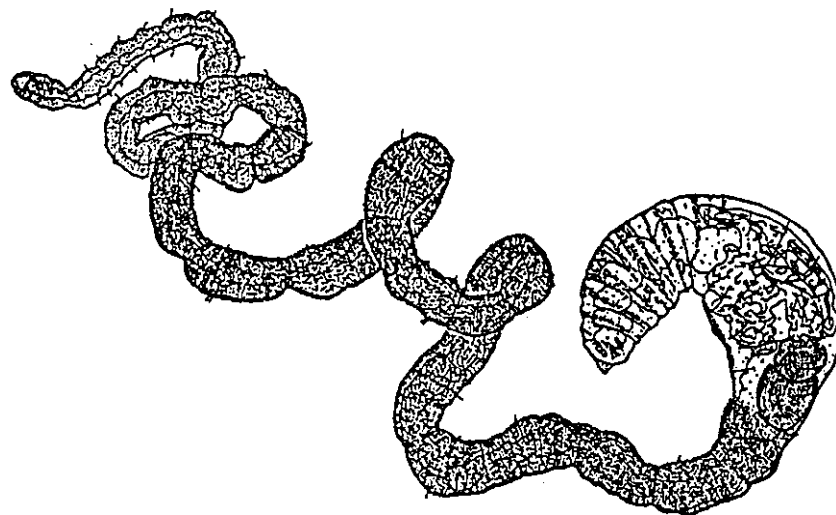


IDENTIFICATION MANUAL
FOR THE
AQUATIC OLIGOCHAETA
OF
FLORIDA

VOLUME I
FRESHWATER OLIGOCHAETES



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INTRODUCTION

Accurate identification of oligochaetes is imperative to any environmental bioassessment project. Oligochaetes generally comprise in excess of 50% of the macroinvertebrate communities in Florida lakes, rivers and streams, and at least 10% of the benthic community in estuaries and near shore coastal areas.

Unfortunately, they have developed a reputation for being a taxonomically difficult group because they, like chironomid larvae, must be mounted on microscope slides for examination, and frequently require fully mature individuals for specific determination. While it is true that oligochaetes must be examined under a compound microscope necessitating preparation on microscope slides, the majority of the species in Florida may be identified based on somatic characters. The remainder, generally tubificids and lumbriculids, can be identified based on the associated mature individuals within the community, relating their somatic characters with those of the immature forms.

Both freshwater and marine oligochaetes form an integral component of aquatic communities throughout Florida, largely contributing to the diet of bottom feeding omnivores. Many environmental studies have focused on the use of freshwater oligochaetes as indicators of trophic conditions. As a result, a great deal of information concerning the taxonomy and ecology of freshwater taxa has been compiled since the first Oligochaeta was formally identified by Linnaeus in the 18th century. Currently, there are approximately 80 species of freshwater oligochaetes, represented by two major families, Tubificidae and Naididae, recorded from Florida or expected to occur. Less than one-quarter account for the majority of taxa commonly encountered throughout the state.

The complexity of the taxonomy and ecology of estuarine and marine oligochaetes has only recently been recognized. In the last two decades, the number of described saltwater tubificids has increased from 40 species known worldwide to more than 600. More than half have been recorded from the eastern seaboard of North America, with the majority inhabiting the subtropical and tropical waters of the Gulf of Mexico and the Caribbean.

Few comprehensive taxonomic treatises have been prepared concerning aquatic oligochaetes. Stephenson (1930) authored one of the earlier major reviews of Oligochaeta, but this was primarily meant as an overview of the zoology of the group, not to be used as a taxonomic reference. More recently, Christina Sperber published the most comprehensive contribution to the taxonomy of Naididae in 1948. Not until Brinkhurst and Jamieson (1971) compiled an all-encompassing treatise on the systematics and taxonomy of aquatic oligochaetes throughout the world could the frustration of non-taxonomists attempting to identify oligochaetes be somewhat alleviated. This monograph provided a broad general base establishing uniformity in nomenclature up to that time.

Since the publication of *Aquatic Oligochaeta of the World* in 1971, the nomenclature and systematics of Oligochaeta have undergone numerous revisions and modifications. In an effort to remain current, Brinkhurst and Wetzel (1984) produced a supplement to the 1971 global review providing an annotated list of freshwater oligochaetes described or revised between 1971 and 1984.

Shortly thereafter, Brinkhurst (1986) published the *Guide to the Freshwater Aquatic Microdile Oligochaetes of North America*. This publication is a necessary supplement to the library of any biologist dealing with freshwater oligochaete taxonomy. However, the more serious student of systematics should make every attempt to obtain a copy of the Brinkhurst and Jamieson (1971) classic for comprehensive background information regarding the biology, morphology and systematics of the aquatic Oligochaeta.

Although the Guide previously noted, effectively compiled the literature regarding freshwater oligochaetes of North America into a single cohesive publication, it is now over a decade old and in need of revision. The taxonomic and distributional information contained therein is still invaluable. However, the novice marine or estuarine biologist is not as fortunate to have the same guidance through the taxonomic labyrinth created by their saltwater cousins. Many regional publications pertaining to marine oligochaete taxonomy have been produced. Brinkhurst was most instrumental in recognizing the potential diversity of marine oligochaetes and wrote numerous publications in the '60s concerning marine Oligochaeta in Great Britain. The guide authored by Brinkhurst (1982) for the British estuarine and marine oligochaetes contains a wider geographic range than indicated by the title and is very useful for generic information. Brinkhurst in the '60s, '70s, and '80s contributed to the knowledge of the fauna associated with coastal regions of North America. However, up until the early '70s, marine Oligochaeta were considered a relatively insignificant taxonomic component of the benthic community. Cook and Brinkhurst (1973) listed only two species of truly marine Naididae, 21 marine Tubificidae, 13 marine Enchytraidae, and two megascolecid taxa for a total of 38 marine species listed for the east coast of North America. Since then a taxonomic "Big Bang" has occurred along the eastern seaboard, with approximately 300 species presently described from that region. Dr. C. Erséus of Sweden is primarily responsible for this expansion. Although he has written more than 100 manuscripts regarding the taxonomy of marine oligochaetes, the vast majority are restricted to a single taxonomic entity or isolated geographic region. The most comprehensive publications pertaining to the Florida waters are his works on the fauna of the U. S. barrier reef in Belize (Erséus, 1990), and that on oligochaetes of Hutchinson Island on the east coast of Florida (Erséus, 1986). However, neither of those publications provide taxonomic guides, and are simply checklists with descriptions. Giere and Pfannkuche's (1982) compilation and review of the literature regarding the ecology of brackish water and marine oligochaetes is highly informative and is recommended for a more complete ecological evaluation.

The purpose of this manual is to provide a guide for the non-taxonomist to identify rapidly oligochaetes expected to be encountered throughout Florida waters using, in most

cases, the most discriminating readily observable somatic characters. The manual is divided into two volumes. The first volume concentrates on freshwater taxa and Volume II concerns the estuarine and marine fauna.

The vast majority of oligochaetes inhabiting aquatic ecosystems of Florida belong to two families: Naididae and Tubificidae. Although species of the family Enchytraeidae are frequently encountered in the course of an aquatic investigation, many taxa within this family are not truly aquatic. Sixty-five years ago when oligochaete taxonomy was still in a relative state of infancy, Stephenson (1930) suggested that no single author could do justice to a review of Oligochaeta as a whole and the taxa were becoming so numerous serious investigators may have more than they can handle concentrating on one family. Brinkhurst and Jamieson (1971) reinforced this opinion a quarter of a century ago, and that was before the more than tenfold increase in the descriptions of marine species.

Unfortunately, the "explosion" of knowledge regarding the taxonomy of this group has resulted in an accumulation of uncompiled species descriptions. Recently, the number of new taxa being described has reached a steady state. The time is now appropriate to produce a cohesive compilation of the literature, collating the taxonomic and ecological information into a single volume. Currently, approximately 70 saltwater species have been recorded from estuaries and near shore coastal regions of Florida. An additional forty or fifty taxa, which have been recorded from the Caribbean, can also be expected to be encountered in the tropical waters off southern Florida.

This identification manual will enable environmental specialists responsible for identifying macroinvertebrates to also recognize accurately the oligochaete fauna associated with Florida lakes, streams, estuaries and near shore marine waters. This can be accomplished with minimal sample preparation, relying primarily on somatic characters or cuticularized genital structures.

ECOLOGY

The diversity of habitats oligochaetes inhabit is immeasurable. Oligochaeta have successfully exploited virtually every habitable niche from submerged caves and the anaerobic sulfur-rich thiobiotic sediments off the coast of Florida to the icefields of Alaska. Most aquatic oligochaetes are free-burrowing deposit feeders, ingesting sediment. Some species, however, lack a mouth, anus and alimentary canal. This small group of phallodriline tubificids inhabit the thiobiotic marine sediments, existing off the metabolic by-products of subcuticular symbiotic bacteria.

Ecology of specific taxa is presented in the text with more detailed information available throughout the literature (see, for example, Brinkhurst and Jamieson, 1971; Brinkhurst and Cook, 1979; Pfannkuche, 1978; Giere and Pfannkuche, 1982; and Diaz and Erséus, 1994), but is primarily restricted to the freshwater fauna. Since the vast majority of marine and estuarine species have been described only in the last two decades, and very few ecologists identify them beyond class, detailed ecological requirements are largely unknown. However, recent taxonomic studies by Dr. C. Erséus and the author from the Gulf of Mexico, Caribbean and east coast of Florida have provided significant insight regarding the diversity, ecological associations and habitat preferences of the more cosmopolitan taxa. For instance, salt marsh with silty sediment, and salinities ranging from about 10 ppt to 27 ppt are generally dominated by the subfamily Limnodriloidinae, with three to four species of Limnodriloidinae frequently co-occurring. Fine coralline sands with a small percentage of silt at depths from two to four meters harbor an extremely diverse community of phallodriline tubificids. In a recent study by Erséus (1986) twenty-five species of Tubificidae were identified from just two adjacent collecting areas in coralline sands just off Hutchinson Island on the east coast of Florida. Diaz and Erséus (1994) have recently correlated environmental relationships with marine species associated with the barrier reef off Belize in the Caribbean. Details regarding specific taxa are provided in Volume 2.

Freshwater families can be more readily generalized with respect to their individual habitat preferences. Naididae are common in the sediments of streams, ponds and slow moving rivers. Although they coexist with Tubificidae, Naididae occur in highest concentrations where tubificid densities are low and are most commonly associated with aquatic vegetation and in the coarse sediments of fast flowing streams. Many species appear to be herbivorous, grazing on algae, diatoms and plant fragments. However, at least one genus, *Chaetogaster*, is carnivorous. Naididae are primarily freshwater inhabitants. Although many species can tolerate short periods of saline exposure, only one species in Florida is truly estuarine: *Paranais litoralis*. This worm will frequently establish dense populations in the lower oligo- to meso-saline stretches of estuaries. Many species are capable of swimming, enabling them to enter the water column, enhancing their distributional capabilities and allowing them to colonize submerged substrates. As a result, they are able to colonize rapidly artificial substrate sampling devices (Hester-Dendy's) commonly deployed for ecological investigations throughout Florida. Naididae primarily

reproduce asexually forming long chains of zooids enabling them to establish large populations in a very short time period. A high diversity of naids is frequently associated with pristine conditions. Many species are easily recognized by their anal gills, proboscis, or ocular pigmentation.

Tubificidae are commonly referred to as "sludge worms" because they often form dense mats or writhing balls in the very fine sediments associated with organically enriched waters.

The explanation for the extremely high densities of tubificids in organically polluted situations may be correlated to an increase of food and living space created by the exclusion of competitors due to the occurrence of anaerobic conditions. Providing there is sufficient water flow for the elimination of metabolic wastes, and there is a periodic replenishment of oxygen, population increases may be dramatic in the absence of competitors. Tubificids generally exist in fine sediments such as muds and silts, where they graze off the microflora associated with the sediment they ingest. They less frequently occur in association with naids where aquatic vegetation is abundant, or in the stagnant water of ponds and pools with high algal concentrations.

From middle to lower peninsular Florida, the vast majority of tubificids encountered will be one of four taxa: *Limnodrilus hoffmeisteri*, *Aulodrilus pigueti*, *Haber speciosus*, and *Psammoryctides convolutus*. The last two taxa frequently co-occur, inhabiting lotic waters with sediments composed primarily of fine sand with little organics. This is in contrast to the two former species, which are associated with larger rivers and lakes with a mud and silt substrate. However, there may be substantial overlap among these four taxa.

The Panhandle of Florida is frequently designated as part of the Carolinian zoogeographic province, harboring temperate communities. As a result, the diversity and species composition of tubificids is more variable than in the West-Indian province associated with lower peninsular Florida.

Enchytraeids are primarily terrestrial, generally comprising less than 1% of the annelid community in aquatic environments. Identification of most taxa require detailed examination of the internal anatomy. For the most part, this is beyond the scope of non-taxonomists and their presence may be considered incidental in the overall environmental evaluation. Additionally, the lack of recent taxonomic reviews of North American taxa hinders the identification of enchytraeids beyond family level. One notable exception is the *Grania* complex. The setae of *Grania* spp. are of sufficient distinction to separate this marine assemblage from all related taxa. Consequently, until a comprehensive review of the aquatic Enchytraidae of North America is complete, the extent of their inclusion in this manual will be to family level.

Lumbriculidae are normally infrequently encountered. However, they are generally the largest aquatic microdrile oligochaetes encountered in Florida. Of the 20 species recorded from North America, the two aquatic species recorded from Florida are for the most part restricted to the littoral margins of lakes and rivers where they are associated with detritus, stones and rooted vegetation.

The only other oligochaete family likely to be encountered in Florida waters is Opistocystidae. A single taxon, *Crustipellis tribranchiata* has been reported, but is uncommon, throughout Florida. This species has the same habitat requirements of Naididae, with which is sympatric, existing in shallow, relatively "clean" habitats with some degree of aquatic vegetation. Its distribution throughout Florida may be underestimated because it will frequently be confused with Naididae if the posterior end is lacking. A closely related species, *Trieminentia corderoi*, is also included in this manual since I have identified it from various regions from Florida, but is otherwise unrecorded from North America.

One final note worth discussing is the systematic placement of Aeolosomatidae. Historically, this family has been included with Oligochaeta. However, aeolosomatids are now generally considered to be in the Aphanoneura, an annelid taxon with uncertain position, and will not be discussed.

COLLECTION AND PREPARATION

Many environmental investigations require collecting a large number of substrate samples in a very short time period with the organisms to be sorted from the debris and identified at a later time. The most common method of collecting sediment is with either a grab sampler (*i.e.*, a Ponar or Ekman) or hand core. Epsom salts may be added to the sample for 15 to 30 minutes to narcotize the organisms. The sediment is then washed through a 0.5 mm or less screen. The residue is then fixed with a 10% formalin solution stained (generally with rose bengal) to facilitate separation of the worms from the sediment. After a minimum of 48 to 72 hours, the formalin is decanted and replaced with 70% ethyl or isopropyl alcohol. These samples may remain in this condition indefinitely, providing the alcohol level is periodically checked for evaporation. Sorting the worms from the residue is accomplished using a dissecting microscope.

If the purpose of the collection is strictly for finding oligochaetes and quantification is not a factor, an alternate method may be employed: elutriation. For elutriation, a bucket is filled about one-third to one-half full with sediment. The sediment is passed through a 1 cm to 2 cm screen to remove the rocks, coarse gravel, detritus and vegetation. Water is added to the sediment and swirled to suspend the organisms, the supernatant is decanted into a 0.25 mm screen and the resulting organisms rinsed into an appropriately labelled container. The sediment should be elutriated an additional two or three times to ensure removal of the majority of worms from the sediment.

The live worms are then sorted from the sediment within 12 hours and fixed in a 10% formalin solution for at least 48 to 72 hours, and transferred to 70% alcohol.

For routinely examining large collections, the fastest method is to mount the worms on microscope slides in Amman's lactophenol. This is a temporary medium composed of phenol (carbolic acid), lactic acid, glycerol and water in a ratio of 1:1:2:1. Two drops of mounting medium are placed on each slide. One to five worms (depending on their size) are arranged in a row within each drop, and a cover slip is placed over the worms. Placement of the worms in a single row with their heads pointing in the same direction facilitates identification of large numbers of specimens simply by moving the stage left to right without having to look away from the microscope trying to locate each specimen. Tubificids may be fairly long and have a tendency to coil upon fixation, frequently obscuring taxonomically important characters. To straighten when mounting, grab one end with the forceps and drag it on the dry part of the slide into the drop of Amman's. This usually removes the kinks. The slides are placed on stackable slide trays, and are available through scientific supply distributors. Metal cookie sheets can be an inexpensive alternative, gluing thin spacers at 2.5 cm intervals to keep the slides separate. After each tray is mounted, examine the slides to ensure there are no air bubbles. If necessary, add a drop of mounting medium to the edge of the cover slip. Capillary action will draw the fluid in to eliminate air spaces.

Identification of freshwater material requires examination of setae and/or cuticular structures, such as penis sheaths. For this purpose, chemical maceration of the internal structures facilitates these observations. Gentle heating in a drying oven set at approximately 90°C, or on top of an electric range with burner control set at 3-1/4, for about 15 to 30 minutes, depending on the size of the worms, hastens this process. Since temperature controls vary for each unit, experimentation and continuous examination of the specimens is initially required to prevent melting the worms, leaving only a scattered mass of setae.

If permanent mounts are required, Hydramount or CMC-10 may be used. The specimens may be mounted directly into these media from water, alcohol, or Amman's as described previously for temporary mounts. Both media will also clear the specimens after a day or two.

Identification of marine oligochaetes frequently requires the examination of internal structures. Generally, mount all specimens temporarily in Amman's lactophenol for preliminary examination. Specimens which need to be maintained for reference are carefully removed from the slide, stained in paracarmine stain, destained to the appropriate tint in acidified alcohol, dehydrated through an alcohol series, cleared in terpineol (xylene works well, but renders the material brittle), and mounted in Canada Balsam.

Dissection of the male genitalia of large specimens, such as *Thalassodrilides* is recommended for accurate identification. The dorsum of segments VII through XIII is torn open to expose the spermathecae and male genitalia. The lateral portions of the body wall are teased away, leaving only the ventral section containing the male and female pores and associated genital structures. Care may be taken to then remove the alimentary canal. The dissection may either be accomplished in the final mounting medium or completed in alcohol, dehydrated and mounted in Canada Balsam. Care must be exercised in the latter method to avoid loss of or damage to the specimen.

MORPHOLOGY

Oligochaetes are segmented, coelomate, bilaterally symmetrical, vermiform organisms. Aquatic oligochaetes are generally much smaller than their terrestrial counterparts. Usually they possess a subterminal anterior mouth and a terminal anus. However, these are absent in two genera of marine tubificids which are common in the coastal waters of Florida (*Olavius* and *Inanidrilus*). Each segment is separated by an "intersegmental groove" and designated by a roman numeral (Fig. 1). The first segment (I) is the peristomium immediately posterior to the terminal prostomium which is produced into an elongate proboscis in some naidids and lumbriculids. Additionally, paired purple pigment spots (eyes) may be present in some species of naidids. This segment always lacks setae. Setae, generally first appear on segment II and are arranged in four discrete bundles, two dorso-lateral (dorsal bundles) and two ventro-lateral (ventral bundles). The dorsal bundles of setae of most naidids begin posterior to II. However, since this family reproduces primarily by asexual fission, with the anterior-most segments developing last, confusion frequently results when attempting to identify species based solely on setal placement. Examination of whole communities containing parent specimens alleviates this problem by associating the setal morphology of newly budded individuals with mature specimens examined from the community.

The most obvious character useful in the identification of oligochaetes is setal morphology. First, a discussion of the use of setae v. chaetae is appropriate. A great deal of emphasis has been placed on replacing the word setae with "chaetae" as the correct term of the hair-like extensions from the body wall to conform with the suffix of the class name. However, whereas "chaeta" is derived from a Greek word meaning "hair", seta is from a Latin word for "bristle or bristle-like". Traditionally, "setae" has been used in reference to these structures for over a century, because they are not simply hair-like, but have a wide range of distal variation (see below). Being a traditionalist, and not wishing to introduce more confusion into the preexisting quagmire of taxonomic verbiage, "setae" will be used throughout this manual. At any rate, by whatever term, the reader will know to what is referred.

Setae may be divided into two basic forms: hairs and crotchets (Fig. 2, 3). Hairs are elongate, slender and terminate in a distally acute point, and lack a nodulus or intermediate swelling along the shaft. However, they may have lateral hairs or serrations occasionally appearing hispid. This type of setae is present only in dorsal bundles and occurs in the majority of Naididae, many of the Tubificidae and the Opistocystidae. Hairs are not present in Lumbriculidae and Enchytraeidae.

Crotchets may be either bifid with an upper(distal) and lower (proximal) tooth, with or without intermediate teeth between the two main laterals, or they may be simple-pointed, in which case the term crotchet is somewhat of a misnomer. These setae are characteristically stouter, have a characteristically sigmoid configuration and possess a nodulus, which is a swelling of the setal shaft at the point of emergence through the body

wall. The crotchets of Naididae are usually more slender, with teeth not as robust as those of tubificids. The dorsal simple-pointed "crotchets" of naidids, which are frequently associated with hair setae, are referred to as needle setae, and may be minutely bifid.

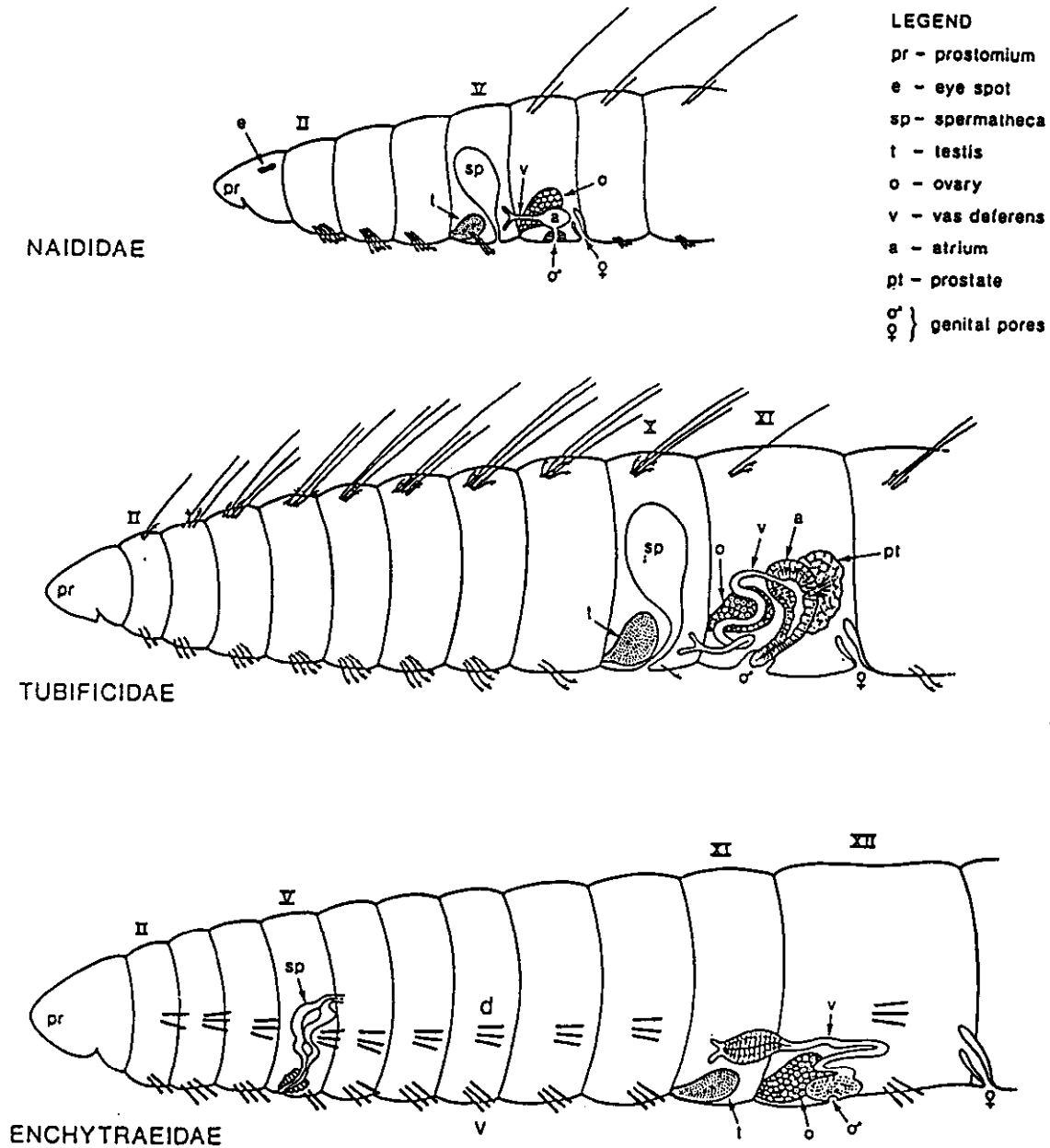


Figure 1. (after Brinkhurst, 1986)

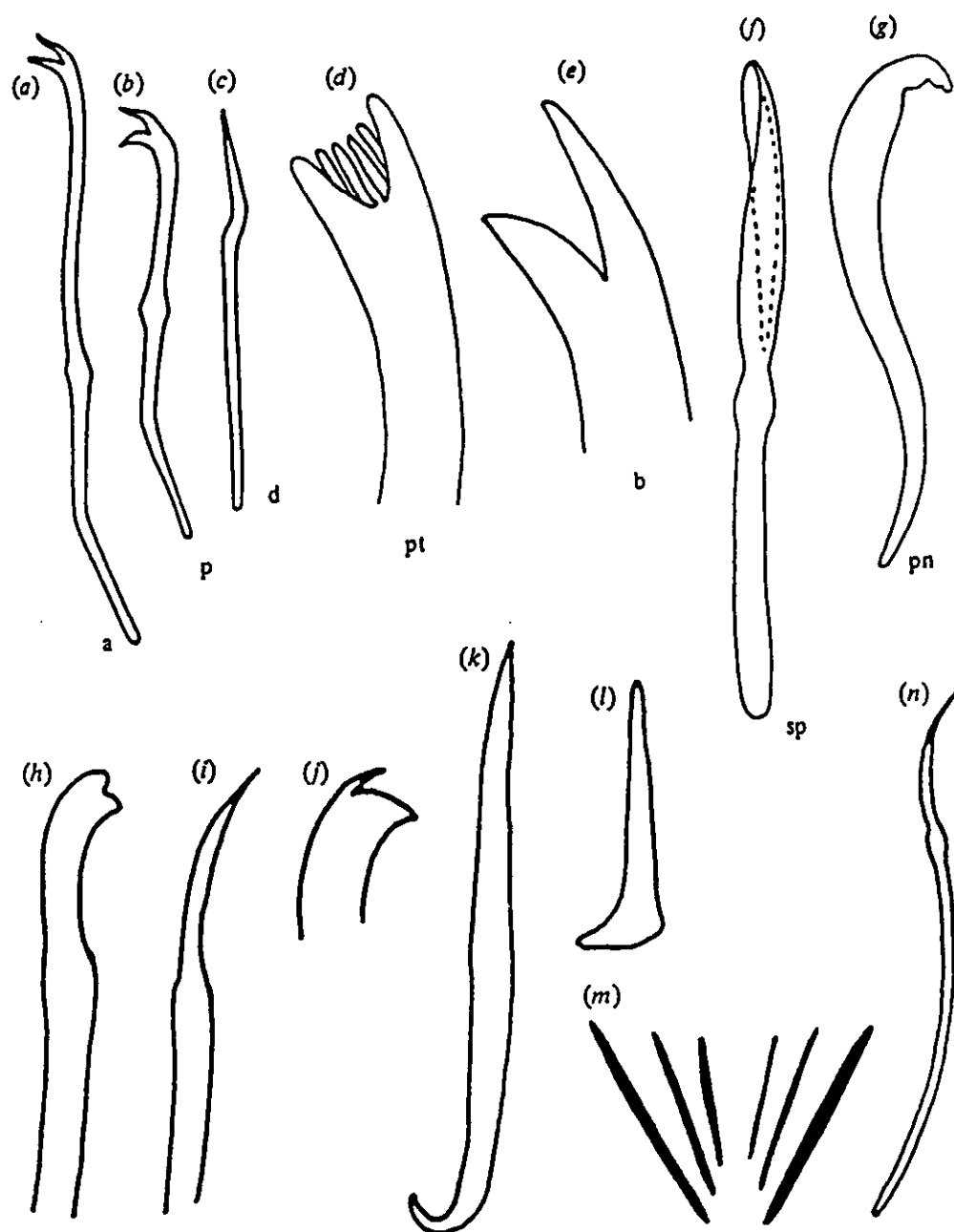


Figure 2. (after Brinkhurst, 1982) Oligochaete setae: (a)-(c) Naididae; (d)-(g) Tubificidae; (h)-(j) Lumbriculidae; (k)-(n) Enchytraeidae (k, *Lumbricillus*, l, *Grania*, m, *Fridericia*, n, *Cernosvitoviella*). Key: d = dorsal; a = anterior ventral; p = posterior ventral; b = bifid (present in some form in all ventral bundles of tubificids, and in the dorsals when both hair and pectinate setae absent); pt = pectinate (usually with hair setae in dorsal bundles in tubificids, rarely in naidids); sp = spermathecal (usually the ventrals of X); pn = penials (usually the ventrals of XI) (spermathecal and penials, if present, are the genital setae of mature individuals.).

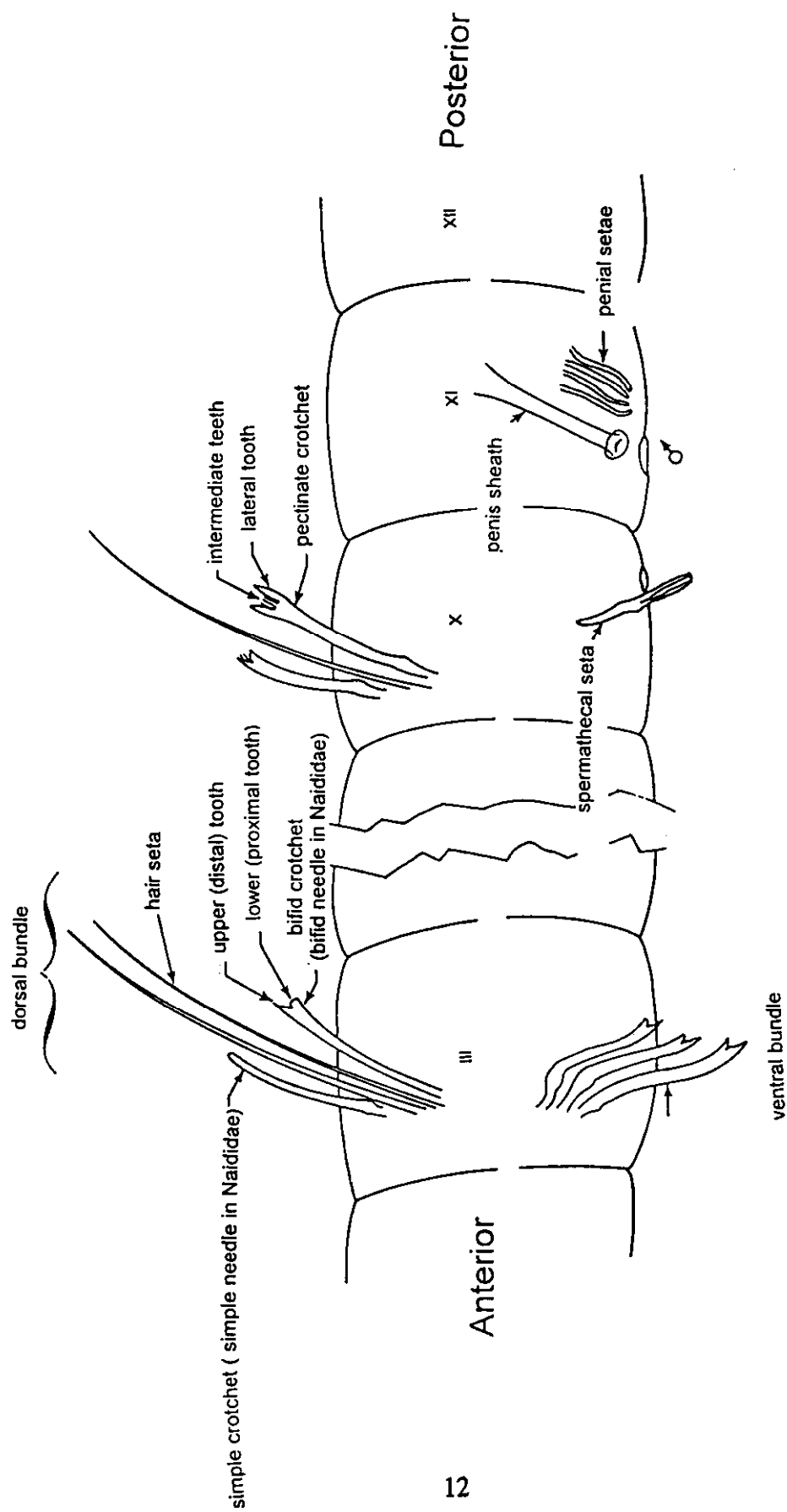


Figure 3. (after Hiltunen and Klemm, 1980). Generalized tubificid.

Crotchets with intermediate teeth are called pectinate and, in many species, can only be discerned at 1,000x magnification, although with experience pectinate setae may be determined at a lower power by the configuration of the lateral teeth. Pectinate setae are normally restricted to the dorsal bundles and are only found in tubificids and naidids. Except for a few species of Tubificidae in the genus *Tubificoides*, pectinate setae in marine taxa are rare. The anterior ventral bundles of some tubificids occasionally exhibit small intermediate teeth, however this character appears to exhibit a great deal of intraspecific variation and may be a result of environmental conditions.

Two additional variations with respect to their distal termination only occur in marine taxa. Most species of *Heterodrilus* have trifid setae. This is the only genus found in Florida waters possessing this aberration. The other variation pertaining to dorsal crotchets is the presence of a subdental ligament extending from the shaft to the distal end of the lower tooth. This type of aberrant setae is species specific for many taxa of tubificids, but is most prevalent in the species of Phallodrilinae.

Modified ventral setae associated with genital pores occur in mature individuals of many taxa. These can be diagnostic characters for many species of Tubificidae, but are of incidental importance in species discrimination Naididae. The latter family reproduces primarily asexually; mature individuals are infrequent.

In Tubificidae, modified setae associated with the spermathecal pore, usually on segment X, are called "spermathecal setae" and have a characteristic elongate spoon shape (Figure 3 A). As a general rule, there is only one seta per "bundle". Modified setae associated with the male pore, usually on segment XI, are referred to as "penial setae". These setae exhibit considerable interspecific variation, with generally more than one per bundle, and may be arranged in a fan-shaped configuration (Figure 3 C). Rarely do both spermathecal and penial setae occur in the same species.

The reproductive structures are the primary distinguishing characters among oligochaete taxa. Oligochaetes are hermaphrodites, possessing both fully developed male and female organs simultaneously within a single mature individual. Although self-fertilization has not definitively been demonstrated, parthenogenetic reproduction is suspected in a few taxa lacking spermathecae. Cross fertilization with the exchange of sperm between concopulants is generally the rule. A mucoid cocoon forms around the genital segments with the sperm from the concopulant and the eggs from the mate released into the cocoon, resulting in fertilization which is therefore considered to be external. Sperm may aggregate into structures formed by sperm "glued together" in some way (spermatozeugmata) or be randomly distributed within the spermathecae. The arrangement of sperm is a taxonomically significant character in Tubificidae, particularly the marine Limnodriloidinae. The position of the spermathecal pores may be dorsal, ventral, lateral, anterior, or posterior, single or paired, and is also species specific.

The morphology of the spermatheca and male genitalia are particularly significant in the identification of Tubificidae. The spermatheca is generally formed by an ectal vestibule, an intermediate spermathecal duct and an ental spermathecal ampulla where the sperm is stored. The male reproductive structures consist of an ental sperm funnel leading into a ciliated vas deferens, which empties into an atrium. The atrium customarily has a prostate gland associated with it. This gland may be diffusely attached to the atrium as in the Rhyacodrilinae, broadly attached as in the Limnodriloidinae, or attached by a short stalk as in the Tubificidae. Entally, the atrium may form an ejaculatory duct terminating simply as a pore, or forming a penis or pseudopenis which may be ensheathed in cuticle, the shape of which is highly diagnostic, particularly in the freshwater *Limnodrilus* and the marine *Tubificoides*. The cuticularized penis sheath is most easily distinguished in cleared specimens. The penis may be withdrawn into a copulatory sac, and it may have copulatory glands, as in *Tectidrilus bori*, associated with it. Although the male organs may be paired, they occasionally unite ectally or discharge through a common bursa. The male pores are always ventral or ventro-lateral in position in Tubificinae.

Three additional somatic characters are significant in the identification of oligochaetes. Small cuticular papillae may be distributed along the body wall, which apparently serve an excretory function, and are occasionally sloughed off. Therefore, care must be exercised when using this character. This ornamentation is only present in tubificids and some species of naidids.

A modification of the gut in segment IX characterizes the subfamily Limnodriloidinae. This modification may be in the form of an enlarged gut with a distinct blood plexus or having two anterior projecting digitiform processes.

The final character having taxonomic significance with reference to this manual is the presence of coelomocytes. These are small to large nucleated cells which float free in the coelomic fluid. They are derived from the chlorogogen tissue associated with the alimentary canal, and presumably aid in the distribution of nutrients throughout the body. Although they are present to some degree in all taxa, they are particularly abundant and conspicuous in most Rhyacodrilinae.

USE OF KEYS

The taxonomic keys in Volumes I and II are artificial utilizing the most readily observable characters to separate the taxa. This is only a regional key for taxa which have been reported or may logically be expected to occur in Florida waters. The freshwater taxa are fairly well documented based on the large number of environmental studies conducted by state agencies and various consulting companies in compliance with state regulations. Estuarine and marine taxa have not been analyzed to the extent of their freshwater counterparts. Even so, the coastal oligochaete fauna of Florida has been investigated in more depth in recent years than any state on the eastern seaboard. The diversity is also far greater due to the tropical influence, therefore the list of taxa included within the two volumes is considered to be fairly comprehensive. This taxa included in Volume II omits species expected to occur in depths greater than 30 meters, or which have been described only from isolated Caribbean reefs and not expected to be found in Florida waters. When a decision between two taxa is very close, distributional and ecological information may facilitate the choice.

In many instances specimens are not completely intact, *i.e.*, the majority of setae may be broken, the posterior end may be lacking or, in the case of naidids, the anterior end may be regenerating, giving a false representation of which segment the dorsal setae first appear. Therefore examination of large populations is frequently necessary for accurate identification.

The keys in Volume I are dichotomous, providing only two choices. The keys in Volume II, estuarine and marine species, may terminate in a "species group" of closely related taxa. Species within each group require closer scrutiny than the inexperienced biologist is able to provide. In these instances, an illustrated table is provided for comparison of species specific distinguishing characters. In most cases, once a taxon has been determined to fit into a specific group, distributional information will provide insight toward a specific determination.

One final note: Always compare the specimen with the complete diagnosis provided in the text, rather than just relying on "key" characters. The taxonomy of oligochaetes, especially the marine fauna, is a dynamic science. Taxa are continuously being synonymized and split. In fact, the genus *Limnodriloides* is currently being revised by Dr. Erséus and may be split into a number of new genera. This revision is under review and will be published shortly. The user is advised to keep abreast of all current literature.

