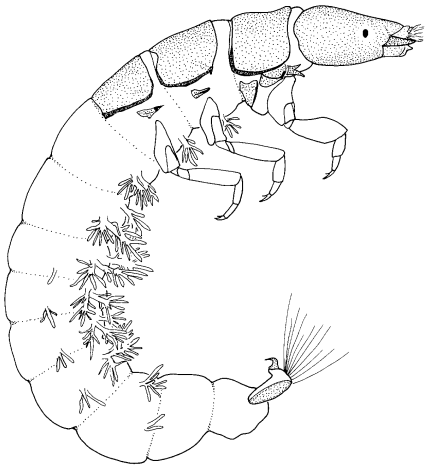

IDENTIFICATION MANUAL

FOR THE

CADDISFLY (TRICHOPTERA) LARVAE

OF

FLORIDA

REVISED EDITION 2004

Manuel L. Pescador
Andrew K. Rasmussen
Steven C. Harris

State of Florida
Department of Environmental Protection
Division of Water Resource Management
Tallahassee

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IDENTIFICATION MANUAL FOR THE CADDISFLY (TRICHOPTERA) LARVAE OF FLORIDA

REVISED EDITION 2004

by

Manuel L. Pescador, Ph.D.
Professor of Entomology
Florida A&M University
Tallahassee, Florida 32307-4100
and
Research Associate
Florida State Collection of Arthropods
Gainesville, Florida 32611

Andrew K. Rasmussen, Ph.D.
Research Associate
Entomology, Center for Water Quality
Florida A&M University
Tallahassee, Florida 32307-4100
and
Florida State Collection of Arthropods
Gainesville, Florida 32611

Steven C. Harris, Ph.D.
Professor of Biology
Clarion University
Clarion, Pennsylvania 16214-1232

Karen Savage, Project Manager
Division of Water Resource Management
Florida Department of Environmental Protection

Requests for copies of this document should be addressed to:
Bureau of Laboratories, Attn: Joy Jackson
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399-2400

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INTRODUCTION

Caddisflies (Trichoptera) are a diverse and vital biotic component of freshwater ecosystems, having been able to adapt and succeed in nearly every type of aquatic habitat. Although the greatest species diversity occurs in cool running waters, many species inhabit lakes and ponds, as well as specialized habitats such as marshes, swamps, springs, seeps, and intermittent streams. A few species live on marine shores and some in moist soil as well. The biological roles of caddisflies in freshwater ecosystems have been well documented (Scott and Crossman, 1973; Wallace et al., 1982; Merritt et al., 1984; Irons et al., 1988), and their potential use as biological indicators of water quality is well known (Plafkin et al., 1989; Resh and Jackson, 1993; Johnson et al., 1993; Barbour et al., 1999).

Caddisflies are one of the dominant aquatic insect groups in Florida. However, knowledge of the systematics of the caddisfly fauna in the state is still limited, most particularly for the larvae, the life stage that benthologists most often encounter in the field. Caddisflies are excellent indicators of water quality, and to appreciate fully the utility of the group as a bioassessment tool requires a good taxonomic knowledge of the fauna, particularly at the species level (Resh and Unzicker, 1975; Lenat, 1988). The ability to distinguish the larvae provides a better understanding of the patterns of population and production dynamics in freshwater ecosystems (Resh, 1976). The literature dealing with the taxonomy of the caddisflies of Florida is very scattered in various publications, and it is a time-consuming exercise to search these references. This manual represents our attempt to consolidate the available taxonomic information on the larval taxonomy of the caddisfly fauna in the state. The manual is far from being a panacea to the problem of limited taxonomic knowledge of the group but rather serves as a reminder of how much work still needs to be done. Larval-adult associations are available for only approximately 50% of the approximately 192 species represented in the state. The manual leaves plenty of room for improvement in this regard. A group as large as caddisflies requires years to conduct a more thorough and comprehensive taxonomic study.

ABOUT THIS MANUAL

Area covered: This manual was prepared to aid aquatic biologists in the identification of the caddisfly larvae of Florida. The manual provides keys to the families, genera, and species (where possible) for the mature larvae of the caddisflies presently thought to occur in the state. In cases where the family is represented by a single genus, the generic names are included in the key to the families (e.g., Dipseudopsidae, Lepidostomatidae, Molannidae). Furthermore, in cases where the family is represented by a single species, the specific names are indicated (i.e., Helicopsychidae). Similarly, in the key to genera of a particular family, a genus may be represented by one species, the specific name is then indicated in the key [e.g., *Ironoquia* (Limnephilidae), *Cyrnellus* (Polycentropodidae)]. The sources of information from which the keys are adapted are indicated at the beginning of each key.

During the course of preparing the manual, we found many species and a few genera that represent new state records. Certainly more new state records will be added in the future and more larval-adult associations of species will be accomplished. Therefore, we strongly recommend that other sources must be consulted in addition to this manual when identifying the larvae of the caddisfly fauna of the state. For larval keys of families and genera, the papers by Ross (1944), Wiggins (1996a, 1996b), Unzicker et al. (1982), Morse and Hozenthal (1996), and Moulton and Stewart (1996) are very useful. Significant references for the larval taxonomy of a given genus are included in the text as ADDITIONAL REFERENCES following the NOTES section. Complete information on these references is indicated in the LITERATURE CITED section of the manual.

Changes from 1995 edition: This revised edition incorporates substantial amounts of new data gathered subsequent to the 1995 edition (Pescador et al., 1995). New data are represented in the form of many new state records and newly discovered species, as well as by recent advancements in larval taxonomy. Most of the keys and write-ups have been rewritten in one way or another. Of the 192 caddisfly species presently known in Florida (See Appendix A), 16 of these are newly discovered species and an additional 13 species are new state records that we have documented since the first edition. In this edition we have not included a database report of collection records because the large number of new records makes the tables overly large for printing. We intend to provide a species checklist and distributional summary, with maps, in a future publication.

Illustrations: The figures in this manual are a combination of original illustrations based on Florida specimens and illustrations adapted from other sources. If the illustrations were adapted or modified from other publications, the source of each figure is cited in the caption. If there is no source given in the figure legend then the figure is an original illustration produced for this manual. Diagnostic characters in the keys that a novice may have difficulty locating are indicated by arrows in the illustrations.

Classification: Our species checklist (Appendix A) lists taxa under the widely used 3 suborder scheme: Annulipalpia (fixed-retreat makers), Spicipalpia (closed-cocoon makers), and Integripalpia (portable-case makers). Taxonomic accounts (i.e., synonymies) of the genera and species are excluded in the text. Species that are presumably new to science are simply referred to as sp. A, B, etc... and their descriptions will be published elsewhere. Additionally, the appendix includes species (with question marks) that have not been recorded in the state but may occur here, based on their present geographic range.

Text: The text for each family summarizes genera represented in the state and provides a short diagnosis of the larva and larval case/retreat and general habitat information. This is followed by a key to larvae of the Florida genera. The text for each genus gives a brief morphological DIAGNOSIS; NOTES of general information on the morphology, life history and ecology of the various species represented in the state; and ADDITIONAL REFERENCES for significant literature regarding the larval taxonomy of that particular genus.

ACKNOWLEDGEMENTS

This revised edition is a result of the collective work of many friends and colleagues. We would like to thank Wills Flowers, Michael Hubbard, Jan Peters, and Bart Richard for their encouragement and contributions to the caddisfly research at Florida A&M University. Our gratitude is extended to Jim Glover, Michael Floyd, and John Morse for their contributions that have led to a better understanding of the Florida fauna. Additionally, we thank them for the illustrations they have allowed us to use. This second edition was enhanced by the generous loan of specimens from the following biologists: Bob Rutter, Ford Walton, Dana Denson, John Epler, Theresa Thom, Donald Ray, Laurence Donelan, and Frank Butera. We thank Dana Denson for his time and effort to join us on many collecting trips on the peninsula. Likewise, Donald Ray and Lawrence Donelan have assisted us in many of our panhandle collecting trips. We thank Bob Rutter, Dana Denson, and Donald Ray for their review of the manuscript. Lastly, we thank Karen Savage and Ellen McCarron for their outstanding assistance in the funding and management of this project.

WORKING WITH SPECIMENS

Preservation and Storage: Generally, caddisfly larvae preserve well in alcohol provided they are fixed and handled properly in the first place. Bulk benthic samples should be placed in strong (85-95%) ethyl alcohol or a formalin solution, if samples are put in alcohol it should be replaced within 24 hours if the samples are not processed or sorted immediately, or else the integrity of the insect tissues is destroyed. Once the specimens are sorted, they should be preserved in 75-80% ethyl alcohol. For museum quality specimens, particularly larger specimens, larvae should be placed in a special fixative upon collection. Wiggins (1996a) recommended an initial preservation in Kahle's fluid for its superior fixing quality. Satisfactory alternative methods include heating the larva in water to a near boil, similar to how Lepidoptera larvae are fixed, or heating the larva in a water/alcohol mixture. We have experienced difficulty identifying specimens that were treated with Rose Bengal stain. The stain diffuses the cuticular coloration, thus making it difficult to discern the patterns of muscle scars. Small-sized species (e.g., *Oecetis* spp., *Hydroptila* spp.) are better stored in microvials inside 2 or 4-dram vials filled with alcohol. This procedure prevents or minimizes the mutilation of the larvae and breakage of the larval cases. Vials or any storage container with specimens must have complete locality labels. One of the pet peeves of systematists is identifying specimens that are not properly labeled or with field codes only. Locality, to some extent, may provide invaluable information for the identification of specimens.

Examining Specimens: The morphological characters that are involved in identifying the larvae are adequately viewed using a quality stereomicroscope equipped with 50X magnification and proper lighting. Adjusting the intensity and angle of the lighting is extremely important in getting the best view possible. The magnification needed will depend on the size of the specimen and structure being examined. Specimens can be viewed by placing them in a Petri dish or Syracuse watch glass filled with alcohol. Fine-tip forceps, dissecting pins, and microdissecting scissors are useful for manipulating and removing structures for closer examination. Placing the structure in glycerin on a depression slide allows for excellent viewing. To store dissected structures they should be placed in microvials and kept with the specimens.

Identification Suggestions: After running a specimen through the keys we recommend reading the diagnosis and identification notes before arriving at a final determination. Also we encourage consulting other taxonomic references referred to in the manual. If, after careful examination a question still remains as to the taxonomic identity, the identification should be left at the taxonomic level (e.g., family or genus) for which no doubt exists. Often questions concerning taxonomic identity can be answered through consulting a reference collection of correctly identified specimens. By having quality reference specimens one can compare the specimen in question with specimens of known identity. Another option is to consult a taxonomist specializing in the taxa of interest. In any case, for QA/QC purposes voucher specimens should be kept so that identifications can be checked later.

MORPHOLOGY (Refer to Fig. 1)

A general knowledge of the morphological terms associated with caddisfly larvae is necessary for ease of identification. The head is dorsally divided by a Y-shaped ecdysial line also referred to as the frontoclypeal and coronal sutures; the frontoclypeus is bordered laterally by the frontoclypeal sutures; and the parietals extend posteromesally along the coronal suture. Ventrally, the parietals mostly occupy the venter of the head and are separated by the ecdysial line, and the anterior and posterior apotomes. On the anterolateral portion of the head is located the eyes and antennae, which vary in location from family to family. Mouthparts include the labrum and labium, between which are mandibles and maxillae. Closely associated with the labium is the opening of the silk gland. The posterior portion of the head often has a number of muscle scars which appear as dark or light spots.

The thorax is composed of three segments: the prothorax, mesothorax and metathorax, each of which bears a pair of legs and often a sclerotized notum. The prothorax often has a finger-like prosternal horn and a lateral pair of trochantins, which can be distinctive for several families. The prothorax is always covered by dorsal sclerotized plates, while the meso- and metathorax are variable both in presence or absence of notal plates, and in extent of notal subdivisions. Setae, if arising on the meso- or metanota, are located in distinct areas termed setal area 1 (sa1), setal area 2 (sa2) and setal area 3 (sa3). Arrangement of both setal areas and sclerites can be of taxonomic significance. Thoracic legs are subdivided into the basal coxa, followed by the trochanter, femur, tibia and tarsus, which bears a tarsal claw apically. Tarsal claws usually each have a basal seta, the size of which can be of taxonomic value.

The abdomen has nine segments that are usually membranous except for segment IX which has dorsal sclerites in some families. The first abdominal segment often bears a dorsal hump and a pair of lateral humps which function in allowing circulation of water through the case, as well as in securing the larva in the case. Some families have abdominal segments with numerous tracheal gills which function in gaseous exchange. Chloride epithelia, seen as oval rings especially on the venter of the abdomen, are found in the Limnephilidae, Hydroptilidae and Molannidae, and function in osmoregulation. The anal prolegs vary from family to family in degree of separation from the body, in associated sclerites, and in extent and nature of setation. Anal prolegs each have an anal claw which may be simple or complex, and which may bear accessory spines.

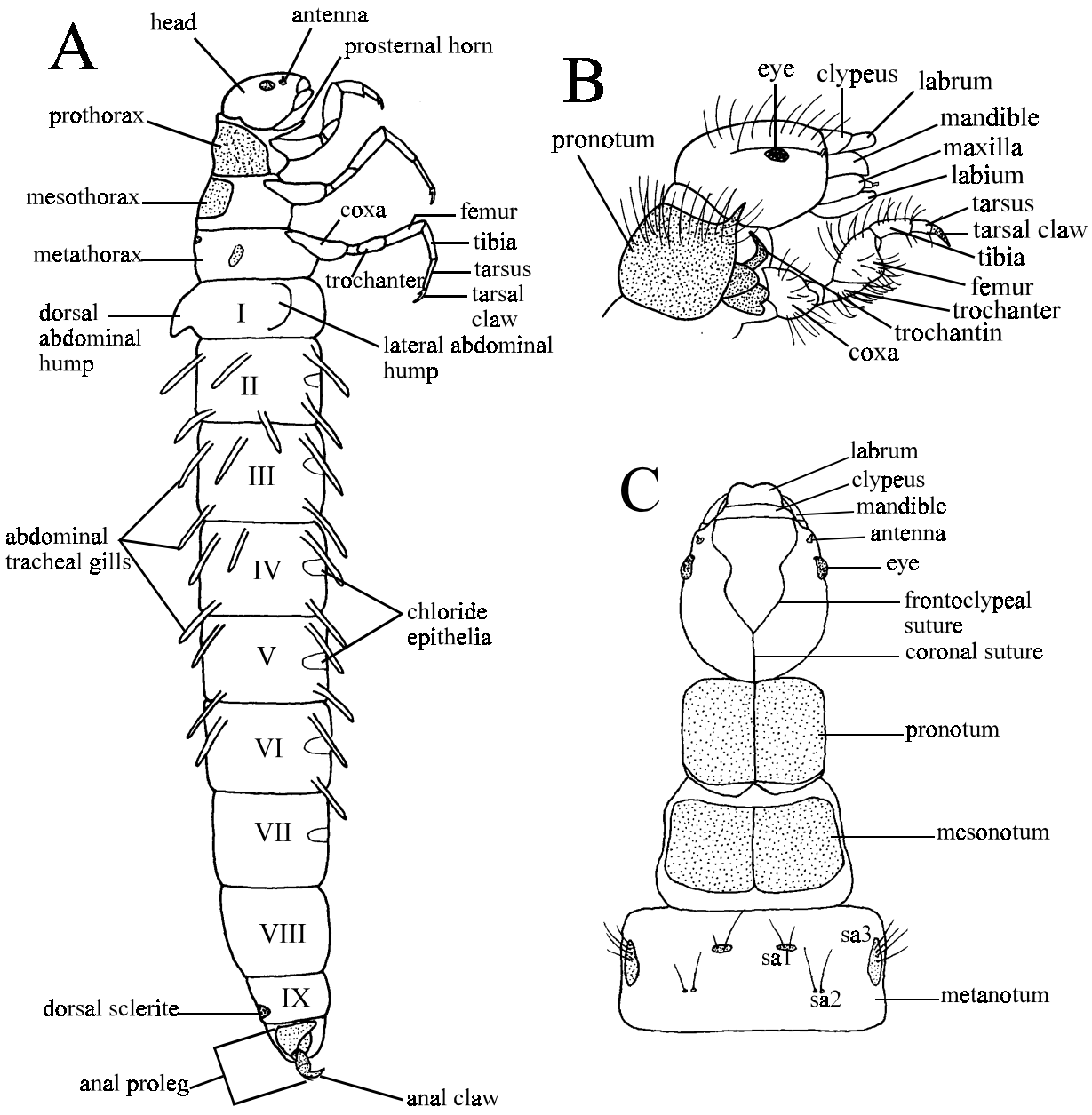

Figure 1. Morphology of caddisfly larva; A. habitus, lateral; B. head and prothorax, lateral; C. head and thorax, dorsal.

KEY TO FAMILIES FOR LARVAE OF THE CADDISFLIES (TRICHOPTERA) OF FLORIDA

[modified from Wiggins (1996b)]

1. Anal claw comb-shaped (Fig. 2); larva constructing portable case of sand grains or small rock fragments, coiled to resemble a snail shell (Fig. 3)
. . . . . Helicopsychidae (p. 33), *Helicopsyche borealis*

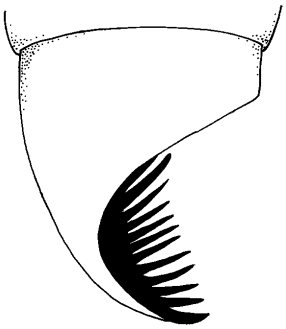

Fig. 2. *Helicopsyche borealis*, anal claw, lateral.

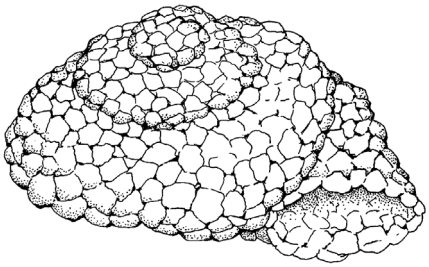

Fig. 3. *Helicopsyche borealis*, larval case.

Anal claw hook-shaped (Fig. 4); larval case straight or nearly so, not resembling a snail shell, or larva not constructing a portable case 2

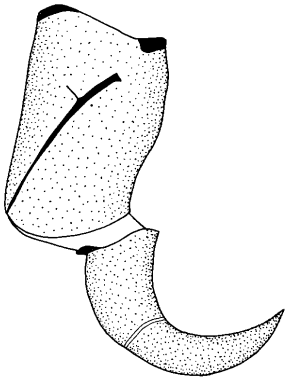

Fig. 4. *Rhyacophila* sp., anal claw, lateral.

2(1) Top of each thoracic segment covered by plates, usually closely appressed along the middorsal line, sometimes subdivided with thin transverse sutures, or some sclerites undivided (Fig. 5) 3

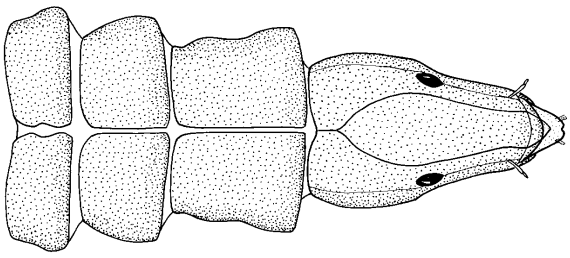

Fig. 5. *Mayatrichia* sp.

Metanotum and sometimes mesonotum entirely membranous, or largely so and bearing several pairs of smaller sclerites (Fig. 6)
. 4

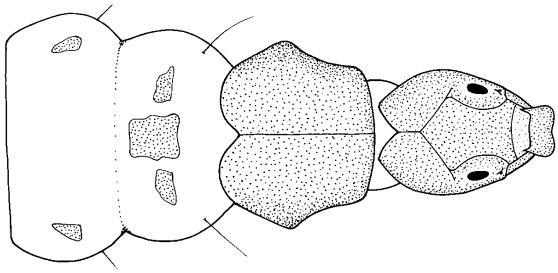

Fig. 6. *Protoptila* sp.

3(2) Abdomen with ventrolateral rows of branched gills, and with prominent brush of long hairs at base of anal claw (Fig. 7); larvae construct fixed retreats (Fig. 8)
. . . . . Hydropsychidae (p. 34)

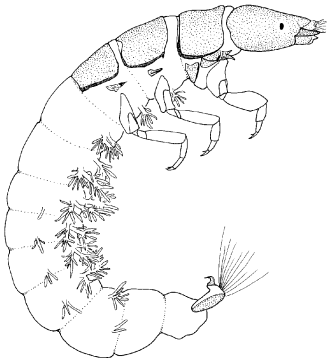

Fig. 7. *Cheumatopsyche* sp.

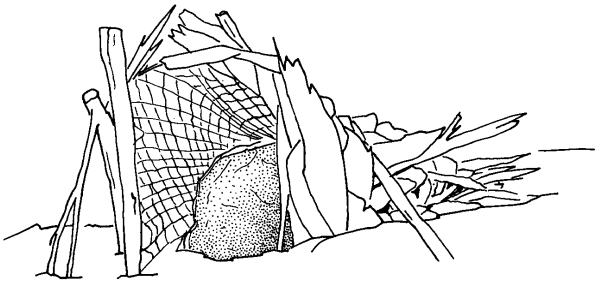

Fig. 8. *Hydropsyche* sp., larval retreat.

Abdomen without ventrolateral gills (Fig. 9), and with only 2 or 3 hairs at base of anal claw; larvae small, usually less than 6 mm long; construct portable cases of sand, algae, or fixed cases of silk (Fig. 10) . . . . . Hydroptilidae (p. 48)

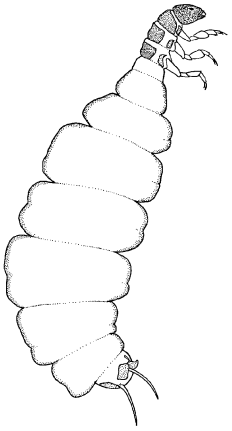

Fig. 9. *Hydroptila* sp.

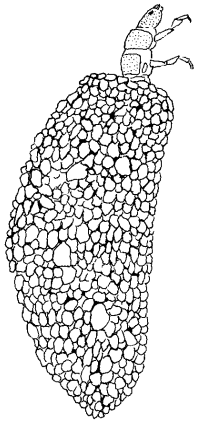

Fig. 10. *Hydroptila* sp., with case.

4(2) Antennae very long and prominent, at least six times as long as wide (Fig. 11) and/or sclerites on mesonotum lightly pigmented except for a pair of dark curved lines on posterior half (Fig. 12); larvae construct portable cases of various materials . . . . . Leptoceridae (p. 56)

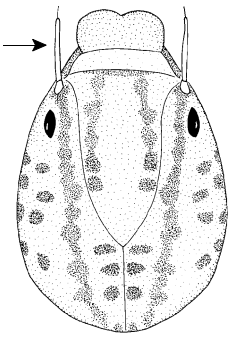

Fig. 11. *Triaenodes injustus*.

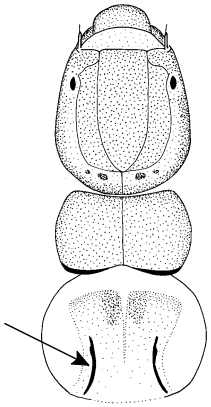

Fig. 12. *Ceraclea* sp.

Antennae of normal length, no more than three times as long as wide (Fig. 13), or not apparent; mesonotum without a pair of dark curved lines 5

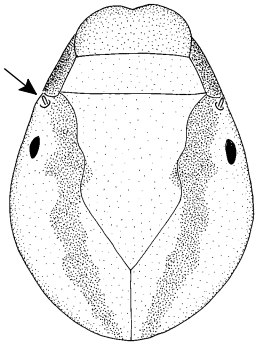

Fig. 13. *Agrypnia* sp.

5(4) Mesonotum largely or entirely membranous (Fig. 14), or with small sclerites covering not more than half of notum (Fig. 15); pronotum without anterolateral projections 6

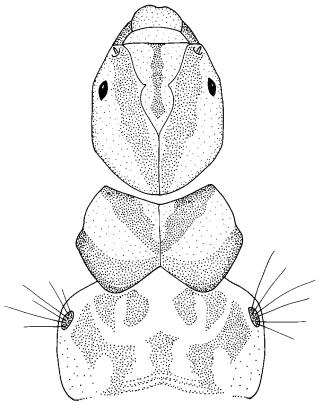

Fig. 14. *Agrypnia* sp.

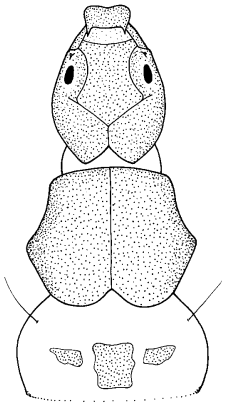

Fig. 15. *Protoptila* sp.

Mesonotum largely covered by variously subdivided sclerotized plates (Figs. 16, 17); pronotum sometimes with prominent anterolateral projections or processes (Fig. 17) 12

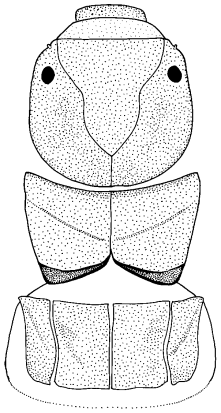

Fig. 16. *Brachycentrus* sp.

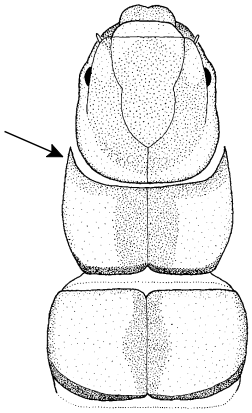

Fig. 17. *Psilotreta* sp.

6(5) Abdominal segment IX with sclerite on dorsum, sometimes difficult to see and detectable only by its shiny surface (Fig. 18) 7

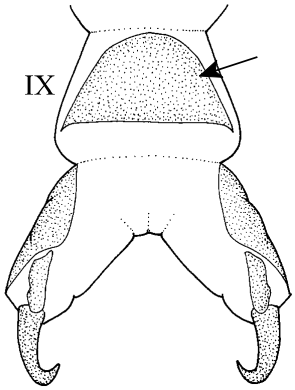

Fig. 18. *Rhyacophila* sp., terminal abdominal segments.

Abdominal segment IX with dorsum entirely membranous (Fig. 19) 9

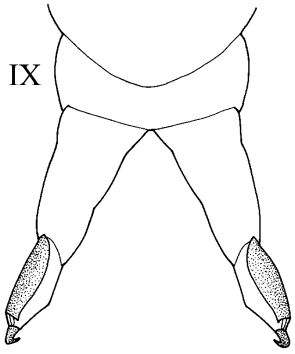

Fig. 19. *Chimarra* sp., terminal abdominal segments.

7(6) Metanotal sa3 usually consisting of a cluster of setae arising from a small rounded sclerite (Fig. 20); prosternal horn present (Fig. 21); larvae construct tubular portable cases, mainly of plant materials . . . . . Phryganeidae (p. 105)

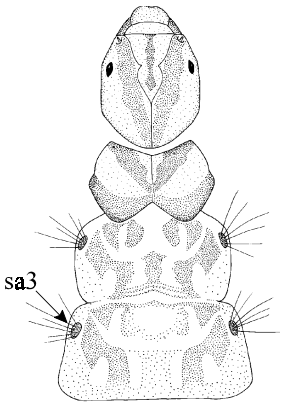

Fig. 20. *Agrypnia* sp.

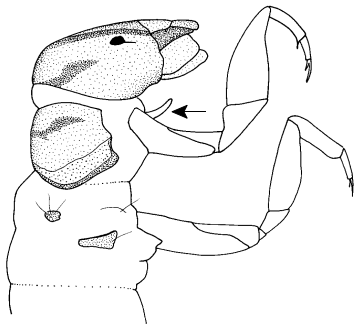

Fig. 21. *Ptilostomis* sp.

Metanotal sa3 consisting of a single seta not arising from a sclerite (Fig. 22); prosternal horn absent; larvae either constructing a tortoise-like case of stones or free living 8

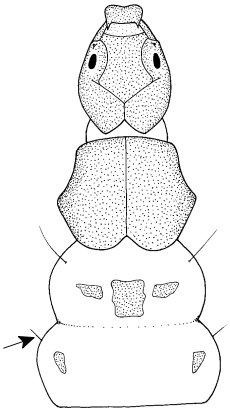

Fig. 22. *Protoptila* sp.

8(7) Anal claw with at least one dorsal accessory hook (Fig. 23); basal half of anal proleg broadly joined with segment IX; larvae construct tortoise-like portable cases of small stones (Fig. 24) . . . . . Glossosomatidae (p. 32), *Protoptila*

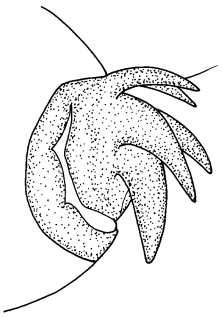

Fig. 23. *Protoptila* sp., anal claw.

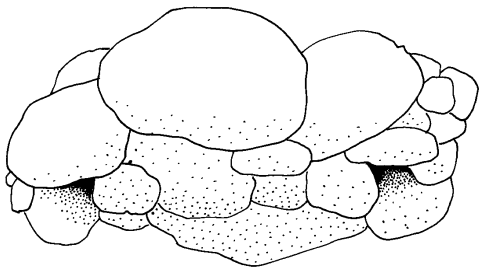

Fig. 24. *Protoptila* sp., larval case.

Anal claw without dorsal accessory hooks (Fig. 25); most of anal proleg free from segment IX; larvae free living without cases . . . . . Rhyacophilidae (p. 120), *Rhyacophila* (key to species, p. 121)

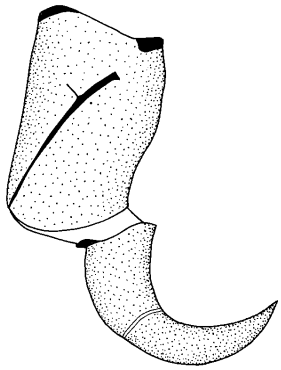

Fig. 25. *Rhyacophila* sp., anal claw.

9(6) Labrum membranous and T-shaped (Fig. 26), often withdrawn from view in preserved specimens; larvae construct fixed sac-shaped nets of silk (Fig. 27) . . . . . Philopotamidae (p. 103)

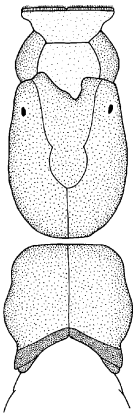

Fig. 26. *Chimarra* sp.

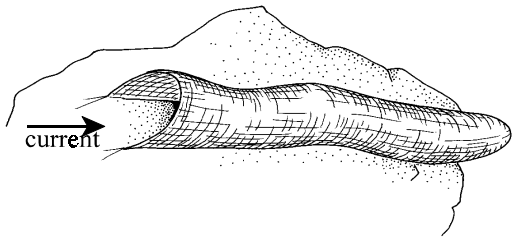

Fig. 27. *Dolophilodes* sp., larval retreat/capture net.

Labrum sclerotized, rounded and articulated in normal way (Fig. 28), always exposed 10

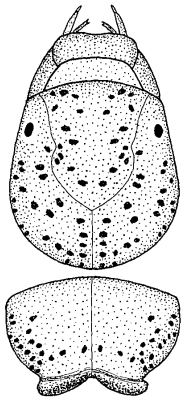

Fig. 28. *Polycentropus* sp.

10(9) Trochantin of prothoracic leg with apex acute (Fig. 29); larvae construct exposed funnel-shaped capture nets, flattened retreats, or tubes buried in loose sediments 11

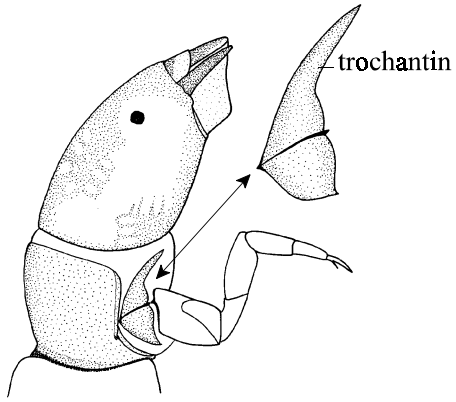

Fig. 29. *Cyrnellus fraternus*.

Trochantin of prothoracic leg broad and hatchet-shaped (Fig. 30); larvae construct tubular retreats on rocks and logs . . . . . Psychomyiidae (p. 117)

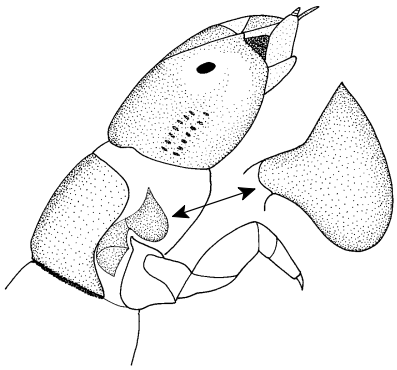

Fig. 30. *Lype diversa.*

11(10) Tarsi of all legs broad and flat, tarsal claws reduced (Fig. 31); tip of labium extremely elongate (Fig. 31) . . . . . Dipseudopsidae (p. 29), *Phylocentropus* (key to species, p. 30)

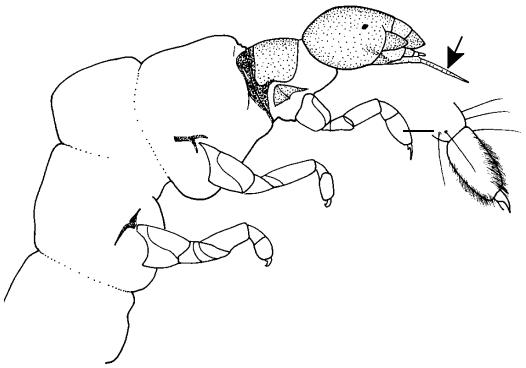

Fig. 31. *Phylocentropus* sp.

Tarsi of all legs elongate, not broad and flat, tarsal claws not reduced (Fig. 32); tip of labium not as elongate . . . . . Polycentropodidae (p. 109)

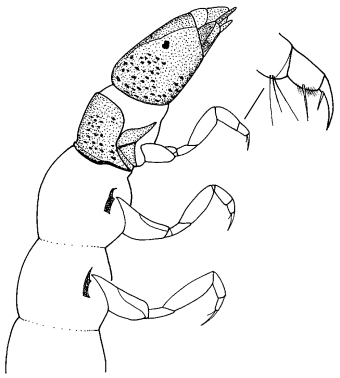

Fig. 32. *Polycentropus* sp.

12(5) Abdominal segment I lacking both dorsal and lateral humps (Fig. 33); metanotal sa1 usually lacking entirely, or, represented only by a single seta without a sclerite (Fig. 34); mesonotal sclerites subdivided (Fig. 34) . . . . . Brachycentridae (p. 20)

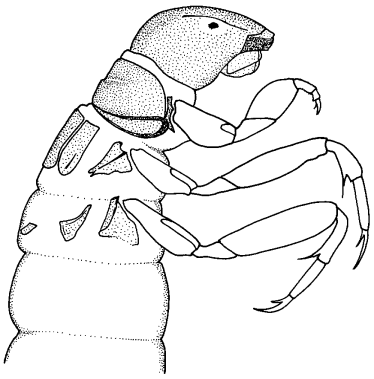

Fig. 33. *Brachycentrus* sp.

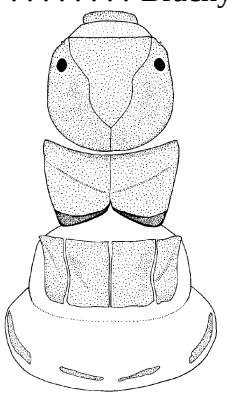

Fig. 34. *Brachycentrus* sp.

Abdominal segment I always with a lateral hump on each side although not always prominent, and with or without a median dorsal hump (Fig. 35); metanotal sa1 always present, usually represented by a sclerite bearing several setae, but with at least a single seta (Fig. 36); mesonotal sclerites not as above (Fig. 36) 13

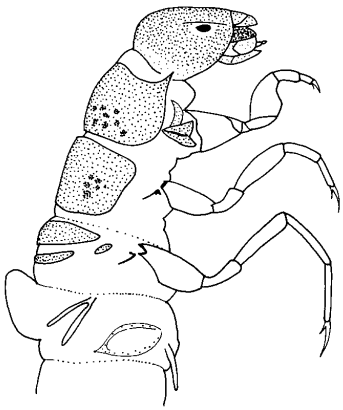

Fig. 35. *Agarodes* sp.

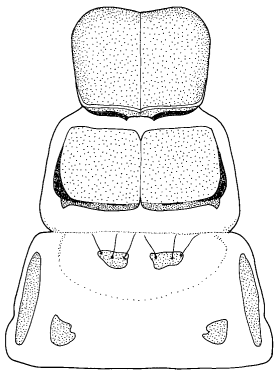

Fig. 36. *Pycnopsyche* sp. thorax, dorsal.

13(12) Tarsal claw of hind leg modified to form a short setose stub (Fig. 37), larval case of sand grains with a dorsal cowl and lateral flanges (Fig. 38) . . . . . Molannidae (p. 98), *Molanna* (key to species, p. 99)

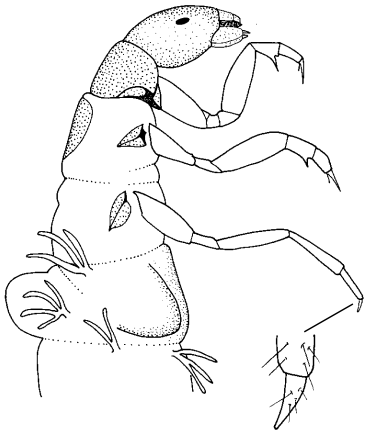

Fig. 37. *Molanna* sp.

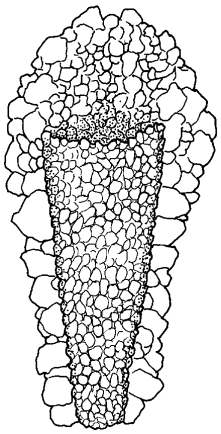

Fig. 38. *Molanna* sp., larval case.

Tarsal claw of hind legs no different in structure from those of other legs (Fig. 39); larval case not as above 14

Fig. 39. *Agarodes* sp.

14(13) Labrum with transverse row of approximately 16 long setae across central part (Fig. 40); larval case a hollowed twig (Fig. 41) or 2 leaf pieces (Fig. 42) . . . . . Calamoceratidae (p. 26)

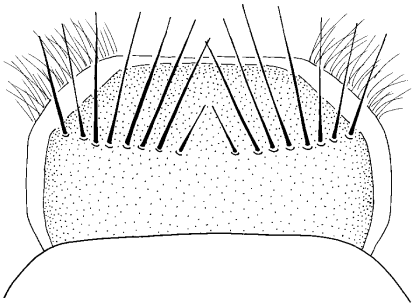

Fig. 40. *Anisocentropus pyraloides*, labrum, dorsal.

Fig. 41. *Heteroplectron* sp. larval case.

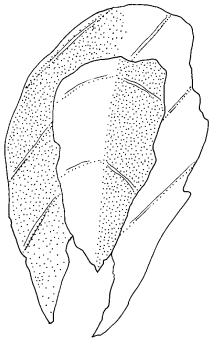

Fig. 42. *Anisocentropus pyraloides*, larval case.

