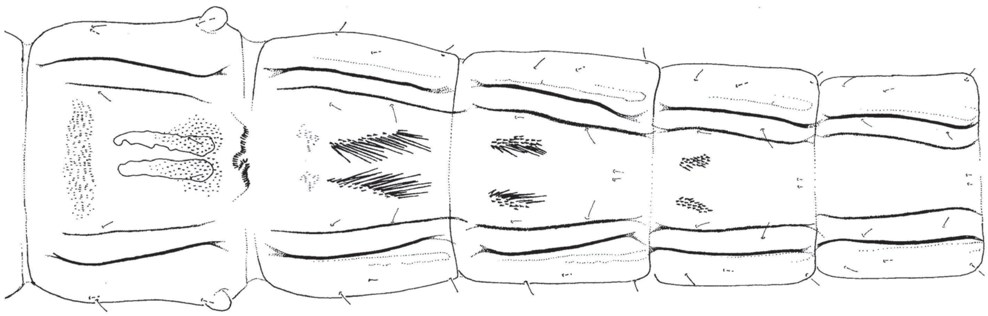
65. With prominent, narrow cephalic tubercles .... *Tanytarsus* **sp. A**

Also tergite II shagreen with anterior band of fine spines but without distinct anteromedial cluster of stronger spinules; tergite IV spine groups usually with some longer spines.

Common in borrow pits (Paurotis and Sweet Bay Ponds), also present in sloughs and prairies.



Tanytarsus sp. A: frontal apotome comb on VIII

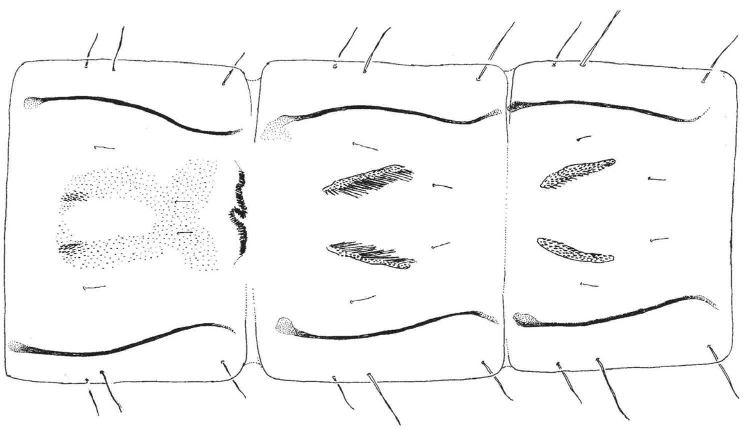


Tanytarsus sp. A, abdominal segments II-VI

65'. Cephalic tubercles very small or absent .... *Tanytarsus* **sp. H**

Also tergite II shagreen with distinct anteromedial cluster of stronger spinules; spine patches on tergite IV with only small spinules.

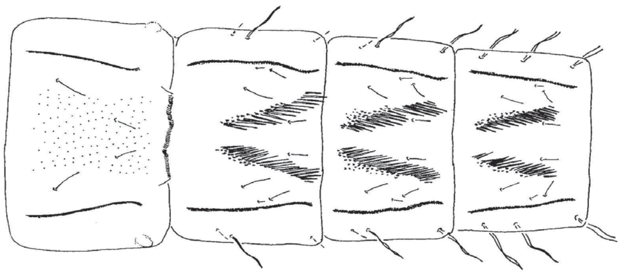
In ENP, only found at Chekika marl-prairie sites and near retention ponds. Also present in enriched ditches in the Redland.



Tanytarsus sp. H, tergites II-IV

66. Tergites III-V with longitudinal bands of long spines .... ***Tanytarsus* sp. D**

This is the same species as Epler's (2001) *Tanytarsus* sp. R. Widespread and very abundant where calcareous periphyton is abundant. The species is considered by King (2001) and McCormick and others (2004) to be an indicator of high water quality, but this species increased in abundance with P-enrichment in Shark Slough P-dosing flumes. *T.* sp. D is an indicator of good water quality, but clearly not highly sensitive to low levels of enrichment. However, specimens collected near sources of enrichment such as retention ponds usually have deformed or aberrant longitudinal bands of long spines on tergites III-V, suggesting these water sources impose some degree of developmental stress on this species.



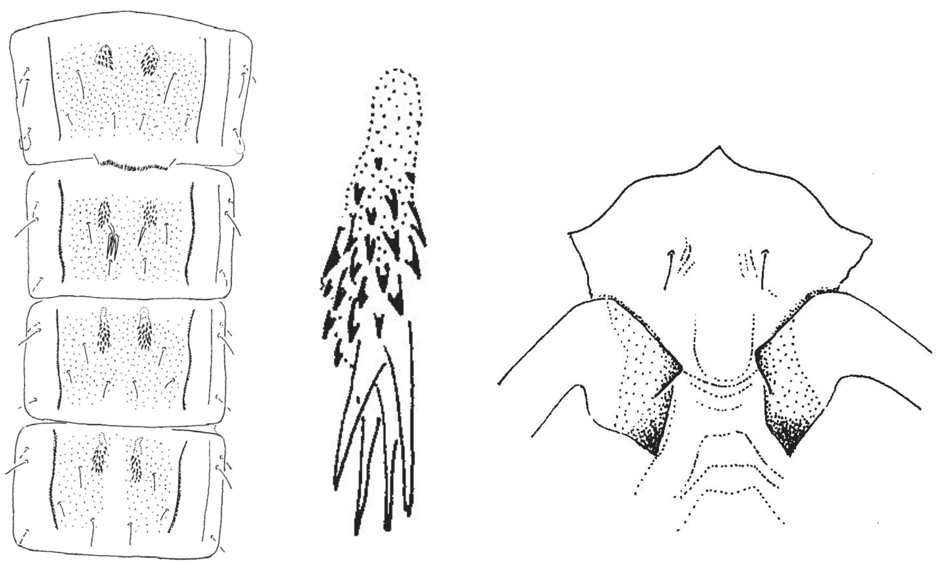
Tanytarsus sp. D, tergites II-V

66'. Tergite V with only small anterior patches of small points **67**

67. Tergites III and IV with extensive fine shagreen; spine patches on III and sometimes IV with a few posterior long, stout spines .... ***Tanytarsus* sp. B (in part)**

Most specimens of *Tanytarsus* sp. B have spine patches on tergite III with at least 1 or more long stout spines. However, some specimens may lack long spines and resemble *T.* sp. E. The base of the antennal sheath is conspicuously darkened. Reared specimens closely resemble *Tanytarsus allicis* Sublette and may be this species. Associated larvae of this species as well as *T.* sp. F key to *Tanytarsus* sp. C in Epler (2001).

Uncommon in ENP; collected at Taylor Slough near L-31W canal, and near retention ponds, both sites located along the periphery of the Park. Abundant at a slough site along Loop Road.



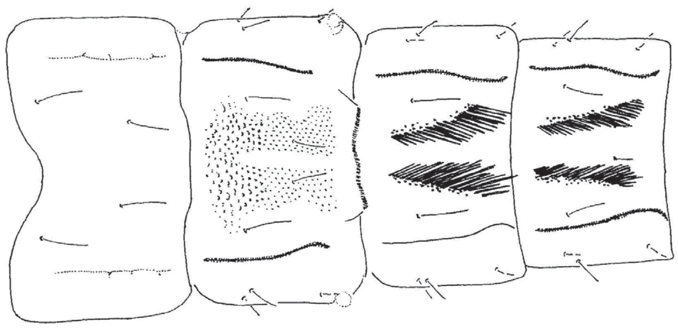
Tanytarsus sp. B: tergites II-V   anterior spine patches on III   frontal apotome

67'. Tergites III and IV without extensive fine shagreen; spine patches on III and IV consist of an elongate slanted row of numerous posteromedially directed long spines with some smaller more lateral points **68**

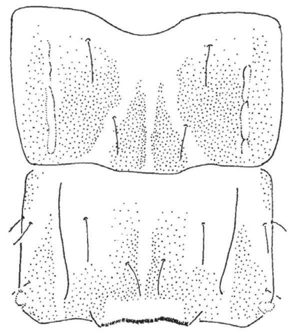
68. Tergites I and II with distinct pattern of pigmentation: tergite I with 4 triangular patches of pigment, pigmentation of tergite II medially divided .... ***Tanytarsus* sp. F**

Tergite II has an extensive field of fine shagreen.

Common at slough and wet-prairie sites in upper Taylor Slough, Shark Slough at Pa-hay-okee, and near the 332 retention ponds. This species is also common in streams in central Florida.



Tanytarsus sp. F, shagreen on TI-IV



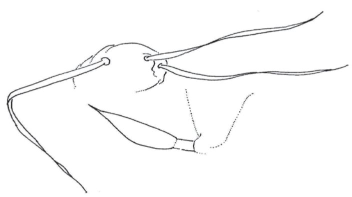
color pattern on TI-II

68'. Tergites I and II without distinct pigmentation .... ***Tanytarsus* sp. L**

Tergite II has only a small postero-median patch of fine shagreen

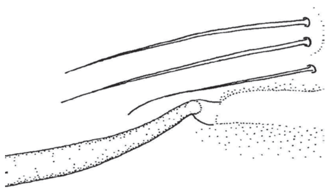
Tanytarsus sp. L has been collected in sloughs north of Bear Island in Big Cypress National Preserve. It has not been collected Everglades National Park in this study but it may be present in sloughs in the Northern Everglades.

69. Precorneal setae taeniate and inserted on a mound; thoracic horn very short, extending, at most, halfway to the edge of the cephalothorax when flattened against cephalothorax on slides, or thoracic horn absent .... ***Cladotanytarsus*, 70**



Cladotanytarsus sp., thoracic horn and taeniate precorneal setae

69'. Precorneal setae hair-like; thoracic horn usually much longer, typically extending beyond cephalothorax when flattened on slides (but short and digitiform in *Tanytarsus* sp. K) .... ***Tanytarsus* (in part), 71**

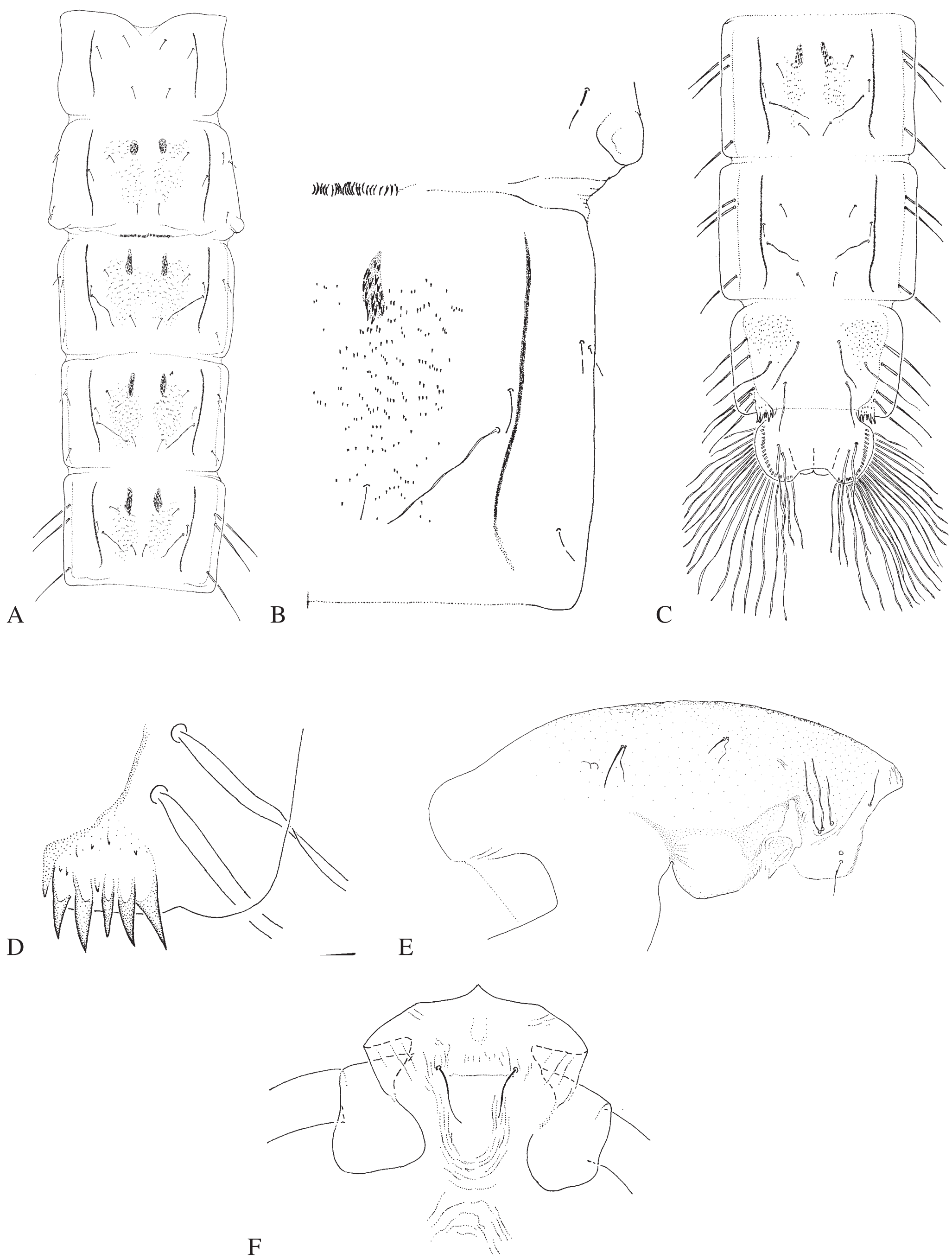


Tanytarsus sp., base of thoracic horn and adjacent hair-like precorneal setae

70. Thoracic horn absent; tergites II-VI with extensive fields of fine shagreen in addition to spine patches; anal comb with about 5 teeth ....*Cladotanytarsus acornutus*

Base of antennal sheath lacks a pointed spur.

This species is widespread and abundant, particularly at marl-prairie sites. It is rarely found near retention ponds or in upper Taylor Slough near the L-31W canal. It is a good indicator of marshes with excellent water quality; it appears to be more intolerant than *C.* sp. C. A full description of this species is presented in Jacobsen and Bilyj (2007).



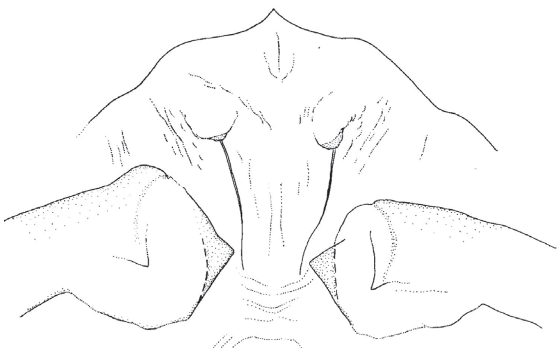
Cladotanytarsus acornutus: A. tergites I-V, B. shagreen on tergite III, C. tergites VI-IX and anal lobes, D. comb on VIII, E. thorax, F. frontal apotome

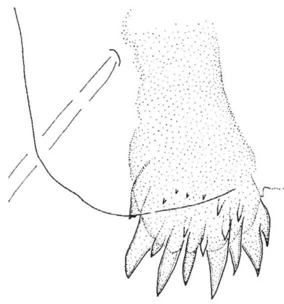
70'. Thoracic horn present, though often very small; tergites II-VI with only a few small spinules near spine patches; anal comb with at least 9 teeth ....***Cladotanytarsus* sp. C, also *Cladotanytarsus* sp. B (see below)**

Originally thought to be one variable species, Mr. Bohdan Bilyj (oral communication) believes that there are at least two *Cladotanytarsus* species with thoracic horns in material collected from ENP. The most common species, *C*. sp. C, has a short thoracic horn that is quite variable in length (35-75 µm long), spindle-shaped, and with 0-2 short apical chaetae. The base of the antenna has a pointed spur. This species is widespread and very common.

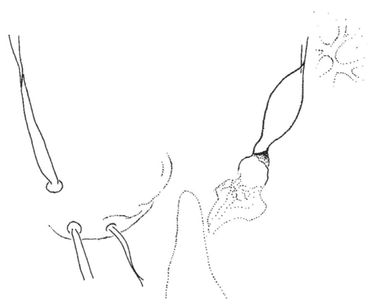
The second species, *C*. sp. B, has a longer thoracic horn (120-170 µm long, with 5-10 long chaetae). It also has a pointed spur at the base of the antennal sheath, but appears to be slightly larger that *C*. sp. C. This species is more common in Shark River Slough slough habitats and will need to be reared to conclusively determine if it is a distinct species from *C*. sp. C. The variability present in the antennal lengths of larval exuviae suggests that Bohdan Bilyj is correct in that there is more than one species.

Both species are indicators of nutrient-poor, high quality water.



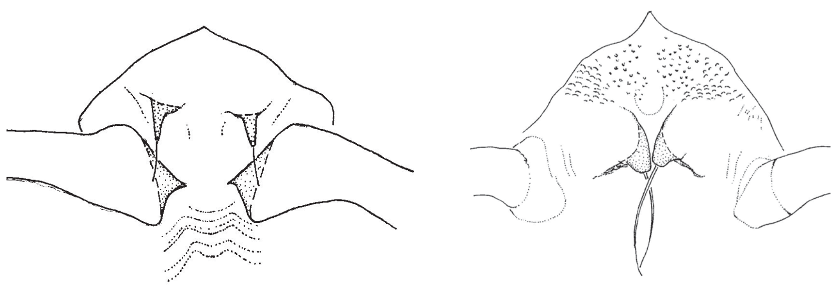


Cladotanytarsus sp. C: frontal apotome comb on VIII



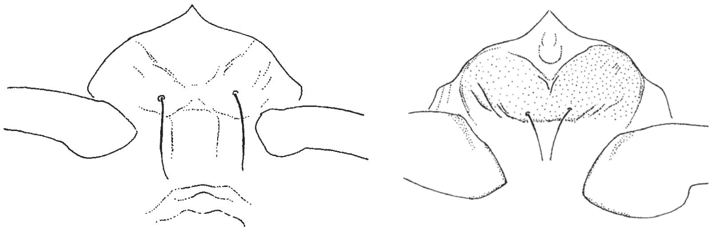
Cladotanytarsus sp. C, precorneal setae and thoracic horn

71. Cephalic tubercles prominent, acuminate...**72**



Tanytarsus spp. with prominent, acuminate cephalic tubercles

71’. Cephalic tubercles absent, frontal setae arise from a low rounded prominence.. **73**

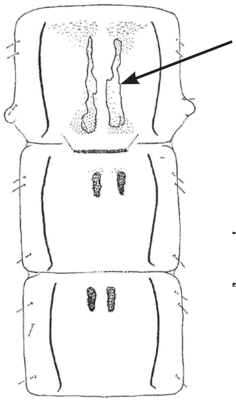


Tanytarsus spp. without distinct cephalic tubercles

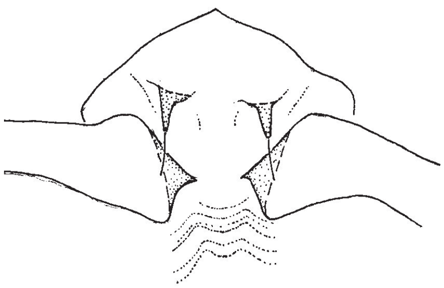
72. Tergite II with 2 longitudinal bands of pigmentation (arrow); cephalic tubercle slender, without rugosity at base; antennal sheath with pointed tubercle at base .... ***Tanytarsus* sp. G**

This taxon may be comprised of 1-3 very similar species in the *Tanytarsus mendax* group. Extensive rearing is needed to resolve what species are present in ENP.

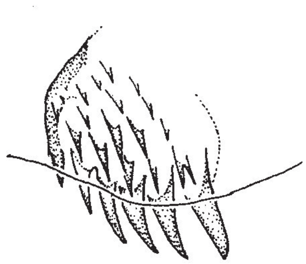
Widespread and common. *Tanytarsus* sp. G. often becomes abundant near the 332 retention ponds and may be an indicator of enrichment. However, the taxonomic uncertainties with this taxon, and the general difficulties in separating species in the *T. mendax* group, somewhat undermines its value as an indicator of enrichment at the present time.



Tanytarsus sp. G: segments II-IV



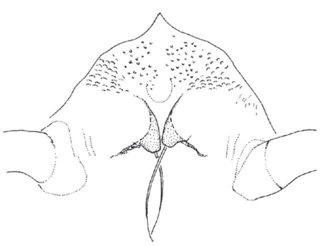
frontal apotome



anal comb

72’. Tergite II without bands of pigmentation; cephalic tubercle more stout and with rugosity at base; antennal sheath without pointed tubercle at base .... ***Tanytarsus* sp. I**

Widely scattered distribution: Big Lostman’s Bay, Chekika marl-prairie, Taylor Slough below the pump station and at the FL S.R. 9336 bridge.



Tanytarsus sp. I: frontal apotome

comb on VIII (two specimens)

73. Tergites III-VI with extensive fine shagreen.. **74**

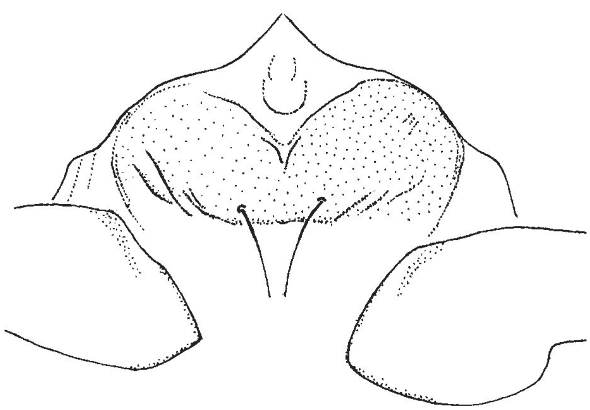
73'. Tergites III-VI without fine shagreen **75**

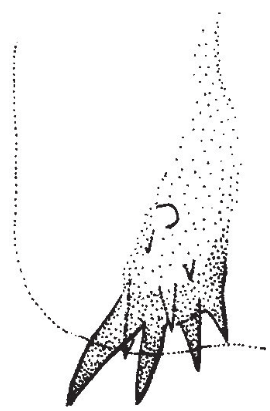
74. Point patches on tergites III-VI yellow to amber-colored, with fine points; paratergites III and IV with fine shagreen ....***Tanytarsus* sp. E**

Tanytarsus sp. E is the same species as Epler's larval taxon, *Tanytarsus* sp. J (Epler, 2001: 8.154-8.162). *Tanytarsus* sp. E resembles specimens of *T*. sp. B that lack long posterior spines in the point patches on tergite III but can be separated from *T*. sp. B by having more than 30 fine amber-colored points in each point patch on tergites III and IV. On *T*. sp. B, these points are much coarser, darker, and number less than 30 per point patch on tergites III and IV. Also, *T*. sp. E lacks a dark spur at the base of the antennal sheath.

This species is fairly widespread but rare in ENP; it is most abundant in Taylor Slough near the L-31W canal and in enriched marshes near retention ponds 332B and 332C. In Water Conservation Area 2A, *T*. sp. E was very abundant in highly enriched marsh sites (King, 2001; Jacobsen, personal observation) and should be regarded as an indicator of enrichment when collected in large numbers.

Tanytarsus sp. E, spine patch on tergite IV



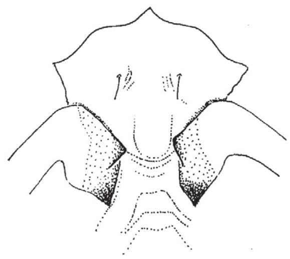


Tanytarsus sp. E: frontal apotome comb on VIII

74’ Point patches on tergites III-VI brown, with coarser points; paratergites III and IV without extensive shagreen.. ***Tanytarsus* sp. B (in part)**

Most specimens of *Tanytarsus* sp. B have spine patches on tergite III with at least 1 or more long stout spines. However, some specimens may lack long spines and resemble *T*. sp. E. The base of the antennal sheath is conspicuously darkened. Reared specimens closely resemble *Tanytarsus allicis* Sublette and may be this species. Associated larvae of this species as well as *T*. sp. F key to *Tanytarsus* sp. C in Epler (2001).