FIGURE ABBREVIATIONS FOR VOLUME I

a	atrium
at	atrium
bm	basement membrane
de	ejaculatory duct
dp	diffuse prostate
ed	ejaculatory duct
ff	female funnel
gs	gland associated with spermathecal seta
mb	male bursa
mf	male funnel
mss	spermathecal seta
ov	ovary
pa	penial apparatus
pr	prostate gland
ps	penial seta
rm	retractor muscles
s	seta
sf	sperm funnel
sg	spermathecal gland
sp	spermatheca
spz	spermatozeugmata
ssg	spermathecal setal gland
st	spermatheca
sts	spermathecal seta
t	testes
vd	vas deferens

FAMILY DIAGNOSES

The position of genital organs and associated structures is of primary importance determining the taxonomy of oligochaete families. However, mature individuals account for only a small fraction of a population, and staining techniques are generally necessary for accurate observations. Structure and arrangement of setae are of secondary importance, and exhibit considerable interspecific and intergeneric variation allowing for only artificial family separation based on that criteria. Mature individuals are not required to observe setal characters which may be readily observed using simple clearing techniques. A considerable degree of intraspecific morphological variation of setal morphology is known to occur in populations of many taxa which may be the result of environmental inducement. However, some generalizations can be made at the family level. Caution must be exercised using the following diagnoses for family identification, as there is considerable overlap in the setal features between some families. A more complete diagnosis with Remarks is provided at the beginning of each familial section, and should be reviewed for an accurate determination.

Opistocystidae

Prostomium with a proboscis. Dorsal setae generally begin in II; bundles with 1-2 hairs and 1-2 simple-pointed needles. Ventral setae generally bifid, more than 2 per bundle. Genital setae absent. Posteriorly with 3 terminal digitiform processes not retractable into a branchial fossa.

Lumbriculidae

Prostomium with or without an elongate proboscis. Four pairs of simple-pointed or bifid setae per segment; hair-like setae rarely present; modified genital setae rarely present. Posterior gills or elongate processes absent.

Enchytraeidae

Prostomial proboscis absent. Setae begin in II or farther back (if setae begin behind II, they are bootshaped, and the dorsals begin behind XV and ventrals begin behind III); 1 or more simple-pointed straight or sigmoid setae per bundle; modified genital setae absent. Posterior gills or digitiform processes absent.

Naididae

Prostomium with or without a proboscis. Dorsal setae generally begin behind II; bundles may include hairs, simple-pointed, spatulate, or pectinate needles. Ventral setae begin in II, generally bifid, and usually differentiated from the dorsals. Modified penial setae present or absent. Posterior terminal gills retractable into a branchial fossa may be present (if present proboscis is absent).

Tubificidae

Prostomial proboscis absent. Setae begin in II; dorsal bundles may include hairs, bifid, trifid, pectinate, or simple-pointed crotchets. Ventral setae usually bifid or occasionally simple-pointed or pectinate crotchets; usually more than 2 per bundle. Modified spermathecal or penial setae often present, rarely both together. Terminal posterior gills or digitiform processes absent. Cuticularized penis sheaths frequently present in XI.

FAMILIES

Opistocystidae

Type Genus. *Opistocysta* Černosvitov, 1936

Diagnosis. Eyes absent. Proboscis present. Three ciliated caudal appendages: two long ventro-lateral, one short dorso-median. Setae present from II; dorsal bundles composed of hairs, needles, or a combination. Hairs with or without serrations. Ventral setae as bifid crotchets. Genital setae absent. Male pores paired in XII, XV, or XXI. Spermathecal pores paired in segment immediately posterior to male pores. Reproduction primarily asexual by budding.

Remarks. The presence of a proboscis and three caudal appendages readily identifies species within this family. *Crustipellis tribranchiata* has been reported from North America, with its distribution restricted to the southeast. Based on immature specimens, a second species, *Trieminentia corderoi*, has recently been collected from Florida. Mature specimens are required for absolute confirmation.

Key to Species of Opistocystidae in Florida

1. A) Dorsal hairs smooth; proboscis $\sim 660 \mu\text{m}$ long;
hairs of III $\sim 70 \mu\text{m}$ long; needle setae
with a distal nodulus; ventral setae with distal nodulus.
Trieminentia corderoi pg. 21
- B) Dorsal hairs serrate; proboscis $\sim 100 \mu\text{m}$ long;
hairs of III $\sim 130 \mu\text{m}$ long; needle setae
with a nodulus; ventral setae with median nodulus
Crustipellis tribranchiata pg. 23

Genus. *Trieminentia* Harman and Loden, 1978

Type Genus. *Opistocysta corderoi* Harman, 1969.

Diagnosis. Prostomium with a proboscis. Three ciliated caudal appendages present. Dorsal setae begin in II and include smooth hairs and needles (needles not always distinct). Male genitalia paired in XV or XVI; eversible pseudopenes present. Spermathecae paired in segment immediately posterior to male segment. Reproduction primarily by budding with the first 5 segments regenerated.

Remarks. After budding, the posterior caudal appendages are generally not fully regenerated in the "parent". Consequently, individuals are not easily identifiable if the caudal end is lacking or undeveloped, and are frequently mistaken for the naidid *Pristina* in which the dorsal setae also begin in II and has a prostomial proboscis. However, all ventrals are similar in *Trieminentia*, whereas the ventrals of II are enlarged in *Pristina*. This is a monospecific genus and the only taxon of Opistocystidae with smooth hair setae. Additionally, *Trieminentia* is distinguished from *Crustipellis* by: longer proboscis (~660 μm vs. ~100 μm , respectively); shorter hairs in II and III (~70 μm vs. ~130 μm , respectively); longer caudal appendages in *Trieminentia*; and a distal nodulus of the ventral setae vs. a median nodulus, respectively. However, the primarily asexual reproductive mode of this family, with the first 5 segments being regenerated, may create a great deal of intraspecific variation. The only consistent characters appear to be the lack of serrations on the hair setae and the position of the genitalia. Careful scrutiny of entire populations are required for accurate identification.

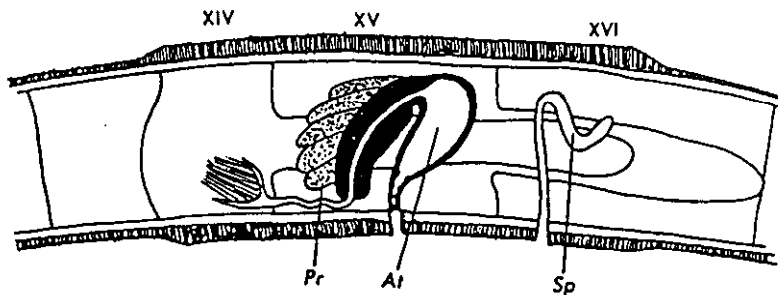
Trieminentia corderoi (Harman, 1969)

Opistocysta corderoi Harman, 1969:474-475.

Diagnosis. Length: 10-12 mm; segments: 56-76. Proboscis up to 660 μm long. Three caudal appendages: laterals to 900 μm long; median to 190 μm . Dorsal setae from II, bundles composed of 1-2 smooth hairs and 1-2 single-pointed needles. Ventral setae 4-5 per bundle bifid with upper tooth thinner than lower. Atria in XV with thickened walls. Spermathecae in XVI.

Distribution and Habitat. Uruguay, Costa Rica, North America (Florida). Type material from a pool associated with rotting vegetation.

Remarks. See Remarks for genus for additional information. As with *C. tribranchiata*, this species may be confused with *Pristina*. However, the only species of *Pristina* from Florida with hairs and simple-pointed (or minutely bifid) needles are *P. proboscidea* and *P. leidyi*. The latter is easily distinguished by the elongate hairs in III, and the former has more setae in the dorsal bundles (1-4 hairs and 1-4 needles).



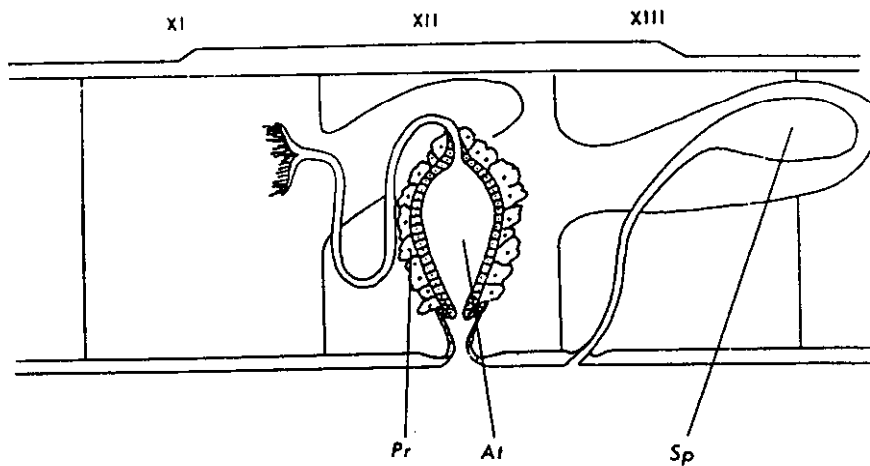
Trieminentia corderoi: (after Harman and Loden, 1978a) reproductive structures in the genital segments.

Genus. *Crustipellis* Harman and Loden, 1978

Type Species. *Opistocysta tribranchiata* Harman, 1969.

Diagnosis. Prostomium with a proboscis. Three ciliated caudal appendages. Dorsal setae begin in II and include hairs and needles. Male genitalia paired in XII; protrusible penes present. Spermathecae paired in XIII. Reproduction primarily by budding with the first 5 segments regenerated.

Remarks. This is a monospecific genus widely distributed throughout the southeastern United States. Serrations of the hair setae, and length of the proboscis, hair setae and caudal appendages will differentiate immature specimens of *C. tribranchiata* from *T. corderoi*. Refer to Remarks for *Trieminentia* for additional details.



Crustipellis tribranchiata: (after Harman and Loden, 1978a) reproductive structures in the genital segments.

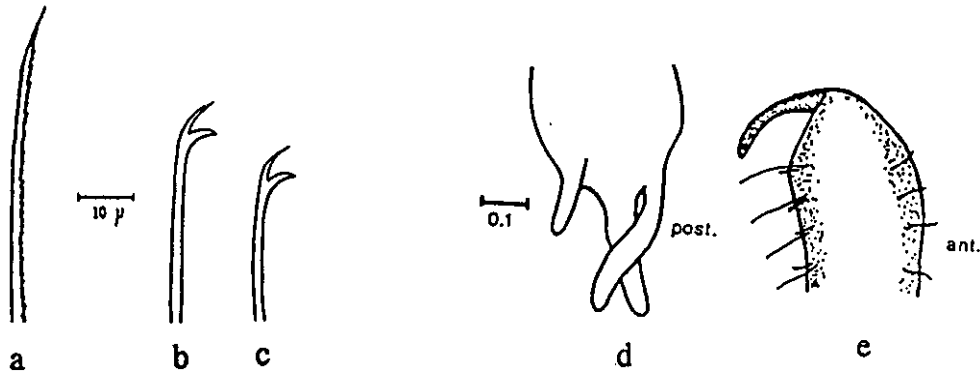
Crustipellis tribranchiata (Harman, 1969)

Opistocysta tribranchiata Harman, 1969:476-477, Fig. 1.

Diagnosis. Length: 1.7-2.9 mm; segments: 15-30. Proboscis up to 180 μ m long. Three caudal appendages: ventro-lateral to 300 μ m long; dorso-median to 90 μ m long. Dorsal setae from II, bundles composed of 1-4 finely serrated hairs and 1-4 simple-pointed needles without nodulus. Ventral setae, 3-5 per bundle, bifid, upper tooth longer and thinner anteriorly; teeth equal posteriorly. Atria in XII, pear-shaped. Spermathecae in XIII.

Distribution and Habitat. Florida, Louisiana, Mississippi, North Carolina, Mexico. Roadside ditches, ponds, streams.

Remarks. The primary difference between immature specimens of *C. tribranchiata* and *T. corderoi* is the presence of serrated hairs in the former species, while the latter has only smooth hair setae, shorter hair setae of II and III, a longer proboscis, and longer caudal appendages. See Remarks of *T. corderoi* for additional information.



Crustipellis tribranchiata: a, serrated hair; (after Harman, 1969) b, ventral seta from II; c, posterior ventral seta; (after Brinkhurst, 1986) d, posterior end; e, anterior end.

Lumbriculidae

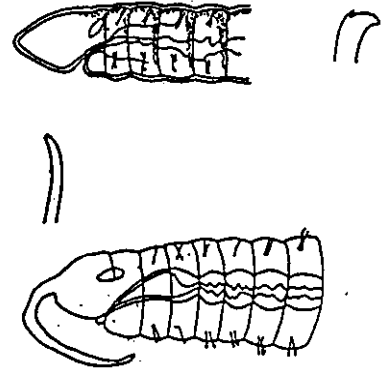
Type Genus. *Lumbriculus* Grube, 1844.

Diagnosis. Eyes absent, proboscis present or absent. Setae present from II, 2 per bundle, either simple-pointed or bifid with reduced or rudimentary upper tooth; sigmoid with distinct nodulus; modified genital setae absent. Male and spermathecal pores variable in position and number between VI and XVI. Reproduction primarily sexual, but may be parthenogenic or by fragmentation.

Remarks. The large size of these worms and the bisetal bundles with simple-pointed or unequally bifid, sigmoid shaped setae readily distinguish species of this family from all others. Two species are known to occur in Florida. Both taxa are immediately distinguished by the setal morphology: *Lumbriculus variegatus* has bifid setae, whereas *Eclipidrilus palustris* has simple-pointed setae. Additional species of Lumbriculidae without a proboscis and simple pointed setae have been collected from Florida waters. These taxa are referred herein as *Eclipidrilus* sp., because it is the only genus of Lumbriculidae with this combination of characters found in the surface waters of eastern North America.

Key to Species of Lumbriculidae in Florida

1. A) Proboscis absent; setae bifid with reduced or rudimentary tooth.
Lumbriculus variegatus pg. 26
- B) Proboscis present or absent; setae simple-pointed.
- 2.(1) A) Proboscis present.
Eclipidrilus palustris pg. 28
- B) Proboscis absent. *Eclipidrilus* pg. 27



Genus. *Lumbriculus* Grube, 1844

Type Species. *Lumbricus variegatus* Müller, 1774.

Diagnosis. Prostomium without a proboscis. Two bifid setae per bundle beginning in II. Up to 4 pairs of male genitalia with the male pores located between VII and XIII. Two to 5 pairs of spermathecae beginning 2 segments behind the last male segment.

Remarks. The large size, lack of proboscis, and bifid bisetal bundles readily distinguish *Lumbriculus* from all other Lumbriculidae known from Florida.

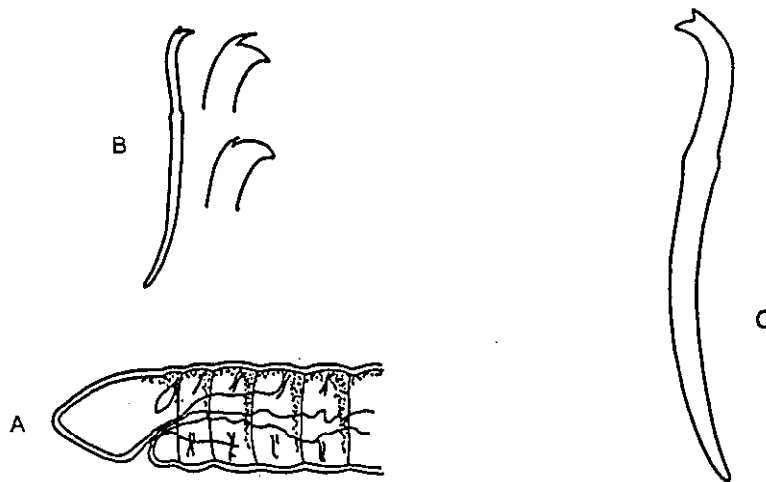
Lumbriculus variegatus (Müller, 1774)

Lumbricus variegatus Müller, 1774:26.

Diagnosis. Length: up to 100 mm; segments: about 170. Proboscis absent. Color in live specimens dark red with greenish tinge anteriorly. Setae, 2 per bundle, upper tooth very reduced. One pair of male pores between VII and XII. Four pairs of spermathecal pores in segments posterior to male pores.

Distribution and Habitat. Widespread throughout northern hemisphere, South Africa, Australia, New Zealand. Ponds, littoral regions of lakes and streams.

Remarks. Considerable intraspecific variation regarding the number and position of the reproductive organs exists. Apparent confusion concerning the validity of species assigned to this genus has been prevalent in recent years. Brinkhurst (1986) lists one species, *L. inconstans* (species inquirendae) which also may occur in Florida, but, as a species inquirendae, the distinction between the 2 taxa is unclear because of the extreme inconsistency in the arrangement of their respective reproductive structures.



Lumbriculus variegatus: (after Brinkhurst and Jamieson, 1971) A, anterior end; B, setae; (after Chekanovskaya, 1962) C, seta.

Genus. *Eclipidrilus* Eisen, 1881

Type Species. *Eclipidrilus frigidus* Eisen, 1881.

Diagnosis. Prostomium with or without a proboscis. Two simple-pointed sigmoid setae per bundle. Paired male genitalia with male pores paired or single in X. Spermathecae in IX (and/or rarely VIII).

Remarks. Only one species of Lumbriculidae with a proboscis, *E. palustris*, has been reported from Florida. However, additional species without a proboscis may be collected from Florida. *Eclipidrilus* is the only genus of surface water Lumbriculidae without a proboscis and has simple-pointed setae reported east of California.

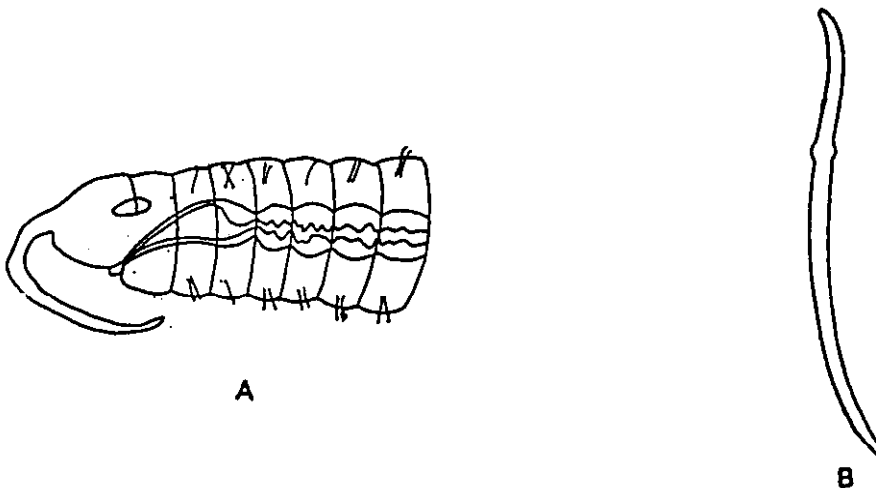
Eclipidrilus palustris (Smith, 1900)

Premnodrilus palustris; Smith, 1900b:459, Plate XLI, fig 1.

Diagnosis. Length: to 50 mm; proboscis present. Anterior segments biannulate. Setae, 2 per bundle, simple-pointed. Male pores paired on X. Spermathecal pores paired on IX. Atrium with thick muscle layer arranged diagonally, becoming thin distally. Thin cuticular penis sheaths present.

Distribution and Habitat. Florida and South Carolina. Collected from the Escambia River and a decaying stump in a marsh in Polk County, Florida.

Remarks. This species is easily recognized by the long proboscis and bisetal bundles with simple-pointed sigmoid shaped setae. *E. palustris* is the only species of *Eclipidrilus* described from Florida. However, a closely related taxon, *E. daneus* Brinkhurst and Cook, 1966, has been reported from elsewhere in the Southeast (Louisiana and South Carolina). The only difference between the 2 species is the apparent thickness of the atrial walls, which is thinner in *E. daneus*. As this is the only difference, Brinkhurst and Jamieson (1971) suggest that further research may result in the invalidation of this taxon.



Eclipidrilus palustris: (after Brinkhurst and Jamieson, 1971) A, lumbriculid type prostomium with proboscis; (after Chekanovskaya, 1962) B, seta.

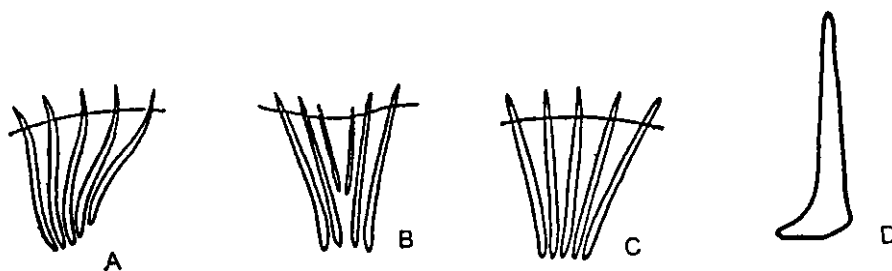
Enchytraeidae

Type Genus. *Enchytraeus* Henle, 1837.

Diagnosis. Eyes absent. Proboscis absent. Dorsal and ventral setae similar, may be absent from a varying number of anterior segments or altogether. When present, setae simple-pointed, straight, boot shaped or sigmoid, with or without nodulus, up to 12 per bundle. Male pores paired on XII, spermathecal pores paired on V.

Remarks. Species in this family are usually fairly small and frequently listed as meiofauna. They can be recognized by their unique setal distribution, number of setae per bundle, and position of the male and female pores on XII and V, respectively. The majority of this taxon is terrestrial, however some genera include freshwater and marine species which are relatively uncommon and easily overlooked.

Very few published accounts of species composition and distribution of freshwater and marine Enchytraeidae are available for Florida. Only one species, *Barbidrilus paucisetosus* (Loden and Locy, 1980) has been described from freshwater, and two species of *Grania*, *G. americana* (Kennedy, 1966) and *G. monospermatheca* (Erséus and Lasserre, 1976), from marine subtidal habitats of Florida (Coates and Erséus, 1985). *Grania* is distinguished from other genera of enchytraeids, by the characteristic boot-shaped setae beginning posterior to III.



(after Chekanovskaya, 1962) Types of setae and their arrangement in a fascicle in family Enchytraeidae. A, S-shaped (*Lumbricillus*); B, outer setae larger than middle setae (*Fridericia*); C, straight setae (*Enchytraeus*); D boot-shaped seta (*Grania*).

Naididae

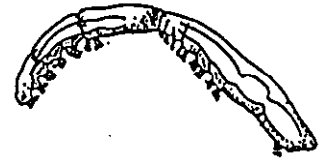
Type Genus. *Nais* Müller, 1773.

Diagnosis. Eyes present or absent. Proboscis present or absent. Gills present posteriorly, laterally or absent. Ventral setae begin on II. Dorsal setae absent, beginning from II-VI, or much farther posteriorly. Ventral setae generally bifid crotchets, but may be simple-pointed, variable number per bundle. Dorsal setae hairs (occasionally serrate) and needles, or only needle setae. Penial setae frequently present on mature individuals. Spermathecae paired on IV, V or VII. Male pores located in segment immediately subsequent to spermathecae. Reproduction primarily asexual by budding or fragmentation.

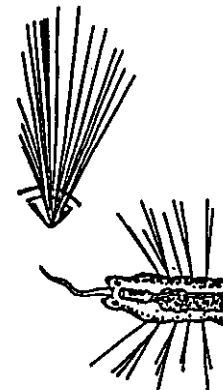
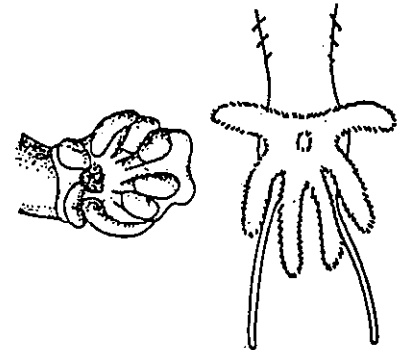
Remarks. This is the only family found in Florida freshwater in which some species have eyes and/or terminal posterior gills. This family is identified by the dorsal setae, usually beginning on IV, V or VI (II or III in *Pristina*, *Pristinella*, *Bratislavia*, *Stephensoniana* and *Amphichaeta*, and posterior to XV in *Haemonais*). Naidids are generally small, short worms which do not coil around themselves as do tubificids, lumbriculids and enchytraeids.

Key to the Genera of the Family Naididae in Florida

1. A) Dorsal setae absent; ventral setae absent from III-V. *Chaetogaster* pg. 34
- B) Dorsal setae present. 2.
- 2.(1B) A) Hair setae absent in dorsal bundles. 3.
- B) Hair setae present in dorsal bundles. 6.
- 3.(2A) A) Dorsal setae beginning in III, eyes absent. *Amphichaeta* pg. 38
- B) Dorsal setae beginning in V or VI. 4.
- 4.(3B) A) Dorsal "bundles" composed of one stout, straight needle; dorsal setae begin in VI; eyes present. *Ophidonais* pg. 45
- B) Dorsal bundles composed of more than one bifid seta. 5.
- 5.(4B) A) Dorsal setae begin in V; eyes absent. *Paranais* pg. 41
- B) Dorsal setae begin in VI; eyes present. *Uncinais* pg. 47
- 6.(2B) A) Dorsal setae begin in II or III. 7.
- B) Dorsal setae begin IV, V, VI, or further back. 10.
- 7.(6A) A) Body well encrusted with foreign matter. Posterior ventral setae with upper tooth remaining longer than lower ; no proboscis; dorsal setae begin II. *Stephensoniana* pg. 108
- B) Body wall naked. Posterior ventral setae with upper tooth becoming shorter; proboscis present or absent; dorsal setae begin in II or III. 8.



- 8.(7B) A) Dorsal setae begin in II or III; if from II, dorsal needles simple-pointed, very stout and hair setae may be missing from many bundles; proboscis absent.
Bratislavia pg. 111
- B) Dorsal setae from II, needles bifid or simple-pointed, none very stout; hairs present in all dorsal bundles; if hairs elongate in III they are serrated beginning in IV; proboscis present or absent. 9.
- 9.(8B). A) Proboscis present; hairs may be elongate in III.
Pristina pg. 51
- B) Proboscis absent; hairs may be elongate in II.
Pristinella pg. 114
- 10.(6B) A) Dorsal setae beginning far back, usually in XVIII, XIX, or XX. *Haemonais* pg. 65
- B) Dorsal setae begin in IV, V, or VI. 11.
- 11.(10B) A) Terminal gills present in a branchial fossa posteriorly; dorsal setae begin in IV, V, or VI, eyes and proboscis absent (gills are absent in the subgenus *Allodero* which lives commensal in frogs and toads).
Dero pg. 67
- B) Terminal gills and branchial fossa absent; dorsal setae begin in V or VI, eyes and proboscis present or absent. 12.
- 12.(11B) A) Proboscis present. 13.
- B) Proboscis absent. 14.
- 13.(12A) A) All dorsal bundles with a large number of set(hair setae 8-18), *Arcteonais* pg. 63
- B) Dorsal bundles with 1-3 hair setae.
Stylaria pg. 61



- 14.(12B) A) Hair setae of VI very elongate; body encrusted with foreign matter.

Slavina pg. 89

- B) No elongate hair setae. 15.

- 15.(14B) A) Hair setae stout, rigid, strongly serrated; needle setae straight, fine, simple-pointed.

Vejdovskyella pg. 91

- B) Hair setae smooth, not stout; needles simple-pointed or bifid. 16.

- 16.(15B) A) Eyes absent; dorsal needles all bifid resembling ventral setae. *Specaria* pg. 49

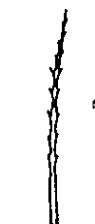
- B) Eyes present or absent; needles simple-pointed, pectinate or bifid, not resembling ventrals. 17.

- 17.(16B) A) Eyes present or absent, anterior ventral setae usually differentiated from median and posterior setae; dorsal needles usually bifid or simple-pointed (one species has pectinate setae with long lateral teeth)

Nais pg. 93

- B) Eyes absent; needles usually pectinate, very distinctive, lower tooth may be reduced or vestigial.

Allonais pg. 86



Genus. *Chaetogaster* von Baer, 1827

Type Species. *Chaetogaster limnaei* von Baer, 1827.

Diagnosis. Eyes, proboscis and caudal appendages absent. Dorsal setae absent (rarely present). Ventral setae absent from III-V, bifid or simple.

Remarks. Ventral setae are distinctive: straight, with an angular proximal curve. The absence of dorsal setae (except in rare instances) separates this taxon from all other nauidids.

Key to Species of *Chaetogaster* in Florida

1. A) Teeth of ventral setae strongly curved at right angle to the shaft, upper tooth equal or slightly shorter than lower. Up to 20 setae per bundle. Parasitic or commensal on mollusks. *C. limnaei* pg. 37



- B) Upper tooth of ventral setae longer than lower. Less than 13 setae per bundle. Free living. 2.



- 2.(1B) A) Prostomium conspicuous, pointed. Ventral setae on II less than 120 μ m long. *C. diastrophus* pg. 36



- B) Prostomium inconspicuous. Ventral setae on II more than 145 μ m long. *C. diaphanus* pg. 35



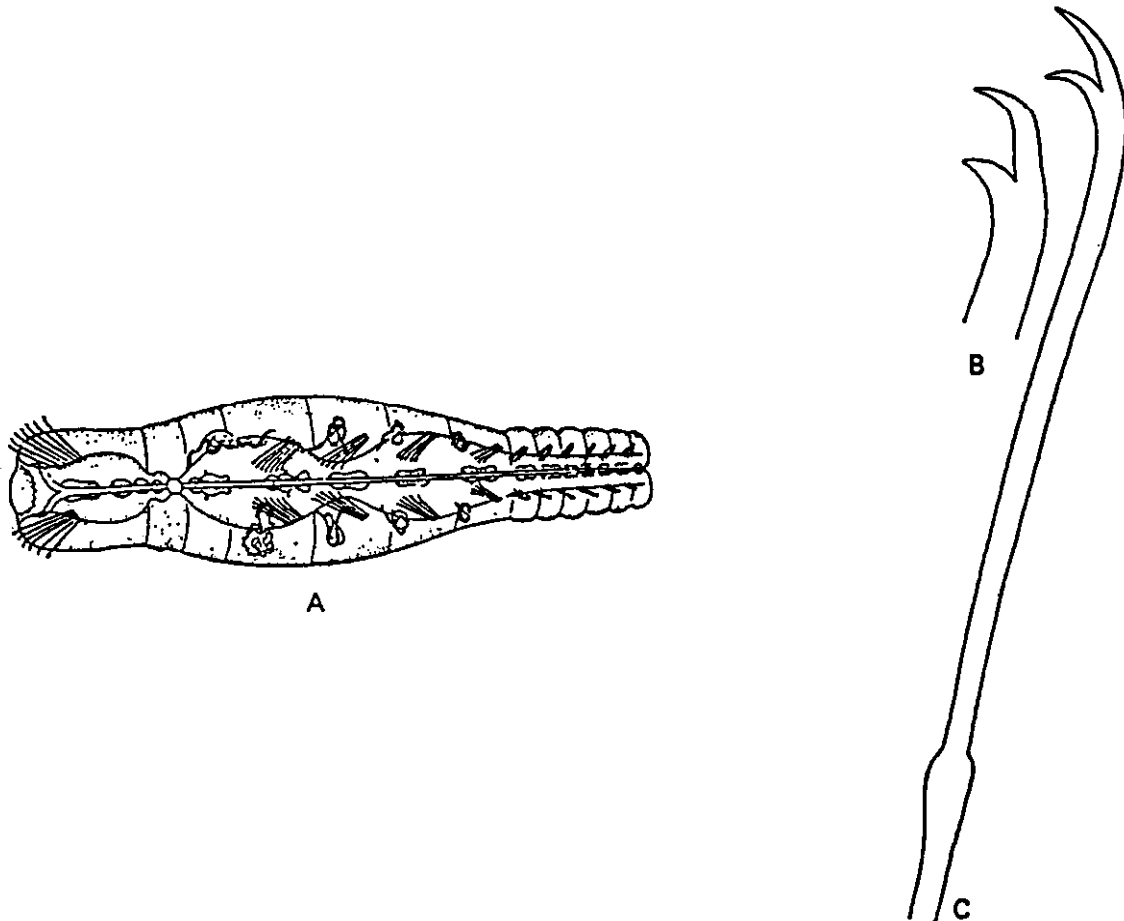
Chaetogaster diaphanus (Gruithuisen, 1828)

Nais diaphana Gruithuisen, 1828:409-416, Plate XXV, fig. 1-5.

Diagnosis. Length: 2.5-25 mm; segments: 14-15. Prostomium inconspicuous. Dorsal setae absent. Ventral setae all bifid, upper tooth longer than lower, 6-13 per bundle on II, 4-10 from VI posteriorly. Setae on II longer than 145 μ m.

Distribution and Habitat. Europe, Asia, widespread in North America. Rivers, lakes, brackish water.

Remarks. The inconspicuous prostomium without an incision, and bifid setae longer than 145 μ m in II separates this species from other *Chaetogaster*. This species is common throughout Florida, frequently found in brackish water.



Chaetogaster diaphanus: (after Sperber, 1948-1950) A, entire worm in contracted state; B, end of seta of segment II; C, distal half of seta of segment VI (at same magnification).

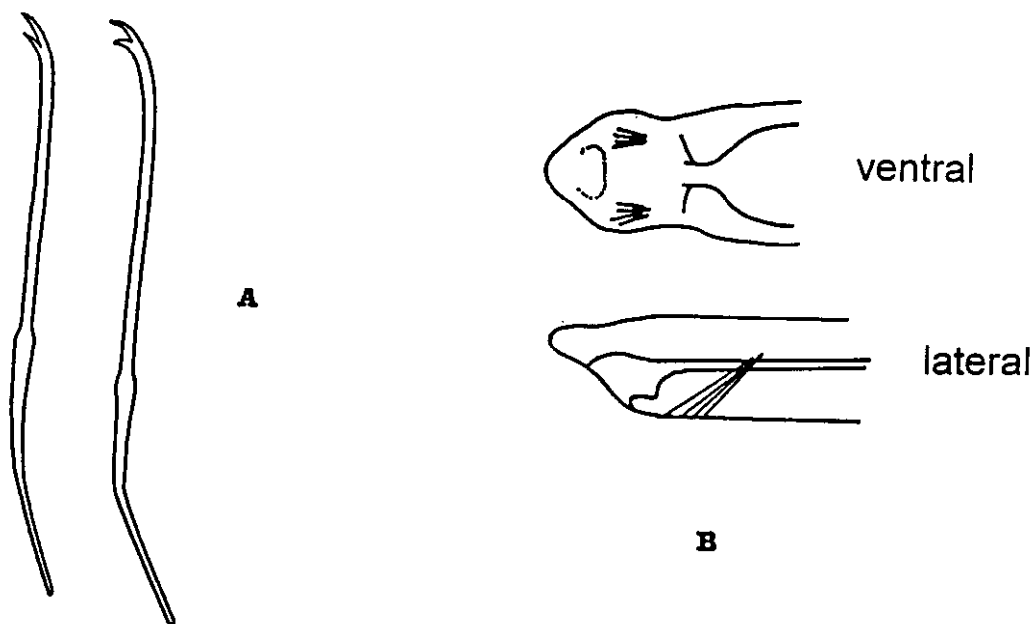
Chaetogaster diastrophus (Gruithuisen, 1828)

Nais diastrophus Gruithuisen, 1828:416-420, Plate XXV, fig. 7-9.

Diagnosis. Length: 1-5 mm; segments: 10-16. Prostomium relatively conspicuous, pointed. Dorsal setae absent. Ventral setae all bifid with upper tooth longer than lower, 4-8 per bundle on II, less than 120 μm long, from VI 3-7 setae per bundle.

Distribution and Habitat. Europe, India, China, South America, Afghanistan, widespread in North America. Associated with vegetation in lakes, rivers, streams.

Remarks. The pointed, fairly well developed prostomium and short (less than 120 μm) ventral setae on II separates this species from other *Chaetogaster*. Hiltunen and Klemm (1980) synonymized *C. langi* Bretscher, 1896, with this species even though the prostomium of *C. langi* is considered to be inconspicuous, and the range of the length of setae on II is somewhat shorter.



Chaetogaster diastrophus: (after Sperber, 1948) A, ventral setae from VI; (after Brinkhurst, 1986) B, prostomium.

Chaetogaster limnaei von Baer, 1827

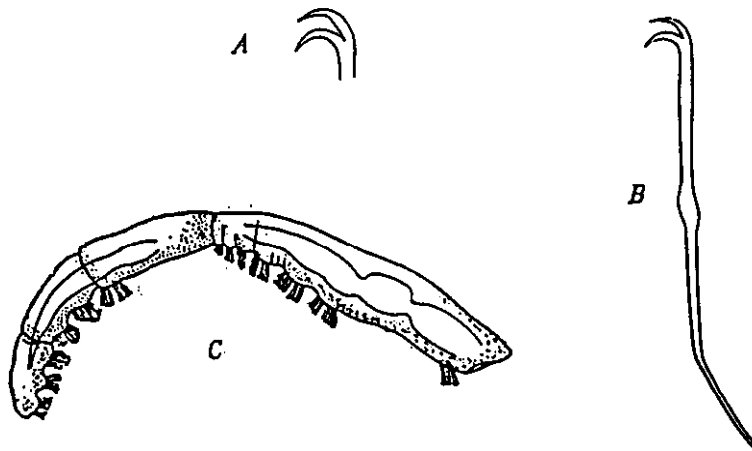
Chaetogaster limnaei von Baer, 1827:611-615, Plate XXX, fig. . 23-24.

Diagnosis. Length: 1.2-5 mm; segments: 13. Prostomium vestigial. Dorsal setae absent. Ventral setae bifid, upper tooth slightly shorter than lower, strongly curved, 5-20 per bundle on II, from 4-20 per bundle. Penial setae bifid.

Distribution and Habitat. Europe, Asia, widespread in North America. Parasitic or commensal on mollusks in ponds, lakes, streams, rivers, brackish water.

Remarks. The symbiotic nature of this species in mollusks separates it from all other taxa of *Chaetogaster*. Gastropods which have been found to harbor this species are: *Limnaea* spp., *Planorbis* spp. and *Bithynia tentaculata*. On the Gulf coast, *C. limnaei* has been found living in the gills of the asiatic clam, *Corbicula fluminea*. Morphologically, the vestigial prostomium, large number of ventral setae with teeth set at a right angle to the shaft, upper tooth slightly shorter than lower, distinguish this species from its congeners.

Sperber (1948) separated four subspecies of *C. limnaei* partly on the basis of "ecological races" and differences in hosts. The subspecies in North America is *C. limnaei limnaei*. The other subspecies have only been reported from Asia and Australia.



Chaetogaster limnaei: (after Sperber, 1948) A, distal end of seta from II; B, seta from VI; (after Michaelsen, 1927) C, chain of individuals.

Genus. *Amphichaeta* Tauber, 1879

Type Species. *Amphichaeta leydigii* Tauber, 1879.

Diagnosis. Eyes, proboscis and caudal appendages absent. Dorsal setae beginning on III all bifid or with an intermediate tooth. Ventral setae bifid; bundles on II and III close together, a much wider gap between III and IV. Penial setae absent.

Remarks. The dorsal bundles beginning in III with only bifid needles distinguishes this genus from all other naidids.

Five species of *Amphichaeta* have been described, 3 of which have been reported from North America with 2 taxa expected to be found in Florida.