Labrum with no more than 6 long setae across central part (Fig. 43) 15

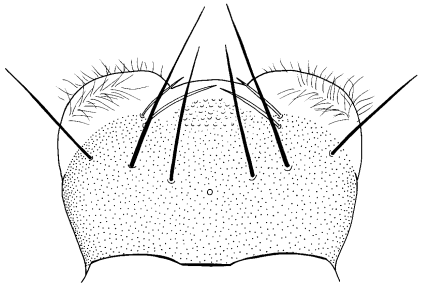

Fig. 43. *Neophylax* sp., labrum, dorsal.

15(14) Anal proleg with lateral sclerite much reduced in size and produced posteriorly as a lobe from which a stout apical seta arises (Fig. 44); base of anal claw with ventromesal membranous surface bearing a prominent brush of 25-30 fine setae (Fig. 45); transverse carina on pronotum (fig. 15C); larval case of sand grains . . . . . Beraeidae (p. 19), *Beraea*

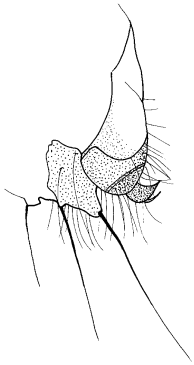

Fig. 44. *Beraea* sp., anal proleg, lateral.

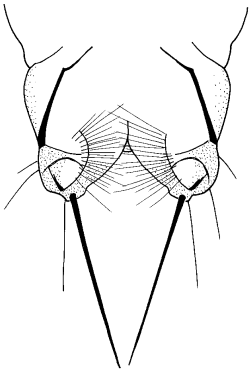

Fig. 45. *Beraea* sp., anal prolegs, ventral.

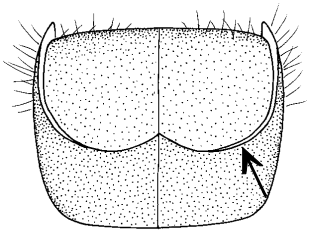

Fig. 46. *Beraea* sp., pronotum.

Anal proleg with lateral sclerite not produced posteriorly as a lobe around base of apical setae (Figs. 47, 48); base of anal claw with ventromesal surface lacking prominent brush of fine setae although setae may be present dorsally (Fig. 48) 16

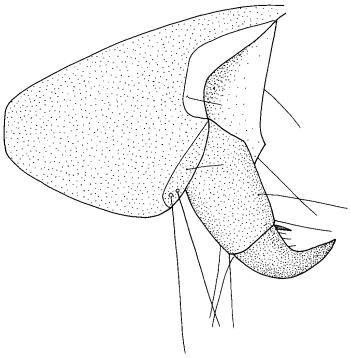

Fig. 47. *Psilotreta* sp., anal proleg, lateral.

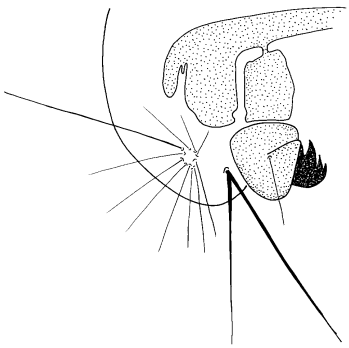

Fig. 48. *Agarodes* sp., anal proleg, lateral.

16(15) Antennae situated at or very close to the anterior margin of the head capsule (Figs. 49, 50); prosternal horn lacking; larval cases composed mainly of mineral materials 17

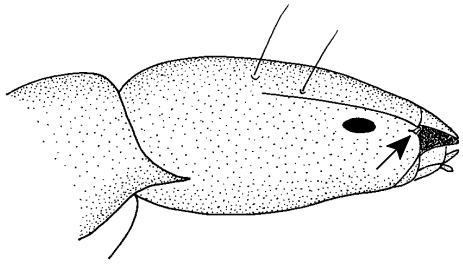

Fig. 49. *Psilotreta* sp.

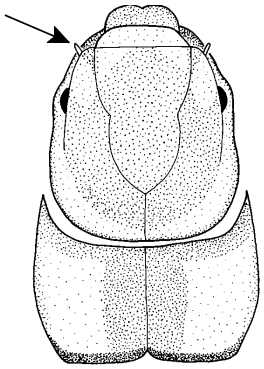

Fig. 50. *Psilotreta* sp.

Antennae removed from the anterior margin of the head capsule and approaching the eye (Fig. 51); prosternal horn present although sometimes short (Fig. 51); larval cases usually composed mainly of plant materials, sometimes mineral materials 18

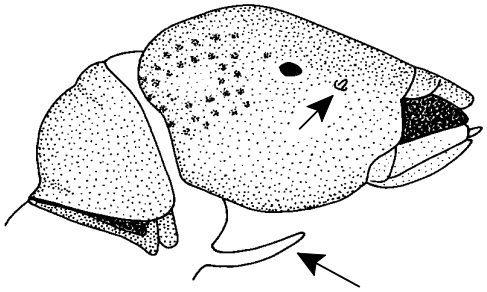

Fig. 51. *Ironoquia* sp.

17(16) Anal proleg with dorsal cluster of setae posteromesad of lateral sclerite (Figs. 52, 53); foretrochantin relatively large, the apex hook-shaped (Fig. 54); head, pro- and mesonotum without dark mid-dorsal band; larval case mainly of sand . . . . . Sericostomatidae (p. 122), *Agarodes*

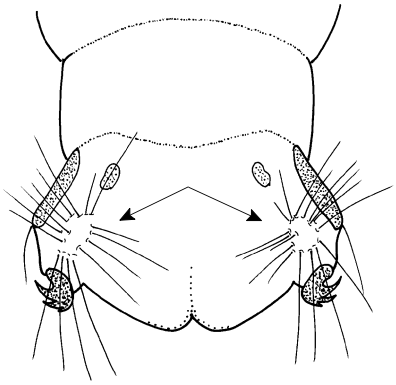

Fig. 52. *Agarodes* sp., anal prolegs, dorsal.

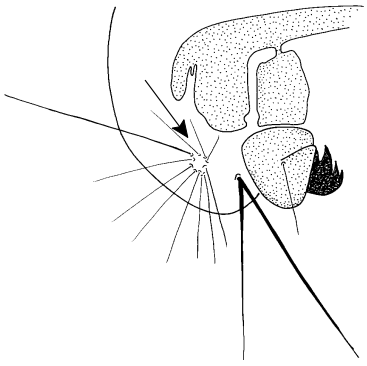

Fig. 53. *Agarodes* sp., anal proleg, lateral.

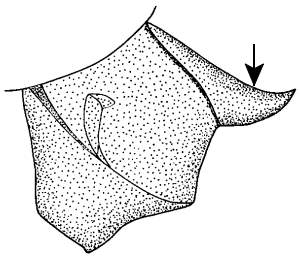

Fig. 54. *Agarodes* sp., prothoracic trochantin.

Anal proleg without cluster of dorsal setae posteromesad of lateral sclerite (Figs. 55, 56); foretrochantin small, the apex not hook-shaped (Fig. 57); head, pro- and mesonotum with dark mid-dorsal band (Figs. 287, 289); larval case mainly of coarse quartz fragments . . . . . Odontoceridae (p. 101), *Psilotreta* (key to species, p. 102)

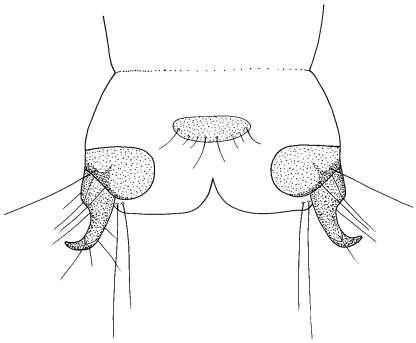

Fig. 55. *Psilotreta* sp., anal prolegs, dorsal.

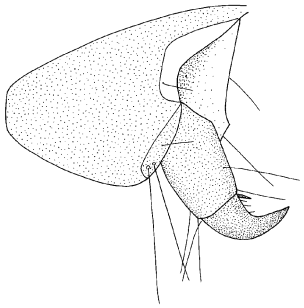

Fig. 56. *Psilotreta* sp., anal proleg, lateral.

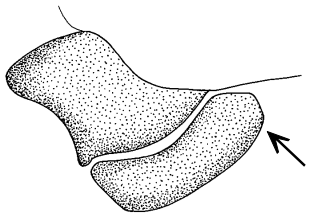

Fig. 57. *Psilotreta* sp., prothoracic trochantin.

18(16) Antennae close to the anterior margin of the eye (Fig. 58), median dorsal hump of segment I lacking (Fig. 58); larval case 4-sided, composed of small panels of bark . . . . . Lepidostomatidae (p. 55), *Lepidostoma*

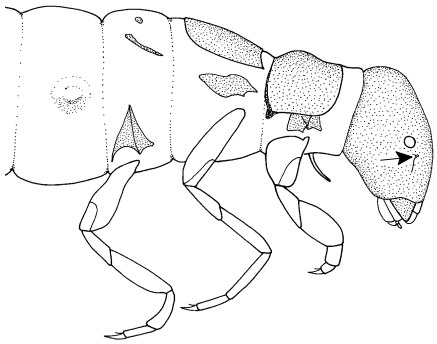

Fig. 58. *Lepidostoma* sp.

Antennae approximately halfway between the anterior margin of the head capsule and the eye (Fig. 59); median dorsal hump of segment I almost always present (Fig. 60); case not 4-sided and composed of panels of bark 19

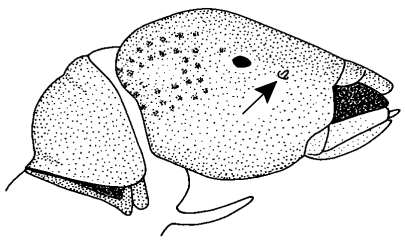

Fig. 59. *Ironoquia* sp.

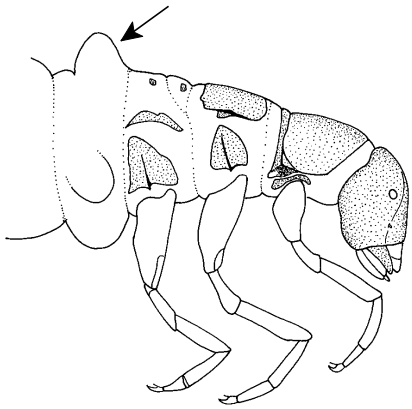

Fig. 60. *Neophylax* sp.

19(18) Anterior margin of pronotum rounded and anterior margin of mesonotum notched on either side of meson (Fig. 61); prosternal horn reduced; basal seta of tarsal claw elongate, extending to near tip of claw (Fig. 62) . . . . . Uenoidae (p. 123), *Neophylax*

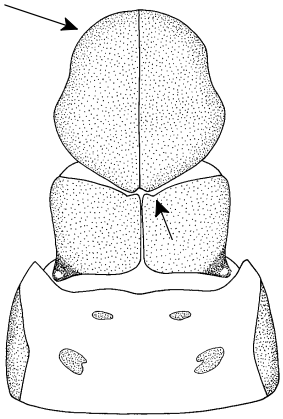

Fig. 61. *Neophylax* sp.

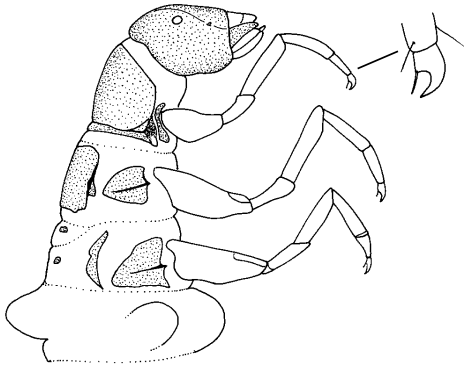

Fig. 62. *Neophylax* sp.

Anterior margin of pronotum and mesonotum more or less straight (Fig. 63); prosternal horn not reduced (Fig. 64); basal seta of tarsal claw short, not extending to tip of claw . . . . . Limnephilidae (p. 95)

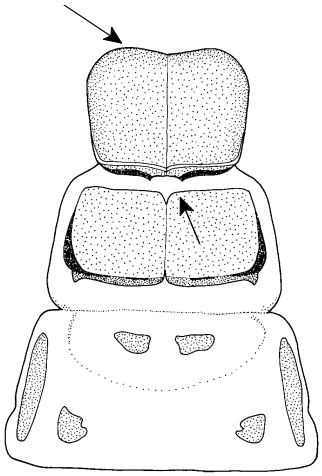

Fig. 63. *Pycnopsyche* sp.

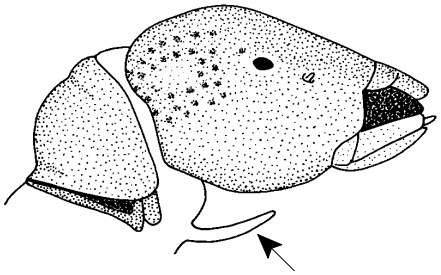

Fig. 64. *Ironoquia* sp.

FAMILY BERAEIDAE

Beraeids are small, rarely encountered caddisflies, represented in eastern North America by several species within the genus *Beraea*. North American species are sparsely distributed, very localized and restricted to spring-seepage habitats.

Genus ***Beraea*** Stephens

DIAGNOSIS: Larvae of *Beraea* are characterized as follows: greatly reduced lateral sclerite of the anal prolegs, each with posteriorly produced lobe supporting a single stout seta (Fig. 44); setaceous ventromesal membranous base of the anal claw (Fig. 45); and pronotum with transverse carina (Fig. 46) terminating in a rounded lobe at each anterolateral corner (Fig. 65). The larval case closely resembles that of *Agarodes* (Sericostomatidae), and is curved, slightly tapered, and constructed mainly of sand grains.

NOTES: The only beraeid known from Florida is a new species that was collected as adults from a steephead stream (Turkey Hen Ck., Okaloosa Co.) on Eglin Air Force Base (Rasmussen, 2004). Adults were taken in April by both light trap and by beating riparian vegetation within the steephead that forms the east branch of the stream. This species will be described in a separate paper. Larvae of the newly found species from Eglin have yet to be collected, but probably occur in the sediments of the seepage springs that are found at the head of this deep ravine.

Of the other 3 North American species of *Beraea*, *B. gorteba*, *B. fontana*, *B. nigritta*, only *B. gorteba* occurs in the Southeast. Although the species has never been collected in Florida, the proximity of the type locality in central Georgia suggests that the species may occur in the state. According to Hamilton (1985), the larvae and pupae were collected in a side channel of Spring Creek, a small, second order, blackwater stream near the town of Roberta (Crawford County). The side channel where the larvae were mostly collected receives ground water and seepage from hillside springs as the main source of water. Larvae were primarily found in the seepage areas where they burrow into the sand and organic sediments. Gut content analysis indicated that the larvae are primarily detritivores. According to Hamilton (1985), *Beraea gorteba* most likely overwinters as 5th instars, pupates in April and then emerges in May and early June. The larva of *B. gorteba* has 3-4 large spines on each anterolateral process of the pronotum (Fig. 65) compared to 5-7 smaller spines in *B. fontana* and *B. nigritta* (Hamilton, 1985).

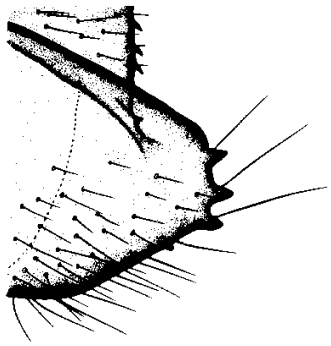

Fig. 65 [from Hamilton (1985)] – *Beraea gorteba*, anterolateral process of pronotum, right lateral.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1954, 1996a); Hamilton (1985).

FAMILY BRACHYCENTRIDAE

The brachycentrid caddisflies are represented in Florida by the genera *Brachycentrus* and *Micrasema*. Both genera occur throughout much of North America. Larvae are morphologically distinguished from the other caddisfly families by the following combination of characters: absence of dorsal and lateral humps on abdominal segment I (Fig. 33); metanotal sa1 either entirely lacking (Fig. 34) or represented by a single seta without a sclerite; and mesonotal plates usually subdivided (Fig. 34). The portable larval cases are constructed of various materials and arrangements. The larvae are most abundant in cool lotic habitats such as springbrooks, creeks, and small rivers. Some species also inhabit the wave-washed shores of lakes in northern latitudes.

KEY TO GENERA FOR LARVAE OF FLORIDA BRACHYCENTRIDAE

[modified from Morse and Holzenthal (1996)]

1. Meso- and metathoracic legs long, femora about as long as head capsule, tibiae each produced distally into prominent process from which stout spur arises (Fig. 66) . . . . . *Brachycentrus* (p. 22)

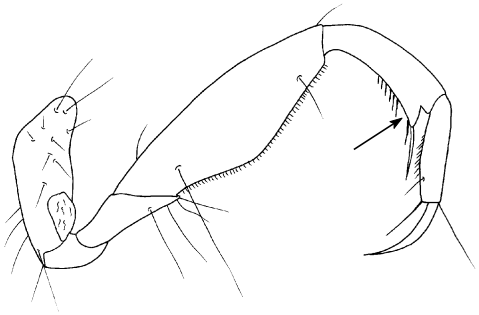

Fig. 66.

Meso- and metathoracic legs shorter, femora much shorter than head capsule, each tibia not produced distally into prominent process, although spur arises from about the same point on unmodified tibia (Fig. 67) . . . . . *Micrasema* (p. 23)

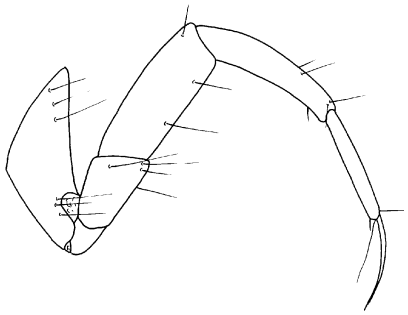

Fig. 67.

Genus ***Brachycentrus*** Curtis

DIAGNOSIS: Larvae of *Brachycentrus* are characterized as follows: ventral margin of femora, tibiae, and tarsi of meso- and metathoracic legs each with row of modified, short spinous setae (Fig. 66); and tibiae each produced distally into prominent process with stout spur (Fig. 66). The larval cases are typically 4-sided, tapered, and constructed of small rectangular pieces of plant material.

NOTES: There are two species of *Brachycentrus* in Florida, *B. chelatus* and *B. numerosus*. The species, *B. americanus*, was erroneously reported to occur in Florida by Denning (1971) (Flint, 1984). The larvae of *B. chelatus* have a uniformly dark brown or fuscous head and brownish-fuscous meso- and metathoracic tarsi compared to the banded or spotted head and generally pale yellow meso- and metathoracic tarsi (except ventral margins dark brown) of *B. numerosus.* *Brachycentrus chelatus* and *B. numerosus* appear to be restricted in Florida to streams and rivers of the panhandle. By far most of our collections are from the western panhandle with *B. chelatus* more common in occurrence. Both belong to the subgenus *Sphinctogaster*, a group that uniquely has 2 pairs of long submesal setae on the abdominal sternum. The larvae attach the anterior end of the case to the substrate and extend the head and legs in a filtering posture to obtain food (Flint, 1984).

ADDITIONAL REFERENCES: Ross (1944); Flint (1984); Wiggins (1996a).

KEY TO SPECIES FOR LARVAE OF FLORIDA *BRACHYCENTRUS*

[modified from Flint (1984)]

1. Head uniformly dark brown or fuscous, rarely paler over muscle scars (Fig. 68); coloration of meso- and metathoracic tarsi dark brown (Fig. 69)
. . . . . *B. chelatus* Ross

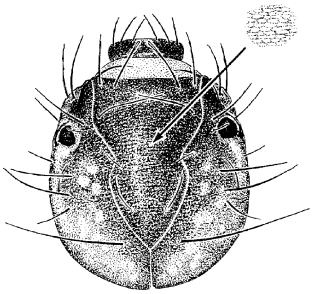

Fig. 68. [from Flint (1984)].

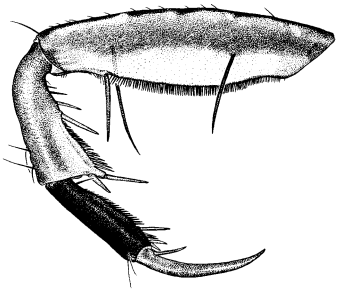

Fig. 69. [from Flint (1984)].

Head distictly banded or spotted with fuscous and yellow marks (Fig. 70); meso- and metathoracic tarsi pale except ventral margins dark brown (Fig. 71)
. . . . . *B. numerosus* (Say)

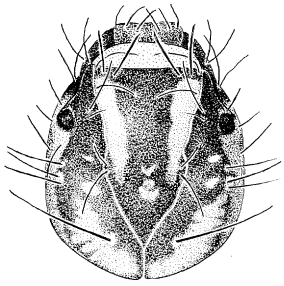

Fig. 70. [from Flint (1984)].

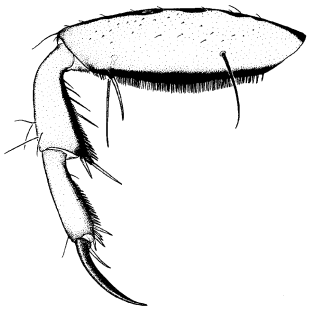

Fig. 71. [from Flint (1984)].

Genus ***Micrasema*** MacLachlan

DIAGNOSIS: Larvae of *Micrasema* are distinguished from *Brachycentrus* by the following: ventral margins of meso- and metathoracic legs lacking specialized setal fringe (Fig. 67); and apex of each tibia unmodified but with one large seta (Fig. 67). Larval cases are cylindrical, either constructed of sand or small strips of plant material, depending on the species.

NOTES: Three species of *Micrasema*, *M. rusticum*, *M. wataga*, and *Micrasema* n. sp., occur in Florida. All three species belong to the *M. rusticum* group whose larvae have the mesonotal sclerite partially or completely divided into four plates. The larvae are easily separated by the pattern of muscle scars on the head, and the material and construction of their larval cases. *Micrasema rusticum* has a curved larval case constructed of sand, and a distinctly bold, regular pattern of muscle scars on the head. *Micrasema wataga* and *Micrasema* n. sp. both have straight larval cases constructed of plant material, the latter, however, has more well-defined muscle scars on the head than the former.

Micrasema spp. mainly occur in cool spring-fed streams and rivers of northern Florida. Larvae are typically associated with aquatic plants including aquatic mosses, macroalgae, and vascular macrophytes. We have examined larvae of *Micrasema rusticum*, an uncommon species in Florida, collected from the Shoal River, Okaloosa Co. and the Econfina Creek, Bay Co. Additionally, we have collected adults from the Chipola River basin. *Micrasema* n. sp. is endemic to lower coastal plain Alabama and the western Florida panhandle. The larva and adult of *Micrasema* n. sp. were described in a dissertation by Chapin (1978). This species is particularly abundant within the high volume steephead springruns on Eglin Air Force Base. *Micrasema wataga* is widespread across northern Florida and appears to be the only *Micrasema* species to occur in peninsular Florida. This species is particularly abundant on the Sante Fe River.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1965, 1996a); Chapin (1978).

KEY TO SPECIES FOR LARVAE OF FLORIDA *MICRASEMA*

[modified from Chapin (1978)]

1. Case curved, constructed of sand (Fig. 72); head pale yellow to light brown, with bold, regular muscle scar pattern of dark spots (Fig. 73) . . . . . *M. rusticum* (Hagen)

Fig. 72. [from Chapin (1978)].

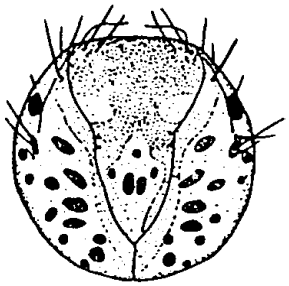

Fig. 73. [from Chapin (1978)].

Case straight, constructed of strips of plant materials wound around the circumference (Fig. 74); head lacking pattern of bold, regular muscle scars, if evident, these appearing as indistinct blotches or rings or light brown spots (Figs. 75, 76) 2

Fig. 74. [from Chapin (1978)].

2(1) Head pattern with very irregular or mottled appearance (Fig. 75) . . . . . *M. wataga* Ross

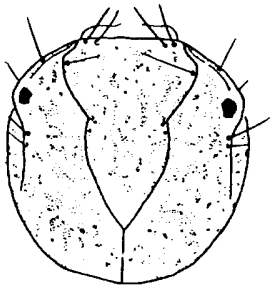

Fig. 75. [from Chapin (1978)].

Head pale yellow with posterior light brown muscle scars (Fig. 76)
. . . . . *Micrasema* n. sp.

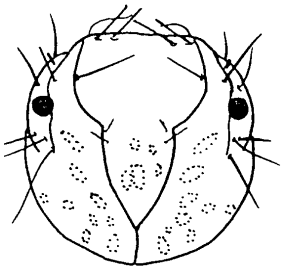

Fig. 76. [from Chapin (1978)].

FAMILY CALAMOCERATIDAE

The Calamoceratidae include three North America genera of which *Anisocentropus* and *Heteroplectron* are found in Florida. Calamoceratid larvae are morphologically recognized by a prominent midtransverse row of approximately 16 long setae on the labrum (Fig. 40). Larvae of both Florida genera are shredders, feeding upon decomposing vascular plant tissue (Unzicker et al., 1982). *Anisocentropus* larvae construct relatively flat cases of two fastened and overlapping leaf pieces. *Heteroplectron* use twigs which are hollowed out and lined with silk for their cases.

KEY TO THE GENERA AND SPECIES FOR LARVAE OF FLORIDA CALAMOCERATIDAE

[modified from Morse and Holzenthal (1996)]

1. Anterolateral corners of pronotum each extended into prominent projection (Fig. 77); gills branched; larval case consists of two leaf pieces, larger dorsal piece overlapping smaller ventral one (Fig. 78) . . . . . *Anisocentropus, A. pyraloides* (Walker)

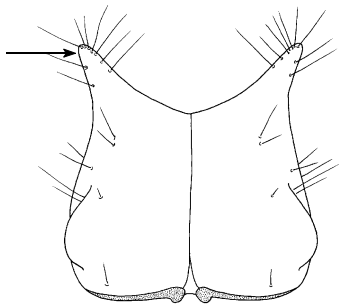

Fig. 77.

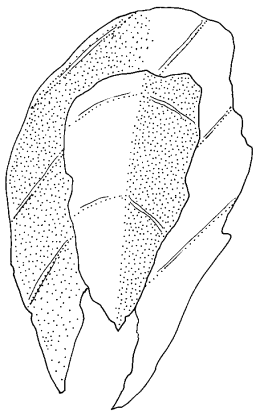

Fig. 78.

Anterolateral corners of pronotum somewhat extended, but much less than above (Fig. 79); gill filaments single; larval case a hollowed twig (Fig. 80)
. . . . . *Heteroplectron, H. americanum* (Walker)

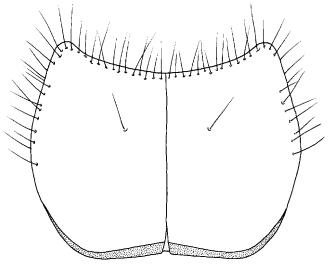

Fig. 79.

Fig. 80.

Genus ***Anisocentropus*** (MacLachlan)

DIAGNOSIS: Larvae of *Anisocentropus* are characterized as follows: anterolateral corners of pronotum each produced into prominent projection (Fig. 77); and abdominal gill filaments branched. The larval case is constructed from 2 ovately cut leaf pieces with a larger dorsal piece fastened to smaller ventral piece (Fig. 78).

NOTES: Larvae are easily recognized by their distinctive cases and dorsoventrally flattened body form, spindly hind legs that are twice as long as the mesothoracic legs, and abdomen that is laterally fringed with dense setae. The head and thorax are yellowish brown.

Anisocentropus contains only a single species in North America (*A. pyraloides*). It is primarily restricted in distribution to the southeastern United States. Within the Florida panhandle *Anisocentropus pyraloides* occurs commonly in sand-bottomed streams flowing through intact deciduous forest.

Wallace and Sherberger (1970) observed the species to have multi-cohort populations, with early- and last-instar larvae occurring in both late winter and early spring in southern Georgia. Our collection records and results from emergence trapping in Florida also suggest a multi-cohort life history as indicated by nearly year round emergence and presence of a mixture of larval size-classes throughout the year. We have found that the larvae are commonly associated with trapped debris, snags and exposed roots where the stream undercuts the bank. Adults are day-active and can easily be seen when flying and ovipositing near larval habitats.

ADDITIONAL REFERENCES: Wallace and Sherberger (1970); Wiggins (1996a).

Genus ***Heteroplectron*** (MacLachlan)

DIAGNOSIS: Larvae of *Heteroplectron* differ from *Anisocentropus* as follows: anterolateral corners of pronotum not extended into prominent projections (Fig. 79); and abdominal gills single. The larval case consists of a hollowed-out twig lined with silk (Fig. 80).

NOTES: Larvae of *Heteroplectron* differ greatly in general appearance from *Anisocentropus*. The abdomen of *Heteroplectron* is cylindrical and lacks the lateral fringe of dense setae of *Anisocentropus*. The head and thoracic sclerites are dark brown, and the hind and middle legs are subequal in length.

Heteroplectron contains only two species (*H. americanum* and *H. californicum*). *Heteroplectron americanum*, once thought to occur only as far south as the Appalachians of Georgia and Alabama, has been found in scattered panhandle localities, primarily in spring-fed ravine streams. We have collected both larvae and adults from steephead ravines on Eglin Air Force Base as well as from the Apalachicola Bluffs and Ravines region. Larvae of *H. americanum* are difficult to detect in the field because their hollow twig case provides excellent camouflage. On several occasions we have found the larvae of *H. americanum* using the cases of *Psilotreta frontalis* instead of the usual hollowed out twig case.

The life history of *H. americanum* in the Southeast has not been studied. However, a life history study of *H. americanum* from a coastal plain stream in Delaware by Patterson and Vannote (1979), established that *H. americanum* is univoltine and has a single population cohort.

ADDITIONAL REFERENCES: Wiggins (1996a).

FAMILY DIPSEUDOPSIDAE

Wells and Cartwright (1993) recently broadened the definition of the family Dipseudopsidae based primarily on the morphological features of the female abdomen and the larvae. These authors also discussed briefly the taxonomic history of the group. Earlier papers by Ross (1965) and Ross and Gibbs (1973) discussed the evolutionary history of the group as well. Of the four dipseudopsid genera presently recognized worldwide, only the genus *Phylocentropus* is represented in the Nearctic Region; species are mostly found in eastern North America.

The dipseudopsid larvae are morphologically recognized by the flat tarsi which are broader than the tibiae, the long tip of the labium (Fig. 31), and the short and basally broad mandibles, each with a thick mesal brush. These modifications of the legs and mandibles are adaptations to life in sand tubes which are buried deeply into the substrate and project a short distance up into the current of the stream (Ross and Gibbs, 1973; Wallace et al., 1976).

Genus ***Phylocentropus*** Banks

DIAGNOSIS: Larvae of *Phylocentropus* are characterized as follows: broad and densely pilose tarsi (Fig. 31); and mandibles short and triangular with thick mesal brush. The larvae construct bi- and multibranched tubes of fine sand glued together with silk and buried into the substrate.

NOTES: Of the five presently recognized Nearctic species of *Phylocentropus*, three are represented in Florida, *P. carolinus*, *P. lucidus*, and *P. placidus*. One other species, *P. harrisi*, known only from lower coastal plain streams of Alabama, may also be found in the state.

Descriptions and a key to adults of all 5 species were provided in Schuster and Hamilton (1984). The recent paper of Sturkie and Morse (1998) provides larval descriptions and a key to the 3 species known to occur in Florida. The larva of *P. harrisi* remains undescribed. Larvae of the 3 Florida species can be separated based on a combination of body length, head coloration pattern, and number of spines on the hind tibia. Detecting the number of spines on the hind tibia requires very close examination and is best done after removing the leg so that it can be more easily observed from all sides.

Phylocentropus placidus is widespread throughout the Florida panhandle and northern part of the peninsula. We have collected it from a wide variety of streams and rivers. *Phylocentropus lucidus* appears to be restricted in Florida to headwater seepage streams in the central panhandle. *Phylocentropus carolinus* appears to be widespread across the panhandle and tends to occur in higher order streams. Larvae of *Phylocentropus* are often detectable in the field along stream margins where their sand tubes can be seen projecting from sandy substrates.

ADDITIONAL REFERENCES: Ross (1944); Wells and Cartwright (1993); Wiggins (1996a); Sturkie and Morse (1998).

KEY TO SPECIES FOR LARVAE OF FLORIDA *PHYLOCENTROPUS*

[from Sturkie and Morse (1998)]

1. Head light yellowish brown, with posterior region of frontoclypeus darkened (Fig. 81); hind tibiae each with 2 stout spines and 3 long hairs (Fig. 82); body length of last instar 15-20 mm . . . . . *P. carolinus* Carpenter

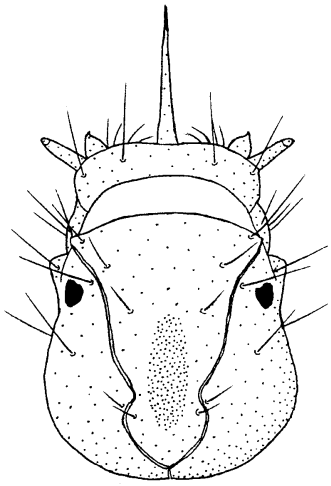

Fig. 81. *Phylocentropus carolinus* [from Sturkey and Morse (1998)].

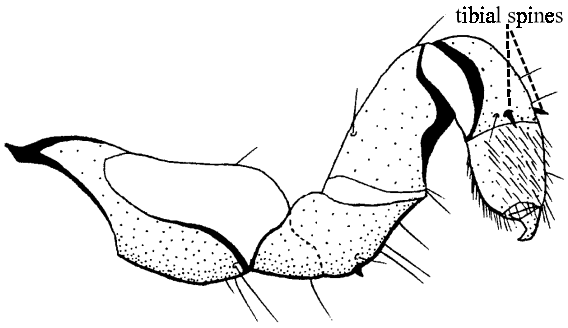

Fig. 82. *Phylocentropus carolinus*, right hind leg, caudal view [from Sturkey and Morse (1998)].

Head uniformly brown with light spots, posterior region of frontoclypeus not darkened (Figs. 83, 84); hind tibiae each with 2 stout spines (Fig. 85) or 3 stout spines (Fig. 86); body length of last instar variable 2

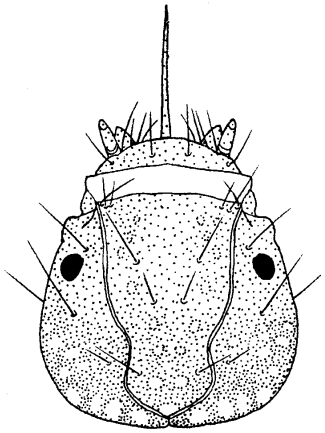

Fig. 83. *Phylocentropus lucidus* [from Sturkie and Morse (1998)].

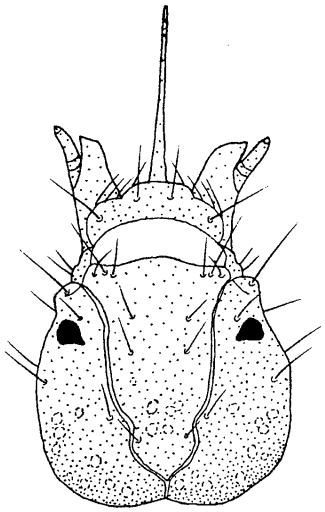

Fig. 84. *Phylocentropus placidus* [from Sturkie and Morse (1998)].

2(1) Hind tibiae each with 2 stout spines (Fig. 85); body length no more than 15 mm
. . . . . *P. lucidus* (Hagen)

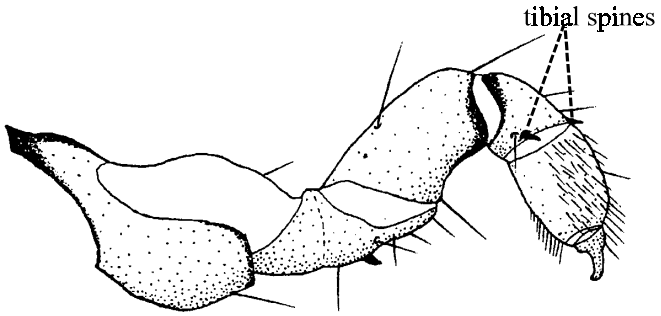

Fig. 85. *Phylocentropus lucidus*, right hind leg, caudal view [from Sturkie and Morse (1998)].

Hind tibiae each with 3 stout spines (Fig. 86); body length of last instar 15-19 mm
. . . . . *P. placidus* Banks

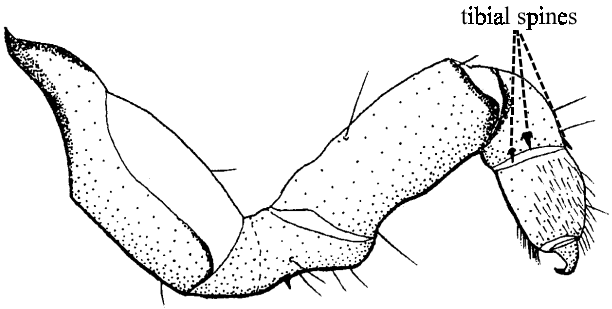

Fig. 86. *Phylocentropus placidus*, right hind leg, caudal view [from Sturkie and Morse (1998)].

FAMILY GLOSSOSOMATIDAE

The genus *Protoptila* is the only glossosomatid caddisfly represented in Florida. The glossosomatid larvae are easily distinguished by the presence of anal claws with at least one dorsal accessory hook (Fig. 23) and the unique tortoise-like case constructed of small stones (Fig. 24).

Genus ***Protoptila*** Banks

DIAGNOSIS: Larvae of *Protoptila* are characterized as follows: tarsal claws each with long, thin seta arising from side of stout process at base of claw (Fig. 87); and larval case made of relatively large stones (Fig. 24).

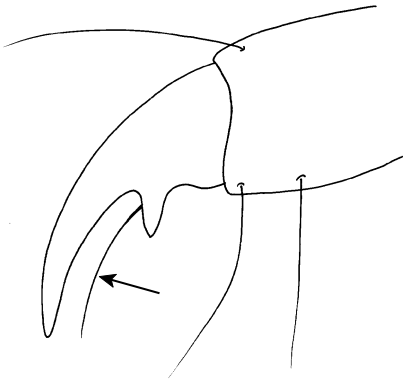

Fig. 87. *Protoptila* sp., mesothoracic tarsus.

NOTES: This New World genus has 13 species known from the United States and Canada. In Florida *Protoptila* is known only from the Chipola River basin in the central panhandle. Both larvae and adults have been collected on the Chipola River, Calhoun Co. and Holmes Creek, Washington Co. The specimens collected from the Chipola River were associated with limestone outcroppings and were collected from the same locality as the larvae of *Setodes*. *Protoptila* are very small, length only up to about 4 mm.

Due to taxonomic uncertainty of species placement in this genus we are leaving our identifications of both larvae and adults at *Protoptila* sp. until future revisionary work on this genus provides clarification. *Protoptila palina* has been recorded near the Alabama-Florida line (Harris et al., 1991), and there is a good possibility that the *Protoptila* collected in Florida may include *P. palina*.

ADDITIONAL REFERENCES: Wiggins (1996a).