Generally rare; collected at Taylor Slough near L-31W canal and pond at Chekika ranger station. Abundant at a slough site along Loop Road.



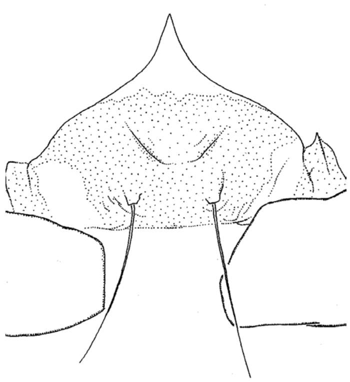
Tanytarsus sp. B: spine patch on tergite IV   frontal apotome and bases of antennal sheaths

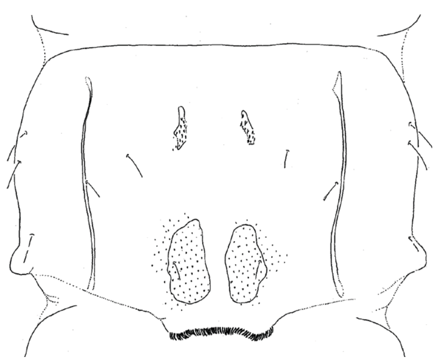
75. Lateral setae on abdominal segments VI-VII are hair-like.. ***Tanytarsus* sp. K**

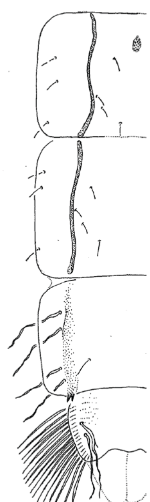
Tanytarsus sp. K can also be separated from *T*. sp. C by the former having a short, stout, barrel-shaped thoracic horn, and tergite II having small oval fields of fine shagreen with background pigmentation anterior to the hooklet row. *Tanytarsus* sp. C has a long, tapering thoracic horn. Tergite II of *T*. sp. C also has fine posterior shagreen, but usually there is no accompanying distinct oval pigmentation. Also, the frontal apotome of *T*. sp. K extends forward more than *T*. sp. C and comes to an acute point.

Rearing confirms *T*. sp. K is the same species as Epler’s (2001) *T*. sp. F. This taxon may represent a new genus separate from *Tanytarsus*.

Tanytarsus sp. K has been collected from slough habitats south of Loop Road, in Water Conservation Area 3B just north of the Tamiami Canal, and from a eutrophic ditch southwest of Florida City. This species is common in Big Cypress National Preserve.





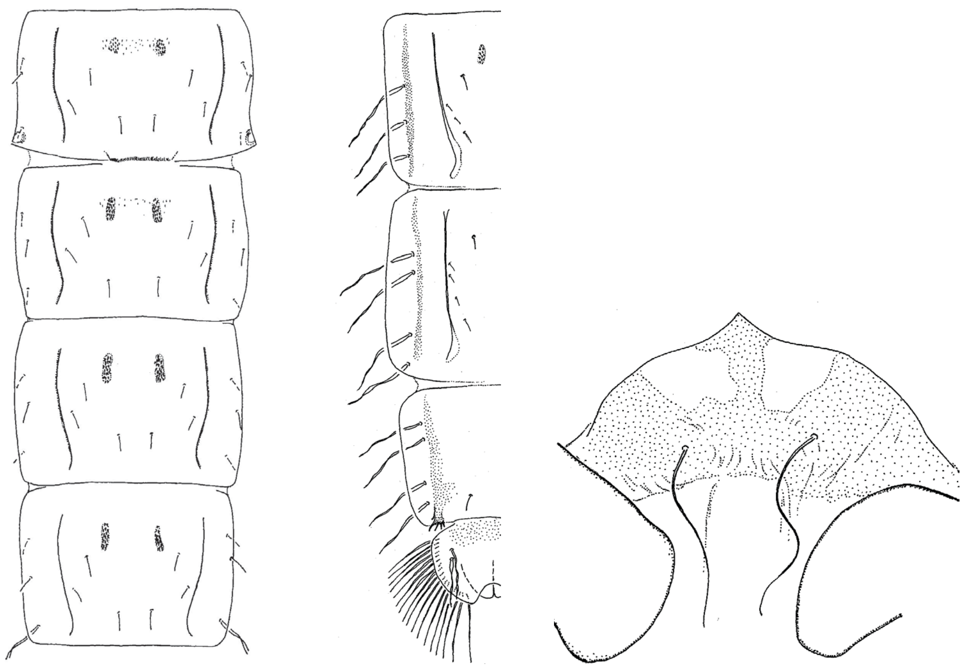


Tanytarsus sp. K: frontal apotome   Tergite I   Tergite VI-IX and anal lobe

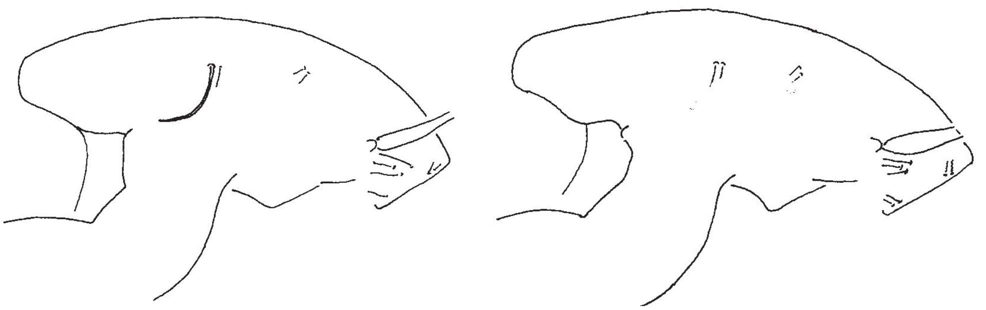
75'. Lateral setae on abdominal segments VI-VII are taeniate.. ***Tanytarsus* sp. C**

Frontal apotome often with a pair of light spots on margin anterior to cephalic ridge with frontal setae.

Common in Taylor Slough in deeper waters, also Pa-hay-okee. Specimens from Shark R. Slough have an elongated, curved 4th dorsocentral seta (Dc4) on the cephalothorax. Taylor Slough specimens usually do not have a conspicuously elongated Dc4 seta. This may be a variable species or a complex of several species. Epler (2001) suspects that his *T*. sp. T, which is tentatively thought to be the larva of this species, may also be either variable or comprised of more than one species.



Tanytarsus sp. C: tergites II-V   tergites Vi-IX and anal lobe   frontal apotome



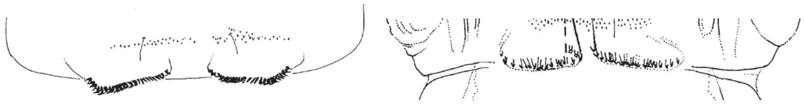
Thorax (Shark R. Slough)   Thorax (Taylor Slough)

Anal comb (Shark R. Slough)   Anal comb (Taylor Slough)

Tanytarsus sp. C, comparison between specimens from Shark R. Slough and Taylor Slough

Chironomini

76. Row of hooklets on posterior margin of tergite II on two separate flap-like protuberances so that hooklet row is distinctly interrupted.. **77**

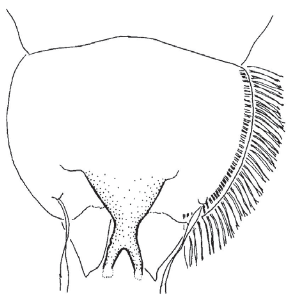


Posterior hooklets on tergite II of: *Cryptochironomus* sp. *Polypedilum* sp. M

76'. Row of hooklets on segment II on one protuberance so that hooklet row is continuous, or at most, only narrowly interrupted (by a crease or missing hooklet) **89**

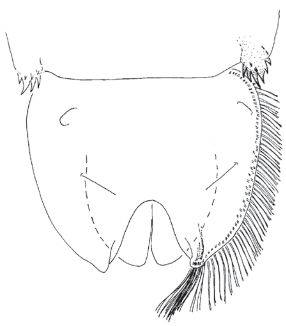
Tergite II rook rows of: *Polypedilum epleri* *Tribelos fuscicorne* *Cryptotendipes* sp.

77. Caudal region with a forked posterior extension.. ***Cryptochironomus*, 79**



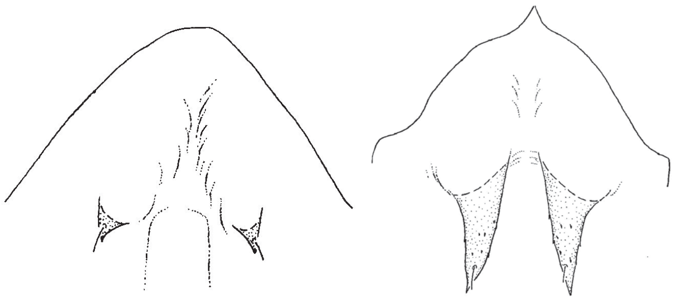
Cryptochironomus sp., forked posterior extension of tergite IX

77'. Caudal region without a forked posterior extension.. **78**



Endochironomus sp., anal lobe without forked posterior extension

78. Frontal apotome with pointed cephalic tubercles **85**

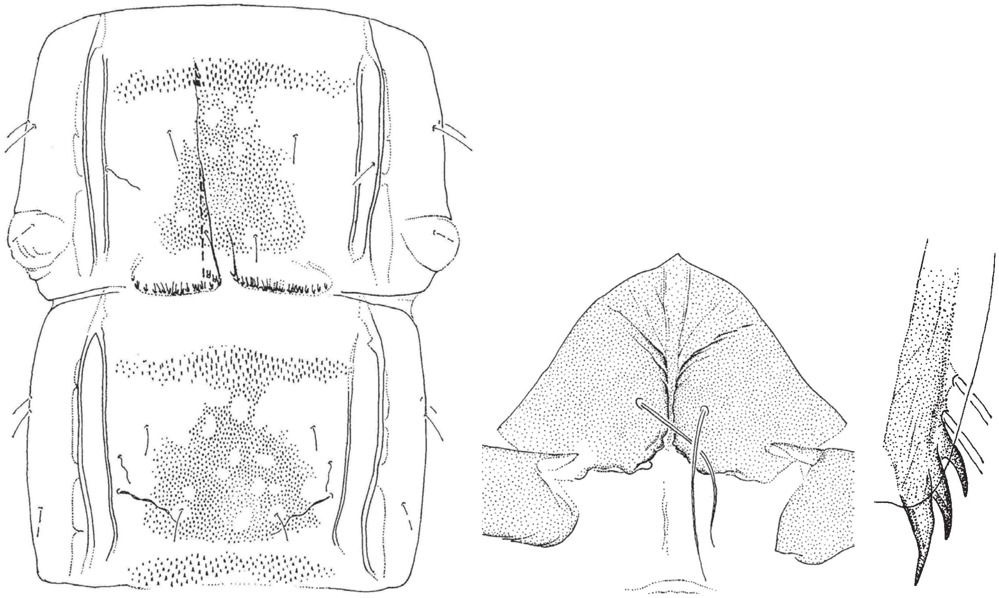


Cephalic tubercles of *Cladopelma* spp.

78'. Frontal apotome without pointed cephalic tubercles .... ***Polypedilum* sp. M**

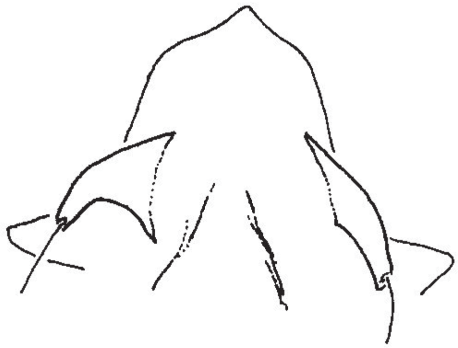
This species is unusual for *Polypedilum* in that it has the posterior hooklet row on II on two narrowly separated protuberances. It very likely is an undescribed species. On most specimens, the hooklet row does not bridge the gulf between the two protuberances, creating a 3-5-hooklet-width break in the hooklet row. However, on some specimens, the hooklets diminish in size and bridge the gulf between the two protuberances. One should check for the presence of two protuberances. This can be difficult to see because the protuberances often collapse into each other during slide mounting. The frontal apotome with two rounded cephalic prominences and strong frontal setae, the coarse, multiple long toothed armature on VIII, and the extensive reticulate shagreen on tergites II-V help to identify this species.

In borrow pits near the Homestead Air Reserve Base. This species has not been collected in the Everglades. It may be present in canals and borrow pits in the Everglades.



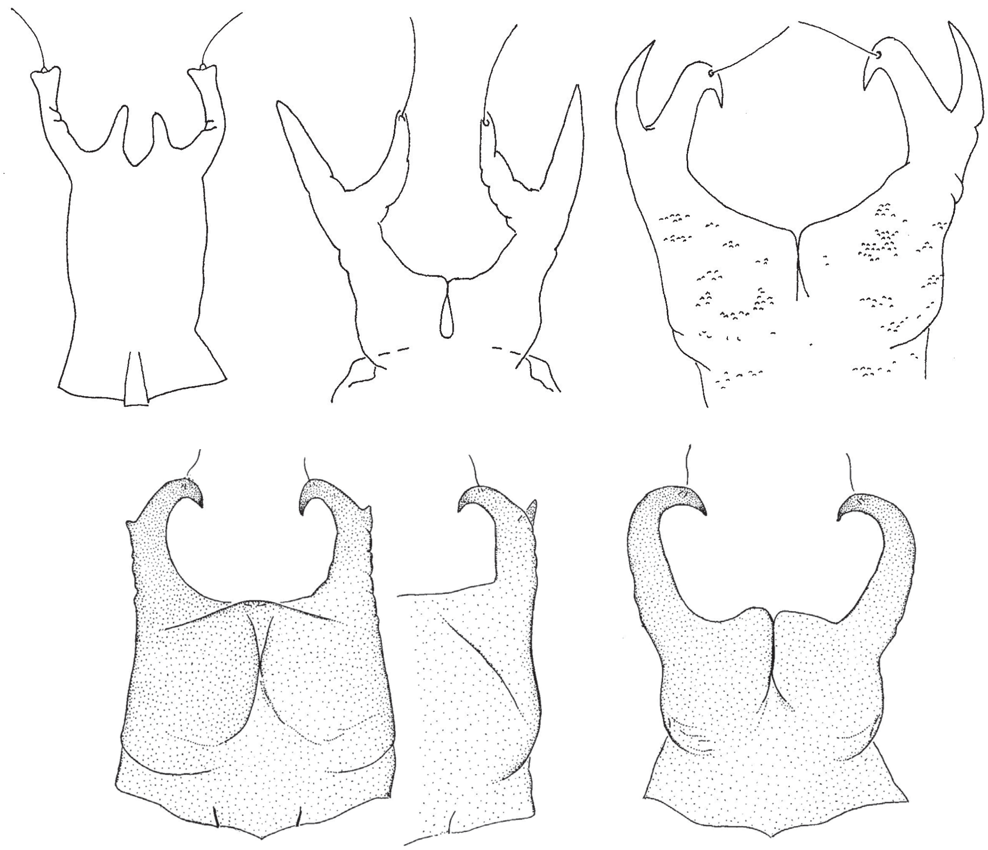
Polypedilum sp. M: tergites II-III frontal apotome spur on VIII

79. Cephalic tubercles of normal size, simple, cone-shaped; tergites I-VI with coarse or fine reticulation **80**



Cryptochironomus sp. B, cephalic tubercles

79'. Cephalic tubercles greatly enlarged, elaborate, with curved or forked arms arising from a broad base **81**

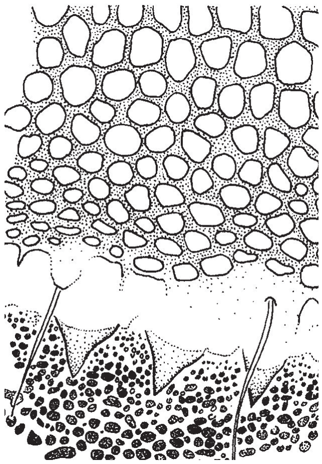


Examples of ornate cephalic tubercles of *Cryptochironomus* spp.

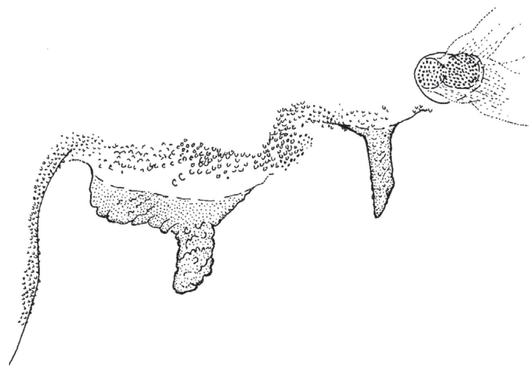
80. Surface of tergites I-VI with coarse, chain-mail-like reticulation; with prominent postcorneal and prealar tubercles..***Cryptochironomus* sp. E**

This species is easily identified by the thick, reticulate pattern on TI-VI, the presence of both prealar and postcorneal tubercles, and the heavily pebbled conjunctives and other surfaces. This species is likely to be *C. psittacinus.*

Pond north of library at Florida International University. Not yet collected from the Everglades. It may be present in canals or borrow pits.



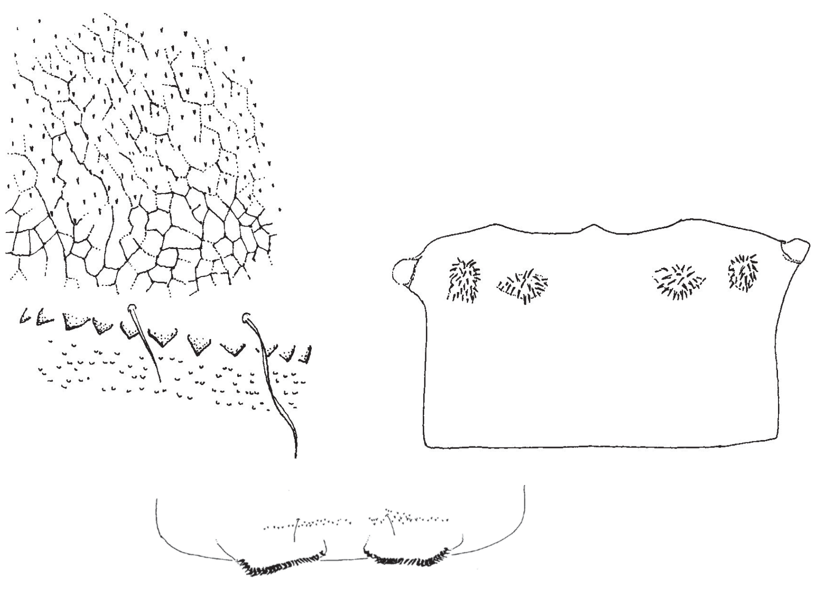
Cryptochironomus sp. E: posterior margin of tergite



Prealar and postcorneal tubercles

80'. Surface of tergites I-VI with light reticulation; lacking postcorneal and prealar tubercles..........***Cryptochironomus* sp. B**

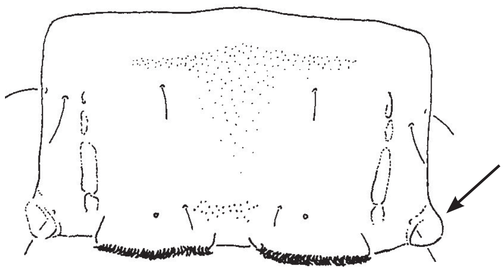
Present in a wide variety of habitats: solution holes, marl-prairie sites, slough sites, and borrow pits. The most common *Cryptochironomus* species in the wet- and marl-prairie.



Cryptochironomus sp. B: posterior margin of tergite, sternite I showing paired spiniferous tubercles, posterior margin of tergite II.

81. Pedes spurii B absent on II **82**

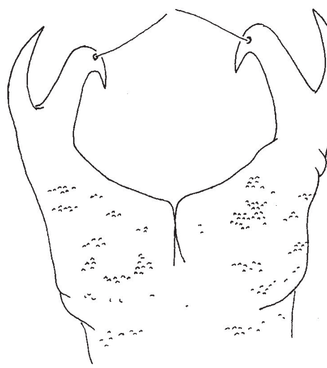
81'. Pedes spurii B (arrow) well developed on II **83**



Cryptochironomus sp. with pedes spurii B on segment II

82. Inner ramus of cephalic tubercle bent medially, hook-shaped; tubercles with pebbled surface .... ***Cryptochironomus* sp. A**

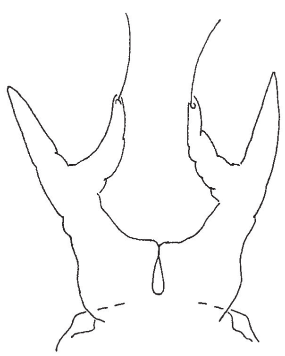
Collected from the main channel of upper Taylor Slough just downstream from the S332 pumping station while pumps were operating. Probably not a native Everglades species.



Cryptochironomus sp. A, cephalic tubercles

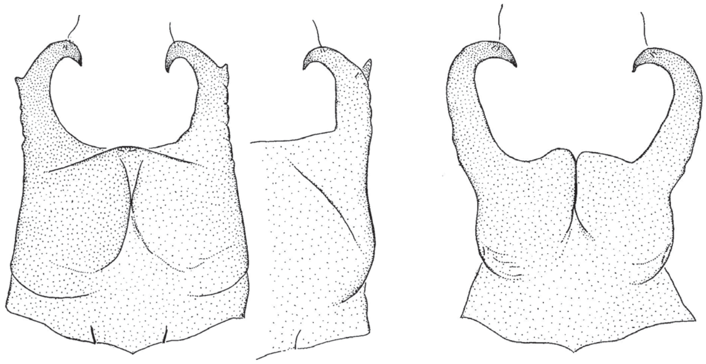
82'. Both rami of cephalic tubercles straight, surface of tubercles smooth .... ***Cryptochironomus* cf. *fulvus***

Collected from the main channel of upper Taylor Slough just downstream from the S332 pumping station while pumps were operating. Probably not a native Everglades species.



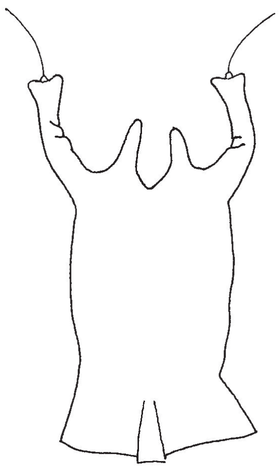
Cryptochironomus cf. *fulvus*, cephalic tubercles

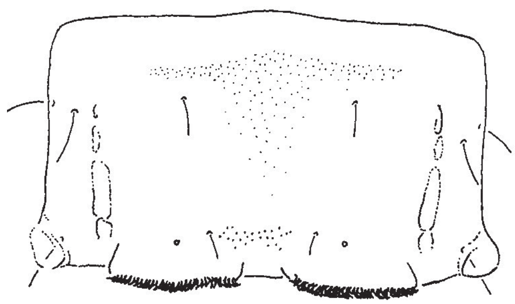
83. Longer ramus of cephalic tubercle hooked; sternite I with anterior spiniferous tubercles... **84**



83'. Longer ramus not hooked; sternite I without anterior spiniferous tubercles...............................***Cryptochironomus* sp. C**

Numerous in Big Lostman's Bay. This is probably an undescribed species.



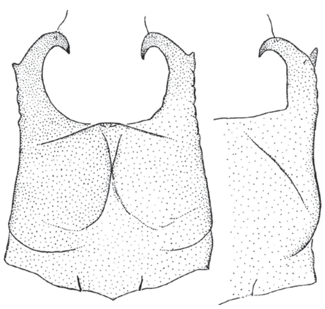


Cryptochironomus sp. C: cephalic tubercles AS II showing posterolateral pedes spurii B

84. Bases of arms fused; sternite I with 1 pair of spiniferous tubercles............................ ***Cryptochironomus* cf. *ponderosus***

Each arm with an incurved terminal ramus and a shorter outer ramus.