Key to Species of *Amphichaeta* in Florida

1. A) Upper tooth of dorsal setae longer than lower, up to 3 times longer in posterior segments. *A. americana* pg. 39
- B) Upper tooth of dorsal setae equal or slightly shorter than lower tooth. *A. leydigii* pg. 40



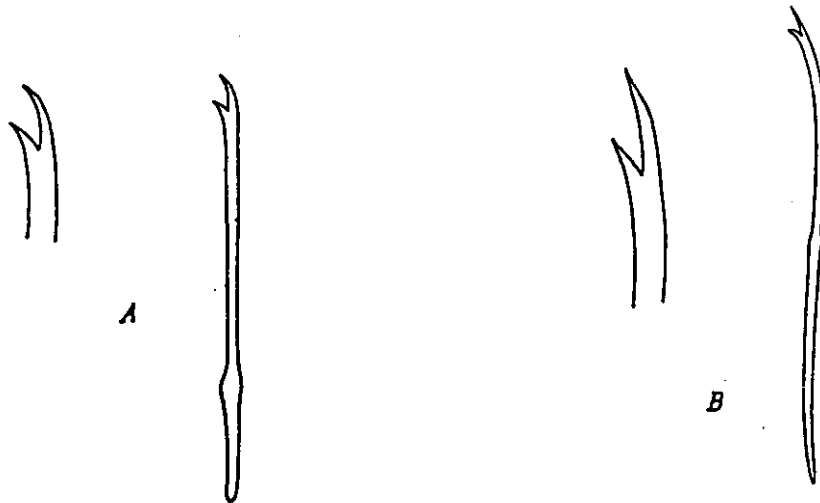
Amphichaeta americana Chen, 1944

Amphichaeta americana Chen, 1944:2-3, Fig. 1.

Diagnosis. Length: 1.5 mm; segments: 9. Prostomium slightly elongate. Dorsal setae begin on III, all bifid with upper tooth longer than lower, increasing to up to 3 times the length of the lower posteriorly; 3-4 per bundle. Ventral setae with upper tooth thinner and slightly longer than lower, 2-4 per bundle on II and III, 3-5 per bundle thereafter.

Distribution and Habitat. Only recorded from North America (North and South Carolina, New Jersey, Michigan, Mississippi [Escatawpa River]) Lakes (reservoirs), rivers.

Remarks. The extremely long upper tooth in the posterior bundles separates this species from all congeners. The specimens collected from Mississippi were from brackish water habitats.



Amphichaeta americana: (after Brinkhurst and Jamieson, 1971) A, setae of II; B, setae from mid-body.

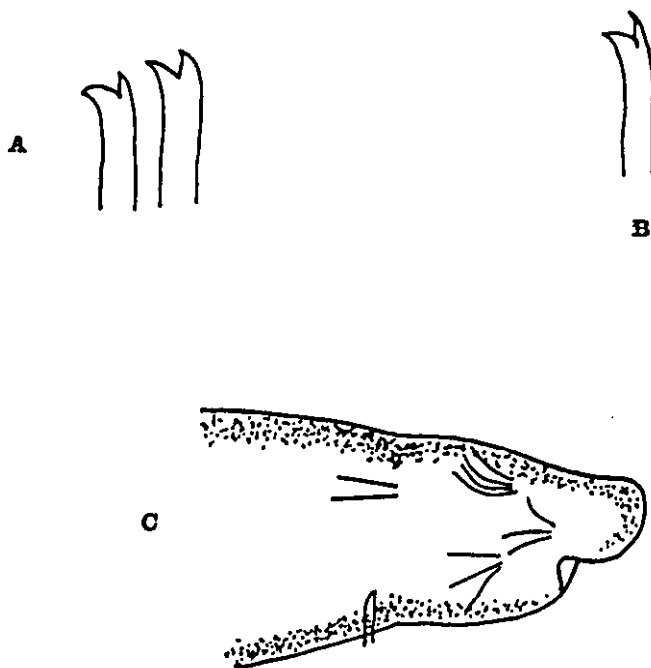
***Amphichaeta leydigii* Tauber, 1879**

Amphichaeta leydigii, Tauber, 1879:76.

Diagnosis. Length: 1.5 mm; segments: 13-14. Prostomium moderately developed. Dorsal setae generally 5 per bundle, all bifid with upper tooth shorter and thinner than lower; posteriorly upper tooth still thinner but equal in length to lower, 4, occasionally 1-3, per bundle. Ventral setae of II-III 4 per bundle, IV-V 2 per bundle, the rest usually 4, but may be 1-3 per bundle.

Distribution and Habitat. Europe, widespread in North America. Strictly freshwater on sandy substrates. Does not swim.

Remarks. The subequal or equal upper tooth of posterior setae separates this species from all congeners.



Amphichaeta leydigii: (after Brinkhurst, 1986) A, anterior setae; B, posterior seta; C, anterior end.

Genus. *Paranais* Czerniavsky, 1880

Type Species. *Nais litoralis* Müller, 1784.

Diagnosis. Eyes, proboscis and caudal appendages absent. All setae bifid, similar in shape. Dorsal setae from V. Ventral setae from II, those on II generally longer than the rest. Penial setae present. Body wall frequently covered with foreign matter or papillae..

Remarks. Lack of hair setae, all setae bifid, similar in shape, and dorsals starting on V separates this genus from all other Naidids.

Four species are currently considered valid. A review by Brinkhurst and Coates (1985) resulted in combining *Wapsa* Marcus, 1965, with this genus and questioning the validity of 8 species previously included in *Paranais* or *Wapsa*. All 4 valid taxa are reported from North America, with 3 likely to be collected in Florida.

Key to Species of *Paranais* in Florida

- | | | |
|--------|---|----|
| 1. | A) Upper tooth in all setae distinctly longer than lower tooth. | 2. |
| | B) Upper tooth distinctly longer than lower only on II, teeth more or less equal in all other segments. <i>P. litoralis</i> pg. 44 | |
| 2.(1A) | A) Ventrals on II 6-7 per bundle, all other segments 3 per bundle. Body wall papillate. <i>P. grandis</i> pg. 43 | |
| | B) Ventrals on II 2-4 per bundle, on all other segments 1-2 per bundle. Papillae absent, but thin layer of foreign matter present. <i>P. frici</i> pg. 42 | |



Paranais frici Hrab, , 1941

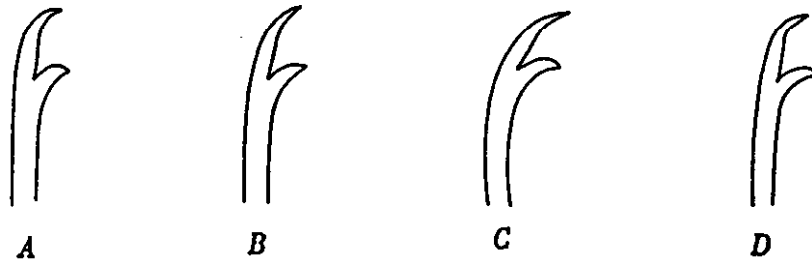
Paranais frici Hrab, , 1941:20-22, fig. 16-19.

Diagnosis. Length: 2.7-5.7 mm (preserved), 9 mm (living); segments: 13-14. All setae bifid, similar in shape with upper tooth much longer than lower. Dorsal setae from V, 1-2 per bundle. Ventral setae on II, 2-4 per bundle, all other segments 1-2 per bundle. Penial setae bifid, thicker than somatic setae. Cuticle generally with thin layer of foreign matter.

Distribution and Habitat. Africa, Europe, widespread in North America. Rivers and bays, generally coastal in brackish water, but also occurs in freshwater.

Remarks. This species is separated from all congeners by the longer upper tooth of all setae, with only 1-2 setae per bundle except ventrally on II, which has 2-4 setae per bundle.

This species is occasionally found in coastal rivers of Florida.



Paranais frici: (after Sperber, 1948) A, ventral seta from II; B, ventral seta from III; C, ventral seta from posterior segment; D, dorsal seta.

Paranais grandis (Harman, 1977)

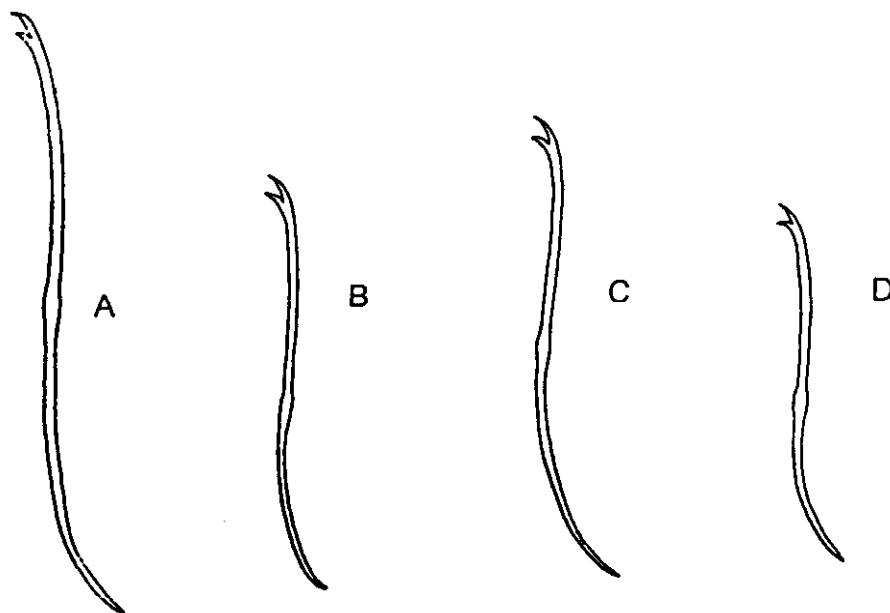
Wapsa grandis Harman, 1977:483-485, Fig 1.

Diagnosis. Length: 3-4 mm; segments: 28+. Dorsal setae from V, bifid, upper tooth longer than lower, 2-3 per bundle. Ventral setae on II longer than all others with upper tooth much longer than lower, 6-7 per bundle. Ventral setae in all other segments also with long upper tooth, but only 3 setae per bundle. Penial setae present, bifid. Body wall papillate.

Distribution and Habitat. Texas and Louisiana. Boggy areas with about 16‰ salinity.

Remarks. This species has long upper teeth similar to *P. frici*, but has a greater number of setae in all bundles: 6-7 on II, and three on all others in *P. grandis*, v. 2-4 on II and 1-2 on all others in *P. frici*. The presence of papillae is also shared with *P. birsteini*.

This species is strictly coastal and has not yet been reported from Florida, but does occur elsewhere in the Gulf of Mexico and may be expected in the Panhandle.



Paranais grandis: (after Harman, 1977) A, anterior ventral seta; B, posterior ventral seta; C, anterior dorsal seta; D, posterior dorsal seta.

Paranais litoralis (Müller, 1784)

Nais litoralis Müller, 1784:120-123, Plate LXXX, fig. 2-6.

Diagnosis. Length: 9-14 mm (living), 2-3.5 mm (preserved); segments: 13-46. Dorsal setae from V, slightly thinner than ventrals. Teeth approximately equal in length, (2)3(4) per bundle. Ventral setae on II with upper tooth longer than lower, 4-7 per bundle, slightly longer than the rest; both teeth becoming nearly equal with 2-3 setae per bundle on remaining segments. Penial setae 3-7 per bundle with small bifid tips. Body wall frequently with attached foreign material.

Distribution and Habitat. Hong Kong, Australia, Africa, Europe, widespread throughout North America. Salt or brackish water, generally coastal.

Remarks. The ventral setae on II with long upper tooth and equal teeth on posterior setae, and lack of cuticular papillations, separate this from all congeners. This is the most common naidid in the oligohaline regions in coastal rivers of Florida.



Paranais litoralis: (after Sperber, 1948) A, ventral seta of II; B, ventral seta of III; C, ventral seta from posterior segment; D, dorsal seta.

Genus. *Ophidonais* Gervais, 1838

Type Species. *Nais serpentina* Müller, 1773.

Diagnosis. Eyes present, proboscis and caudal appendages absent, cuticular papillae present. Dorsal setae from VI, all stout, straight needles. Ventral setae all similar in shape, bifid. Penial setae present.

Remarks. The stout dorsal needles beginning on VI are very distinctive for this genus.

This genus is monospecific and, although as yet unreported from Florida waters, is likely to occur there.

Ophidonais serpentina (Müller, 1773)

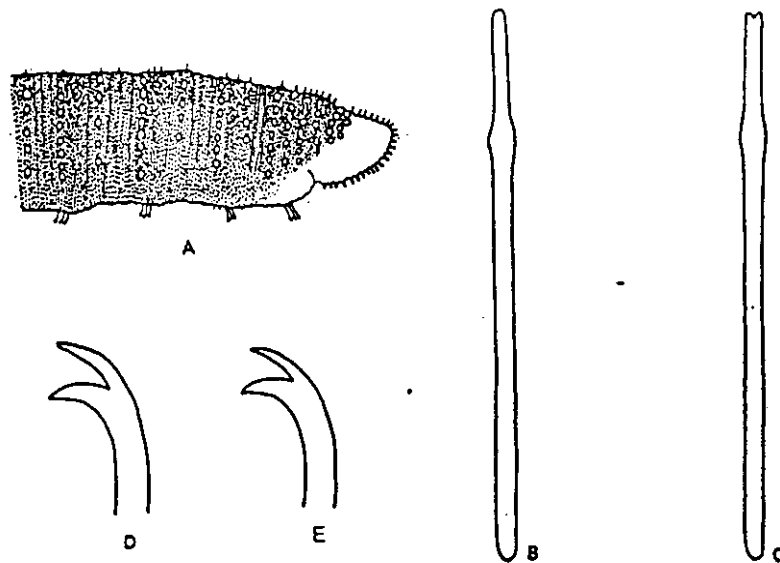
Nais serpentina Müller, 1773:20-21.

Diagnosis. Length: 6-36 mm; segments: 35-97. Anterior end with 3-4 transverse brownish pigment stripes. Dorsal setae stout, bluntly simple-pointed or minutely bifid beginning on VI, all "bundles" unisetal. Ventral setae on II longer than all others, all bundles with 2-6 setae per bundle, upper tooth slightly longer than lower. Penial setae simple-pointed, distally hooked, 2-3 per bundle. Scattered papillae present, occasionally with a thick crust of foreign particles.

Distribution and Habitat. Europe, South America, Siberia, Turkey, widespread throughout North America. Lakes and rivers, associated with vegetation along littoral margins in silty substrates.

Remarks. This species has unique stout, blunt dorsal setae. Although most descriptions state that dorsal "bundles" are represented by a solitary seta, Hiltunen and Klemm (1980) state that the complement of dorsal chaetae "...may vary from none to several".

This species has not been documented from Florida waters but is expected, particularly in the Panhandle, because of its more temperate distribution.



Ophidonais serpentina: (after Piguet, 1909) A, anterior end; (after Sperber, 1950) B, dorsal seta; C, dorsal seta; (after Brinkhurst, 1986) D, anterior ventral seta; E, posterior ventral seta.

Genus. *Uncinais* Levinsen, 1883

Type Species. *Nais uncinata* Ørsted, 1842.

Diagnosis. Eyes present, proboscis and caudal appendages absent. Dorsal setae from VI, all bifid. Ventral setae all similar, bifid. Penial setae present.

Remarks. This genus is separated from all other naidids by the absence of hair setae on the dorsal bundles and bifid needles from VI dorsally.

Two species are placed within this genus. Only 1 has been reported from North America, while the other has not been documented outside of Lake Baikal.

Uncinais uncinata (Ørsted, 1842)

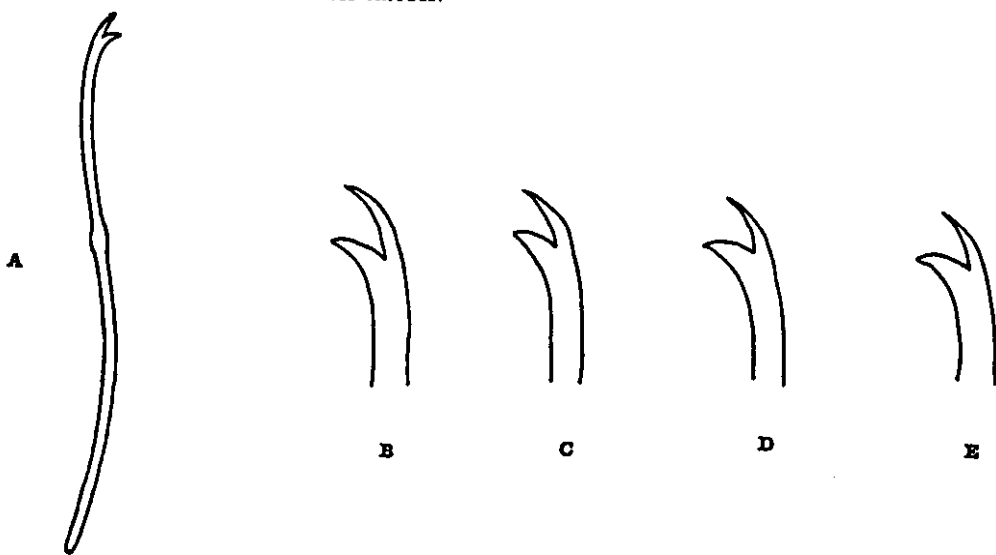
Nais uncinata Ørsted, 1842:136.

Diagnosis. Length: 5-18 mm; segments: 31-54. Series of dorsal brown pigment bands present anteriorly. Dorsal setae from VI shorter than ventrals, upper tooth longer and thinner than lower, 2-4 per bundle. Ventrals on II longer than the rest, all with upper tooth longer and thinner than lower, 2-7 per bundle. Penial setae single, hooked, 2-3 per bundle.

Distribution and Habitat. Europe, Turkistan, widespread throughout North America. Fresh and brackish water, up to 20‰ salinity in the Baltic.

Remarks. Dorsal bundles with only bifid setae with the upper tooth longer than lower beginning on VI separates this species from all others.

This species has not been reported from Florida, but is likely to be encountered. Care should be taken not to confuse this species, which may resemble *Paranais*, whose dorsal setae begin on V. Hiltunen and Klemm (1980) state that dorsal setae may be present on V in *Uncinais* and *Piguetiella*, the latter has short needles which are occasionally lost in the dorsal bundles, but is a northern taxon.



Uncinais uncinata: (after Sperber, 1950) A, dorsal seta; (after Brinkhurst, 1986) B, ventral seta from II; C, ventral seta from VII; D, posterior ventral seta; E, dorsal seta.

Genus. *Specaria* Sperber, 1939

Type Species. *Nais josinae* Vejdovsky, 1883.

Diagnosis. Eyes present or absent, proboscis and caudal appendages absent. Dorsal setae from VI, bundles composed of 2-6 serrate or non-serrate hairs, and 2-6 bifid or finely pectinate needles. Ventral setae all similar, bifid, with upper tooth longer than lower. Penial setae present.

Remarks. *Specaria* is distinct from the other naidids by having 2-6 bifid or pectinate needle setae, 2-6 serrate or non-serrate hair setae in dorsal bundles which start on VI, and all similar ventral setae. Dorsal bundles having more than 2 hairs with needles which start on VI is not shared with any other genus in Florida except *Vejdovskyella* Michaelsen, 1903, which differs from *Specaria* by having up to 9 hairs and is distinctly papillate. Additionally, *Vejdovskyella* is primarily a northern taxon, but may occur in the Florida Panhandle.

This genus is represented by 3 species. Only *S. josinae* is found in Florida. The other 2 have only been reported from their type localities in the Pacific Northwest.

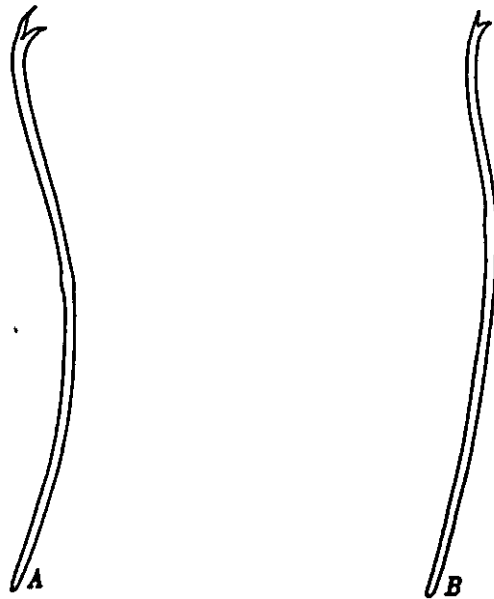
Specaria josinae (Vejdovsky, 1883)

Nais josinae Vejdovsky, 1883:215.

Diagnosis. Length: 3-10 mm; segments: 14-53. No eyes. Dorsal setae from VI, bundles composed of 2-6 non-serrate hairs and 2-6 bifid needles with teeth equal in length. Ventral setae bifid, 6-10 per bundle, all similar, upper tooth longer but as thick as lower. Penial setae simple-pointed, hooked distally, 1-3 per bundle.

Distribution and Habitat. Europe, widespread in North America. Freshwater reservoirs, on silt and sand substrates in relatively shallow, to about 1.5 m depth, may be associated with aquatic plants.

Remarks. The numerous hair and needle setae on the dorsal bundles, numerous ventral setae all of one shape and lack of papillae separate this from all other species of Naididae. The other 2 species of *Specaria* have fewer ventral setae.



Specaria josinae: (after Sperber, 1948) A, ventral seta; B, needle seta.

Genus. *Pristina* Ehrenberg, 1828

Type Species. *Pristina longiseta* Ehrenberg, 1828.

Diagnosis. Eyes absent, proboscis present, caudal appendages absent. Dorsal setae usually from II, hair setae and simple-pointed or bifid needles present. Ventral setae bifid, upper tooth becoming shorter posteriorly. Genital setae of various shapes.

Remarks. Species of this genus are distinguished from all other naidids by the presence of a proboscis, dorsal bundles with hair setae usually beginning on II and no papillae. Three other naidid genera have hairs from II, but *Stephensoniana* has papillae and the upper tooth of the ventral setae becomes longer posteriorly. *Pristinella* lacks a proboscis. *Bratislavia* may have dorsal setae beginning on II, but the dorsals will include very stout simple-pointed needles, and hairs are frequently lacking in many bundles.

Brinkhurst (1985) erected *Pristinella* for those species of *Pristina* without a proboscis. Seven species of *Pristina* occur in North America and have been, or are anticipated to be, found in Florida waters.

Key to Species of *Pristina* in Florida

1. A) Hair setae elongate on III. *P. leidy* pg. 56
B) Hair setae not elongate on III. 2.
- 2.(1B) A) Needle setae simple-pointed. *P. proboscidea* pg. 59
B) Needle setae bifid. 3.
- 3.(2B) A) Needle teeth fine, equal in length, giant ventral setae may be present in IV, V, and/or VI. *P. aequiset* pg. 53
B) Needle teeth long, equal or unequal, no enlarged ventral setae in IV, V, or VI. 4.
- 4.(3B) A) Needle teeth equal. *P. breviseta* pg. 55
B) Needle teeth unequal. 5.
- 5.(4B) A) Upper tooth of needles longer and thicker than lower, hairs serrated with serrations in two rows. *P. plumaseta* pg. 58
B) Upper tooth of needles shorter than lower, hairs serrated or non-serrate, if serrated, serrations in only one row. 6.
- 6.(5B) A) Upper tooth of needles slightly shorter than lower, hairs non-serrate. *P. synclites* pg. 60
B) Upper tooth of needles much shorter than lower, hairs serrated. *P. americana* pg. 54



***Pristina aequiseta* Bourne, 1891**

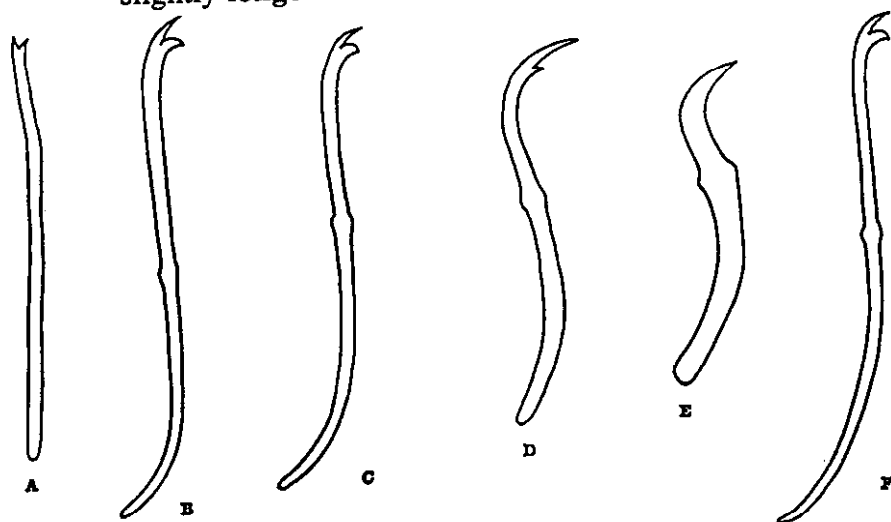
Pristina equiseta Bourne, 1891:352-353.

Diagnosis. Length: 2-8 mm; segments: 18-23. No eyes, proboscis present. Dorsal bundles from II with 1-4 finely serrated hairs and 1-4 finely bifid needles without a nodulus. Ventral setae bifid, longer on II than other segments, upper tooth longer than lower on II-VII, teeth equal posteriorly; setae on IV, V, or VI may be enlarged with upper tooth more than twice as long as lower, or lower may be absent. Penial setae present or absent.

Distribution and Habitat. Cosmopolitan. Europe, Asia, South America, widespread distribution in North America. Littoral regions of lakes, ponds and rivers. Associated with aquatic vegetation and has been found in oligohaline habitats.

Remarks. This species is characterized by the presence of a proboscis, dorsal bundles beginning on II with hairs and finely toothed needles. Enlarged, thickened setae with a very long upper tooth may be present on IV, V and/or VI. *Pristina foreli* and *P. evelinae* have been synonymised with *P. aequiseta*, as a result, the presence of enlarged ventral setae is no longer required to identify this taxon.

This species is very common throughout Florida. The description by Brinkhurst (1986) had a typographical error in that he stated that the upper tooth of the ventral setae on III-VII are slightly longer than the lower, not shorter.



Pristina aequiseta: (after Brinkhurst and Jamieson, 1971) A, dorsal seta; B, ventral seta of II; C, ventral seta of IX; D, E, giant ventral setae of V; F, posterior ventral seta.

Pristina americana Černosvitov, 1937

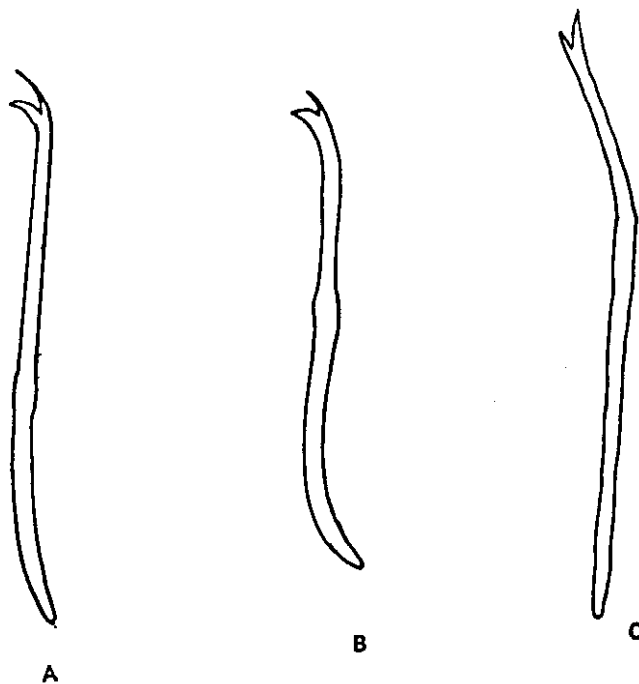
Pristina americana f. *typica* Černosvitov, 1937:136-138, Fig. 1-5, 10.

Diagnosis. Length: 10-30 mm. Eyes absent, proboscis present. Dorsal bundles from II with 1-2 serrated hairs and 1-2 bifid needles with long, thin, straight teeth, upper tooth shorter than lower, but may be occasionally absent. Ventral setae longer on II, upper tooth longer than lower, teeth equal on III, and upper tooth shorter than lower on remaining segments, 3-6 per bundle anteriorly, 1-2 posteriorly.

Distribution and Habitat. South America, North America (Texas). Streams.

Remarks. Only two other species, *P. peruviana*, Černosvitov, 1939, and *P. plumaseta*, share the following characters: a proboscis, serrated hair setae and long needle teeth. However, the needle teeth of *P. peruviana* are equal in length, and the upper tooth of *P. plumaseta* is longer and thicker, and the latter has only been reported from Peru.

In North America *P. americana* has only been reported from streams in Texas. However, there is a possibility it may occur in Florida.



Pristina americana: (after Brinkhurst, 1986) A, anterior ventral seta; B, posterior ventral seta; C, dorsal needle seta.

Pristina breviseta Bourne, 1891

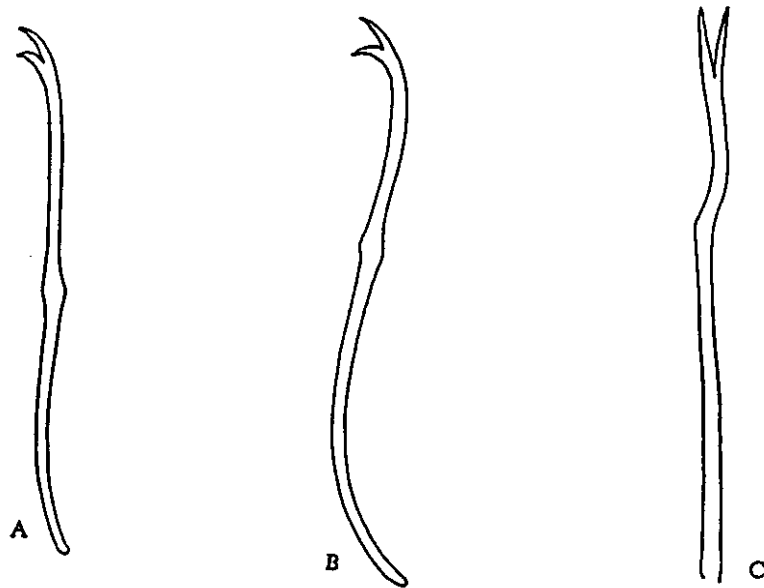
Pristina breviseta Bourne, 1891:353-355, Plate XXVII, fig. 11-15.

Diagnosis. Length: 10-20 mm; segments: 35-120. Eyes present, short proboscis present. Dorsal bundles from II, 1 hair and 1 smooth bifid needle per bundle, teeth diverging, equal in length. Ventral bundles with 3-5 setae per bundle, upper tooth longer anteriorly, both teeth equal but setae more curved on posterior segments. Genital setae present on VII and/or VIII, strongly curved with 2 enormous converging prongs.

Distribution and Habitat. South and East Asia, South America, widespread throughout North America.

Remarks. *Pristina breviseta* is separated from all other naidids by the presence of a proboscis, dorsal bundles from II with 1 hair and 1 needle seta with long equal teeth, and ventrals with upper tooth longer anteriorly. It belongs to a complex of species which have dorsal hairs and bifid setae with long teeth: *P. peruviana*, *P. synclites*, and *P. americana*. The former taxon has parallel needle teeth and serrate hairs, and the latter 2 both have unequal needle teeth.

This species has a widespread distribution and is expected to occur in Florida.



Pristina breviseta: (after Brinkhurst and Jamieson, 1971) A, ventral seta from II; B, ventral seta from XX; C, dorsal seta.

***Pristina leidy* Smith, 1896**

Pristina leidy Smith, 1896:396, Plate XXV, fig. 1-6.

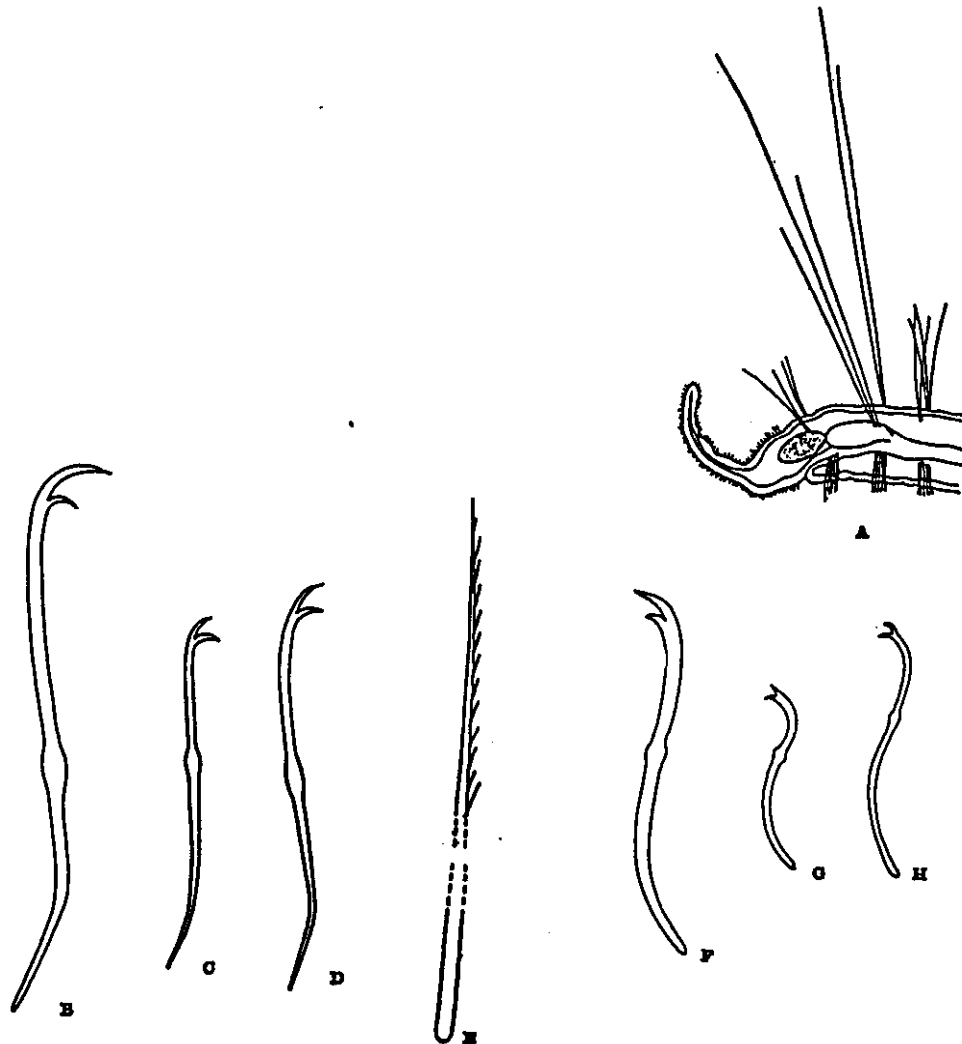
Diagnosis. Length: 4-8 mm; segments: (mature) 30. Eyes absent, proboscis present. Dorsal bundles from II, composed of 1-4 hairs and 1-4 minutely bifid needles, hairs on II-III non-serrate, serrate on following segments, extremely elongate on III. Ventral setae 2-10 per bundle, longer and stouter on II and III, bifid with upper tooth 1.5-2 times longer than lower on II, teeth equal posteriorly, 2-12 setae per bundle. Penial setae 1-3 per bundle, bifid, long and straight.

Distribution and Habitat. Hawaii, South America, widespread throughout North America. Lakes, rivers, streams.

Remarks. The presence of a proboscis with the dorsal bundles composed of hairs and minutely bifid needles with the hairs on III extremely elongate distinguish this species from all other naidids. The long dorsals of III readily identify this species. Harman and McMahan (1975) conducted an excellent review of the *Pristina longiseta* complex, which was comprised of 3 subspecies (*longiseta*, *bidentata*, and *leidy*) according to Brinkhurst and Jamieson (1971). Harman and McMahan (1975) synonymized *bidentata* with *leidy* and elevated it to specific status. The distinction between *P. longiseta* and *P. leidy* is based on presence of minutely bifid tips of the needle setae and its distribution is limited to Hawaii and North and South America in the latter, whereas *P. longiseta* has simple-pointed needles, and is distributed throughout Europe, Asia, and Africa. Klemm (1985) retains the specific status of *P. longiseta* and recognizes 2 subspecies, *bidentata* and *longiseta*, does not recognize *P. leidy*, and states that both the *longiseta* and *bidentata* forms are present in North America. Based on Harman and McMahan's (1975) extensive research on this complex. Their conclusion that all *Pristina* from North America with elongate hairs on III and a proboscis should be referred to as *P. leidy* may be more valid, since the minutely bifid tips of the needles are frequently overlooked and may only be discerned at 1000X.

Ten to 16 segments are formed anterior to the budding zone, resulting in segment III with the associated elongate hairs not

always present in newly budded specimens. Therefore, if the posterior end is absent, this species may be confused with *Crustipellis tribranchiata* and *P. proboscidea*; however, the former species lacks the modified ventral setae of II and the latter lacks the elongate hairs on III. Large populations should be examined closely for the presence of the tridigitate caudal ends in *C. tribranchiata*, and elongate hairs on III in *P. leidyi* which are frequently broken.



Pristina leidy: (after Piguet, 1906, as *P. longiseta*) A, anterior end of worm; (after Harman and McMahan, 1975) B, ventral seta of II; C, ventral seta of III; D, posterior ventral seta; (after Sperber, 1950, as *P. longiseta*) E, serrate dorsal hair; (after Brinkhurst and Jamieson, 1971, as *P. bidentata*) F, ventral seta of II; G, ventral seta of IV; H, ventral seta of VII.

Pristina plumaseta Turner, 1935

Pristina plumaseta Turner, 1935:253-258, Fig. 1-2.

Diagnosis. Length: 8-12 mm; segments: approximately 52. Eyes absent, short proboscis present. Dorsal bundles from II with 1-2 hairs bearing 2 rows of serrations, and 1-2 bifid needles with teeth relatively long, lower tooth shorter and thinner than upper. Ventral setae bifid with teeth subequal, 4-8 per bundle anteriorly and 2-4 per bundle posteriorly. Genital setae on VI and VIII, distally knobbed, twice as long as somatic setae.

Distribution and Habitat. Only reported from North America (Georgia, Illinois, Mississippi, Virginia, and Ontario). Rivers and springs.

Remarks. This species is unique in having hair setae with serrations in two rows. Additionally, the unusual combination of a proboscis, serrated hair setae and bifid needle setae with the upper tooth longer than the lower, and genital setae separate this taxon from all other naidids.

This species is relatively rare and, although not yet reported from Florida, may be present in Florida waters, at least in the Panhandle, since it has been reported from Mississippi (Harman, 1966).



Pristina plumaseta: serrated hair seta.

Pristina proboscidea Beddard, 1896

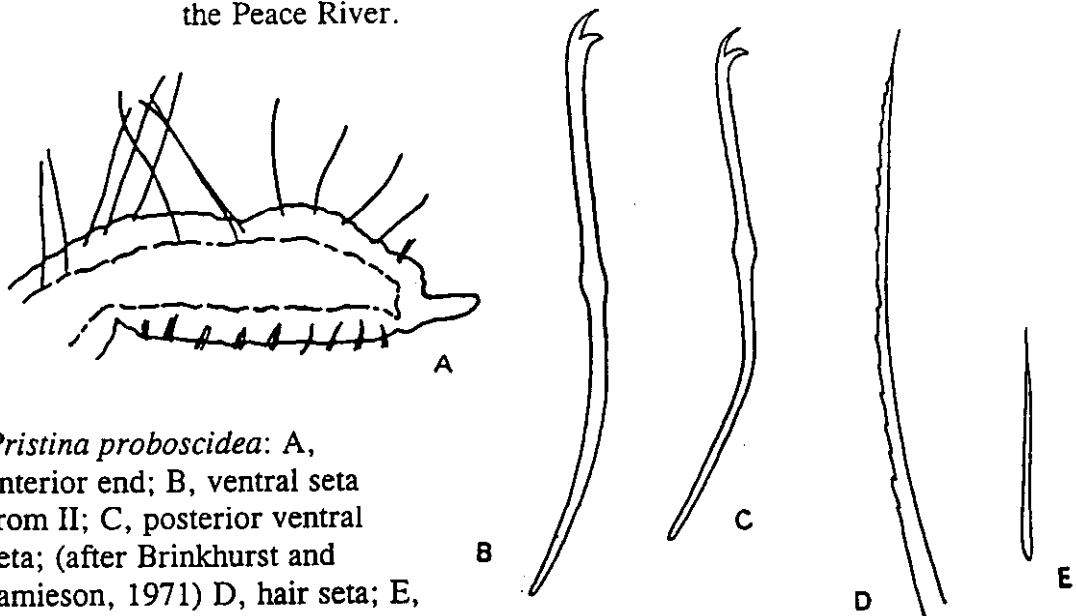
Pristina proboscidea Beddard, 1896:4, Fig. 18.