FAMILY HELICOPSYCHIDAE

The family Helicopsychidae is represented in North America by the geographically widespread genus *Helicopsyche*. The larvae are morphologically recognized by the broad joint of the basal-half of the anal proleg and abdominal segment IX, and the comb-shaped anal claw (Fig. 2). Unique to the group is the helical, snail-like, larval case which is constructed of sand grains (Fig. 3).

Genus ***Helicopsyche*** von Siebold

DIAGNOSIS: The characters above define the larva of the genus as well.

NOTES: This is a worldwide genus with 6 currently recognized subgenera (Johanson, 1998), of which Nearctic species are all placed in the subgenus *Feropsyche*. Species in this subgenus are endemic to the New World and number 72 valid extant species (Johanson, 2002).Of the five species of *Helicopsyche* represented North of Mexico, *H. borealis* and *H. paralimnella* are the only species known to occur east of the Mississippi.

Helicopsyche borealis extends its southern geographic range to Florida where it occurs primarily in calcareous systems such as the Chipola, Santa Fe, Suwannee, and St. Marks rivers. We have collected this species on the peninsula as far south as Juniper Creek in Marion County. Johanson (2002) in his revision of the subgenus *Feropsyche* noted significant morphological differences in the adult male genitalia of *H. borealis* specimens from Florida, which raises the question as to whether the Florida populations represent a distinct species. He indicated that these differences would be examined in a separate analysis.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

FAMILY HYDROPSYCHIDAE

The highly diverse hydrosychid caddisflies are represented in Florida by the genera *Cheumatopsyche*, *Diplectrona*, *Hydropsyche*, *Macrostemum*, and *Potamyia*. The heavily sclerotized plate of each thoracic notum and conspicuously branched ventral abdominal gills of the larvae (Fig. 7) easily separate the Hydropsychidae from the other caddisfly families. The larvae typically construct a fixed retreat where they live and spin a net for capturing food (Fig. 8). Larvae are mostly lotic dwellers and are quite common in streams and rivers of various sizes. Some larvae also live in lentic habitats, particularly along the wave-swept shores of lakes and impoundments, and lotic-depositional habitats as well.

KEY TO GENERA FOR LARVAE OF FLORIDA HYDROPSYCHIDAE

[modified from Morse and Holzenthal (1996)]

1. Posterior ventral apotome at least one-half as long as median ecdysial line (Fig. 88) . . . . . (Subfamily Diplectroninae), *Diplectrona* (p. 38)

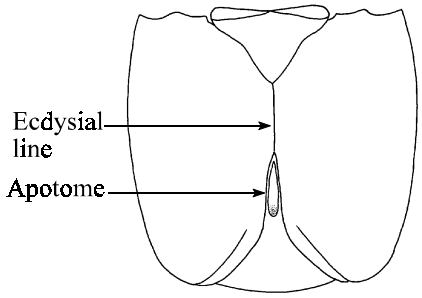

Fig. 88. *Diplectrona* sp., head capsule, ventral.

Posterior ventral apotome much less than one-half as long as median ecdysial line or inconspicuous (Fig. 89) 2

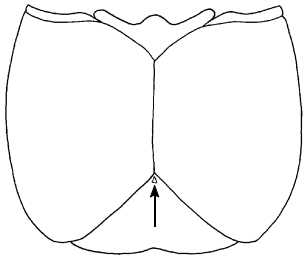

Fig. 89.

2(1) Abdominal gills with up to 40 filaments arising fairly uniformly along central stalk; foretrochantin never forked
. . . . . (Subfamily Macronematinae), *Macrostemum, M. carolina* (Banks)

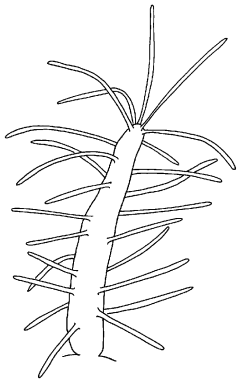

Fig. 90.

Abdominal gills with up to 10 filaments arising mostly near apex of central stalk; foretrochantin usually forked . . . . . (Subfamily Hydropsychinae)...3

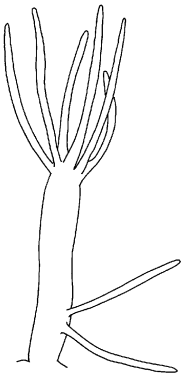

Fig. 91.

3(2) Prosternum with a pair of large sclerites in intersegmental fold posterior to prosternal plate (Fig. 92); anterior margin of frontoclypeus entire (Fig. 93)
. . . . . *Hydropsyche* (p. 40)

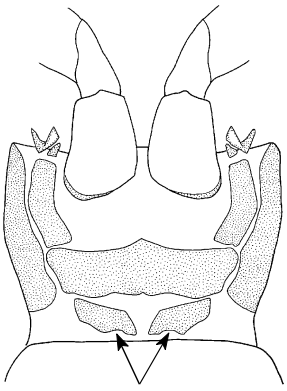

Fig. 92.

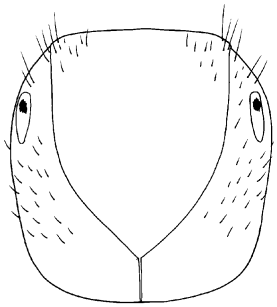

Fig. 93.

Prosternum with 2 very small sclerites posterior to prosternal plate (Fig. 94); anterior margin of frontoclypeus usually with median notch (Fig. 95) 4

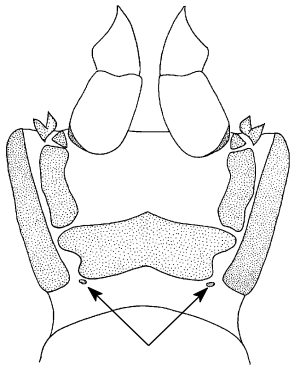

Fig. 94.

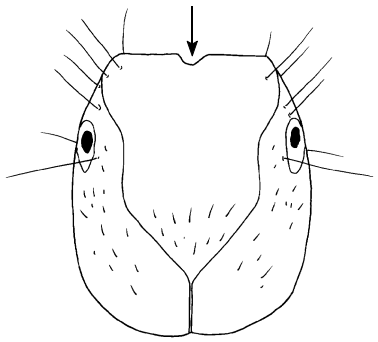

Fig. 95.

4(3) Anterior ventral apotome of head with prominent anteromedian projection (Fig. 96); posterior margin of each sclerite on abdominal sternum IX entire (Fig. 97); lateral border of each mandible flanged (Fig. 98); foretrochantin forked or not . . . . . *Potamyia*, *P. flava* (Hagen)

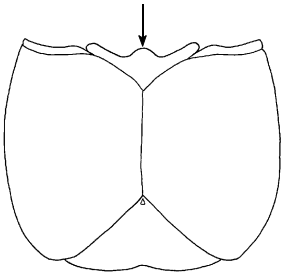

Fig. 96.

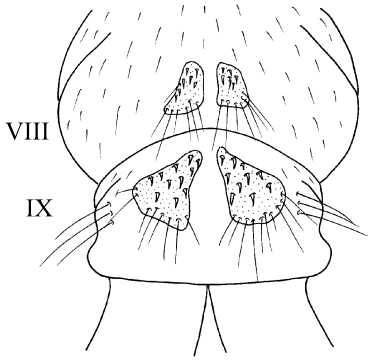

Fig. 97.

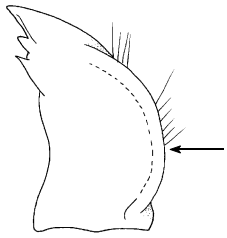

Fig. 98.

Anterior ventral apotome without anteromedian projection; posterior margin of each sclerite on abdominal sternum IX notched (Fig. 99); mandible not flanged (Fig. 100); fore trochantin forked . . . . . *Cheumatopsyche*

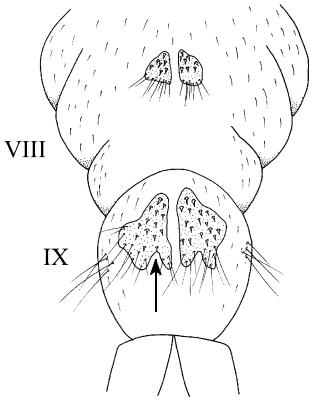

Fig. 99.

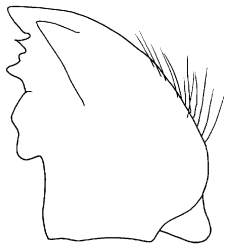

Fig. 100.

Genus ***Cheumatopsyche*** Wallengren

DIAGNOSIS: Larvae of *Cheumatopsyche* are distinguished from other hydropsychid genera by the following combination of characters: absence of anteromedian projection on anterior ventral apotome of head; notched posterior margin of each sclerite on abdominal sternum IX (Fig. 99); inconspicuous posterior ventral apotome; tiny posterior sclerites on prosternum (Fig. 94); and forked trochantins. *Cheumatopsyche* larvae are generally smaller than *Hydropsyche* and tend to have uniformly dark heads, unlike the contrasting head color patterns of many *Hydropsyche* species. Most, but not all, *Cheumatopsyche* species have the frontoclypeus with a crenulated and notched anterior margin (Fig. 95).

NOTES: The ten *Cheumatopsyche* species occurring in Florida (see Appendix A) are known only from the adults. Two other species, *C. geora*, and *C. sordida*, very likely occur in the state based on their geographic distribution. Harris et al. (1991) reported both species from streams and rivers near the Alabama-Florida state line. The Florida *Cheumatopsyche* fauna includes 2 narrowly endemic species, *C. gordonae* and *C. petersi*. *Cheumatopsyche gordonae* is known only from the streams on Eglin Air Force Base in the western panhandle, whereas *C. petersi* has a somewhat larger range that includes parts of the western Florida panhandle and coastal Alabama and Mississippi.

Cheumatopsyche is a common and often one of the most dominant hydropsychid genera in many river systems in the Southeast. We also found this to be the case in Florida; the genus is not only geographically widespread in the state, but the larvae are found in a wide variety of habitats ranging from small streams to large rivers, and pristine to seriously damaged systems. The presence of *Cheumatopsyche* larvae in the Fenholloway River, a damaged system that has received about 190 million liters per day of cellulose mill wastes the past 50 years, strongly suggests a broad spectrum of tolerance to organic pollution. Although *Cheumatopsyche* is generally considered a pollution-tolerant group, the various species certainly have different levels of tolerances to contamination. Unfortunately, the larvae of *Cheumatopsyche* are taxonomically one of the least known and presently are not identifiable to species.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

Genus ***Diplectrona*** Westwood

DIAGNOSIS: Larvae of *Diplectrona* are distinguished from other Florida hydropsychid genera as follows: length of posterior ventral apotome at least one-half of median ecdysial line (Fig. 88). Larvae of *Diplectrona* are distinguished from the Diplectroninae genus *Homoplectra* by the lack of a transverse sulcus on the pronotum. The broad lateral angles near the midlength of the frontoclypeus (Fig. 101) are characteristic of *D. modesta* as well as other species of this subfamily.

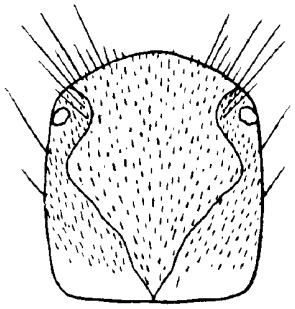

Fig. 101. [from Ross (1944)] *Diplectrona modesta*.

NOTES: Five nominal species of *Diplectrona* are known in North America but of these, only the widespread eastern species *D. modesta* occurs in Florida. It is a specialist of spring-fed headwater streams and occurs abundantly in ravine springruns within the Florida panhandle where it is typically the dominant hydropsychid. The filter feeding larvae are commonly associated with areas of leaf accumulation.

Recently, a distinct larval form of *Diplectrona* (*Diplectrona* sp. A) was discovered within the steephead ravine in Gold Head Branch State Park (Clay County) (Rasmussen, 2004). Larvae of this species have distinctive light-colored spots on the frontoclypeus, in contrast to the unicolorous reddish brown frontoclypeus of *D. modesta*. These larvae likely represent a new species.

Diplectrona modesta is univoltine in Florida, as well as across other parts of its range (Cushman et al., 1977; Benke and Wallace 1980). Results of an emergence study reported in Rasmussen (2004) showed that a population of *D. modesta* from a headwater stream in the central panhandle emerged throughout the year, exhibiting an emergence peak in the spring and a secondary peak in the fall.

ADDITIONAL REFERENCES: Ross (1944); Morse and Barr (1990); Wiggins (1996a); Reeves and Paysen (1999).

KEY TO SPECIES FOR LARVAE OF FLORIDA *DIPLECTRONA*

1. Frontoclypeus with three conspicuous light colored spots, 2 laterally and 1 posteriorly . . . . . *Diplectrona* sp. A

   Frontoclypeus without light colored spots, uniformly reddish brown . . . . . *D. modesta* Banks

Genus ***Hydropsyche*** Pictet

DIAGNOSIS: Larvae of *Hydropsyche* are distinguished from other hydropsychid genera by the pair of large sclerites in the intersegmental fold posterior to the prosternal plate (Fig. 92).

NOTES: A key to the larvae of the caddisfly genera *Hydropsyche* Pictet and *Symphitopsyche* Ulmer (now *Ceratopsyche* Ross and Unzicker for Nearctic species, debatably genus or subgenus) in eastern and central North America by Schuster and Etnier (1978) includes most of the species occurring in Florida. The key, however, relies heavily on color pattern and it must be used with caution. We found that the *Hydropsyche* larvae in Florida are generally paler than the northern conspecific populations, and the color patterns are often not as distinctive as the figures in the key show.

Nine species of *Hydropsyche* are known to occur in Florida (see Appendix A), and perhaps three more, *H. scalaris*, *H.* (*Ceratopsyche*) *sparna*, and *H. venularis*, may be found in the state based on their present geographic distribution. Except for *H. alabama, H. alvata* and *H. orris* the rest of the *Hydropsyche* represented in Florida are known from the larval stage. Based on the specimens that we have examined, it appears that *H. decalda*, *H. incommoda*, and *H. rossi*, are the most common species of *Hydropsyche* in the state. *Hydropsyche alabama* is known only from southeastern Alabama and the Chipola River basin in the central panhandle of Florida. Like the genus *Cheumatopsyche*, *Hydropsyche* spp. are geographically widespread in Florida, and occur in a wide variety of lotic habitats and from relatively clean to heavily contaminated systems.

Numerous studies on the ecology and general biology of *Hydropsyche* have been conducted (e.g., Gordon and Wallace, 1975; Wallace, 1975; Wallace et al. , 1977; Merritt and Wallace, 1981), but none have been from Florida. *Hydropsyche* larvae (e.g., *H. betteni*) feed primarily on fine particles collected in their nets, primarily animal remains and diatoms (Fuller and Mackay, 1981). A more recent study of *Hydropsyche* spp., including *H. betteni* and *H. sparna*, has indicated the importance of microhabitat flow on larval distribution (Osborne and Herricks, 1987). Furthermore, experimental evidence has shown that sympatric hydropsychid species alter near bed flows through their retreat construction in such a way that facilitates filtering success among species (Cardinale et al., 2002). This is strong evidence as to the importance of hydropsychid species diversity in the removal of suspended particles and overall ecosystem functioning of lotic systems.

ADDITIONAL REFERENCES: Ross (1944); Schuster and Etnier (1978); Flint, Voshell, and Parker (1979); Schefter and Wiggins (1986); Wiggins (1996a).

KEY TO SPECIES FOR LARVAE OF FLORIDA *HYDROPSYCHE* *

[adapted from Schuster and Etnier (1978)]

1. Dorsum of abdominal segments with minute spines on at least segments I-III; scale hairs present on at least the last 3 abdominal segments (Fig. 102) . . . . . (Subgenus *Hydropsyche*). . . 2

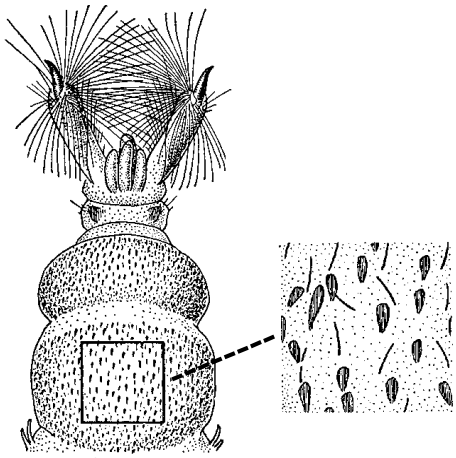

Fig. 102. [from Ross (1944)].

Dorsum of abdomen lacking minute spines; club hairs present on dorsum of abdomen (Fig. 103); scale hairs lacking . . . . . (Subgenus *Ceratopsyche*), *H. sparna* Hagen

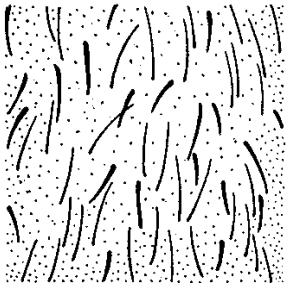

Fig. 103. [from Ross (1944)].

2(1) Anterior margin of frontoclypeus with 2 upturned teeth or denticles (Fig. 104) . . . . . *H. incommoda* Hagen

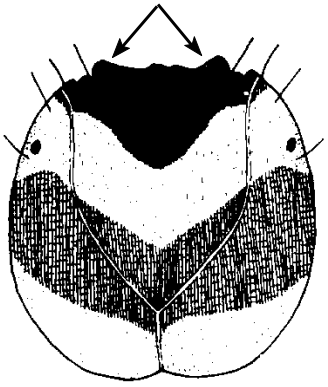

Fig. 104. [from Schuster and Etnier (1978)].

Anterior margin of frontoclypeus without teeth, margin straight or convex; color pattern of head not as above 3

3(2) Frontoclypeus produced into a low, wide angle forming a triangular point (Fig. 105) . . . . . *H. phalerata* Hagen

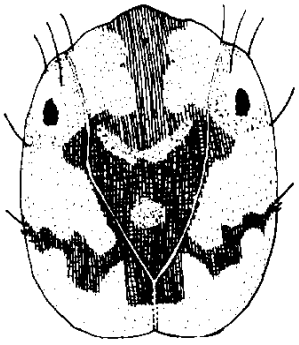

Fig. 105. [from Schuster and Etnier (1978)].

Anterior margin of frontoclypeus straight or, at most, broadly rounded 4

4(3) Venter of anal leg with large, stout, heavily sclerotized setae (Fig. 106) . . . . . *H. scalaris* Hagen

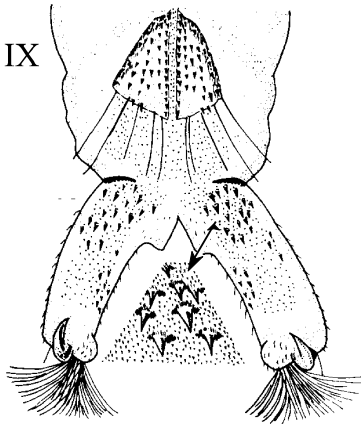

Fig. 106. [from Schuster and Etnier (1978)].

Venter of anal leg without such setae 5

5(4) Posterior angle of frontoclypeus with elevated mound or tubercle (best seen in lateral or posterior aspect of head) (Fig. 107) 6

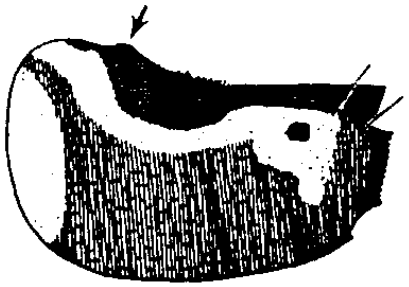

Fig. 107. [from Schuster and Etnier (1978)].

Posterior angle of frontoclypeus level with remaining posterior part of sclerite, mound or tubercle absent (Fig. 108) 7

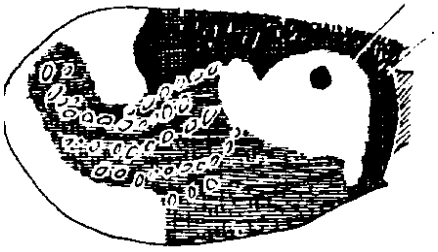

Fig. 108. [from Schuster and Etnier (1978)].

6(5) Sides of head evenly curved (Fig. 109); head typically unicolored dark brown to black except for light area around eye and occasionally behind eye (Fig. 109) . . . . . *H. betteni* Ross

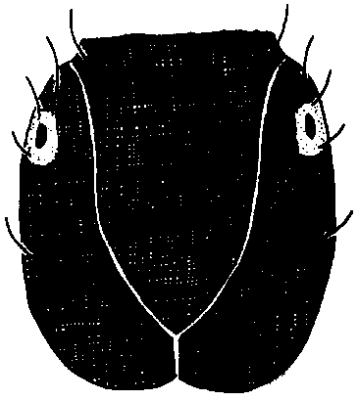

Fig. 109. [from Schuster and Etnier (1978)].

Sides of head constricted centrally and widened anteriorly (in dorsal aspect), posterior area of head not as wide as anterior (Fig. 110); head mostly dark brown with pair of large, diagonal, tear-shaped spots; sides and top of head near epicranial stem with several dark brown, oval muscle scars . . . . . *H. elissoma* Ross

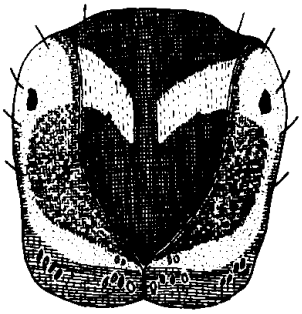

Fig. 110. [from Schuster and Etnier (1978)].

7(5) Frontoclypeus (FC) with many stout, bristle-like setae conspicuous on body of sclerite, most abundant on posterior half of sclerite (Fig. 111)
. . . . . *H. mississippiensis* Flint

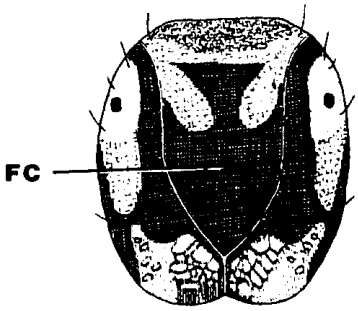

Fig. 111. [from Schuster and Etnier (1978)].

Bristle-like setae if present, restricted to anterolateral corners of frontoclypeus; posterior half of sclerite may have minute, clear, spine-like setae, but lacks larger bristle-like setae; color pattern of head not as above 8

8(7) Scale hairs sparse on at least abdominal segments I-IV (Fig. 112)
. 9

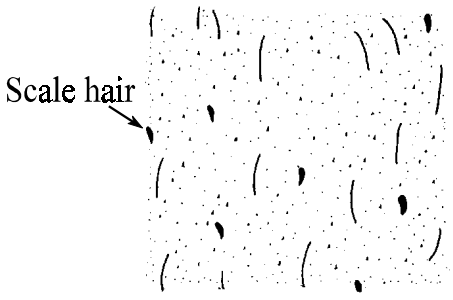

Fig. 112. [from Schuster and Etnier (1978)].

Scale hairs abundant on abdominal segments I and II (Fig. 113)
. 10

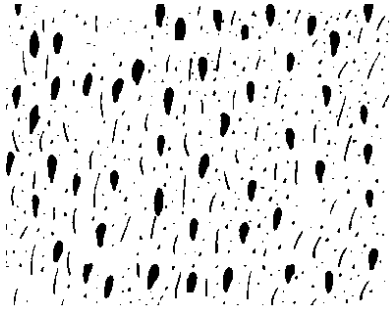

Fig. 113. [from Schuster and Etnier (1978)].

9(8) Frontoclypeus brown with large anterolateral, tear-shaped yellow spots (Fig. 114); genae with numerous dorsolateral brown muscle scars (Fig. 114)
. . . . . *H. decalda* Ross

Fig. 114. [from Schuster and Etnier (1978)].

Frontoclypeus brown with tranverse yellow band anterior to anterolateral pale yellow spots (Fig. 115); genae with dorsolateral pale yellow muscle scars (Fig. 115)
. . . . . *Hydropsyche* sp.

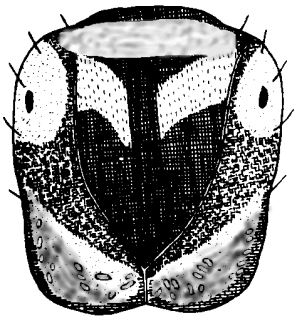

Fig. 115. [modified from Schuster and Etnier (1978)].

10(8) Frontoclypeus with 2 pairs of yellow spots, 1 pair located centrally, and 2nd pair anterolateral to lst pair, often fused to form large, diagonal streaks on anterior portion of sclerite, posterior half of sclerite mottled (Fig. 116); in lateral aspect, dark area behind eye with 3 to 4 horizontal rows of yellow muscle scars curved dorsad posteriorly, dark pigment behind eye contiguous with dark pigment on venter of head (Fig. 117)
. . . . . *H. venularis* Banks

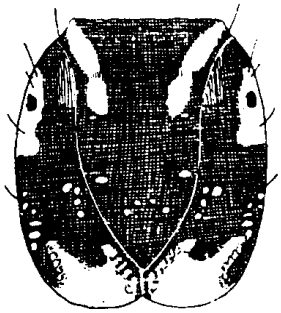

Fig. 116. [from Schuster and Etnier (1978)].

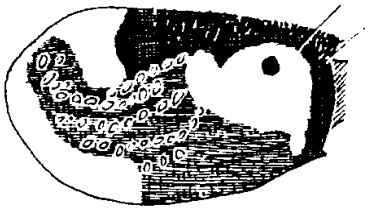

Fig. 117. [from Schuster and Etnier (1978)].

Frontoclypeus with single pair of centrally located spots, posterior half of sclerite solid brown, not mottled (Fig. 118); in lateral aspect, area behind eye as in Fig. 119
. . . . . *H. rossi* Flint et al.

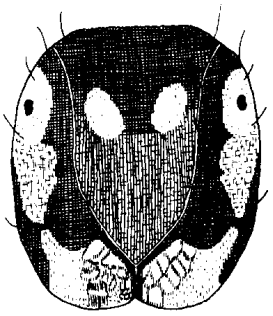

Fig. 118. [from Schuster and Etnier (1978)].

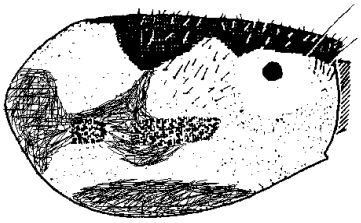

Fig. 119. [modified from Schuster and Etnier (1978)].

* The key does not include *H. alabama*, *H. alvata*, or *H. orris*. Larvae of these species are unknown.

Genus ***Macrostemum*** (Pictet)

DIAGNOSIS: Larvae of *Macrostemum* are characterized as follows: distinctively flat head with U-shaped carina; pair of sclerites at base of labrum; and gills with up to 40 filaments attached to common stalk (Fig. 90). The larval retreat consists of a feeding chamber and retreat compartment.

NOTES: *Macrostemum* includes three species in North America, but only *M. carolina* is represented in Florida. This species is widespread across northern Florida. *Macrostemum carolina* is morphologically distinguished from the other North American *Macrostemum* species by having a large tubercle near each eye (Fig. 120). Larvae of the genus have dense brushes of setae on the prothoracic tibia and tarsus (Fig. 121), which are used to clean food from their capture net. Wallace and Sherberger (1974) aptly described the larval retreat of *M. carolina* and discussed the functions of the food and retreat chambers.

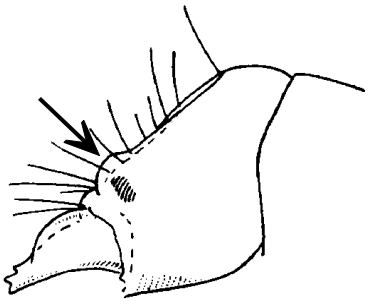

Fig. 120. *Macrostemum carolina*, head, lateral [from Ross (1944)].

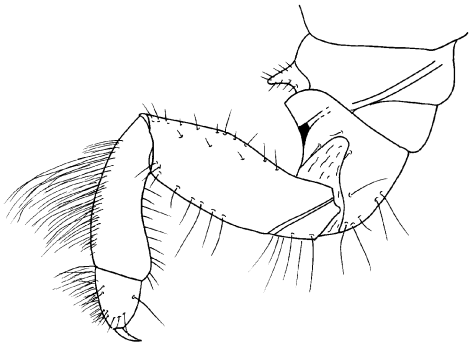

Fig. 121. *Macrostemum carolina*, prothoracic leg.

Like many hydropsychids found in Florida, *M. carolina* lives in a wide variety of lotic habitats, but are especially abundant in larger streams and rivers. We found the larvae of *M. carolina* to be most abundant in areas where snags and submerged tree limbs abound; such habitat preferences are related to their retreat construction behavior.

ADDITIONAL REFERENCES: Ross (1944); Wallace and Sherberger (1974); Wiggins (1996a).

Genus ***Potamyia*** Banks

DIAGNOSIS: Larvae of *Potamyia* are distinguished from other hydropsychid genera by the following: prominent anteromedian projection on ventral apotome of head (Fig. 96); entire posterior margin of each sclerite on abdominal sternum IX (Fig. 97); and prominently flanged lateral border of each mandible (Fig. 98).

NOTES: *Potamyia flava* is the only known species of *Potamyia* in North America. The species is rare in Florida, and has been collected (as adults) only from streams in the Apalachicola Bluffs and Ravines region north of Bristol. The species, normally associated with large rivers, has probably invaded these streams from the Apalachicola River. The life history of the species in Florida is unknown. Our adult collections were taken in spring, summer and fall months. *Potamyia flava* has been observed to have either a univoltine (Hilsenhoff, 1975) or bivoltine life cycle (Fremling, 1960).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

FAMILY HYDROPTILIDAE

The Hydroptilidae, or microcaddisflies, include the smallest of the caddisflies, most members being 2-4 mm in length. In North America there are 16 genera and nearly 250 species known. In Florida, the family is represented by at least 6 genera and 58 species (See Appendix A), making it the states most speciose caddisfly family. Efforts to collect adults by light trapping has resulted in the recent discovery of many new species [see Harris and Armitage (1987); Harris (1991, 2002); Harris et al. (1998); and Harris and Keth (2002)].

In addition to their small size, hydroptilids are recognized by the presence of sclerotized plates on all thoracic nota (Fig. 5) and lack of gills on the abdominal segments, with the exception of larvae of *Hydroptila* which have three, very thin filamentous gills on the posterior end of the abdomen (Fig. 9).

The life cycle of the Hydroptilidae is unusual among caddisflies in that the first four larval instars are free-living, with case construction taking place in the final (5^{th}) instar. Case type and construction material are variable and may be diagnostic for a genus.

Hydroptilids occur in a wide array of lotic environments from small springs and seeps to large streams and rivers. Many species are also found in standing waters, including ponds, marshes, lakes and reservoirs, with some genera being more predominant in such environments. Larvae occur on variety of substrates, including submerged vegetation and algae, root masses, as well as rocks, sand and gravel, but are easily overlooked because of their size. Most microcaddisfly larvae feed on algae, either by grazing on diatoms and periphyton or by piercing filamentous forms.

KEY TO GENERA FOR LARVAE (FINAL INSTAR) OF FLORIDA HYDROPTILIDAE

1. Anal prolegs elongate and cylindrical, projecting well beyond abdomen (Fig. 122); head narrowing anteriorly in dorsal aspect (Fig. 5) 2

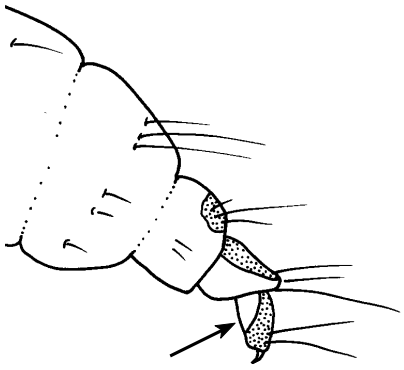

Fig. 122.

Anal prolegs short, not projecting conspicuously beyond abdomen (Fig. 123); head not noticeably narrowing anteriorly in dorsal aspect 3

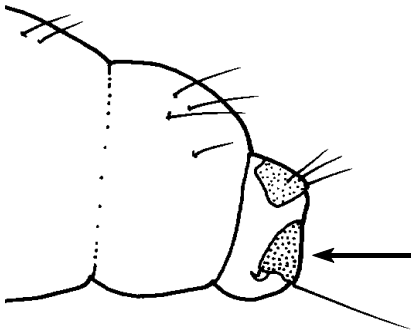

Fig. 123.

2(1) Abdomen with lateral fringe of hair (Fig. 124); intersegmental grooves of abdomen prominent (Fig. 124); cylindrical case of sand or sometimes plant pieces (Fig. 125) . . . . . *Neotrichia*

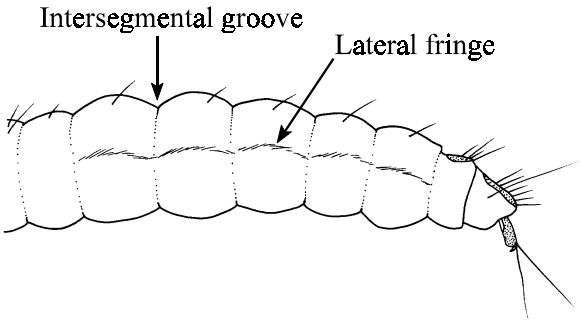

Fig. 124.

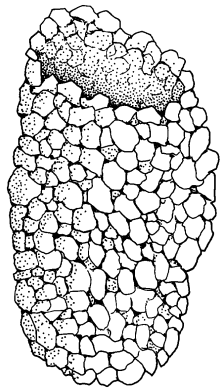

Fig. 125.

Abdomen without lateral fringe of hair (Fig. 126); intersegmental grooves of abdomen not prominent (Fig. 126); case of silk, with longitudinal ridges (Fig. 127) . . . . . *Mayatrichia*, *M. ayama* Mosely

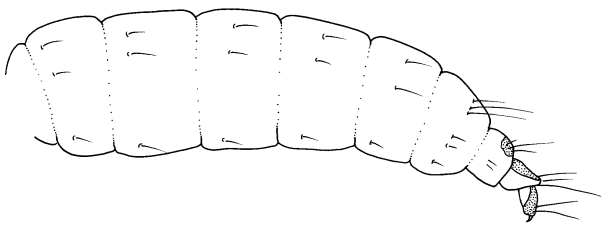

Fig. 126.

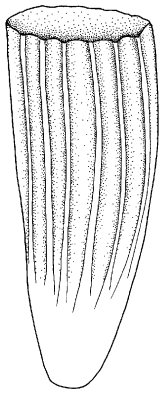

Fig. 127

3(1) Middle and hind legs over twice as long as foreleg; bottle-like case constructed of silk (Fig. 128) . . . . . *Oxyethira*

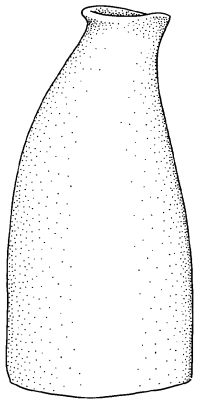

Fig. 128.

Middle and hind legs similar in length to forelegs; purse-like cases of sand or silk, sometimes mixed with plant material 4

4(3) Tarsal claws stout with thick, blunt spur at base (Fig. 129); case almost entirely of silk (Fig. 130) . . . . . *Stactobiella*

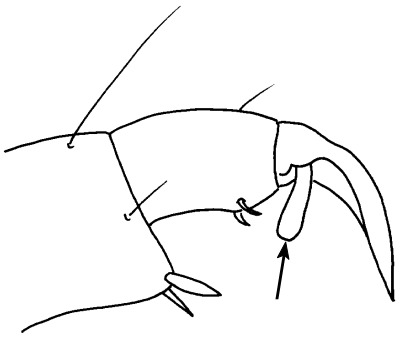

Fig. 129.

Fig. 130.

Tarsal claws slender with thin, pointed spur at base (Fig. 131); case of sand or silk, sometimes mixed with plant material 5

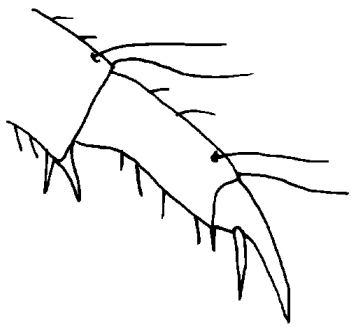

Fig. 131.

5(4) Tibia of foreleg with prominent, posteroventral lobe (Fig. 132); middle and hind legs thickened; case of sand, sometimes mixed with plant material 6

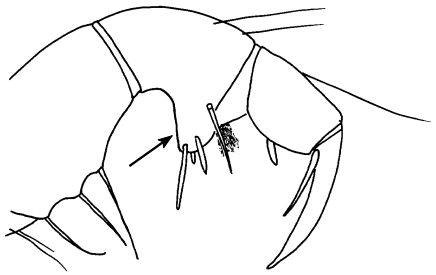

Fig. 132.

Tibia of foreleg without prominent, posteroventral lobe (Fig. 133); middle and hind legs slender; case entirely of silk, with prominent longitudinal ridges (Fig. 134) . . . . . *Orthotrichia*

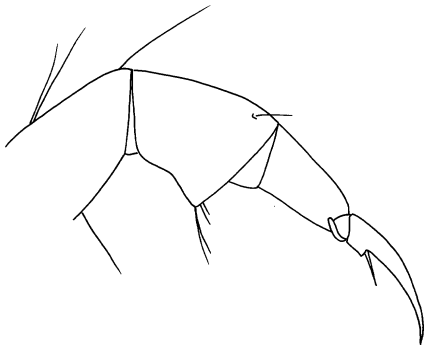

Fig. 133.

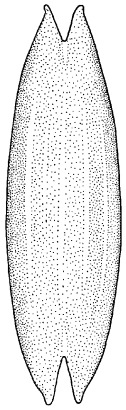

Fig. 134.

6(5) Three filamentous gills arising from posterior end of abdomen (Fig. 135); anterior edge of meso- and metathoracic plates square at lateral edges (Fig. 136) . . . . . *Hydroptila*

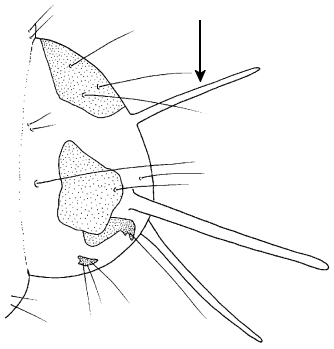

Fig. 135. lateral view.

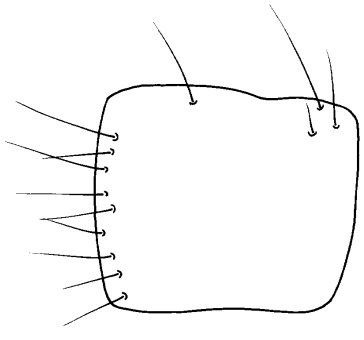

Fig. 136. left lateral view of metanotum.

Posterior end of abdomen without filamentous gills; anterior edge of meso- and metathoracic plates lobate at lateral edges (Fig. 137) . . . . . *Ochrotrichia*

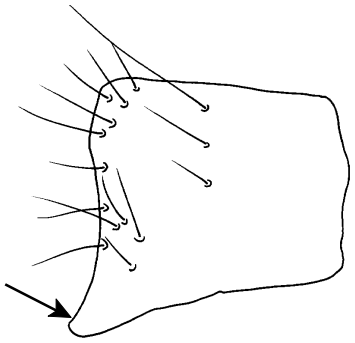

Fig. 137. left lateral view of metanotum.