Lake Istokpoga, Highland Co. FL. This species has not been collected in the Everglades.

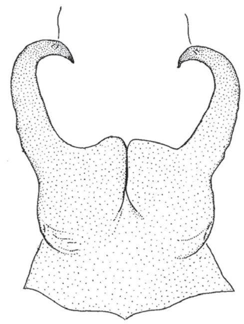


Cryptochironomus cf. *ponderosus*, cephalic tubercles

84'. Bases of arms of cephalic tubercles separated, producing a bulbous base for each arm; sternite I with 2 pairs of spiniferous tubercles .... ***Cryptochironomus* cf. *eminentia***

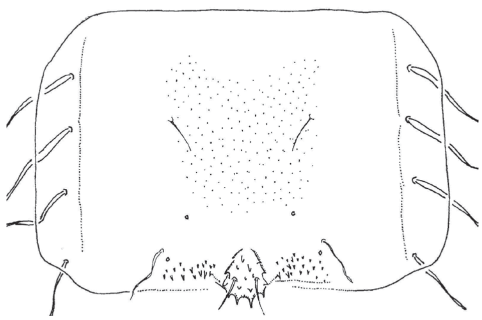
Apex of each arm with two curved rami, but only one is visible in ventral view.

Silver Glen Springs, Marion Co., FL. This species has not been collected in the Everglades.



Cryptochironomus cf. *eminentia*, cephalic tubercles

85. Tergite VI with posteromedian spiniferous tubercle .... ***Cladopelma*, 86**

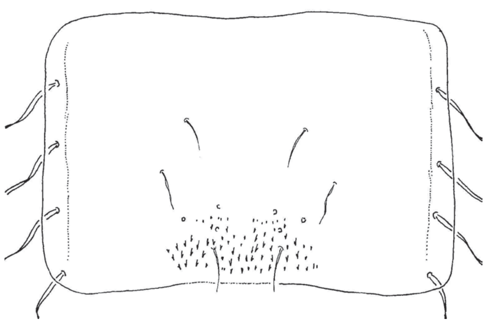


Cladopelma sp., tergite VI

85'. Tergite VI without posteromedian spiniferous tubercle ....***Microchironomus* sp.**

Pupal exuviae almost colorless; with 1-2 small pale spines on caudolateral margins of segment VIII.

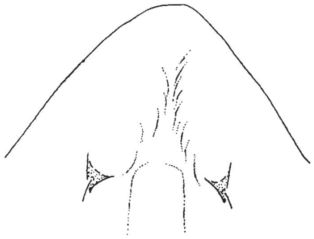
This species has been collected from a ditch at Homestead Air Force Base.

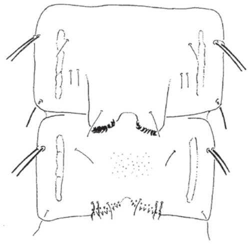


Microchironomus sp., tergite VI

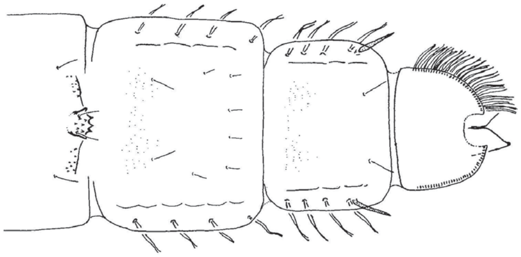
86. Cephalic tubercles short .... ***Cladopelma* sp. A**

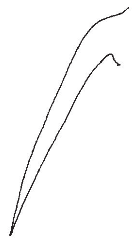
Widespread and common in sloughs, prairie, and solution holes; usually associated with longer hydroperiods or peaty substrates.





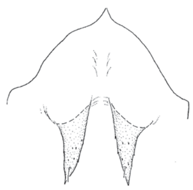
Cladopelma sp. A: frontal apotome abdominal segments II and III





Cladopelma sp. A: posterior abdominal segments Spur on VIII

86'. Cephalic tubercles long **87**

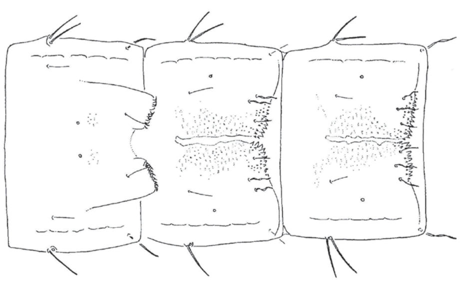


Example of *Cladopelma* sp. with a long cephalic tubercle

87. Tergites III and IV almost completely divided medially by a narrow unsclerotized area extending from the posteromedial margin .... ***Cladopelma forcipis***

Caudolateral margin of VIII with a curved spine.

Taylor Slough downstream of pumping station; possible indicator of enrichment.



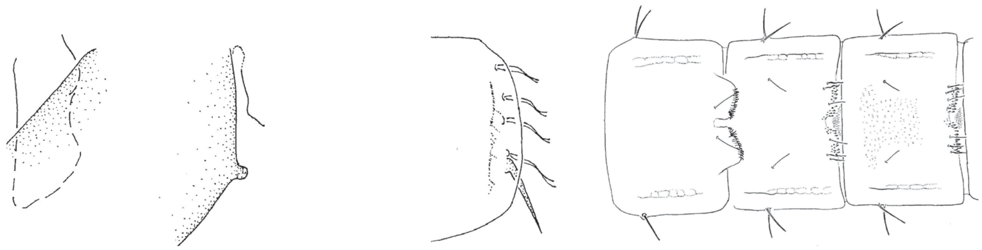
Cladopelma forcipis: segments II-IV caudolateral spur on VIII

87’. Tergites III and IV not divided medially by a narrow unsclerotized area **88**

88. Anterior margin of wing sheath with a nipple-like projection; caudolateral spine on VIII is long, slender and straight; abdominal segments darkly infuscate.. ***Cladopelma* sp. B**

This is a variable taxon that may be comprised of more than one species. Specimens from Holiday Park, Broward Co. show well developed spines on the leg sheaths as described for the pupae of *C. galeator* by Beck and Beck (1969). Other specimens show, at most, only weak papillae on the leg sheaths. Whether this absence of leg sheath spines represents intraspecific variation or a different species needs to be determined through rearing.

Taylor Slough downstream of pumping station and along Wilderness Waterway; possible indicator of enrichment.



Cladopelma sp. B: anterior wing sheath spur on VIII tergites II-IV

88’. Anterior margin of wing sheath smooth, without a nipple-like projection; caudolateral spine on VIII shorter, more stout, often with two spines; abdominal segments pale, only lightly infuscate .... ***Cladopelma* sp. C**

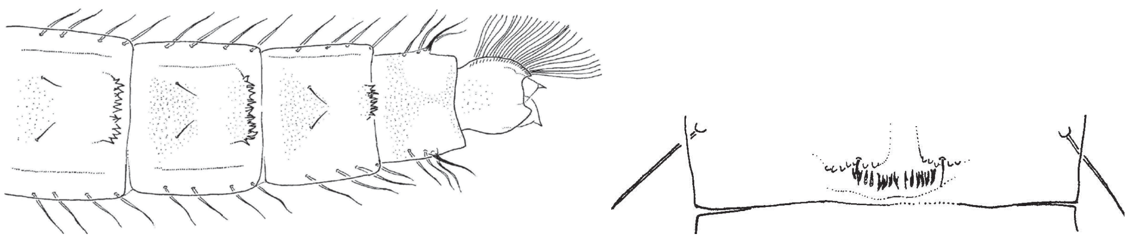
Pond north of Florida International University library. This species has not been collected in the Everglades yet, but may be present in canals or borrow pits.

Cladopelma sp. C: anterior wing sheath spur on VIII (two views)

89. Thoracic horn extremely long (2X length of thorax), slender, apically branched; tergites III-VII with posteromedial flap-like protuberances fringed with stout curved spines .... ***Cryptotendipes* sp.**

Caudolateral margin of VIII with long slender, curved spine or pair of spines.

Present in canals (C-102 and C103). Not found in ENP in this study.



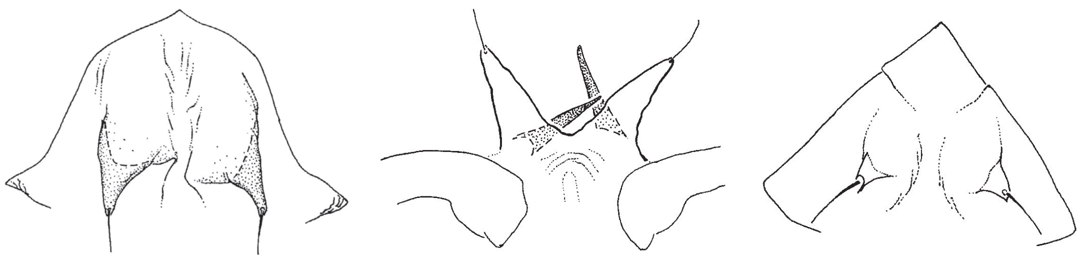
Cryptotendipes sp.: segments V-IX and anal lobes hook row on tergite II

89'. Thoracic horn otherwise, if long, not apically branched; tergites III-VII without spiniferous, posteromedial, flap-like protuberances **90**

90. Caudolateral margins of segment VIII with a spine or a group of spines (Note: In some species, these spines may be pale spinules and be very small) **96**

90'. Caudolateral margins of segment VIII without spines **91**

91. Pointed cephalic tubercles present **92**



Examples of Chironomini with pointed cephalic tubercles

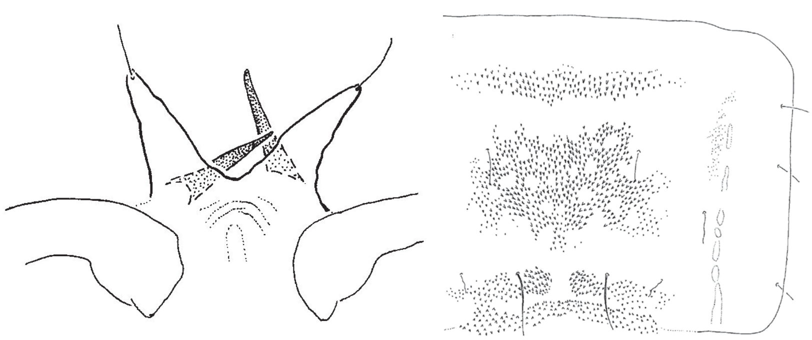
91'. Pointed cephalic tubercles absent **95**

92. Shagreen on tergites II-V separated into 3 groups (anterior band, median field, posterior band) of strong points .... ***Chironomus* sp. E**

This taxon may consist of a single variable species or more than one species. Specimens vary considerably in size and frontal wart development, with some having extremely long conical frontal warts, others having small frontal warts, and others having no apparent warts. Specimens from Sweet Bay Pond are 9-10 mm long and have very elongate frontal warts. Specimens collected from the pond north of the FIU library are 5-6 mm long and have either elongate warts, small warts or no warts at all. Otherwise, these specimens are all very similar morphologically. Rearing is necessary to determine if these variations represent different species.

This taxon was called "*Einfeldia* species group B" in Pinder and Reiss (1986). This group has since been placed within *Chironomus*.

Sweet Bay Pond, pond north of Florida International University library. This species is present in deep borrow ponds, canals, and ditches.



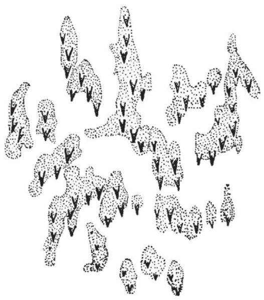
Chironomus sp. E, frontal apotome and TIV of Sweet Bay Pond specimen.

92'. Shagreen otherwise, not divided into 3 groups.. **93**

93. Tergites II-V with coarse shagreen arranged in a fenestrated pattern with many spinules located on pigmented spots of cuticle .... ***Xenochironomus xenolabis* (in part)**

Cephalic tubercles low, rounded, and wrinkled. Pedes spurii B absent.

Obligate miners of freshwater sponge; present in low numbers from a variety of deeper marl-prairies, wet-prairies, sloughs, and borrow pits.



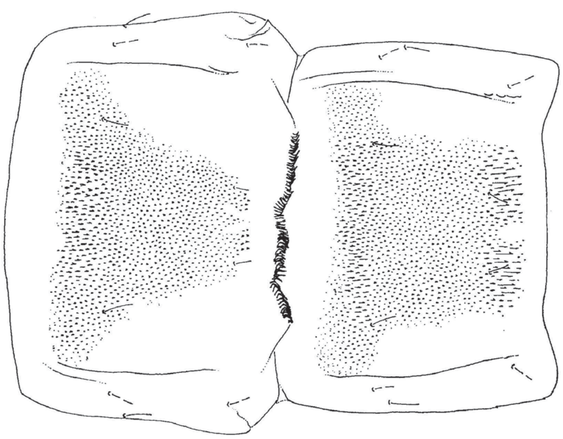
Xenochironomus xenolabis, shagreen pattern

93'. Shagreen not as described above **94**

94. Shagreen on tergites II-VI extensive and coarse, with a posterior band of larger points; exuviae large (> 7 mm) and well pigmented ....***Goeldichironomus fluctuans/natans* (in part)**

This is perhaps an atypical form of *Goeldichironomus fluctuans* or *G. natans* that lacks armature on VIII. There is considerable variability in this taxon suggesting that both species may be present in the Everglades. The pupal taxonomy of these two species in south Florida needs to be resolved through extensive rearing.

Tamiami Canal. Typical form (with caudolateral spine group on VIII) is widespread. This species becomes more abundant with phosphorus enrichment and is a good indicator of enrichment when comprising more than 2 percent of the chironomid pupal exuviae in a sample.

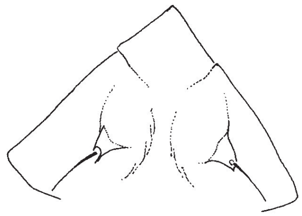


Goeldichironomus fluctuans/natans, tergites II-III

94'. Shagreen on tergites II-VI much less extensive; exuviae smaller (< 5 mm) and pale..................... ***Parachironomus* sp. A**

Cephalic tubercles small, conical. This taxon is likely comprised of more than one species. Based upon larvae, it includes at least *P. directus*.

Widely distributed. This taxon tends to become abundant with enrichment, but its unresolved taxonomy, and the difficulty in distinguishing between possible other similar *Parachironomus* species under a dissecting microscope, undermines its usefulness as a water-quality indicator.



Parachironomus sp. A, frontal apotome

95. Tergites II-V with coarse shagreen arranged in a fenestrated pattern with many spinules located on pigmented spots of cuticle .... ***Xenochironomus xenolabis* (in part)**

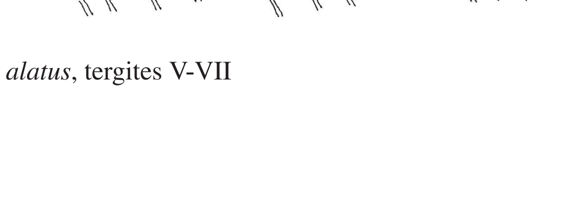
Obligately associated with sponge; present in low numbers from a variety of deeper marl-prairie, wet-prairie, slough and borrow pit sites.

Xenochironomus xenolabis, shagreen pattern

95'. Shagreen not as described above .... ***Parachironomus alatus***

Tergites II-VII with strong, spine-like pair of dorsal setae; on VI, they arise from a posteromedian epaulette-like flap beset with spines.

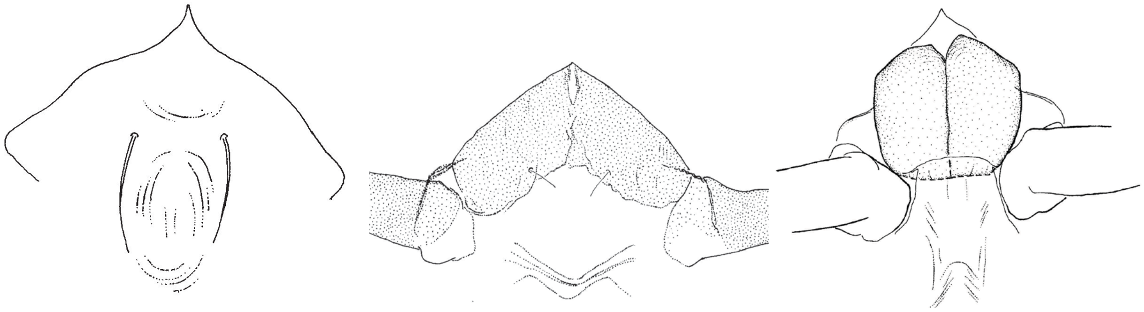
Widely distributed in deeper marl-prairies, wet-prairies, and sloughs. This species is an indicator of excellent water quality.



Parachironomus alatus, tergites V-VII

96. Pointed or truncate and apically spinose cephalic tubercles absent **97**

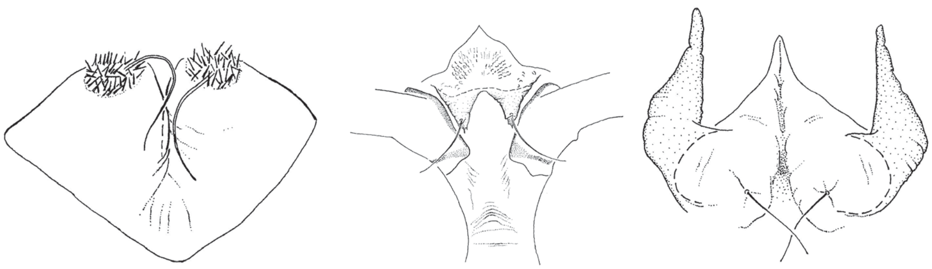
Note: Cephalic tubercles may be present, but they are not pointed or truncate with apical spinules.



Examples of frontal apotome without pointed or truncate, apically spinose cephalic tubercles.

96'. Pointed or truncate, apically spinose cephalic tubercles present.. **116**

Note: Cephalic tubercles are defined in this key as pointed projections, or in one case, truncated projections with apical spinules, projections that bear the frontal setae.



Examples of frontal apotome with truncate, apically spinose or pointed cephalic tubercles.

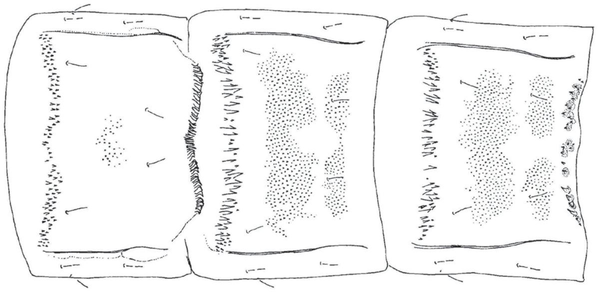
97. Segment V with no clearly taeniate lateral setae (setae are hair-like or are only slightly flattened); tergites II-V or II-VI with prominent, dark-pigmented, anterior bands of stronger spines **98**

97'. Segment V with 3-4 taeniate lateral setae; tergites may have anterior bands of stronger shagreen, but they are not darkly pigmented and prominent **100**

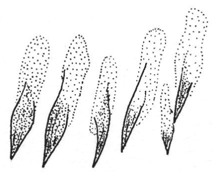
98. Anterior of tergites II-V with single or multiple rows of strong, dark spines; anal lobe without a prominent apical tuft of setae .... ***Polypedilum beckae***

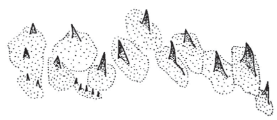
Prominent, darkly pigmented spines on conjunctive IV/V; overall, strongly contrasting pattern of pigmentation; anal lobe without apical tuft of taeniate fringe setae.

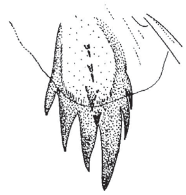
Taylor Slough near L-31W canal, ENP canals, solution holes (generally not present at prairie sites).



Polypedilum beckae, abdominal segments II-IV





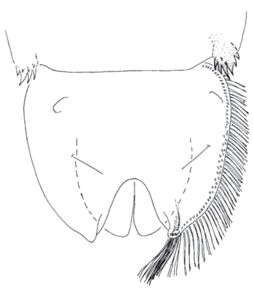


Polypedilum beckae: anterior spines on IV conjunctive IV/V spines spur on VIII

98'. Anterior of tergites II-VI with multiple row of dark spines; anal lobe with a prominent apical tuft of setae ....***Endochironomus*, 99**

Apex of anal lobe with prominent tuft of taeniate fringe setae; conjunctive spines not conspicuously pigmented.

The two species present in ENP, *E. nigricans* and *E. subtendens*, are virtually identical except for their degree of pigmentation. *Endochironomus nigricans* is brown while *E. subtendens* is yellow. It may be difficult to distinguish individual species until both species have been encountered and one can compare the difference in pigmentation between these species. *Endochironomus nigricans* is more frequently encountered than *E. subtendens*.



Anal lobe of *Endochironomus* sp.

99. Abdomen with brown coloration ....***Endochironomus nigricans***

99'. Abdomen with yellow coloration ....***Endochironomus subtendens***

100. Segment V with 3 taeniate lateral setae **106**

100'. Segment V with 4 taeniate lateral setae **101**

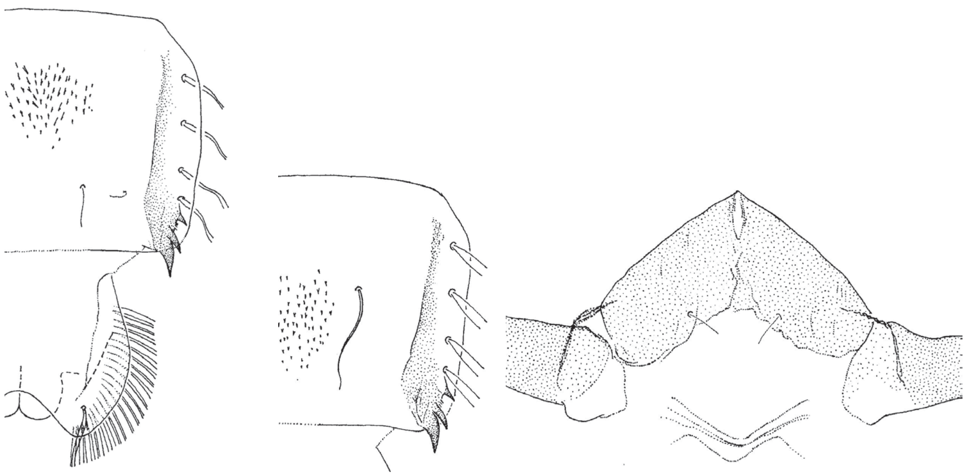
101. Segment IV with at least 1 taeniate lateral setae **102**

101'. Segment IV without taeniate lateral setae, all lateral setae are hair-like **104**

102. Central field of strong shagreen present on both sternite and tergite of VIII .... ***Nilothauma* sp.**

Pupal exuviae usually with strong pigmentation on paratergites, antennal sheath of male with pigment rings. All adult males collected have been *N. babiyi*.

Widespread and common. An indicator of excellent water quality.