Diagnosis. Length: 2 mm; segments: 18-36. Eyes absent, proboscis present. Dorsal bundles from II with 1-4 serrate hairs of equal length, and 1-4 simple-pointed needles without a nodulus. Ventral setae on II longer and thicker than the rest, 2-4 per bundle anteriorly, increasing to 9 posteriorly; upper tooth longer than lower in all segments.

Distribution and Habitat. South America, Zanzibar, South and East Asia, Australia, North America (North and South Carolina[?], Florida). Rivers, standing water and swamps.

Remarks. This species is easily recognized by the presence of a proboscis, dorsal bundles starting on II composed of serrated hairs all of equal length and simple-pointed needles, and ventral setae of all the same shape with the upper tooth longer than the lower. This species is distinguished from the other species of *Pristina* in Florida by the large number of posterior ventrals. This species could be confused with *Trieminentia corderoi* and *Crustipellis tribranchiata* if the posterior end is missing. However, *P. proboscidea* can be distinguished from the aforementioned opisthocystids by its greater number of hairs and needles (1-4 of each), and the more diversified ventral setae of II.

This species may be present in North Carolina (Brinkhurst, 1986), and has been collected from the west coast of Florida in the Peace River.



Pristina proboscidea: A, anterior end; B, ventral seta from II; C, posterior ventral seta; (after Brinkhurst and Jamieson, 1971) D, hair seta; E, needle seta.

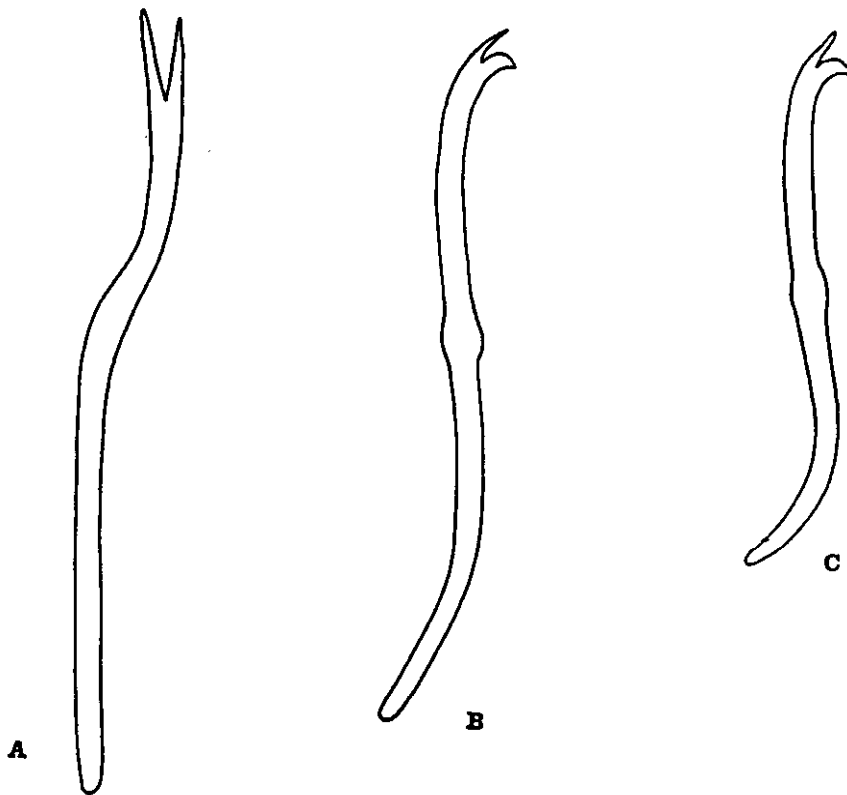
Pristina synclites Stephenson, 1925

Pristina synclites Stephenson, 1925:45-46, Plate III, fig. 1.

Diagnosis. Length: 5-7 mm (preserved); segments: 35-61. Eyes absent, short proboscis present. Dorsal bundles from II with 1-2 non-serrate hairs and 1-2 bifid needles, teeth relatively long, upper tooth shorter than lower, distinctive bend slightly distal to middle of shaft. Ventral setae bifid, 4 per bundle, fewer posteriorly, teeth equal in length, with upper tooth thinner than lower.

Distribution and Habitat. Southern Asia, Africa, North America, widespread east of the Mississippi. Common in rivers and streams on the west coast of Florida.

Remarks. With the distinctive distal crook in the shaft and long unequal teeth the unique shape of the dorsal needles characterizes this taxon.



Pristina synclites: (after Brinkhurst and Jamieson, 1971) a, dorsal needle seta; B, ventral seta from II; C, posterior ventral seta.

Genus. *Stylaria* Lamarck, 1816

Type Species. *Nereis lacustris* Linnaeus, 1767.

Diagnosis. Eyes usually present, long proboscis present, pigmented anteriorly. Dorsal bundles from VI, composed of non-serrated hairs and simple-pointed needles without a nodulus. Ventral setae bifid, lower tooth reduced, shaft with double angular bend proximally, 4-14 per bundle. Penial setae present.

Remarks. This genus is characterized by the long narrow proboscis which may or may not project from a notch between 2 lateral lobes, the absence of bifid needles, and uniquely shaped ventral setae with the characteristic double bend.

Stylaria is considered a monospecific taxon. Specimens with the proboscis arising terminally, not projecting from a notch, have previously been considered as a separate species, *S. fossularis* Leidy, 1852. Currently, the accepted viewpoint is that they are the same species, since this character has exhibited a great deal of variation within cultures.

Stylaria lacustris (Linnaeus, 1767)

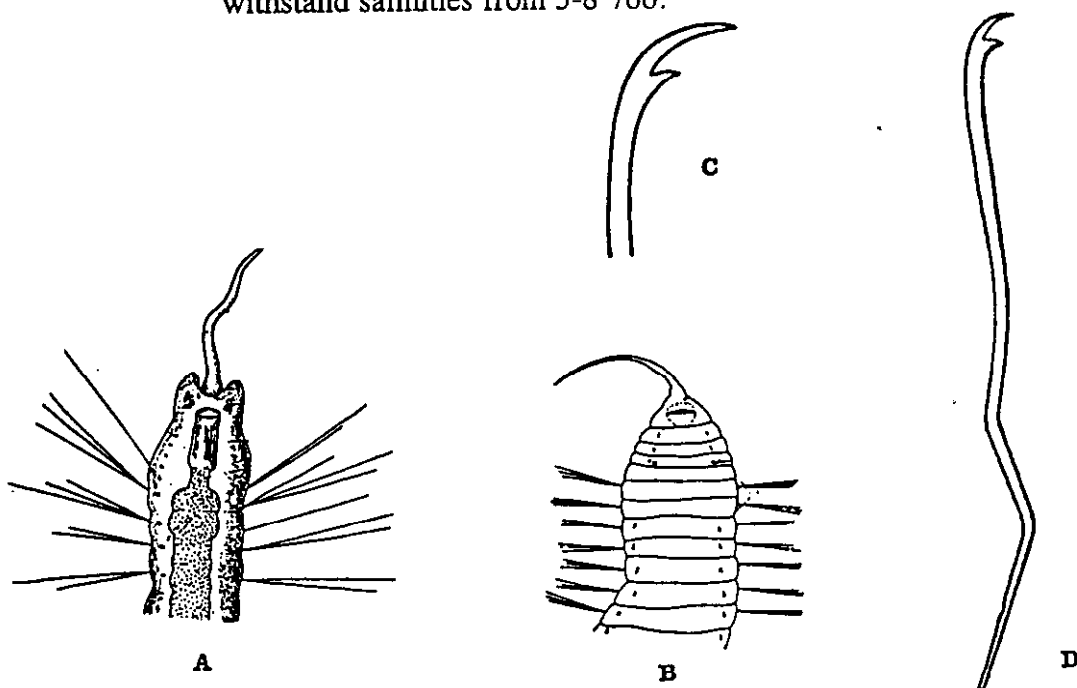
Nereis lacustris Linnaeus, 1767:1085 (partim).

Diagnosis. Length: 5.5-18 mm; segments: 23-49. Eyes present, long proboscis present which may or may not arise from between lateral lobes of the prostomium. Dorsal bundles begin on VI with 1-3 non-serrate hairs, and 3-4 simple-pointed needles without a nodulus. Ventral setae all similar with a reduced lower tooth, shafts with a double angular bend proximally, 4-14 setae per bundle. Penial setae 2 per bundle, simple-pointed, ectally hooked.

Distribution and Habitat. Europe, Asia, Africa, widely distributed throughout North America. Fresh and brackish water, rivers, lakes and ponds, frequently associated with littoral aquatic plants.

Remarks. This species is distinguished from all other naidids by the presence of a long thin proboscis, dorsal hairs and simple-pointed needles from VI, and the characteristically shaped ventral setae.

This species is very common throughout North America. Although it is more common north of Florida, it is present in Florida waters, primarily in rivers and estuaries where it can withstand salinities from 5-8‰.



Stylaria lacustris: (after Linnaeus, 1767) A, anterior end; D, ventral seta; (after Leidy, 1852, as *S. forsularis*) B, anterior end; C, ventral seta.

Genus. *Arcteonais* Piguet, 1928

Type Species. *Stylaria lomondi* Martin, 1907.

Diagnosis. Eyes present or absent, proboscis present, caudal appendages absent. Dorsal bundles composed of numerous smooth hair setae and fine, straight simple-pointed needles without a nodulus. Ventral setae bifid, all similar in shape. Penial setae present.

Remarks. *Arcteonais* is distinguished from other naidids by the short proboscis, dorsal bundles from VI with numerous hairs and fine simple-pointed needles, all of relatively equal length respectively. This genus is fairly similar to *Ripistes* Dujardin, 1842, but is easily distinguished from the latter because of the presence of giant hair setae on VI-VIII in *Ripistes*. Additionally, *Ripistes* is a northern inhabitant, unlikely to occur in Florida.

Arcteonais is a widely distributed, monospecific taxon common throughout North America.

Arcteonais lomondi (Martin, 1907)

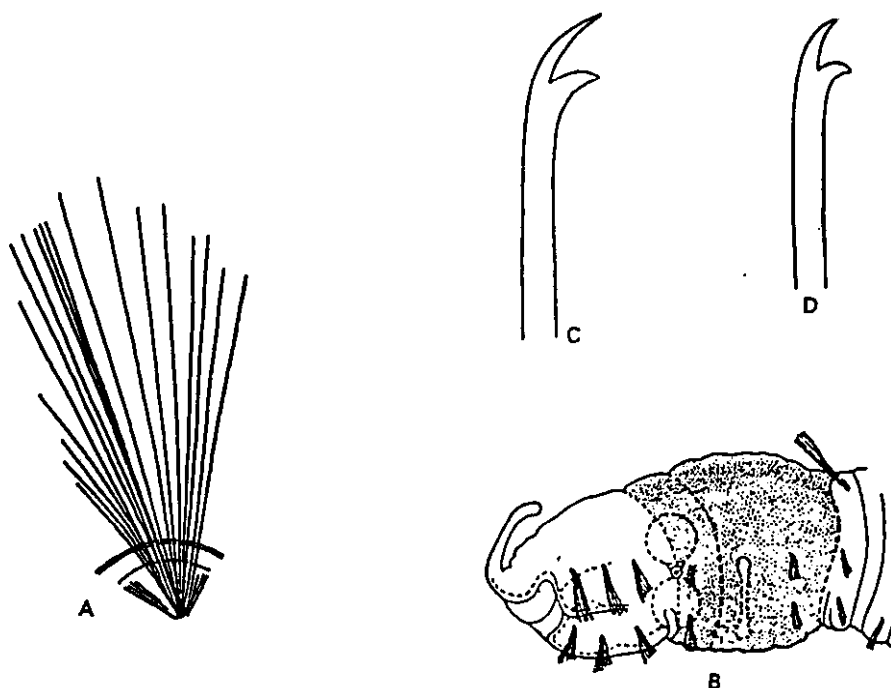
Stylaria lomondi Martin, 1907:25, Plate II.

Diagnosis. Length: 8-10 mm; segments: 42-50. Eyes present, short thin proboscis present, caudal appendages absent. Dorsal bundles from VI composed of 8-18 fine smooth hairs and 9-12 fine simple-pointed needles without a nodulus, hairs and needles of relatively equal length respectively throughout. Ventral setae bifid, all similar in shape but longest on II, decreasing in length progressively posteriorly to V, upper tooth longer and thinner than lower. Penial setae simple-pointed, hooked distally, 4 per bundle.

Distribution and Habitat. Europe, Asia, widely distributed throughout North America. Freshwater, generally shallow water, 2.5 m or less, on silty substrates.

Remarks. This species is readily separated from all other naidids by the short thin proboscis and numerous fine dorsal hairs and needles, lacking giant hairs anteriorly.

This species is a common inhabitant of the freshwater environments of Florida.



Arcteonais lomondi: (after Piguet, 1928) A, dorsal bundle of setae; B, anterior end; (after Martin, 1907) C, ventral seta from II; D, ventral seta from XXVII.

Genus. ***Haemonais* Bretscher, 1900**

Type Species. *Haemonais waldvogeli* Bretscher, 1900.

Diagnosis. Eyes, proboscis, and caudal appendages absent. Dorsal setae generally bifid, originating from II or VI and shed from a number of anterior segments upon budding, hair setae may be present. Ventral setae bifid differing in shape from anterior to posterior. Penial setae present.

Remarks. Although the distribution of dorsal setae is somewhat variable due to shedding on anterior segments, a common character which readily identifies individuals in this genus is the lack of anterior dorsal setae, predominantly from the first 16 or 17 segments.

Three species have variously been assigned to this genus. However, currently only 1 is considered valid. Although *H. waldvogeli* was reported from Michigan in 1922, the first well-established record was not until 1975 (Harman and Harrel, 1975), and is now known to be widely distributed in middle and eastern North America.

Haemonais waldvogeli Bretscher, 1900

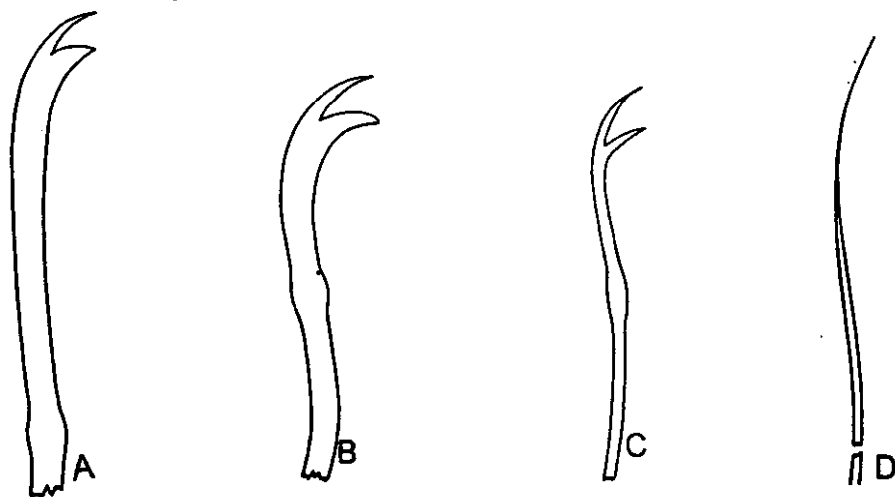
Haemonais waldvogeli Bretscher, 1900:16-18, Plate I, Fig. 11-14.

Diagnosis. Length: 5-20 mm; segments: 40-60. Anterior with orange-brown pigment. Eyes, proboscis and caudal appendages absent. Dorsal setae present from XVIII-XX, bundles composed of 1 short, smooth hair and 1 bifid needle with upper tooth much longer than lower. Ventral setae bifid, longer and thinner on the first 15-17 segments, with upper tooth longer than lower, posteriorly upper tooth equal or slightly shorter and thinner than lower, 2-4 per bundle on all segments. Penial setae bifid, 10-30 per bundle, strongly curved.

Distribution and Habitat. Europe, Asia, South America, widely distributed throughout central and eastern North America. Ponds, lakes and rivers associated with aquatic vegetation and detritus.

Remarks. This species is the only naidid which has dorsal setae beginning on the posterior region, generally from XVIII-XX. However, anterior dorsal setae originate from II or VI, they are shed upon budding. Even if dorsal setae are present on anterior segments the orange-brown pigmentation and teeth of the posterior needles readily identify this taxon.

This species is frequently encountered in Florida, and is usually associated with ponds, littoral regions of lakes and slow moving shallow waters.



Haemonais waldvogeli: (after Harman and Harrel, 1975) A, ventral seta of II; B, posterior ventral seta; C, needle seta; D, hair seta.

Genus. *Dero* Oken, 1815

Type Species. *Nais digitata* Müller, 1773.

Diagnosis. Eyes and proboscis absent. Caudal region modified into a ciliated branchial fossa which generally contains gills and may have a pair of palps projecting posteriorly. Dorsal bundles from IV, V or VI, hairs present or absent, needles variable, bifid, pectinate or palmate. Penial setae present or absent.

Remarks. The primary generic criterion separating this genus from all other naidids is the presence of a branchial fossa (chamber). *Dero* is subdivided into 3 subgenera based on lifestyle and the presence or absence of caudal palps.

The majority of species in this genus are tropical in their distribution. Following is a breakdown of the subgenera.

Dero (Allodero) Sperber, 1948

Commensal on eyes and in the ureters and bladders of frogs and toads. Free living forms unknown for North American species. Dorsal setae begin in IV. Branchial fossa rudimentary. Gills absent (rarely present). Ventral setae all of one form. Distribution exclusively tropical.

Dero (Dero) Oken, 1815

Free living. Dorsal setae from IV or VI. Ventral setae of II-V differentiated from those following. Gills present in branchial fossa (except *D. abbranchiata*), caudal palps absent.

Dero (Aulophorus) Schmarda, 1861

Free living. Dorsal setae from IV, V or VI. Ventral setae of II-V may or may not be differentiated from those following. Branchial fossa with a posterior pair of projecting ciliated palps, gills usually present

Subgenus. *Allodero* Sperber, 1948

Type Species. *Nais malayana* Stephenson, 1931a.

Diagnosis. Dorsal setae begin in IV, hairs and bifid or trifid needles present (occasionally missing). Ventral setae all of one form. Branchial fossa rudimentary, gills absent, or rarely present.

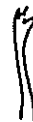
Remarks. The commensal nature of the species within a vertebrate is unique among the naidids. Only one other species within the genus *Dero* possesses a branchial fossa devoid of gills. (*D. abbranchiata* which has dorsals beginning in VI and spatulate needles.) However, one species, *D. (A.) lutzi* (Michaelson, 1926), developed gills when cultured as a free-living form (Sperber, 1948).

Sperber (1948) erected this subgenus originally for 3 species of *Dero* sharing the unique combination of characters which included dorsal setae beginning on IV, all ventral setae approximately equal, and asexual reproduction by fragmentation.

Two species of *Allodero* have been reported from North America and appear to be restricted to the southeastern region parasitizing the ureters of toads and frogs.

Key to Species of *Allodero* in Florida

1. A) Some dorsal needles appear trifid. Hairs and needles present from IV. Anterior ventral setae 3-4 per bundle
D. floridana pg. 69
- B) All dorsal needles bifid. Hairs rarely present. Anterior ventral setae 4-8 per bundle.
D. hylae pg. 70



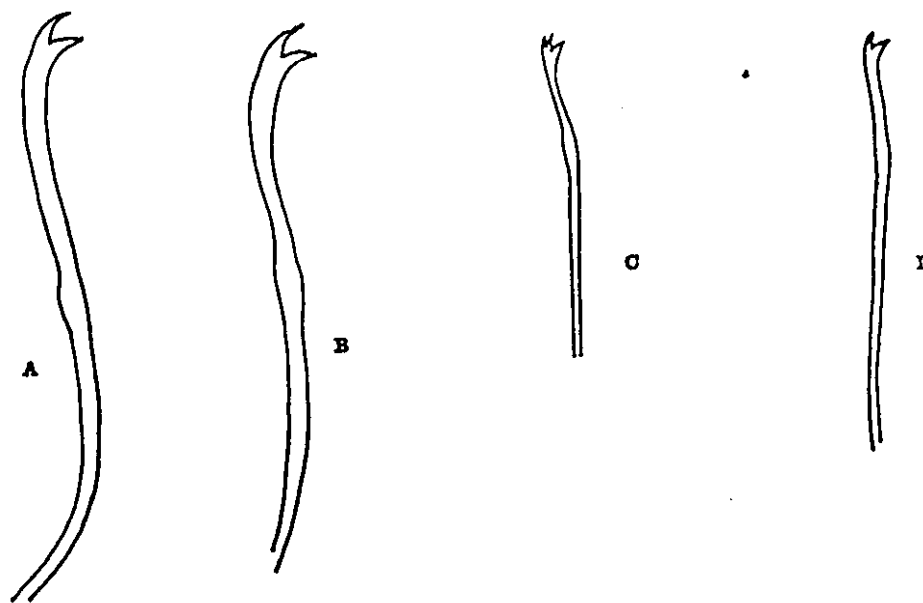
Dero (Allodero) floridana (Harman, 1971)

Dero (Allodero) floridana Harman, 1971:225, Fig. 1-2.

Diagnosis. Dorsal setae present from IV, bundles composed of 1 smooth hair and 1 bifid needle which may have an intermediate tooth.
Ventral setae bifid with equal teeth; all similar, 3-4 per bundle.
Branchial fossa rudimentary, gills absent.

Distribution and Habitat. Only reported from Florida inhabiting the ureters of the toad, *Bufo terrestris*.

Remarks. The unique habitat of this species, lack of anal gills, and a combination of hair and needle setae in dorsal bundles beginning in IV, distinguish this species from all other naidids.



Dero (Allodero) floridana: (after Harman, 1971) A, ventral seta of II; B, posterior ventral seta; C, D, dorsal needle setae.

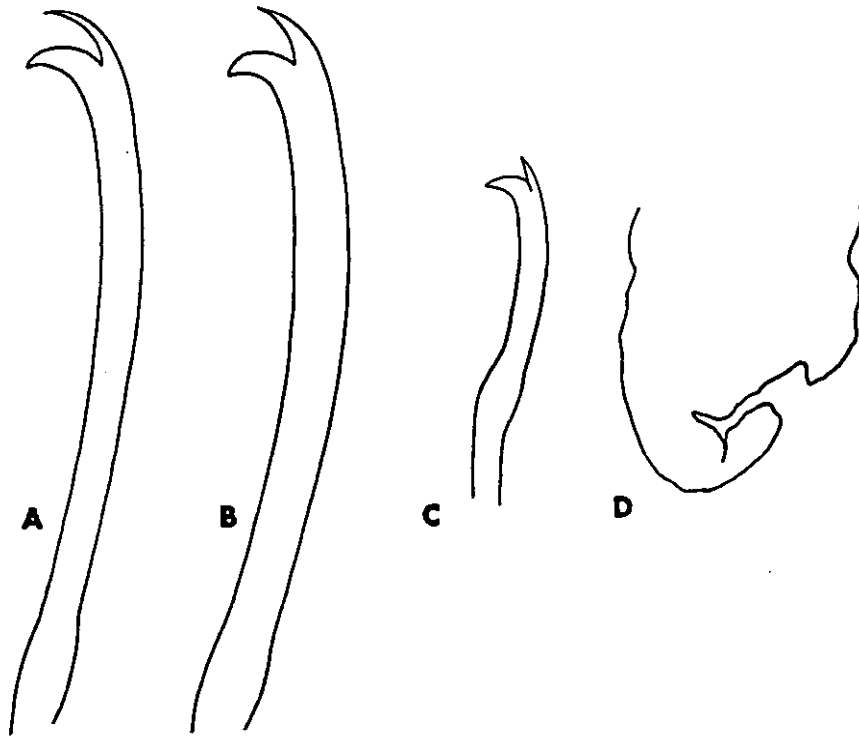
Dero (Allodero) hylae (Goodchild, 1951)

Schmardaella hylae Goodchild, 1951:205, Plate IV, fig. 1-6.

Diagnosis. Length: 4 mm; segments: 31-40. Dorsal setae present from IV, frequently missing in many segments; bundles composed of 1 thin, delicate hair (usually absent), and 1 bifid needle with upper tooth thinner and shorter than lower. Ventral setae bifid with equal teeth, upper tooth thinner than lower; 4-6 (8) per bundle. Branchial fossa rudimentary; gills lacking.

Distribution and Habitat. Reported from Mississippi, Louisiana, and Florida, inhabiting the ureters of toads and frogs (*Hyla versicolor*, *H. squirella*, *H. cinerea*, *Pseudacris nigrita*, *Bufo terrestris*, *Rana clamitans*, and *R. catesbiana*.) Harman and Lawler (1975) suggested that this species may be terrestrial.

Remarks. The commensal life style, rudimentary gill-less branchial fossa, dorsal setae from IV with the hairs frequently missing separate this species from all others. This species has not been found free-living.



Dero (Allodero) hylae: (after Harman, 1973a) A, ventral seta from II; B, ventral seta from VII; C, dorsal seta; D, posterior end.

Subgenus. *Dero* Oken, 1815

Type Species. Nais digitata Müller, 1773.

Diagnosis. Dorsal setae begin in IV or VI; ventral setae of II-V generally morphologically distinct from those of following segments. Branchial fossa with gills usually present, devoid of palps.

Remarks. This subgenus is generally recognized by the presence of gills within the branchial fossa, absence of anal palps, and dorsal setae beginning on VI. However, as in most taxa, there are always exceptions, and a certain degree of inter- and intraspecific variation with overlapping characters occur. For example, *D. abbranchiata* lacks branchiae, as the specific epithet indicates, and the dorsal setae of *D. dorsalis* begin on IV.

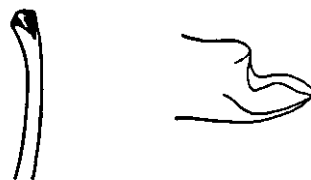
Separation of species within this subgenus has been fraught with confusion to the point where Michaelsen (1903) suspected that all European species of *Dero* without palps are in reality nothing more than variations of a single species, *Dero digitata*. Many taxonomists dealing with the dilemma of separating these species have also arrived at this conclusion. Harman (1980) recognized this by indicating that "there are many (species) which show variation to a greater degree than any of us would like. Several species of *Dero* and *Nais* will illustrate this point. Perhaps these are in reality complexes of species which we have not been able to sort out. I feel particularly sensitive to this possibility when dealing with *Dero digitata* - *obtusa* - *nivea*." *Dero trifida* could also be included in this complex. However, since all these species appear to share the same ecological requirements, specific determination may not be critical. Brinkhurst and Wetzel (1984) share the same opinion: "It has always been our experience that keys to the naidids work rapidly and easily all the way to the final dichotomy. It is possible that such fine differences established by the typological method have little practical value for ecologists..."

For practical purposes, and for the sake of preventing further confusion, the four aforementioned species may be referred to as the "*Dero digitata* complex".

Key to Species of *Dero* (Dero) in Florida

1. A) Gills absent within the branchial fossa; dorsal needles bifid with a web between the lateral teeth so they appear spatulate.

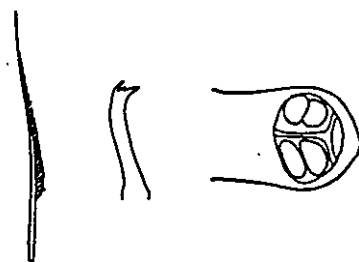
D. abranchiata pg. 73



- B) Gills present within branchial fossa; dorsal needles bifid, with or without an intermediate tooth. 2.

- 2.(1B) A) Hair setae plumose; dorsal needles with 1 or 2 fine intermediate teeth. Two pairs of gills.

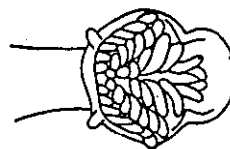
D. pectinata pg. 78



- B) Hairs smooth; dorsal needles with or without intermediate tooth; number of gills variable. 3.

- 3.(2B) A) About 20 pairs of gills (40 total).

D. botrytis pg. 74



- B) 2-4 pairs of gills. *4.

- 4.(3B) A) Some dorsal needles with an intermediate tooth; 4-5 pairs of gills. *D. trifida* pg. 79



- B) All dorsal needles bifid; 3-4 pairs of gills. 5.

- 5.(4B) A) Upper tooth of dorsal needles 1-2 times the length of the lower; four pairs of gills.

D. digitata pg. 75



- B) Needle teeth short, equally long; generally three pairs of gills. 6.



- 6.(5B) A) Ventral gills finger-shaped; branchial fossa not prolonged. *D. obtusa* pg. 77



- B) Ventral gills short, stumpy; branchial fossa prolonged behind gills. *D. nivea* pg. 76



* As indicated in the Remarks of this subgenus, *D. trifida*, *D. digitata*, *D. obtusa*, and *D. nivea* may all be lumped together and referred collectively as the "*Dero digitata* complex".

Dero (Dero) abbranchiata Harman, 1977

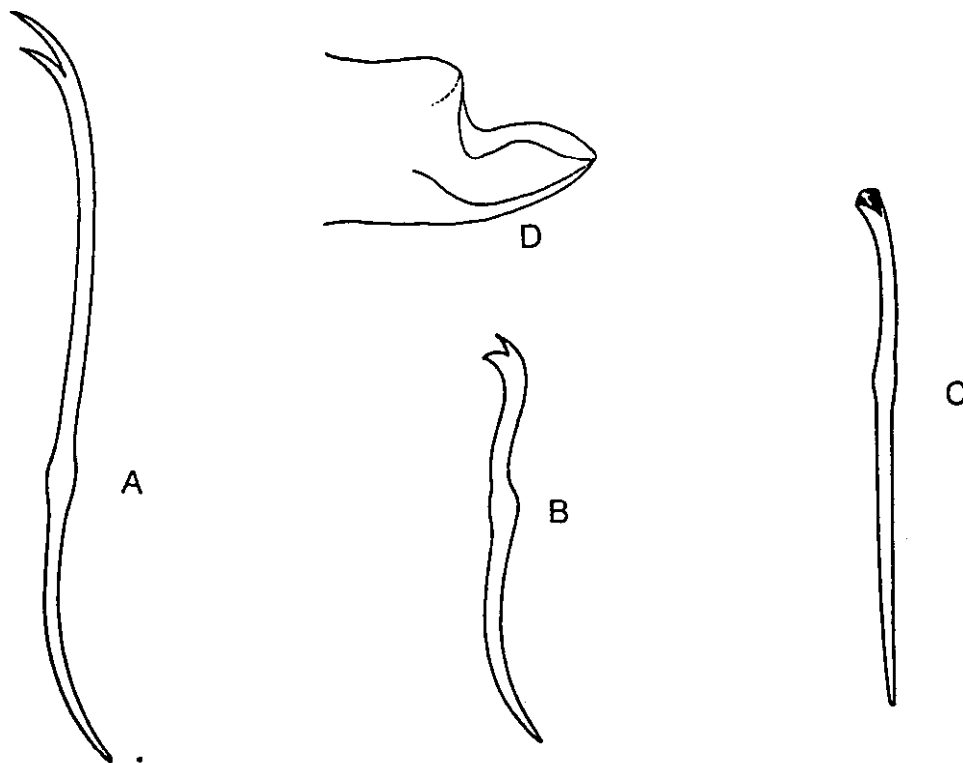
Dero (Dero) abbranchiata Harman, 1977:488-490, Fig. 3.

Diagnosis. Segments: 38. Dorsal setae present from VI, bundles composed of 1 thin hair and 1 spatulate needle. Ventral setae bifid, those of II and III longer, straighter and thinner than the rest with upper tooth $1\frac{1}{2}$ times longer than lower, 4-5 per bundle; posterior to VIII upper tooth thinner and shorter than lower, 3-4 per bundle. Branchial fossa well developed, lacking gills.

Distribution and Habitat. This species is known only from the type locality, a pond in western Louisiana, and from Texas.

Remarks. The unique combination of the following 3 characters separates this taxon from all other species: 1) the presence of a well-developed branchial fossa without gills; 2) dorsal setae beginning on VI; and 3) the unique shape of the spatulate dorsal needles which are distinctly bifid with the interdentary space filled by a web with setae similar to *Aulophorus*.

This species has not yet been reported from Florida.



Dero (Dero) abbranchiata: (after Harman, 1977) A, anterior ventral seta; B, posterior ventral seta; C, needle seta; D, branchial fossa of posterior end.

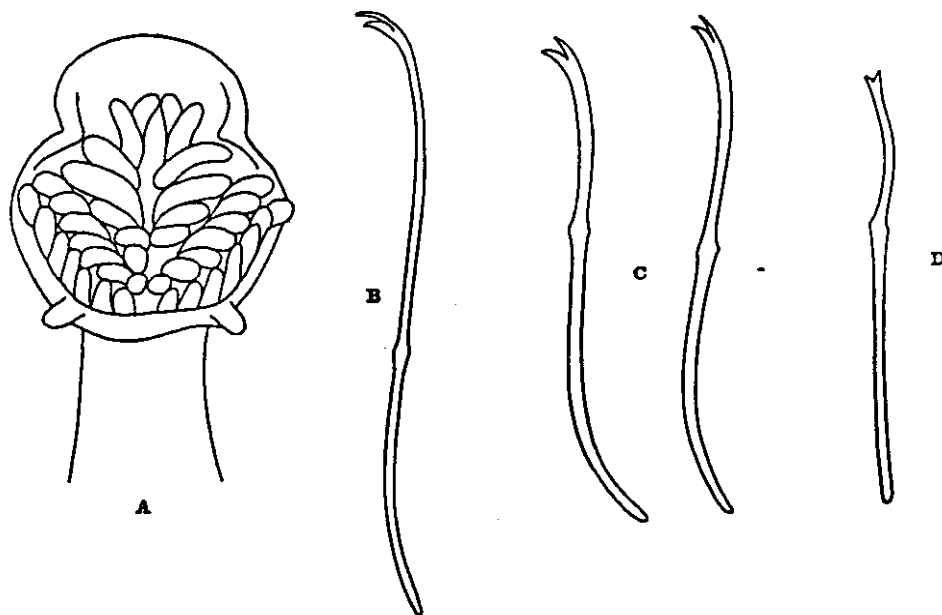
Dero (Dero) botrytis Marcus, 1943

Dero botrytis Marcus, 1943:37-39, Plate V, fig. 21-22.

Diagnosis. Length: to 30 mm; segments: 34. Dorsal setae begin on VI, bundles composed of one hair and one finely bifid needle with widely divergent short teeth, lower tooth slightly thicker than upper. Ventral setae of II-V longer than the rest with upper tooth longer and thinner than lower, 6-7 per bundle; 4-6 per bundle in remaining segments with upper tooth thinner and shorter than the rest, penial setae absent. Branchial fossa disk-shaped with about 20 pairs of finger-shaped gills.

Distribution and Habitat. This species has previously been only reported from South America (Brazil). However, it has been collected in small densities from various locations throughout central Florida. Small streams and rivers with a relatively clean, fine sand substrate.

Remarks. The unusually large number of gills readily separates *D. botrytis* from all other species of *Dero*. This species has previously been confused with *Dero multibranchiata* in some collections from Florida. The latter taxon has only seven or eight pairs of gills, was originally described from Brazil and has not been reported from North America. The confusion stems from a misinterpretation in the number of gills. Both Sperber (1948) and Brinkhurst and Jamieson (1971) cite the number of branchiae as "forty pairs", whereas their accompanying illustration has only 21 pairs (42 total).



Dero (Dero) botrytis: (after Brinkhurst and Jamieson, 1971) A, posterior end; B, ventral seta of II; C, ventral setae of X; D, dorsal needle seta.

Dero (Dero) digitata (Müller, 1773)

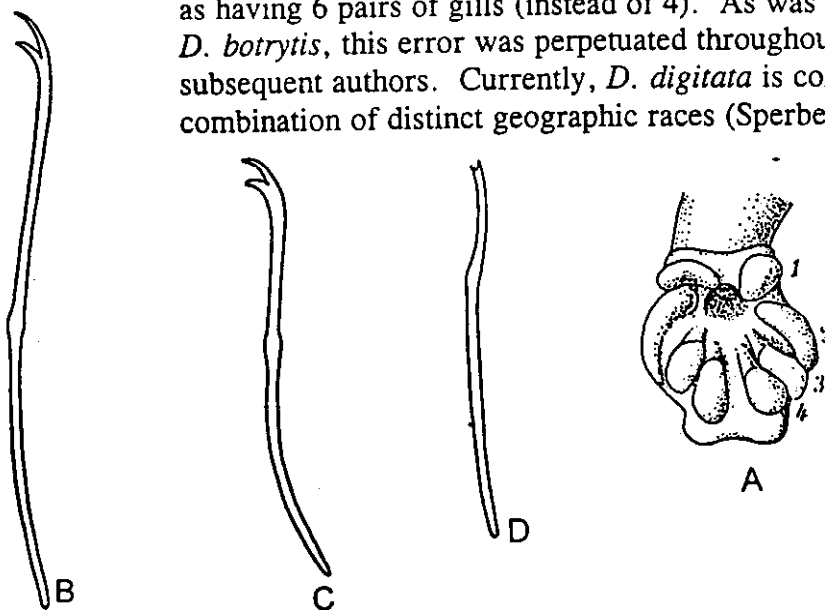
Nais digitata (coeca) Müller, 1773:22-23.

Diagnosis. Length: 6-32 mm; segments: 20-105. Dorsal setae begin on VI, bundles composed of 1 hair and 1 bifid needle, with upper tooth 1-2 times longer than the lower. Ventral setae all bifid, those of II-V longer and thinner than the rest, upper tooth $1\frac{1}{2}$ - 2 times longer than the lower, 3-6 per bundle; from VI upper tooth thinner and shorter than lower, 2-5 per bundle, penial setae absent. Branchial fossa usually with 4 pairs of gills, 1 small dorsal and 3 foliate ventral pairs; occasionally 1 or more pairs lacking, or 1-3 pairs cleft forming supernumary gills.

Distribution and Habitat. Cosmopolitan. One of the most common species of oligochaetes in Florida, frequently forming dense populations. Occurs in most aquatic habitats in the littoral margins associated with vegetation on sandy, silty, and silty-sand substrate.

Remarks. As previously indicated in the Remarks for the subgenus, this species may more appropriately be considered a complex of four species: *D. digitata*, *D. trifida*, *D. nivea*, and *D. obtusa*. Many preserved specimens lack a posterior end, and there is a high degree of intraspecific variation of the branchial apparatus and the length of the needle teeth. Consequently, misidentifications are frequent.

D. digitata has been one of the most described naidids in literature. Many of the descriptions have been in a variety of languages which have resulted in many misinterpretations. Even the original description (Müller, 1773) erroneously described the type specimens as having 6 pairs of gills (instead of 4). As was the case with *D. botrytis*, this error was perpetuated throughout the literature by subsequent authors. Currently, *D. digitata* is considered to be a combination of distinct geographic races (Sperber, 1948).



Dero (Dero) digitata: (after Chen, 1940) A, dorsal and lateral view of branchial apparatus. The numbers indicate the order of the gills; (from Sperber, 1950) B, ventral seta of II; C, ventral seta of VI; D, dorsal needle seta.