Genus ***Hydroptila*** Dalman

DIAGNOSIS: Larvae of *Hydroptila* are characterized by having three long, thin gills arising from posterior end of abdomen (Fig. 135). *Hydroptila* and *Ochrotrichia* are similar in overall appearance and in their construction of purse-like cases of sand, sometimes with plant material mixed in. In addition to apical abdominal gills, *Hydroptila* are distinguished from *Ochrotrichia* by the lack of anterolateral lobes on meso- and metanota (Fig. 136).

NOTES: The genus *Hydroptila* is likely the most speciose genus of microcaddisflies in Florida, as is the case in North America. The genus inhabits a wide variety of habitats from small streams to large rivers and most lentic environments. All instars feed on filamentous algae (Nielsen, 1948), as well as diatoms and other algae (Wiggins, 1996a). Most microcaddisflies complete development in a year or less.

ADDITONAL REFERENCES: Ross (1944); Nielson (1948); Wiggins (1996a).

Genus ***Mayatrichia*** Mosely

DIAGNOSIS: Overall, larvae of *Mayatrichia* are similar to those of *Neotrichia*. However, the anterior narrowing of head is more acute in *Mayatrichia* (Fig. 5) and the legs are shorter and less slender. *Mayatrichia* larvae also lack the lateral hair fringe found on the abdomen of *Neotrichia* and the intersegmental grooves are less well-defined (Fig. 126). Cases of *Mayatrichia* are cylindrical and made entirely of silk (Fig. 127).

NOTES: Larvae of *Mayatrichia* occur in a variety of streams and large rivers, often on rocks and gravel. Only a single species, *Mayatrichia ayama*, is reported from Florida. In Alabama, this species occurred in small sandy streams and large rivers on the Coastal Plain and emerged from May through October (Harris et al., 1991). Larvae are characterized as algal scrapers by Wiggins (1996b); gut contents examined by Wiggins (1996a) consisted of fine organic particles.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

Genus ***Neotrichia*** Morton

DIAGNOSIS: *Neotrichia* larvae, as with *Mayatrichia*, are recognized as follows: distal narrowing of head; long, slender meso- and metatarsi; and anal prolegs projecting free of body (Fig. 124). Among the smallest of hydroptilids, larvae of *Neotrichia* are separated from *Mayatrichia* as follows: lateral fringe of hair on the abdomen; and well-defined intersegmental grooves of abdomen (Fig. 124). Cases of *Neotrichia* are cylindrical and composed of sand grains (Fig. 125) or sometimes plant material.

NOTES: Larvae occur in a variety of lotic habitats, including swift, rocky streams and slow-moving rivers. *Neotrichia* immatures are classified as algal scrapers on rocks and fixed substrates (Wiggins, 1996a). Many of the *Neotrichia* species occurring in Alabama appeared to be multivoltine (Harris et al., 1991).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

Genus ***Ochrotrichia*** Mosely

DIAGNOSIS: Larvae of *Ochrotrichia*, in overall appearance, are similar to those of *Hydroptila*. Larvae of both genera have short, rather thick legs, with foretibiae each bearing a posteroventral lobe. *Ochrotrichia* larvae are distinguished from those of *Hydroptila* by the lack of apical, abdominal gills and the presence of anterolateral lobes on meso- and metanota (Fig. 137). Cases of *Ochrotrichia* are similar to those of *Hydroptila*, being purse-shaped and constructed of sand, sometimes with plant material mixed in.

NOTES: Five species of *Ochrotrichia* have been reported from Florida. *Ochrotrichia tarsalis*, the only widespread species, occurs in a wide variety of streams and rivers. *Ochrotrichia confusa*, *O. okaloosa*, and *O. apalachicola* are known from only a few spring-fed panhandle streams, and *O. provosti* is known from only the type locality in Hillsborough County. Larvae are characterized by Wiggins (1996b) as detritivores and piercing herbivores, but Vaillant (1965) suggested some species are diatom scrapers on rock surfaces.

ADDITIONAL REFERENCES: Ross (1944); Vaillant (1965); Wiggins (1996a).

Genus ***Orthotrichia*** Eaton

DIAGNOSIS: Larvae of *Orthotrichia* are distinguished as follows: slender meso- and metathoracic legs; patch of spines on each fore coxa; and asymmetrical labrum. The purse-like, silken larval case with longitudinal ridges is distinctive for the genus (Fig. 134).

NOTES: Only six species of *Orthotrichia* are known from North America and all are reported from Florida. Larvae are abundant on submerged vegetation along the littoral zones of lakes and other standing waters. The larvae also occur on vegetation along the margins of slow-moving rivers and streams. Nielson (1948) observed *Orthotrichia* larvae feeding on the contents of large algal filaments. In Alabama, *Orthotrichia* species had long emergence patterns suggesting multiple generations each year (Harris et al., 1991).

ADDITIONAL REFERENCES: Ross (1944); Kingsolver and Ross (1961); Wiggins (1996a); Keiper (2002).

Genus ***Oxyethira*** Eaton

DIAGNOSIS: *Oxyethira* larvae are easily identified by their long, thin meso- and metathoracic legs. Fore tibiae each possess an elongate posteroventral process similar to that found in *Hydroptila* and *Ochrotrichia*. *Oxyethira* spp. are also readily recognized by their bottle-shaped, silken cases (Fig. 128).

NOTES: Larvae of *Oxyethira* are often abundant in lakes and other lentic environments, but they also occur in slower stretches of streams and rivers, particularly in beds of submerged vegetation. In number of species likely to be found in Florida, *Oxyethira* is second only to *Hydroptila*.

ADDITIONAL REFERENCES: Ross (1944); Kelley (1982); Wiggins (1996a); Keiper (2002).

Genus ***Stactobiella*** Martynov

DIAGNOSIS: Larvae of *Stactobiella* are recognized among hydroptilids in Florida by the thick tarsal claws each having a large, blunt basal spur (Fig. 129). The blunt spurs are easily discerned, being nearly as long as the claws. The larval case is purse-like and composed nearly entirely of silk (Fig. 130).

NOTES: The genus *Stactobiella* has not been reported from Florida, but both *S. palmata* and *S. martynovi* have been documented from adjacent Alabama counties (Harris et al., 1991). The genus would be expected to occur in the cool, spring-fed streams of northern Florida. Harris et al. (1991) reported *Stactobiella* spp. emerging early in spring through late summer.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

FAMILY LEPIDOSTOMATIDAE

The family Lepidostomatidae has two North American genera, *Lepidostoma* and *Theliopsyche*, but only the former is represented in Florida. Lepidostomatid larvae are morphologically distinguished from the other caddisfly families by the placement of the antenna close to the anterior margin of the eye, and the lack of a median dorsal hump on abdominal segment I (Fig. 58). The larval cases which are constructed from various materials are often four sided.

Genus ***Lepidostoma*** Banks

DIAGNOSIS: Larvae of *Lepidostoma* are distinguished from *Theliopsyche* as follows: longer body length (approximately 10 mm); rounded dorsal profile of head; and ventral apotome of head as long as, or longer than, median-ecdysial line. The larval case of most species is four-sided and constructed of wood panels.

NOTES: The four species of *Lepidostoma* presently known to occur in Florida (See Appendix A) can be determined only from the adult stage. Adults of *Lepidostoma griseum* and *L. latipenne*, appear to be restricted in Florida to spring-fed streams within the Apalachicola ravines. *Lepidostoma serratum* occurs in ravine-head springruns in both the western and central panhandle (Rasmussen, 2004). *Lepidostoma morsei* was described by Weaver (1988) in which the adult paratypes were collected in Walton Co., (Portland, Little Alaqua Ck). This species has not been collected from other areas of Florida and is considered a threatened species in Florida (Deyrup and Franz, 1994).

In North America the larvae of *Lepidostoma* have been collected from a wide variety of habitats ranging from small cool springs and streams, intermittent streams, backwater areas of rivers to wave-washed shores of lakes (Clifford, 1966; Anderson, 1976; Barton and Hynes, 1978; Unzicker et al., 1982). In Florida we collected larvae of the genus only from small spring-fed streams. All of our collections are from the panhandle with the exception of one *Lepidostoma* larva collected from a tributary of the South Fork of Black Creek in Clay County, indicating the genus is represented in the northern portion of the peninsula.

SELECTED REFERENCES: Ross (1944); Weaver (1988); Wiggins (1996a).

FAMILY LEPTOCERIDAE

The Leptoceridae, a highly diverse family, are represented in Florida by six genera: *Ceraclea*, *Leptocerus*, *Nectopsyche*, *Oecetis*, *Setodes*, and *Triaenodes*. The larval taxonomy of the leptocerids is the most well known among the large caddis families in the state. Recent work on the larvae makes it possible to identify most of the approximately 50 Florida leptocerids to species level.

The larvae of Leptoceridae, commonly known as "long-horned caddisflies", can be distinguished from the other caddis families by the relatively long antennae which are at least six times as long as wide (Fig. 11). The exception is *Ceraclea*, which have short antennae in some species, but may be identified by the dark curved lines on the posterior half of the mesonotum (Fig. 12).

This family, along with Hydroptilidae, is the most geographically widespread and speciose in Florida due to the wide range of environmental tolerances its species exhibit in both lotic and lentic habitats. Many species are well adapted to inhabiting the warm waters so prevalent in the state. Leptocerids occupy a number of trophic groups depending on the genus, including carnivore, herbivore, detritivore and grazer. Larvae construct portable cases which are generally cylindrical and tapered. Case materials and structures differ among genera and species, and are often used as diagnostic characters.

KEY TO GENERA FOR LARVAE OF FLORIDA LEPTOCERIDAE

[adapted from Morse and Holzenthal (1996)]

1. Tarsal claws of each mesothoracic leg hooked and stout (Fig. 138); tarsus curved; slender case of transparent silk (Fig. 139) . . . . . *Leptocerus*, *L. americanus* (Banks)

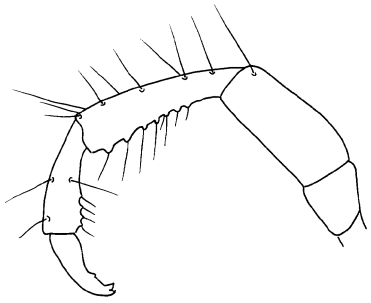

Fig. 138.

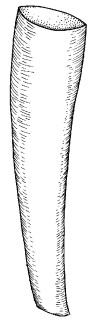

Fig. 139.

Tarsal claws of each mesothoracic leg slightly curved and slender; tarsus straight 2

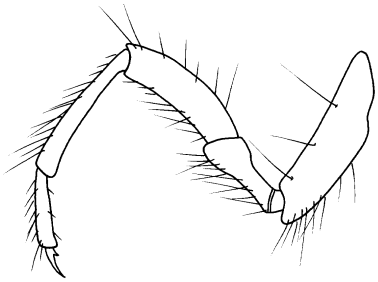

Fig. 140.

2(1) Sclerotized, concave plate with marginal spines on each side of anal opening and exiting onto ventral lobe (Fig. 141); cylindrical case of stones . . . . . *Setodes* (p. 81)

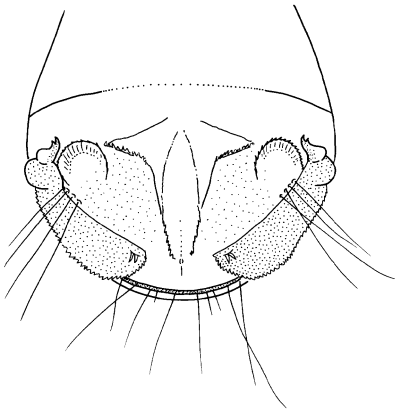

Fig. 141.

Sclerotized, spiny plates absent, although patches of spines or setae may be present (Fig. 142) 3

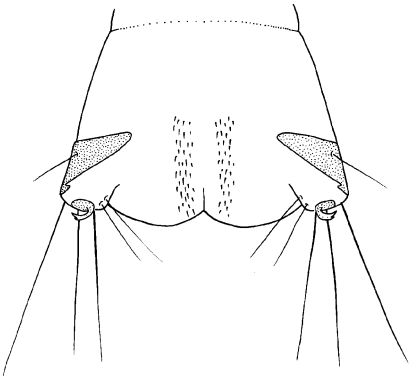

Fig. 142.

3(2) Maxillary palpi extending far beyond labrum (Fig. 143); mandibles long and bladelike, with sharp apical tooth separated from remainder of teeth (Fig. 144); cases of various types and materials . . . . . *Oecetis* (p. 74)

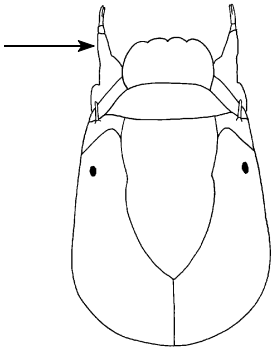

Fig. 143.

Fig. 144.

Maxillary palpi extending little, if any, beyond labrum (Fig. 145); mandibles short, wide, with teeth grouped close to apex around central concavity (Fig. 146) 4

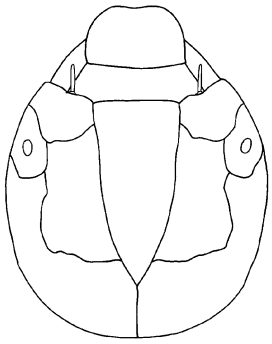

Fig. 145.

Fig. 146.

4(3) Mesonotum with pair of dark, curved bars on weakly sclerotized plates (Fig. 147); abdomen broad basally, tapering posteriorly, with gills usually in clusters of 2 or more (Fig. 148); cases of various shapes and materials, sometimes including spicules and pieces of freshwater sponges . . . . . *Ceraclea* (p. 61)

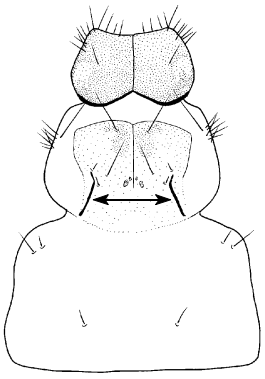

Fig. 147.

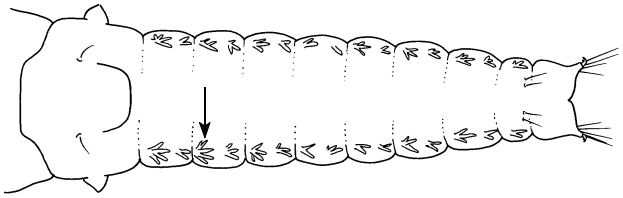

Fig. 148.

Mesonotum without pair of dark bars (Fig. 149); abdominal segments I-VII more slender anteriorly, nearly parallel-sided, with gills single or absent (Fig. 150) 5

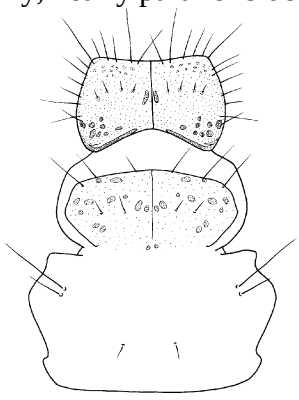

Fig. 149.

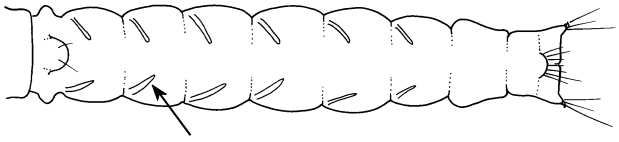

Fig. 150.

5(4) Ventral apotome of head triangular (Fig. 151); tibia of each hind leg usually without apparent constriction; pair of ventral bands of uniformly small spines beside anal opening or spines absent in this position, but no lateral patches of longer spines (Fig. 152); slender case of plant fragments, fine sand, and/or diatoms with usually twigs or conifer needles extending length of case and beyond at 1or both ends (Fig. 153)

. . . . . *Nectopsyche* (p. 69)

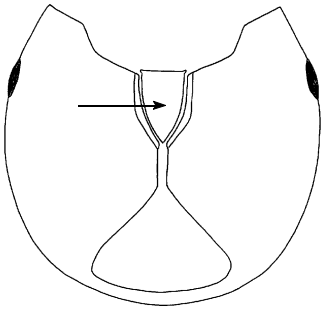

Fig. 151.

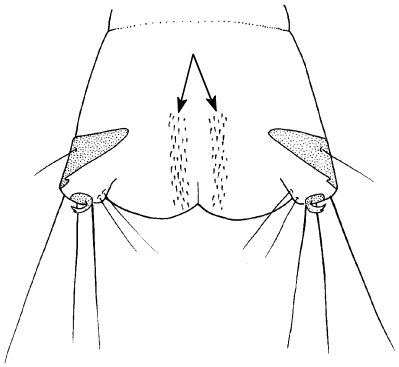

Fig. 152.

Fig. 153.

Ventral apotome of head rectangular (Fig. 154); tibia of each hind leg with translucent constriction, apparently dividing it into 2 subequal parts (Fig. 155); patch of longer spines laterad of each band of short anal spines (Fig. 156); case a spiral of plant pieces (Fig. 157)

. . . . . *Triaenodes* (p. 85)

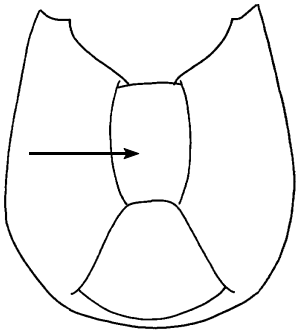

Fig. 154.

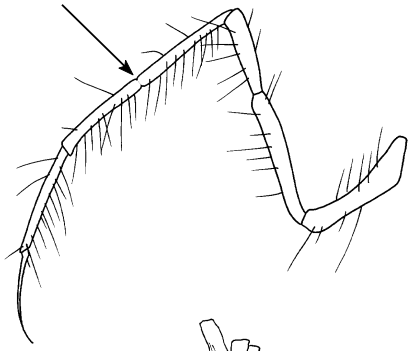

Fig. 155.

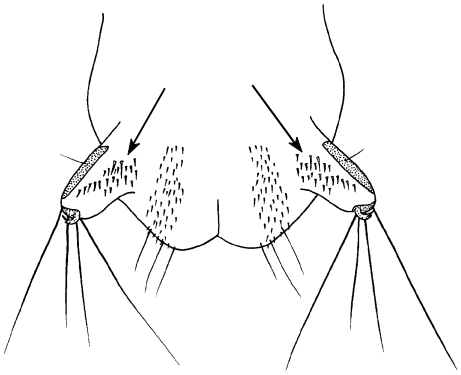

Fig. 156.

Fig. 157.

Genus ***Ceraclea*** Stephens

DIAGNOSIS: Larvae of *Ceraclea* are distinguished from other leptocerid genera by the presence of a pair of dark curved bars on the mesonotum (Fig. 147). Larvae are stout bodied, widest at first abdominal segment and tapering posteriorly (Fig. 148). Abdominal gills are usually in clusters of two or more (Fig. 148).

NOTES: Of the approximately 36 species of *Ceraclea* known from North America, we have at least 13 species. Larvae of 10 of the 13 Florida species are known and can be identified to species using the key presented below. One species, *C. floridana*, is known only from the holotype specimen collected along Biscayne Bay in 1903 and has not been reported since. This species may now be extinct. *Ceraclea ophioderus* and *C. protonepha*, both of which occur in northern Florida, are the other species still unknown as larvae. The previous report of *Ceraclea spongillovorax* presented in Gordon (1984) was found to be erroneous. Larvae from South Florida that we tentatively identified as *C. spongillovorax* may in fact be *C. enodis*, whose larvae are quite similar to *C. maculata* and *C. spongillovorax*. *Ceraclea* n. sp. was discovered from Lucas Lake in the Florida panhandle and is being described by James Glover and John Morse.

Feeding habits range from detritus and algal grazing to several species of *Ceraclea* (e.g., *C. resurgens*, *C. transversa*, *C. enodis*) which feed on freshwater sponges (Resh, 1976; Resh et al., 1976; Whitlock and Morse, 1994). Case construction varies among species as to materials and architecture. Certain sponge-feeding species construct cases almost entirely of silk secretions, while other species incorporate mineral and plant materials to varying degrees into the silk matrix. Some species construct cornucopia-shaped cases while others construct cases which are stout and cylindrical. *Ceraclea flava* constructs a case with lateral expansions which form a dorsal awning.

Ceraclea spp. are geographically widespread throughout the state and occur in a wide array of lotic and lentic habitats, although some species may be restricted to a narrow range of habitat types based on unique ecological requirements.

ADDITIONAL REFERENCES: Resh (1976); Whitlock and Morse (1994).

KEY TO SPECIES FOR MATURE LARVAE OF FLORIDA *CERACLEA* *

[modified from Resh (1976)]

1. Parafrontal areas absent (Fig. 158); mesonotal bars with anterior portion yellow (Fig. 159); case made primarily of silk secretion, occasionally adorned with sand or pieces of freshwater sponge (Fig. 160); sponge feeders 2

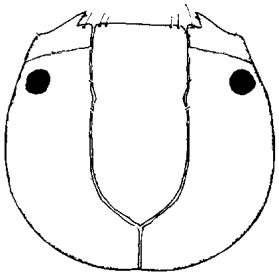

Fig. 158. [from Resh (1976)].

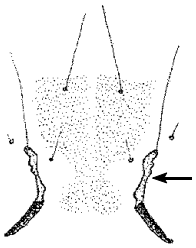

Fig. 159. [from Resh (1976)].

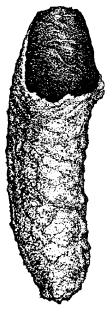

Fig. 160. [from Resh (1976)].

Parafrontal areas present (Fig. 161); mesonotal bars unicolored (Fig. 162); case made of silk or of sand (Fig. 163), pebbles, or plant material; usually detritus or algae feeders 3

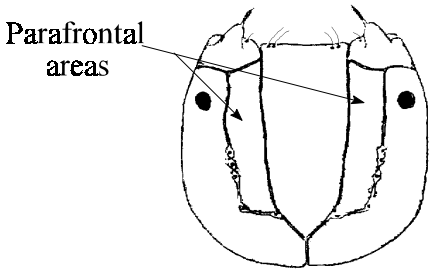

Fig. 161. [from Resh (1976)].

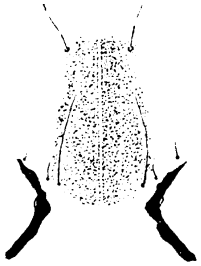

Fig. 162. [from Resh (1976)].

Fig. 163. [from Resh (1976)].

2(1) Pronotum lacking contrasting spots (Fig. 164); head with spots pale yellow on a yellow background (Fig. 165); length of last instar larva, 5-7 mm . . . . . *C. transversa* (Hagen)

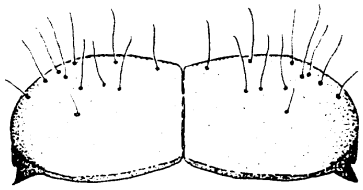

Fig. 164. [from Resh (1976)].

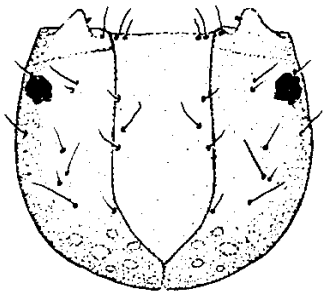

Fig. 165. [from Resh (1976)].

Pronotum with some contrasting spots (Fig. 166); head with brown spots on yellow background (Fig. 167); length of last instar larva, 11-12 mm
. . . . . *C. resurgens* (Walker)

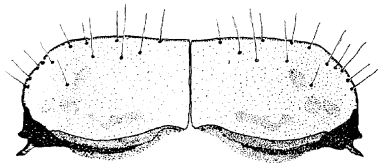

Fig. 166. [from Resh (1976)].

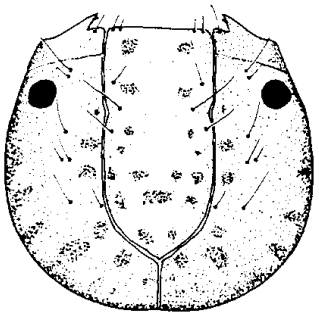

Fig. 167. [from Resh (1976)].

3(1) Pronotoum with distinct dark band along anterior margin (Fig. 168); antennae short, only about 2 times longer than wide; head, pro- and mesonotum as in Fig. 168
. . . . . *Ceraclea* n. sp.

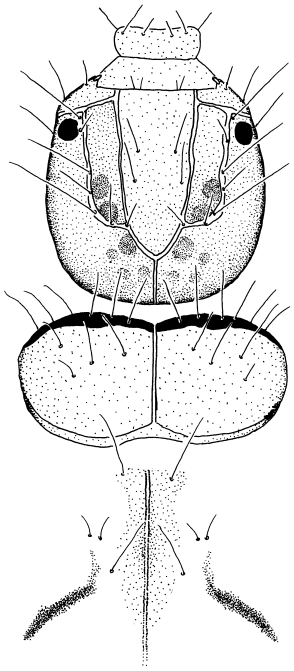

Fig. 168. [from Glover and Morse (In Prep)].

Pronotum without distinct dark band along anterior margin; antennae usually more than 2 times longer than wide 4

4(3) Mesonotum with at least 20 setae along middorsal groove (Fig. 169); head with longitudinal stripes (Fig. 170); trochantin with 2 or more dorsal setae . . . . . *C. slossonae* (Banks)

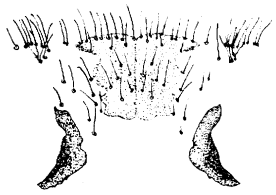

Fig. 169. [from Resh (1976)].

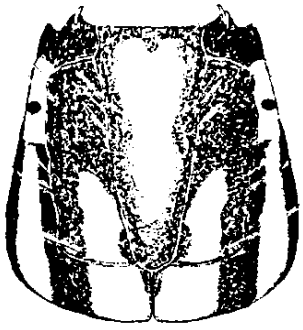

Fig. 170. [from Resh (1976)].

Mesonotum with only a few setae along middorsal groove (Fig. 171); head lacking longitudinal stripes (Fig. 172); trochantin with 1 dorsal seta 5

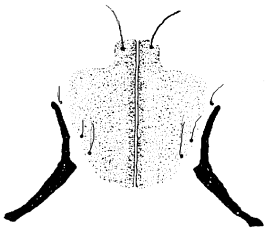

Fig. 171. [from Resh (1976)].

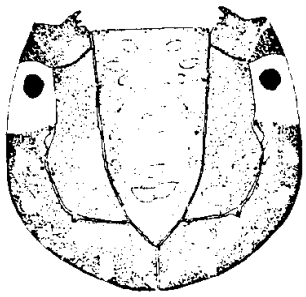

Fig. 172. [from Resh (1976)].

5(4) Two pairs of long setae on 9th abdominal tergite 6

One pair of long setae or setae lacking entirely on 9th abdominal tergite 10

6(5) Dorsolateral sclerite on anal leg long and rodlike (Fig. 173) 7

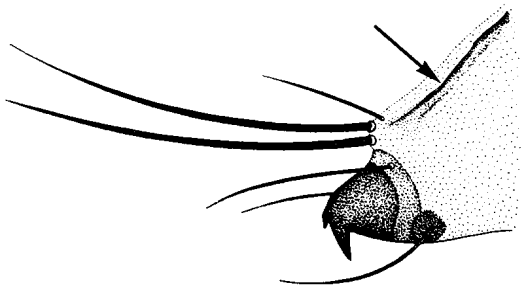

Fig. 173. [from Resh (1976)].

Dorsolateral sclerite not rodlike, or absent entirely (Fig. 174) 9

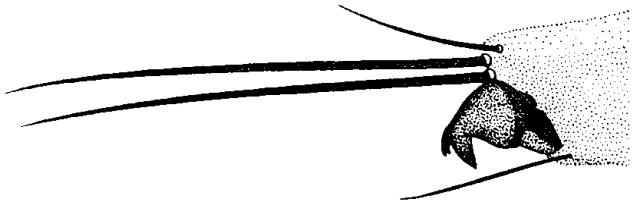

Fig. 174. [from Resh (1976)].

7(6) Mesonotal bars gently curved (Fig. 175); head lacking contrasting spots posteriorly (Fig. 176) . . . . . *C. cancellata* (Betten)

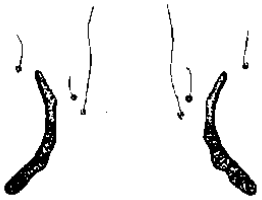

Fig. 175. [from Resh (1976)].

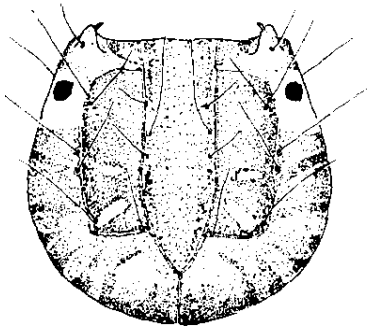

Fig. 176. [from Resh (1976)].

Mesonotal bars sharply angled (Fig. 177); head with contrasting spots posteriorly (Fig. 178) 8

Fig. 177. [from Resh (1976)].

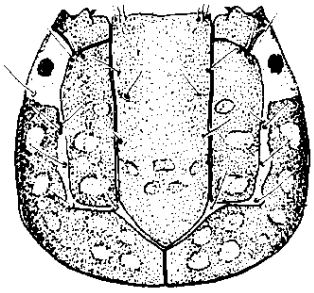

Fig. 178. [from Resh (1976)].

8(7) Antennae long, about 6 times longer than wide (Fig. 179); white region on side of head with 2 dark spots (Fig. 180); pronotum with about 22 setae along anterior margin (Fig. 181); larvae found in assoiciation with freshwater sponge . . . . . *C. enodis* Whitlock and Morse

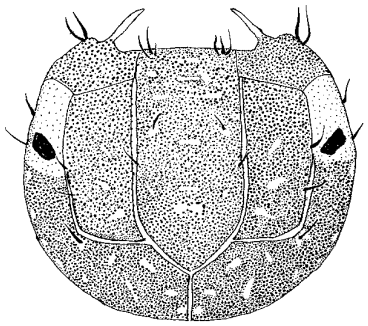

Fig. 179. [from Whitlock and Morse (1994)].

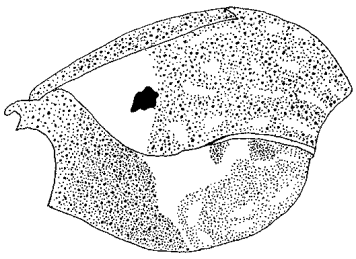

Fig. 180. [from Whitlock and Morse (1994)].

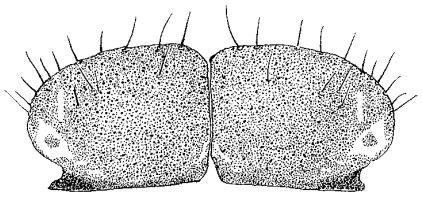

Fig. 181. [from Whitlock and Morse (1994)].

Antennae short, about 2 times longer than wide (Fig. 182); white region on side of head with 3 dark spots (Fig. 183); pronotum with about 28 setae along anterior margin (Fig. 184); larvae not found with freshwater sponge . . . . . *C. maculata* (Banks)

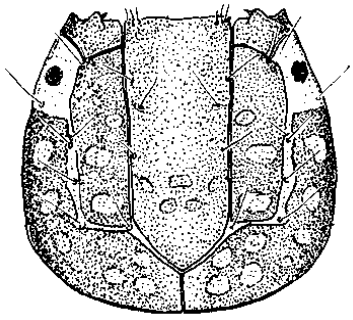

Fig. 182. [from Resh (1976)].

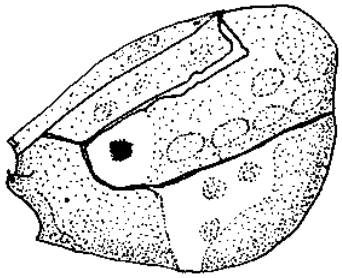

Fig. 183. [from Resh (1976)].

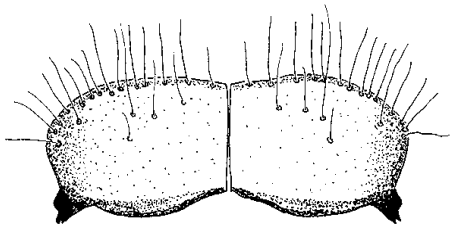

Fig. 184. [from Resh (1976)].

9(6) Case made of plant material (Fig. 185) . . . . . *C. tarsipunctata* (Vorhies)

Fig. 185. [from Resh (1976)].

Case made entirely of sand grains (Fig. 186)
. . . . . *C. nepha* (Ross), *C. protonepha* Morse and Ross ?**

Fig. 186. [from Resh (1976)].

10(5) Case with lateral expansions (Fig. 187); pronotum with single lateral spot surrounded by a light corona (Fig. 188) . . . . . *C. flava* (Banks)

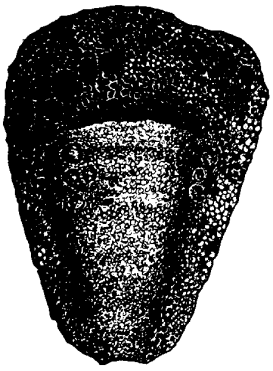

Fig. 187. [from Resh (1976)].

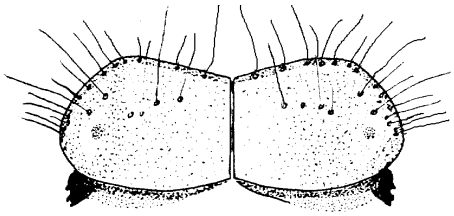

Fig. 188. [from Resh (1976)].

Case cornucopia-shaped, without lateral expansions (Fig. 189); pronotum usually lacking a lateral spot (Fig. 190) . . . . . *C. diluta* (Hagen)

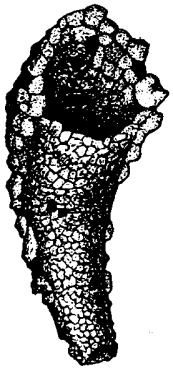

Fig. 189. [from Resh (1976)].

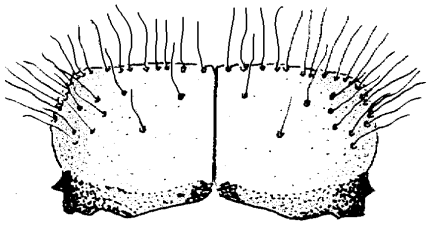

Fig. 190. [from Resh (1976)].

* Key does not include *C. floridana* or *C. ophioderus* the larvae of which are unknown.

** Larva of *C. protonepha* is unknown but will likely key out to *C. nepha*.

Genus ***Leptocerus*** Leach

DIAGNOSIS: Larvae of *Leptocerus* are distinguishable from other leptocerid genera as follows: tarsal claw of mesothoracic leg hooked with two apical points (Fig. 138); and curved mesotarsi (Fig. 138). The mesothoracic tibiae and tarsi are each thickened and bear a ventral row of teeth with stout setae (Fig. 138). Larval cases are long and slender, constructed of translucent silk (Fig. 139).

NOTES: Only a single species, *Leptocerus americanus*, occurs in North America. Ross (1944) provided a larval description for this species. The head and pronotum have many black spots (Fig. 191). The hind legs have dense swimming hairs; abdominal gills are absent.

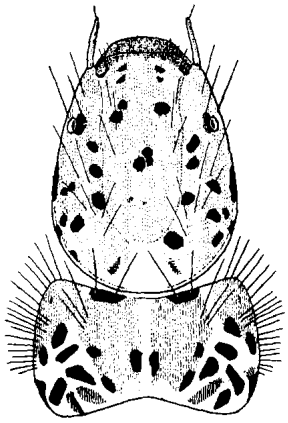

Fig. 191. *Leptocerus americanus* [from Ross (1944)].

Leptocerus americanus is widespread across eastern North America. This species is known to occur in lakes and marshes as well as in slow stretches of river among aquatic macrophytes (Unzicker et al., 1982). Larvae are able to swim among aquatic plants, and the modified mesothoracic tibiae and tarsi are believed to enable the larva to hold firmly in a resting position on plants (Wiggins, 1996a).

Leptocerus americanus has been reported from Columbia and Baker counties within the Osceola National Forest (Gordon, 1984). We have collected adults along streams and rivers across much of the central panhandle and have examined larvae from Lake Rowell, Bradford County and Orange Lake, Alachua County. Additional collecting in lentic habitats should provide a better understanding of its geographic distribution here in Florida.

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

Genus ***Nectopsyche*** Müller

DIAGNOSIS: Larvae of *Nectopsyche* are distinguished from other leptocerid genera as follows: hind tibiae not secondarily subdivided as in *Triaenodes*; sclerotized bar and circular roughened area on each lateral hump; unpigmented lines delimiting anterolateral corners of pronotum; and ventral apotome triangular (Fig. 151) .

NOTES: *Nectopsyche* larvae occur in lentic and lotic habitats throughout the state and, like most leptocerids, have a very broad range of environmental tolerances. In lentic habitats they are often associated with aquatic macrophytes. In lotic habitats they can be collected along the margins of slowly moving sections of streams and rivers. With the exception of *N. pavida*, larval cases are usually long and slender, made with sand grains and/or plant materials incorporated into the matrix. Stems or pine needles may be attached to the case extending beyond either end (Fig. 153). *Nectopsyche pavida* builds a non-tapering case which is dorsoventrally compressed with uneven sides.

Nectopsyche exquisita and *N. pavida* are widely distributed and fairly common in small to medium size streams and rivers throughout much of Florida. *Nectopsyche pavida* also occurs in lakes of central Florida. *Nectopsyche spiloma*, widely distributed in the Mississippi River drainage, has not been recorded in Florida but may occur in the state, based on adults collected near the Florida-Alabama state line (Harris et al., 1991).

Nectopsyche tavara is endemic to lakes of peninsular Florida and is widespread over most of the peninsula. We have examined larvae collected from several lakes in Highlands Co., Lake Samson, Bradford Co., as well as larvae associated with *Najas* sp., collected from Lake Okeechobee, Glades Co. Adults of *N. tavara* have been reported to emerge from March to October, with peak emergence occurring in early July (Daigle and Haddock, 1981).

The larva of *Nectopsyche paludicola* was recently described in Glover and Floyd (2004). Harris et al. (1991) reported that this species is endemic to small coastal streams of Alabama and the western portion of the Florida panhandle. *Nectopsyche paludicola* is especially abundant in sandhill streams on Eglin Air Force Base.

ADDITIONAL REFERENCES: Ross (1944); Haddock (1977); Daigle and Haddock (1981); Glover and Floyd (2004).

KEY TO SPECIES FOR LARVAE OF FLORIDA *NECTOPSYCHE*

[adapted from Glover and Floyd (2004)]

1. Metasternum with 2 setae (Fig. 192); case sometimes dorsoventrally compressed 2

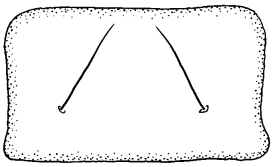

Fig. 192.

Metasternum with more than 2 setae; case never dorsoventrally compressed 3

2(1) Head with pattern of dark pigmentation (Fig. 193); case dorsoventrally compressed, with uneven sides, made entirely of plant materials, such as leaf fragments . . . . . *N. pavida* (Hagen)

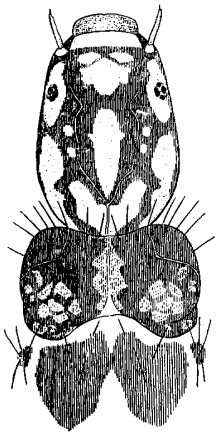

Fig. 193. [from Ross (1944)].