Nilothauma sp.: tergite VIII and AL sternite VIII frontal apotome

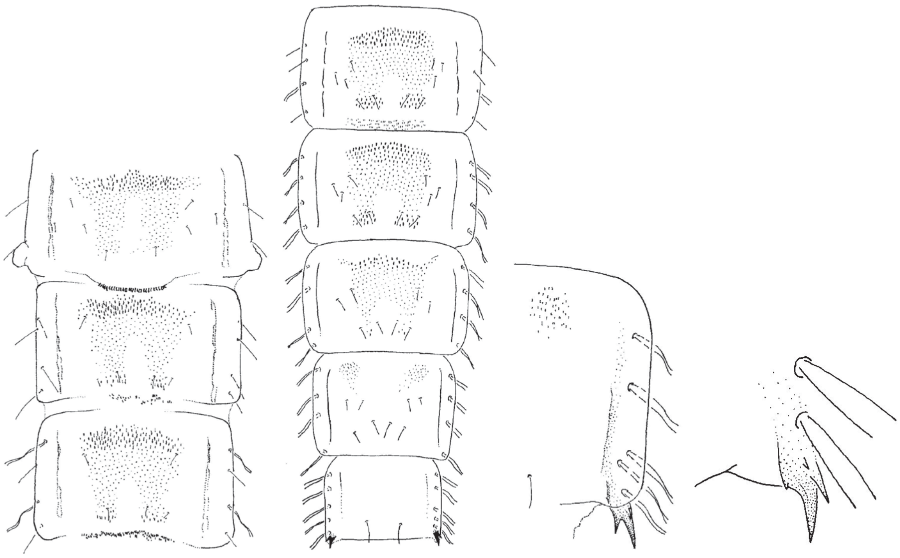
102'. Sternite and tergite VIII without central field of strong shagreen .... ***Apedilum*, 103**

Abdominal segments are not conspicuously pigmented. Note that *Apedilum* will not key out properly in Coffman and Ferrington (1996) (keys to *Stelechomyia*). In their key, *Apedilum* is erroneously described as having cephalic tubercles, which it does not (Epler, 1988). Epler (1988) provides a key for separating the two species in all life stages.

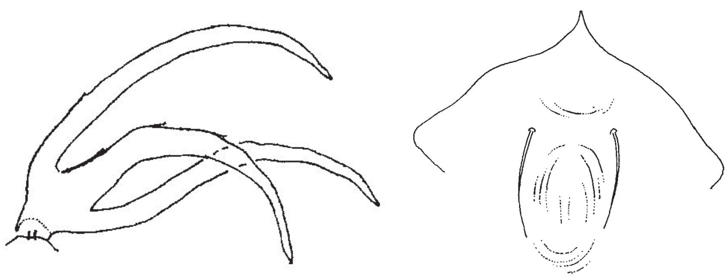
103. Abdominal segment VIII with 5 distinct taeniate L-setae..***Apedilum elachistus***

Thoracic horn with 3 branches. Specimens in ENP have a largely pale dorsum of the cephalothorax with a narrow longitudinal band of pigmentation. Overall, they are lighter in color than *A. subcinctum*. However, specimens from WCA-2A are darker than *A. subcinctum*, so pigmentation is not a reliable character for separating these two species. The number of taeniate setae on VIII (5) is the best character for separating *A. elachistus* from *A. subcinctum*.

Abundant in Paurotis Pond, present in low numbers throughout the marl-prairie but particularly common in marshes near the 332 retention ponds.



Apedilum elachistus: II-IV IV-VIII spur on VIII spur on VIII



Apedilum elachistus: thoracic horn frontal apotome

103'. Abdominal segment VIII with 4 distinct taeniate L-setae, occasionally with a hair-like 5th L-seta.................................... ....***Apedilum subcinctum***

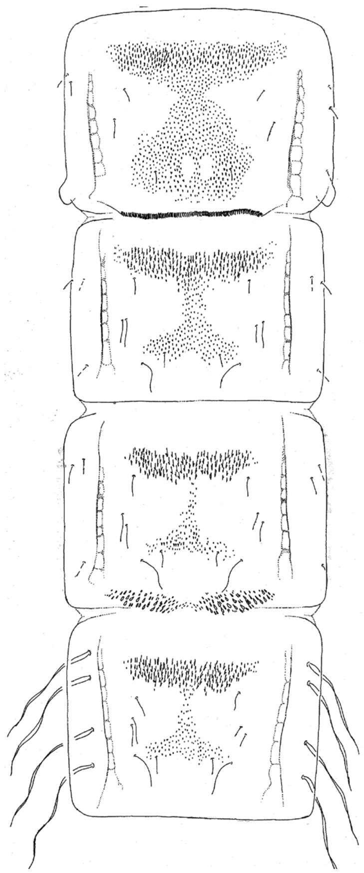
Thoracic horn with 4 branches. Specimens of *A. subcinctum* in ENP have darker pigmentation on the dorsal surface of the cephalothorax than those of *A. elachistus.*

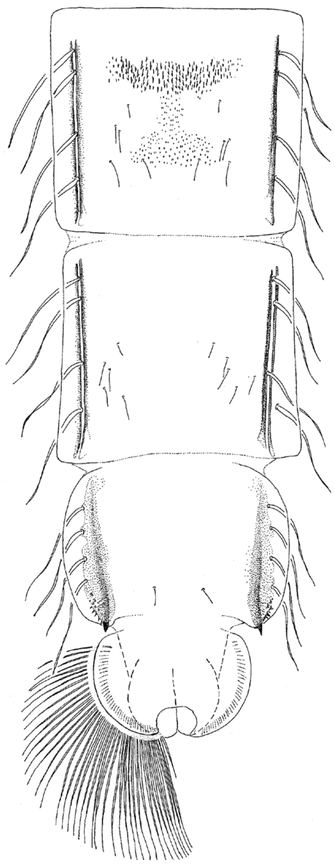
Common in marsh sites near the 332 retention ponds. *Apedilum subcinctum* appear to be subsidized by retention pond operations.

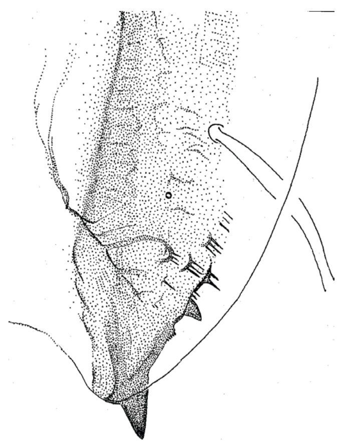
104. Antenna with about 6-8 stout branches, exuviae with distinct dark pigmentation pattern............ **Chironomini Genus A**

This unusual species resembles *Paratendipes* or *Nilothauma* but does not fit within the current taxonomic boundaries of any Chironomini genus. It may be a new genus. Aside from the characters in the key, this species also has conspicuous pigmentation on tergites I and II, the paratergites of all segments, and on the anal lobes.

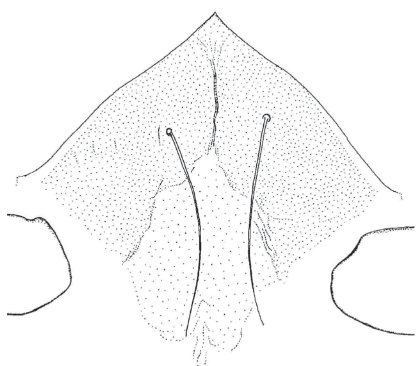
Slough in eastern Big Cypress National Preserve and ditch east of Homestead Speedway. Not collected from Everglades National Park in this study but may be present in western sloughs within the Park.







Chironomini Genus A: segments II-V segments VI-IX and anal lobe spur on VIII



Chironomini Genus A, frontal apotome

104'. Antenna with finely plumose branches as well as a single stout spinose branch; exuviae pale yellow to amber-colored... .... ***Stenochironomus*, 105**

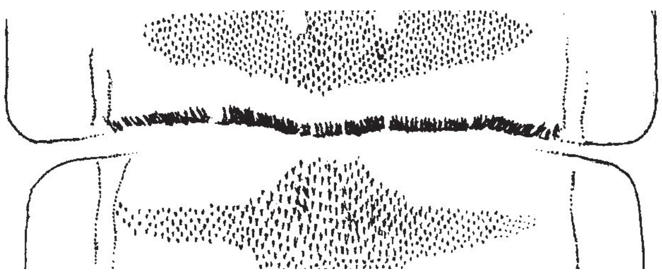
Caudolateral armature on VIII consists of a comb of 3-7 flat spines. *Stenochironomus* was reviewed in all life stages by Borkent (1984).

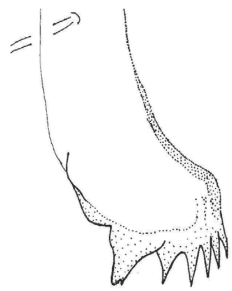
Stenochironomus spp: caudolateral armature on VIII

105. Posterior hook row on II extending to the lateral margins of the tergite .... ***Stenochironomus (Stenochironomus)* sp.**

Tergites VII and VIII without shagreen. Tentatively identified as *S. (S.) macateei*.

Wood miner, common where submerged wood is abundant: willowheads, solution holes with wood.



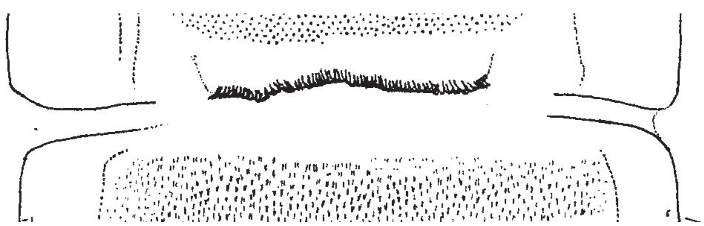


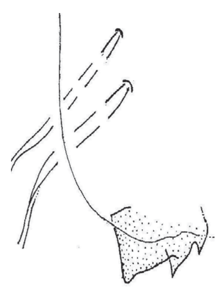
Stenochironomus (Stenochironomus) sp.: hooklet row on II armature on VIII

105'. Posterior hook row restricted to the median part of tergite II................................ ***Stenochironomus (Petalopholeus)* sp.**

Tergites VII and VIII with anterior shagreen. Tentatively identified *as S. (P.) cinctus*.

Leaf miner. Only specimen found in mangrove areas in Big Lostman's Bay along Wilderness Waterway.



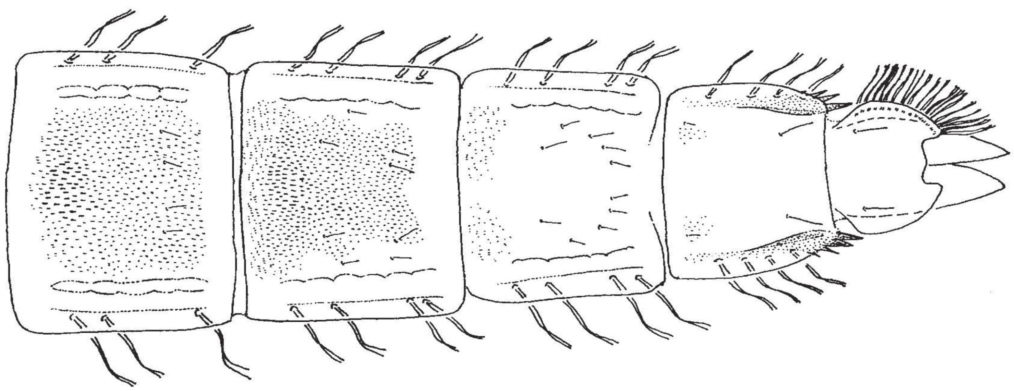


Stenochironomus (Petalopholeus) sp.: hooklet row on II armature on VIII

106. Segment VI with 4 taeniate lateral setae; shagreen on segments II-VI with points generally uniform in length and spacing, and covering most of the tergite .... ***Paratendipes* sp.**

Caudolateral armature of VIII consists of a 3-4 toothed comb; all larvae collected to date are *P. subaequalis*. Note that this species does not key out properly in Coffman and Ferrington (1996) – it keys to *Polypedilum* (couplet 83) in their key.

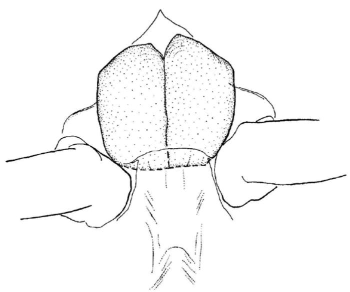
Abundant at marl-prairie sites. A good indicator of short-hydroperiod habitats.



Paratendipes sp., segments V-IX and anal lobes

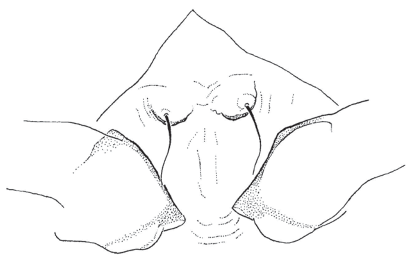
106'. Segment VI with 3 taeniate setae; shagreen on II-VI with uneven distribution of points and points often unequal in length .... ***Polypedilum* (in part), 107**

107. Frontal apotome lacking frontal setae **108**



Polypedilum sp. without frontal setae

107'. Frontal apotome with frontal setae **109**

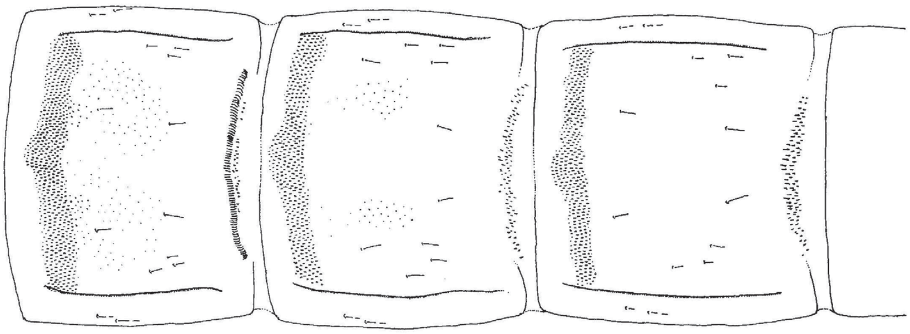


Polypedilum sp. with frontal setae

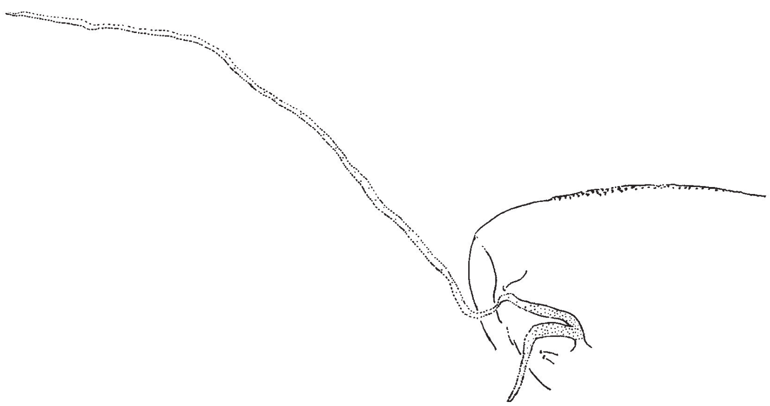
108. Abdominal segment VII with 3 taeniate L setae .... ***Polypedilum* sp. J**

This unusual species has distinctive large round processes on the frontal apotome but lacks frontal setae. The thoracic horn appears to have only 2 branches, the longest of which is as long as the length of the thorax excluding the wing pads. It is easy recognized by having a massive spur on VIII comprised of one long tooth and many secondary teeth. Tergite II often has extra hooklets posterior to the main hooklet row. The wide anterior band of shagreen on tergite II-VI and sparse median and posterior shagreen on tergites IV-V is also unusual and distinctive. The dorsal seta on the anal lobe suggests that this may belong to the subgenus *Tripodura*.

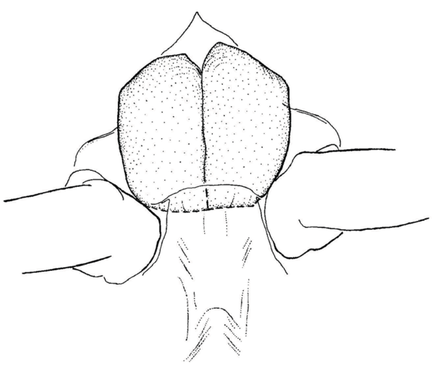
Long hydroperiod habitats like gator holes, *Pontedaria* stands. Taylor Slough and northeast Shark River Slough. Also in WCA-3B and Big Cypress National Preserve.

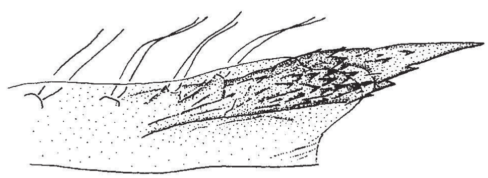


Polypedilum sp. J, abdominal segments II-IV



Polypedilum sp. J, thoracic horn



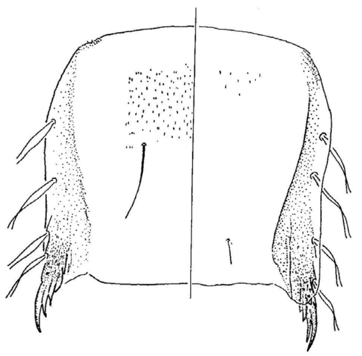


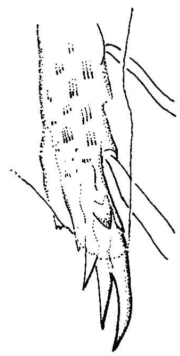
Polypedilum sp. J: frontal apotome spur on VIII

108’. Abdominal segment VII with 4 taeniate L setae ....***Polypedilum* sp. K**

Frontal apotome with a U-shaped ridge (presumably from complete fusion of round cephalic protuberances), but like *P*. sp. J, lacks frontal setae. Tergite and sternite VIII both have shagreen. The dorsal seta on the anal lobe suggests that this may belong to the subgenus *Tripodura*.

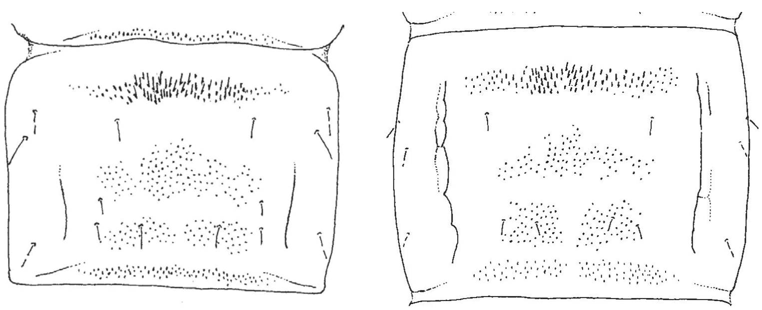
Longer hydroperiod habitats like *Pontederia* stands. Chekika and northeast Shark River Slough. Also in WCA-3B and Big Cypress National Preserve.





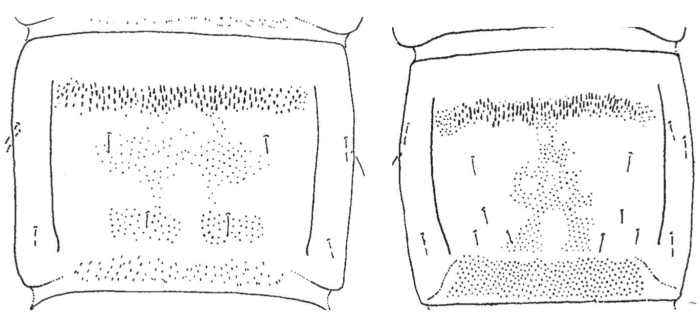
Polypedilum sp. K: ventral (left) and dorsal views of VIII armature on VIII

109. Shagreen on tergite IV consists of 3 completely separated fields of points: an anterior band, a median field, and one continuous or 2 separated posterior fields; anal lobe lacks dorsal seta **113**



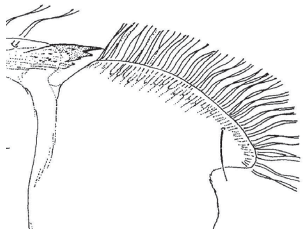
Tergite IV with shagreen consisting of 3-4 distinctly separate fields.

109’. Tergite IV with anterior band of points contiguous with extensive complete or fenestrate posterior field of smaller spinules or anterior and median fields at least partially joined, sometimes by only a few points................................. **110**



IV shagreen patterns: 3 fields connected by points continuous fenestrate shagreen

110. Anal lobe with a dorsal hair-like seta (may break off or be difficult to see) **112**



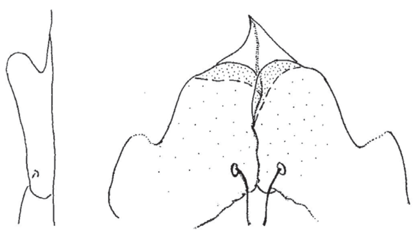
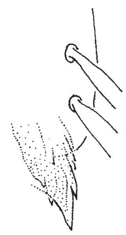
Anal lobe of *Polypedilum trigonus* showing dorsal seta

110’. Anal lobe without a dorsal seta **111**

111. Frontal apotome with protuberances that become enlarged toward the apex..***Polypedilum* sp. L**

The apically enlarged, over-folding cephalic tubercles are distinctive. The abdominal segments are infuscate (‘smokey”) in color. Most tergites have extensive shagreen that is not noticeably fenestrate or broken up into fields.

Northeast Shark River Slough and marshes near retention pond 332B.

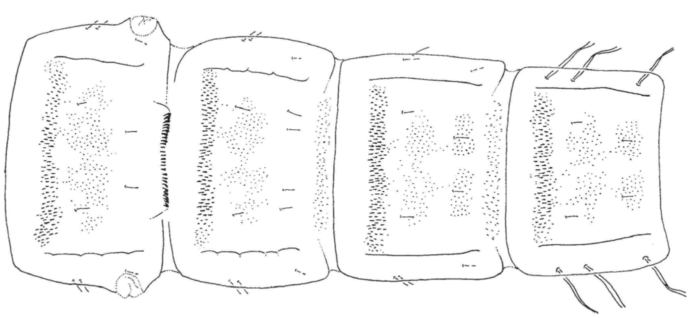
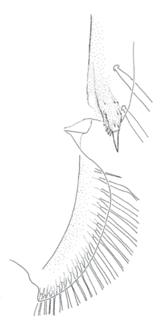
 

Polypedilum sp. L: lateral view and dorsal view of frontal apotome   anal spur on VIII

111’. Frontal apotome otherwise .... ***Polypedilum tritum***

This species closely resembles *Polypedilum epleri*, but differs in having anterior and median shagreen fields that tend to be connected, often by only a few points, and TII has much more extensive shagreen than *Polypedilum epleri*. This species can be recognized under a dissecting scope by its smaller anal spur than *Polypedilum epleri*, the more extensive shagreen on TII, and by the distinctive pigmentation of the anal lobe (however, compare with other *Polypedilum* spp.).

Widespread. This species may be an indicator of enrichment. In WCA-2A, it was present in the enriched “transition” zone but was not found in the unenriched zone.

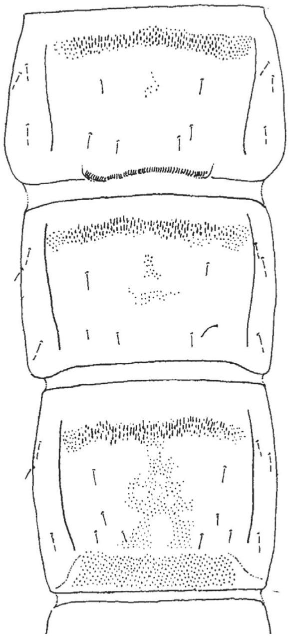
 

Polypedilum tritum: abdominal segments II-V   anal spur and anal lobe

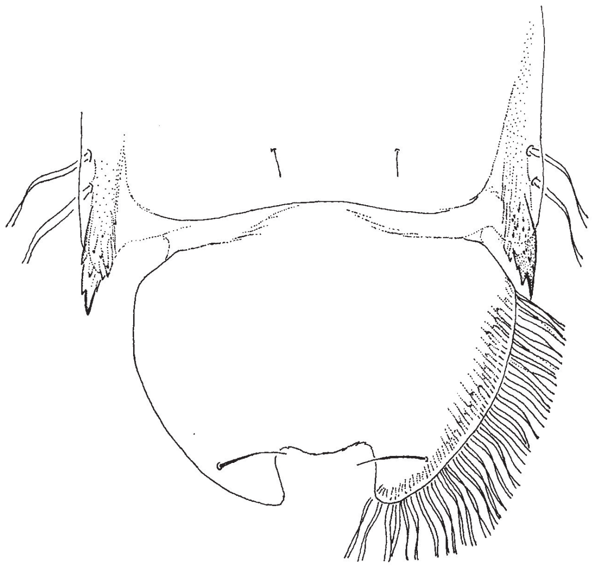
112. Spines absent on conjunctive III/VI ....***Polypedilum trigonus***

Caudolateral spur on VIII beset with secondary spines.