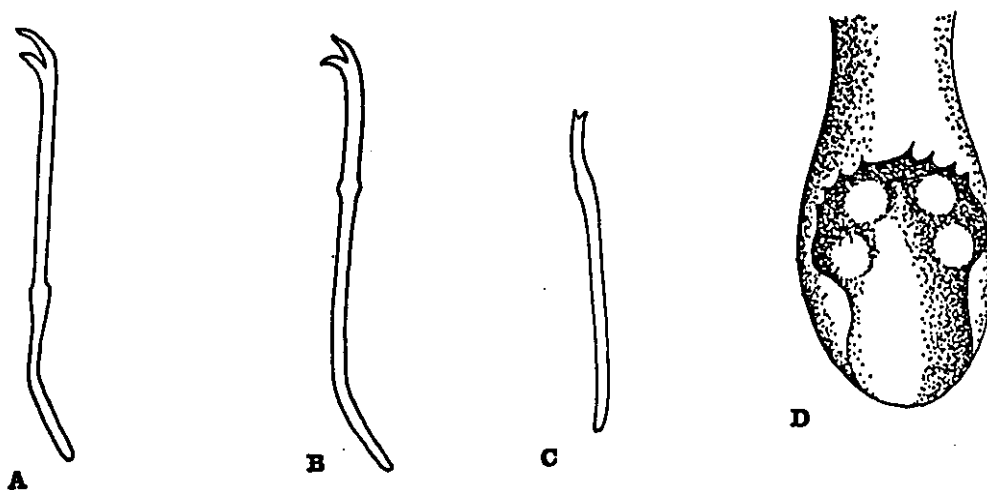
Dero (Dero) nivea Aiyer, 1930

Dero niveum Aiyer, 1930:40-41, Fig. 16-17.

Diagnosis. Length: 2.5-10 mm; segments: 23-45. Dorsal setae begin on VI, bundles composed of 1 hair and 1 bifid needle with short equal teeth. Ventral setae all bifid, 4 per bundle, those of II-V longer and thinner than the rest, upper tooth about 2 times longer than lower; from VI teeth equal in length, upper tooth somewhat thinner than lower. Branchial fossa slightly prolonged posteriorly with 3 pairs of short, stumpy gills, 2 ventral and 1 dorsal, dorsal pair may be reduced to ciliated swellings.

Distribution and Habitat. Europe, Asia, America, Africa, and Australia. Inhabits littoral margins of most aquatic systems, generally associated with aquatic vegetation and fine sediments.

Remarks. The posterior prolongation of the branchial fossa beyond the 2-3 pairs of short gills, and the short needle teeth of equal length distinguish *D. nivea* from the other species of *Dero*. However, the morphology of the branchial apparatus may be altered by fixation, it may be missing, or in the process of regeneration. Unless large populations are examined, with all individuals sharing the same unique configuration of the branchial apparatus, specimens should simply be regarded as a member of the *D. digitata* complex.



Dero (Dero) nivea: (after Brinkhurst and Jamieson, 1971) A, anterior ventral seta, B, posterior ventral seta; C, dorsal needle seta; D, branchial apparatus.

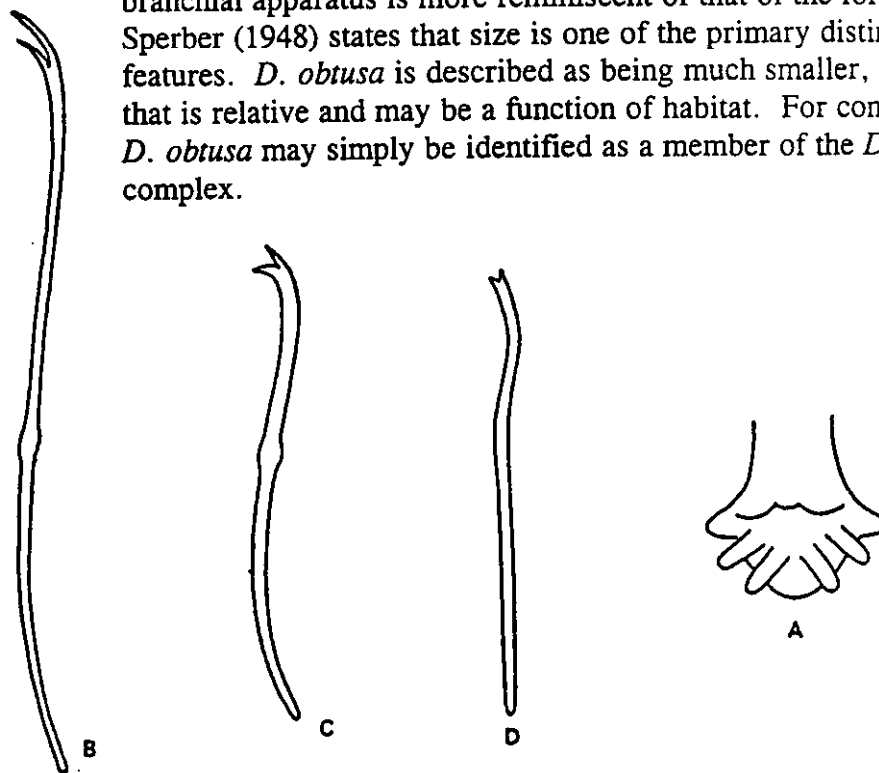
Dero (Dero) obtusa d'Udekem, 1855

Dero obtusa d'Udekem, 1955:549-550, Plate I, fig. 1.

Diagnosis. Length: 5-17 mm; segments: 21-35. Dorsal setae begin in VI, bundles usually composed of 1 hair and 1 bifid needle with short equal teeth. Ventral setae all bifids, those of II-V longer and thinner than the rest with upper tooth about 2 times longer than lower, 2-4 per bundle; from VI teeth equal in length, upper tooth somewhat thinner than lower, 3-6 per bundle, penial setae absent. Branchial fossa usually with 3 pairs of gills: 2 digitate ventral and 1 foliate lateral, lateral pair may be reduced to ciliated swellings and more dorsal in position.

Distribution and Habitat. Europe, Asia, Palestine, North and South America, China, Africa. Occurs in slow moving or still waters in the littoral margins associated with aquatic vegetation on sandy and silty-sand substrates.

Remarks. This species is an intermediate between *D. digitata* and *D. nivea*. The setal morphology resembles that of the latter, whereas the branchial apparatus is more reminiscent of that of the former. Sperber (1948) states that size is one of the primary distinguishing features. *D. obtusa* is described as being much smaller, however, that is relative and may be a function of habitat. For consistency, *D. obtusa* may simply be identified as a member of the *D. digitata* complex.



Dero (Dero) obtusa: (after Hrab, , 1954) A, branchial apparatus; (after Sperber, 1948-50) B, ventral seta from II; C, ventral seta from VI; D, dorsal needle seta.

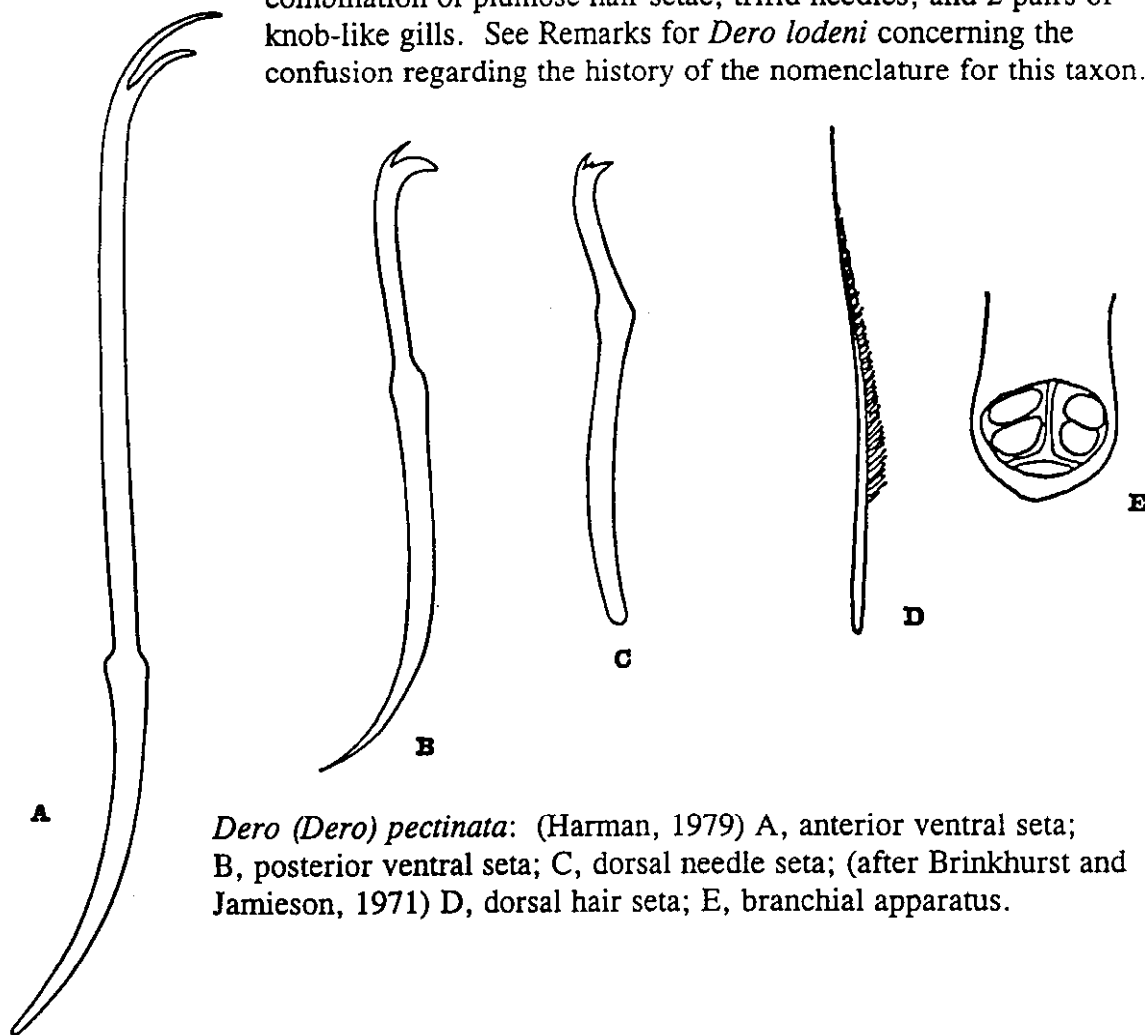
Dero (Dero) pectinata Aiyer, 1930

Dero pectinata Aiyer, 1930:36-38, Fig. 12-13.

Diagnosis. Length: to 2 mm; segments: 19-25. Dorsal setae begin in VI, bundles composed of 1 plumose hair and 1 trifid needle. Middle tooth of needle slightly smaller than upper and lower. Ventral setae all bifid, those of II-V two times longer, and straighter and thinner than the rest with upper tooth longer than lower, 2-4 per bundle; from VI upper tooth shorter and thinner than lower, penial setae absent. Branchial fossa with 2 pairs of small knob-like ventral gills.

Distribution and Habitat. Southern India, West Indies (Oligohaline), Surinam, Australia, North America (Texas and Florida).

Remarks. This species is readily distinguished from all others by the unique combination of plumose hair setae, trifid needles, and 2 pairs of knob-like gills. See Remarks for *Dero lodeni* concerning the confusion regarding the history of the nomenclature for this taxon.



Dero (Dero) pectinata: (Harman, 1979) A, anterior ventral seta; B, posterior ventral seta; C, dorsal needle seta; (after Brinkhurst and Jamieson, 1971) D, dorsal hair seta; E, branchial apparatus.

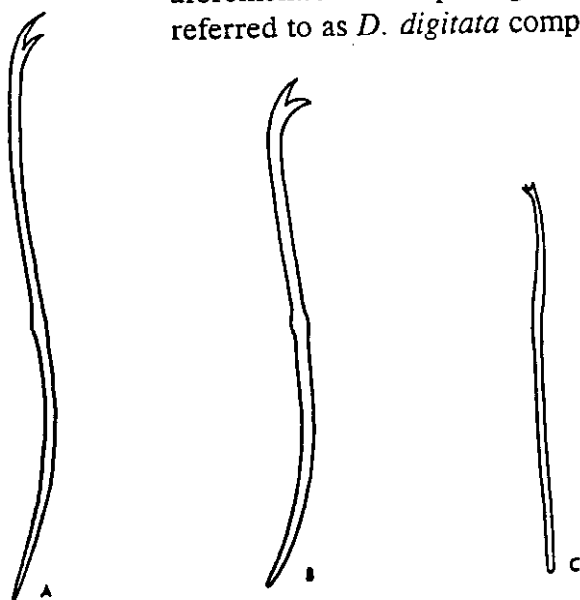
Dero (Dero) trifida Loden, 1979

Dero (Dero) trifida Loden, 1979a:583-587, Fig. 1.

Diagnosis. Dorsal setae being in VI, bundles composed of 1 hair and 1 bifid or trifid needle. Ventral setae all bifid, those of II-V longer and thinner than the rest with upper tooth $1\frac{1}{2}$ times as long as lower, 4-5 per bundle; from VI upper tooth about as long as or slightly shorter than lower, 3-4 per bundle, penial setae absent. Branchial fossa with 4-5 pairs of gills.

Distribution and Habitat. North America (Louisiana, North Carolina, Florida). According to the original description, the ecology of *D. trifida* warrants distinguishing it from the other species comprising the *D. digitata* complex. Whereas *D. digitata*, *D. obtusa*, and *D. nivea*, attain maximum abundance in lentic conditions, *D. trifida* is restricted almost exclusively to running water habitats. However, all the species of the *D. digitata* complex have been found to be sympatric.

Remarks. Although the author "was hesitant to describe (*D. trifida*) as a new species" because of morphological overlap to other species of *Dero (Dero)*, Loden (1979a) maintained that the ecological variations were sufficient to designate it as a distinct taxon. The morphology of the needle setae was demonstrated to be highly variable when specimens were cultured in the laboratory. Wild populations had trifid needles, whereas cultured specimens apparently shed the trifid setae and replaced them with setae lacking the intermediate tooth and with a longer upper tooth resembling *D. digitata*. Because of the aforementioned morphological plasticity, this taxon should be referred to as *D. digitata* complex.



Dero (Dero) trifida: (after Loden, 1979a) A, anterior ventral seta; B, posterior ventral seta; C, needle seta; D, E, variation of the needle setae.

Subgenus. *Aulophorus* Schmarda, 1861

Type Species. *Nais furcata* Müller, 1773.

Diagnosis. Dorsal setae begin in IV, V, or VI. Ventral setae of II-V may or may not be morphologically dissimilar from those of following segments. Posterior margin of branchial fossa usually projecting into two palps.

Remarks. The presence of a pair of branchial palps emerging from the posterior margin of the branchial fossa is the one unique character separating the species within this subgenus from all others. Sperber (1948) distinguishes 3 groups within *Aulophorus* based on where the dorsal setae begin: 1) dorsal setae begin on VI; ventral setae of II-V are very well differentiated from the rest, usually being twice as long, thinner and straighter with the upper tooth longer than the lower; this is the only group which includes species with palmate needles; species from Florida include *D. flabelliger* and *D. vaga*; 2) dorsal setae begin in V and include only bifid or pectinate needles and hairs; ventral setae gradually change in shape backwards; species from Florida include *D. furcatus* and *D. lodeni*; 3) dorsal setae begin in IV; ventral setae all alike. *Dero* (A.) *superterrenus* (Michaelsen, 1912) is the only species in this group. Klemm (1985) cites *D. superterrenus* as an unconfirmed record from North America. *Dero superterrenus* is common in South America (Brazil and Argentina) and the Dutch West Indies, inhabiting epiphytes, tree holes and cisterns. Since Florida shares a rich nauidid community with tropical South America, it is possible that this species may be collected. *Dero superterrenus* is easily recognized by the presence of dorsal setae from IV and the short upper tooth of all ventral setae. For verification of this species, refer to the description by Sperber (1948) or Brinkhurst and Jamieson (1971).

Key to Species of *Dero* (*Aulophorus*) in Florida

1. A) Dorsal setae begin in VI, needles palmate. 2.

- B) Dorsal setae begin in V, needles bifid or pectinate. 3.

- 2.(1A) A) Ventral setae of II-V more than twice as long as rest, needles with a very wide palm.
D. flabelliger pg. 82



- B) Ventral setae of II-V not more than twice as long as rest, needles with a relatively narrow palm.
D. vaga pg. 85



- 3.(1B) A) Needles only bifid, 3-4 pairs of gills.
D. furcata pg. 83



- B) Needles bifid with intermediate teeth, 4 pairs of gills.
D. lodeni pg. 84



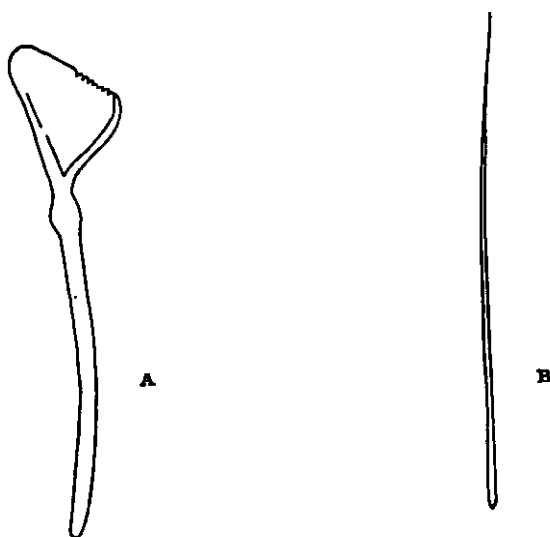
Dero (Aulophorus) flabelliger Stephenson, 1931

Dero flabelliger Stephenson, 1931b:44-46, Fig. 4.

Diagnosis. Length: 2.75 mm; segments: 27. Dorsal setae begin in VI, bundles composed of 1 hair and 1 palmate needle with strongly diverging lateral margins and an obliquely cut web. Ventral setae all bifid, 5-7 per bundle, those of II-V more than twice as long as the rest and straighter with the upper tooth longer than lower; from VI upper tooth much shorter and thinner than lower. Branchial fossa with 2-3 pairs of long cylindrical gills and long parallel palps.

Distribution and Habitat. Africa (Kenya), Australia, China, and North America (New York, North Carolina, and Florida). Lakes and slow flowing lotic systems.

Remarks. The distinctive shape of the needles with its wide web and obliquely cut distal margin readily separates this taxon from all others. The number of gills associated with the branchial fossa is, however, somewhat variable. While the African and North American forms have 3 pairs of long gills, Australian specimens have a much reduced third pair, and an extra median gill has been reported for Chinese specimens.



Dero (Aulophorus) flabelliger: (after Brinkhurst and Jamieson, 1971) A, dorsal palmate seta; B, dorsal hair seta.

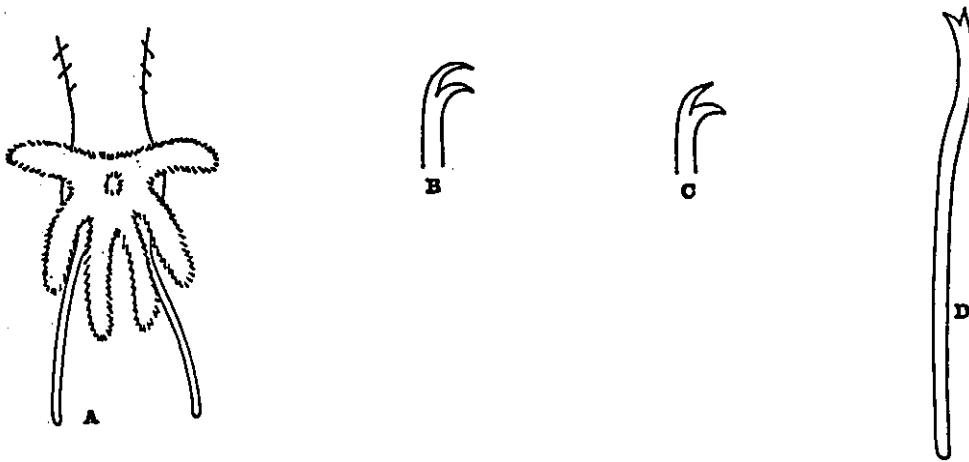
Dero (Aulophorus) furcata (Müller, 1773)

Nais furcata Müller, 1773:23.

Diagnosis. Length: 6-20 mm; segments: 35-82. Dorsal setae begin in V, bundles composed of 1 hair and 1 bifid needle with the lower tooth slightly longer than the upper. Ventral setae all bifid, 2-5 per bundle, those of II-IV slightly longer than the rest with lower tooth slightly shorter than upper; from V upper tooth shorter than lower. Branchial fossa with 3-4 pairs of cylindrical gills and parallel palps.

Distribution and Habitat. Cosmopolitan. In North America, east of a line from Wisconsin to Texas. Primarily inhabiting lakes and slow-moving rivers.

Remarks. *Dero furcata* is distinguished from all other species of the subgenus *Aulophorus* by having the dorsal setae beginning in V, anterior ventrals not substantially differentiated from those of the posterior and bifid needles with upper tooth shorter than lower. This species is easily confused with *Dero lodeni* which has pectinate needles which may be easily overlooked if observed only under low magnification.



Dero (Aulophorus) furcata: (after Sperber, 1950) A, branchial fossa; B, ventral seta of VIII; C, posterior ventral seta; D, dorsal needle seta.

Dero (Aulophorus) lodeni (Stephenson, 1931)

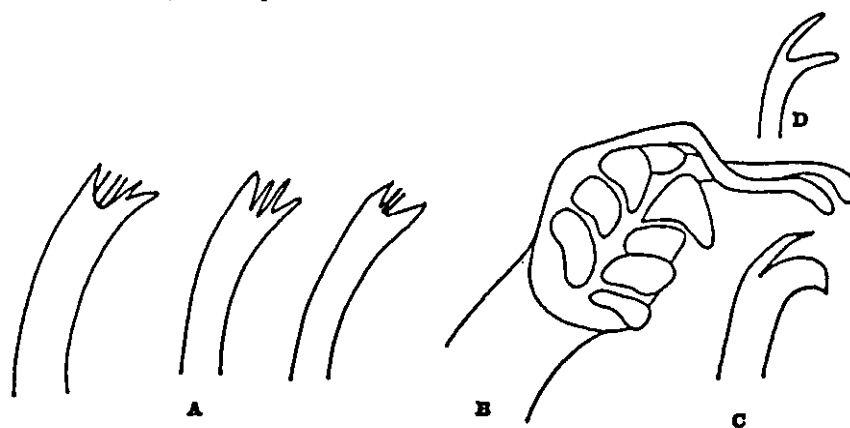
Aulophorus pectinatus Stephenson, 1931c:308-309, Plate XVII, fig. 6.

Diagnosis. Length: 12-16 mm; segments: 108-113. Dorsal setae begin in V, bundles composed of 1 hair and 1 pectinate needle with 2-4 intermediate teeth. Ventral setae all bifid, anteriorly the upper tooth is longer and thinner than lower, 3-4 per bundle; teeth of posterior ventrals equal in length, lower tooth thicker than the upper, 2-3 per bundle. Branchial fossa with 4 pairs of gills and a pair of long diverging palps.

Distribution and Habitat. South America, Africa, North America (Pennsylvania, Louisiana, Texas, Florida). This species has been collected from rivers, small lakes, acid swamps, and alkaline pools.

Remarks. This species differs from all species within the subgenus *Aulophorus* by having the unique combination of dorsals beginning in V, pectinate needles and 4 pairs of gills. It was originally described as *Dero (Aulophorus) pectinata* and changed to *D. intermedius* by Loden and Harman (1982) because the name was preoccupied, and then to *D. lodeni* by Brinkhurst (1986) after it had been pointed out by Brinkhurst and Kathman (1983) that *D. intermedius* was preoccupied.

This species may be mistaken for *D. furcata* if the intermediate teeth of the needles are overlooked. The record of *D. lodeni* in Africa is questionable because the hair setae were apparently fringed with lateral hairs, not reported elsewhere.



Dero (Aulophorus) lodeni: (after Brinkhurst and Jamieson, 1971) A, dorsal needle setae; B, branchial apparatus; C, posterior ventral seta; D, anterior ventral seta.

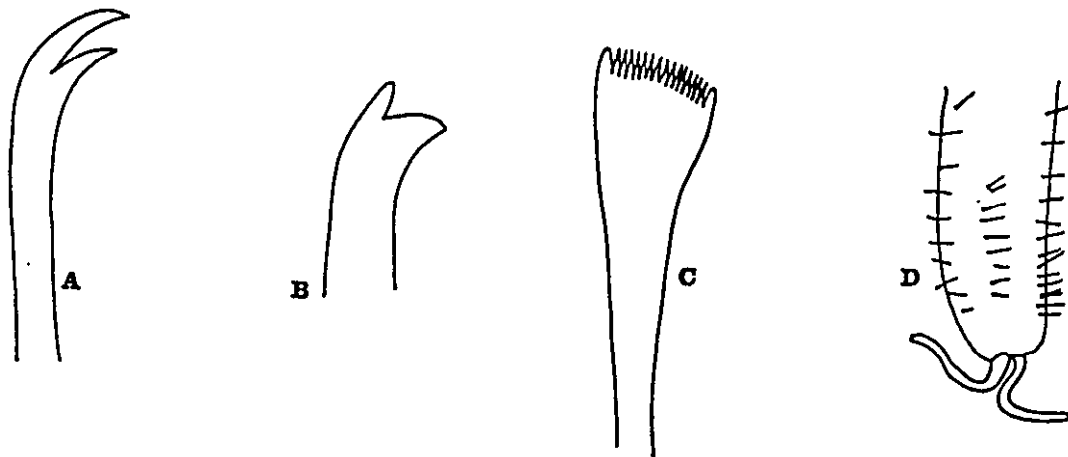
Dero (Aulophorus) vaga (Leidy, 1880)

Aulophorus vagus Leidy, 1880, 423-425, Fig. 3-4.

Diagnosis. Length: 5-10 mm; segments: 24-60. Dorsal setae begin in VI, bundles composed of 1-3 hairs and 1-3 palmate needles. Ventral setae all bifid, those of II-V longer and straighter than the rest with the upper tooth up to 2 times the length of the lower, 7-14 per bundle; from VI upper tooth shorter and thinner than lower, 4-7 per bundle. Branchial fossa with 1(?) pairs of small ventral gills and strongly diverging palps.

Distribution and Habitat. North America (Michigan, Massachusetts, Mississippi, Texas, and Florida).

Remarks. This species is distinguished by the palmate needles beginning on VI, the single (double?) pair of small gills and large number of anterior ventral setae.



Dero (Aulophorus) vaga: (after Brinkhurst and Jamieson, 1971) A, anterior ventral seta; B, posterior ventral seta; C, dorsal palmate seta; D, posterior end.

Genus. *Allonais* Sperber, 1948

Type Species. *Nais inaequalis* Stephenson, 1911.

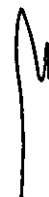
Diagnosis. No eyes, proboscis or caudal appendages. Dorsal setae normally from VI, bundles include hairs and bifid or pectinate needles. Penial setae present or absent.

Remarks. Sperber (1948) erected this genus to accommodate those species formerly included in *Nais* which lack eyes, whose anterior ventral setae are only weakly differentiated from the rest, and are confined to tropical regions.

The genus includes 6 species, only 2 of which have been reported from North America. Although the species originally assigned to *Allonais* were confined to tropical climates, the range of *A. pectinata* has since been extended to the temperate regions of North America into Ontario. *Allonais paraguayensis* has been collected from Louisiana and Florida. Brinkhurst (1986) suggested that *Allonais inaequalis* may also be represented in southeastern North America. However, *A. paraguayensis* and *A. inaequalis* are so similar, including their sexual organs, as to be indiscernible, I include only a description of the former. As Brinkhurst (1986) indicates, a satisfactory revision of this genus is required.

Key to Species of *Allonais* in Florida

1. A) Needle teeth equally long, or upper tooth longer than lower, with 1-5 intermediate teeth. *A. pectinata* pg. 88
- B) Needle teeth unequal, upper tooth shorter than lower. *A. paraguayensis* pg. 87



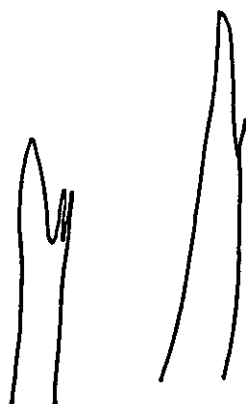
Allonais paraguayensis (Michaelsen, 1905)

Nais paraguayensis Michaelsen, 1905:354-355.

Diagnosis. Length: 4-60 mm; segments: 15-200. Dorsal setae begin in VI (sometimes missing), bundles composed of 1-2 hairs and 1-2 simple-pointed, bifid or pectinate needles, if bifid or pectinate, lower tooth up to 2 times longer than upper. Ventral setae all bifid, 2-8 per bundle anteriorly with upper tooth slightly longer than lower; posteriorly, teeth equally long. Penial setae present, 3-11 per bundle.

Distribution and Habitat. Asia, Africa, South America and North America (Louisiana, Florida). Inhabiting the littoral margin of lakes, associated with aquatic vegetation.

Remarks. The morphology of the dorsal needles is extremely variable. However, the long lower tooth usually accompanied by 2-4 much shorter teeth is unique. Occasionally the upper tooth is much reduced, rudimentary, or absent. This species is indistinguishable from *A. inaequalis* based on available descriptions and the extreme intraspecific variability.



Allonais paraguayensis: (after Brinkhurst and Jamieson, 1971) dorsal needle setae.

Allonais pectinata (Stephenson, 1910)

Nais pectinata Stephenson, 1910:236-237, Plate XI, fig. 1.

Diagnosis. Length: 1-5-8 mm; segments: 15-65. Dorsal setae begin in VI, bundles composed of 1-2 hairs and 1-2 pectinate needles with 1-6 intermediate teeth. Ventral setae all bifid, those of II-V more slender than the rest with upper tooth slightly longer than lower, 3-5 per bundle; from VI teeth are of equal length, 2-7 per bundle. Penial setae present.

Distribution and Habitat. India, China, Ethiopia, Australia, Central, South and North America (Ontario, Illinois, Ohio, New York, Pennsylvania, Georgia, and Florida). Generally inhabiting large rivers.

Remarks. The lack of eyes, pectinate needles with 1-6 intermediate teeth and anterior ventral setae only slightly differentiated from those of the posterior distinguish this species. *Allonais pectinata* is relatively similar to *Nais magnaseta* Harman, 1973, which also has pectinate needles with more than 1 or 2 intermediate teeth and lacks eyes; however, the ventral setae of II-V are significantly differentiated from the rest in the latter.



Allonais pectinata: (after Brinkhurst and Jamieson, 1971) dorsal needle seta.

Genus. *Slavina* Vejdovsky, 1884

Type Species. *Slavina appendiculata* (d'Udekem, 1855).

Diagnosis. Eyes present or absent, proboscis and caudal appendages absent. Body wall ornamented with rows of sensory papillae and generally surrounded by a crust of adhering foreign matter. Dorsal setae begin in IV or VI, bundles composed of smooth hairs and slightly curved fine pointed needles. Ventral setae all similar. Penial setae present.

Remarks. Four species are currently assigned to *Slavina*. Only *Slavina appendiculata* has been reported from North America. The most obvious characters differentiating *Slavina* from other nauidids are the body wall papillae and the uniform ventral setae. *Stephensoniana* also has the body wall encrusted with foreign matter, but it lacks sensory papillae and the dorsal setae begin on II. *Ophidonais* has sensory papillae and may have a thick crust of particles but lacks hair setae.

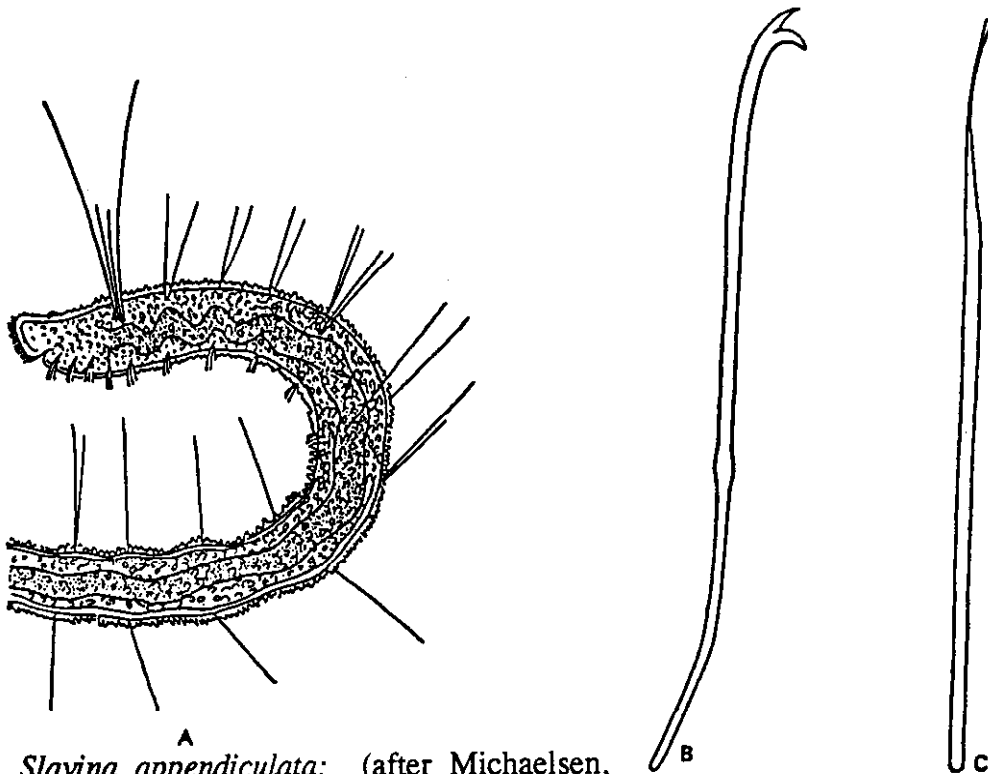
Slavina appendiculata (d'Udekem, 1855)

Nais appendiculata d'Udekem, 1855:552, Plate I, fig. 3.

Diagnosis. Length: 2-20 mm; segments: 23-46. Eyes present. Body encrusted by thick coat of foreign matter, sensory papillae present. Dorsal setae begin in VI, bundles composed of 1-2 stout hairs and 1-2 straight fine needles slightly distended distally, hairs of VI elongate with up to 3 per bundle. Ventral setae 2-5 per bundle; those of II-V thinner than the rest, slightly longer in II, all with an angular proximal bend and upper tooth somewhat thinner and longer than the lower. Penial setae present, 3 per bundle.

Distribution and Habitat. Widespread throughout Europe, South and East Asia, North and South America, Africa, and New Zealand. Occurs in a wide variety of habitats including peat bogs and the littoral margin of lakes, ponds, and rivers, associated with aquatic vegetation and silty substratum.

Remarks. This species is readily identified by the presence of eyes, elongate hairs in VI and the presence of sensory papillae. Some of the specimens collected from Florida lack (lost or broken ?) elongate hairs of VI but were otherwise identical.



Slavina appendiculata: (after Michaelsen, 1909) A, anterior part of worm; B, ventral posterior seta; C, dorsal needle seta.

Genus. *Vejdovskyella* Michaelsen, 1903

Type Species. *Vejdovskyella comata* (Vejdovsky, 1884)

Diagnosis. Eyes present or absent, proboscis and caudal appendages absent. Dorsal setae begin in V or VI, bundles composed of serrated hairs and fine, straight, simple-pointed needles. Ventral setae all of similar shape. Penial setae present.

Remarks. Much confusion exists concerning this genus. Brinkhurst and Wetzel (1984) suggested that a careful generic revision is required. Brinkhurst (1971) synonymized *V. intermedia* (Vejdovsky, 1884) with *V. comata* and established a new species, *V. hellei* Brinkhurst and Jamieson, 1971. Brinkhurst and Kathman (1983) reestablished *V. intermedia* as a valid species and transferred *V. hellei* into the genus *Specaria*. Apparently, at the present, only *V. intermedia* and *V. comata* comprise the genus *Vejdovskyella* with *V. c. macrochaeta* Lastockin, 1937, and *V. c. grandisetosa* Finegenova, 1962, representing forms of *V. comata* (Brinkhurst and Kathman, 1983).

The coarsely serrate hairs beginning in V or VI, simple-pointed needles, and similar ventral setae separate this genus from all others.

Although *Vejdovskyella comata* has not been reported from Florida, it has been documented as far south as South Carolina and may occur at least in the Florida Panhandle. However, its conspecific, *V. intermedia*, is a more northern species occurring from Illinois northward into Canada and is unlikely to be present in Florida.

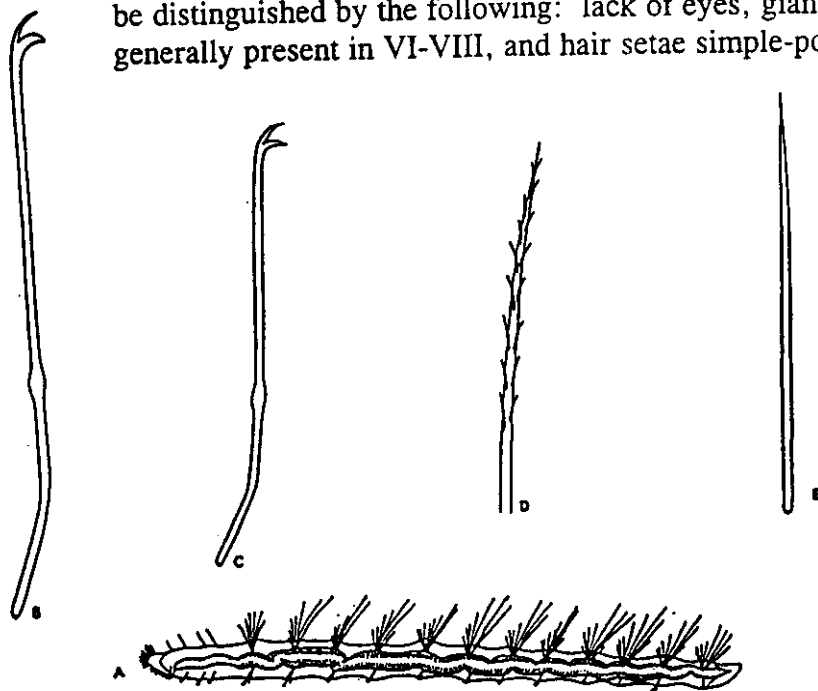
Vejdovskyella comata Vejdovsky, 1884

Bohemilla comata Vejdovsky, 1884:218.

Diagnosis. Length: 2-8 mm; segments: 24-34. Eyes present. Body with scattered papillae. Dorsal setae begin in VI (opposite the fourth ventral bundles in VI), bundles composed of 4-8 stout hairs with very large thick lateral serrations in 2 rows and bifid tips, and 1-8 fine sharp-pointed needles. Ventral setae all bifid with a proximal bend, upper tooth longer and thinner than the lower; those of II long, decreasing in length to IV (may be absent in IV) and absent in V, 3-6 per bundle anteriorly; 2-3 setae per bundle posterior to VI; in IV-IX giant setae with a single thin upper tooth may rarely be present; Penial setae present, 1 per bundle.

Distribution and Habitat. Europe, Asia, Africa, North America (Wisconsin, Maryland, Maine, South Carolina, Washington, Nova Scotia). Occurs in marshy lakes and large rivers. Not yet reported from Florida.

Remarks. The presence of eyes, coarsely serrated hairs, simple-pointed needles beginning on VI, and ventrals of V absent, distinguish this species from all others. *Vejdovskyella intermedia* is similar but may be distinguished by the following: lack of eyes, giant ventral setae generally present in VI-VIII, and hair setae simple-pointed.



Vejdoskyella comata: (after Vejdovsky, 1884) A, adult worm; (after Sperber, 1948) B, ventral seta of II; C, posterior ventral seta; D, dorsal hair seta; E, dorsal needle seta.

Genus. *Nais* Müller, 1773

Type Species. *Nais barbata* Müller, 1773:23-24.

Diagnosis. Eyes normally present, proboscis and caudal appendages absent. Dorsal setae begin in VI, bundles composed of hairs and bifid, pectinate or simple-pointed needles. Ventral setae all bifid, those of II-V mostly well differentiated from the rest. Penial setae present.

Remarks. This genus is composed of a relatively homogeneous assemblage of species which are characterized by the following: dorsal setae begin in VI which include smooth hairs (except for a rare form of *N. elinguis*), none especially elongate, and simple-pointed, bifid or pectinate needles which are distinctly different from the ventrals; eyes normally present; gills and a proboscis lacking; body wall naked; and ventral setae on II-V usually differentiated from median and posterior setae.