Head only slightly pigmented, patterned with small dark spots (Fig. 194); case tubular, often with twigs extending from end . . . . . *N. paludicola* Harris

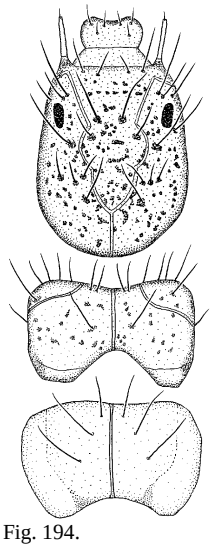

Fig. 194.

3(1) Metasternum with more than 20 setae (Fig 195); head with sharply contrasting light muscle scars against a darker background (Fig. 196) . . . . . *N. tavara* (Ross)

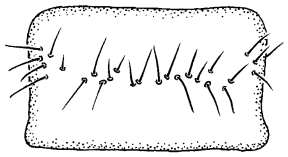

Fig. 195.

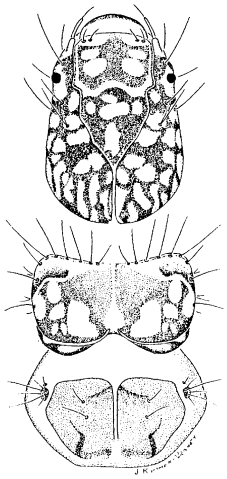

Fig. 196. [from Daigle and Haddock (1981)].

Metasternum with less than 15 setae, usually 8-10; head pattern variable but usually appearing reticulate, without well-defined muscle scars 4

4(3) Meso- and metathoracic legs with conspicuous dark bands at joints (Fig. 197) . . . . . *N. exquisita* (Walker)

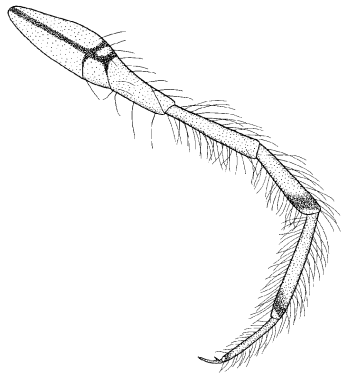

Fig. 197.

Legs without dark banding (Fig. 198) . . . . . *N. candida* (Hagen)

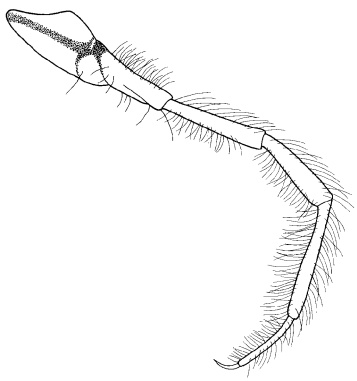

Fig. 198.

Genus ***Oecetis*** MacLachlan

DIAGNOSIS: Larvae of *Oecetis* are easily distinguished from other leptocerid genera as follows: maxillary palpi which extend beyond labrum (Fig. 143); and long knife-like mandibles with sharp apical tooth separated from remainder of teeth (Fig. 144).

NOTES: Approximately thirty species of *Oecetis* occur in North America, north of Mexico, 18 of which are known or are likely to occur in Florida. The publication Floyd (1995) provided descriptions and a larval key for 22 North American species along with notes on biology and distribution. Floyd's key covered 14 of the 18 Florida species, including four species believed to belong to the *Oecetis inconspicua* complex.

Larvae of *Oecetis* are predatory, as evidenced by their elongate bladelike mandibles, making them unique among Leptoceridae. They are highly diverse in terms of habitat preferences and have succeeded in exploiting nearly every type of aquatic habitat. Adults have been frequently collected in coastal areas, indicating that some species may be tolerant of brackish water (Floyd, 1995). Case construction is highly variable among species in terms of materials and architecture.

SPECIES NOTES:

Oecetis avara - This species is widespread across eastern North America. In Florida it appears to be restricted to limestone-bottom river reaches in northern Florida. We have collected this species from the Chipola, Aucilla, and Santa Fe rivers. *Oecetis avara* is easily distinguished by the two groups of micro-hooks present on abdominal segment I.

Oecetis cinerascens - One of the most commonly collected *Oecetis* species in Florida. It is widepread throughout the state and can be found in lentic and lotic environments including canals. Larvae are often associated with aquatic macrophytes. The brown head with pale muscle scars is distinctive and makes identification easy.

Oecetis daytona - Larvae are unknown. This species is endemic to the southeastern Coastal Plain and is listed as Rare in Florida (Deyrup and Franz, 1994). In Florida, adults have been reported from Baker, Duval, and Volusia counties by Gordon (1984). We have additional adult collection records of a few individuals from scattered and varied habitats across the panhandle and northern peninsula.

Oecetis ditissa - Larvae are unknown. Adults have been reported from Alachua Co. (Gordon, 1984). We have collected adults across the panhandle and northern peninsula.

Oecetis floridanus - Larvae are unknown. This species is known only from the female and quite possibly is not a valid species. In Deyrup and Franz (1994) Morse indicated this species is known from a unique type specimen collected along Biscayne Bay. The species should be renamed since it is preoccupied in *Oecetis* by *Oecetina floridana*, which was synonymised to *Oecetis cinerascens* (Holzenthal, 1982; Chen, 1993).

Oecetis georgia - Endemic to the southeastern United States. According to Floyd (1995), this species is strictly lotic, usually found on root mats and snags. Larvae are common in blackwater streams in northern Florida. Larvae most resemble *Oecetis persimilis* but, unlike those of *O. persimilis*, *O. georgia* larvae lack dark muscle scars on the head.

Oecetis inconspicua complex - Floyd (1995) presented sufficient evidence to support the notion that *Oecetis inconspicua* is actually a complex of species, which as adults are very difficult to distinguish but as larvae are morphologically distinct. Floyd (1995) associated seven different species with distinctive larvae which as adults fit the description of *Oecetis inconspicua*. The species complex theory is further supported by the fact that *Oecetis* spp. are widespread throughout North America and show a great deal of variation in terms of genitalic structure and overall size of the adults. It is likely that the number of species in the complex will grow.

Oecetis inconspicua - The actual larval identity of *O. inconspicua* is unknown until further investigations and taxonomic revisions of member species is completed.

Oecetis sp. A - Floyd (1995) reported this species from only Alabama and South Carolina; however the species appears to be widespread throughout Florida. We have examined specimens from Escambia and Walton counties in North Florida as well as Desoto, Glades, and Hendry counties in South Florida. Larvae were collected from small to medium size rivers.

Oecetis sp. C - Floyd's (1995) larval associations were made from specimens collected from two small ponds in Clay Co. We have examined specimens collected from Lake Placid and Lake Grassy, Highlands Co. and Santa Fe Lake, Alachua Co. The species has not been reported from any states other than Florida. Larvae are easily distinguished by the dense patch of setae on the meso- and metasterna.

Oecetis sp. E - Larvae of this species have turned up in both South and North Florida. Floyd (1995) reported this species from emergent grasses in two Carolina Bay lakes in South Carolina.

Oecetis sp. F - The larval association made by Floyd (1995) is based on specimens collected from Lake Tohopekaliga, Osceola Co. We have examined larvae collected from widespread localities that appear to be this species. However, there does seem to be a lot of variation in the number of setae on the metasternum (8-15), so it is possible this represents more than one species.

Oecetis morsei - Larvae cannot be distinguished from *O. sphyra* based on the associations done by Floyd (1995). This species was listed as Rare in Florida (Deyrup and Franz, 1994) and is known in Florida only from Ramer Branch on Eglin Air Force Base, Okaloosa Co., (Harris, et al., 1982). Extensive light-trap collections of adults from northern Florida in recent years have yielded no new specimens.

Oecetis nocturna - This species is widespread throughout Florida and occurs in both lentic and lotic habitats. The larval case is easily recognized by the laterally attached ballast stones.

Oecetis osteni - Widespread throughout Florida, inhabiting both lentic and lotic habitats, often in association with aquatic vegetation. Larvae are easily recognized by the irregular darkened areas on the mesonotum.

Oecetis parva - Endemic to the southeastern United States, this species has only been recorded from Florida and Alabama. Floyd's (1995) larval-adult association is based on larvae collected from Lucas Lake, Washington Co., and were found attached to *Myriophylum laxum*. *Oecetis parva* is uncommon, and we were unable to collect nor borrow specimens for examination. Floyd (1995) indicated the larvae can be recognized by their small size, long antennae, and case structure.

Oecetis persimilis - Widespread and common throughout Florida as well as the eastern United States. Larvae occur in a wide array of lotic habitats. This species is morphologically similar to *O. georgia* but can be distinguished by the presence of dark muscle scars on the head.

Oecetis porteri - Endemic to the southeastern United States, this species has been reported from Florida, Alabama, and North Carolina. Floyd (1995) reported this species from numerous natural sand-bottomed lakes throughout much of Florida. We have examined specimens collected from Lake Josephine, Lake Clay, and Lake Annie in Highlands Co.; Santa Fe Lake, Alachua Co.; as well as specimens associated with *Eleocharis* sp. and *Utricularia* sp. collected from Lake Okeechoobee. Larvae are immediately recognizable by the reddish brown reticulations on the head and pronotum.

Oecetis pratelia - Larvae are unknown. This species is known only from the holotype specimen collected from Hendry Co., and described by Denning (1948). Floyd (1995) believed this species may be extinct and was unable to collect the species from the type locality.

Oecetis sphyra - Widespread and common across the Florida panhandle, occurring in creeks and medium size rivers.

ADDITIONAL REFERENCES: Ross (1944); Floyd (1995).

KEY TO SPECIES FOR LARVAE OF FLORIDA *OECETIS* *

[modified from Floyd (1994)]

1. Dorsal hump of abdominal segment I with 4-6 rows of micro-hooks on each side (Fig. 199) . . . . . *O. avara* (Banks)

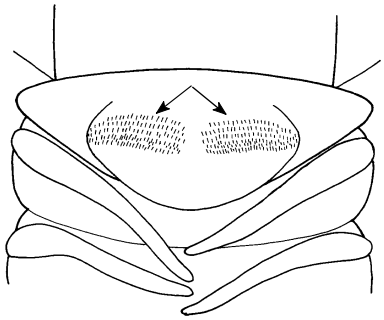

Fig. 199.

Dorsal hump of abdominal segment I without micro-hooks 2

2(1) Postgenal sclerites demarcated by distinctive brown and pale areas (Fig. 200); lateral hump of abdominal segment I with dark, elongate sclerite (LS) (Fig. 201) . . . . . *O. sphyra*/*morsei*

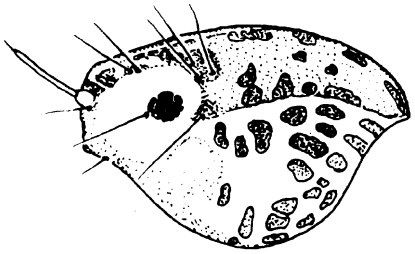

Fig. 200. [from Floyd (1994)].

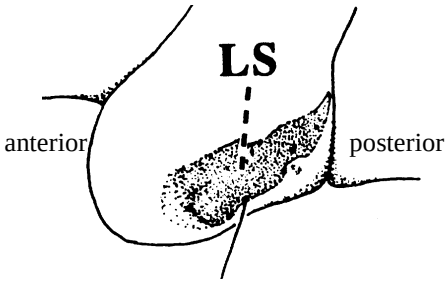

Fig. 201. [from Floyd (1994)].

Postgenal sclerites not demarcated by dark and pale areas, shape of lateral sclerite of abdominal segment I variable 3

3(2) Metasternum with 2 setae; swimming hairs present on hind tibiae (Fig. 202); hind tarsi longer than tarsal claws (Fig. 202); case constructed of root or plant fragments placed transversely 4

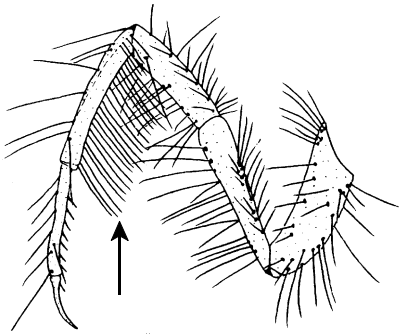

Fig. 202. [from Floyd (1994)].

Metasternum with more than 2 setae (except *O. osteni* which may have only 2), often with row of 10 or more; swimming hairs absent on hind tibiae (Fig. 203); hind tarsi each as short as or shorter than its tarsal claw (Fig. 203); case constructed of sand grains or irregularly placed plant or detrital pieces 6

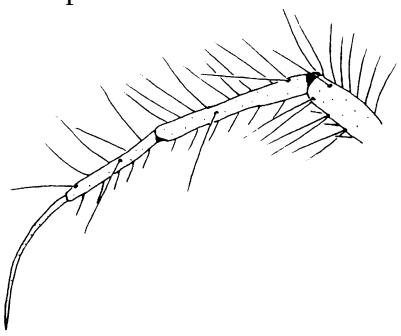

Fig. 203. [from Floyd (1994)].

4(3) Head brown with light muscle scars (Figs. 204, 205); case constructed either of short twigs or roots (angled "log cabin" appearance) (Fig. 206) or thin, flat, quadrate, plant fragments (Fig. 207); on vegetation in lakes, some slow-moving streams . . . . . *O. cinerascens* (Hagen)

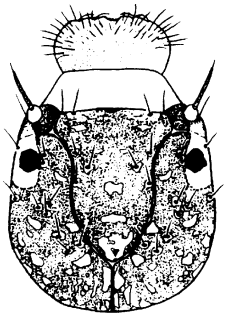

Fig. 204. [from Floyd (1994)].

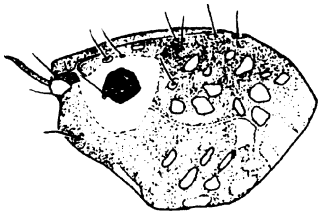

Fig. 205. [from Floyd (1994)].

Fig. 206. [from Floyd (1994)].

Fig. 207. [from Floyd (1994)].

Head yellow with dark muscle scars or pale; case exterior more rounded and often curved, especially in early instars (Fig. 208); on roots, woody debris, and vegetation in streams 5

Fig. 208. [from Floyd (1994)].

5(4) Head with scattered, well-defined muscle scars (Fig. 209); antennae short, reaching posterior edge of labrum (Fig. 209) . . . . . *O. persimilis* (Banks)

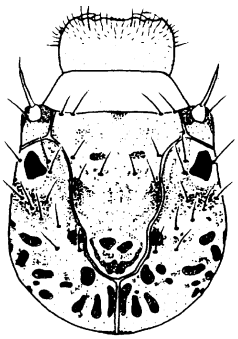

Fig. 209. [from Floyd (1994)].

Head without dark, well-defined muscle scars (Fig. 210); antennae longer, reaching to middle of labrum (Fig. 210) . . . . . *O. georgia* Ross

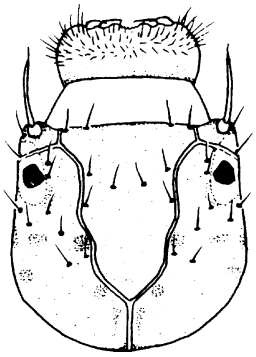

Fig. 210. [from Floyd (1994)].

6(3) Mesonotum with pair of irregular dark areas on each side of meson (Fig. 211); coronal suture bordered by row of 3-4 dark muscle scars on each side (Fig. 212); left mandible with deep crease running from apical tooth (Fig. 213); case constructed of sand grains . . . . . *O. osteni* Milne

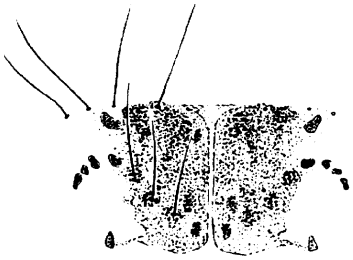

Fig. 211. [from Floyd (1994)].

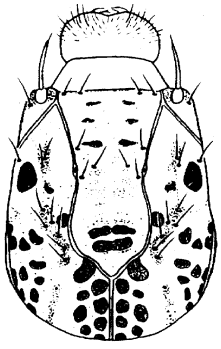

Fig. 212. [from Floyd (1994)].

Fig. 213. [from Floyd (1994)].

Mesonotum without distinct pair of irregular dark areas; coronal suture bordered by 0-2 muscle scars; left mandible without crease; case constructed of plant or sand grains 7

7(6) Antennae long, reaching at least to anterior edge of labrum (Fig. 214); case as shown in Figures 215, 216; on vegetation in natural lakes . . . . . *O. parva* (Banks)

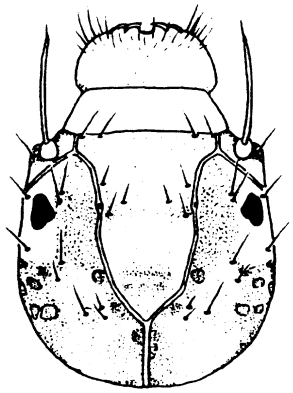

Fig. 214. [from Floyd (1994)].

Fig. 215. [from Floyd (1994)].

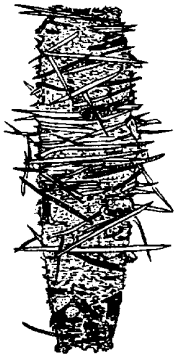

Fig. 216. [from Floyd (1994)].

Antennae short, reaching only to posterior edge of labrum 8

8(7) Head and pronotum usually with several light brown muscle scars (Figs. 217, 218); case constucted of sand or rock pieces with larger ballast stones attached to the sides (Figs. 219, 220) . . . . . *O. nocturna* Ross

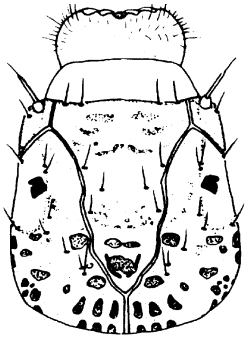

Fig. 217. [from Floyd (1994)].

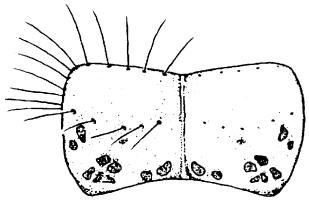

Fig. 218. [from Floyd (1994)].

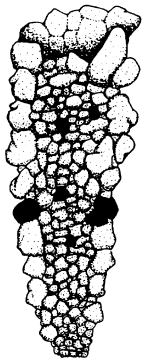

Fig. 219. [from Floyd (1994)].

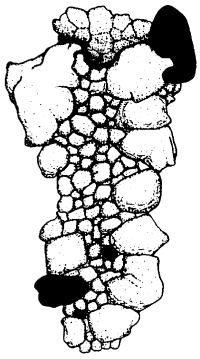

Fig. 220. [from Floyd (1994)].

Head and pronotum pale or with various combinations of dark muscle scars, spots, or stripes; case constructed of variety of materials 9

9(8) Head and pronotum covered with dense, brown markings in addition to well-defined muscle scars (Figs. 221, 222); ventral apotome reddish-brown, subrectangular (Fig. 223); case constructed of sand, curved, and with a very smooth exterior (Fig. 224); sand-bottomed lakes . . . . . *O. porteri* Ross

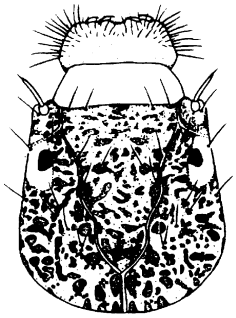

Fig. 221. [from Floyd (1994)].

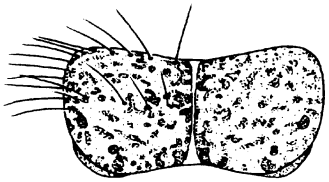

Fig. 222. [from Floyd (1994)].

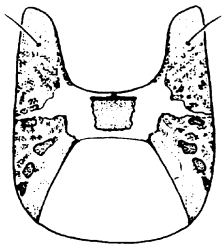

Fig. 223. [from Floyd (1994)].

Fig. 224. [from Floyd (1994)].

Head and pronotum with variable markings; ventral apotome variable; case constructed of sand or plant/detrital pieces; diverse habitats . . . . . *O. inconspicua* complex** 10

10(9) Mesosternum with irregular patch of 80 to 100 setae; case somewhat flattened dorsoventrally, composed of sand; dorsum of hind legs dark brown; head and pronotum dark brown with pattern as shown in Figs. 225, 226 . . . . . *Oecetis* sp. C Floyd

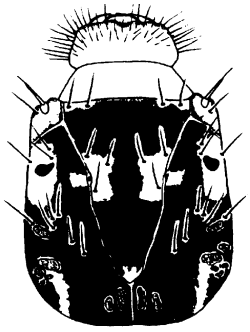

Fig. 225. [from Floyd (1994)].

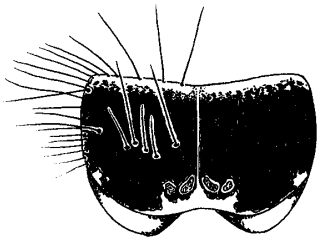

Fig. 226. [from Floyd (1994)].

Mesosternum with no more than 6 setae; case tubular, composed of sand or woody debris; dorsum of hind legs same color as rest of leg; head and pronotum pattern not as above 11

11(10) Head with dark longitudinal stripe on middle of frontoclypeus (Fig. 227); ventral apotome dark brown . . . . . *Oecetis* sp. E Floyd

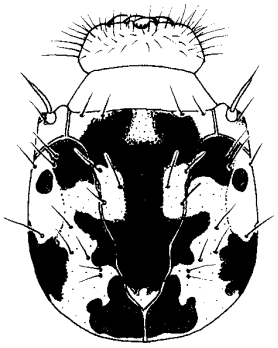

Fig. 227. [from Floyd (1994)].

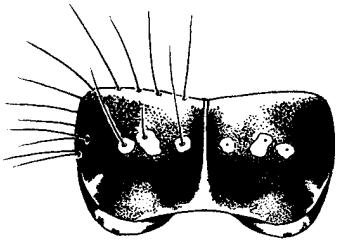

Fig. 228. [from Floyd (1994)].

Head without dark longitudinal stripe on frontoclypeus; ventral apotome light brown or yellow 12

12(11) Metanotum with no more than 4 sa3 setae; metasternum with row of 8-15 setae; head and pronotum as shown in Figs. 229, 230; case constructed of sand
. . . . . *Oecetis* sp. F Floyd

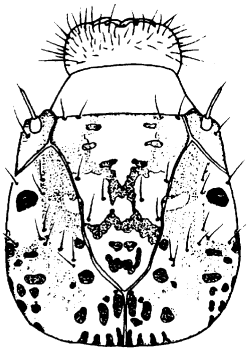

Fig. 229. [from Floyd (1994)].

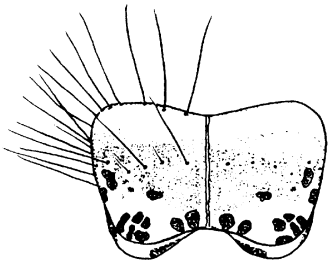

Fig. 230. [from Floyd (1994)].

Metanotum with 8-9 sa3 setae; metasternum with 30-36 setae; head and pronotum as shown in Figs. 231, 232; case constructed of wood and bits of detritus
. . . . . *Oecetis* sp. A Floyd

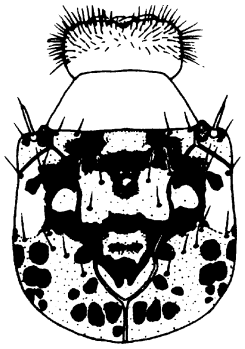

Fig. 231 [from Floyd (1994)].

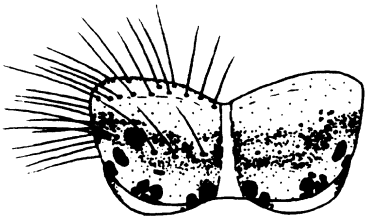

Fig. 232. [from Floyd (1994)].

* Key does not include *O. daytona*, *O. ditissa*, *O. inconspicua*, *O. pratelia*. Larvae of these species are unknown.

** The actual number of species belonging to the *O. inconspicua* complex is unknown. It contains at least 7 North American species of which *Oecetis* species A, C, E, and F occur in Florida.

Genus ***Setodes*** Rambur

DIAGNOSIS: Larvae of *Setodes* are distinguished from other leptocerid genera by the presence of sclerotized concave plates with marginal spines on each side of anal opening (Fig. 141).

NOTES: Eight recognized species of *Setodes* are known to occur in North America. The genus is represented in the state by possibly three species: *S. guttatus*, *S. dixiensis* ?, and *Setodes* n. sp., all of which appear to be restricted in Florida to streams within the Chipola River Basin. All specimens that we have examined were either collected in the main river stem or from tributaries (Dry Creek and Rocky Creek, Jackson County). Adults of *Setodes* n. sp. were collected in large numbers along Rocky Creek and the Chipola River in the middle part of May. The adult of the new species is being described by S. C. Harris and A. K. Rasmussen.

Larvae of the eight North American species of *Setodes* were described and keyed in Nations (1994). Prior to that, only the larvae of *S. incerta* (=*incertus*) were known (Merrill and Wiggins, 1971). Nations (1994) found that there is little morphological variation among the larvae; however differences in head coloration and gill structure were deemed suitable characters for differentiating the species. Larval cases of *Setodes* are cylindrical, generally straight, with little or no taper, and constructed of flat sand grains fitted tightly together. The posterior end of the larval case is open and without a sieve plate or other obstruction. Larvae are known to burrow into sand and are able to reverse their position within the case, hence the advantage of a non-tapering case which is open and essentially the same at both ends (Merrill and Wiggins, 1971).

Setodes spp. are primarily rheophilics and can be collected in pockets of sand on limestone shoals or from sand deposited on the leeward side of rocks in riffle areas. Larvae may also be found with their cases attached to stones by thick cords of silk (Nations, 1994). Nations (1994) surmised that this adaptation allows the larva to graze the surface of the stone effectively in the 360^{o} area around the point of attachment, while maintaining its position in rapid current via the anchor line.

A tentative key to Florida *Setodes* is presented below. The key is considered tentative since it is based on only 25 larvae; hopefully improvements can be made as more specimens are collected and examined. *Setodes* larvae with many dorsal gills can be confidently determined as *S. guttatus*. Larvae examined by Nations that key to *S. dixiensis*? were found to fit the description of *S. dixiensis* in Alabama, but some of the Florida specimens included a pair of dorsal gills on abdominal segment III, thus the uncertainty. Both *S. guttatus* and *Setodes* n. sp. have variable head coloration which includes a light and dark morph. *Setodes* n. sp. can be distinguished from *S. dixiensis* by the single pair of forked gills on the ventral surface of abdominal segment II.

ADDITIONAL REFERENCES: Merrill and Wiggins (1971); Nations (1994); Wiggins (1996a).

TENTATIVE KEY TO SPECIES FOR LARVAE OF FLORIDA *SETODES*

[key and figures prepared by Victoria C. Nations]

1. One pair of forked or single gills on dorsal surface of abdominal segments 5-7 (and usually segments 2-4), and forked and single gills on ventral surface of abdominal segments 2-7 (Fig. 233); head tan or completely dark brown, with ring of lighter color around each eye spot (Figs. 234, 235) . . . . . *S. guttatus* (Banks)

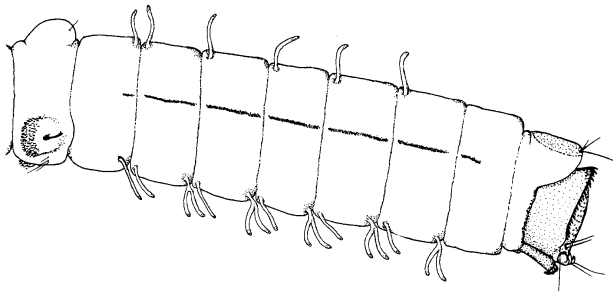

Fig. 233.

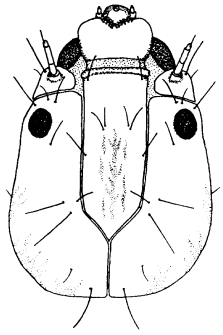

Fig. 234.

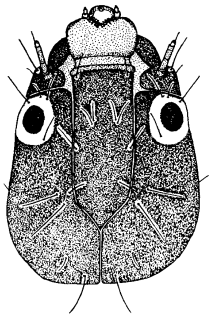

Fig. 235.

No more than one pair of gills on dorsal surface of abdomen 2

2(1) Single gills on ventral surface of abdominal segments 2-7, and sometimes one pair of single gills on dorsal surface of abdominal segment 3 (Fig. 236); head tan, perhaps with darker mottling or streaks (as in Fig. 234) . . . . . *S. dixiensis* Holzenthal ?

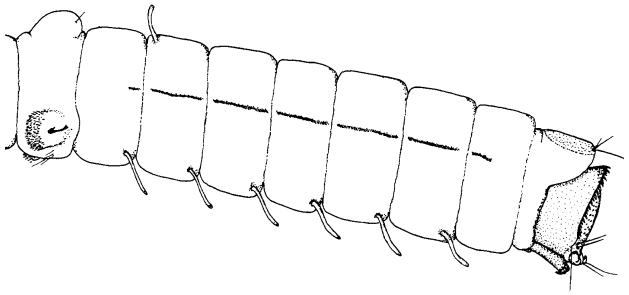

Fig. 236.

Forked gills on ventral surface of abdominal segment 2, and single gills on ventral surface of abdominal segments 3-7 (Fig. 237); head tan (as in Fig. 234) or completely dark brown with ring of lighter color around each eye spot (as in Fig. 235) . . . . . *Setodes* n. sp.

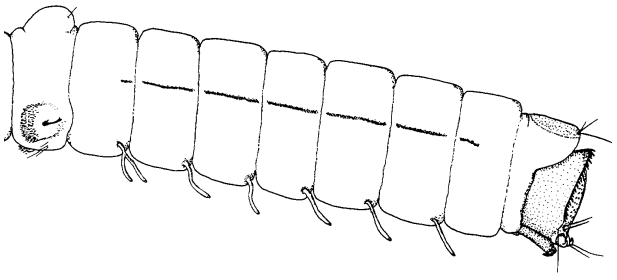

Fig. 237.

Genus ***Triaenodes*** MacLachlan

DIAGNOSIS: Larvae of *Triaenodes* are characterized as follows: ventral apotome of head rectangular (Fig. 154), except in early instars where it may appear triangular; tibia of each hind leg with constriction near center (Fig. 155); hind legs usually with dense fringes of long setae (swimming hairs), except in *T. perna, T. helo,* and *T. taenia* in which setae not nearly as dense. Larval cases of *Triaenodes*, unusual among North American trichopteran genera, are constructed of spirally arranged plant pieces (Fig. 157); the cases are usually long and tapered with the exception of *T. perna* and *T. helo*, which have cases only slightly longer than the larvae and tapered only slightly.

NOTES: According to Glover (1996) twenty-three species of *Triaenodes* occur in North America. In Florida we have documented 14 species, including a previously unknown species (See Appendix A). There are an additional four species that are likely to occur in Florida based on their known distributions. The publication of Glover (1996) on larval taxonomy and biology of *Triaenodes* has provided an excellent key to species for 19 of the 23 species. Of the *Triaenodes* species known or likely to occur in Florida only the larva of *T. smithi* and *Triaenodes* n. sp. are unknown.

Larvae occur in two basic habitats: submerged roots of riparian vegetation and aquatic macrophytes. They inhabit the full range of lotic and lentic environments. Successful collecting can be done by vigorously shaking or kicking root mats into a collecting net or hand screen. Aquatic plants can be sampled by sweeping a dipnet through the plants.

Glover (1996) reported that species found predominately in lotic roots show a tendency for parallel stripes on the dorsum of the head, reduced swimming hairs on the hind legs, and reduced abdominal gills. Lentic species occurring in macrophytes usually have spotted heads or heads with light brown lines, well developed swimming hairs, and well developed abdominal gills. Patterns of muscle scars and other pigmentation of the head and pro- and mesothorax, and chaetotaxy of the metathoracic legs are the most useful characters for species identification (Glover, 1996). Case structure, while distinctive to the genus, varies little among different species. The case is constructed of spirally arranged pieces of aquatic macrophytes or the tips of roots from riparian vegetation.

SPECIES NOTES:

Triaenodes aba - This is an uncommon species in Florida. Gordon (1984) reported it from Columbia County. We have collected adults on two occasions from streams in Jefferson and Liberty counties. Glover (1996) considers it to be a macrophyte species.

Triaenodes flavescens - Considered a macrophyte species, found in both lentic and lotic habitats. We have collected larvae in aquatic macrophytes from the St. Marks River, Wakulla Co.

Triaenodes florida - Widespread in lakes throughout Florida, occurring among macrophytes. Glover (1996) reported collecting large numbers in emergent sedges and coontail (*Myriopyllum*) from Lucas Lake,Washington Co. Identification of this species is quite easy, as the black bands surrounding leg segments are distinctive. The case is light, long and tapered making this species an especially proficient swimmer (Glover, 1996).

Triaenodes furcella - Endemic to peninsular Florida where it is widespread in both lakes and streams. We have examined larvae of this species collected from North Prong Alligator Ck., Charlotte Co.; Fisheating Ck., Glades Co.; and Lake Placid and Arbuckle Ck., Highlands Co., and Sweetwater Ck., Putnam County. Deyrup and Franz (1994) listed this species as Threatened.

Triaenodes helo - Widely distributed across the state. It has been reported from streams of Eglin Air Force Base (Harris et al., 1982); steephead streams along the Apalachicola River (Rasmussen, 2004) and Highlands Hammock State Park and an unnamed tributary of Six Mile Creek, Duval County (Glover, 1996). *Triaenodes helo* is closely related to *T. perna* and positive identification of the larvae is still considered unresolved (Glover, 1996). However, Glover (1996) indicated that the head of *T. helo* usually has a strong mesal indentation along the posterior edge of dark pigmentation near the occipital foramen, while in *T. perna* the line of dark pigmentation is nearly straight.

Triaenodes ignitus - The most widespread and common species in Florida, as well as North America. It is mainly a lotic root species which can occur in large numbers. Tolerant of a wide range of water quality conditions, this species has been collected in a wide array of lotic habitats, from small spring-fed streams to larger rivers such as the Suwannee and Apalachicola.

Triaenodes injustus - Widely distributed in the eastern U.S., although not commonly found in coastal areas (Glover, 1993). This species has not been reported within the state; however it is likely to occur, having been recorded from the Blackwater River basin, Covington Co., Alabama (Harris et al., 1991).

Triaenodes marginatus - Another species that probably occurs in North Florida, although we have not collected nor seen any record of it. It has been collected to a limited extent in southern Alabama, Apalachicola River Basin (Harris et al., 1991).

Triaenodes melaca - This species probably occurs in Florida, although there is no record of it. The species has been collected in southern Alabama where it occurs in cool, gravel-bottom streams and rivers (Harris et al., 1991).

Triaenodes n. sp. - An adult male of this new species was collected from Lowry Lake Run on Camp Blanding Training Center in Clay County. We are in the process of describing the new species. The larva remains unknown.

Triaenodes new sp. A Glover - Endemic to the southeastern United States, found primarily in small headwater streams and swamps of Alabama and the western portions of the Florida panhandle. Rasmussen (2004) reported collecting adults of this species from several streams on Eglin Air Force Base. According to Glover (1996), larval identification should be considered tentative until further associations have been done.

Triaenodes new sp. C Glover - This species is known to occur only in North Carolina, South Carolina, and Florida (Glover, 1996). We have examined larvae collected from a wet prairie pond in Clay County; and an unnamed pond in the Ocala National Forest (Lake Co.) when in May, mature larvae were abundant in emergent sedges inundated by the pond.

Triaenodes nox - Probably widely distributed in North Florida but uncommon. It has been collected in aquatic macrophytes from Lake Miccosukee, Jefferson Co.; and the Escambia River Basin, Escambia Co., Alabama (Harris et al., 1991).

Triaenodes ochraceus - This species is not commonly found in Florida. We have collected larvae from the upper Aucilla River, Jefferson/Madison Co. and Attapulgus Creek, in Gadsden County. It has also been reported from an unnamed tributary of Six Mile Creek, Duval Co. (Glover, 1996).

Triaenodes perna - Widespread in North Florida. It may be collected in roots of riparian vegetation from small streams to large rivers or swamps (Glover, 1996). This species lacks the dense fringe of swimming hairs, and the dorsum of the head is very black, like that of *T. helo*. Possible distinguishing characters are described under *T. helo.*

Triaenodes smithi - Present in the Blackwater and Chipola river basins in southern Alabama (Harris et al., 1991) and likely to occur in Florida. Besides *Triaenodes* n. sp. this is the only *Triaenodes* species thought to occur in Florida in which the larvae have not yet been associated with the adults.

Triaenodes tardus - This species is more northern in its distribution and is uncommon in Florida. The extent of its presence in lakes of North Florida is unknown; sampling of macrophytes should provide more information on Florida distribution. The larval association, made by Glover (1996), is based on larvae collected along with a pharate male pupa from Lake Jackson, Leon Co. We have collected adults from Deep Ck., Putnam County as well as from several streams in the central panhandle.

ADDITIONAL REFERENCES: Ross (1944); Manuel and Braatz (1984); Glover (1996); Wiggins (1996a).

KEY TO SPECIES FOR MATURE LARVAE OF FLORIDA *TRIAENODES* *

[adapted from Glover (1993)]

1. Dorsum of head almost completely black (Fig. 238); swimming hairs on rear legs reduced (Fig. 239); antennae unpigmented (Fig. 238); case usually only slightly longer than larva and composed of tips of rootlets of riparian vegetation . . . . . *T. perna/helo*

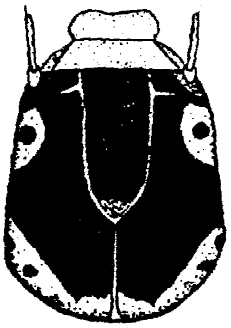

Fig. 238. [from Glover (1993)].

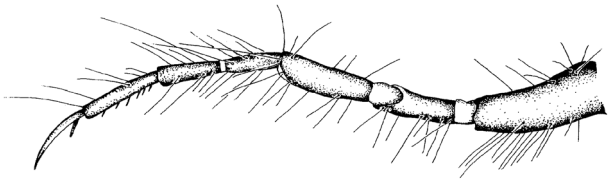

Fig. 239. [from Glover (1993)].

Dorsum of head not as above, marked with dark parallel stripes, muscle scars, or combination of both; swimming hairs usually well developed (Fig. 240); antennae pigmented or unpigmented; case usually long and tapered, composed of rootlets or aquatic macrophytes 2

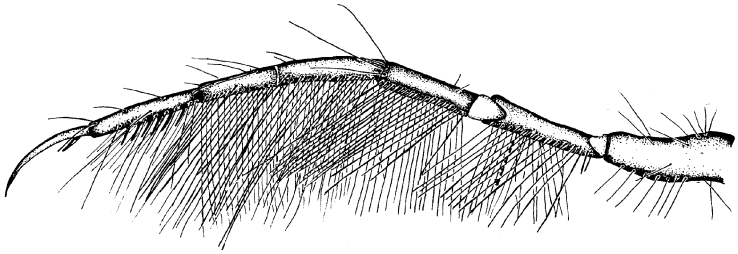

Fig. 240. [from Glover (1993)].