Widespread and abundant, the most commonly encountered *Polypedilum* in the Everglades. King (2001) considers this species to be an indicator of enrichment in WCA-2A. However, this species is widespread across the Everglades and is able to withstand drying so that it is at a competitive advantage in short-hydroperiod, marl-prairie habitats. Consequently, this species is not considered to be a reliable indicator of enrichment in ENP.



Polypedilum trigonus: segments II-IV

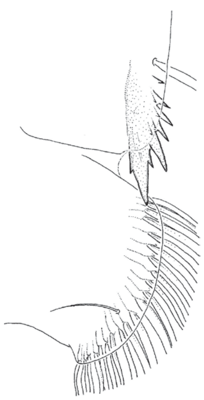


Posterior margin of VIII and anal lobes

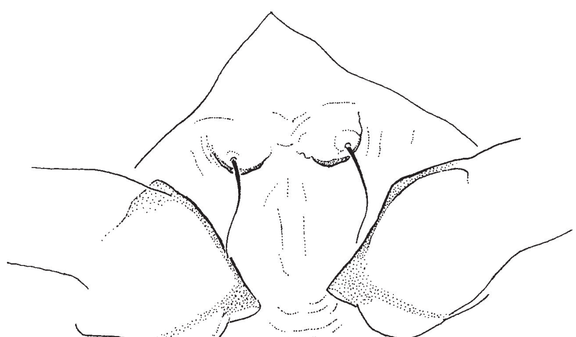
112'. Spines present on conjunctive III/I .... ***Polypedilum (Tripodura)* sp. B (in part)**

Exuviae rather pale, anterior bands on tergites are not prominent like they are in *P. trigonus*. The anal spur is a comb-like splay of 6-8 spines; frontal setae arise from a wrinkled, rounded tubercle (a rounded cephalic tubercle). This species should not be regarded as equivalent to *P. (Tripodura)* sp. B in Epler (2001).

Wilderness Waterway: Chevelier Bay inlet, Big Lostman's Bay. Also enriched ditches.

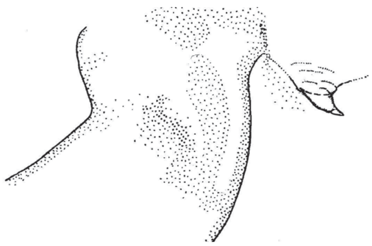


Polypedilum (T.) sp. B: caudolateral armature on VIII



frontal apotome

113. Thorax with prealar tubercle; posterolateral corners of anterior abdominal segments darkened, adjacent conjunctives often with dark pigment.. **114**



Polypedilum sp. N showing prealar tubercle (arrow)

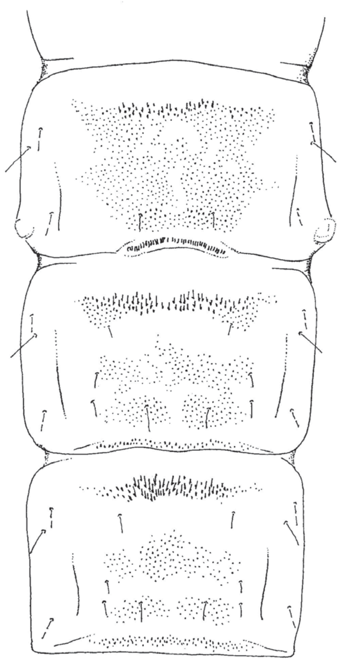
113'. Thorax without prealar tubercle; lateral margins of conjunctives on anterior abdominal segments not pigmented...... **115**

114. Tergites with distinct infuscate pigmentation between shagreen fields; posterolateral armature on VIII consists of a 2-tooth spur..***Polypedilum* cf. *falciforme***

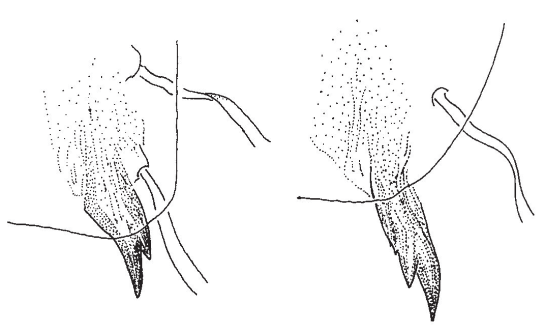
Anal lobe with less than 36 taeniae.

This species belongs to the *Polypedilum illinoense* species group and perhaps should be called "*P. illinoense* group sp." It has been tentatively identified as *P*. cf. *falciforme* based upon the presence of a prealar tubercle and an associated male specimen having a hypopygium closely resembling *P. falciforme* (see Maschwitz and Cook, 2000). However, the prealar tubercle may be weak or absent, and more specimens need to be reared for identification confirmation. Since *P. nymphaeorum* and most likely *P*. sp. N are also members of the *illinoense* species group, the name "cf. *falciforme*" has been retained.

Common at deeper marl-prairie sites and sloughs.



Polypedilum cf. *falciforme*: tergites II-IV

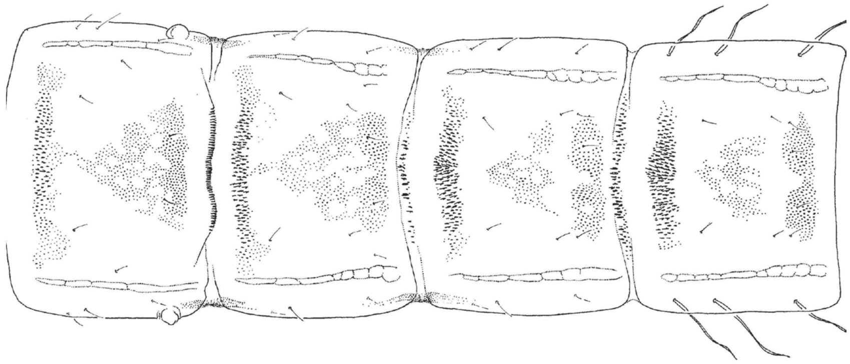


Spur on VIII (2 specimens)

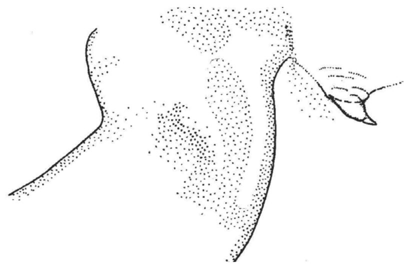
114'. Tergites without distinct pigmentation between shagreen fields; posterolateral armature on VIII with 3-5 teeth.............. ....***Polypedilum* sp. N**

Anal lobe with 40 or more taeniae. This species is easily separated from *P*. cf. *falciforme* by the lack of infuscate pigmentation on the tergites and the greater number of taeniae on the anal lobes. This species keys to *P. bergi* in Maschwitz and Cook (2000) and is very likely to be a member of the *illinoense* species group.

Found in Sweet Bay Pond.



Polypedilum sp. N: segments II-V

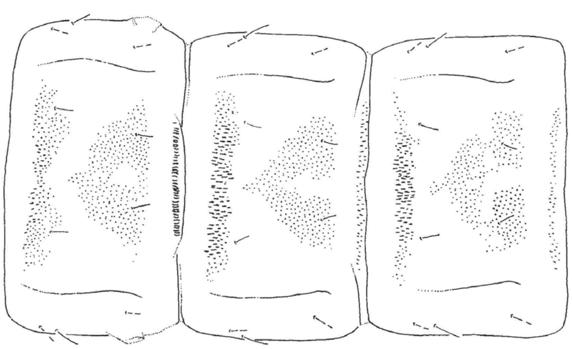


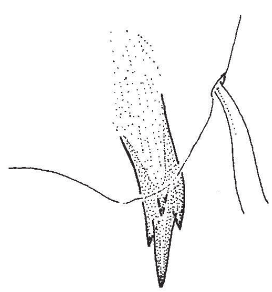
Polypedilum sp. N: prealar tubercle   spur on VIII

115. Tergites II and III with large triangular shagreen fields, tergite I unpigmented, spur on VIII without small accessory points ....***Polypedilum nymphaeorum***

This species is commonly associated with *P. epleri* on *Nymphaea* and *Nuphar*. It can be most easily separated from *P. epleri* by the characters in the key and by its overall pale appearance. *P. epleri* has distinct pigmentation on tergite I, paratergite II, and to a lesser extent on the more distal paratergites.

In sloughs, alligator holes, and ponds with water lilies.





Polypedilum nymphaeorum: segments II-IV   Spur on VIII

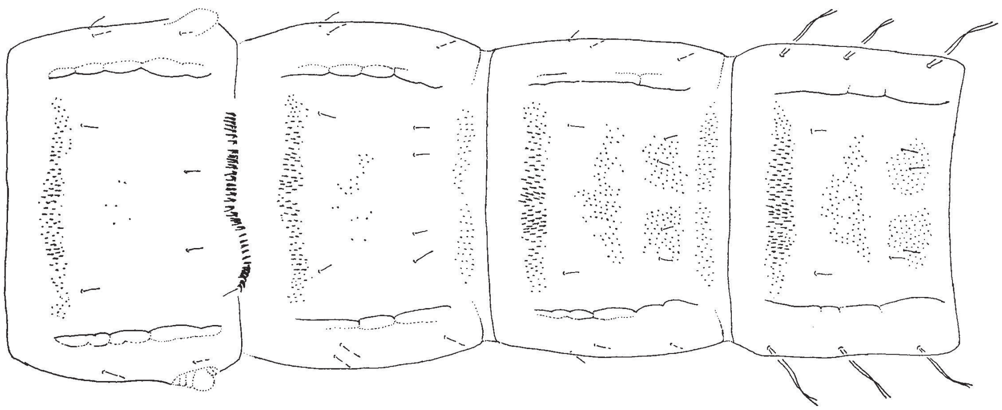
115'. Tergites II and III with at most, only small median patches of points, tergite I pigmented, spur on VIII with 5-10 accessory points...***Polypedilum (Pentapedilum) epleri***

Note that the caudolateral spur on VIII is beset with fine secondary spines.

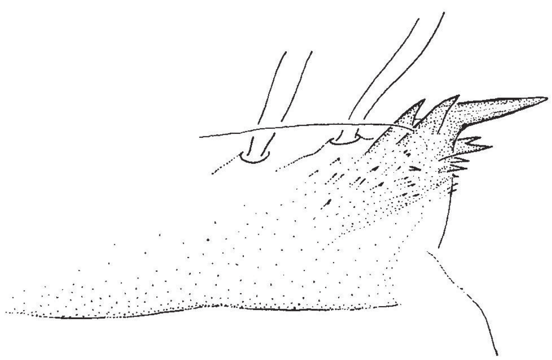
This species is very similar to *P. tritum* with respect to shagreen pattern and the shape of the anal spur on VIII. However, in this species, the median shagreen fields on IV and V are entirely separate from the anterior band and the two posterior fields, whereas in *P. tritum*, the median field of shagreen on T IV-V are connected to the anterior band by at least a few points. Also, the anal spur on VIII is larger, with more teeth and secondary spinules than that of *P. tritum*. Finally, tergite II only has a few scattered points, while *P. tritum* has a rather extensive median field of points. This species is the same as Epler's (1992, 1995, 2001) *Polypedilum* sp. A. A complete description is provided in Oyewo and Jacobsen (2007).

Polypedilum epleri is often found with *P. nymphaeorum* in slough habitats with abundant lily pads. *P. epleri* pupal exuviae show more distinct pigmentation than the pale pupal exuviae of *P. nymphaeorum.*

Miner in scenescent stems of *Nymphaea* and *Sagittaria*, abundant where these species are present.



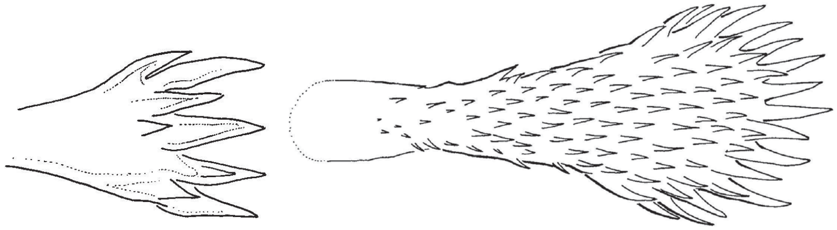
Polypedilum epleri: abdominal segments II-V



Polypedilum epleri: spur on VIII

frontal apotome

116. Abdominal tergites II-VI or III-VI with epaulettes .... ***Glyptotendipes*, 117**



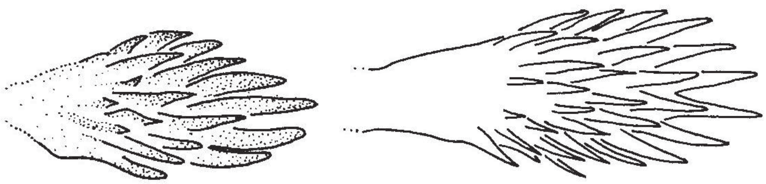
Glyptotendipes sp., epaulettes on anteromedian margin of tergites III and VI

116'. Abdominal tergites without large anteromedian epaulettes... **121**

117. Epaulettes present on tergites II-VI **118**

117'. Epaulette absent on tergite II, present on tergites III-VI .... ***Glyptotendipes (Caulochironomus)* cf. *seminole***

Rare. Shark River Slough.

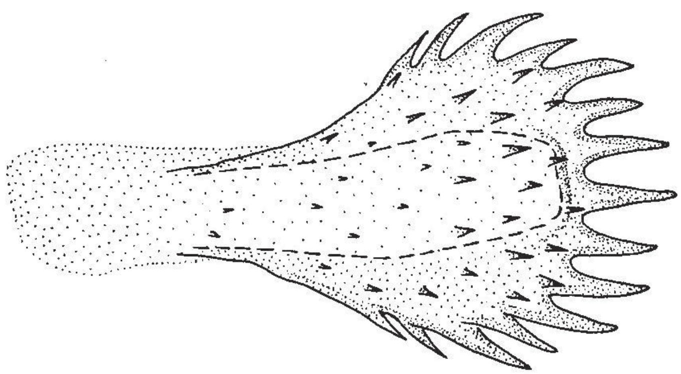


Glyptotendipes cf. *seminole*: process on tergite III process on tergite VI

118. Shagreen fields on TII and TIII small, confined to medial third to half of tergites .... ***Glyptotendipes* sp. B**

Shagreen fields on TII and TIII consisting of small points that grade to coarser points along the medioposterior margin. Small exuviae (5-8 mm total length).

Glytotendipes sp. B has been collected from Lake Istokpoga and the Lake Istokpoga canal at U.S. 98. It has not yet been collected from the Everglades but may be present in canals and borrow pits.



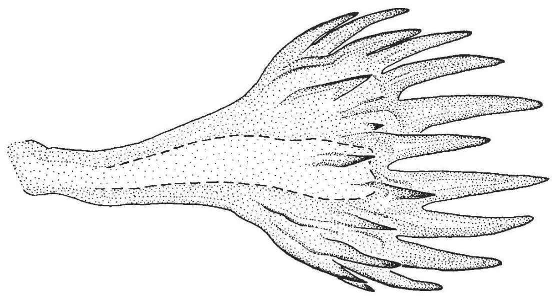
Glyptotendipes sp. B, spiniferous process on TVI

118’ Shagreen fields on TII and TIII more extensive, covering at least 75 percent of tergites **119**

119. Epaulette on TVI with less than 10 secondary spines ....***Glytotendipes paripes***

Caudolateral margin of VIII with a few very fine spinules; large exuviae (10-14 mm).

Lake Istokpoga. This species has not been collected from the Everglades but may be present in Lake Okeechobee and discharge canals from Lake Okeechobee.



Glyptotendipes paripes, epaulette on TVI

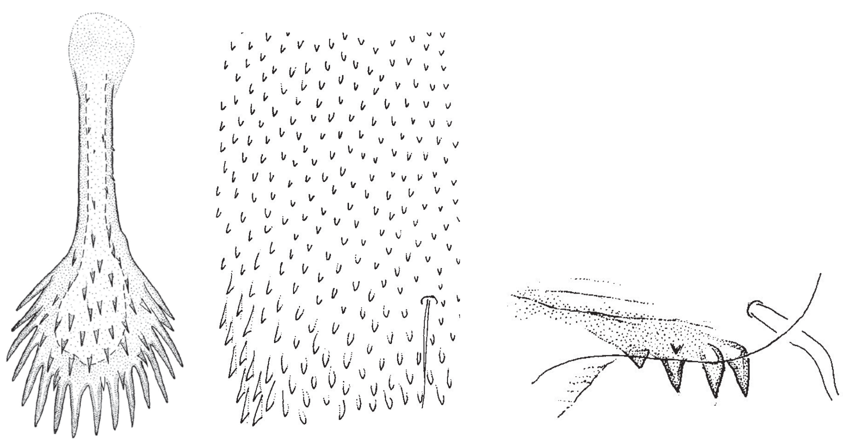
119’. Spiniferous processes on TVI with more than 10 secondary spines ....***Glyptotendipes meridionalis*****, 120**

Michael Heyn (Florida Department of Environmental Protection) has looked at pupal exuviae specimens from Sweet Bay Pond and northeast Shark River Slough that differ in their shagreen points and caudolateral armature on VIII and determined that they both represent one species, *G. meridionalis*. The differences between the two types that follow are admittedly slight. However, the fact that Type A was found in two separate water bodies, and that these types have not been reared to enable a more reliable evaluation has led to the inclusion of both types in this key. The type names “A” and “C” represent their original species designations. There is no *G. meridionalis* Type B.

120. Shagreen on TII relatively uniform, points along posterior margin are, at most, only about 2-3 times longer than median points. Individual points discernable at about 20X ....***Glyptotendipes meridionalis*** **Type C**

Caudolateral comb consists of small, dark, tooth-like spines.

Northeast Shark River Slough.

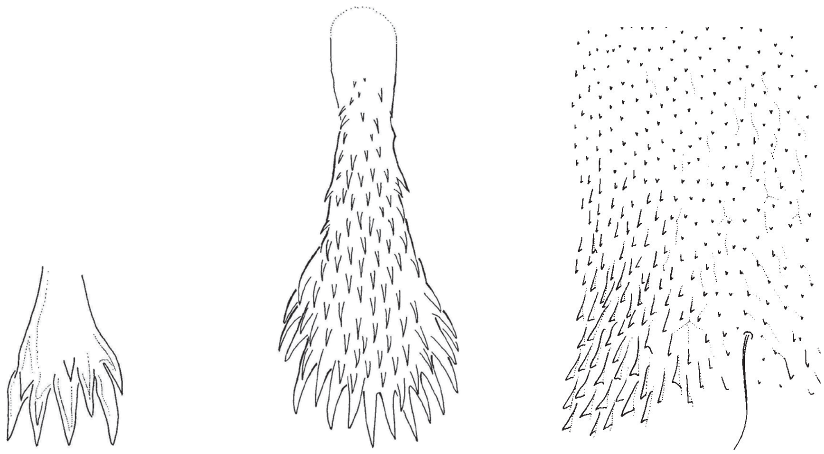


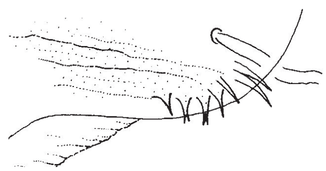
G. meridionalis Type C: epaulette on VI shagreen on TII anal comb on VIII

120’. Shagreen on TII not as uniform in point size, with points along medioposterior margin 4-5X longer than points in median field. Individual points in median fields discernable at about 30X.............***Glyptotendipes meridionalis*** **Type A**

Caudolateral comb on VIII consists of small, fine, pale spines; spines often forked.

Borrow pits. Abundant in Paurotis Pond, also in Sweet Bay Pond. Presumably likes enriched environments but is rare in typical Everglades habitats.



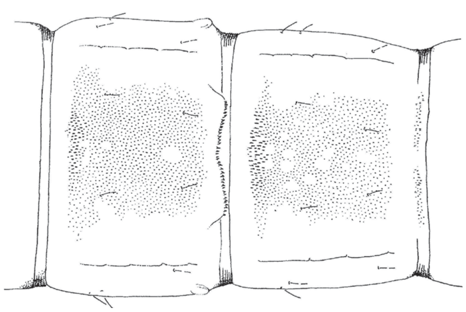


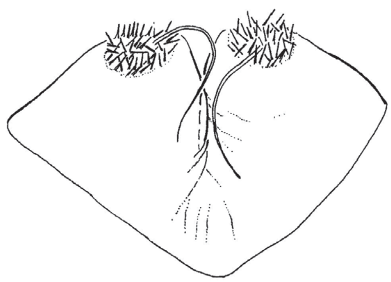
G. meridionalis Type A: epaulettes on TII & TVI, shagreen on TII anal comb on VIII

121. Cephalic tubercles truncate and with an apical cluster of spinules ....***Endotribelos*** **sp.**

Frontal setae long, about twice the diameter of the truncated apices of the cephalic tubercles. Exuviae of this species resemble *P. illinoense* grp. sp. in having conspicuous pigmentation on the abdominal segments and in having the anterior conjunctives pigmented laterally. Although Coffman and Ferrington (1996, p. 726, couplets 41-42) erroneously indicate that the anterior conjunctives are darkened laterally in *Phaenopsectra* but not in *Endotribelos,* the species determination for this key is based upon a larva-pupa association and is reliable (larvae of *Endotribelos* are quite distinctive). Also be aware that there are 3 other genera with truncate cephalic tubercles: *Hyporhygma, Phaenopsectra*, and *Sergentia*. Of these genera, *Phaenopsectra* and particularly *Hyporhygma* (larvae mine in *Nymphaea* and *Nuphar* stems) may be present in the Everglades. Reared specimens of *Endotribelos* were all *E. hesperium*. However, there may be additional species of *Endotribelos* in Florida.

Larvae have been reported to mine in the stems and leaves of aquatic macrophytes. Larvae have been collected in ENP from stems of *Nymphaea* and *Sagittaria*; exuviae have been collected in sloughs, and solution holes with *Sagittaria.*



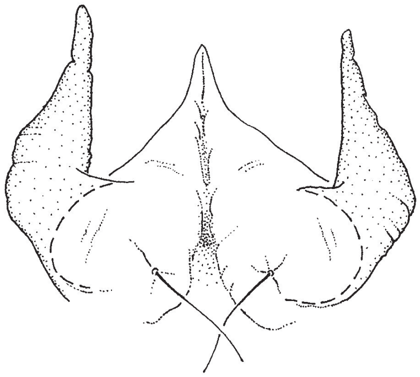


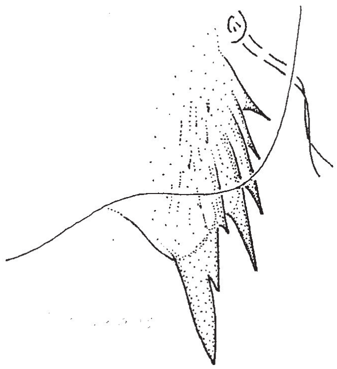
Endotribelos sp., segments II-III frontal apotome

121’. Cephalic tubercles not truncate and tipped with a cluster of spines..**122**

122. Cephalic tubercles extremely long and tapering; frontal setae attached near the bases of the tubercles .... ***Polypedilum (Tripodura) simulans***

Widespread and common in marshes with extensive calcareous periphyton. *Polypedilum simulans* is an indicator of excellent water quality.