Although this genus is relatively cosmopolitan, it is much more abundant in temperate zones than in tropical or subtropical regions.

Seven species are likely to be encountered in the waters of Florida. Four species are often sympatric and may be combined and referred to as the *Nais communis* complex. These species include *N. elinguis*, *N. communis*, *N. variabilis* and *N. pardalis*.

Key to Species of *Nais* in Florida

1. A) Needles pectinate with long lateral teeth and
 1-3 intermediate teeth. *N. magnaseta* pg. 103
- B) Needles bifid or simple-pointed. 2.
- 2.(1B) A) Needles bifid. 3.
- B) Needles simple-pointed. 7.
- 3.(2A) A) Ventral setae from VI enlarged with upper
 tooth of most setae longer than lower. 4.
- B) No enlarged ventral setae, upper tooth may
 be longer or equal to lower on posterior
 ventrals. 5.
- 4.(3A) A) Some anterior ventral segments with a
 single giant seta with much reduced or
 vestigial lower tooth. *N. bretscheri* pg. 98
- B) Some anterior ventral segments with
 enlarged setae with a long upper tooth,
 giant setae absent. *N. pardalis* pg. 104
- 5.(3B) A) Needle teeth long, parallel; all ventral setae
 with upper tooth about 2 times longer than
 lower. *N. elinguis* pg. 101
- B) Needle teeth short; posterior ventral setae
 with upper tooth as long as lower. 6.
- 6.(5B) A) Ventral setae of II-V with upper tooth
 longer than lower, posterior ventrals with
 teeth equal, needle teeth very short, may be
 inconspicuous except at 1,000x. *N. variabilis* pg. 107
- B) Ventral setae of II-V similar to posterior
 ventrals with teeth approximately equal in
 length, needle teeth widely divergent,
 discernible at 400x. *N. communis* pg. 99



- 7.(2B) A) Ventral setae of II-V with long thin teeth, upper tooth very long, lower tooth reduced or vestigial, appressed to shaft; from VI ventrals stouter with upper tooth about 2 times longer than lower.

N. behningi pg. 97



- B) Ventral setae of II-V of "normal" appearance, lower tooth not greatly reduced or vestigial; from VI ventrals with upper tooth as thick as and 2 times longer than lower.

8.

- 8.(7B) A) Needles hair-like with long sharp tips. 9.

- B) Needle setae with short, fairly obtuse tips; posterior ventral setae with teeth equally long.

N. simplex pg. 106



- 9.(8A) A) Ventral setae from VI shorter, thicker and more curved than those of II-V with upper tooth equal to lower, hairs and needles each up to 5 per bundle.

N. barbata pg. 96



- B) Ventral setae from VI thin, not greatly curved with upper tooth longer than lower, hairs and needles each up to 1-3 per bundle.

N. pseudobtusa pg. 105



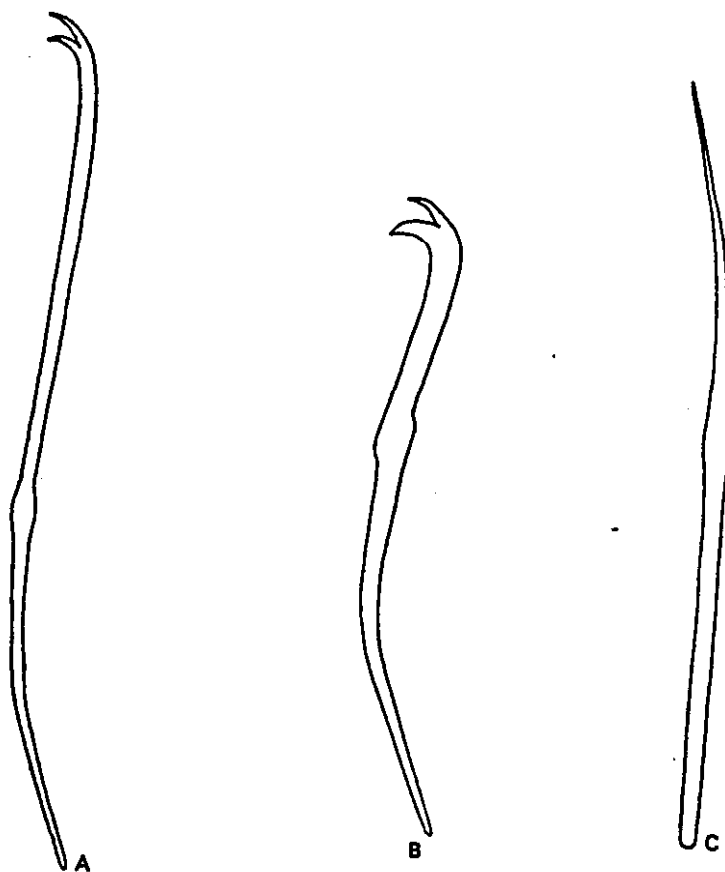
Nais barbata Müller, 1773

Nais barbata Müller, 1773:80-83, Plate III, fig. 1-3.

Diagnosis. Length: 3.5-6 mm; segments: 25-33. Eyes present. Dorsal setae begin in VI, bundles composed of 2-5 needles, simple-pointed with a long, sharp tip and nodulus median or slightly distal, and 1-5 hairs. Ventrals of II-V much longer, straighter, and thinner than the rest, with upper tooth longer and slightly thinner than lower, from VI, teeth approximately equal in length, lower tooth much thicker, 2-5 per bundle. Penial setae present, 2-3 per bundle.

Distribution and Habitat. Europe, Asia, North America (Wisconsin, Illinois, Maine, Louisiana). Occurs on silty substrates, associated with macrophytes.

Remarks. This species has the largest number of hairs and needles (up to 5) of any species of *Nais*. The hair-like needles and ventrals with the upper tooth longer than lower anteriorly and of equal length posteriorly also differentiate this species.



Nais barbata: (after Sperber, 1950) A, ventral seta of II; B, posterior ventral seta; C, dorsal needle seta.

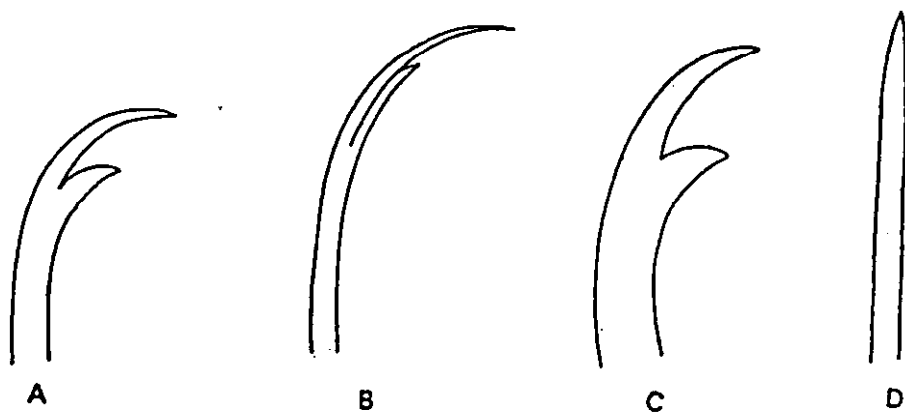
Nais behningi Michaelsen, 1923

Nais behningi Michaelsen, 1923:34-37.

Diagnosis. Length: 4 mm; segments: 36. Eyes present. Dorsal setae begin in VI, bundles composed of 1-2 hairs and 1-2 simple-pointed needles. Ventral setae all bifid, those of II-V longer, straighter and thinner than the rest with upper tooth very long and strongly curved, lower tooth reduced or vestigial and may be closely appressed to upper, 2-6 setae per bundle; from VI setae become much thicker with upper tooth 2 times longer and thinner than lower, 2-5 per bundle. Penial setae present, 2-4 per bundle.

Distribution and Habitat. Europe, Costa Rica, North America. Generally inhabits rivers or streams with swift currents and is associated with coarse substrates.

Remarks. The morphology of the ventral setae of II-V is unique for this species.



Nais behningi: (after Hrabe, 1941) A, ventral seta of II; B, ventral seta of IV; C, ventral seta of XIV; D, dorsal needle seta.

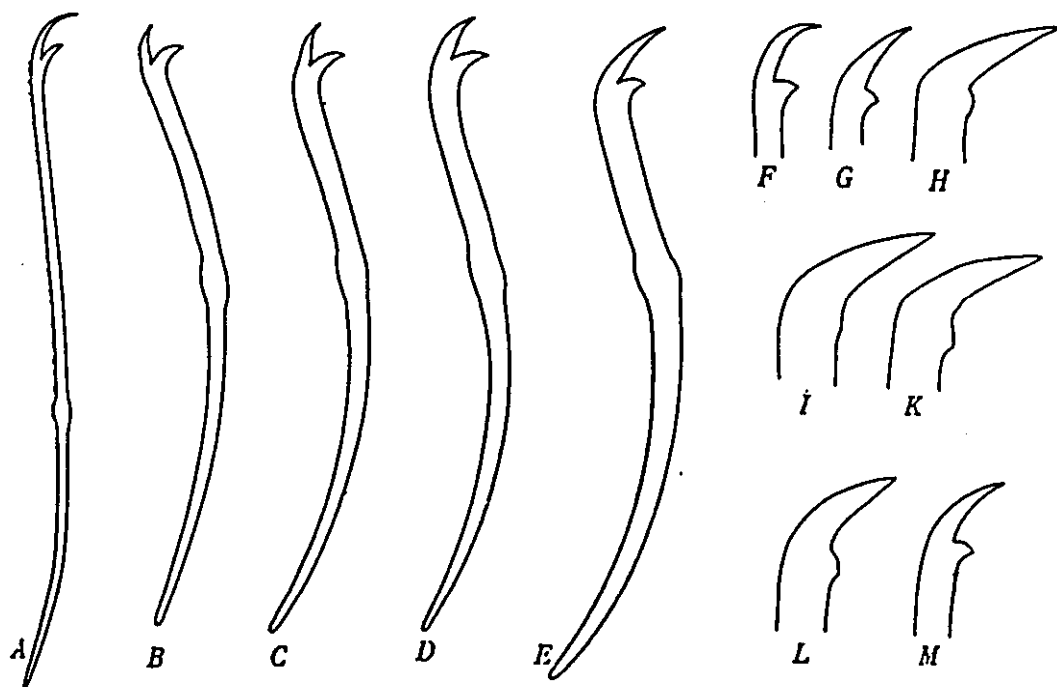
Nais bretscheri Michaelsen, 1899

Nais bretscheri Michaelsen, 1899:121-122.

Diagnosis. Length: 3-7 mm; segments: 19-34. Eyes usually present. Dorsal setae begin in VI, bundles composed of 1-2 hairs and 1-2 bifid needles with short parallel teeth of equal length. Ventral setae all bifid, those of II-V thin and straight with upper tooth thinner and 2 times longer than lower, 2-7 per bundle; from VI three types are distinguishable: 1) normal setae with upper tooth thinner and 1-3 times longer than lower; 2) thick setae, longer and thicker than the former, with upper tooth thicker and 2-3 times longer than the lower, and 3) giant setae, very long and thick with upper tooth sharply bent at the base and reduced lower tooth. Giant setae always single, thick, 1-2 per bundle, often together with 1-2 normal setae. Penial setae present, 2 per bundle.

Distribution and Habitat. Europe, Turkestan, North and South America. An unconfirmed record has been reported from Florida. Associated with aquatic vegetation on a variety of substrata.

Remarks. The giant ventral setae from VI characterizes this species.



Nais bretscheri: (after Sperber, 1948) Ventral setae, A from II, B-D, normal seta from XV; E, thick seta from VIII of a specimen without giant setae; F, distal end of thick seta from VI; G, from VII; H-L giant setae from VIII-XI of the same; M, from XIII of a specimen with giant setae.

***Nais communis* Piguet, 1906**

Nais communis Piguet, 1906:247-253; Plate X, fig. 9, Plate XI, fig. 14-17, 19, Plate XII, fig. 11.

Diagnosis. Length: 1.8-12 mm; segments: 12-32. Eyes normally present. Dorsal setae begin in VI, bundles composed of 1-2 hairs and 1-2 bifid needles with short, equal divergent teeth. Ventral setae 2-6 per bundle all bifid, those of II-V slightly straighter and thinner than the rest with upper tooth thinner and longer than lower; from VI length of upper tooth decreasing in length posteriorly until teeth become equal in length. Penial setae present, 2-3 per bundle.

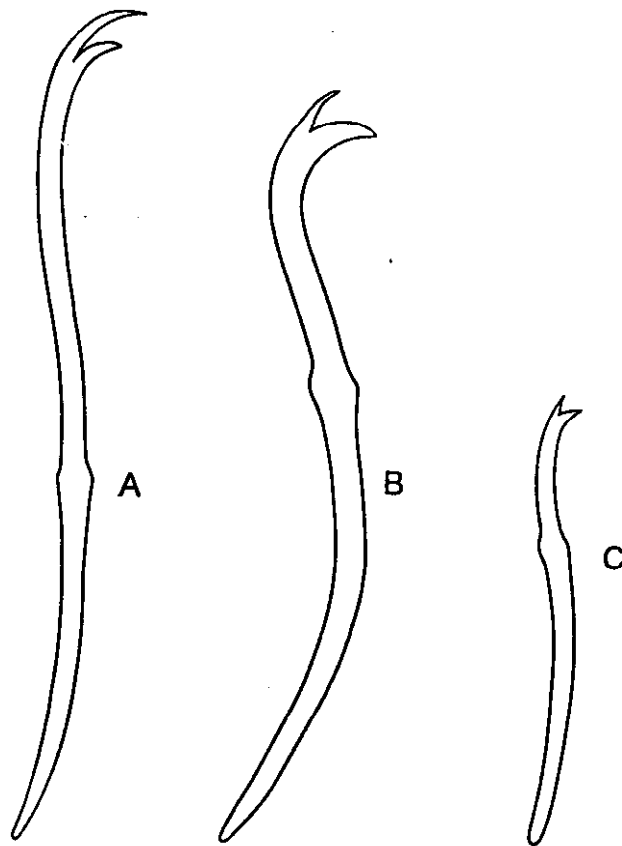
Distribution and Habitat. Cosmopolitan. Occupies a wide variety of habitats including rivers, lakes, ponds, and springs; usually associated with aquatic vegetation. It is highly tolerant of pollution and has been collected from brackish waters.

Remarks. Characters of *N. communis* are highly variable which has led to a great deal of confusion. Generally, this species is distinguished by the short diverging needle teeth and essentially similar anterior and posterior ventrals with the upper tooth gradually decreasing in length posteriorly. Although Brinkhurst and Kathman (1983) include the presence of eyes as a distinguishing character between *N. communis* and *N. elinguis*, many authors have recorded populations of individuals with and without eyes (Sperber, 1948).

The distinctions among *N. communis*, *N. elinguis*, and *N. variabilis* have been unclear throughout the literature. In fact, many of the specimens described as *N. elinguis* were in fact *N. communis*, *N. variabilis*, or other species. Sperber (1948) stated that the original description of *N. elinguis* by Müller (1773) was based on specimens of *N. communis*. Chen (1940) found that the characters separating *N. communis* and *N. variabilis* were variable or inconstant in the Chinese populations, and that his material was "somewhat intermediate between the two" (Sperber, 1948).

Although many specimens clearly fit the accepted diagnosis of *N. communis*, *N. variabilis*, *N. elinguis*, and *N. pardalis*, many intermediate forms also exist; therefore, to alleviate further confusion, it seems more appropriate not to differentiate this species or at least the intermediate forms, as a separate taxon, but to refer to it simply as a member of the "*N. communis* complex", pending future

taxonomic studies of the North American material. See Remarks for *N. elinguis*.



Nais communis: (after Harman, 1979) A, anterior ventral seta; B, posterior ventral seta; C, dorsal needle seta.

***Nais elinguis* Müller, 1773**

Nais elinguis Müller, 1773:22.

Diagnosis. Length: 2.2-12 mm; segments: 15-37. Eyes usually present. Dorsal setae begin in VI, bundles composed of 1-3 hairs and 1-3 bifid needles with long parallel teeth, lower tooth subequal to upper. Ventral setae 2-5 per bundle, those of II-VI thinner and slightly straighter than the rest with upper tooth thinner than and about 2 times as long as the lower; from VI upper tooth remains thinner and about twice as long as lower. Penial setae present, 4-5 per bundle.

Distribution and Habitat. Cosmopolitan. Apparently can exist under a wide variety of environmental conditions from cold, fast running water, to muddy, evil-smelling oxygen-poor situations. It also frequently inhabits brackish waters with salinities as high as 23‰.

Remarks. As discussed previously (see *N. communis*), *N. elinguis* has frequently been confused with other species of *Nais*. There is a general consensus, however, that although many intermediate forms occur, the consistent distinguishing characters for *N. elinguis* are: all ventral setae with upper tooth longer and thinner than lower; and dorsal needles with relatively long parallel teeth. The presence of eyes, however, is variable and Brinkhurst and Kathman (1983) have reported some specimens having serrate hair setae.

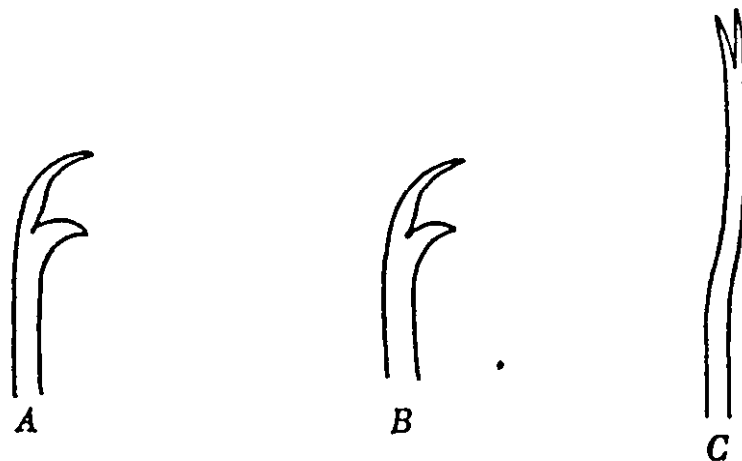
This species is a member of the *Nais communis* complex which also includes *N. communis*, *N. variabilis* and *N. pardalis*. Although many specimens conform to the traditional diagnosis of *N. elinguis*, many intermediate forms exist and should be referred to as "*Nais communis* complex". The primary differences separating species comprising this complex are as follows:

N. communis: anterior ventral setae similar with long upper tooth gradually decreasing in length posteriorly, needles with short diverging teeth.

N. elinguis: all ventral setae with upper tooth twice as long as lower, needles with long parallel teeth.

N. variabilis: anterior ventral setae with upper tooth twice as long as lower, posterior ventrals with teeth of equal length. Needles with relatively inconspicuous teeth, which may only be discriminated at 1,000x magnification.

N. pardalis: anterior ventral setae with upper tooth twice as long as lower, posterior ventral setae with teeth variable in length, and include setae with upper tooth 2-3 times longer than lower. Needles with fine equal teeth.



Nais elinguis: (after Sperber, 1948) A, ventral seta from II; B, ventral seta from middle region of body; C, dorsal needle seta.

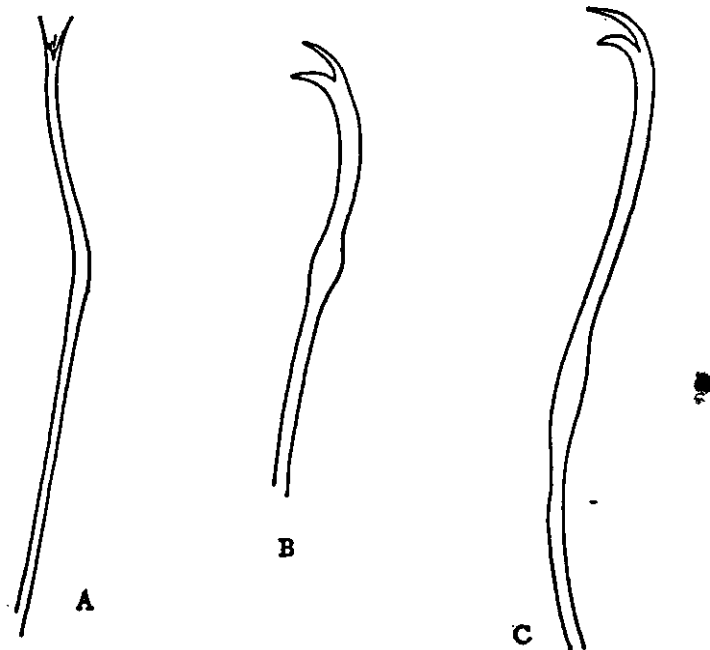
Nais magnaseta Harman, 1973

Nais magnaseta Harman, 1973b:154-157, Fig. 1.

Diagnosis. Length: 2 mm; segments: 31. Eyes absent. Dorsal setae from VI, bundles composed of 1-2 hairs and 1-2 pectinate needles with long diverging lateral teeth and 1-3 intermediate teeth. Ventral setae 2-5 per bundle all bifid, those of II-V with upper tooth thinner and longer than lower; from VI upper tooth thinner and subequal to lower.

Distribution and Habitat. The description of this species is based on one specimen from a stream in Texas.

Remarks. Although the species was described from a single specimen, the large pectinate needles were considered distinctive enough to distinguish it from other species of *Nais*. It may occur in Florida.



Nais magnaseta: (after Harman, 1973b) A, dorsal needle seta; B, posterior ventral seta; C, ventral seta of II.

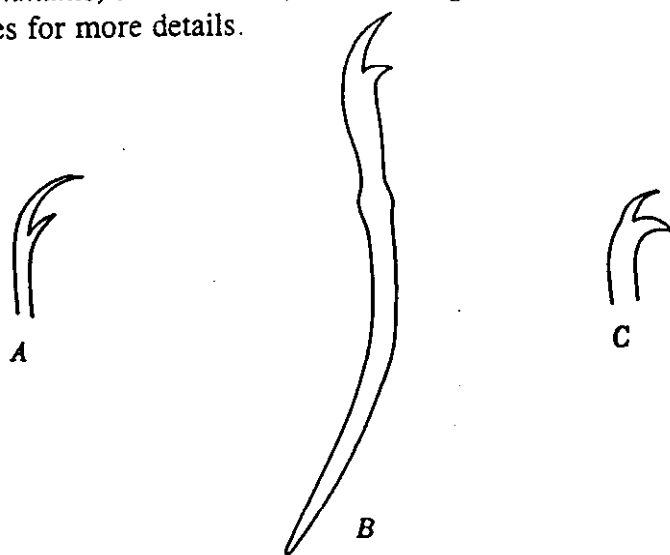
Nais pardalis Piguet, 1906

Nais bretscheri Michaelsen var. *pardalis* Piguet, 1906:270-274, Plate X, fig. 20, Plate XII, fig. 4, 5, 17.

Diagnosis. Length: 2.5-7 mm; segments: 19-32. Eyes present. Dorsal setae from VI, bundles composed of 1-2 hairs and 1-2 bifid needles with short, equal teeth. Ventral setae all bifid, 2-5 per bundle, those of II-V with upper tooth 1.5-2 times longer than lower; from VI ventral setae may be of 2 sorts: 1) normal setae of variable thickness, with upper tooth equally long, slightly shorter than or longer than lower; 2) thick setae with upper tooth 2-3 times longer than lower, 1-5 per bundle. Penial setae present, 3 per bundle.

Distribution and Habitat. Europe, Asia, North and South America. Occurs in the littoral regions of ponds, lakes, and rivers associated with aquatic vegetation on a silty-sandy substratum.

Remarks. This species is another member of the *N. communis* complex. Originally described as a variant of *N. bretscheri* because of the occasional presence of enlarged ventral setae, Brinkhurst and Jamieson (1971) suggest that the original decision was correct. *Nais pardalis* has also been considered to be a variant of *N. variabilis* by a number of authors. Based on the plasticity of the morphology of the posterior ventral setae, even within the same individual, unless one has specimens with the characteristic enlarged setae and lacking the giant setae indicative of *N. bretscheri*, the best alternative is to classify this taxon as *Nais communis* complex, which also includes *N. communis*, *N. variabilis*, and *N. elinguis*. See remarks for those species for more details.



Nais pardalis: (after Sperber, 1948) A, ventral setae of II; B, ventral seta from VI; C, ventral seta from XVIII.

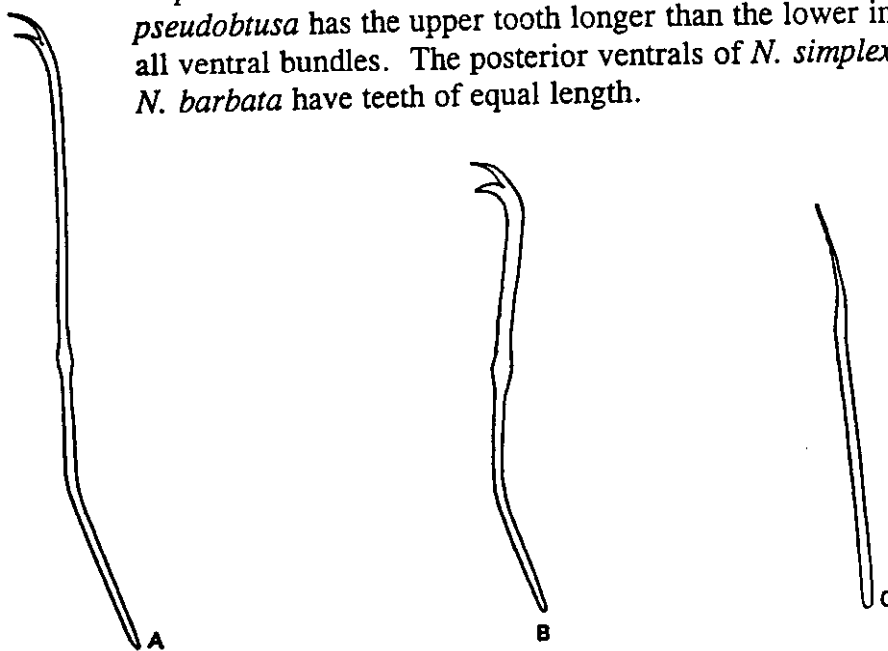
Nais pseudobtusa Piguet, 1906

Nais obtusa var. *pseudobtusa* Piguet, 1906:238-241, Plate X, fig. 5-7, Plate XI, fig. 4, 6, 7, Plate XII, fig. 9.

Diagnosis. Length: 1.7-6 mm; segments: 17-28. Eyes present. Dorsal setae begin in VI, bundles composed of 1-3 hairs and 1-3 simple-pointed needles with long, pointed tips and nodulus 1/3 from the tip. Ventrals of II-V longer, straighter, and thinner than the rest with upper tooth 1-1.5 times longer than lower, 2-5 per bundle; from VI upper tooth remains longer than lower, but is thinner, 2-6 per bundle. Penial setae present, 2 per bundle.

Distribution and Habitat. Europe, Africa, Afghanistan, North America (Virginia, Louisiana, Michigan, British Columbia, Northwest Canada). An unconfirmed specimen has been found in Florida. Occurs in rivers and lakes in the littoral region associated with aquatic vegetation.

Remarks. This species is very similar to *N. barbata* and *N. simplex*, both also have hairs and simple-pointed needles in the dorsal bundles. *Nais simplex* differs by having blunt needles, whereas in *N. barbata* and *N. pseudobtusa* the tips of the needles are long and fine. *Nais barbata* has up to 5 needles and 5 hairs dorsally whereas *N. pseudobtusa* and *N. simplex* have only up to 3 each. *Nais pseudobtusa* has the upper tooth longer than the lower in the setae of all ventral bundles. The posterior ventrals of *N. simplex* and *N. barbata* have teeth of equal length.



Nais pseudobtusa: (after Sperber, 1948) A, ventral seta from II; B, posterior ventral seta; C, dorsal needle seta.

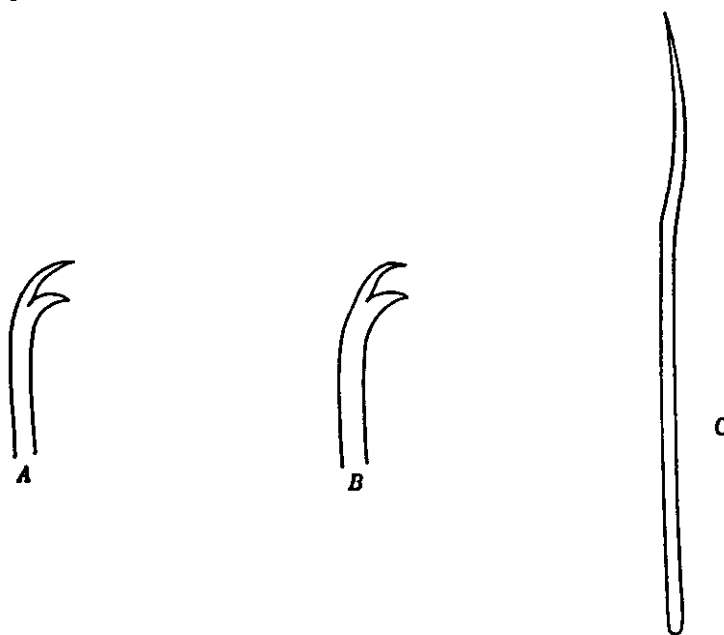
Nais simplex Piguet, 1906

Nais variabilis var. *simplex* Piguet, 1906:260-266, Plate XI, fig. 22, 24, Plate XII, fig. 1-3, 14.

Diagnosis. Length: 4-8 mm; segments: 18-37. Eyes present. Dorsal setae begin in VI, bundles composed of 1-2 hairs and 1-2 simple-pointed needles. Ventrals of II-V longer and straighter than the rest with upper tooth thinner and nearly 2 times longer than lower, 2-6 per bundle; from VI teeth are equal in length with the upper tooth somewhat thinner than lower. Penial setae present, 2 per bundle.

Distribution and Habitat. Europe, Tibet (?), South and North America (generally east of the Mississippi). Usually along the littoral margins of still waters associated with aquatic vegetation, but also occurs in rivers.

Remarks. This species is distinguished by the anterior ventral setae having a longer upper tooth than lower, posterior ventral setae having equally long teeth, and dorsal bundles with hairs and simple-pointed needles with obtuse tips. Originally this species was described as a variant of *N. variabilis* which it closely resembles, except that the latter has bifid needle setae which may appear simple-pointed.



Nais simplex: (after Sperber, 1948) A, ventral seta from II; B, ventral seta from middle region of body; C, dorsal needle seta.

Nais variabilis Piguët, 1906

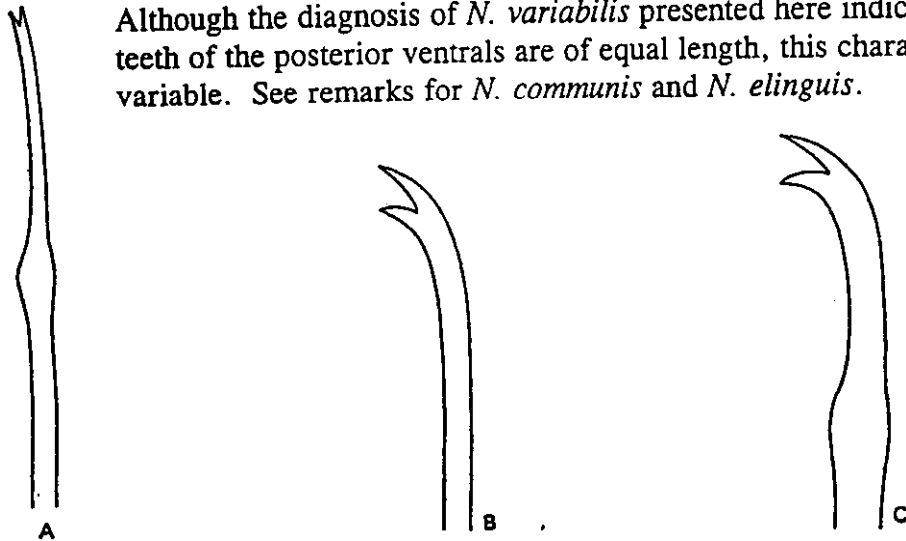
Nais variabilis Piguët, 1906:253-260, Plate X, fig. 10-18, Plate XI, fig. 18, 20, 21, 23, Plate XII, fig. 12-13.

Diagnosis. Length: 3-10 mm; segments: 18-38. Eyes usually present. Dorsal setae begin in VI, bundles composed of 1 hair and 1 bifid needle with short equal teeth which may be inconspicuous. Ventral setae 2-7 per bundle, those of II-V straighter and thinner than the rest with upper tooth longer than lower, from VI teeth of equal length. Penial setae present, 2-4 per bundle.

Distribution and Habitat. Cosmopolitan. Associated with aquatic vegetation in fresh and brackish water.

Remarks. *Nais variabilis* exhibits considerable morphological variation regarding the size and shape of setae. The question concerning the validity of this taxon is still unresolved. Sperber (1948) states that the size and shape of the setae are extremely variable, but can be easily recognized by the sudden stomachal dilation, longer and stronger hair setae and its readiness to swim. Brinkhurst and Jamieson (1971) consider these characters "dubious to say the least". Chen (1940) also considers these characters inconstant.

Although the diagnosis of *N. variabilis* presented here indicates the teeth of the posterior ventrals are of equal length, this character is variable. See remarks for *N. communis* and *N. elinguis*.



Nais variabilis: (after Piguët, 1906) A, dorsal needle seta; B, ventral seta from II; C, ventral seta from VI.

Genus. *Stephensoniana* Černosvitov, 1938

Type Species. *Naidiam* (?) *trivandrana* Aiyer, 1926.

Diagnosis. Eyes, proboscis and caudal appendages absent. Dorsal setae begin in II, include smooth hairs and simple-pointed or bifid needles. Ventral setae bifid, all similar. Foreign matter encrusting cuticle. Penial setae may be present.

Remarks. This genus is most similar to *Pristinella* due to the lack of proboscis and the dorsal setae originating on II. *Stephensoniana* differs by having foreign matter coating the cuticle. Two species presently comprise this genus. *Stephensoniana trivandrana* has been collected from Florida. Although *S. tandyi* has as yet not been reported in Florida, its presence in Louisiana indicates that it is likely to occur, at least in the Panhandle region.

Key to Species of *Stephensoniana* in Florida

1. A) Dorsal needles bifid. *S. tandyi* pg. 109
- B) Dorsal needles simple-pointed.
 S. trivandrana pg. 110



***Stephensoniana tandyi* Harman, 1975**

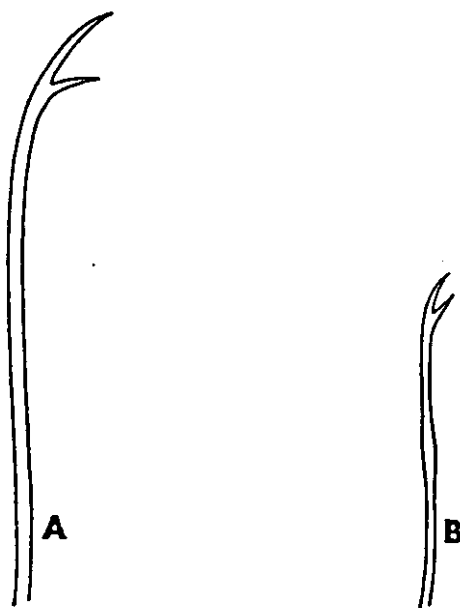
Stephensoniana tandyi Harman, 1975:1-4.

Diagnosis. Length: about 1-2 mm; segments: 1-4. Foreign matter adhering to cuticle. Dorsal setae begin in II, bundles include 1-2 hairs and one bifid needle with upper tooth about 2 times longer than lower and slightly thicker. Ventral setae all bifid, with upper tooth more than 2 times longer than lower, 1(2) per bundle, posterior third of body asetigerous.

Distribution and Habitat. Type location is a swampy region with intermittent streams covering much of the land, also reported from Maryland and Virginia.

Remarks. This species is readily discerned based on the dirty appearance of the cuticle due to adhering foreign matter, the dorsal setae beginning on II, the undifferentiated anterior and posterior ventral setae and the bifid needles, which separates this species from *S. trivandran*.

Although *S. tandyi* has not been reported from Florida, it is likely to occur because of the preponderance of swampland characteristic of the type locality.



Stephensoniana tandyi: (after Harman, 1975) A, ventral seta from VI; B, dorsal needle seta from X.

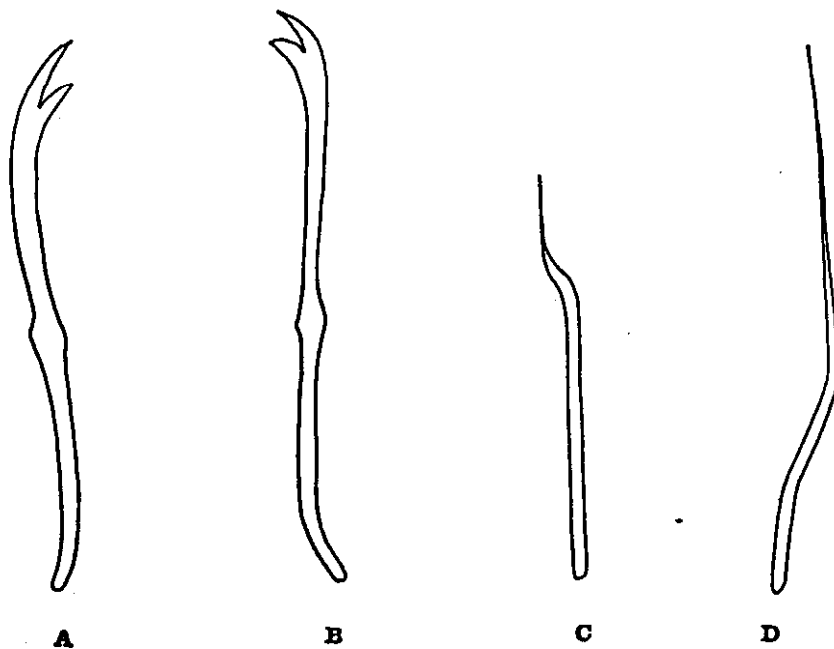
Stephensoniana trivandranana (Aiyer, 1926)

Naidium (?) *trivandranum* Aiyer, 1926:139-141, Plate V, VI.

Diagnosis. Length: 2-6 mm; segments: 21-43. Foreign matter adhering to cuticle. Dorsal setae begin in II, bundles include 3-4 hairs and 3-4 simple-pointed needles which suddenly taper toward the distal end. Ventral setae all bifid with upper tooth longer than lower anteriorly and becoming equal in posterior segments. Penial setae present, 2-5 per bundle.

Distribution and Habitat. India, Palestine, Africa, South America, North America (Mexico, West Virginia, Illinois, Pennsylvania, Maryland, Texas, Florida). Generally inhabiting rivers.

Remarks. *Stephensoniana trivandranana* is characterized by the adhering coat of foreign matter, dorsal setae from II, and the simple-pointed needles, the latter of which distinguishes it from *S. tandyi*.



Stephensoniana trivandranana: (after Brinkhurst and Jamieson, 1971) A, ventral seta of II; B, ventral seta of V; C, dorsal needle seta; D, dorsal hair seta.

Genus. *Bratislavia* Košel, 1976

Type Species. *Pristina elegans* Finogenova, 1966.

Diagnosis. Eyes, proboscis, and caudal appendages absent. Dorsal setae from II or III, bundles include smooth hairs and bifid or simple-pointed needles.

Remarks. This genus was established by Košel (1976) to accommodate those species with dorsal setae which start in III and lack eyes and a proboscis. Two species have been described from North America and occur in Florida. *Naidium bilongata* has dorsals beginning in III and was transferred to *Bratislavia* by Timm and Popchenko (1978). Harman and Loden (1978) redescribed *Pristina unidentata* and transferred it to *Bratislavia*, expanding the generic limits to include species with dorsals from II.