2(1) Conspicuous pattern of four inner muscle scars from occipital foramen to base of frontoclypeal suture on either side of coronal suture (Fig. 241); other dorsal muscle scars often present 3

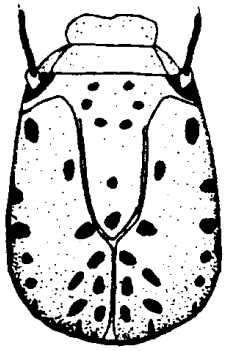

Fig. 241. [from Glover (1993)].

Dorsum of head capsule with inner muscle scars connected by dark pigment forming brown or black lines parallel with frontoclypeal and coronal sutures from subocular lines to occipital foramen (Figs. 242, 243); at most two inner muscle scars parallel to coronal suture but usually appearing light brown or lighter than background color 12

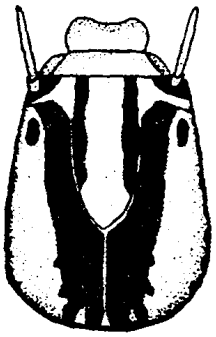

Fig. 242. [from Glover (1993)].

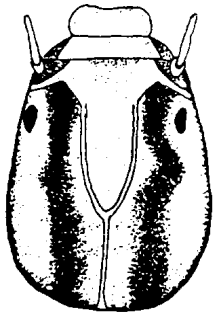

Fig. 243. [from Glover (1993)].

3(2) Dorsum of head with parallel black lines extending from subocular line posteriorly and parallelling at least part of coronal suture, gradually broken into muscle scars near occipital foramen (Fig. 244); longitudinal black lines on frontoclypeal apotome well developed; antennae black, sometimes tipped in white 4

Fig. 244. [from Glover (1993)].

Dorsum of head without such black lines, although sometimes diffuse dark lines along outside of frontoclypeal sutures present but not encompassing coronal suture scars (Fig. 245); head with pattern of muscle scars; without thick black longitudinal lines on frontoclypeus, although thin broken lines sometimes present (Fig. 246); antennae pale, brown or black 5

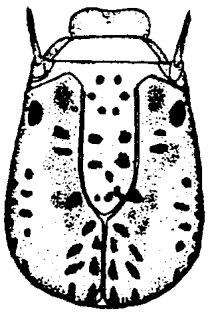

Fig. 245. [from Glover (1993)].

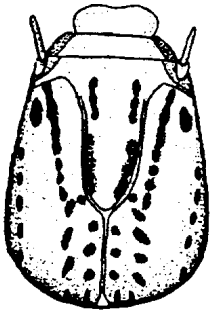

Fig. 246. [from Glover (1993)].

4(3) Ventral apotome appearing brown in places; anterior portion of pronotum also slightly pigmented (Fig. 247) . . . . . *T. furcellus* Ross

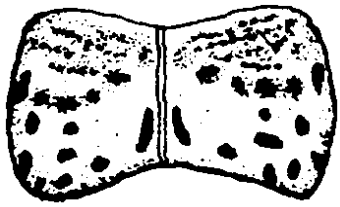

Fig. 247. [from Glover (1993)].

Ventral apotome pale, without pigmentation; anterior portion of pronotum pale (Fig. 248) . . . . . *T. injustus* (Hagen)

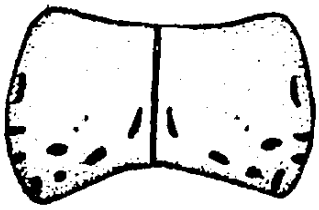

Fig. 248. [from Glover (1993)].

5(3) Legs with conspicuous black bands at joints; antennae black (Fig. 249); case long and tapering, constructed of aquatic macrophytes . . . . . *T. florida* Ross

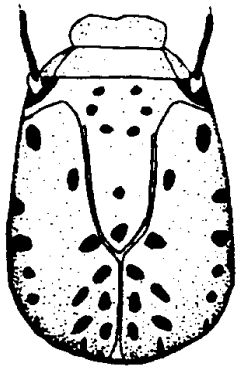

Fig. 249. [from Glover (1993)].

Legs without conspicuous black bands at joints; antennae black or pale 6

6(5) Swimming hairs on metathoracic legs much reduced as in Fig. 239; head pattern as in Fig. 250 . . . . . *T. taenia* Ross

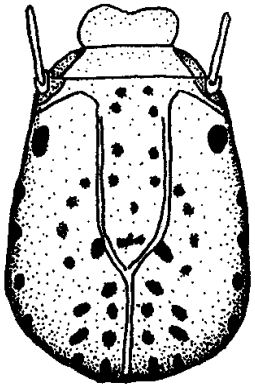

Fig. 250. [from Glover (1993)].

Swimming hairs on metathoracic legs well developed (Fig. 240); head pattern may be similar to Fig. 250 or otherwise 7

7(6) Muscle scars reduced on pronotum and mesonotum (Fig. 251); antennae usually pale . . . . . *T. tardus* Milne

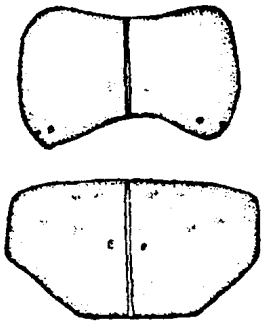

Fig. 251. [from Glover (1993)].

Muscle scars well developed on pronotum and mesonotum (Fig. 252); antennae pale or dark 8

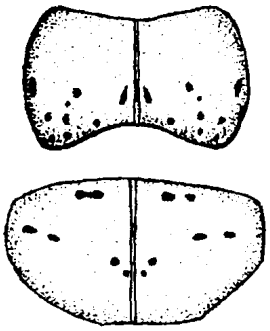

Fig. 252. [from Glover (1993)].

8(7) Head in dorsal view with parallel dark stripes or diffuse shading along outer portion of frontoclypeal suture (Figs. 253, 254); scars never present at base of ventral apotome; antennae brown or sometimes black, base usually lighter than tip 9

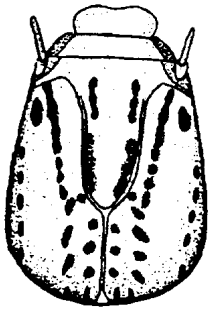

Fig. 253. [from Glover (1993)].

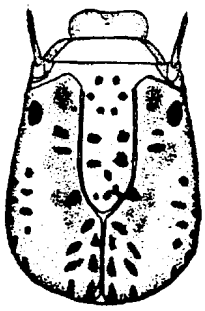

Fig. 254. [from Glover (1993)].

Head in dorsal view not as above (Fig. 255); scars sometimes present at base of ventral apotome (Fig. 256); pigmentation of antennae variable 10

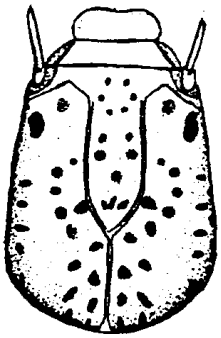

Fig. 255. [from Glover (1993)].

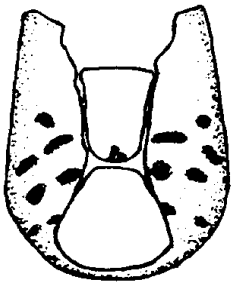

Fig. 256. [from Glover (1993)].

9(8) Parallel lines outside frontoclypeal sutures thin (Fig. 257); frontoclypeal muscle scars usually coalesced to form thin parallel lines; pronotum background color uniform . . . . . *T. flavescens* Banks, in part

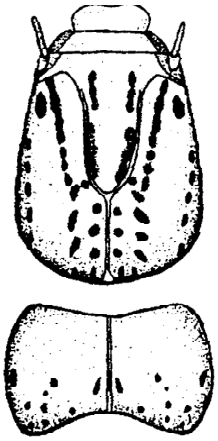

Fig. 257. [from Glover (1993)].

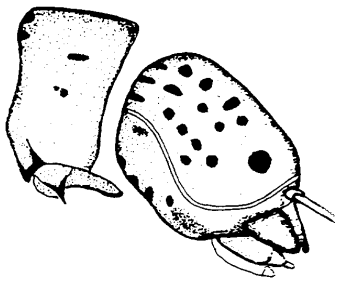

Fig. 258. [from Glover (1993)].

Parallel lines outside frontoclypeal sutures usually wide and diffuse (Fig. 259); frontoclypeal muscle scars not coalesced; anterior portion of pronotum loosely pigmented . . . . . *T. ochraceus* (Betten and Mosely)

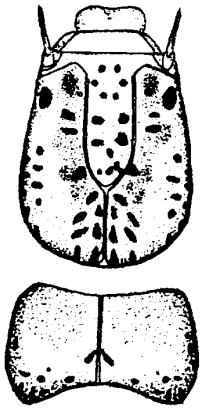

Fig. 259. [from Glover (1993)].

10(8) Head in dorsal view with series of five or six muscle scars in semicircle on each side of ecdysial line, first at midpoint of frontoclypeal suture and last where frontoclypeal suture joins coronal suture (Fig. 260); antennae without pigmentation; muscle scars usually present at base of ventral apotome (Fig. 261) 11

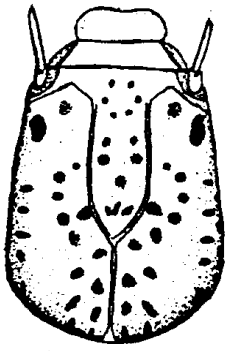

Fig. 260. [from Glover (1993)].

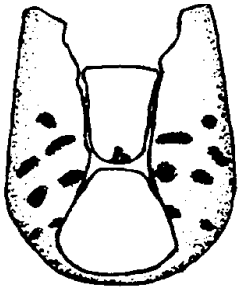

Fig. 261. [from Glover (1993)].

Head without semicircle of muscle scars (Fig. 262); antennae usually lightly pigmented to black; muscle scars absent from base of ventral apotome . . . . . *T. flavescens* Banks, in part

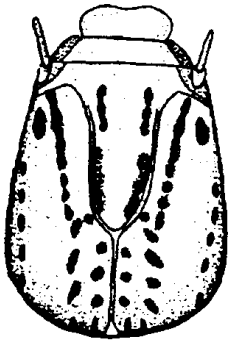

Fig. 262. [from Glover (1993)].

11(10) Muscle scars present on ventral apotome (Fig. 263); head pattern as in Fig. 264; anterior fringe of tarsal swimming hairs absent from metathoracic legs . . . . . *T. ignitus* (Walker)

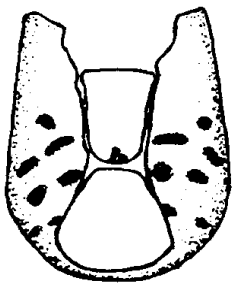

Fig. 263. [from Glover (1993)].

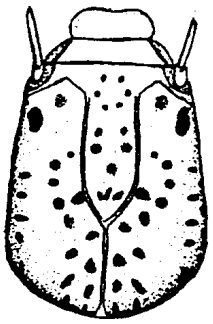

Fig. 264. [from Glover (1993)].

Muscle scars absent from ventral apotome; head pattern as in Fig. 265; anterior fringe of tarsal swimming hairs present on each metathoracic leg . . . . . *Triaenodes* n. sp. A ?

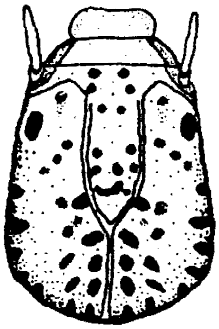

Fig. 265. [from Glover (1993)].

12(2) Dorsal head stripes diffuse, not appearing to be sharply delineated, often appearing brown and having muscle scars parallel to coronal suture lighter than background color (Figs. 266, 267); pronotum often with pair of complete or incomplete longitudinal stripes; antennae usually pale 13

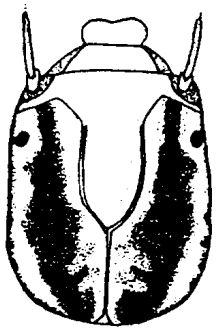

Fig. 266. [from Glover (1993)].

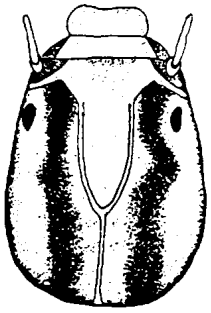

Fig. 267. [from Glover (1993)].

Dorsal head stripes black and well defined, without light muscle scars parallel to coronal suture (Fig. 268); pronotum without longitudinal stripes; antennae usually black 14

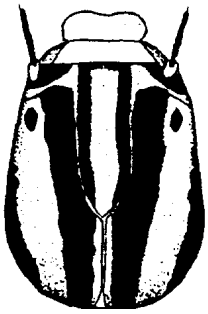

Fig. 268. [from Glover (1993)].

13(12) Dark stripes often covering most of dorsum of head (Fig. 269); pronotum with pair of triangular patches of pigmentation anteriorly (Fig. 270); mesonotum with large mesal region darkened (Fig. 270) . . . . . *Triaenodes* n. sp. C

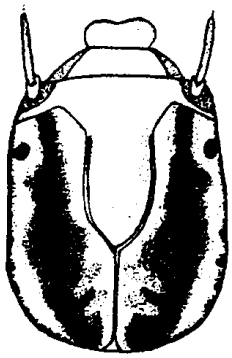

Fig. 269. [from Glover (1993)].

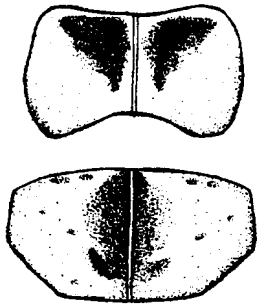

Fig. 270. [from Glover (1993)].

Dark stripes of dorsum of head narrower than above (Fig. 271); pronotum usually with pair of complete longitudinal stripes (Fig. 272); mesonotum without large region of pigmentation (Fig. 272) . . . . . *T. nox* Ross

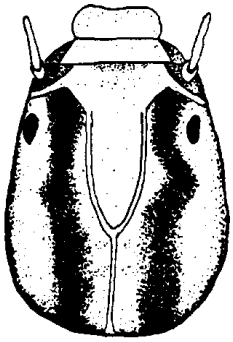

Fig. 271. [from Glover (1993)].

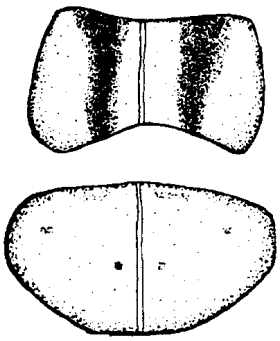

Fig. 272. [from Glover (1993)].

14(12) Pronotum nearly completely black, sometimes with small unpigmented area posteromesally (Fig. 273) . . . . . *T. melacus* Ross

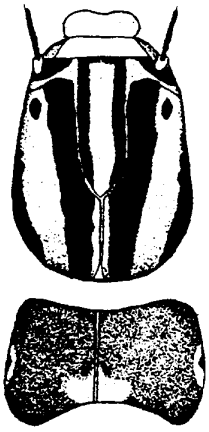

Fig. 273. [from Glover (1993)].

Pronotum light with muscle scars and sometimes small patches of pigmentation near anterior margin (Figs. 274, 275) 15

Fig. 274. [from Glover (1993)].

Fig. 275. [from Glover (1993)].

15(14) Postgenae with distinct muscle scars present (Fig. 276); antennae pale or black . . . . . *T. abus* Milne

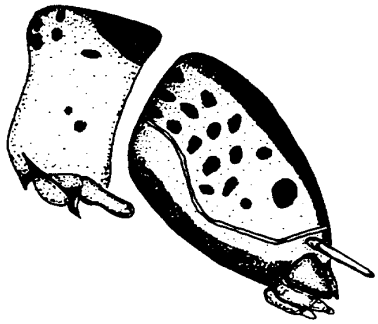

Fig. 276. [from Glover (1993)].

Postgenal muscle scars coalesced to form stripes (Fig. 277); antennae black
. . . . . *T. marginatus* Sibley

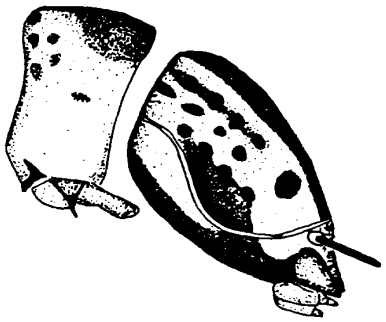

Fig. 277. [from Glover (1993)].

* Key does not include *Triaenodes smithi* and *Triaenodes* n. sp. Larvae of these species are unknown.

FAMILY LIMNEPHILIDAE

Considered the largest caddisfly family in North America, with more than 300 species assigned to 39 genera, the Limnephilidae are represented in Florida by only two genera, *Ironoquia* and *Pycnopsyche*. Limnephilid larvae are distinguished morphologically by the following combination of characters: antennae located halfway between anterior margin of head capsule and eye (Fig. 64); anterior margin of pronotum straight (Fig. 63); prosternal horn not reduced (Fig. 64); and basal seta of tarsal claw short, not extending to tip of claw. The larval cases are constructed of plant materials or rock fragments with rough or irregular texture. Limnephilid larvae live in a wide variety of lotic habitats ranging from temporary or permanent streams, springs, spring seeps, rivers, and lentic environments which include pools, ponds, marshes, swamps, and lakes (Unzicker et al., 1982).

KEY TO GENERA FOR LARVAE OF FLORIDA LIMNEPHILIDAE

1. Abdominal gills single or unbranched; lateral hump of abdominal segment I with one long sclerite adjacent to base, the sclerite sometimes only lightly pigmented but distinguishable by the smooth and relatively shinier surface (Fig. 278)
. . . . . *Pycnopsyche*

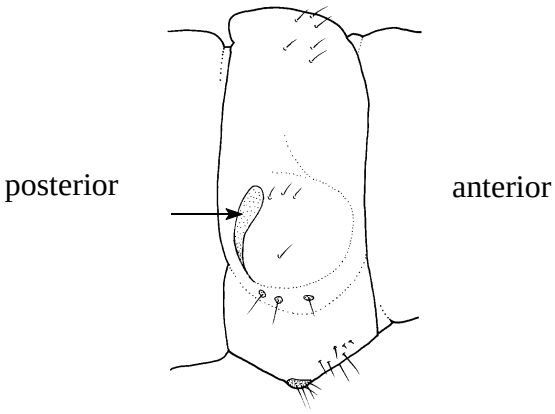

Fig. 278.

Most abdominal gills with multiple branching of up to 10-15 filaments; sclerite absent from area adjacent to base of lateral hump.
. . . . . *Ironoquia*, *I. punctatissima* (Walker)

Genus ***Ironoquia*** Banks

DIAGNOSIS: Larvae of *Ironoquia* are characterized as follows: multibranched abdominal gills; lack of sclerite adjacent to base of lateral hump; and meso- and metathoracic femora each with 5-7 major setae along ventral edge. The cylindrical larval cases are slightly tapered and curved, and constructed of either sand grains or pieces of plant materials.

NOTES: The larva of *Ironoquia punctatissima*, the only species of *Ironoquia* represented in Florida, was first described by Flint (1960). The larvae are characterized by the distinct dark spots and infuscations of the head and thoracic nota.

Ironoquia punctatissima appears to be uncommon in Florida; we have examined larvae from only three localities in the state: Ochlockonee River, near State Road 12; and St. Marks River, and Black Creek at Baum Road, Leon County. Previously, one adult male specimen was collected from the Tall Timbers research station in Leon County and reported by Gordon (1984).

Little is known about the life history of *Ironoquia punctatissima* in Florida. The late instars were collected in February. The adult from Tall Timbers was collected in November. The species has been reported to have a univoltine life cycle in temporary streams (Unzicker et al., 1982), and adults have been collected in September in the Northeast (Flint, 1960) and in July to early October in North and South Carolina (Unzicker et al., 1982). *Ironoquia punctatissima* and other species in this genus are known to migrate as larvae from drying streams in late spring to bankside leaf litter where they aestivate and pupate terrestrially (Flint, 1958; Williams and Williams, 1975; Alexander and Whiles, 2000.)

ADDITIONAL REFERENCES: Flint (1960); Wiggins (1996a).

Genus ***Pycnopsyche*** Banks

DIAGNOSIS: Larvae of *Pycnopsyche* are characterized as follows: single and unbranched abdominal gills; presence of long sclerite adjacent to base of lateral hump on abdominal segment I (Fig. 278); and metanotal sa1 sclerites not fused (although often close together) along midline as in *Hydatophylax* (Fig. 63). The variously shaped, occasionally 3-sided, larval cases are constructed from twigs, leaves, sand, and gravel.

NOTES: Based on adult collections, two species of *Pycnopsyche* are known to occur in Florida (*P. antica* and *P. indiana*). *Pycnopsyche antica* is the most common of the two and has been reported from Leon Co. (Gordon, 1984), Gadsden and Okaloosa counties (Wojtowicz, 1982); Rasmussen (2004) reported *P. antica* was common and abundant in ravine streams across northern Florida. *Pycnopsyche indiana* has only been reported from Calhoun, Okaloosa, and Seminole counties (Rasmussen and Denson, 2000). *Pycnopsyche indiana* appears to occur more in tannic lowland streams, whereas *P. antica* is abundant in spring-fed sandhill streams.

Pycnopsyche scabripennis has also been reported to occur in Florida (Harris et al., 1982; Gordon, 1984); however, these identifications predated Wojtowicz's (1982) dissertation on *Pycnopsyche*, which included a revision of the *P. scabripennis* species complex, where he indicated that the species *P. scabripennis* southern most range is limited to the Virginias. Previous reports of *P. scabripennis* in Florida are very likely to be *P. antica*. The previous report of *P. guttifera* in Florida by Gordon (1984) was in error. After a re-examination of *Pycnopsyche* adults reported by Gordon (1984) as *P. guttifera*, we discovered they had been misidentified and were actually *P. antica*.

Larvae of *Pycnopsyche* have been collected from a wide variety of stream types across North Florida. Unfortunately, the lack of reliable larval characters makes it very difficult to distinguish species of *Pycnopsyche*. Larval descriptions of *P. indiana* and *P. antica* by Wojtowicz (1982) indicated that these species cannot be reliably separated based on larval or case morphology. The case structure of *P. antica* and *P. indiana* is variable. *Pycnopsyche antica* constructs a case either of firmly attached wood pieces (Fig. 279) or of leaf fragments arranged to form a 3-sided case, or a combination of both. Likewise, the case structure of *P. indiana* is variable, composed either totally of plant material (similar to *P. antica*) or of a mix of plant and mineral materials (Wojtowicz, 1982). Last instars (16-21 mm in length) of *P. indiana* are 5-10 mm shorter than those of *P. antica* (Rasmussen and Denson, 2000).

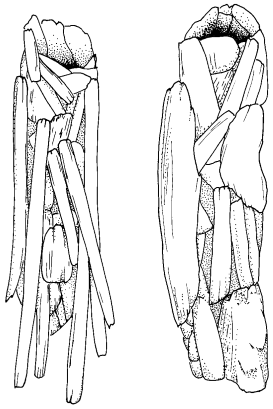

Fig. 279. *Pycnopsyche antica*, larval cases.

ADDITIONAL REFERENCES: Ross (1944); Flint (1960); Wojtowicz (1982); Wiggins (1996a).

FAMILY MOLANNIDAE

The family Molannidae is represented in the Nearctic Region by two genera, *Molanna* and *Molannodes*. The Florida fauna includes only the genus *Molanna*. Late instar molannids can be distinguished from other caddis families by the presence of reduced metatarsal claws (Fig. 37) and case constructed of quartz pieces with a dorsal hood and lateral flanges (Fig. 38). Molannids occur in a wide range of lotic habitats throughout North Florida extending into central Florida.

Genus ***Molanna*** Curtis

DIAGNOSIS: Larvae of *Molanna* are characterized as follows: tarsal claw of each metathoracic leg setose, and greatly reduced compared to those on fore- and mesothoracic legs (Fig. 37); and abdominal gill filaments with two to four branches. The larval case is composed of coarse sand and features a prominent lateral flange and dorsal hood over the anterior end, giving the case a flattened appearance (Fig. 38).

NOTES: Three of the six North American species of *Molanna* are found in Florida (*M. blenda*, *M. tryphena*, and *M. ulmerina*). Sherberger and Wallace (1971) described the larvae of *M. blenda* and *M. tryphena*, and discussed their ecology and biology as well. The larvae of these species are distinguished morphologically by the development of the foretibial spine and the shape of the membranous frontal constrictions, as indicated in the following key to species. Recent larva/adult associations of *Molanna ulmerina* by Dana Denson has revealed that *M. ulmerina* can be easily separated from the other two species by the much narrower black banding on the dorsum of the head.

Molanna blenda, *M. tryphena*, and *M. ulmerina* are lotic dwellers. Sherberger and Wallace (1971) indicated that larvae of *M. blenda* have been collected only in spring seeps and spring-fed streams with waters uniformly cool throughout the year, and larvae of *M. tryphena* occur in larger streams. In Florida, larvae and adults of *M. blenda* were reported from small spring-fed ravine streams in the central and western panhandle (Rasmussen, 2004). *Molanna tryphena* and *Molanna ulmerina* are both widespread in streams and creeks across the north central peninsula and panhandle of Florida, the former, however, is far more common.

Molanna tryphena was found to be univoltine with an extended adult emergence in two East Texas spring-fed streams (Gupta and Stewart, 2000). Our adult collection records of *Molanna* species also suggest an extended adult emergence throughout most of the year.

ADDITIONAL REFERENCES: Ross (1944); Sherberger and Wallace (1971); Wiggins (1996a).

KEY TO SPECIES FOR LARVAE OF FLORIDA *MOLANNA*

[modified from Sherberger and Wallace (1971]

1. Apex of base of spine on fore tibia extending well past tibiotarsal joint (Fig. 280); membranous area at constriction of frons capitate (Fig. 281) . . . . . *M. blenda* Sibley

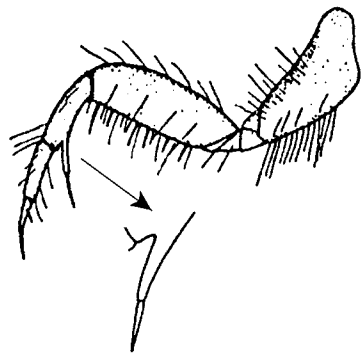

Fig. 280. [from Sherberger and Wallace (1971)].

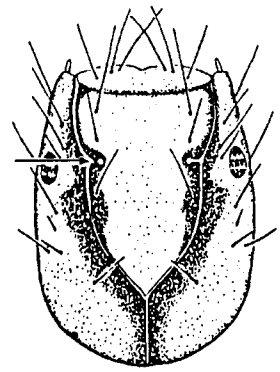

Fig. 281. [from Sherberger and Wallace (1971)].

Apex of base of spine on fore tibia not extending well past tibiotarsal joint (Figs. 282, 283); membranous area at constriction of frons quadrate 2

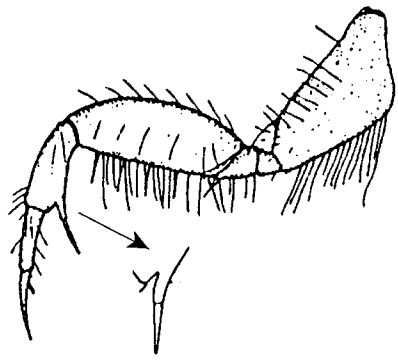

Fig. 282. *Molanna tryphena* [from Sherberger and Wallace (1971)].

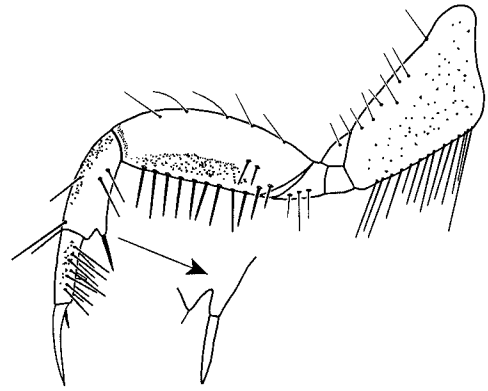

Fig. 283. *Molanna ulmerina* [Denson and Rasmussen, unpublished figure].

2(1) Head with dark banding along frontoclypeal and coronal sutures relatively wide (Fig. 284) ..... *M. tryphena* Betten

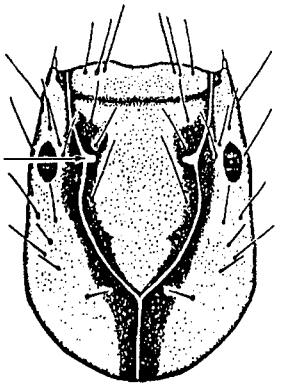

Fig. 284. [from Sherberger and Wallace (1971)].

Head with dark banding along frontoclypeal and coronal sutures narrow (Fig. 285) ..... *M. ulmerina* Navás

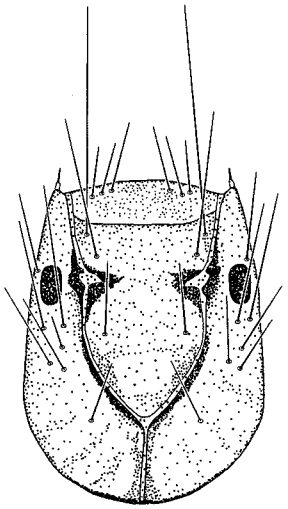

Fig. 285. [Denson and Rasmussen, unpublished figure].

FAMILY ODONTOCERIDAE

The family Odontoceridae is represented in the Nearctic by six genera but only the genus *Psilotreta* extends its geographic range to Florida. The larvae are morphologically recognized by the following: anal proleg without cluster of dorsal setae posteromesad of lateral sclerite (Figs. 55, 56); foretrochantin small, apex not hook-shaped (Fig. 57); and dorsal sclerites of metathorax entire. The larval case is constructed of coarse sand or small rock fragments tightly glued together. The larvae are generally lotic dwellers but are most common in springbrooks to medium-sized streams with substrates made up of mixtures of sand and gravel.

Genus ***Psilotreta*** Banks

DIAGNOSIS: Larvae of *Psilotreta* are distinguished from other odontocerid genera in eastern North America as follows: metanotum with fusion of Sa 1 sclerites into broad, undivided rectangular plate. The cylindrical larval cases are slightly tapered and constructed of coarse quartz fragments.

NOTES: Of the six Nearctic species of *Psilotreta*, only *P. frontalis* has been reported in Florida. It will be to no surprise if *P. labida* also occurs in the state because Harris et al. (1991) collected the adults near the Alabama-Florida line, and the geographic ranges of both *P. frontalis* and *P. labida* are largely sympatric (Parker and Wiggins, 1987). The larvae of these species are distinguished by the development of the anterolateral corner of the pronotum, and the coloration on the dorsum of the head and pro- and mesonotum.

The larvae of *P. frontalis* are primarily found in well shaded spring-fed streams. In Florida, this species appears to be restricted to small spring-fed streams in the panhandle; it is especially abundant in ravine streams associated with the Apalachicola River.

Knowledge of the life history of *P. frontalis* is limited. Unzicker et al. (1982) indicated that in North and South Carolina, adults of the species have been collected in May and June. In Florida adults are present primarily in the spring. In an emergence study of a ravine stream in the central panhandle, Rasmussen (2004) found that *P. frontalis* adult emergence was limited to April and May. The population appeared to develop as a single cohort over a one-year time period.

ADDITIONAL REFERENCES: Parker and Wiggins (1987).

KEY TO SPECIES FOR LARVAE OF FLORIDA *PSILOTRETA*

[adapted from Parker and Wiggins (1987)]

1. Anterolateral corners of pronotum long and acute (Fig. 286); head and pro- and mesonotum with wide black band (Fig. 287); frontoclypeus uniformly black (Fig. 287) . . . . . *P. labida* Ross

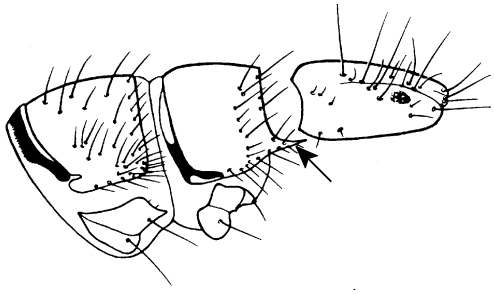

Fig. 286. [from Parker and Wiggins (1987)].

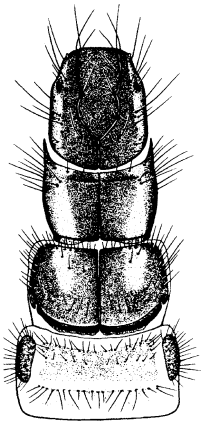

Fig. 287. [from Parker and Wiggins (1987)].

Anterolateral corners of pronotum short (Fig. 288); head, pro- and mesonotum with black band narrower than above (Fig. 289); frontoclypeus with anterolateral light areas (Fig. 289) . . . . . *P. frontalis* Banks

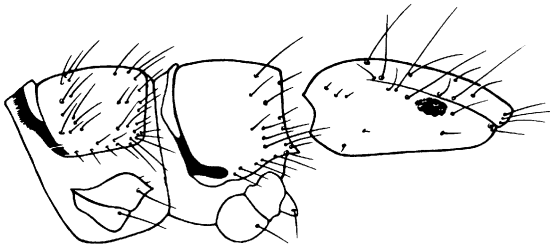

Fig. 288. [from Parker and Wiggins (1987)].

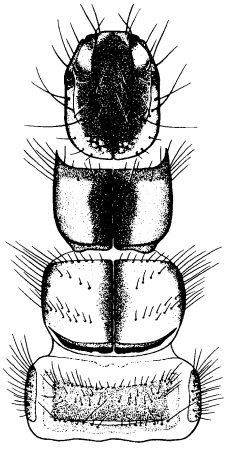

Fig. 289. [from Parker and Wiggins (1987)].

FAMILY PHILOPOTAMIDAE

Two of the three Nearctic genera of Philopotamidae, *Chimarra* and *Wormaldia*, are represented in Florida, the former a widespread genus in the state. Philopotamid larvae have a unique membranous and T-shaped labrum (Fig. 26). The strictly lotic dwelling larvae spin tubular, sac-like, capture nets with fine mesh to filter particulate organic matter. The larvae have the distinction of constructing capture nets with the smallest known mesh openings of any net-spinning caddisflies (Wallace and Malas, 1976).

KEY TO GENERA FOR LARVAE OF FLORIDA PHILOPOTAMIDAE

[adapted from Morse and Holzenthal (1996)]

1. Anterior margin of frontoclypeus with prominent notch asymmetrically right of midline (Fig. 290); prothoracic coxa with long, slender, subapical seta-bearing process (Fig. 291) . . . . . *Chimarra*

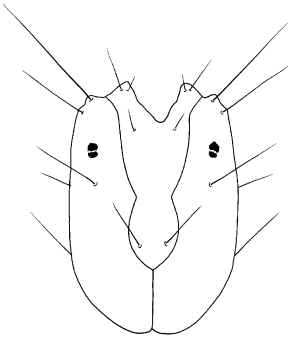

Fig. 290.

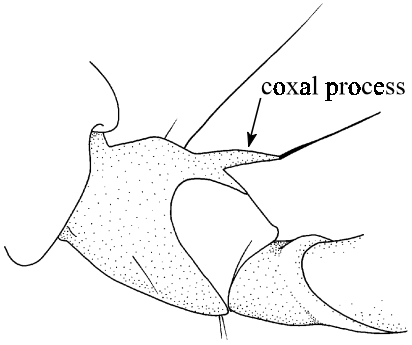

Fig. 291.

Anterior margin of frontoclypeus evenly convex, symmetrical (Fig. 292); prothoracic coxa without long subapical process (Fig. 293) . . . . . *Wormaldia, W. moesta* (Banks)

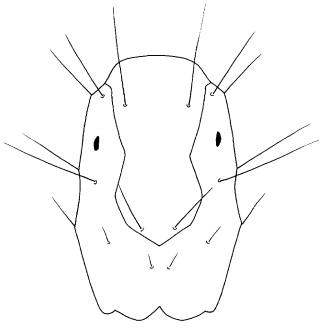

Fig. 292.

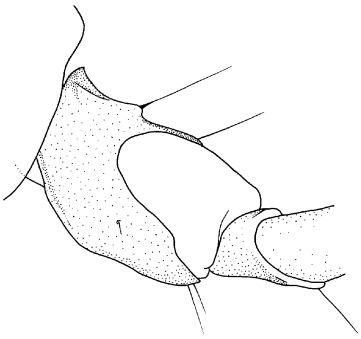

Fig. 293.

Genus ***Chimarra*** Stephens

DIAGNOSIS: Larvae of *Chimarra* are characterized as follows: anterior margin of frontoclypeus with prominent notch asymmetrically right of midline (Fig. 290); and each prothoracic coxa with long slender seta-bearing process (Fig. 291).

NOTES: We have documented five species of *Chimarra* in Florida (*C. aterrima, C. falculata, C. florida*, *C. moselyi*, *C. obscura*). *Chimarra socia* has also been reported to occur in Florida, but because of the taxonomic confusion of *C. socia* with *C. parasocia*, previous Florida records for the former are properly applied to the latter (Lago and Harris, 1987). The occurrence of the species *C. argentella* in Florida was reported by Milne (1936), but the accuracy of Milne's identification according to Deyrup and Franz (1994) has never been confirmed, thus the validity of the Florida record is questionable. Ross (1944) provided a key to the larvae of some species of *Chimarra*, including those of *C. aterrima, C. obscura*, and *C. socia*, but because larvae of the other species remain unknown larval identifications of *Chimarra* are best left at genus.

As previously stated, *Chimarra* is geographically widespread in the state, and we found that the larvae are very common in relatively clean, small and clear sand-bottomed streams in northern and central Florida. We have collected larvae of various sizes throughout the year. Light-trap and emergence trap collections indicate that adults emerge almost all year except in December-February. Whether *Chimarra* spp. have univoltine or multivoltine life cycles in Florida remains to be investigated. Elsewhere, species such as *C. aterrima* and *C. moselyi* are bivoltine (Unzicker et al., 1982; Wallace and Anderson, 1996).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

Genus ***Wormaldia*** MacLachlan

DIAGNOSIS: Larvae of *Wormaldia* are distinguished from *Chimarra* spp. by the evenly convex and symmetrical anterior margin of frontoclypeus (Fig. 292); and absence of subapical process on each prothoracic coxa (Fig. 293). The capture net consists of several layers of mesh, each layer having elongate openings of variable sizes (Unzicker et al., 1982).

NOTES: Of the 16 known species of *Wormaldia*, only *W. moesta* is represented in Florida. Ross (1944) briefly described the larva and characterized the species by the absence of a stout coxal spine on each front leg and presence of inconspicuous transverse bars on the frons. The species is restricted in Florida to the panhandle. Larval collections have come from several streams in the Blackwater, Chipola, and Escambia river basins. Adults have been collected with light traps beside Rocky Creek on Eglin Air Force Base in Walton County (Harris et al., 1982).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

FAMILY PHRYGANEIDAE

The phryganeid caddisflies have nine genera in North America and three of the genera, *Agrypnia*, *Banksiola*, and *Ptilostomis*, are represented in Florida. The larvae are morphologically defined by the presence of a cluster of setae arising from a small rounded sclerite on metanotal sa3 (Fig. 20) and a well-developed prosternal horn (Fig. 21). The larval cases are constructed primarily of plant materials in which the pieces are either fastened together to produce a continuous, spirally wound case, or fitted together to form discrete ring-like sections. The larvae inhabit an array of lentic and lotic habitats and are among the largest caddisflies.