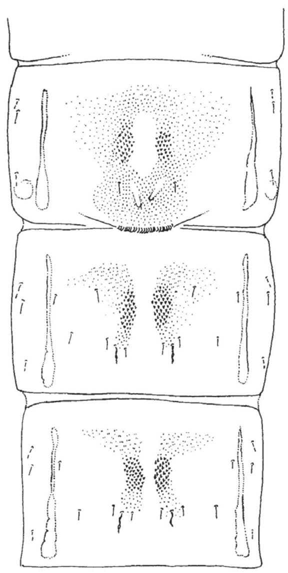
Polypedilum (Tripodura) simulans: frontal apotome armature on VIII

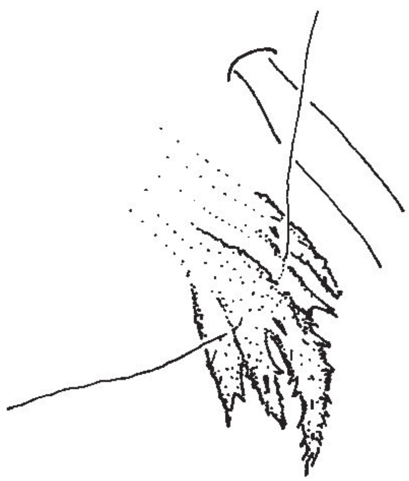
122'. Cephalic tubercles are not as above.. **123**

123. Tergites II-VI with paired patches of short spines similar to many Tanytarsini............................. ***Zavreliella marmorata***

Caudolateral armature on VIII is a group of small, serrated spines. Abdominal tergites II-VI distinctively marked with a median longitudinal light stripe between areas of darker pigment. Tanytarsini in ENP do not show this color pattern and do not have a branched thoracic horn.

Widespread and common. The larvae live within a small portable case.





Zavreliella marmorata: segments II-IV comb on VIII

123'. Tergites II-VI without paired patches of spines.. **124**

124. Sternite II with rows of needle-like spines **125**

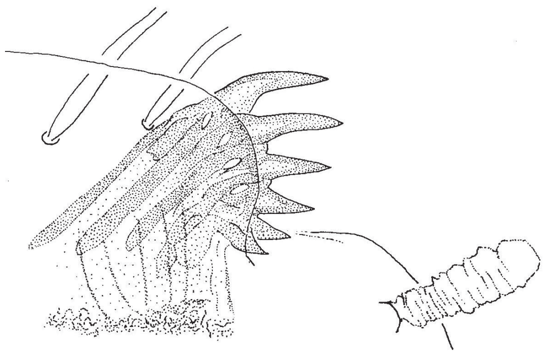
124'. Sternite II without rows of needle-like spines **129**

125. Caudolateral armature on VIII a comb of 4 or more spines **126**

125'. Caudolateral armature on VIII consists of 1-3 spines .... ***Dicrotendipes*, (in part), 127**

126. Needle-like spines on sternite II in transverse rows only .... ***Goeldichironomus pictus* grp. sp.**

Paurotis Pond. Also collected in WCA-2A near boat launch area and in enriched ditches near Homestead Speedway. It should be considered a strong indicator of enrichment.

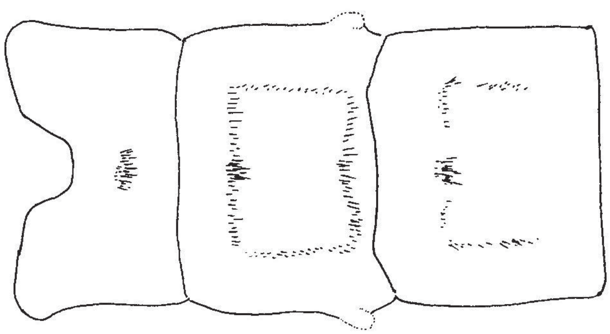


Goeldichironomus pictus group sp., comb on VIII and gill remnant

126'. Needle-like spines on sternite II in both transverse and longitudinal rows .... ***Kiefferulus (Wirthiella) pungens***

Easily recognized by the strong comb of curved spines that extend along the posterolateral margin of tergite VIII.

Northeast Shark River Slough and Chekika boat launch.



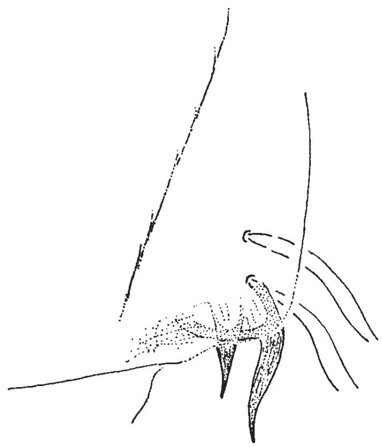
Kiefferulus pungens: sternites I-III anal comb on VIII

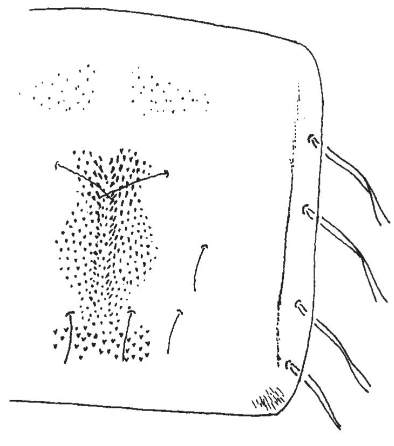
127. Caudolateral spur on VIII a single spine **128**

127'. Caudolateral spur on VIII a double spine .... ***Dicrotendipes tritomus***

Some specimens may have a single spine. In this case, *D. tritomus* can be separated from *D. modestus* and *D*. sp. A Epler by the more uniform point size in the median shagreen field. In *D. modestus* and *D*. sp. A, the anterior points of the median shagreen field are larger than the points in the middle of this field (see figure for *D. modestus* below). See Epler (1987, 1988b) for descriptions of south Florida *Dicrotendipes* spp.

Uncommon in long-hydroperiod marshes and solution holes in Upper Taylor Slough. In WCA-2A, it was abundant in the enriched "transition" zone but absent in the unenriched zone, suggesting it should be considered an indicator of enrichment in ENP.



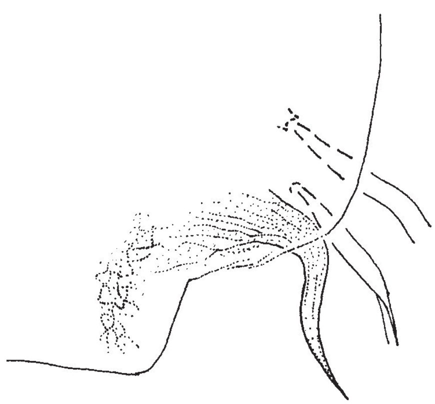


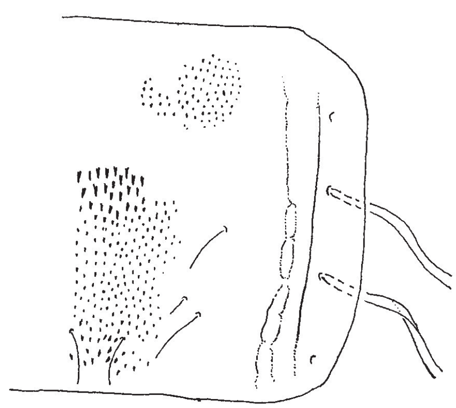
Dicrotendipes tritomus: spur on VIII tergite VI

128. Shagreen on TIV-VI is broken up into a completely separate anterior field and a median-posterior field .... ***Dicrotendipes modestus***

Very similar to *D*. sp. A Epler. Aside from the difference in shagreen, exuviae of *D. modestus* are darker in pigmentation, being brown in color, while *D*. sp. A exuviae are a pale tan color.

Sloughs; deep, well vegetated solution holes; solution holes in upper Taylor Slough and near the 332 retention ponds; enriched ditches in the Redland. This species is considered to be an indicator of enrichment.



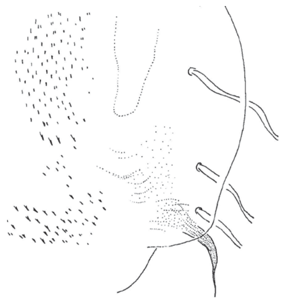


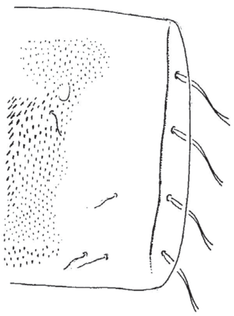
Dicrotendipes modestus: spur on VIII tergite VI

128'. Anterior and median-posterior fields are connected on TIV-VI .... ***Dicrotendipes* sp. A Epler**

Pupal exuviae of *Dicrotendipes* sp. A are tan in color, whereas *D. modestus* are a darker brown. This species is currently undescribed, but the larvae were first discovered and described by Epler (1995), and a complete description is forthcoming. The association here is based upon finding pupal exuviae with attached larval exuviae, and identifying the larval exuviae using Epler (1995, 2001).

Abundant at the Shark Slough flume sites. Also collected in upper Taylor Slough. In WCA-2A, this species was present in the enriched "transition" zone but not in the unenriched zone. This species is considered an indicator of enrichment.



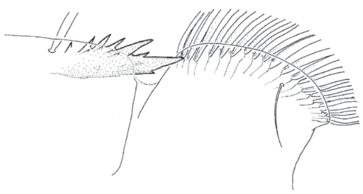


Dicrotendipes sp. A Epler: anal spur on VIII shagreen on TV

129. 3 taeniate L setae on V and VI .... ***Polypedilum* (in part), 130**

129'. One or both of V and VI with 4 taeniate L setae **132**

130. Anal lobe with hair-like dorsal seta .... ***Polypedilum* (*Tripodura*), 131**

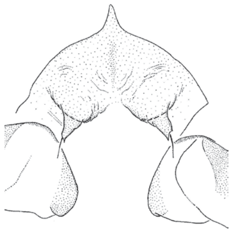


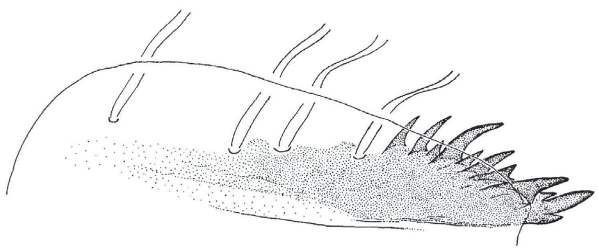
Polypedilum (Tripodura) sp., anal lobe with single dorsal seta

130'. Anal lobe without a dorsal seta .... ***Polypedilum nubifer***

Caudolateral armature on VIII a large, dark, irregular, multitoothed comb. Unlike other *Polypedilum* spp., the thoracic horn has many fine branches and appears plumose.

Found in huge numbers in retention ponds 332C and 332D after initial operation in 2002. Also found in neighboring ENP marshes close to 332C in 2002. *P. nubifer* has not been collected since 2002.

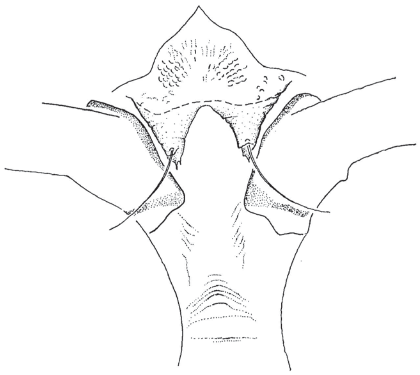


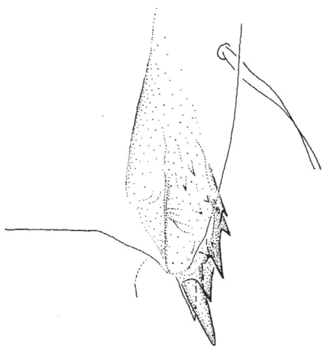


Polypedilum nubifer: frontal apotome armature on VIII

131. Frontal setae inserted subapically on cephalic tubercle, cephalic tubercle conical, with apical spines .... ***Polypedilum (Tripodura)* sp. C (in part)**

Wilderness Waterway: Big Lostman’s Bay, Chevelier Bay inlet. Also in enriched ditches near the Homestead Speedway.

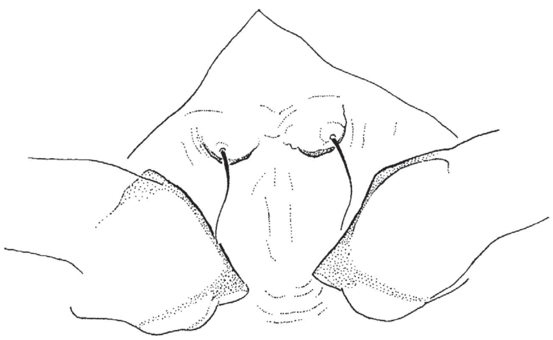


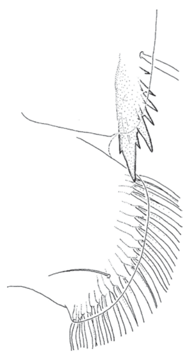


Polypedilum (T.) sp. C: frontal apotome armature on VIII

131’. Frontal setae on a low, wrinkled, rounded cephalic tubercle.............................. ***Polypedilum (Tripodura)* sp. B (in part)**

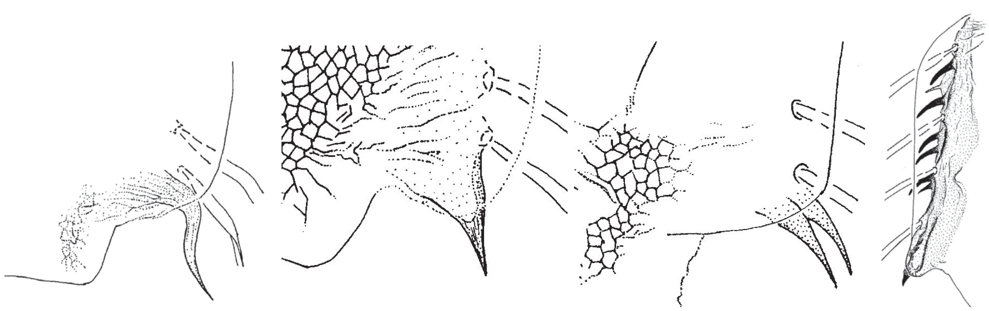
Wilderness Waterway: Big Lostman’s Bay, Chevelier Bay inlet.



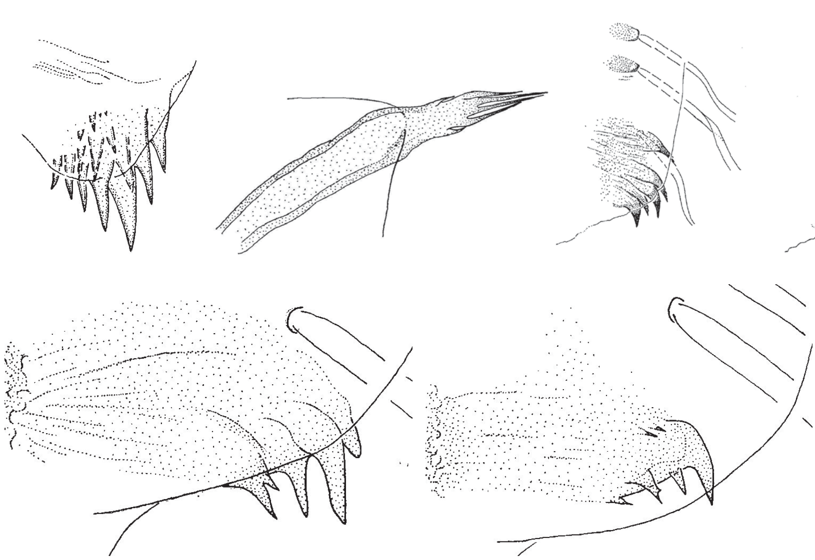


Polypedilum (T.) sp. B: frontal apotome armature on VIII

132. Caudolateral armature of VIII usually a single (occasionally double), stout or sinuate spine; sometimes with additional very slender, often curved spines and/or spinules irregularly-spaced along the lateral margin anterior to main posterolateral spine **133**

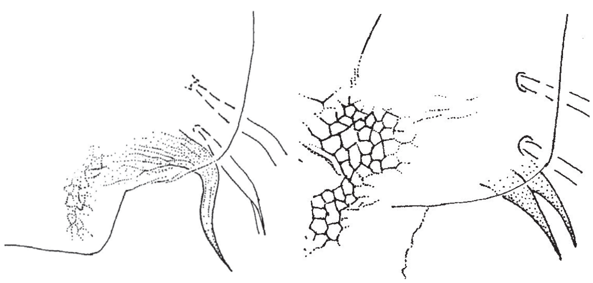


132'. Caudolateral armature of VIII a comb of weak to strong spines, a mace-like cluster of spines, or a compound spur (a spur that has multiple points or is dissected apically into a tight cluster of 3 or more slender, closely pressed spines)...... .... **140**



133. Caudolateral armature on VIII a simple or double spine, but with additional very slender, straight or curved spines and/or spinules irregularly spaced along lateral margin. **134**

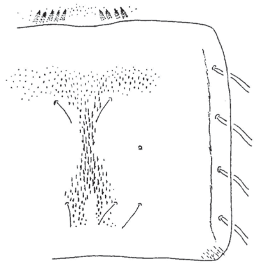
133'. Caudolateral armature on VIII usually a single, occasionally a double, straight or sinuate spine **137**



134. Conjunctive IV/V with fine spinules, V/VI with strong sclerotized spines amidst fine spinules ....*Dicrotendipes leucoscelis* **(in part)**

Fairly large species with very uniform shagreen covering almost entire surface of tergites II-V; armature on VIII is a lateral comb of stout spines, occasionally a spine or two is missing to create an irregular spine array.

Large, deep, extensively vegetated solution hole along Context Road, also Taylor Slough near S.R. 9336 bridge, and Chekika slough (*Eleocharis*) habitat, uncommon. In ENP, this species is found in deep but otherwise unenriched sites and may be the most sensitive *Dicrotendipes* species to enrichment. However, in Big Cypress National Preserve, *D. leucoscelis* is found in clean and enriched sites. It appears to show some phenotypic plasticity in the number of stout spines in the armature on VIII with the number of spines decreasing with enrichment to where some individuals lacked projecting lateral spines or spur.

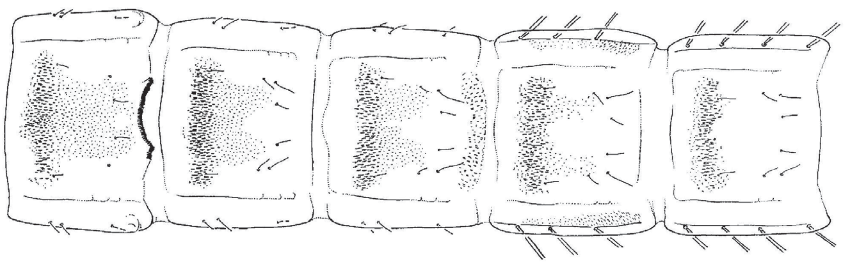
Dicrotendipes leucoscelis: comb on VIII conjunctive V/VI and tergite VI

134'. Conjunctive IV/V with strong spinules, V/VI bare ....***Beardius*, 135**

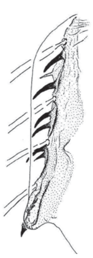
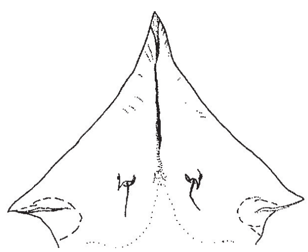
135. Shagreen on tergite II with distinct anterior band of stronger points; paratergite V with fine spinules extending over half of segment length..***Beardius reissi***

Tergites III-VI with 4 pairs of D setae. Anterior margin of frontal apotome comes to an acute point. Pupae of south Florida *Beardius* spp. are described in Jacobsen and Perry (2000).

Abundant in marl-prairie habitats, particularly at shallow sites with *Muhlenbergia* and *Schizachyrium* immediately after rewetting in the spring and summer.

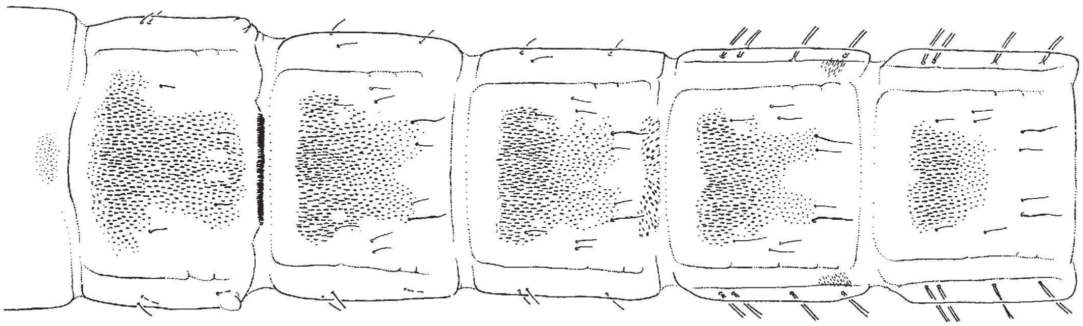


Beardius reissi, tergites II-VI

Beardius reissi: spur on VIII frontal apotome

135’. Shagreen points on tergite II strong and uniform in length; paratergite V with fine spinules confined to a small posterior patch **136**

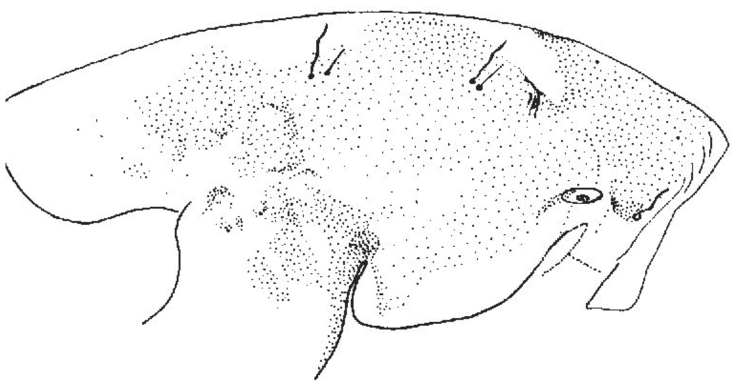


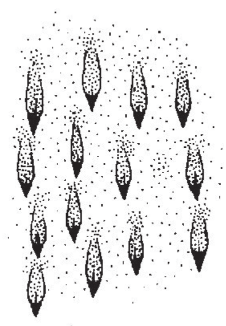
Beardius truncatus, segments II-VI

136. Abdominal segment V with 3 taeniate lateral setae; cephalothoracic hinge with an unpigmented area near median suture (see arrow below); pigmentation within shagreen on tergite II diffusely spread between points .... ***Beardius breviculus***

Conjunctive I/II without a patch of fine spinules; hook row on II with 30 to 44 hooklets.

Associated with *Cladium* stands in Taylor Slough and Shark River Slough, very common in northeast Shark River Slough. King (2001) considers this species to be indicative of unenriched waters.



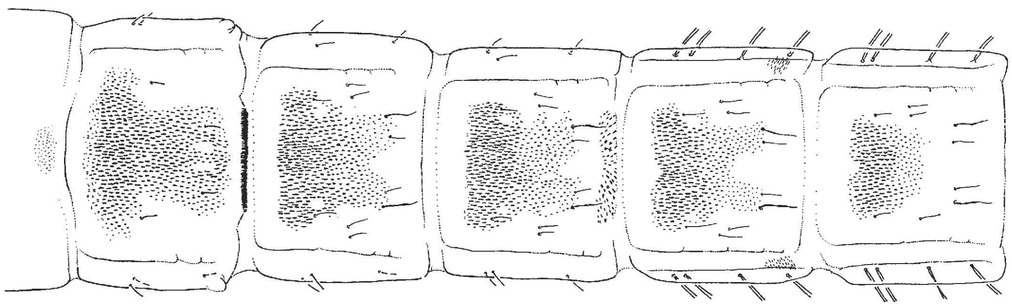


Beardius breviculus: thorax shagreen pigmentation

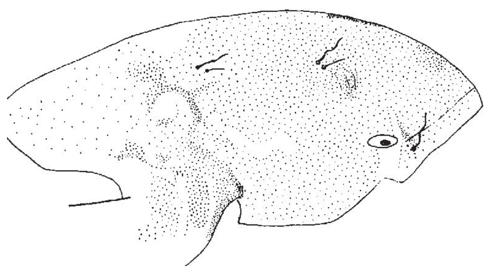
136’. Abdominal segment V with 4 taeniate lateral setae: cephalothoracic hinge pigmented near median suture; pigmentation within shagreen on tergite II confined to discrete blotches at base of points and between points .... ***Beardius truncatus***

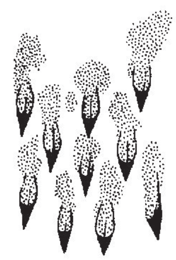
Conjunctive I/II with median patch of fine spinules; hook row on II with 46-73 hooklets.