Key to Species of *Bratislavia* in Florida

1. A) Dorsals begin in II. Dorsal bundles with 1 thin hair (frequently missing) and 1 stout simple-pointed needle.
B. unidentata pg. 113
- B) Dorsals begin in III. Dorsal bundles with 1 hair and 2 bifid needles. Hairs of III greatly elongate. *B. bilongata* pg. 112



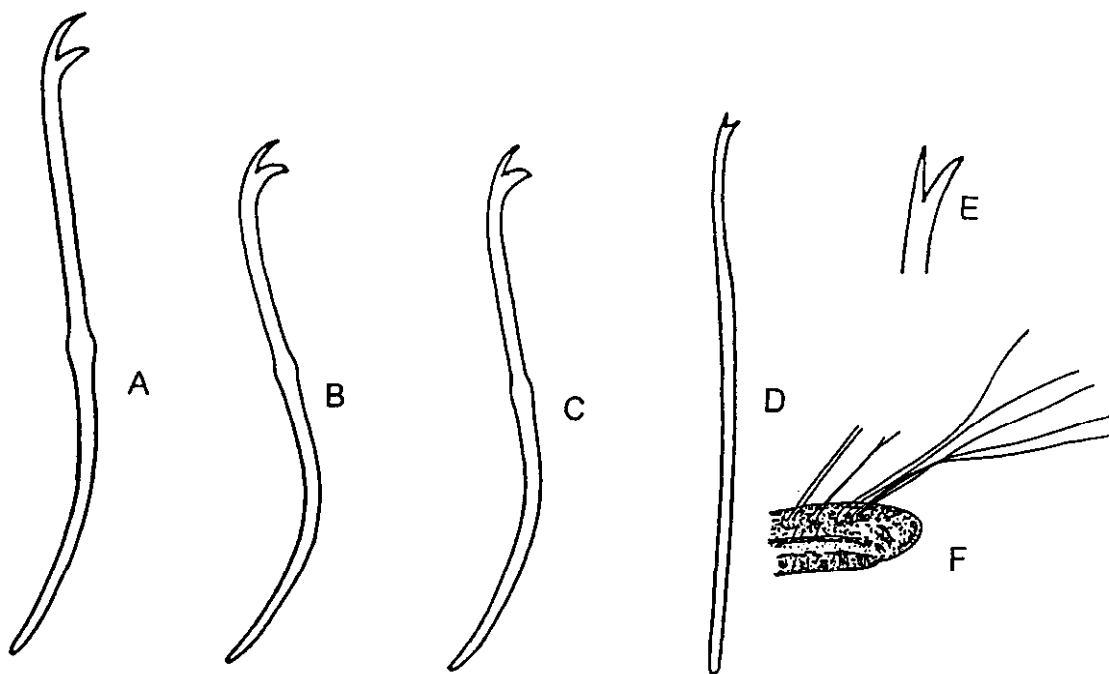
Bratislavia bilongata (Chen, 1944)

Naidium bilongatum Chen, 1944:5, Fig. 3.

Diagnosis. Length: 6-8.5 mm; segments: 40-65. Dorsal setae begin in III, bundles composed of 2 hairs and 2 bifid needles anteriorly and 1 of each posteriorly; hairs greatly elongate in III (or IV) and may be absent in IV, needles with relatively short teeth of equal length, upper tooth thinner and straighter than lower. Ventral setae all bifid with upper tooth longer and thinner than lower anteriorly, 6-10 per bundle, gradually diminishing in length posteriorly until both teeth are equal in length with upper tooth remaining thinner, 4-6 per bundle.

Distribution and Habitat. New Jersey, Florida. Florida record was from a swamp near Yeehaw Junction in Indian River County.

Remarks. The dorsal setae beginning in III with elongate smooth hairs on III and bifid needles differentiate *B. bilongata* from all other naidids. *Pristina leidy* also has elongate hairs on III; however, it has a proboscis, the dorsal setae begin in II, hairs from IV are serrated, the needles are minutely bifid, and the ventrals of II are longer and thicker than the rest.



Bratislavia bilongata: (after Harman and Loden, 1979) A, anterior ventral seta; B, ventral seta from middle of body; C, posterior ventral seta; D, dorsal needle seta; E, enlarged view of distal end of needle seta; (after Brinkhurst and Jamieson, 1971) F, anterior end of worm.

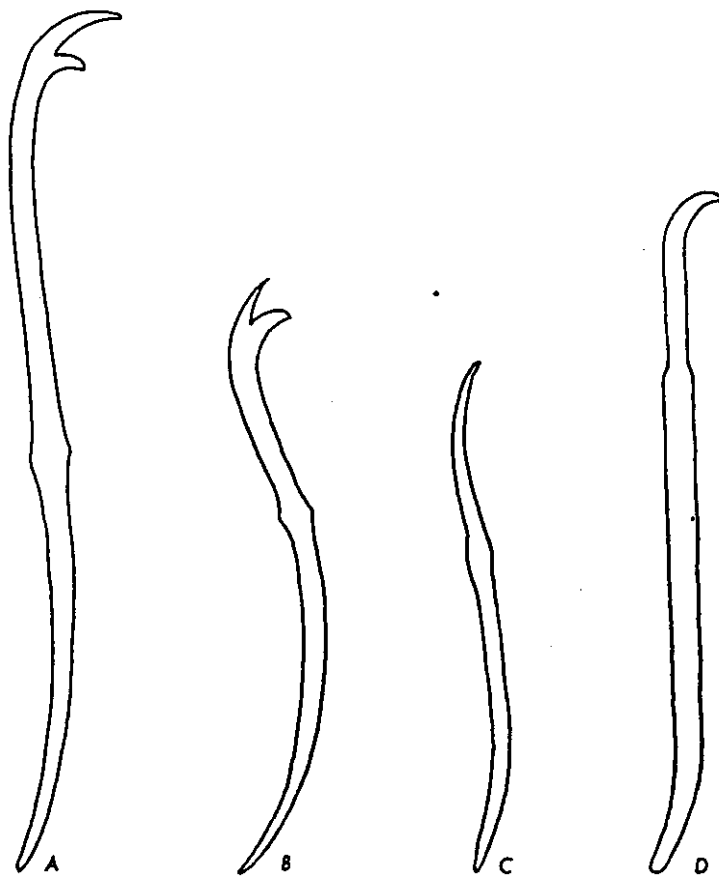
Bratislavia unidentata (Harman, 1973)

Pristina unidentata Harman, 1973b:161-163, Fig. 2.

Diagnosis. Segments: about 66. Dorsal setae begin in II, bundles composed of one thin, delicate hair (frequently missing) and stout simple-pointed needle. Ventral setae all bifid with upper tooth about 2 times longer and thinner than lower anteriorly, 3 per bundle, in mid-body the teeth are of equal length, 3-4 per bundle.

Distribution and Habitat. North America (Oklahoma, Texas, North Carolina, Alabama, Florida, Louisiana), South America. Occurs in creeks and lakes.

Remarks. The stout unidentate needles beginning in II with the delicate hairs, usually absent anteriorly, are the most distinguishing features of *B. unidentata*.



Bratislavia unidentata: (after Harman and Loden, 1978b) A, ventral seta of II; B, posterior ventral seta; C, needle seta; D, penial seta.

Genus. *Pristinella* Brinkhurst, 1985

Type Species. *Naidium bilobatum* Bretscher, 1903.

Diagnosis. Eyes, proboscis and caudal appendages absent. Dorsal setae begin in II, bundles composed of hairs and simple-pointed, bifid or pectinate needles. Penial setae present or absent.

Remarks. Brinkhurst (1985) created this genus to separate those species of *Pristina* with a proboscis from those without. Based on his analysis, using the presence or absence of a proboscis as the sole generic criterion, other seemingly unrelated characters were associated.

Of the 7 species of *Pristinella* thus far reported from North America, only *P. acuminata* Liang, 1958, has not been, or is expected to be, collected from Florida.

Key to Species of *Pristinella* in Florida

1. A) Hair setae of II extremely elongate; hairs smooth; needles simple-pointed.
P. longisoma pg. 117
- B) No elongate hair setae on II; hairs with or without serrations; needles bifid. 2.
- 2.(1B) A) Needle teeth long, parallel or slightly divergent, hairs smooth or serrated. 3.
- B) Needle teeth short, widely divergent, may have intermediate teeth, hairs smooth. 4.
- 3.(2A) A) Hairs serrate; upper tooth of anterior ventral setae longer than lower.
P. longidentata pg. 116
- B) Hairs smooth; anterior ventral setae with teeth of equal length. *P. jenkiniae* pg. 115
- 4.(2B) A) Needles distinctly pectinate with 2-3 intermediate teeth. *P. sima* pg. 120
- B) Needles bifid, may have 1 or 2 intermediate teeth posteriorly.
P. osborni pg. 119
P. minuta pg. 118



Pristinella jenkiniae (Stephenson, 1931)

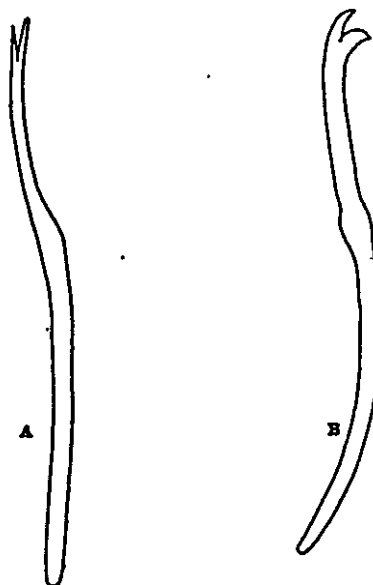
Naidium jenkiniae Stephenson, 1931b:39-41, Fig. 1.

Diagnosis. Length: 1-4 mm; segments: to 28. Dorsal bundles from II, composed of 1-2 smooth hairs and 1-2 bifid needles with upper tooth generally thinner and shorter or subequal to lower tooth. Ventral setae all bifid with teeth of equal length and thickness, 2-9 (usually 4-6) per bundle anteriorly and 2-3 (rarely 4-5) posteriorly. Penial setae present.

Distribution and Habitat. Cosmopolitan. Generally in creeks and rivers.

Remarks. Although a great deal of intraspecific variation exists regarding the morphology of the needles, this species is distinguished by the dorsal needles having relatively long parallel teeth with the upper shorter or subequal to the lower.

Kathman (1985) demonstrated that *Pristinella idrensis* (Sperber, 1948) was synonymous with *P. jenkiniae* based upon the intraspecific geographic variations of the setal morphology. Kathman also suggested a possible relationship with *P. amphibiotica* (Lastockin, 1927), a view shared by Sperber (1948) and Liang (1963), and with *P. longidentata* (Harman, 1965) and *P. rosea* (Piguet, 1906).



Pristinella jenkiniae: (after Brinkhurst and Jamieson, 1971) A, dorsal needle seta; B, ventral seta.

Pristinella longidentata (Harman, 1965)

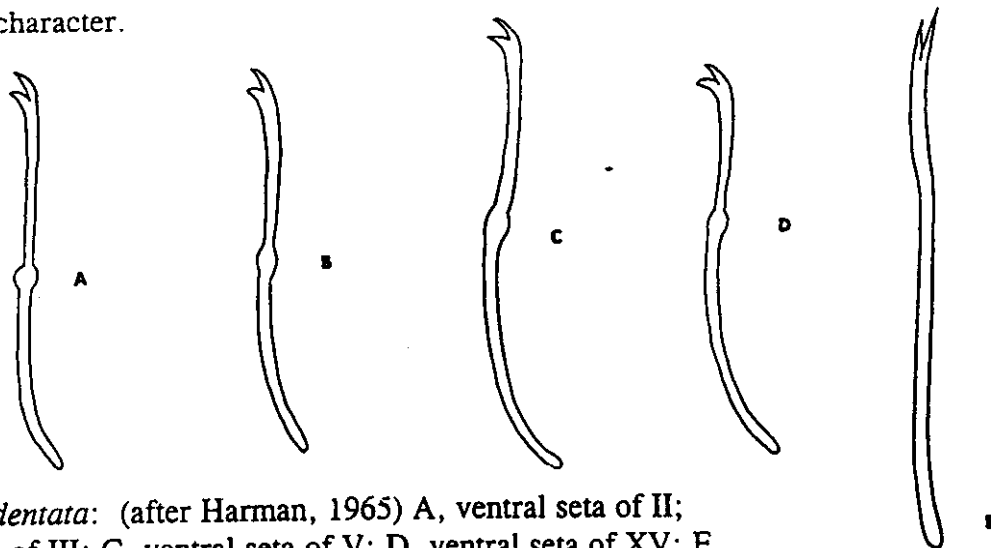
Pristina longidentata Harman, 1965:28-31, Fig. 1, 2.

Diagnosis. Segments: 18-46. Dorsal setae begin in II, bundles composed of 1(2) finely serrate hair, and 1 bifid needle curved distally with long parallel teeth, upper tooth shorter than lower. Ventral setae all bifid upper tooth longer than lower anteriorly, teeth becoming equal posteriorly, up to 5 per bundle.

Distribution and Habitat. South America, North America (Oklahoma, Texas). Previously collected from small lakes and streams.

Remarks. The serrations on the hair setae and longer length of all setae differentiate *P. longidentata* from other closely related species. The specific status of this species is questionable, based solely on the presence of serration and length of setae. This species is a member of a closely related group of *Pristinella* having needles with long teeth, and 1(2) hair comprising the dorsal bundles. This group also includes *P. jenkinsae*, *P. rosea*, and *P. amphibiotica*, all of which have variously been regarded as synonymous by a variety of authors.

Pristinella longidentata was synonymized with *P. idrensis* by Brinkhurst and Jamieson (1971), then resurrected by Harman (1974), a decision upheld by Brinkhurst (1986). It differs from *P. jenkinsae* by having a longer upper tooth of the anterior ventrals and finely serrate hairs. The serrations are only discernible at 1,000x according to Harman (1965). Therefore, the longer upper tooth of the anterior ventral setae is the most readily distinguishing character.



Pristina longidentata: (after Harman, 1965) A, ventral seta of II; B, ventral seta of III; C, ventral seta of V; D, ventral seta of XV; E, dorsal needle seta.

Pristinella longisoma (Harman, 1977)

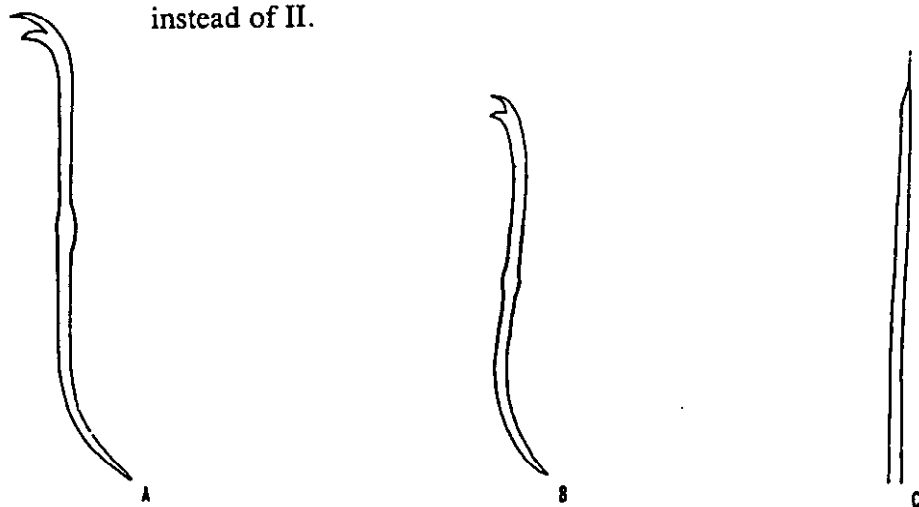
Pristinella longisoma Harman, 1977:485-488, Fig. 2.

Diagnosis. Length: relatively long, uninterrupted by fission zones (hence the specific epithet); segments: to 112. Dorsal setae begin in II, bundles composed of 3-4 smooth hairs and 2-4 simple-pointed needles which taper abruptly distally; hairs of II greatly elongate. Ventral setae all bifid, those of II-V upper tooth longer and thinner than lower, 3 per bundle; from VI setae are shorter with upper tooth thinner and slightly longer than lower, 2-8 per bundle.

Distribution and Habitat. Arkansas, Louisiana, Florida. Arkansas and Louisiana specimens were collected from roadside ditches with flowing water after rains. Florida material was found in streams, intermittently flowing roadside ditches and ponds throughout the state.

Remarks. This species is recognized by the dorsal bundles beginning on II composed of sharply tapering simple-pointed needles and long smooth hairs. The extremely elongate hairs of II are the primary diagnostic character.

This species belongs to a group of species having elongate hairs on II or III. *Pristina leidy* has a proboscis, elongate hairs on III with hairs from IV serrate and minutely bifid needles. *Bratislavia bilongata* also has elongate hairs in III, but the dorsal setae are absent in II, all hairs are smooth and the needles are bifid with relatively large teeth. Due to a typographical error Brinkhurst (1986) reported *P. longisoma* as having elongate hair setae on III instead of II.



Pristinella longisoma: (after Harman, 1977) A, anterior ventral seta; B, posterior ventral seta; C, dorsal needle seta.

***Pristinella minuta* (Stephenson, 1914)**

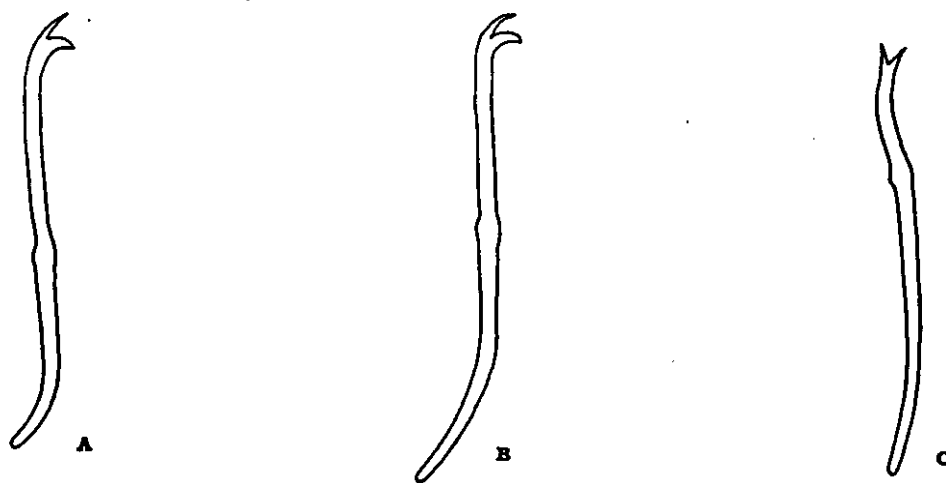
Naidium minutum Stephenson, 1914: 327-330, Figs. 3-5.

Diagnosis. Length: 2 mm. Dorsal setae being in II, bundles composed of 1 smooth hair and 1 bifid needle with short, widely diverging teeth of equal length. Ventral setae all bifid, those of II may be thinner than the rest with upper tooth longer than lower, teeth becoming equally long posteriorly, 3-5 per setae bundle anteriorly, 2-3 posteriorly.

Distribution and Habitat. India, Brazil, North America (Texas). The specimens from Texas were collected from an intermittent stream.

Remarks. This species cannot be distinguished from *P. osborni* except on the basis of setal size according to Harman (1973b): hairs 77-105 μm ; needles 33-35 μm ; ventrals 33-37 μm . These measurements agree with those given by Walton (1906) for *P. osborni*. Sperber (1948) suggested the species were synonymous giving priority to *P. minuta* because of Walton's questionable descriptions. Brinkhurst and Jamieson (1971) also considered them synonymous, but gave priority to *P. osborni* because of its earlier publication date. Brinkhurst (1986) maintained them as separate taxa following Harman's (1973b) suggestion based on setal length.

Because of the confusion and differences based solely on setal length, I suggest following the synonymy presented by Brinkhurst and Jamieson (1971) and refer all specimens to *P. osborni* due to the rule of priority.



Pristinella minuta: (after Brinkhurst and Jamieson, 1971, as *P. osborni*)
A, ventral seta of II; B, ventral seta from middle of body; C, dorsal needle seta.

Pristinella osborni (Walton, 1906)

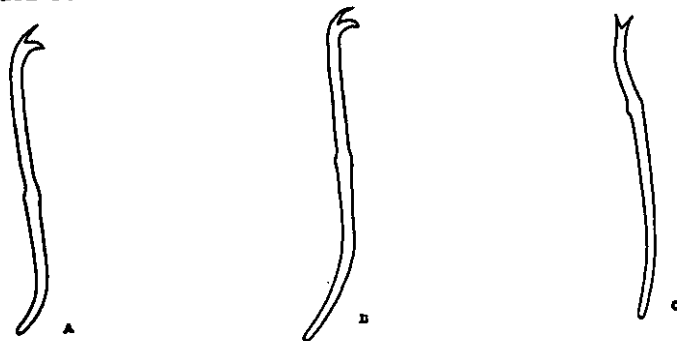
Naidium osborni Walton, 1906:703-704, Fig. 12.

Diagnosis. Length: 2 mm. Dorsal setae begin in II, bundles composed of 1 smooth hair and 1 bifid needle with short, widely diverging teeth of equal length. Ventral setae all bifid, those of II may be thinner than the rest with upper tooth longer than the lower, teeth becoming equally long posteriorly; 3-5 per setae per bundle anteriorly, 2-3 posteriorly.

Distribution and Habitat. India, Brazil, North America (eastern United States). Collected from a river on the Panhandle and a small lake in peninsular Florida.

Remarks. See remarks for *P. minuta* for additional information. Loden and Harman (1980) discovered specimens of *P. osborni* with pectinate needles in the posterior bundles, which may have been overlooked in specimens referred to as *P. minuta*. The development of intermediate needle teeth was considered to be an environmentally induced condition. The presence of intermediate teeth was apparently one of the primary diagnostic characters separating *Pristinella sima* from *P. osborni*. As this character now seems to be unstable and environmentally dependent, a more accurate criterion is the relative length of the needle teeth. The upper tooth of *P. sima* is longer than the lower, whereas the teeth are of equal length in *P. osborni* (Loden and Harman, 1980).

Sperber (1948) states that the needle teeth of *P. sima* resemble *P. minuta*. As such, all three species may be synonymous. Unless the length of the teeth are noticeably different and the intermediate needle teeth very distinct, questionable specimens of *P. sima* should be referred to as *P. osborni*.



Pristinella osborni: (after Brinkhurst and Jamieson, 1971) A, ventral seta of II; B, ventral seta from middle of body; C, dorsal needle seta.

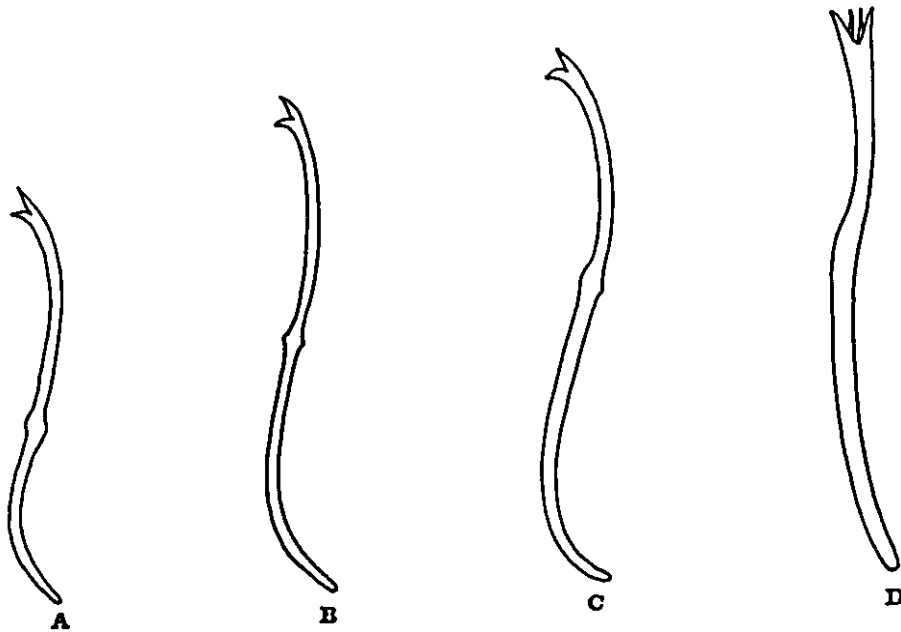
Pristinella sima (Marcus, 1944)

Naidium simum Marcus, 1944:68-69, Plate XIII, fig. 58-59.

Diagnosis. Length: 5-7 mm; segments: 35-61. Dorsal setae begin in II, bundles composed of 1-2 smooth hairs and 1-2 pectinate needles with short, widely divergent teeth, upper tooth longer than lower, and 2-3 intermediate teeth. Ventral setae 3-5 per bundle, those of II-V with upper tooth longer than the lower; from VI upper tooth equal to or shorter than lower.

Distribution and Habitat. South America, North America. Large northeastern rivers including the Mississippi, also small streams of Virginia and the Loxahatchee River in Florida.

Remarks. The needle setae with a longer upper tooth and 2-3 distinct intermediate teeth separate *P. sima* from the other closely related species of *Pristinella*; however, this character is questionable. This species may prove to be an ecomorph of *P. osborni*. See remarks for *P. osborni* for additional information.



Pristinella sima: (after Brinkhurst and Jamieson, 1971) A, ventral seta of II; B, ventral seta of III; C, ventral seta of VIII; D, dorsal needle seta.

Tubificidae

Type Genus. *Tubifex* Lamarck, 1816

Diagnosis. Eyes, proboscis, and caudal gills absent. Dorsal and ventral gills may be present in posterior segments in 1 species, *Branchiura sowerbyi*. Ventral setae usually bifid, beginning in II. Dorsal setae begin in II, and may include bifid crotchets, with or without intermediate teeth, hair and/or simple-pointed or palmate setae. Ventral setae usually bifid crotchets with or without intermediate tooth (teeth). Spermathecal and/or penial setae may be present on genital segments in mature individuals. One pair of testes and ovaries in X and XI, respectively. Male and female pores in succeeding segments of respective gonads. Spermathecae in X, paired, single, or absent (in parthenogenic species). Reproductive organs may be shifted one or more segments anteriorly. Reproduction sexual or asexual by fragmentation.

Remarks. Tubificids frequently form dense populations in organically enriched habitats with a silty or muddy substrate tending toward anoxic conditions. As a result they are often referred to as "sludge worms". They are usually relatively long and coil around themselves or their neighbors unlike naidids or enchytraeids. As a result, when found in high concentrations, they may form writhing red balls.

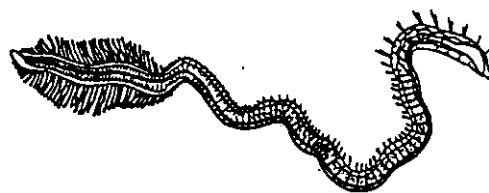
Unlike other families, identification to species of all but a few Florida tubificid taxa require fully mature specimens, relying on genital setae and morphology of cuticularized male structures. On the average, only about 10% of the populations are mature. As a result, immature specimens lacking distinguishing characters are usually separated into "immature tubificids with hair setae" (imm. w/) and "immature tubificids without hair setae" (imm. w/o). The percentage of identifiable mature species within the community may then be applied to the immature specimens and the actual numbers extrapolated, which will provide a relatively accurate assessment of the community.

Twenty-nine freshwater species representing 14 genera have been either reported from Florida or the southeastern United States.

Key to Species of Tubificidae in Florida

1. A) Posterior segments (behind XXX) with dorsal and ventral gill filaments. Dorsal bundles with short hairs and bifid setae with very reduced upper tooth and very fine intermediates.

Branchiura sowerbyi pg. 173



- B) No gill filaments, dorsal setae variable. 2.

- 2.(1B) A) Body wall papillate; prostomium retractile. 3.



- B) Body wall non papillate; prostomium non-retractile. 6.

- 3.(2A) A) Body wall with circlets of very large papillae in setal line and circlet of smaller papillae between setal rows. Dorsal bundles include 3-14 hairs and 1-5 lyre-shaped pectinate setae, ventral setae all bifid. Modified spermathecal setae and penis sheaths absent.

Quistadrilus multisetosus pg. 161



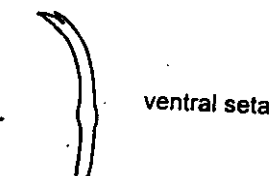
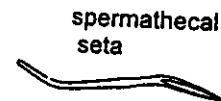
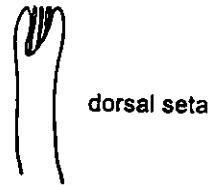
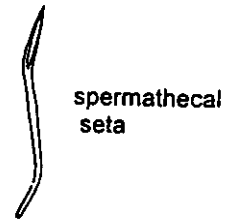
- B) Body wall closely papillate; papillae not in circlets; all fairly uniform in size; dorsal bundles include up to 8 sabre-shaped or fine hair setae and up to 5 bifid or pectinate setae; simple-pointed setae may be present with bifids in anterior ventral bundles; modified hollow-tipped spermathecal setae may be present in X. Thin cuticular penis sheaths present. *Spirosperma* 4.

- 4.(3B) A) Dorsal setae include up to 7 sabre-shaped hairs and up to 5 lyre-shaped crotchets; ventral bundles with only bifid setae; up to 7 per bundle; modified spermathecal setae absent.

Spirosperma ferox pg. 158



- B) Dorsal bundles include 2-8 thin or sabre-shaped hairs and 2-4 crotchets with minute bifid or pectinate tips; ventral bundles include simple-pointed setae and bifids anteriorly. Spermathecal setae present. 5.
- 5.(4B) A) Dorsal bundles with 2-7 sabre-shaped hairs and 2-4 pectinate crotchets; 1-2 setae present in ventrals of II-III or IV; either simple-pointed or bifid with the upper tooth much longer than lower.
Spirosperma nikolskyi pg. 159
- B) Dorsal bundles with 3-8 hairs and 2-4 bifid crotchets; 1 simple-pointed and 1 bifid seta present in ventral bundles of II-VIII or IX.
Spirosperma carolinensis pg. 157
- 6.(2B) A) Hair setae present in dorsal bundles. 7.
 B) Hair setae absent, all setae bifid or simple-pointed. 15.
- 7.(6A) A) Modified genital setae absent. 8.
 B) Spermathecal setae present in X; penial setae present or absent in XI. 14.
- 8.(7A) A) Thin cuticular penis sheaths absent. 9.
 B) Thin cuticular penis sheaths present in XI. 11.
- 9.(8A) A) Ventral setae with upper tooth thinner and shorter than lower; hairs may be absent from II-VII. *Aulodrilus* in part 10.
 B) Ventral setae with teeth approximately equal, upper tooth not especially thinner. These individuals are immature and cannot be identified; they are usually referred to as "unidentifiable immature tubificids with hair setae".



- 10.(9A) A) Hairs usually begin in VI or VII; from VII dorsal crotchets become oar-shaped, with very reduced teeth.

Aulodrilus pigueti pg. 166

- B) Hair setae begin in II; all dorsal crotchets with thin, short upper tooth which is frequently replicated.

Aulodrilus pluriseta pg. 167

- 11.(8B) A) Penis sheaths thin, longer than wide with expanded base, narrowed midsection and distal opening set at an angle; posterior setae sigmoid with stout recurved lower tooth.

Tasserkidrilus harmani pg. 132

- B) Penis sheaths tub- or cone-shaped; posterior setae not with stout recurved lower tooth.

12.

- 12.(11B) A) Penis sheaths sharply conical; anterior ventral setae (II and sometimes III) with upper tooth longer than lower.

Ilyodrilus templetoni pg. 148

- B) Penis sheaths tub-shaped; anterior ventral setae with teeth of variable length.

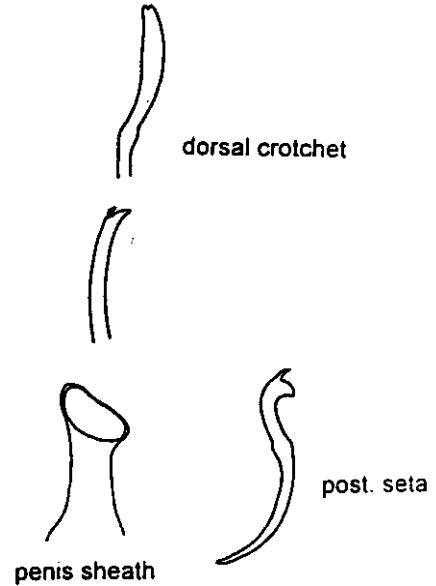
Tubifex 13.

- 13.(12B) A) Hairs serrate, very long (4-5 times body width) and continue to posterior of individual; body very long and thin; anterior ventrals with upper tooth longer and thinner than lower.

Tubifex ignotus pg. 129

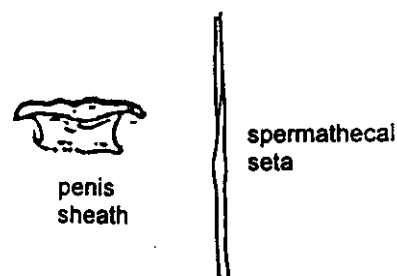
- B) Hairs serrate or smooth, not more than 2 times body width, usually absent or reduced posteriorly; anterior ventrals with upper tooth thinner but as long as lower.

Tubifex tubifex pg. 130



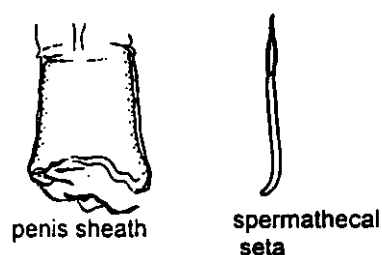
- 14.(7B) A) One hollow-tipped spermathecal seta present in each ventral bundle of X, modified penial setae absent. Hairs and pectinates present in anterior dorsal bundles; posterior dorsal bundles with bifids only. Thin tub-shaped penis sheaths with reflexed hood present in XI.

Psammoryctides convolutus pg. 136



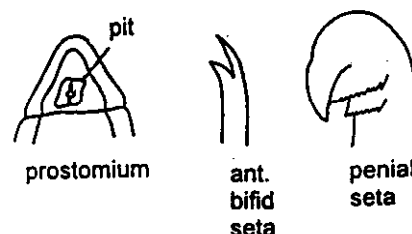
- B) Hollow-tipped spermathecal and penial setae present in X and XI respectively; posterior dorsal bundles with long hairs and bifid crotchets. Basement membrane of penis resembling cuticular penis sheath present, cylindrical, no reflexed ends.

Haber speciosus pg. 154



- 15.(6B) A) Mid-dorsal ciliated prostomial pit present; anterior setae bifid with upper tooth longer than lower; modified penial setae present in XI, distally falcate with 2 rows of denticles.

Bothrioneurum vej dovskyanum pg. 169



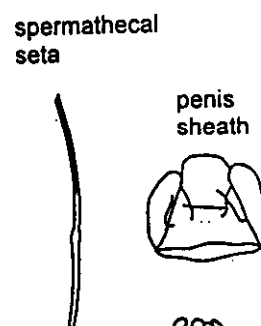
- B) Prostomial pit absent; upper tooth of all setae of variable lengths; modified genital setae present or absent. 16.

- 16.(15B) A) Modified genital setae present in IX or X and/or XI. 17.

- B) Modified genital setae absent. 18.

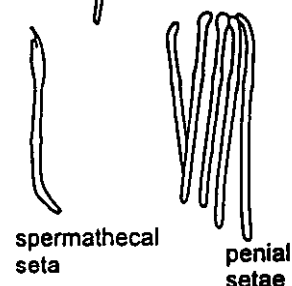
- 17.(16A) A) Modified spermathecal setae present in X; thin cuticular penis sheaths present.

Isochaetides freyi pg. 134



- B) Modified spermathecal setae present in ventral bundles of IX and sometimes X; 4-6 modified penial setae in each ventral bundle of XI; penis sheaths absent.

Rhizodrilus lacteus pg. 171



- 18.(16B) A) Cuticular penis sheaths absent. 19.

- B) Cuticular penis sheaths present. 22.

- 19.(18A) A) Anterior setae simple-pointed or with a rudimentary upper tooth, or upper tooth shorter and thinner than lower.

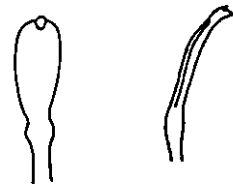
Aulodrilus in part 20.



- B) Anterior setae bifid, upper tooth generally equal to or longer and as thick as lower. These individuals are immature and cannot be identified; they are usually referred to "as unidentifiable immature tubificids without hair setae".

- 20.(19A) A) Setae of mid and posterior bundles with lateral keels, teeth very reduced.

Aulodrilus limnobius pg. 164



- B) Setae of mid and posterior bundles without lateral keels. 21.

- 21.(20B) A) Anterior setae simple-pointed or with a rudimentary upper tooth; palmate setae in all bundles from VI.

Aulodrilus americanus pg. 163



palmate seta

- B) Setae of anterior bundles with upper tooth shorter and thinner than lower, progressively enlarging to IX. Posterior setae with thick recurved lower tooth.

Aulodrilus paucichaeta pg. 165



post. seta

- 22.(18B) A) Length to width ratio of penis sheaths less than 10:1. Setae of II or II-III with upper tooth shorter than lower, or upper tooth slightly longer and thinner than lower, not bent 90° to shaft.

Varichaetadrilus in part 23.

- B) Length to width ratio of penis sheaths usually greater than 10:1; if less than 10:1, then upper tooth of anterior ventrals much longer and thicker than lower and bent at a 90° angle to shaft.

Limnodrilus and *Varichaetadrilus* (in part) pg. 138

- 23.(22A) A) Penis sheaths shaped like an hourglass without a flattened head plate.
Varichaetadrilus fulleri pg. 151



- B) Penis sheaths flask-shaped with the basal third somewhat enlarged, and a flattened head-plate set at 90° to the shaft.
Varichaetadrilus psammophilus pg. 152

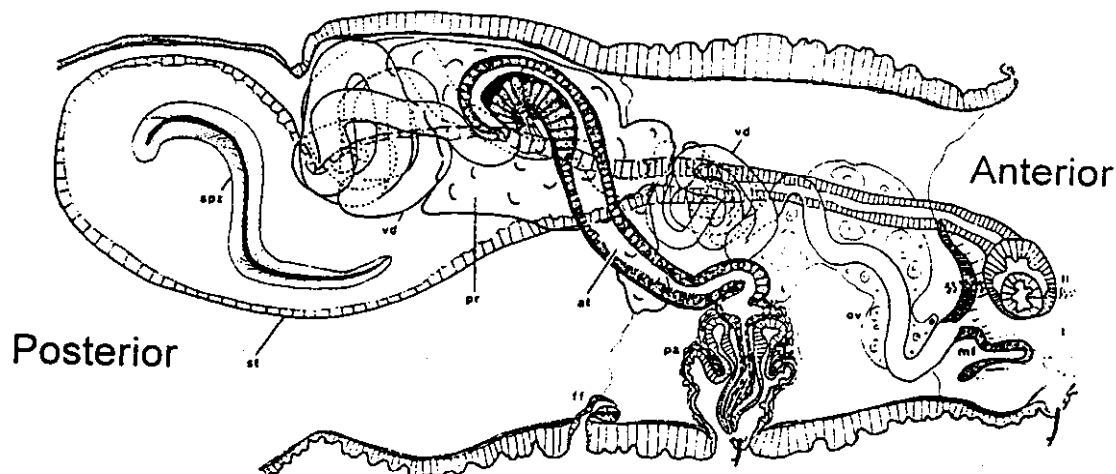


Genus. *Tubifex* Lamarck, 1816

Type Species. *Lumbricus tubifex* Müller, 1774.

Diagnosis. Dorsal bundles with serrate hairs; bifid or pectinate setae usually present anteriorly; modified genital setae absent. Well developed penes present enclosed in penial sacs with a bundle of strong circular muscles producing a circumferential fold; ejaculatory ducts absent, atria comma-shaped, prostates stalked, entering atria subapically on anterior side, vasa deferentia long, bipartite, entering atria apically or subapically, non-ciliate distally. Spermatzeugmata present.