KEY TO GENERA FOR LARVAE OF FLORIDA PHRYGANEIDAE

[modified from Morse and Holzenthal (1996)]

1. Pronotum with dark band along anterior margin, lacking dark markings across mid-section (Fig. 294); ventral combs of prothoracic coxae conspicuous, their teeth evident at 50X magnification (Fig. 295) . . . . . *Agrypnia*, *A. vestita* (Walker)

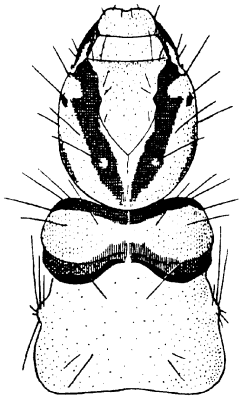

Fig. 294. [from Ross (1944)].

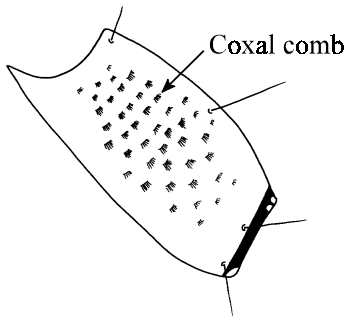

Fig. 295.

Pronotum without dark band along anterior margin, diagonal or transverse markings present across each side (Figs. 297, 298); ventral combs of prothoracic coxae small, each comb appearing as a tiny raised point at 50X magnification (Fig. 296); 2

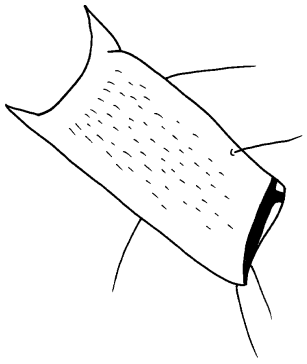

Fig. 296.

2(1) Pronotum with dark bands extending diagonally across each side (Fig. 297); case constructed of small plant pieces arranged in spiral pattern . . . . . *Banksiola, B. concatenata* (Walker)

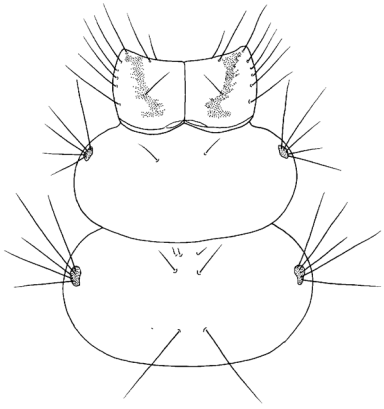

Fig. 297.

Pronotum with dark bands extending transversely across anterior portion only (Fig. 298); case constructed of large rectangular plant pieces arranged in ring-like sections that fit end-to-end . . . . . *Ptilostomis*

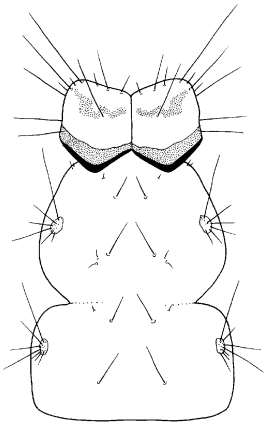

Fig. 298.

Genus ***Agrypnia*** Curtis

DIAGNOSIS: Larvae are morphologically characterized by the following: prothoracic coxae with conspicuous ventral combs (Fig. 295) [Note: prothoracic coxal combs of *A. vestita* are smaller than those of other *Agrypnia* species]; and coxal combs of mesothoracic legs each with basal axis both transverse and parallel to long axis of coxa. The larval case is constructed of leaf and bark pieces arranged in a spiral pattern.

NOTES: Only one species of *Agrypnia*, *A. vestita*, is represented in Florida. The larva, described by Ross (1944) and Wiggins (1960, 1998), is characterized by the absence of diagonal dark brown bandings on the pronotum; the relatively narrow dorsal banding on the head (Fig. 294); and the frontoclypeus which is usually without markings.

Agrypnia vestita is quite uncommon in Florida. The species has only been collected from a few localities. Gordon (1984) indicated the occurrence of the species in Leon, Liberty, and Okaloosa counties. The larvae have been collected in Roaring Creek, a tributary of the Suwannee River in Hamilton Co. The creek is medium-sized, and has a moderate flow and mostly sandy substrate with plenty of snags and leaf packs in some reaches (R. Frydenborg, pers. comm.).

The life history of *A. vestita* in Florida is unknown. The adults have been collected in April and October through November, and the larvae in January. The species has been reported to emerge in May to October in North and South Carolina (Unzicker et al., 1982).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1960, 1996a, 1998).

Genus ***Banksiola*** Martynov

DIAGNOSIS: Larvae of *Banksiola* are distinguished from *Agrypnia* and *Ptilostomis* by the following combination of characters: ventral combs of prothoracic coxae inconspicuous; and dark banding of pronotum extending diagonally across pronotum (Fig. 297). The larval case, similar to *Agrypnia*, is arranged in a spiral fashion.

NOTES: *Banksiola* is represented in Florida by the species *B. concatenata*. The species has been reported from Alachua, Baker, and Leon counties (Gordon, 1984) and Walton Co. (Harris et al., 1982). We have additional adult records from Okaloosa and Suwannee counties. The larva of this species is undescribed. We have seen only one larva of *Banksiola* collected in Florida (Hamilton County). We presume this to be *B. concatenata* because it is the only *Banksiola* species occurring in the southeastern United States. This specimen lacks the dark banding on the meso- and metanotum that is characteristic of other *Banksiola* species.

ADDITIONAL REFERENCES: Wiggins (1960, 1996a, 1998).

Genus ***Ptilostomis*** Koslenati

DIAGNOSIS: Similar to larvae of the genus *Banksiola*, larvae of *Ptilostomis* have inconspicuous ventral combs on the prothoracic coxae. Unlike *Banksiola*, larvae of *Ptilostomis* have: pronotal transverse bands limited to anterior half (Fig. 298); and larval case consisting of 4-6 rings of large rectangular pieces of plant material attached end-to-end.

NOTES: Two (*P. postica* and *P. ocellifera*) of the four known North American species of *Ptilostomis* occur in Florida. Distinguishing larval characteristics for these two species are unknown. Larvae of *Ptilostomis* have been collected in a backwater area of the Blackwater River, Okaloosa Co.; Dry Creek, a tributary of the Chipola River, Jackson Co.; and the Econfina River, Taylor County. We have collected adults of both species from a variety of stream types across the panhandle.

Like the other Florida phryganeid caddisflies, information on the life histories of *Ptilostomis* spp. is limited. The adults of *P. postica* appear to emerge almost throughout the year, as light-trap collections indicate their flight in March through November. Adults of *P. ocellifera* were collected April through June. Larvae of *Ptilostomis* examined during this study were collected from January through April.

ADDITIONAL REFERENCES: Wiggins (1960, 1996a, 1998).

FAMILY POLYCENTROPODIDAE

The diverse polycentropodids are represented in Florida by the genera *Cernotina*, *Cyrnellus*, *Neureclipsis*, *Nyctiophylax*, and *Polycentropus*. The genus *Phylocentropus*, previously placed within Polycentropodidae, is now classified within the family Dipseudopsidae (Wells and Cartwright, 1993; Weaver and Malicky, 1994).

Polycentropodid larvae are most easily recognized by the pointed foretrochantin fused to the episternum without a separating suture and the elongate tarsi (Figs. 29, 32) which distinguish this family from the Dipseudopsidae. Larvae of this family generally occur in lotic habitats, although larvae of *Cernotina* and *Cyrnellus* species are also found in lentic habitats. The family is geographically widespread throughout the state. Larvae construct a variety of fixed retreats and capture nets with the materials, architecture, and placement of the retreats varying among genera.

KEY TO GENERA FOR LARVAE OF FLORIDA POLYCENTROPODIDAE

[adapted from Morse and Holzenthal (1996)]

1. Anal claw with 6 or fewer ventral teeth (Fig. 299); pronotum with short, stout bristle arising near each ventrolateral margin (Fig. 300)
. . . . . *Nyctiophylax*

Fig. 299.

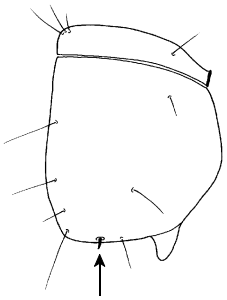

Fig. 300.

Anal claw without ventral teeth (Fig. 301) *or* with 10 or more tiny ventral spines (Fig. 302); pronotum without short, stout bristle near each ventrolateral margin
. 2

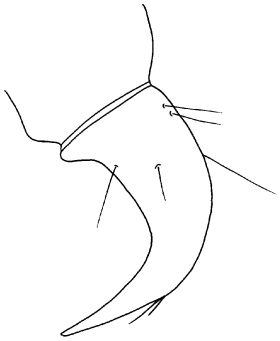

Fig. 301.

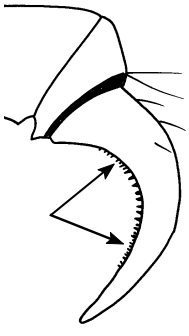

Fig. 302.

2(1) Basal segment of anal proleg about as long as distal segment and with only 2 or 3 apicoventral setae (Fig. 303); anal claw with many tiny ventral spines (Fig. 303) . . . . . *Neureclipsis* (p. 114)

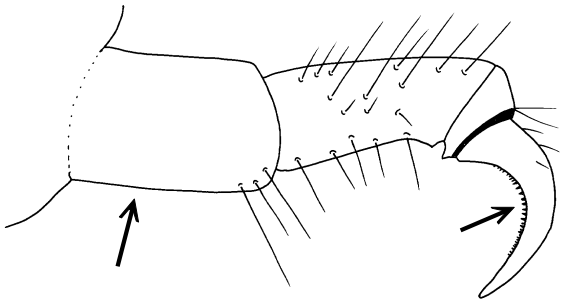

Fig. 303.

Basal segment of anal proleg longer than distal segment in mature larvae and with many setae scattered over most of its surface (Fig. 304); anal claw without tiny ventral spines (Fig. 304) 3

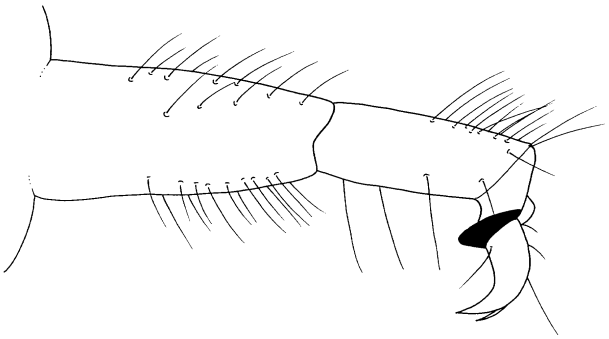

Fig. 304.

3(2) Dorsal region between anal claw and sclerite of distal segment of anal proleg with 2 mesally contiguous dark bands (Fig. 305); meso- and metanotal sa1 setae short, not more than one-third as long as longest sa2 setae (Fig. 306) 4

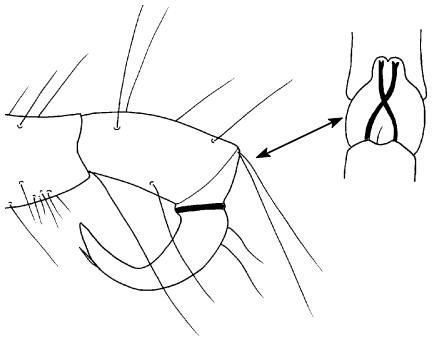

Fig. 305.

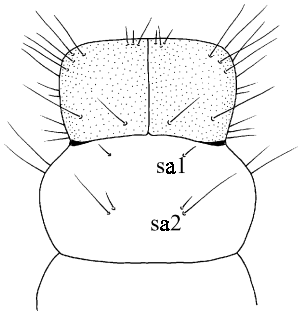

Fig. 306.

Dorsal region between anal claw and sclerite of distal segment of anal proleg with 2 mesally non-contiguous dark bands (Fig. 307); meso- and metanotal sa1 setae about as long as longest sa2 setae (Fig. 308)

. . . . . *Cyrnellus*, *C. fraternus* (Banks)

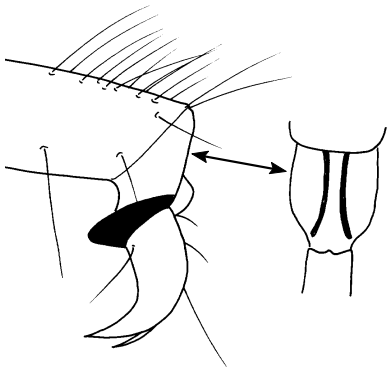

Fig. 307.

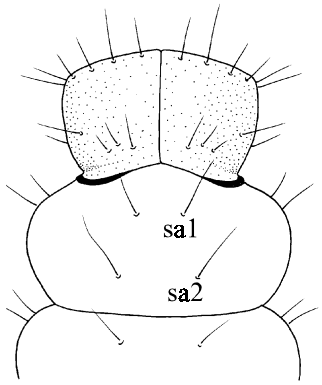

Fig. 308.

4(3) Prothoracic tarsi each broad and approximately one-half as long as its prothoracic tibia (Fig. 309); *or* anal claw obtusely curved (Fig. 310); mature larvae 10 mm or longer

. . . . . *Polycentropus*

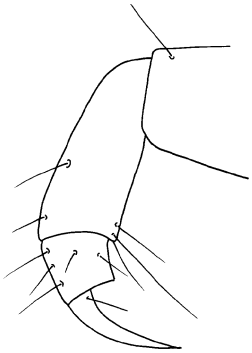

Fig. 309.

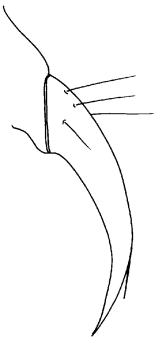

Fig. 310.

Prothoracic tarsi each narrow and at least two-thirds as long as its prothoracic tibia (Fig. 311); *and* anal claw curved approximately 90º (Fig. 312); mature larvae less than 8 mm

. . . . . *Cernotina*

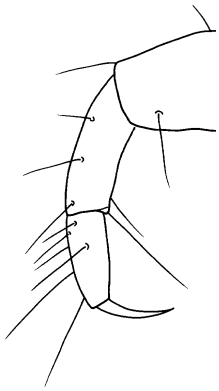

Fig. 311.

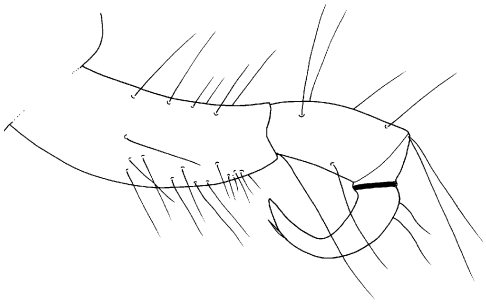

Fig. 312.

Genus ***Cernotina*** Ross

DIAGNOSIS: Larvae of *Cernotina* are distinguished from other polycentropodid genera as follows: mesally contiguous dark bands on dorsal region between anal claw and distal segment of anal proleg (Fig. 305); narrow protarsi at least two-thirds as long as protibiae (Fig. 311); anal claw curved approximately 90^{o} and with only 1 dorsal accessory spine (Fig. 312); and mature larva less than 8mm in length.

NOTES: It was not until the work of Hudson et al. (1981), with the description of *C. spicata*, that the first positive larval association for this genus was accomplished. The larvae of *Cernotina* and *Polycentropus* species bear close resemblance and careful examination using the characters presented in the key is necessary to distinguish the two. Also it should be noted that the mature larvae of *Cernotina* are quite small, only 4-7 mm long, while mature larvae of *Polycentropus* species are much longer. Larvae are predaceous and occur in both lotic and lentic habitats where they construct silk tube retreats.

Three species of *Cernotina* have been reported in Florida (see Appendix A) based on adult collections. The geographic distribution of the genus appears to be widespread across the central and northern parts of the state. Deyrup and Franz (1994) listed *C. truncona* as Rare although it has been recorded from a number of counties in the state. Adult collections are sparse, suggesting small populations. *Cernotina spicata* and *C. calcea* are more common based on collection records of adult specimens.

ADDITIONAL REFERENCES: Hudson et al. (1981); Wiggins (1996a).

Genus ***Cyrnellus*** Banks

DIAGNOSIS: Larvae of *Cyrnellus* are easily distinguished from other polycentropodid genera as follows: presence of 2 non-contiguous dark bands on dorsal region between anal claw and lateral sclerite of distal segment of anal proleg (Fig. 307); and meso- and metanotal sa1 setae as long as sa2 setae (Fig. 308).

NOTES: *Cyrnellus* contains a single Nearctic species, *C. fraternus*, first described in the larval stage by Flint (1964); it is widespread across the eastern United States. Larvae most closely resemble *Polycentropus* species but are not difficult to differentiate using the characters presented in the key. Larvae construct a silk retreat, roughly circular in outline, about 20mm in diameter, spun in shallow depressions on rock surfaces. The flat roof of the chamber has circular entrance and exit holes at the ends (Wiggins, 1996a). *Cyrnellus fraternus* is geographically widespread in Florida, ranging from the panhandle into southern Florida, and occurs in a wide range of lotic as well as lentic habitats.

ADDITIONAL REFERENCES: Flint (1964); Wiggins (1996a).

Genus ***Neureclipsis*** MacLachlan

DIAGNOSIS: Larvae of *Neureclipsis* are distinguished from other polycentropodid genera as follows: basal segment of anal proleg about equal in length to distal segment with only few setae arising from basal segment (Fig. 303); and anal claw with row of many tiny spines along ventral margin (Fig. 303). The row of tiny spines along the ventral margin of the anal claw are apparent at 40X magnification viewed from a lateral aspect. It is helpful to use illuminated base lighting as the light will transmit through the spines making them more apparent.

NOTES: Of the five species of *Neureclipsis* occurring in North America only two are found in the southeastern United States, *N. crepuscularis* and *N. melco*; both species have been reported from Florida. Of these two species, only *N. crepuscularis* has been described in the larval stage by Ross (1944). *Neureclipsis crepuscularis* is geographically widespread throughout the state, occurring in streams and rivers from the western panhandle to as far south as the Everglades. *Neureclipsis melco* appears to be more restricted, having been reported based upon adults collected from only the panhandle. Based on the examinations of larvae collected throughout the state, it is apparent that the two species have a distinctive pigmentation pattern on the dorsal and lateral portions of the meso- and metathorax, and abdominal segments. Based on the larval description of *N. crepuscularis* by Ross (1944) and the geographic distribution of the species we feel confident larvae can be identified to species using the following key. The tentative assignment of *N. melco* in the key, while not based upon associated larvae, is consistent with the geographic distribution of adults (Gordon, 1984; Harris et al., 1982, 1991). The larvae we base this circumstantial association on were collected from the Escambia River in northern Escambia County.

Larvae of *Neureclipsis* species construct a trumpet-shaped tube of silk up to 12 cm long with a flared anterior end which tapers to a slender tube in which the larva is concealed. The retreat is anchored so that the large anterior end faces the current, thus filtering food particles (Wiggins, 1996a).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

TENTATIVE KEY TO SPECIES FOR LARVAE OF FLORIDA *NEURECLIPSIS*

1. Areas of purplish pigmentation along dorsal and lateral margins of meso- and metathorax and abdominal segments broken into distinctly separate patches with unpigmented areas between patches (Fig. 313) . . . . . *N. melco* Ross

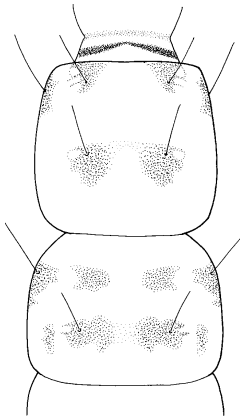

Fig. 313.

Areas of purplish pigmentation along dorsal and lateral margins of meso- and metathorax and abdominal segments not broken into distinctly separate patches but appear as more continuous bands across dorsum (Fig. 314)
. . . . . *N. crepuscularis* (Walker)

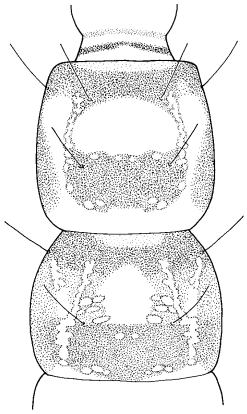

Fig. 314.

Genus ***Nyctiophylax*** Brauer

DIAGNOSIS: Larvae of *Nyctiophylax* are easily distinguished from other polycentropodid genera as follows: presence of 6 or fewer conspicuous teeth on ventral margin of anal claw (Fig. 299); and presence of stout bristle arising near ventrolateral margin of pronotum (Fig. 300).

NOTES: Of the ten species of *Nyctiophylax* known to occur in North America, at least four occur in Florida (see Appendix A). To date the larva of only one out of these four species has been described. Flint (1964) described the larvae of *N. celta* (as *Nyctiophylax vestitus*). We have examined larvae collected from the Suwannee River closely matching Flint's descriptions and illustrations of this species (Fig. 315), but we feel that our species determinations remain questionable until additional associations for other *Nyctiophylax* species have been done. We have examined numerous larvae collected from widespread localities in the state closely resembling Flint's description of *N. moestus* (*Nyctiophylax* sp. A) (Fig. 316). However, it is very possible that these larvae are *N. affinis*, since this species is considered closely related to *N. moestus* (Armitage and Hamilton, 1990) and adult collections indicate it occurs in Florida.

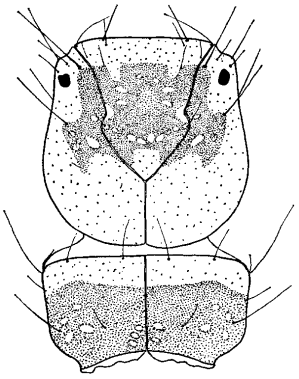

Fig. 315. *Nyctiophylax celta* [from Flint (1964)].

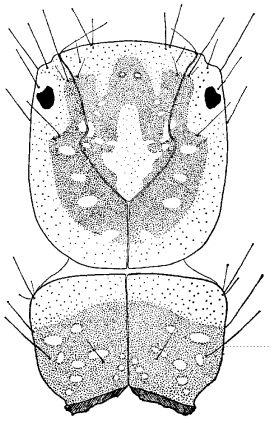

Fig. 316. *Nyctiophylax moestus* [from Flint (1964)].

Larvae of *Nyctiophylax* species construct a silk retreat consisting of an open ended chamber over a depression in rock or woody substrate. The floor of the retreat extends beyond the roof at each end as a threshold of silk threads (Wiggins, 1996a). A loose network of threads float up from the threshold and the larva darts out of the chamber to capture small prey that have caused the threshold threads to move (Noyes, 1914).

ADDITIONAL REFERENCES: Flint (1964); Wiggins (1996a).

Genus ***Polycentropus*** Curtis

DIAGNOSIS: Larvae of *Polycentropus* are most readily distinguished from the other polycentropodid genera (except *Cernotina*) by the presence of two mesally contiguous dark bands on the dorsal region between the anal claw and the distal segment of the anal proleg (Fig. 305). Larvae of *Polycentropus* can be distinguished from *Cernotina* as follows: prothoracic tarsi broad and one-half as long as prothoracic tibiae (Fig. 309), *or* anal claw obtusely curved (Fig. 310), and their larger size (up to 25 mm).

NOTES: Using the key to the genera of Polycentropodidae becomes rather complicated when trying to distinguish *Polycentropus* species from *Cernotina* species. Larvae of the two genera closely resemble each other and close examination is necessary to discriminate the two. Presently, the generic status of *Polycentropus* is questionable. European trichopterists and others consider North American *Polycentropus* to consist of three genera: *Holocentropus*, *Plectrocnemia* and *Polycentropus s. str*. The larval taxonomy of *Polycentropus* should become clearer as more species are described from the larval stage. Presently, six species of *Polycentropus* are known to occur in Florida (See Appendix A). Of these six species only the larva of *P. cinereus* has been described (Ross, 1944). *Polycentropus cinereus* was described as having the basal segment of the anal prolegs with fairly short setae distributed uniformly over the ventral surface (Fig. 317-A) and the spots on the posterior region of the frontoclypeus forming an angle (Fig. 317-B).

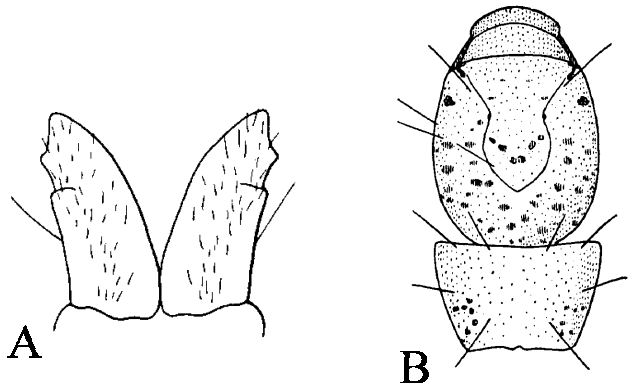

Figure 317. [from (Ross, 1944)] - A. *Polycentropus cinereus*, basal segment of anal prolegs, ventral aspect; B. *Polycentropus cinereus*, head and pronotum.

Gordon (1984) showed *P. cinereus* as being the most widespread species of *Polycentropus*, and our examinations of larvae matching the description of *P. cinereus* by Ross (1944) and numerous adult collections lead us to conclude that indeed it is probably the most widespread and common *Polycentropus* species in the state. *Polycentropus floridensis*, listed as a Threatened species by Deyrup and Franz (1994) is endemic to spring-fed streams of the western panhandle and coastal Alabama. The other Florida *Polycentropus* species have much wider distributions.

Larvae of *Polycentropus* species construct silk retreats of two different types: either a silk tube flared at both ends with a network of silk trip lines for signalling the presence of prey or a bag-like structure expanded by the current (Wiggins, 1996a).

ADDITIONAL REFERENCES: Ross (1944); Wiggins (1996a).

FAMILY PSYCHOMYIIDAE

This family is least common among the net-spinning caddisflies, within Florida as well as North America. The psychomyiids are represented in Florida by two genera: *Lype* (*Lype diversa*) and *Psychomyia* (*Psychomyia flavida*).

Psychomyiid larvae are readily distinguished from the other caddis families by the presence of a broad hatchet-shaped foretrochantin separated from the proepisternum by a basal suture (Fig. 29). The labium, with the opening of the silk gland (spinnerette), extends beyond the anterior margin of the head, facilitating the application of silk within the retreats. Larvae occur in lotic habitats where they construct and live in fixed silken tubes or tunnels attached to rock and wood substrates.

KEY TO GENERA AND SPECIES FOR LARVAE OF FLORIDA PSYCHOMYIIDAE

[adapted from Morse and Holzenthal (1996)]

1. Anal claw with 3 or 4 conspicuous teeth along ventral, concave margin (Fig. 318); paired submental sclerites on ventral surface of labium longer than broad (Fig. 319)
. . . . . *Psychomyia, P. flavida* Hagen

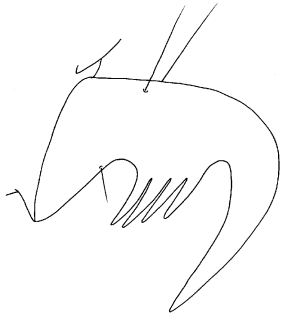

Fig. 318.

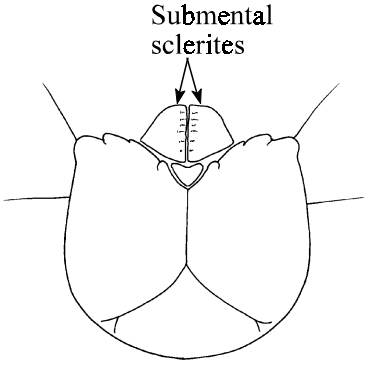

Fig. 319.

Anal claw without teeth on ventral concave margin; paired submental sclerites on ventral surface of labium broader than long (Fig. 320)
. . . . . *Lype, L. diversa* (Banks)

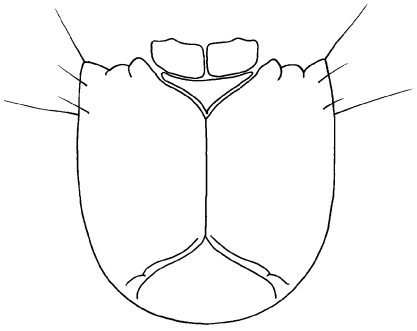

Fig. 320.

Genus ***Lype*** MacLachlan

DIAGNOSIS: Larvae of *Lype* are easily distinguished from *Psychomyia* as follows: absence of teeth on ventral margin of anal claw; and paired submental sclerites of labium broader than long (Fig. 320).

NOTES: The genus *Lype* contains a single North American species, *L. diversa*. The immature stages of this species were described by Flint (1959). The mature larva is 7-8 mm in length. The head coloration pattern is distinctive, with the anterior third yellowish and posterior two-thirds brown in color (Fig. 321). Also noteworthy is the long central spinneret on the maxillo-labium (Fig. 322) which is characteristic of Dipseudopsidae and this family.

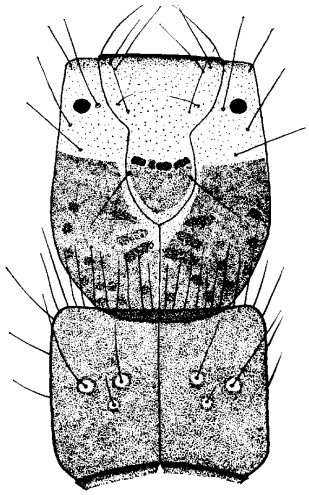

Fig. 321. *Lype diversa* [from Flint (1959)].

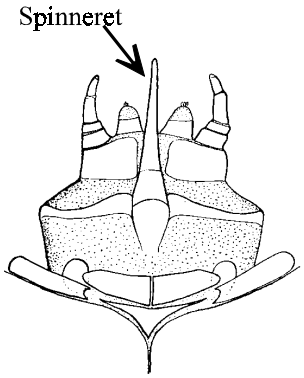

Fig. 322. *Lype diversa*, maxillo-labium, ventral [from Flint (1959)].

Lype diversa is geographically widespread across the northern half of the state. Larvae are most commonly found in small cool streams where they construct well-camouflaged retreats in the grooves of submerged wood. Specimens can be collected either by careful examination of wood substrate or by using artificial substrates such as Hester-Dendy multiplate samplers. Little is known of the life history for this species in Florida. In more northern areas of the United States the species is univoltine.

ADDITIONAL REFERENCES: Flint (1959); Wiggins (1996a).

Genus ***Psychomyia*** Latreille

DIAGNOSIS: Larvae of *Psychomyia* are distinguished from *Lype* as follows: presence of 3 or 4 conspicuous teeth on concave margin of anal claw (Fig. 318); and submental sclerites on ventral surface of labium longer than broad (Fig. 319).

NOTES: The genus *Psychomyia* contains three North American species of which only *P. flavida* occurs in Florida. The larva of this species was first described by Ross (1944) and then later by Flint (1964). Gordon (1984) reported *P. flavida* from Jackson Co. (no specific locality provided); we examined larval specimens collected from the Chipola River, Calhoun Co. and collected adults from the Chipola River and several tributaries. This species is not known to occur anywhere else in the state and is quite possibly restricted to the Chipola River basin. Larvae construct silk tubes covered with sand on rocks (Wiggins, 1996a) and feed on organic particles which they collect. *Psychomyia flavida* is believed to reproduce parthenogenetically, and light trap collections usually consist of large numbers of females with very few males (Swegman, 1978; Unzicker et al., 1982).

ADDITIONAL REFERENCES: Ross (1944); Flint (1964); Wiggins (1996a).

FAMILY RHYACOPHILIDAE

The family Rhyacophilidae is represented in North America by two genera, but only the genus *Rhyacophila* occurs in the eastern United States, extending its geographic range from the Northeast to Florida. More than 100 rhyacophilid species occur in North America, with nearly all of the species belonging to the genus *Rhyacophila* (Dixon and Wrona, 1992).

Rhyacophilid larvae are morphologically recognized by the presence of a dorsal sclerite on abdominal segment IX (Fig. 18), anal proleg which is almost entirely free from abdominal segment IX, and the lack of dorsal accessory hooks on the anal claw (Fig. 25).

Unlike other caddisflies, which construct larval cases or retreats, rhyacophilid larvae are basically free living, and attachment to the substrate is facilitated by the secretion of a silk thread anchor line. The larvae are generally found in fast-flowing streams, and many species are predaceous while a few are herbivorous, feeding on living or dead plant tissues.

Genus ***Rhyacophila*** Pictet

DIAGNOSIS: Larvae of eastern Nearctic *Rhyacophila* species lack the dense gill tufts that larvae of the western genus *Himalopsyche* possess. Final instars are less than 30 mm long.

NOTES: Of the approximately 100 species of *Rhyacophila* known in North America, only two species are known in Florida (*R. carolina* and *Rhyacophila* n. sp.). Another species, *R. ledra*, may eventually appear in the state because it known to occur near the Alabama-Florida line (Harris et al., 1991). Both *R. ledra* and *R. carolina* belong to the *R. carolina* species group, having larvae with edentate anal claws. The larva of *R. carolina*, however, can be distinguished from that of *R. ledra* by its more or less unicolorous golden yellow head, compared to the distinctive pattern of infuscation and muscle scars in the latter. *Rhyacophila carolina* is widespread in the Florida panhandle but is primarily confined to unpolluted spring-fed streams. It is particularly abundant in ravine streams.

The larva of *Rhyacophila* n. sp. is very close to that of *R. lobifera* and will key to it using Flint (1962). We collected larval specimens from Black Creek at Baum Road in Leon County and originally identified them as *R. lobifera*. We later found out that Jim Glover also had larval specimens from South Carolina closely matching *R. lobifera* but that larval/adult rearings he had conducted showed the adult to be of an undescribed species different from that of *R. lobifera.* His comparative examination of the new species with larvae known to be *R. lobifera* revealed differences in pronotal setation. Specimens we sent to Glover confirmed the Florida material was of the same new species, which he and John Morse are now describing.

Some species of *Rhyacophila* have been shown to have univoltine life cycles (Manuel and Folsom, 1982; Singh et al., 1984; Martin, 1985), and one species, *R. vofixa* from an Alaskan stream, appears to require several years to complete a life cycle (Irons, 1987). When ready to pupate, the larvae characteristically construct a silken cocoon inside a dome-like shelter of small stones, but no case or retreat is constructed before then. *Rhyacophila carolina* has been observed to fly in late April to October in North and South Carolina (Unzicker et al., 1982). In Florida we collected adults of *R. carolina* from March to December.

ADDITIONAL REFERENCES: Flint (1962); Weaver and Sykora (1979); Prather and Morse (2001).

KEY TO SPECIES FOR LARVAE OF FLORIDA *RHYACOPHILA*

1. Anal claw with 1 large and usually 1 small ventral tooth (Fig. 323); anal proleg with a baso-ventral hook (Fig. 323); head with distinct pattern of infuscations and muscle scars (Fig. 324) . . . . . *Rhyacophila n. sp.*

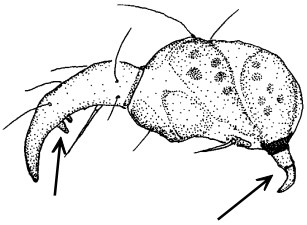

Fig. 323. [from Glover and Morse (In Prep.)].

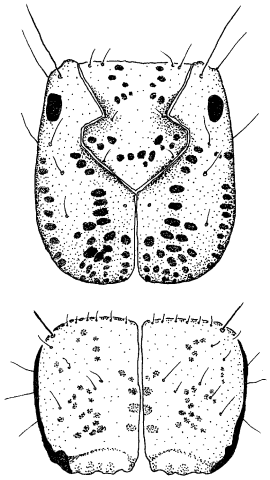

Fig. 324. [from Glover and Morse (In Prep.].

Anal claw without ventral teeth (Fig. 325); anal proleg without baso-ventral hook (Fig. 325); head not as above, near unicolorously golden yellow (Fig. 326) . . . . . *R. carolina* Banks

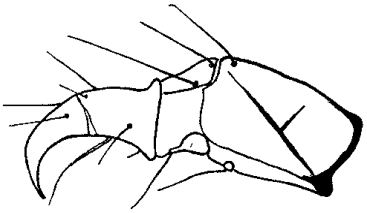

Fig. 325. [from Flint (1962)].

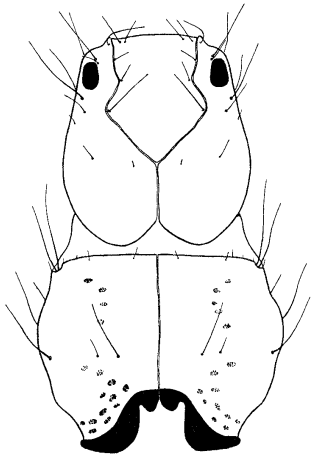

Fig. 326. [from Flint (1962)].

FAMILY SERICOSTOMATIDAE

The family Sericostomatidae is represented in North America by the genera *Agarodes*, *Fattigia*, and *Gumaga.* Only the genus *Agarodes*, the most widespread of the three genera, extends its geographic range to Florida. Twelve species are assigned to this genus with greatest diversity occurring in the southeastern United States.

Sericostomatid larvae are morphologically recognized by a cluster of setae (approximately 30 or more) posteromesad of the lateral sclerite of the anal proleg (Figs. 52, 53), and the large, and apically hooked foretrochantin (Fig. 54).

Genus ***Agarodes*** Banks

DIAGNOSIS: Larvae of *Agarodes* are briefly defined as follows: pronotum with sharp-pointed anterolateral corners (Fig. 39); dorsum of abdominal segment IX with about 4 major setae and about 10 shorter ones along posterior edge; and head rounded dorsally with inconspicuous lateral carina. The larva constructs a curved and slightly tapered case, usually composed of medium to coarse sand with plant pieces mixed in.

NOTES: Four *Agarodes* species are known from Florida (*A. crassicornis*, *A. libalis*, *A. logani*, and *A. ziczac*) The Florida *Agarodes* species are all geographically restricted to the northern region of the state. *Agarodes ziczac*, listed as Threatened by Deyrup and Franz (1994) is endemic to the western panhandle. This species was found to be very abundant in the spring-fed streams on Eglin Air Force Base (Rasmussen, 2004). *Agarodes logani* (listed as *Agarodes* n. sp. in the first edition of this manual) was described in Keth and Harris (1999). It is only known from the type locality, a spring-fed headwater tributary of Quincy Creek in Gadsden County. We have collected adults of *A. crassicornis* and *A. libalis* from widespread localities across northern Florida.

Of the *Agarodes* species known in Florida, only the larva of *A. libalis* is known. Thus, larval identifications can be made only to genus. Larval morphology for this genus is very conservative making the differentiation of larvae difficult at the species level.

Except for the collection records, information on the life history of *Agarodes* in Florida is non-existent. We have collected adults of all species in Florida at various times of year. Larvae of *Agarodes* are mostly restricted to small streams with a medium current and a sandy bottom.

ADDITIONAL REFERENCES: Ross and Wallace (1974); Ross and Scott (1974); McEwan (1980).