Canals, marl-prairie and pineland solution holes; also from deeper waters in Taylor Slough.



Beardius truncatus, abdominal segments II-VI





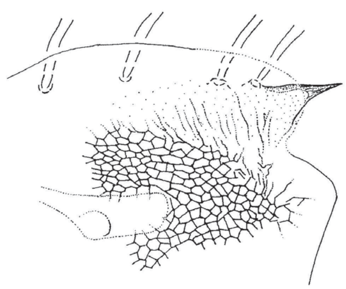
Beardius truncatus: thorax shagreen pigmentation

137. Tergites IV-VI, and particularly VI, with shagreen points either generally uniform in length or the longest points are in the center of the shagreen field; tergites VI-VIII with surface reticulation; segment VIII with 4 taeniate lateral setae ....***Dicrotendipes* (in part), 138**

137’. Tergites IV-VI, and particularly VI, with longest shagreen points along the posterior margin; tergites VI-VIII without any surface reticulation; segment VIII with 5 taeniate lateral setae **139**

138. Tergite VI with shagreen points uniform in length; tergites VI-VIII with strong surface reticulation................................ .... ***Dicrotendipes lobus***

Paurotis Pond, Wilderness Waterway; a brackish water species.

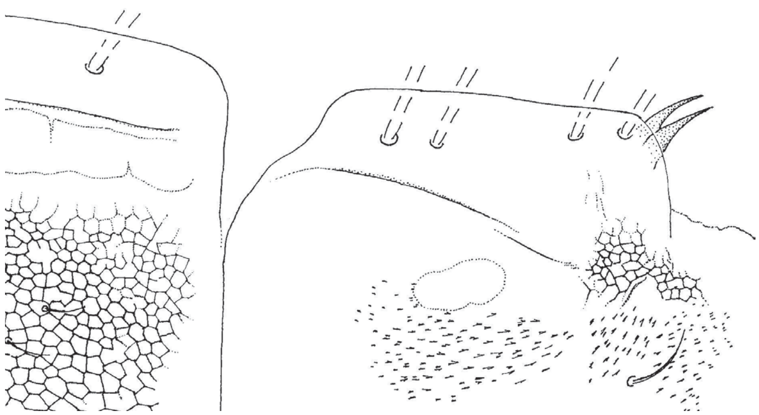


Dicrotendipes lobus, anal spur and reticulate cuticle on tergite VIII

138'. Tergite VI with longest shagreen points in the center of the tergite; surface reticulation tending to fade toward the center of tergite VIII.. ***Dicrotendipes simpsoni***

The anal spur is usually single but occasionally is a double spine as illustrated below.

Taylor Slough near pump station and extending downstream to the S.R. 9336 bridge, Paurotis Pond. Also enriched ditches near Homestead Speedway. This species is an indicator of enrichment.

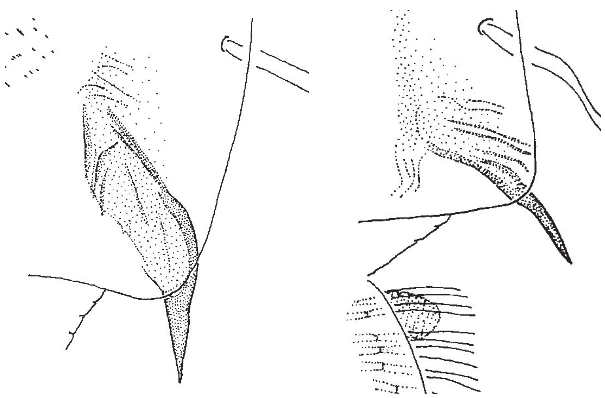


Dicrotendipes nervosus grp. sp., part of VII and VIII showing the anal spur

139. Armature on VIII a single strong spine; conjunctives IV/V-VI/VII with spinules.. ***Chironomus (Lobochironomus)* sp.**

Cephalic tubercle tapers to a narrow, nearly-cylindrical cone. Unlike other *Chironomus* spp., the caudolateral armature is a simple spine and not a compound spine. This species appears to vary greatly in size, with specimens ranging from 4-9 mm in length.

Sloughs, solution holes. This species is often abundant in solution holes near retention ponds and is abundant in upper Taylor Slough near L-31W, but it is commonly found in deep waters with peaty soils such as alligator holes throughout ENP. It appears to be subsidized by low levels of enrichment but is so widespread that it is not considered a reliable indicator of nutrient enrichment.

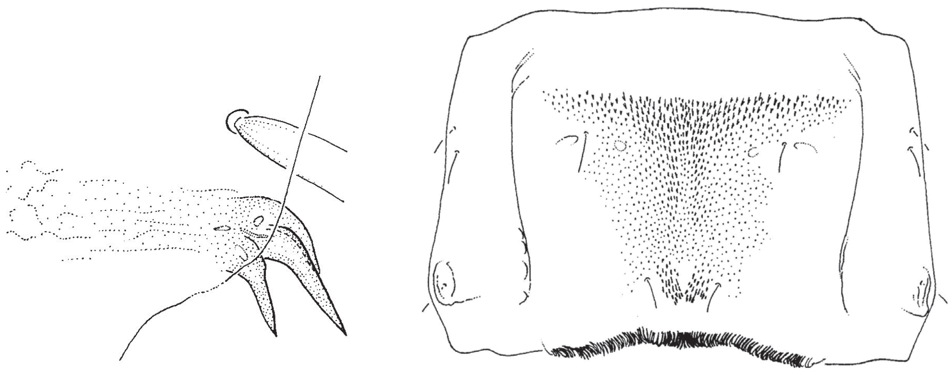


Chironomus (Lobochironomus) sp., spur on VIII, two specimens

139'. Armature on VIII 1-2 small sinuate spines; all conjunctives bare......................***Goeldichironomus amazonicus*** **(in part)**

Goeldichironomus amazonicus has a prominent branch of stout respiratory filaments that extend beyond the rest of the finer plumosity of the thoracic horn similar to *G. fluctuans/natans*. The taeniate setae on the anal lobe are in multiple rows.

Sweet Bay Pond, Tamiami Canal, 332 retention ponds. Wirth (1979) reported that this species reached nuisance population sizes in enriched ditches in south Florida. In this study, it was collected in canals and borrow pits, but not collected in natural Everglades marsh habitats.



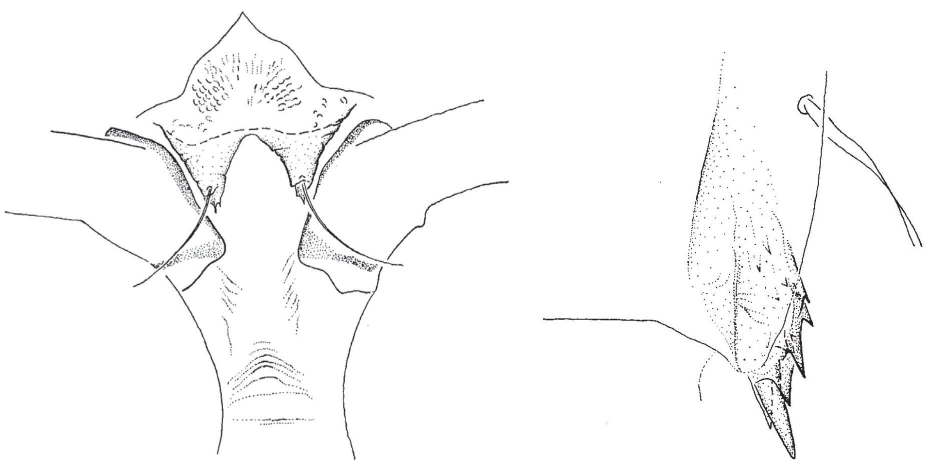
Goeldichironomus amazonicus: comb on VIII tergite II

140. Abdominal segments V-VI each with 3 pairs of taeniate L-setae; tergites II-V with anterior bands of shagreen as well as posterior fields ....***Polypedilum (Tripodura)*** **spp. (in part), 141**

140' Abdominal segments V-VI with 4 pairs of taeniate setae; tergites II-V without distinct anterior bands of shagreen.... **142**

141. Frontal setae inserted subapically on cephalic tubercle, cephalic tubercle conical, with apical spines ....***Polypedilum (Tripodura)*** **sp. C (in part)**

Wilderness Waterway: Big Lostman's Bay, Chevelier Bay inlet. Also in enriched ditches near Homestead Speedway.

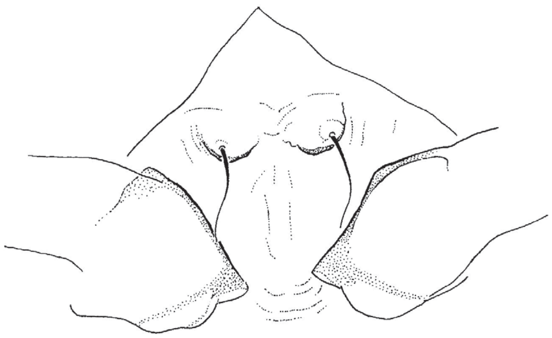


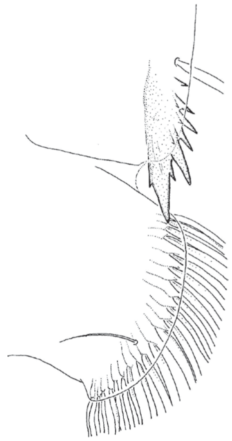
Polypedilum (T.) sp. C: frontal apotome armature on VIII

141’. Frontal setae on a low, wrinkled, rounded cephalic tubercle..............................***Polypedilum (Tripodura)* sp. B (in part)**

Keys to here if one interprets the cephalic tubercle as being pointed.

Wilderness Waterway: Big Lostman’s Bay, Chevelier Bay inlet.





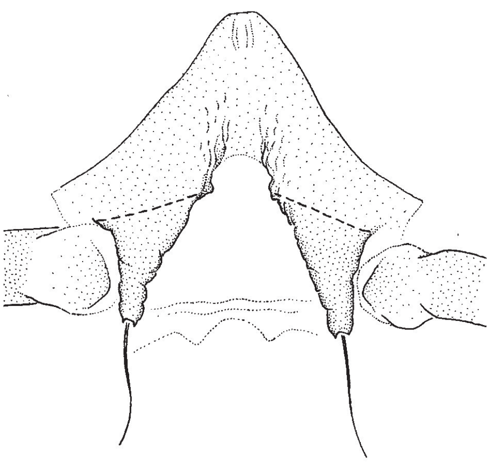
Polypedilum (T.) sp. B: frontal apotome armature on VIII and anal lobe

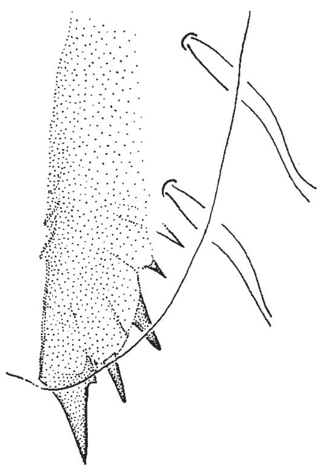
142. Exuviae small (< 5 mm); generally pale in color, one species pigmented **143**

142’. Exuviae large (> 7 mm); well pigmented **144**

143. Pedes spurii B well developed; pupal exuviae well pigmented; cephalic tubercle almost cylindrical; caudolateral armature on VIII consists of a row of 4-5 dark spines; conjunctives III/IV and IV/V with rows of spinules..................... ....***Paralauterborniella nigrohalteralis***

In eutrophic ditches near Homestead.





Paralauterborniella: frontal apotome armature on VIII

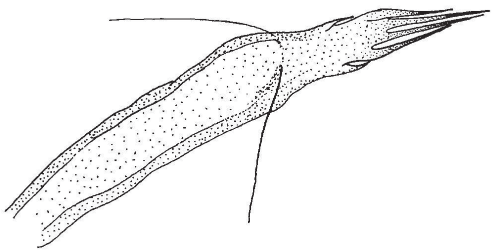
143'. Pedes spurii B absent; pupal exuviae mostly pale; cephalic tubercle conical; caudolateral armature on VIII consists of 2-3 slender pale spines; conjunctives with, at most, only a few points .... ***Parachironomus carinatus***

Like other *Parachironomus*, this species has a postermedian flap-like projection with fine spines on tergite VI, and the hooklet row on the posterior margin of tergite II is on a pronounced flap-like protuberance, with a band of pigmentation just anterior to the hooklet row.

In sloughs and deeper wet and marl-prairie sites.

Parachironomus carinatus, segment VIII showing fine caudolateral spines.

144. Caudolateral armature of VIII a spur that is dissected apically into a cluster of 3 or more slender, closely appressed spines .... ***Chironomus* (in part), 145**

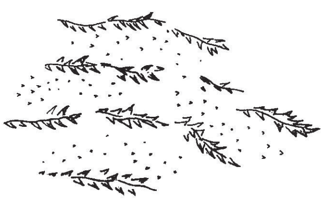


Chironomus stigmaterus, anal spur

144'. Caudolateral armature of VIII not as described above **146**

145. Tergites IV-VI with wrinkles beset with robust, dark spines. Frontal apotome with cephalic tubercles but without frontal warts .... ***Chironomus stigmaterus***

Eutrophic waters such as Paurotis Pond, enriched drainage ditches in the Redland, WCA-2A. Also present in solution holes near the 332B and 332C retention ponds. Otherwise, it is rarely collected in unenriched interior marshes in ENP. Several authors (Adamus and Brandt, 1990; Epler, 2001; King, 2001) have claimed this species is an indicator of enrichment. Data from this study indicates that it is a strong indicator of enrichment.



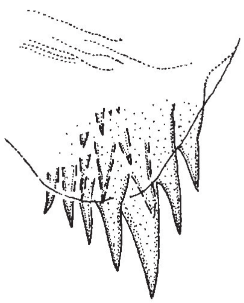
Chironomus stigmaterus, shagreen on tergite V

145'. Tergites without conspicuous wrinkles beset with robust, dark spines. Frontal apotome with cephalic tubercles and frontal warts .... ***Chironomus* sp. B**

Widely distributed in sloughs and solution holes. This species is often abundant in solution holes near retention ponds, but it is commonly found in deep waters with peaty soils throughout ENP. It may be subsidized to some degree by enrichment, but this species is not considered to be a reliable indicator of P enrichment for the Everglades.

Chironomus sp. B, frontal apotome

146. Caudolateral armature on VIII a cluster of about 5-15 straight, posterior-directed spines .... ***Tribelos*, 147**



Tribelos fuscicorne, caudolateral armature on VIII

146'. Armature on VIII either a small or large comb **148**

147. Sternite IV with pedes spurii A; conjunctives III/IV and IV/V with at least 40 spinules; segment VIII usually with 4 taeniate L setae; caudolateral armature with 5-11 spines .... ***Tribelos atrum***

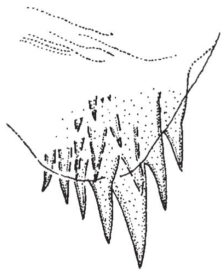
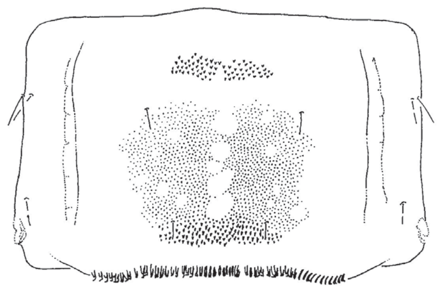
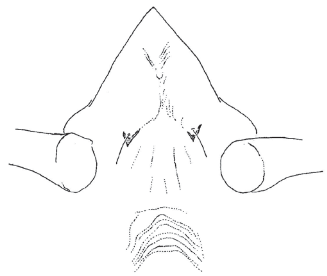
This couplet is based on the descriptions in Grodhaus (1987). Pupal exuviae resembling *T. atrum* in having fewer caudolateral spines on VIII and in having a different overall appearance than *T. fusciforme* have been collected from Loxahatchee National Wildlife Refuge. These specimens have not yet been mounted on slides.

Loxahatchee National Wildlife Refuge (Water Conservation Area 1).

147'. Sternite IV lacking pedes spurii A; conjunctives III/IV and IV/V with fewer than 40 large spinules; segment VIII with 5 taeniate L setae; caudolateral armature with 10-25 spines .... ***Tribelos fuscicorne***

Tergite II shagreen with an anterior band of larger spines, shagreen on posterior tergites with a fenestrated pattern (also true of *T. atrum* as well).

On submerged wood in Taylor Slough.

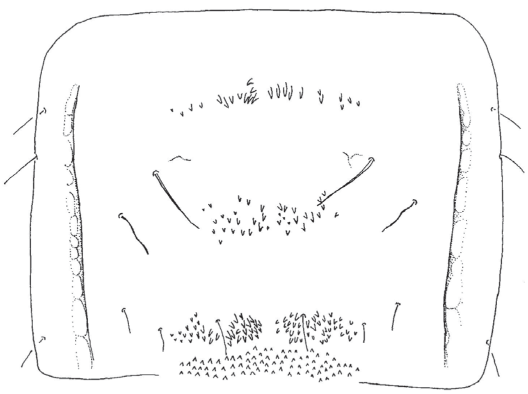
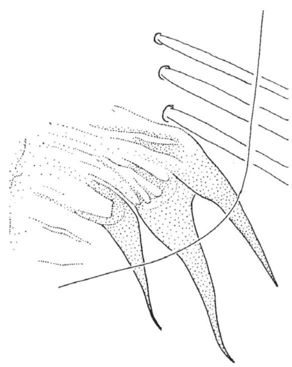




Tribelos fuscicorne:armature on VIII Tergite II frontal apotome

148. Shagreen on TII-VI comprised of 3 separate fields of strong points (aside from conjunctive spines, if present): a narrow anterior band, a median field, and a posterior band..***Einfeldia natchitocheae***

Comb on VIII consists of 2-3 slender sinuate spines; sternite I with large anterolateral tubercles.

Collected from the pond north of the FIU library. *Einfeldia natchitocheae* has not been collected from the Everglades yet, but it may occur in borrow ponds and canals.

Einfeldia natchitocheae: tergite IV comb on VIII

148' Shagreen on TII-VI otherwise, typically a continuous field of spines **149**

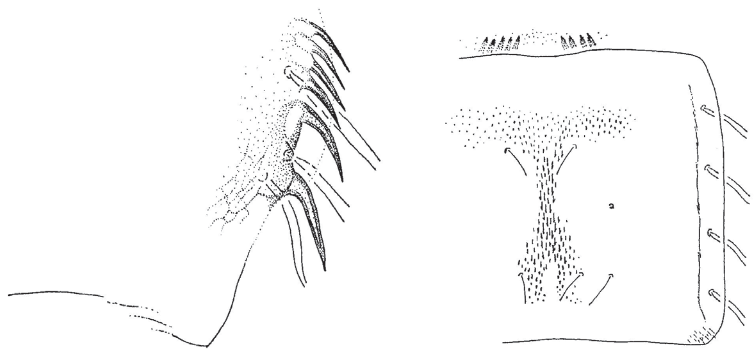
149. Caudolateral armature on VIII a comb of 5 or more spines; some conjunctives with spinules **150**

149'. Caudolateral armature on VIII a small comb or group of 2-4 spines; all conjunctives bare .... ***Goeldichironomus* (in part), 151**

150. Caudolateral armature on VIII a comb of long spines; conjunctive V/VI with about 8-12 strong, sclerotized spines in addition to fine spinules; paratergite V with spinules in anterior third; pigmentation in III-VI uniform within shagreen fields .... ***Dicrotendipes leucoscelis* (in part)**

Often with a bit of reticulation near the caudolateral armature on VIII.

Long-hydroperiod solution holes and sloughs. See comments for couplet 134.

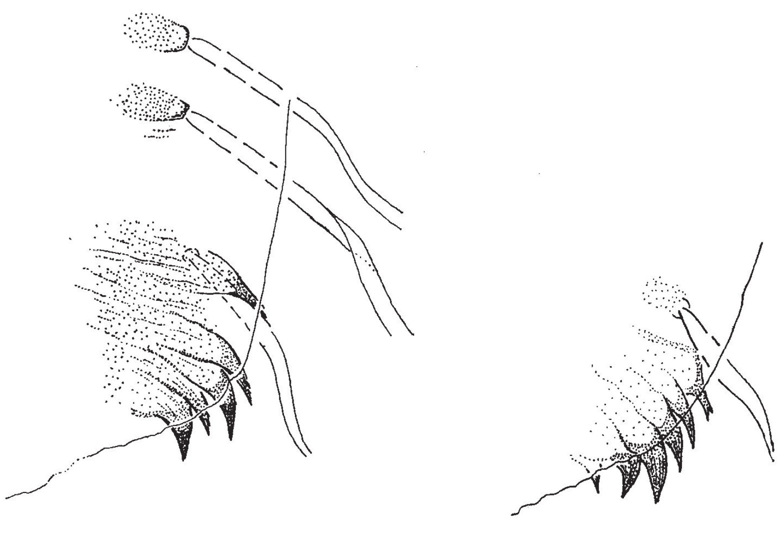


Dicrotendipes leucoscelis: comb on VIII conjunctive V/VI and tergite VI

150'. Caudolateral armature on VIII a comb with short spines; conjunctive V/VI with fine spinules only; paratergite V with extensive field of spinules over entire length; pigmentation within shagreen fields on III-VI only on spines and bases of spines .... ***Kiefferulus (Kiefferulus)* sp.**

All larvae and larval exuviae of *Kiefferulus (Kiefferulus)* sp. that have been observed are *K. (K.) dux.* However, Epler reports collecting an undescribed species in the northern Everglades, his *K.* sp. A (Epler, 2001: 8.86), that has a pupa very similar to *K. (K.) dux*. Therefore, until he publishes his description of this species and how to differentiate it from *K. (K.) dux*, all unassociated pupal exuviae should be properly identified as *K. (K.)* sp.

Solution holes in Long Pine Key and near retention pond 332B and 332C. An indicator of enrichment.



Kiefferulus (K.) sp., comb on VIII, two views.

151. Tergites II-VI with only posterior bands of longer spines, median and anterior shagreen is uniform in spine length......... ....*Goeldichironomus holoprasinus* **group**

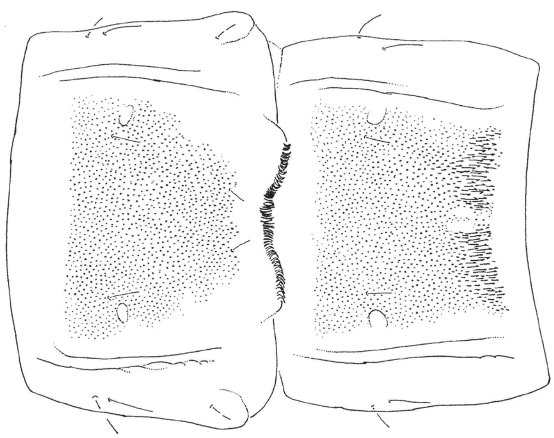
Caudolateral armature on VIII a small comb of 2-3 spines, occasionally with 2-4 other smaller spines.