FAMILY UENOIDAE

The family Uenoidae contains 5 genera in North America but only the genus *Neophylax* is represented in eastern North America. The uenoid larvae are morphologically recognized by the mesally notched anterior margin of mesonotum (Fig. 61); and basal seta of tarsal claw elongate, extending to near the tip of claw (Fig. 62). The smooth and slender larval cases of most genera (except *Neophylax*) are constructed of fine mineral particles, sometimes of silk alone. The larvae are found in a wide array of lotic habitats.

Genus ***Neophylax*** MacLachlan

DIAGNOSIS: Larvae of *Neophylax* are characterized as follows: pronotum distinctly wider posterad of transverse mid-point and with rounded anterior margin (Fig. 61); mesonotal sclerite with deep anteromedian notch (Fig. 61); abdominal segment I with well-developed middorsal hump; and most species with pair of ventral abdominal gills. Larvae of *Neophylax* construct cases which are short and thick, composed of coarse rock fragments with several larger ballast stones along each side (Wiggins, 1996a).

NOTES: *Neophylax concinnus* was thought to occur in Florida but we have been unable to verify any record of it. In the first edition of this manual we reported collecting two immature larvae of *Neophylax* from the Aucilla River. On re-examination of these larvae however we found them to be young *Pycnopsyche* specimens. We now doubt the existence of *Neophylax* in Florida. There are, however, a number of *Neophylax* species occurring in Alabama, including *N. concinnus*, above the Fall Line, which potentially could occur in Florida. Thus, we have included the Uenoidae in the family key.

The larva of *N. concinnus* was first described by Ross (1944) (as *N. autumnus*). Flint (1960) subsequently provided a key to the larvae of some of the species of *Neophylax* and characterized the larvae of *N. concinnus* by the short or barely noticeable setae along the anterior margin of the pronotum, the lack of a frontal tubercle on the head, and the presence of spicules on the entire dorsal surface of the head.

The life history of *Neophylax* species are known to include a long prepupal (spring-summer) diapause which varies in length from two to six months (Vineyard and Wiggins, 1988).

ADDITIONAL REFERENCES: Ross (1944); Flint (1960); Vineyard and Wiggins (1988); Wiggins (1996a).

LITERATURE CITED

Alexander, K. D. and M. R. Whiles. 2000. A new species of *Ironoquia* (Trichoptera: Limnephilidae) from an intermittent slough of the central Platte River, Nebraska. Entomol. News. 111:1-7.

Anderson, N. H. 1976. The distribution and biology of the Oregon Trichoptera. Agric. Exp. Tech. Bull. No. 134, Oregon State Univ., Corvallis. 152 pp.

Armitage, B. J. and S. W. Hamilton. 1990. Diagnostic atlas of the North American caddisfly adults. II. Ecnomidae, Polycentropodidae, and Xiphocentronidae. The Caddis Press. 152 pp.

Banks, N. 1907. Descriptions of new Trichoptera. Proc. Entomol. Soc. Wash. 8:117-133.

Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish, Second Edition. U.S. Environ. Protect. Agency, Office of Water, Washington D.C., EPA 841-B-99-002.

Barton, D. R. and H. B. N. Hynes. 1978. Wave-zone macrobenthos of the exposed Canadian shores of the St. Lawrence Great Lakes. J. Great Lakes Res. 4:27-45.

Benke, A. C., and J. B. Wallace. 1980. Trophic basis of production among net-spinning caddisflies in southern Appalachian stream. Ecology. 61:108-118.

Cardinale, B. J., M. A. Palmer, and S. L. Collins. 2002. Species diversity enhances ecosystem functioning through interspecific facilitation. Nature. 415:426-429.

Chapin, J. W. 1978. Systematics of Nearctic *Micrasema* (Trichoptera: Brachycentridae). Ph.D. Dissertation, Clemson University. Clemson, South Carolina. 136 pp.

Chen, Y. 1993. Revision of the *Oecetis* (Trichoptera: Leptoceridae) of the world. Ph.D. Dissertation, Clemson University. Clemson, South Carolina. 704 pp.

Clifford, H. P. 1966. The ecology of invertebrates in an intermittent stream. Invest. Indiana Lakes Streams. 7:57-98.

Cushman, R. M., J. W. Elwood, and S. G. Hildebrand. 1977. Life history and production dynamics of *Alloperla mediana* and *Diplectrona modesta* in Walker Branch, Tennessee. Am. Midl. Nat. 98:354–364.

Daigle, J. J. and J. D. Haddock. 1981. The larval description and ecological notes of the caddisfly, *Nectopsyche tavara* (Ross) from the Central Florida refugium (Trichoptera: Leptoceridae). Pan-Pacific Entomol. 57:327-331.

Denning, D. G. 1948. New species of Trichoptera. Ann. Entomol. Soc. Am. 41:397-401.

_____. 1971. A new genus and new species of Trichoptera. Pan-Pacific Entomol. 47:202-210.

Deyrup, M. and R. Franz (eds.). 1994. Rare and endangered biota of Florida, volume iv. invertebrates. Univ. Presses of Fla., Gainesville, Florida. 798 pp.

Dixon, R. W. J. and F. J. Wrona. 1992. Life history and production of the predatory caddisfly *Rhyacophila vao* Milne in a spring-fed stream. Freshw. Biol. 27:1-11.

Flint, O. S., Jr. 1958. The larva and terrestrial pupa of *Ironoquia parvula* (Trichoptera, Limnephilidae). J. New York Entomol. Soc. 66:59-62.

_____. 1959. The immature stages of *Lype diversa* (Banks) (Trichoptera, Psychomyiidae). Bull. Brooklyn Entomol. Soc. 54:44-47.

_____. 1960. Taxonomy and biology of Nearctic limnephilid larvae (Trichoptera), with

special reference to species in eastern United States: Entomologia Americana. 40:1-117.

_____. 1962. Larvae of the caddis fly genus *Rhyacophila* in eastern North America (Trichoptera: Rhyacophilidae). Proc. U.S. Nat. Mus. 113:465-493.

_____. 1964. Notes on some Nearctic Psychomyiidae with special reference to their larvae (Trichoptera). Proc. U.S. Nat. Mus. 115:467-481.

_____. 1984. The genus *Brachycentrus* in North America, with a proposed phylogeny of the genera of Brachycentridae (Trichoptera). Smithson. Contr. Zool. 398:1-58.

Flint, O. S., Jr., J. R. Voshell, and C. R. Parker, 1979. The *Hydropsyche scalaris* group in Virginia, with the description of two new species (Trichoptera:Hydropsychidae). Proc. Biol. Soc. Wash. 92:837-862.

Floyd, M. A. 1994. Larvae of the caddisfly genus *Oecetis* (Trichoptera: Leptoceridae) in North America. Ph.D. Dissertation, Clemson University. Clemson, South Carolina. 152 pp.

_____. 1995. Larvae of the caddisfly genus *Oecetis* (Trichoptera: Leptoceridae) in North America. Bull. Ohio Biol. Surv., New Series. 10(3). 85 pp.

Fremling, C. R. 1960. Biology and possible control of nuisance caddisflies of the Upper Mississippi River. Agric. Home Econ. Exp. Sta., Iowa State Univ. Res. Bull. No. 483:856-879.

Fuller, R. L. and R. J. Mackay. 1981. Effects of food quality on growth of three *Hydropsyche* species (Trichoptera:Hydropsychidae). Can. J. Zool. 59:1133-1140.

Glover, J. B. 1993. The taxonomy and biology of the larvae of the North American caddisflies in the genera *Triaenodes* and *Ylodes* (Trichoptera: Leptoceridae). Ph.D. Dissertation, University of Louisville. Louisville, Kentucky. 252 pp.

_____. 1996. Larvae of the caddisfly genera *Triaenodes* and *Ylodes* (Trichoptera: Leptoceridae) in North America. Bull. Ohio Biol. Surv., New Series. 11(2). 89 pp.

Glover, J. B. and M. A. Floyd. 2004. Larvae of the genus *Nectopsyche* (Trichoptera:Leptoceridae) in eastern North America, including a new species from North Carolina. J. N. Am. Benthol. Soc. 23:526-541.

Gordon, E. A. 1984. The Trichoptera of Florida: A preliminary survey. Pp. 161-166 *in* J. C. Morse, ed. Proceedings of the Fourth International Symposium on Trichoptera. Vol. 30. Dr. W. Junk Publ., The Hague.

Gordon, E. A. and J. B. Wallace. 1975. Distribution of the family Hydropsychidae (Trichoptera) in the Savannah River Basin of North Carolina, South Carolina and Georgia. Hydrobiologia. 46:405-302.

Gupta, T. S. and K. W. Stewart. 2000. Life history and case building behavior of *Molanna tryphena* (Trichoptera: Molannidae) in two East Texas spring-fed streams. Ann. Entomol. Soc. Am. 93:65-74.

Haddock, J. D. 1977. The biosystematics of the caddis fly *Nectopsyche* in North America with emphasis on the aquatic stages. Am. Midl. Nat. 98:382-421.

Hamilton, S. W. 1985. The larva and pupa of *Beraea gorteba* Ross (Trichoptera: Beraeidae). Proc. Entomol. Soc. Wash. 87:783-789.

Harris, S. C. 1991. New caddisflies (Trichoptera) from Alabama and Florida. Bull. Alabama Mus. Nat. Hist. 11:11-16.

_____. 2002. New species of microcaddisflies (Trichoptera: Hydroptilidae from northern Florida. Ann. Carnegie Mus. 71:47-57.

Harris, S. C. and B. J. Armitage. 1987. New Hydroptilidae (Trichoptera) from Florida. Entomol. News. 98:106-110.

Harris, S. C. and A. C. Keth. 2002. Two new microcaddisflies from Alabama and Florida. Entomol. News. 113:73-79.

Harris, S. C., P. K. Lago, and J. F. Scheiring. 1982. Annotated list of Trichoptera of several streams of Eglin Air Force Base, Florida. Entomol. News. 93:79-84.

Harris, S. C., P. E. O'Neil, and P. K. Lago. 1991. Caddisflies of Alabama. Geol. Surv. Alabama. Bull. No. 142. 442 pp.

Harris, S. C., M. L. Pescador, and A. K. Rasmussen. 1998. Two new species of microcaddisflies (Trichoptera:Hydroptilidae) from northern Florida. Fla. Entomol. 82:221-224.

Hilsenhoff, W. L. 1975. Aquatic insects of Wisconsin. Generic keys and notes on biology, ecology and distribution. Wisc. Dept. Nat. Res. Tech. Bull. No. 89. 53 pp.

Holzenthal, R. W. 1982. The caddisfly genus *Setodes* in North America (Trichoptera: Leptoceridae). J. Kans. Entomol. Soc. 55:253-271.

Hudson, P. L., J. C. Morse, and J. R. Voshell, Jr. 1981. Larva and pupa of *Cernotina spicata.* Ann. Entomol. Soc. Am. 74:516-519.

Irons, J. G. III. 1987. Life history patterns and trophic ecology of Trichoptera in two Alaskan (U.S.A.) subarctic streams. Can. J. Zool. 66:1258-1265.

Irons, J. G., III, M. V. Oswood, and J. P. Bryant. 1988. Consumption of leaf detritus by a stream shredder: Influence of tree species and nutrient status. Hydrobiologia. 160:53-61.

Johanson, K. A. 1998. Phylogenetic and biogeographic analysis of the family Helicopsychidae (Insecta:Trichoptera). Entomologica Scandinavica, Supplement. 53:1-172.

_____. 2002. Systematic revision of American *Helicopsyche* of the subgenus *Feropsyche* (Trichoptera: Helicopsychidae). Entomologica Scandinavica, Supplement. 60:1-147.

Johnson, R. K., T. Wiederholm, and D. M. Rosenberg. 1993. Freshwater biomonitoring using individual organism, populations, and species assemblages of benthic macroinvertebrates. Pp. 40-158 *in* D. M. Rosenberg and V. H. Resh, eds. Freshwater biomonitoring and benthic macroinvertebrates. Chapman and Hall, New York.

Keiper, J. B. 2002. Biology and immature stages of coexisting Hydroptilidae (Trichoptera) from northeastern Ohio lakes. Ann. Entomol. Soc. Am. 95:608-616.

Kelley, R. W. 1982. The micro-caddisfly genus *Oxyethira* (Trichoptera: Hydroptilidae): Morphology, biogeography, evolution and classification. Ph.D. Dissertation, Clemson University. Clemson, South Carolina. 436 pp.

Keth, A. C. and S. C. Harris. 1999. Two new species of *Agarodes* Banks (Trichoptera: Sericostomatidae) from southeastern United States. Proc. Entomol. Soc. Wash. 101:86-93.

Kingsolver, J. M. and H. H. Ross. 1961. New species of Nearctic *Orthotrichia* (Hydroptilidae, Trichoptera). Ill. Acad. Sci. Trans. 54:28-33.

Lago, P. K. and S. C. Harris. 1987. The *Chimarra* (Trichoptera: Philopotamidae) of eastern North America with descriptions of three new species. J. New York Entomol. Soc. 95:225-251.

Lenat, D. R. 1988. Water quality assessment of streams using qualitative collection method for benthic macroinvertebrates. J. N. Am. Benthol. Soc. 7:222-233.

Manuel, K. L. and D. A. Braatz. 1984. The life cycle and fifth instar larval description of *Triaenodes taenia* (Leptoceridae). Pp. 213-217 *in* Proc. 4th Internat. Symp. Trichoptera. Series Entomologica 30. J.C. Morse, ed. Dr. W. Junk Pub. The Hague.

Manuel, K. L. and T. C. Folsom. 1982. Instar sizes, life cycles, and food habits of five *Rhyacophila* (Trichoptera: Rhyacophilidae) species from the Appalachian Mountains of South Carolina, U.S.A. Hydrobiologia. 97:281-285.

Martin, I. D. 1985. Microhabitat selection and life cycle patterns of two *Rhyacophila* species (Trichoptera: Rhyacophilidae) in southern Ontario streams. Freshw. Biol. 15:1-14.

McEwan, E. 1980. Biology and life history of the genus *Agarodes* (Trichoptera: Sericostomatidae) in the southeastern U.S. M.S. Thesis, Clemson University. Clemson, South Carolina. 67 pp.

Merrill, D. and G. B. Wiggins. 1971. The larva and pupa of the caddisfly genus *Setodes* in North America. Trichoptera; Leptoceridae). Life Sci. Occ. Papers, Roy. Ont. Mus., No. 19. 12 pp.

Merritt, R. W., K. W. Cummins, and T. M. Burton. 1984. The role of aquatic insects in the processing and cycling of nutrients. Pp. 134-163 *in* V. H. Resh and D. M. Rosenberg, eds., The ecology of aquatic insects. Praeger, New York.

Merritt, R. W. and J. B. Wallace. 1981. Filter-feeding insects. Sci. Am. 244:132-144.

Milne, L. J. 1936. Studies in North American Trichoptera. Privately printed, Cambridge, Massachusetts. 3:56-158.

Morse, J. C. and C. B. Barr. 1990. Unusual caddisfly (Trichoptera) fauna of Schoolhouse Springs, Louisiana, with description of a new species of *Diplectrona* (Hydropsychidae). Proc. Entomol. Soc. Wash. 92:58-65.

Morse, J. C. and R. W. Holzenthal. 1996. Trichoptera genera. Pp. 350-386 *in* R. W. Merritt and K. W. Cummins, eds., An introduction to the aquatic insects of North America, 3rd edition. Kendall/Hunt Publishing Co., Dubuque, Iowa.

Moulton, S. R. and K. W. Stewart. 1996. Caddisflies (Trichoptera) of the interior highlands of North America. Mem. Am. Entomol. Inst. Vol. 56. 313 pp.

Nations, V. L. 1994. A phylogenetic analysis of the North American species of *Setodes* (Trichoptera: Leptoceridae) with descriptions of the larvae and key to their identification. M.S. Thesis, University of Alabama. Tuscaloosa, Alabama. 72 pp.

Nielsen, A. 1948. Postembryonic development and biology of the Hydroptilidae. Kgl. Danske Vidensk. Selsk. Biol. Skr. 5:1-200.

Noyes, A. A. 1914. The biology of the net-spinning Trichoptera of Cascadilla Creek. Ann. Entomol. Soc. Am. 7:251-272.

Osborne, L. L. and E. E. Herricks. 1987. Microhabitat characteristics of *Hydropsyche* (Trichoptera: Hydropsychidae) and the importance of body size. J. N. Am. Benthol. Soc. 6:115-124.

Parker, C. R. and G. B. Wiggins. 1987. Revision of the caddisfly genus *Psilotreta* (Trichoptera: Odontoceridae). Life Sci. Contr., Roy. Ont. Mus. 144. 55 pp.

Patterson, J. W. and R. L. Vannote. 1979. Life history and population dynamics of *Heteroplectron americanum*. Environ. Entomol. 8:665-669.

Pescador, M. L., A. K. Rasmussen, and S. C. Harris. 1995. Identification manual for the caddisfly (Trichoptera) larvae of Florida. Fla. Dep. of Environ. Protect., Tallahassee, Florida. 132 pp.

Plafkin, J. L., M. T. Barbour, K. D. Porter, S. K. Gross, and R. M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish. U.S. Environ. Protect. Agency, Assessment and Watershed Protection Division, Washington, D.C., EPA/4404-89-001.

Prather, A. L. and J. C. Morse. 2001. Eastern Nearctic *Rhyacophila* species, with revision of the *Rhyacophila ivaria* Group (Trichoptera: Rhyacophilidae). Trans. Am. Entomol. Soc. 127:85-166.

Rasmussen, A. K. 2004. Species diversity and ecology of Trichoptera (caddisflies) and Plecoptera (stoneflies) in ravine ecosystems of northern Florida. Ph.D. Dissertation, University of Florida, Gainesville. 130 pp.

Rasmussen, A. K. and D. R. Denson. 2000. Range extension, ecological notes, and new records of *Pycnopsyche indiana* (Trichoptera: Limnephilidae) from Florida. Entomol. News. 111: 359-366.

Reeves, W. K. and E. S. Paysen. 1999. Black flies (Diptera: Simuliidae) and a new species of caddisfly (Trichoptera: Hydropsychidae) in a northwestern Georgia cave stream. Entomol. News. 110:253-259.

Resh, V. H. 1976. The biology and immature stages of the caddisfly genus *Ceraclea* in eastern North America (Trichoptera: Leptoceridae). Ann. Entomol. Soc. Am. 69:1039-1061.

Resh, V. H. and J. K. Jackson. 1993. Rapid bioassessment approaches to biomonitoring using benthic macroinvertebrates. Pp. 195-233 *in* D. M. Rosenberg and V. H. Resh, eds., Freshwater biomonitoring and benthic macroinvertebrates. Chapman and Hall, New York.

Resh, V. H., J. C. Morse, and I.D. Wallace. 1976. The evolution of the sponge feeding habit in the caddisfly genus *Ceraclea* (Trichoptera: Leptoceridae). Ann. Entomol. Soc. Am. 69(5):937-941.

Resh, V. H. and J. D. Unzicker. 1975. Water quality monitoring and aquatic organisms: The importance of species identification. Water Pollution Control Federation. Jour. 47:9-19.

Ross, H. H. 1944. The caddis flies, or Trichoptera, of Illinois. Bull. Ill. Nat. Hist. Surv. 23:1-326.

_____. 1965. The evolutionary history of *Phylocentropu*s (Trichoptera: Psychomyiidae). J. Kans. Entomol. Soc. 38:198-400.

Ross, H. H. and D. G. Gibbs. 1973. The subfamily relationships of the Dipseudopsinae (Trichoptera, Polycentropodidae). J. Geor. Entomol. Soc. 8:312-316.

Ross, H. H. and D. C. Scott. 1974. A review of the genus *Agarodes* with descriptions of new species (Trichoptera: Sericostomatidae). J. Geor. Entomol. Soc. 9:147-155.

Ross, H. H. and J. B. Wallace. 1974. The North American genera of the family Sericostomatidae (Trichoptera). J. Geor. Entomol. Soc. 9:42-48.

Schefter, P. W. and G. B. Wiggins. 1986. A systematic study of the Nearctic larvae of the *Hydropsyche morosa* Group (Trichoptera: Hydropsychidae). Roy. Ont. Mus., Life Sci. Misc. Publ. Toronto, Canada. 94 pp.

Schuster, G. A. and D. A. Etnier. 1978. A manual for the identification of the larvae of the caddisfly genera *Hydropsyche* Pictet and *Symphitopsyche* Ulmer in eastern and central North America (Trichoptera: Hydropsychidae): U.S. Environmental Protection Agency, Environmental Support Laboratory, EPA-600/4-78-060. 129 pp.

Schuster, G. A. and S. W. Hamilton. 1984. The genus *Phylocentropus* in North America. (Trichoptera: Polycentropodidae). Pp. 347-362 *in* J. C. Morse, ed., Proceedings of the Fourth International Symposium on Trichoptera. Vol. 30. Dr. W. Junk Publ., The Hague.

Scott, W. B. and E. L. Crossman. 1973. Freshwater fishes of Canada. Bull. Fish. Res. Board Can. 184:1-196.

Sherberger, F. F. and J. B. Wallace. 1971. Larvae of the southeastern species of *Molanna.* J.

Kans. Entomol. Soc. 44:217-224.

Singh, M. P., S. M. Smith, and A. D. Harrison. 1984. Life cycles, microdistribution, and food of two species of caddisflies (Trichoptera) in a wooded stream in southern Ontario. Can. J. Zool. 62:2582-2588.

Sturkie, S. K. and J. C. Morse. 1998. Larvae of the three common North American species of *Phylocentropus* (Trichoptera: Dipseudopsidae). Insecta Mundi. 12:175-179.

Swegman, B. G. 1978. The occurrence of an intersex individual of *Psychomyia flavida* (Trichoptera). Entomol. News. 89:187-188.

Unzicker, J. W., V. H. Resh, and J. C. Morse. 1982. Trichoptera. Pp. 9.1-9.138 *in* A. R. Brigham, W. V. Brigham, and A. Gnilka, eds., Aquatic insects and oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, Illinois.

Vaillant, F. 1965. Les larves de Trichopteres hydroptilides manguses de substrat. P. 165 *in* Proc. XII Int. Congr. Entomol. London. 1964.

Vineyard, F. F. and G. B. Wiggins. 1988. Further revision of the family Uenoidae (Trichoptera): Evidence for inclusion of Neophylacinae and Thremmatidae. Syst. Entomol. 13:361-372.

Wallace, J. B. 1975. Food partitioning in net-spinning Trichoptera larvae: *Hydropsyche venularis, Cheumatopsyche etrona,* and *Macronema zebratum* (Hydropsychidae). Ann. Entomol. Soc. Am. 68:463-472.

Wallace, J. B. and N. H. Anderson. 1996. Habitat, life history, and behavioral adaptations of aquatic insects. Pp. 41-73 *in* R. W. Merritt and K. W. Cummins, eds., Aquatic insects of North America, 3rd edition. Kendall/Hunt Publishing Co., Dubuque, Iowa.

Wallace, J. B. and D. Malas. 1976. The significance of the elongate, rectangular mesh found in capture nets of fine particle filter feeding Trichoptera larvae. Arch. Hydrobiol. 79:205-212.

Wallace, J. B. and F. F. Sherberger. 1970. The immature stage of *Anisocentropus pyraloides* (Trichoptera: Calamoceratidae). J. Geor. Entomol. Soc. 5:217-224.

_____. 1974. The larval retreat and feeding net of *Macronema carolina* Banks (Trichoptera: Hydropsychidae). Hydrobiologia. 45:177-184.

Wallace, J. B., J. R. Webster, and T. F. Cuffney. 1982. Stream detritus dynamics: Regulation by invertebrate consumers. Oecologia (Berl.). 53: 197-200.

Wallace, J. B., J. R. Webster, and W. R. Woodall. 1977. The role of filter feeders in flowing waters. Arch. Hydrobiol. 79:506-532.

Wallace, J. B., W. R. Woodall, and A. A. Staats. 1976. The larval dwelling-tube, capture net and food of *Phylocentropus placidus* (Trichoptera: Polycentropodidae). Ann. Entomol. Soc. Am. 69:149-154.

Weaver, J. S., III. 1988. A synopsis of the North American Lepidostomatidae (Trichoptera). Am. Entomol. Institute Contr. 24:1-141.

Weaver, J. S., III and H. Malicky. 1994. The genus *Dipseudopsis* Walker from Asia (Trichoptera: Dipseudopsidae). Tijdschrift voor Entomologie. 137:95:142.

Weaver, J. S., III and J. L. Sykora. 1979. The *Rhyacophila* of Pennsylvania with larval descriptions of *R. banksi* and *R. carpenteri* (Trichoptera: Rhyacophilidae). Ann. Carnegie Mus. 48:403-425.

Wells, A. and D. Cartwright. 1993. Females and immatures of the Australian caddisfly *Hyalopsyche disjuncta* Neboiss (Trichoptera), and a new family placement. Trans. Roy. Soc. S. Aust. 117:97-104.

Whitlock, H. N. and J. C. Morse. 1994. *Ceraclea enodis*, a new species of sponge-feeding caddisfly (Trichoptera: Leptoceridae) previously misidentified. J. N. Am. Benthol. Soc. 13:580-591.

Wiggins, G. B. 1954. The caddisfly *Beraea* in North America (Trichoptera). Contr. Roy. Ont. Mus. Zool. Paleont. 39:1-18.

_____. 1960. A preliminary systematic study of the North American larvae of the caddisfly family Phryganeidae (Trichoptera). Can. J. Zool. 38: 1153-1170.

_____. 1965. Additions and revisions to the genera of North American caddisflies of the family Brachycentridae with special reference to the larval stages (Trichoptera). Can. Entomol. 97:1089-1106.

_____. 1996a. Larvae of the North American caddisfly genera (Trichoptera), 2nd edition. Univ. Toronto Press, Toronto, Ontario. 457 pp.

_____. 1996b. Trichoptera. Pp. 309-349 *in* R. W. Merritt and K. W. Cummins, eds., An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Co., Dubuque, Iowa.

_____. 1998. The caddisfly family Phryganeidae (Trichoptera). Univ. Toronto Press, Toronto, Ontario. 306 pp.

Williams, D. D. and N. E. Williams. 1975. A contribution to the biology of *Ironoquia punctatissima* (Trichoptera: Limnephilidae). Can. Entomol. 107:829-832.

Wojtowicz, J. A. 1982. A review of the adults and larvae of the genus *Pycnopsyche* (Trichoptera: Limnephilidae) with revision of the *Pycnopsyche scabripennis* (Rambur) and *Pycnopsyche lepida* (Hagen) complexes. Ph.D. Dissertation, University of Tennessee, Knoxville. 292 pp.

APPENDIX A: CHECKLIST OF FLORIDA CADDISFLIES

This checklist includes both species that are known to occur in Florida, based on literature citations and material examined by us, and species that are likely to be found in the state based on their geographic distributions. Taxa are arranged alphabetically within their respective subordinal groupings.

KEY: L= larva known; **LU=** larva unknown; **? =** somewhat likely to occur in Florida; **??=** reported in literature but doubtful or erroneous; ***** = newly discovered species or new state record discovered since the 1st edition of this manual; **PAN** = panhandle Florida; **PEN** = peninsular Florida.

We define the Florida panhandle as all areas of northern Florida to the North and West of the basins drained by the St. Johns, Oklawaha, and Withlacoochee (southern) rivers. The peninsula comprises the above mentioned basins and all others to the South.

Taxa	Larval Identity	Florida Distribution	
Suborder **ANNULIPALPIA**			
Family **Dipseudopsidae**			
Phylocentropus carolinus Carpenter	L	PAN	
P. harrisi Schuster & Hamilton ?	LU		
P. lucidus (Hagen)	L	PAN	
P. placidus (Banks)	L	PAN	PEN
Family **Hydropsychidae**			
Cheumatopsyche burksi Ross	LU	PAN	PEN
C. campyla Ross *	LU	PAN	
C. edista Gordon	LU	PAN	
C. geora Denning ?	LU		
C. gordonae Lago & Harris	LU	PAN	
C. miniscula (Banks) *	LU	PAN	
C. pasella Ross	LU	PAN	
C. petersi Ross, Morse, & Gordon	LU	PAN	
C. pettiti (Banks)	LU	PAN	PEN
C. pinaca Ross	LU	PAN	PEN
C. sordida (Hagen) ?	LU		
C. virginica Denning	LU	PAN	PEN
Diplectrona modesta Banks	L	PAN	
Diplectrona sp. A Rasmussen *	L		PEN
Hydropsyche alabama Lago & Harris *	LU	PAN	
H. alvata Denning	LU	PAN	
H. betteni Ross *	L	PAN	
H. decalda Ross	L	PAN	PEN
H. elissoma Ross	L	PAN	
H. incommoda Hagen	L	PAN	PEN
H. mississippiensis Flint	L	PAN	
H. orris Ross	LU	PAN	

H. phalerata Hagen ?	L		
H rossi Flint, Voshell, & Parker	L	PAN	PEN
H. scalaris Hagen ?	L		
H. sparna Hagen ?	L		
H. venularis Banks ?	L		
Macrostemum carolina (Banks)	L	PAN	PEN
Potamyia flava (Hagen)	L	PAN	
Family **Philopotamidae**			
Chimarra argentella (Ulmer) ??	L		
C. aterrima Hagen	LU	PAN	PEN
C. falculata Lago & Harris	LU	PAN	
C. florida Ross	LU	PAN	PEN
C. moselyi Denning	LU	PAN	PEN
C. obscura (Walker)	LU	PAN	
C. parasocia Lago & Harris ?	LU		
Wormaldia moesta (Banks)	L	PAN	
Family **Polycentropodidae**			
Cernotina calcea Ross	LU	PAN	PEN
C. spicata Ross	L	PAN	PEN
C. truncona Ross	LU	PAN	PEN
Cyrnellus fraternus (Banks)	L	PAN	PEN
Neureclipsis crepuscularis (Walker)	L	PAN	PEN
N. melco Ross	LU	PAN	PEN
Nyctiophylax affinis (Banks)	LU	PAN	
N. celta Denning	L	PAN	PEN
N. denningi Morse ?	LU		
N. moestus Banks ??	L		
N. morsei Lago & Harris	LU	PAN	
N. serratus Lago & Harris *	LU	PAN	PEN
Polycentropus blicklei Ross & Yamamoto	LU	PAN	PEN
P. cinereus Hagen	L	PAN	PEN
P. clinei (Milne) *	LU		PEN
P. crassicornis Walker	LU		
P. floridensis Lago & Harris	LU	PAN	
P. interruptus (Banks) ??	L		
P. nascotius Ross *	LU	PAN	PEN
Family **Psychomyiidae**			
Lype diversa (Banks)	L	PAN	PEN
Psychomyia flavida Hagen	L	PAN	
Suborder **SPICIPALPIA**			
Family **Glossosomatidae**			
Protoptila sp.	LU	PAN	
Family **Hydroptilidae**			
Hydroptila alabama Harris & Kelley ?	LU		
H. apalachicola Harris et al. *	LU	PAN	

H. armata Ross	LU	PAN	PEN
H. berneri Ross	LU	PAN	PEN
H. bribriae Harris *	LU	PAN	
H. circangula Harris	LU	PAN	
H. disgalera Holzenthal & Kelley *	LU	PAN	PEN
H. eglinensis Harris *	LU	PAN	
H. hamiltoni Harris *	LU	PAN	
H. gunda Milne ?	LU		
H. hamata Morton	L	PAN	
H. latosa Ross	LU	PAN	PEN
H. lloganae Blickle	LU	PAN	PEN
H. maculata Banks	LU		PEN
H. metteei Harris ?	LU		
H. molsonae Blickle	LU	PAN	PEN
H. novicola Blickle & Morse *	LU	PAN	
H. parastrepha Kelley & Harris	LU	PAN	
H. quinola Ross	LU	PAN	PEN
H. remita Blickle & Morse	LU	PAN	PEN
H. sarahae Harris *	LU	PAN	
H. scheiringi Harris ?	LU		
H. sykorai Harris *	LU	PAN	
H. wakulla Denning	LU	PAN	PEN
H. waubesiana Betten	L	PAN	PEN
Mayatrichia ayama Mosely	L	PAN	PEN
Neotrichia alabamensis Kelley & Harris	LU	PAN	
N. armitagei Harris	LU	PAN	PEN
N. minutisimella (Chambers)	LU	PAN	PEN
N. mobilensis Harris ?	LU		
N. okopa Ross	LU		
N. rasmusseni Harris & Keth *	LU	PAN	PEN
N. vibrans Ross	LU	PAN	PEN
Ochrotrichia apalachicola Harris et al. *	LU	PAN	
O. confusa (Morton) *	LU	PAN	
O. okaloosa Harris	LU	PAN	
O. provosti Blickle	LU		PEN
O. tarsalis (Hagen)	LU		PEN
Orthotrichia aegerfasciella (Chambers)	L	PAN	PEN
O. baldufi Kingsolver & Ross	LU	PAN	
O. cristata Morton	LU	PAN	PEN
O. curta Kingsolver & Ross	LU	PAN	PEN
O. dentata Kingsolver & Ross	LU		PEN
O. instabilis Denning	LU		PEN
Oxyethira abacatia Denning	LU	PAN	PEN
O. anabola Blickle ?	LU		
O. chrysocara Harris *	LU		PEN
O. elerobi (Blickle)	LU	PAN	

O. florida Denning	LU	PAN	PEN
O. glasa (Ross)	LU	PAN	PEN
O. janella Denning	LU	PAN	PEN
O. kelleyi Harris	LU	PAN	
O. kingi Holzenthal & Kelley	LU		PEN
O. lumipollex Kelley & Harris ?	LU		
O. lumosa Ross	LU	PAN	PEN
O. maya Denning	LU	PAN	PEN
O. novasota Ross	LU	PAN	
O. pallida (Banks)	L	PAN	PEN
O. pescadori Harris & Keth *	LU	PAN	PEN
O. roberti Roy & Harper	LU	PAN	
O. savanniensis Kelley & Harris	LU	PAN	PEN
O. setosa Denning	LU	PAN	
O. sininsigne Kelley	LU	PAN	PEN
O. verna Ross	LU	PAN	PEN
O. zeronia Ross	LU	PAN	PEN
Stactobiella martynovi Blickle & Denning ?	LU		
S. palmata (Ross) ?	L		
Family **Rhyacophilidae**			
Rhyacophila carolina Banks	L	PAN	
R. ledra Ross ?	L		
Rhyacophila n. sp. *	L	PAN	
Suborder **INTEGRIPALPIA**			
Family **Beraeidae**			
Beraea gorteba Ross ?	L		
Beraea n. sp. *	LU	PAN	
Family **Brachycentridae**			
Brachycentrus americanus (Banks) ??	L		
B. chelatus Ross	L	PAN	
B. numerosus (Say)	L	PAN	
Micrasema rusticum (Hagen)	L	PAN	
M. wataga Ross	L	PAN	PEN
Micrasema n. sp.	L	PAN	
Family **Calamoceratidae**			
Anisocentropus pyraloides (Walker)	L	PAN	
Heteroplectron americanum (Walker)	L	PAN	
Family **Helicopsychidae**			
Helicopsyche borealis Hagen	L	PAN	PEN
Family **Lepidostomatidae**			
Lepidostoma griseum (Banks)	LU	PAN	
L. latipenne (Banks)	LU	PAN	
L. morsei Weaver	LU	PAN	
L. serratum Flint & Wiggins	LU	PAN	
L. togatum (Hagen) ?	LU		

Family **Leptoceridae**

Ceraclea cancellata (Betten)	L	PAN	PEN
C. diluta (Hagen)	L	PAN	
C. enodis Whitlock & Morse ?	L		
C. flava (Banks)	L	PAN	
C. floridana (Banks)	LU		PEN
C. maculata (Banks)	L	PAN	PEN
C. nepha (Ross)	L	PAN	
C. ophioderus (Ross)	LU	PAN	
C. protonepha Morse & Ross	L	PAN	
C. resurgens (Walker)	L	PAN	
C. slossonae (Banks)	L	PAN	PEN
C. spongillovorax (Resh) ??	L		
C. tarsipunctata (Vorhies)	L	PAN	
C. transversa (Hagen)	L	PAN	PEN
Ceraclea n. sp. *	L	PAN	
Leptocerus americanus (Banks)	L	PAN	PEN
Nectopsyche albida (Walker) ??	LU		
N. candida (Hagen)	L	PAN	
N. exquisita (Walker)	L	PAN	PEN
N. paludicola Harris	LU	PAN	
N. pavida (Hagen)	L	PAN	PEN
N. spiloma (Ross) ?	L		
N. tavara (Ross)	L		PEN
Oecetis avara (Banks)	L	PAN	
O. cinerascens (Hagen)	L	PAN	PEN
O. daytona Ross	LU	PAN	PEN
O. ditissa Ross	LU	PAN	PEN
O. floridanus (Banks)	LU		PEN
O. georgia Ross	L	PAN	PEN
O. inconspicua (Walker) Complex			
Oecetis sp. A Floyd	L	PAN	PEN
Oecetis sp. C Floyd	L	PAN	PEN
Oecetis sp. E Floyd *	L	PAN	PEN
Oecetis sp. F Floyd	L	PAN	PEN
O. morsei Bueno-Soria	L	PAN	
O. nocturna Ross	L	PAN	PEN
O. osteni Milne	L	PAN	PEN
O. parva (Banks)	L	PAN	PEN
O. persimilis (Banks)	L	PAN	PEN
O. porteri Ross	L	PAN	PEN
O. pratelia Denning	LU		PEN
O. sphyra Ross	L	PAN	
Setodes dixiensis Holzenthal ?	L		
S. guttatus (Banks)	L	PAN	
Setodes n. sp.	L	PAN	

Triaenodes aba Milne	L	PAN	
T. flavescens Banks	L	PAN	
T. florida Ross	L	PAN	PEN
T. furcella Ross	L		PEN
T. helo Milne	L	PAN	PEN
T. ignitus (Walker)	L	PAN	PEN
T. injustus (Hagen) ?	L		
T. marginatus Sibley ?	L		
T. melaca Ross ?	L		
T. nox Ross	L	PAN	
T. ochraceus (Betten & Mosely)	L	PAN	PEN
T. perna Ross	L	PAN	PEN
T. smithi Ross ?	LU		
T. taenia Ross *	L	PAN	
T. tardus Milne	L	PAN	PEN
T. tridonta Ross ?	LU		
Triaenodes n. sp.	LU		PEN
Triaenodes n. sp. A	L	PAN	PEN
Triaenodes n. sp. C	L		PEN
Family **Limnephilidae**			
Ironoquia punctatissima (Walker)	L	PAN	
Pycnopsyche antica (Walker)	L	PAN	PEN
P. guttifera (Walker) ??	L		
P. indiana (Ross)	L	PAN	PEN
Family **Molannidae**			
Molanna blenda Sibley	L	PAN	
M. tryphena Betten	L	PAN	PEN
M. ulmerina Navás	L	PAN	PEN
Family **Odontoceridae**			
Psilotreta frontalis Banks	L	PAN	
P. labida Ross ?	L		
Family **Phryganeidae**			
Agrypnia vestita (Walker)	L	PAN	
Banksiola concatenata (Walker)	LU	PAN	PEN
Ptilostomis ocellifera (Walker) *	L	PAN	
P. postica (Walker)	LU	PAN	
Family **Sericostomatidae**			
Agarodes crassicornis (Walker)	LU	PAN	PEN
A. logani Keth & Harris *	LU	PAN	
A. libalis Ross and Scott	L	PAN	PEN
A. ziczac Ross and Scott	LU	PAN	
Family **Uenoidae**			
Neophylax concinnus MacLachlan ??	L		
Neophylax sp. ?			