This group is comprised of *G. holoprasinus* and *G. devineyae*. All specimens that were reared are *G. holoprasinus*. Associated material of *G. devineyae* have not been examined to enable proper separation of these species at the present time. Beck's description of *G. devineyae* is inadequate for separating these two species. *G. devineyae* is reported by Epler (2001) to inhabit salt marshes and estuaries. However, Broughton Caldwell has collected a male in blackwater, acidic waters near the coast at Waycross, Georgia, so it may occur in freshwater.

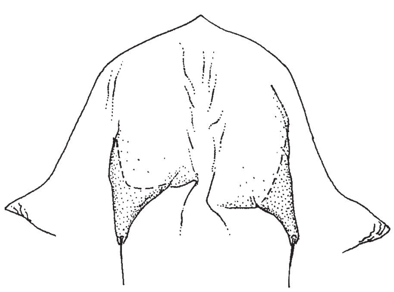
Goeldichironomus holoprasinus group may be somewhat difficult to separate from *G. fluctuans/natans*. To identify this taxon correctly, the median and anterior shagreen on TII-IV should be absolutely equal in spine length, that is, the spines don't become even slightly larger near the anterior edge of the field. The cephalic tubercle is longer for *G. holoprasinus* than for *G. fluctuans/natans.* Also, the thoracic horn of *G. holoprasinus* does not have any notably coarser elements that project beyond the rest of the finely plumose tracheal branches that *G. fluctuans/natans* has.

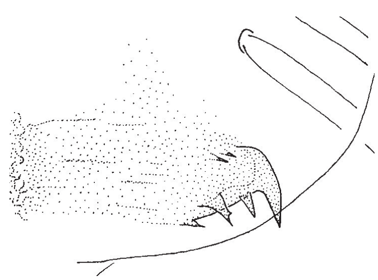
Pinder and Reiss (1986) mention in their key that members of the *holoprasinus* group (which includes *holoprasinus* and *devinyae*) have a single row of taeniate setae on the anal lobe. For this key, associated material of *G. holoprasinus* were observed in which the setal fringe is a double row in parts of the fringe.

Goeldichironomus holoprasinus is typically found in enriched environments such as algae-choked drainage ditches in the Redland, the Tamiami Canal, enriched marshes in WCA-2A, and solution holes near retention pond 332C. It is a strong indicator of enrichment.



Goeldichironomus holoprasinus, tergites II-III





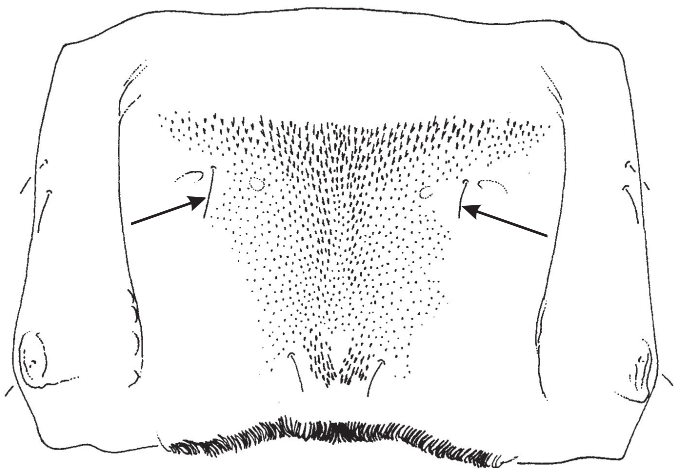
Goeldichironomus holoprasinus: frontal apotome, comb on VIII.

151'. Shagreen on tergites II-IV with anterior points at least slightly larger than central points **152**

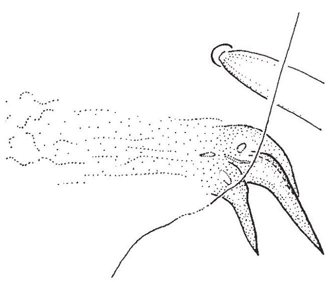
152. Shagreen on II with clearly discernable anterior band of stronger points; shagreen field narrows abruptly after this anterior band so that there are, at most, only a few scattered points posterolaterally positioned relative to the anterior dorsal seta, D_1 ....***Goeldichironomus amazonicus* (in part)**

All specimens examined to date have 1-3 curved to sinuate spines but some specimens may have straight spines. The anal lobe has multiple rows of taeniate setae. The thoracic horn has a coarser branch of strong filaments that extends beyond the plume of finer respiratory filaments.

Sweet Bay Pond, the S332 retention ponds, and Tamiami Canal.



Goeldichironomus amazonicus, abdominal segment II with strongly coarser anterior points (arrows pointing to D_1 setae).



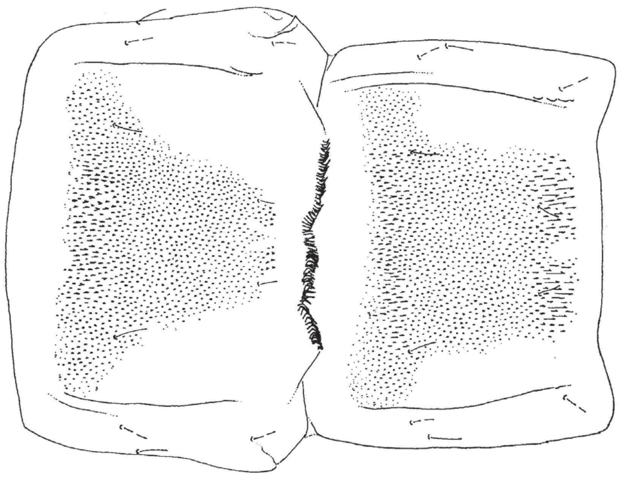
Goeldichironomus amazonicus, armature on VIII

152'. Shagreen on II with anterior points only slightly larger than central points; with extensive shagreen extending posterolaterally beyond the anterior dorsal seta ....***Goeldichironomus fluctuans/natans*** **(in part)**

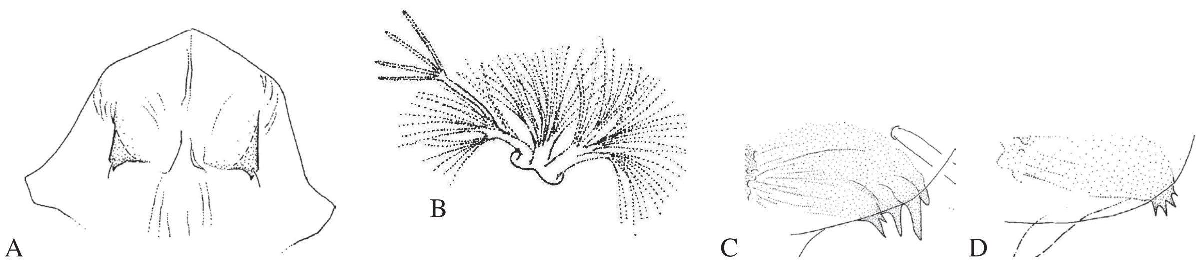
The plumose thoracic horn has a distinct coarser 4-8 branched arm that extends anteriorly beyond the finer filaments of the rest of the thoracic horn. This feature, along with the shorter cephalic tubercle, helps to separate this species from the very similar *G. holoprasinus*. However, *G. amazonicus* also has this extended branched arm of coarser respiratory filaments. *G. fluctuans/natans* can be differentiated from *G. amazonicus* by the more extensive shagreen on tergite II that extends dorsolaterally beyond the anterior dorsal seta (D_1 seta). In *G. amazonicus*, the shagreen field narrows strongly just posterior of the anterior band of strong points and does not surround the D_1 seta.

Reared larvae appear to be *G. fluctuans* but other larvae may be *G. natans*. Pupal exuviae show considerable variation in the coarseness of shagreen and size of shagreen fields on the tergites. This species should be called *G. fluctuans/natans* until more reared material can be obtained to clarify the taxonomy of this taxon.

Mines into stems and woody flotsam. Though widespread and common throughout ENP, this species tends to become more abundant with nutrient enrichment and is considered an indicator of enrichment when abundant.



Goeldichironomus fluctuans/natans: segments II-III, with anterior points slightly larger than median points.



Goeldichironomus fluctuans/natans: A. frontal apotome, B. thoracic horn showing conspicuous coarser branch projecting anteriorly beyond the remaining finer plumosity, C-D. two views of the comb on VIII showing its variability.

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Appendix 1. Scientific Names, Authorities, Dates of Original Description, and Couplet Location in the Key for Genera and Species Mentioned in this Report

[Authorities and date of authorship are given for each genus and each recognized species within each genus. Taxa with letter designations for species names are morphospecies created for this study only and do not correspond to morphospecies designations from other studies. Appendix 2 provides synonymies between pupal species listed here and morphospecies designations for larvae listed in Epler (2001)]

Taxon and authority	Couplet number
Ablabesmyia Johannsen	43’
mallochi Walley, 1926	51
peleensis Walley, 1926	50
sp. A	54’
sp. B	55
sp. C	55’
sp. E	54
sp. F	52’
cf. *Antillocladius* sp. Sæther,	23’
Apedilum Townes, 1945	102’
elachistus Townes, 1945	103
subcinctum Townes, 1945	103’
Beardius Reiss and Sublette, 1985	134’
breviculus Reiss and Sublette, 1985	136
reissi Jacobsen *in* Jacobsen and Perry, 2000	135
truncatus Reiss and Sublette, 1985	136’
Cantapelopia Roback, 1971	36’
gesta Roback, 1971	36’
Chironomus Meigen, 1803	92, 139, 144
stigmaterus Say, 1823	145
sp. B	145’
sp. E	92
(Lobochironomus) sp.	139
Cladopelma Kieffer, 1921	85
forcipis (Rempel, 1939)	87
galeator (Townes, 1995)	88
sp. A	86
sp. B	88
sp. C	88’
Cladotanytarsus Kieffer, 1921	69
Cladotanytarsus acornutus Jacobsen and Bilyj, 2007	70
Cladotanytarsus sp. B	70’
Cladotanytarsus sp. C	70’
Clinotanypus sp. Kieffer, 1913	32
Coelotanypus sp. Kieffer, 1913	32’
Corynoneura Winnertz, 1846	14
Corynoneura sp. A	16
Corynoneura sp. B	16’

Appendix 1. Scientific Names, Authorities, Dates of Original Description, and Couplet Location in the Key for Genera and Species Mentioned in this Report—Continued

[Authorities and date of authorship are given for each genus and each recognized species within each genus. Taxa with letter designations for species names are morphospecies created for this study only and do not correspond to morphospecies designations from other studies. Appendix 2 provides synonymies between pupal species listed here and morphospecies designations for larvae listed in Epler (2001)]

Taxon and authority	Couplet number
Cricotopus Wulp, 1874	18
Cricotopus (C.) bicinctus	19
Cricotopus (Isocladius) sylvestris	20
Cricotopus (Isocladius) sp. A	20’
Cryptochironomus Kieffer, 1918	77
Cryptochironomus cf. *eminentia* Mason, 1985	84’
Cryptochironomus cf. *fulvus* (Johannsen, 1905)	82’
Cryptochironomus cf. *ponderosus* (Sublette, 1964)	84
Cryptochironomus psittacinus Meigen, 1830	80
Cryptochironomus sp. A	82
Cryptochironomus sp. B	80’
Cryptochironomus sp. C	83’
Cryptochironomus sp. E	80
Cryptotendipes sp. Lenz, 1941	89
Denopelopia Roback and Rutter, 1988	37
Denopelopia atria Roback and Rutter, 1988	37
Dicrotendipes Kieffer, 1913	125, 134, 137, 150
Dicrotendipes leucoscelis (Townes, 1945)	134, 150
Dicrotendipes lobus (Beck, 1962)	138
Dicrotendipes modestus (Say, 1823)	128
Dicrotendipes simpsoni Epler, 1987	138’
Dicrotendipes tritomus (Kieffer, 1916)	127’
Dicrotendipes sp. A Epler, 1992	128’
Djalmabatista Fittkau, 1968	24B
Djalmabatista pulchra (Johannsen,	24B
Einfeldia Kieffer, 1924	148
Einfeldia natchitocheae (Sublette, 1964)	148
Endochironomus Kieffer, 1918	98’
Endochironomus nigricans (Johannsen, 1905)	99
Endochironomus subtendens (Townes, 1945)	99’
Endotribelos Grodhaus, 1987	121
Endotribelos hesperium (Sublette, 1960)	121
Fittkauimyia Karunakaran, 1969	31
Fittkauimyia serta Roback, 1971	31
Glyptotendipes Kieffer, 1913	116
Glyptotendipes meridionalis Dendy and Sublette, 1959	119’
Glyptotendipes paripes Edwards, 1929	119
Glyptotendipes cf. *seminole* Townes, 1945	117’
Glyptotendipes sp. B	118

Appendix 1. Scientific Names, Authorities, Dates of Original Description, and Couplet Location in the Key for Genera and Species Mentioned in this Report—Continued

[Authorities and date of authorship are given for each genus and each recognized species within each genus. Taxa with letter designations for species names are morphospecies created for this study only and do not correspond to morphospecies designations from other studies. Appendix 2 provides synonymies between pupal species listed here and morphospecies designations for larvae listed in Epler (2001)]

Taxon and authority	Couplet number
Goeldichironomus Fittkau, 1965	94, 139’, 149’
Goeldichironomus amazonicus (Fittkau, 1965)	139’, 152
Goeldichironomus devineyae (Beck, 1961)	151
Goeldichironomus holoprasinus (Goeldi, 1905)	151
Goeldichironomus fluctuans Reiss, 1974	94, 152’
Goeldichironomus natans Reiss, 1974	94, 152’
Goeldichironomus pictus group	126
Guttipelopia Fittkau, 1962	42
Guttipelopia guttipennis (Wulp, 1874)	42
Kiefferulus Goetghebuer, 1922	126’, 150’
Kiefferulus (Kiefferulus) sp. Goetghebuer, 1922	150’
Kiefferulus (Kiefferulus) dux (Johannsen, 1905)	150’
Kiefferulus (Wirthiella) pungens (Townes, 1945)	126’
Labrundinia Fittkau, 1962	43
Labrundinia becki Roback, 1971	48’
Labrundinia johannseni Beck and Beck, 1966	49
Labrundinia maculata Roback, 1971	49’
Labrundinia neopilosella Beck and Beck, 1966	49
Labrundinia pilosella (Loew, 1866)	48
Labrundinia sp. B Epler, 1992	44
Labrundinia sp. 3 nr. *virescens* Roback, 1987	45
Labrundinia sp. 6 Roback, 1987	46
Labrundinia sp. 10 Roback, 1987	46
Larsia Fittkau, 1962	39
Larsia berneri Beck and Beck, 1966	40
Larsia decolorata (Malloch, 1915)	41
Larsia sp. B	41’
Limnophyes sp. Eaton, 1875	21
Manoa Fittkau, 1963	3
Manoa pahayokeensis Jacobsen *in* Jacobsen and Perry, 2002	3
Microchironomus sp. Kieffer, 1926	85
Monopelopia Fittkau, 1962	35, 36
Monopelopia boliekae Beck and Beck, 1966	35
Monopelopia cf. caraguata Mendes, Marcondes, and de Pinho, 2003	36
Nanocladius Kieffer, 1913	11’
Nanocladius alternantherae Dendy and Sublette, 1959	13’
Nanocladius cf. *balticus* (Palmen, 1959)	12
Nanocladius distinctus (Malloch, 1915)	13

Appendix 1. Scientific Names, Authorities, Dates of Original Description, and Couplet Location in the Key for Genera and Species Mentioned in this Report—Continued

[Authorities and date of authorship are given for each genus and each recognized species within each genus. Taxa with letter designations for species names are morphospecies created for this study only and do not correspond to morphospecies designations from other studies. Appendix 2 provides synonymies between pupal species listed here and morphospecies designations for larvae listed in Epler (2001)]

Taxon and authority	Couplet number
Natarsia sp. Fittkau, 1962	34
Nilothauma Kieffer, 1921	102
Nilothauma babiyi (Rempel, 1937)	102
Parachironomus Lenz, 1921	94’, 95’, 143’
Parachironomus alatus (Beck, 1962)	95’
Parachironomus carinatus (Townes, 1945)	143’
Parachironomus directus (Dendy and Sublette, 1959)	94’
Parachironomus sp. A	94’
Parakiefferiella Thienemann, 1936	18’
Parakiefferiella coronata (Edwards, 1929)	18’
Paralauterborniella Lenz, 1941	143
Paralauterborniella nigrohalteralis (Malloch, 1915)	143
Paramerina sp. Fittkau, 1962	39’
Paratanytarsus sp. Thienemann and Bause *in* Bause, 1913	56
Paratanytarsus grimmii (Schneider, 1885)	58
Paratanytarsus sp. A	58’
Paratanytarsus sp. B	57
Paratendipes Kieffer, 1911	106
Paratendipes subaequalis (Malloch, 1915)	106
Phytotelmatocladius sp. Epler, 2007	23
Polypedilum Kieffer, 1912	98, 106’, 129, 140
Polypedilum beckae (Sublette, 1964)	98
Polypedilum epleri Oyewo and Jacobsen, 2007	115’
Polypedilum cf. *falciforme* Maschwitz *in* Maschwitz and Cook, 2000	114
Polypedilum nubifer (Skuse, 1889)	130’
Polypedilum nymphaeorum Maschwitz *in* Maschwitz and Cook, 2000	115
Polypedilum simulans Townes, 1945	122
Polypedilum trigonus Townes, 1945	112
Polypedilum tritum (Walker, 1856)	111’
Polypedilum sp. B	112’, 131’, 141’
Polypedilum sp. C	131, 141
Polypedilum sp. J	108
Polypedilum sp. K	108’
Polypedilum sp. L	111
Polypedilum sp. M	78’
Polypedilum sp. N	114’
Procladius Skuse, 1889	24C
Procladius (Psilocladius) bellus (Loew, 1866)	29
Procladius (Holotanypus) cf. *freemani* Sublette, 1964	30’
Procladius (Holotanypus) cf. *sublettei* Roback, 1971	30
Procladius (Holotanypus) sp. Roback, 1982	29’

Appendix 1. Scientific Names, Authorities, Dates of Original Description, and Couplet Location in the Key for Genera and Species Mentioned in this Report—Continued

[Authorities and date of authorship are given for each genus and each recognized species within each genus. Taxa with letter designations for species names are morphospecies created for this study only and do not correspond to morphospecies designations from other studies. Appendix 2 provides synonymies between pupal species listed here and morphospecies designations for larvae listed in Epler (2001)]

Taxon and authority	Couplet number
Psectrocladius sp. Kieffer, 1906	11
Pseudochironomus Malloch, 1915	5
Pseudochironomus articaudus Sæther, 1977	8’
Pseudochironomus richardsoni Malloch, 1915	7
Pseudochironomus sp. A	8
Pseudochironomus sp. C	7’
Pseudosmittia Goetghebuer, 1932	22
Pseudosmittia digitata Sæther, 1981	22
Pseudosmittia forcipata (Goetghebuer, 1921)	22
Pseudosmittia sp. A	22
Stenochironomus Kieffer *in* Kieffer and Thienemann, 1919	104’
Stenochironomus (Petalopholeus) cinctus Townes, 1945	105’
Stenochironomus (Petalopholeus) sp. Borkent, 1984	105’
Stenochironomus (Stenochironomus) macateei (Malloch, 1915)	105
Stenochironomus (Stenochironomus) sp. Kieffer in Kieffer and Thieneman, 1919	105
Tanypus Meigen, 1803	24A
Tanypus cf. *carinatus* Sublette, 1964	28’
Tanypus prob. *clavatus* Beck, 1962	26
Tanypus cf. *neopunctipennis* Sublette 1964	26’
Tanypus stellatus Coquillett, 1902	27
Tanypus cf. *vilipennis* (Kieffer, 1918)	28
Tanytarsus Wulp, 1874	59, 69’
Tanytarsus allicis Sublette, 1964	67, 74’
Tanytarsus cf. *epleri* Ekrem, Sublette, and Sublette, 2003	61
Tanytarsus limneticus Sublette, 1964	62’
Tanytarsus mendax group sp.	72
Tanytarsus sp. A	65
Tanytarsus sp. B	67, 74’
Tanytarsus sp. C	75’
Tanytarsus sp. D	66
Tanytarsus sp. E	74
Tanytarsus sp. F	68
Tanytarsus sp. G	72
Tanytarsus sp. H	65’
Tanytarsus sp. I	72’
Tanytarsus sp. K	75
Tanytarsus sp. L	68’
Tanytarsus sp. NA	63
Tanytarsus sp. ND	63’

Appendix 1. Scientific Names, Authorities, Dates of Original Description, and Couplet Location in the Key for Genera and Species Mentioned in this Report—Continued

[Authorities and date of authorship are given for each genus and each recognized species within each genus. Taxa with letter designations for species names are morphospecies created for this study only and do not correspond to morphospecies designations from other studies. Appendix 2 provides synonymies between pupal species listed here and morphospecies designations for larvae listed in Epler (2001)]

Taxon and authority	Couplet number
Thienemanniella Kieffer, 1911	14’
Thienemanniella cf. *lobapodema* Hestenes and Sæther, 2000	15’
Thienemanniella cf. *taurocapita* Hestenes and Sæther, 2000	15
Tribelos Townes, 1945	146
Tribelos atrum (Townes, 1945)	147
Tribelos fuscicorne (Malloch, 1915)	147’
Xenochironomus Kieffer, 1921	93, 95
Xenochironomus xenolabis (Kieffer, 1916)	93, 95
Zavreliella Kieffer, 1920	123
Zavreliella marmorata (Wulp, 1859)	123
Chironomini Genus A	104

Appendix 2. Correspondence between Pupal Morphospecies Designations in this Report and the Larval Morphospecies Designations in Epler (2001)

[Associations were determined from rearing larvae to at least the pupal stage or from finding prepupae or pupae with attached larval exuviae in samples. Tentative associations are based upon collections of larvae or larval exuviae in samples in which a particular pupal taxon was abundant and the predominant or exclusive species of that genus present. "Undetermined" means that the taxon in this key has not been matched or associated with any morphospecies shown in the Epler (2001) larval key.]

Pupal species or morphospecies designation in this study	Larval morphospecies designation in Epler (2001)
Ablabesmyia sp. F	? *Ablabesmyia* sp. A (tentative)
Cladotanytarsus acornutus	*Cladotanytarsus* sp. A
Cladotanytarsus sp. B	*Cladotanytarsus* sp. A
Cladotanytarsus sp. C	*Cladotanytarsus* sp. A
Corynoneura sp. A	Undetermined
Corynoneura sp. B	*Corynoneura* sp. D
Dicrotendipes sp. A	*Dicrotendipes* sp. A
Glyptotendipes sp. B	Undetermined
Labrundinia sp. 3 nr. *virescens*	*Labrundinia* sp. 3 nr. *virescens*
Labrundinia sp. 10 Roback	*Labrundinia* sp. 6 Roback
Labrundinia sp. B	*Labrundinia* sp. B
Larsia sp. B	Undetermined
Paratanytarsus sp. A	Undetermined
Paratanytarsus sp. B	Undetermined
Polypedilum epleri	*Polypedilum* sp. A
Polypedilum sp. B	Undetermined
Tanytarsus sp. B (=*Tanytarsus allicis*)	*Tanytarsus* sp. C
Tanytarsus sp. A	Undetermined
Tanytarsus sp. C	? *Tanytarsus* sp. T (tentative)
Tanytarsus sp. D	*Tanytarsus* sp. R
Tanytarsus sp. E	*Tanytarsus* sp. J
Tanytarsus sp. F	*Tanytarsus* sp. C
Tanytarsus sp. G (=*Tanytarsus mendax* group sp.)	*Tanytarsus* sp. G
Tanytarsus sp. H	Undetermined
Tanytarsus sp. I	? *Tanytarsus* sp. K (tentative)
Tanytarsus sp. K	*Tanytarsus* sp. F
Tanytarsus sp. L	Undetermined
Tanytarsus sp. NA	Undetermined
Tanytarsus sp. ND	Undetermined