Remarks. Holmquist (1983) conducted an extensive review of the type species, *Tubifex tubifex*. The original material "vanished into thin air", therefore she established a neotype from the type locality in Denmark. Holmquist (1985) later examined taxa previously included in *Tubifex* and separated them into 12 genera, including 5 new ones and reinstated 3 previous names. According to Holmquist (1983), one of the common recurrent characters listed for *Tubifex* is a misconception of what is a "cuticularized tub-shaped penis sheath". Holmquist (1985) states that the penis lacks a "reinforced cuticle" in her re-definition of *Tubifex*. In her 1983 description of the neotype, she states that the penis is covered by a "common cuticle" not in the form of a penial sheath of any kind, and that the "penes are plastic without any reinforced cuticular formation...but the surface may be slightly granulated (artifact)...giving a dark shade to the penis". According to Brinkhurst (personal communication) a good anatomical study is required to clarify this terminology.



Tubifex tubifex: (after Holmquist, 1983) genital organs.

Tubifex ignotus (Štolc, 1886)

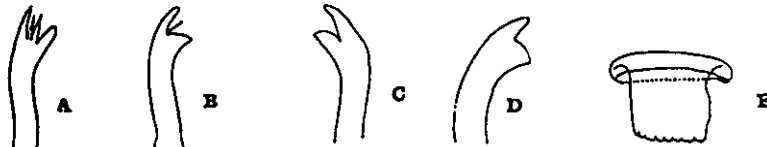
Lophochaeta ignota Štolc, 1886:646

Diagnosis. Length: 80 mm; segments, 170, very slender with long posterior segments. Anterior dorsal bundles composed of 1-3 pectinate setae with u-shaped lateral teeth and a few intermediates, and 2-5 sparsely serrated hairs which are very long and thin, 4-5 times longer than the body; hairs remain long in posterior segments. Ventral setae 3-5 per bundle anteriorly with upper tooth longer and thinner than lower; posteriorly 2 per bundle with upper tooth as long as lower. Modified genital setae absent. Penis sheath thin, tub-shaped, with a reflexed hood.

Distribution and Habitat. Europe, South Africa, North America (Lake Michigan, Lake Ontario, St. Mary's River in Michigan, Alabama). Occurs in large rivers and lakes to a depth of 95 m. This is uncommon in North America, and has not been collected from Florida yet, but its presence in Alabama suggests that it may be found.

Remarks. This species is very similar to *T. tubifex* with respect to the tub-shaped penis sheath, lack of modified genital setae, and dorsal bundles composed of hairs and pectinates. However, it differs by the presence of long posterior hairs, and the filiform body shape. Long hairs are also present posteriorly in *Haber speciosus* but this species has characteristic spermathecal and penial setae. Although *H. speciosus* has an apparent penis sheath, which is somewhat reminiscent of *T. ignotus*, it is actually a thickened basement membrane and lacks the reflexed hood.

This species was reassigned to and designated as the type species for the genus *Lophochaeta* by Holmquist (1985). The differences appear to be the homogeneous thickened vas deferens which is ciliated throughout (non-ciliated distally in *Tubifex*), and lack of strong circular muscles surrounding the penial sac. Apparently, Brinkhurst (1986) did not accept this reassignment, since his description includes a divided vas deferens, therefore maintaining the species as *Tubifex*.



Tubifex ignotus: (after Brinkhurst and Jamieson, 1971) A, anterior dorsal seta; B, posterior dorsal seta; D, posterior ventral seta; E, penis sheath; (after Brinkhurst, 1986) C, anterior ventral seta;

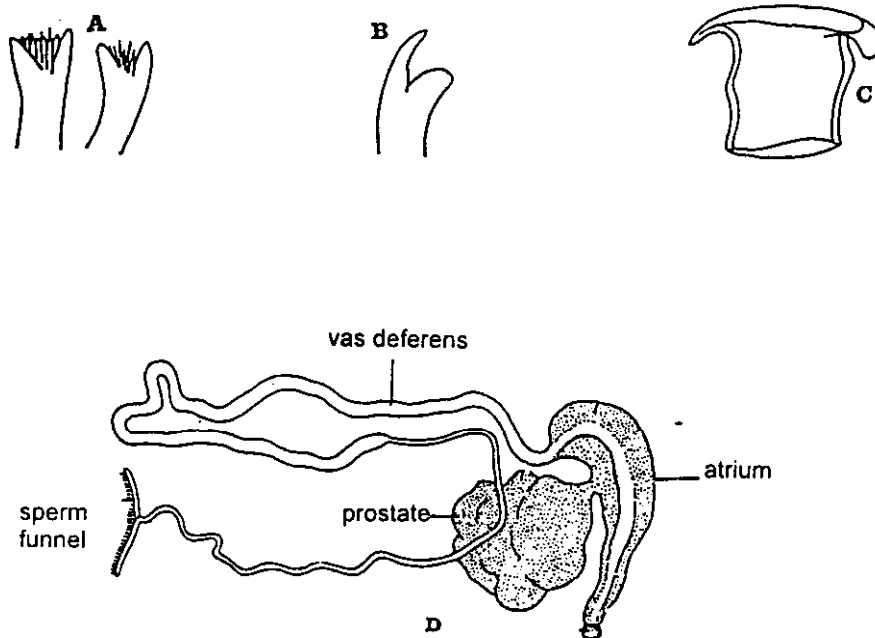
Tubifex tubifex (Müller, 1774)

Lumbricus tubifex Müller, 1774:27.

Diagnosis. Length: 20-200 mm; segments: 34-120. Anterior dorsal bundles composed of 3-5 pectinate crotchets with lateral teeth of equal length and 1-6 smooth or serrate hairs; posteriorly, crotchets with reduced or absent intermediate teeth, hairs may be absent. Ventral setae (2)3-6 per bundle anteriorly, with upper tooth equal or subequal and thinner than lower; 2 posteriorly, upper tooth becoming shorter than lower. Genital setae absent. Penis sheaths thin, tub-shaped, often granular in appearance.

Distribution and Habitat. Cosmopolitan. Although this species is considered to be widely distributed, it is uncommon in the Southeast, and is yet unreported from Florida. This species is highly tolerant to organically enriched habitats where it may dominate all other taxa.

Remarks. This species can only be identified from mature specimens. The tub-shaped granular penis sheath is similar to *T. ignotus*, but *T. tubifex* can be distinguished by its reduced or absent hair setae posteriorly. See Remarks for the genus.



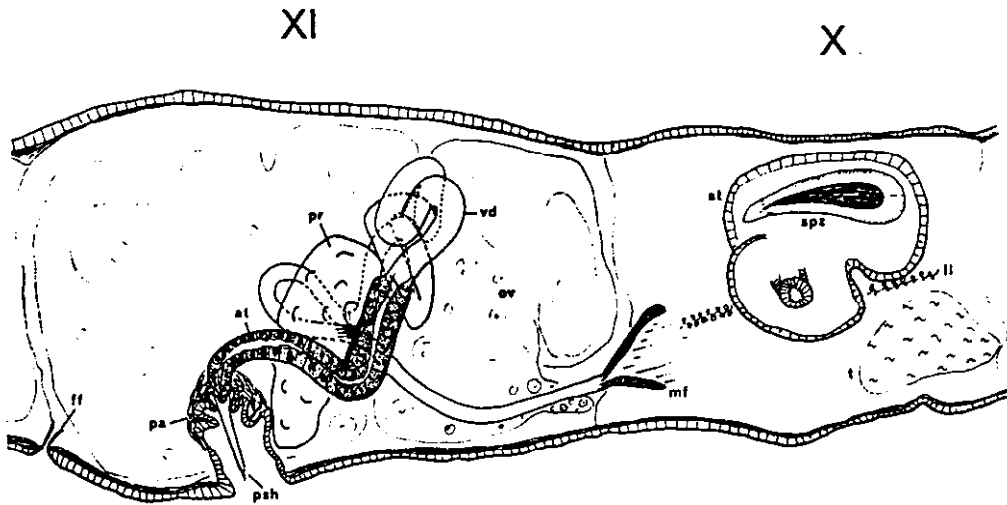
Tubifex tubifex: (after Brinkhurst, 1965) A, dorsal pectinate setae; B, anterior ventral seta; C, cuticular penis sheath; (after Hrabe, 1954) D, male organs.

Genus. *Tasserkidrilus* Holmquist, 1985

Type Species. *Tubifex kessleri americanus* Brinkhurst and Cook, 1966.

Diagnosis. Dorsal bundles with serrate hairs and anterior pectinate setae. Ventral setae all bifid; modified genital setae absent. Penes well developed with cuticular sheaths, ejaculatory ducts absent, atria long, narrow, prostates stalked, entering atria subapically; vasa deferentia about as long as atria, non-ciliated distally. Spermatzeugmata present.

Remarks. This genus was separated from *Tubifex* by Holmquist (1985) based primarily on the undifferentiated vasa deferentia and long narrow atria. Only one species may be expected to be collected in Florida.



Tasserkidrilus americanus: (after Holmquist, 1985) genital organs.

Tasserkidrilus harmani (Loden, 1979)

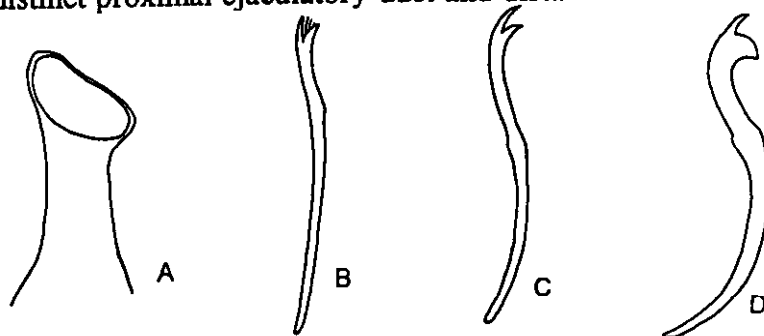
Tubifex harmani Loden, 1979b:601-605, Fig. 1.

Diagnosis. Length: 10-30 mm; segments: 50-95. Anterior dorsal bundles composed of 1-3 finely serrate hairs and 2-3 pectinate setae with subequal lateral teeth and 1-4 intermediate teeth; posterior bundles with 1-2 hairs and 1-2 strongly sigmoid bifid crotchets with upper tooth much thinner and shorter than stout recurved lower tooth. Ventral setae all bifid, 3-5 per bundle, upper tooth longer and thinner than lower in II, equal or shorter in III-X, and resembling posterior dorsals with stout recurved lower tooth in the rest. Modified genital setae absent. Penis sheaths thin, generally conical with expanded base, cylindrical mid-section, and wider head with the opening set at an angle.

Distribution and Habitat. North America (British Colombia, Wisconsin, Louisiana, and Florida). Occurs in standing water of lakes and ditches.

Remarks. The sigmoid posterior setae with stout a recurved lower tooth and the distinctive penis sheaths are diagnostic for this species. Mature specimens have only been identified from the type-locality (Louisiana). Of the 300 specimens collected, only 3 were mature. This species, therefore, may reproduce primarily asexually.

The specific generic placement of this taxon was uncertain, and only tentatively assigned to *Tubifex*, against the suggestions of Brinkhurst to place it in *Isochaeta* (Loden, 1979). Although Holmquist (1985) did not discuss this species in her revision of *Tubifex*, Brinkhurst (1986) reassigned *T. harmani* to the newly created genus, *Tasserkidrilus*, based on the similarity of the long atrium which Loden (1979) considered to be separated into a distinct proximal ejaculatory duct and distal "true" atrium.



Tasserkidrilus harmani: (after Loden, 1979b) A, penis sheath; B, anterior pectinate seta; C, anterior ventral seta; D, posterior ventral seta.

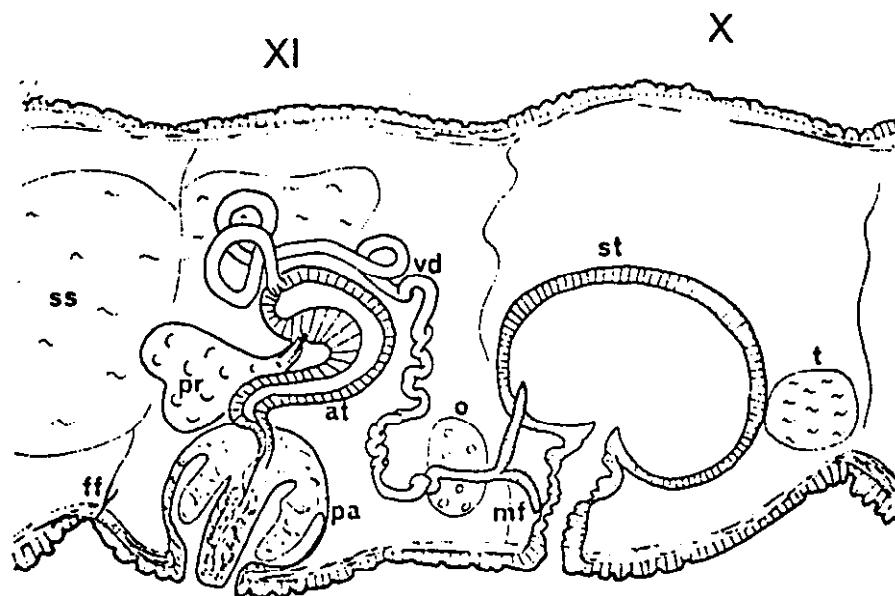
Genus. *Isochaetides* Hrabe, 1966

Type Species. *Limnodrilus baicalensis* Michaelsen, 1901.

Diagnosis. Dorsal bundles with bifid setae, hair setae absent. Ventral setae all bifid; spermathecal setae modified. Thin penis sheaths present or absent, atria short and broad, comma-shaped each with a stalked small prostate attached subapically; vas deferens of uniform thickness, much longer than atrium.

Remarks. Brinkhurst (1981) emended the genus *Isochaetides* to include those species with only bifid setae, modified spermathecal setae and vas deferens of uniform width entering a strongly curved atrium.

Only one species is expected to be collected in Florida.



Isochaetides freyi: (after Holmquist, 1978) genital organs.

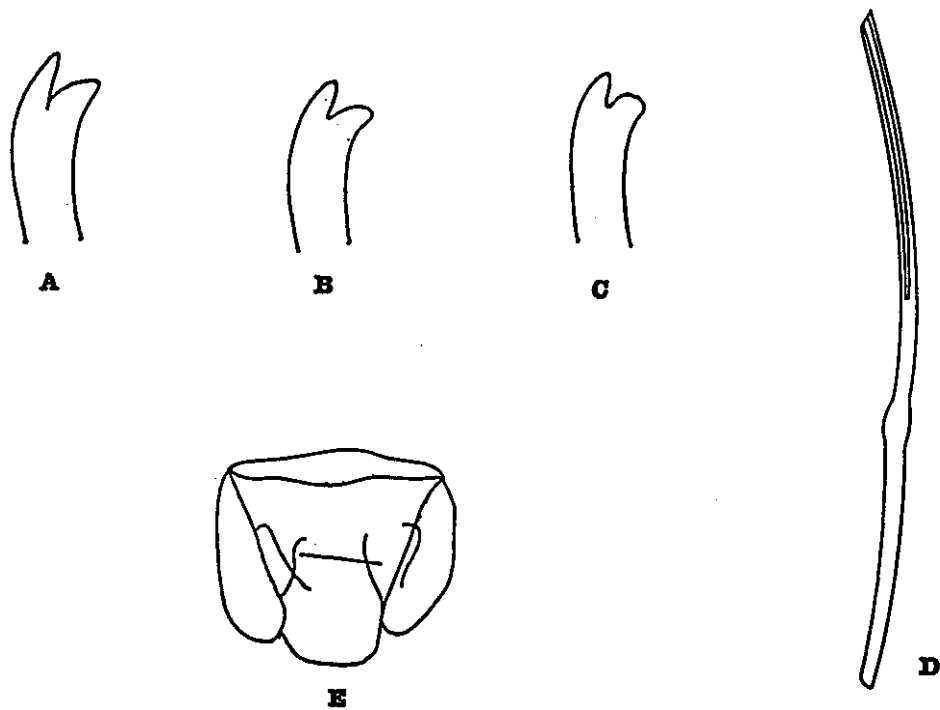
Isochaetides freyi (Brinkhurst, 1965)

Peloscolex freyi Brinkhurst, 1965:139, Fig. 6.

Diagnosis. Length: 20-25 mm; segments: 140. Setae all bifid, upper tooth thinner, but as long as lower tooth; anteriorly 4-8 per bundle, 2-3 posteriorly. Modified spermathecal setae present, straight hollow-tipped. Thin, short penis sheaths present.

Distribution and Habitat. North America (Great Lakes, Mississippi River, Alabama, Indian, Louisiana, New York, North Carolina, Pennsylvania, Tennessee, Wisconsin, and British Columbia). Occurs in large lakes and rivers.

Remarks. This species is characterized by the lack of hair setae, hollow-tipped spermathecal setae and short, thin cuticular penis sheaths. Brinkhurst (1981) transferred *Peloscolex freyi* to *Isochaetides* based on the suggestion by Holmquist (1979).



Isochaetides freyi: (after Brinkhurst, 1965) A, B, C, setae; E, penis sheath; (after Stimpson et al, 1982) D, spermathecal seta.

Genus. *Psammoryctides* Hrabe 1964

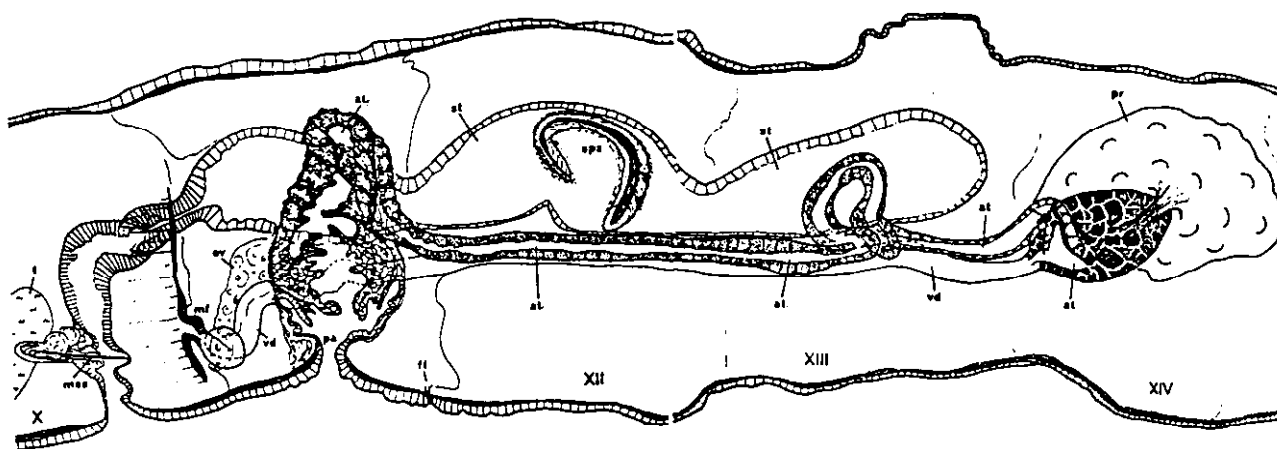
Type Species. *Saenuris barbatus* Grube, 1861.

Diagnosis. Dorsal bundles may include bifid, pectinate or palmate setae, hairs present or absent. Ventral setae all bifid, modified spermathecal or penial setae may be present. Thin penis sheaths present, ejaculatory ducts each with a swollen glandular portion separated from atrium by a narrow tubular portion; atria small, subglobular with stalked compact prostates; vasa deferentia of uniform thickness.

Remarks. The thin, cuticularized penis sheaths leading into distinctly shaped ejaculatory ducts seems to be the only consistent character separating this genus from other Tubificinae.

This genus was emended by Loden (1978) to reclassify *Psammoryctides* into two subgenera, *Psammoryctides* (*Psammoryctides*) and *P. (Spencerius)*, based on the presence or absence of a tube separating the swollen glandular portion of the ejaculatory duct and the penis.

Four species have been reported from North America with only one, *P. convolutus*, occurring in Florida.



Psammoryctides barbatus: (after Holmquist, 1985) genital organs.

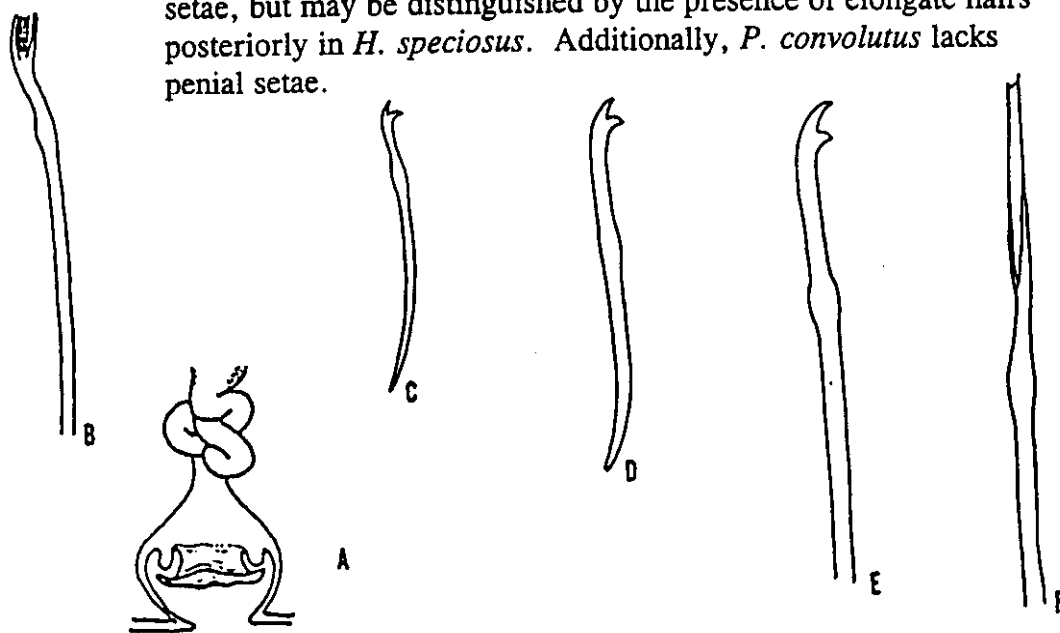
Psammoryctides convolutus Loden, 1978

Psammoryctides convolutus Loden, 1978:78-81, Fig. 3.

Diagnosis. Length: 10-25 mm; segments: 66-88. Dorsal bundles composed of 1-3 smooth or serrated hairs and 1-3 pectinate setae with equally long lateral teeth and numerous fine intermediate teeth; posteriorly 1 bifid seta with equal teeth, hairs absent. Ventral setae all bifid with teeth of equal length and thickness anteriorly, 3-4 per bundle, and upper tooth becoming more than 2 times longer and thicker than lower posteriorly, 1-2 per bundle, modified spermathecal setae present with fused elongate teeth forming a groove. Thin, wide, short penis sheaths present, with reflexed heads.

Distribution and Habitat. North America (east central Mexico, Louisiana, and Florida). Occurs in swamps and streams throughout the Gulf coastal plain of the southeastern U.S. Associated with roots of emergent aquatic vegetation and fine, organic mud. In peninsular Florida, this species is most abundant in fine sand with a small amount of silt and aquatic vegetation.

Remarks. *Psammoryctides convolutus* inevitably co-occurs with *Haber speciosus* in Florida. Both species have hair and pectinate dorsal setae, but may be distinguished by the presence of elongate hairs posteriorly in *H. speciosus*. Additionally, *P. convolutus* lacks penial setae.



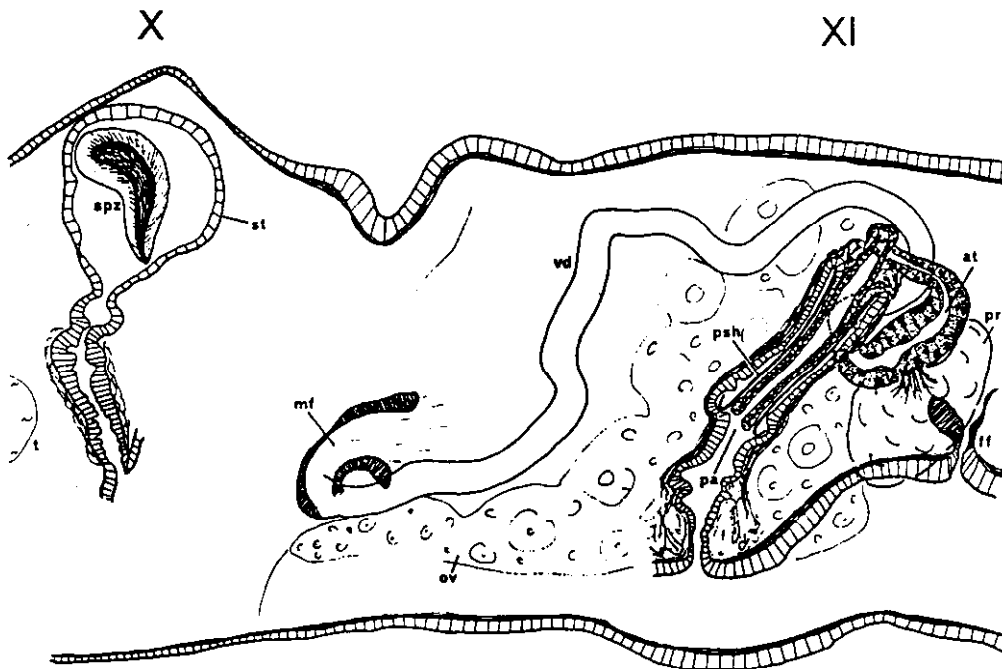
Psammoryctides convolutus: (after Loden, 1978) A, distal end of male duct; B, anterior dorsal seta; C, posterior dorsal seta; D, anterior ventral seta; E, posterior ventral seta; F, spermathecal seta.

Genus. *Limnodrilus* Claparède, 1862

Type Species. *Limnodrilus hoffmeisteri* Claparède, 1862:226, Plate I, fig. 1-3, Plate III, fig. 12, Plate IV, fig. 6

Diagnosis. All setae bifid, modified genital setae absent. Thick, elongate cuticular penis sheaths present, normally ensheathed by spiral muscles; ejaculatory ducts very long; atria small bean-shaped with large stalked prostates; vasa deferentia very long.

Remarks. This is one of the most clearly defined Tubificinae genera. Many authors have unsuccessfully attempted to differentiate species based on immature specimens using setal morphology and distribution. In North and South America, only 2 species can be identified on the basis of somatic setae: *L. udekemianus* and *L. neotropicus* Cernosvitov, 1939. Both species have a much longer upper tooth in the anterior ventrals, but only the former has been reported from North America. Seven of the 10 species reported from North America are expected to occur in Florida.



Limnodrilus cf. *udekemianus*: (after Holmquist, 1985) genital organs.

Key to Species of *Limnodrilus* and *Varichaetadrilus* in Florida

1. A) Penis sheath length:width ratio equal to or greater than about 10:1 in fully mature specimens; upper tooth of anterior setae not greatly elongated or bent at a 90° angle to the shaft. 2.

- B) Penis sheath length:width ratio about 4:1; upper tooth of anterior setae much longer and thicker than lower, bent at about a 90° angle to the shaft. *L. udemekianus* pg. 146



- 2.(1A) A) Penis sheath length:width ratio about 10-14:1. 3.

- B) Penis sheath length:width ratio much larger, usually greater than 40:1. 5.

- 3.(2A) A) Head of penis sheath with 2 tapered lateral projections; ventral setae of IV-IX longer and thicker than the rest, with upper tooth 2 times longer and thicker than lower. *L. rubripenis* pg. 144



- B) Head of penis sheaths without elongate projections, ventral setae of IV-IX not modified. 4.

- 4.(3B) A) Base of penis sheaths narrowing abruptly into shaft; head of penis sheath reflected over shaft. *Varichaetadrilus angustipenis* pg. 150

- B) Shaft of penis sheath narrowing gradually from base to head; head of penis sheath may have overhanging hood or a plate with scalloped margin at a 90° angle to shaft. *L. hoffmeisteri* pg. 142



- 5.(2B) A) Penis sheaths with thick walls 2 layers thick from base to near hood; outer layer absent distally leaving a narrow neck immediately below hood; head of penis set at an angle to the shaft; roughly triangular with a lower corner forming a droopy lip.

L. cervix pg. 140



- B) Penis sheath with a single layer, may be thick or thin; lower margin of hood without droopy lip. 6.

- 6.(5B) A) Penis sheaths extremely long and narrow, up to 4,000 μm in length; hood of penis resembling a corkscrew, with a finger-like proximal projection. *L. tortilipenis* pg. 145



- B) Penis sheaths less than 2,000 μm , head roughly pear-shaped. 7.

- 7.(6B) A) Hood of penis small, pear-shaped shaft enters hood centrally shaft smoothly curving.

L. clapparedeianus pg.141



- B) Hood of penis larger, situated eccentrically on shaft; one wall of shaft narrower distally, producing an abrupt bend.

L. maumeensis pg. 143



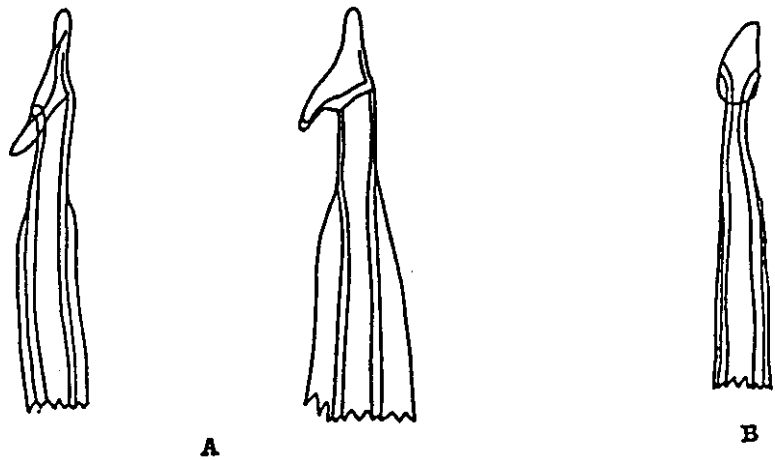
Limnodrilus cervix Brinkhurst, 1963

Limnodrilus cervix Brinkhurst, 1963:36, Fig. 2a-b.

Diagnosis. Length: 30-80 mm; segments: 55-160. All setae bifid, upper tooth slightly longer and thinner than lower, 4-9 per bundle, fewer posteriorly. Penis sheaths up to 48 times longer than wide, with very thick walls composed of 2 distinct layers, reduced to 1 layer just below the hood where the walls narrow abruptly; lower margin of hood forming a droopy lip on one side.

Distribution and Habitat. Widespread throughout North America, introduced to England. Occurs commonly in organically enriched habitats.

Remarks. This species is distinguished by the very long penis sheaths which have a unique double wall, and hood with a droopy lower lip on one side. A rare intermediate form is occasionally found with the characteristic long double-walled penis sheaths of *L. cervix* but has the triangular, symmetrical hood consistent with *L. clapparedianus*. This has been referred to as *L. cclaparedeianus/cervix* until a definite taxonomic decision is published.



Limnodrilus cervix: (after Brinkhurst and Cook, 1966) A, distal end of penis sheaths; B, *claparedeianus/cervix* intermediate form.

Limnodrilus claparedeianus Ratzel, 1868

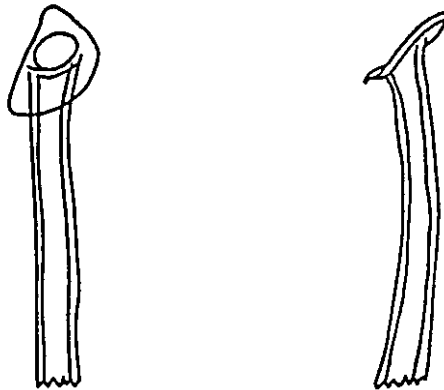
Limnodrilus claparedeianus Ratzel, 1868:590, Plate XLII, fig. 24.

Diagnosis. Length: 30-60 mm; segments: 50-120. All setae bifid, anterior setae with upper tooth longer and thinner than lower, 5-10 per bundle, decreasing in number posteriorly. Penis sheaths up to 43 times longer than wide with thin walls and small triangular hoods set at an angle to the shaft.

Distribution and Habitat. Cosmopolitan. Occurs in rivers, lakes and ponds in silty and silty-sand substrates. Most abundant in organically enriched habitats.

Remarks. The very long, thin penis sheaths are the distinguishing character for this species. Although the length to width ratio is usually about 43-50:1, it can be as low as 23:1 and as high as 80:1.

A note concerning the correct spelling of the specific epithet is worthwhile mentioning. Brinkhurst and Jamieson (1971) stated that the confusion would be alleviated by following the rules of nomenclature: "the simple addition of the suffix 'ianus'" to *Claparède* (for whom it is named). Consequently, the correct spelling is "claparedeianus", not "*claparedianus*" as it is frequently referred.



Limnodrilus claparedeianus: (after Brinkhurst and Cook, 1966) distal end of penis sheaths.

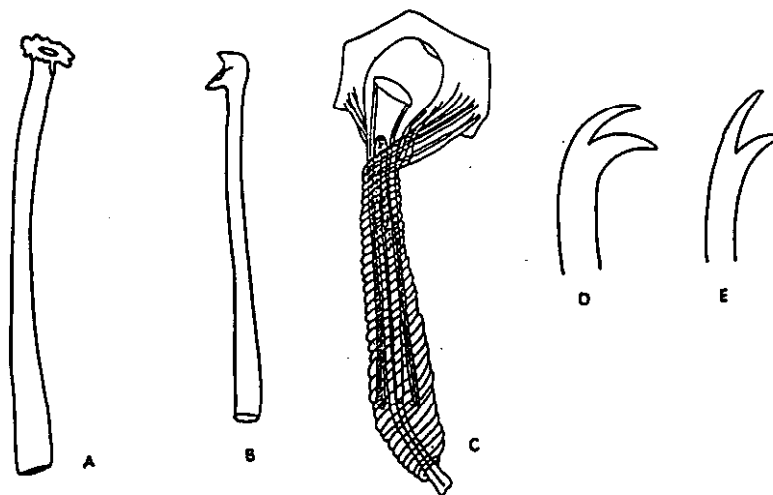
Limnodrilus hoffmeisteri Claparède, 1862

Limnodrilus hoffmeisteri, Claparède, 1862:226, Plate I, fig. 1-3; Plate III, fig. 12; Plate IV, fig. 6.

Diagnosis. Length: 20-35 mm; segments: 55-95. All setae bifid, anterior setae with upper tooth shorter or longer than lower, usually thinner than lower, 3-10 setae per bundle, decreasing to 2-3 in posterior segments. Penis sheaths about 9-14 times longer than wide, generally slightly broader at the base and flared toward the hood which is set at an angle to the shaft and may have a scalloped margin.

Distribution and Habitat. Cosmopolitan. This is probably the most common, widely-distributed tubificid inhabiting a wide range of aquatic habitats ranging from pristine to areas sustaining a high degree of organic enrichment. *Limnodrilus hoffmeisteri* is frequently one of the most abundant taxa in organically enriched habitats.

Remarks. Considerable discussions have revolved around the variation of the hood morphology. The *spiralis* form has the hood set at right angles to the shaft with a uniformly cylindrical shaft, not flared distally. The common "variant" form has a hood with a scalloped margin. The debate concerning the validity of the different forms as discrete taxa is still unresolved. The length:width ratio is the most consistent factor in discriminating this species. The various forms are not considered as separate taxa, but most likely just ecomorphs of *L. hoffmeisteri* (Barbour *et al.*, 1980).



Limnodrilus hoffmeisteri: (after Brinkhurst and Jamieson, 1971) A, penis sheath of variant form; B, typical penis sheath; C, muscles; (after Cernosvitov, 1939) D, anterior ventral seta; E, posterior ventral seta.

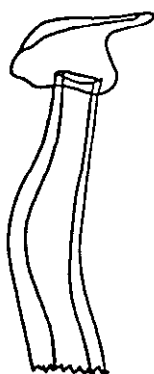
***Limnodrilus maumeensis* Brinkhurst and Cook, 1966**

Limnodrilus maumeensis Brinkhurst and Cook, 1966:15; Fig. 7F.

Diagnosis. Length: 20 mm; segments: 100-135. All setae bifid, anterior setae with upper tooth slightly longer and thinner than lower. Penis sheaths up to 48 times longer than wide with the wall of shaft thinner on one side than the other distally causing a bend of the shaft; hood broadly triangular set eccentrically on the shaft.

Distribution and Habitat. Common east of the Mississippi River in North America. I have also seen this in collections from Great Britain. This species is limited to organically enriched sites.

Remarks. The characteristic bend in the distal quarter of the shaft clearly differentiates this species from the other 2 species of *Limnodrilus* (*L. claparedeianus* and *L. cervix*) with long shafts.



Limnodrilus maumeensis: (after Brinkhurst and Cook, 1966) distal end of penis sheath.

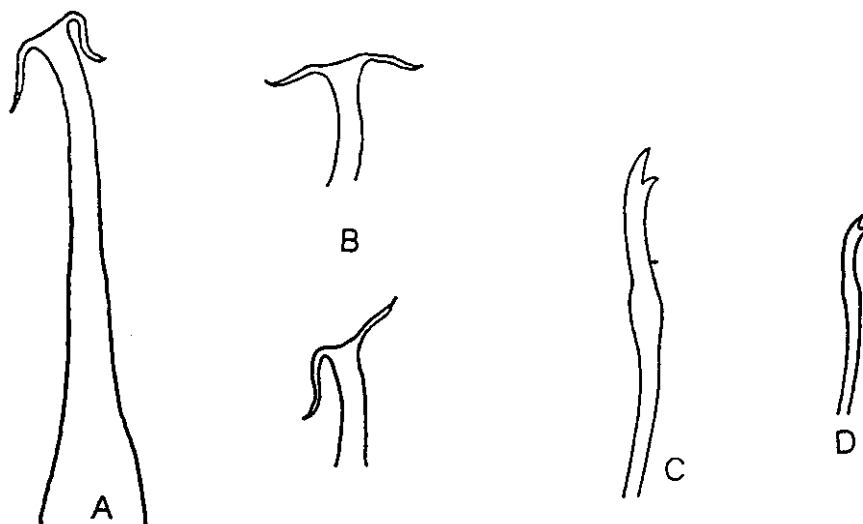
Limnodrilus rubripenis Loden, 1977

Limnodrilus rubripenis Loden, 1977:324-326, Fig. 5-8.

Diagnosis. Length: 12-20 mm; segments: 60-85. All setae bifid, dorsal setae with upper tooth as long as but thinner than lower, 3-5 per bundle anteriorly and 2-3 posteriorly. Ventral setae 2-3 per bundle, those of II-III (IV) similar to dorsals; in (IV) V-IX setae longer and thicker than the rest; with upper tooth 2 times longer and thicker than lower, ventrals absent in X; from XI ventrals similar to dorsals. Penis sheaths expanded basally and slightly distally, head composed of 2 flat, tapered projections which are almost perpendicular to shaft

Distribution and Habitat. North America (Louisiana, North Carolina, Florida). Occurs in streams with a sandy substrate and moderate current.

Remarks. This species is most similar to *L. hoffmeisteri* with respect to the size and general shape of the penis sheaths. The flat, elongate tapered lobes comprising the head of the penis of *L. rubripenis* separates it from all other species of *Limnodrilus*. Enlarged ventral setae of IV-IX are also species specific for *L. grandisetosus* Nomura, 1932, which Brinkhurst (1965) synonymized with *L. silvani* Eisen, 1879, based on the belief that the enlarged setae may be a byproduct of regeneration.



Limnodrilus rubripenis: (after Loden, 1977) A, penis sheath; B, variation of the distal ends of the penis sheaths; C, enlarged ventral seta; D, dorsal seta.

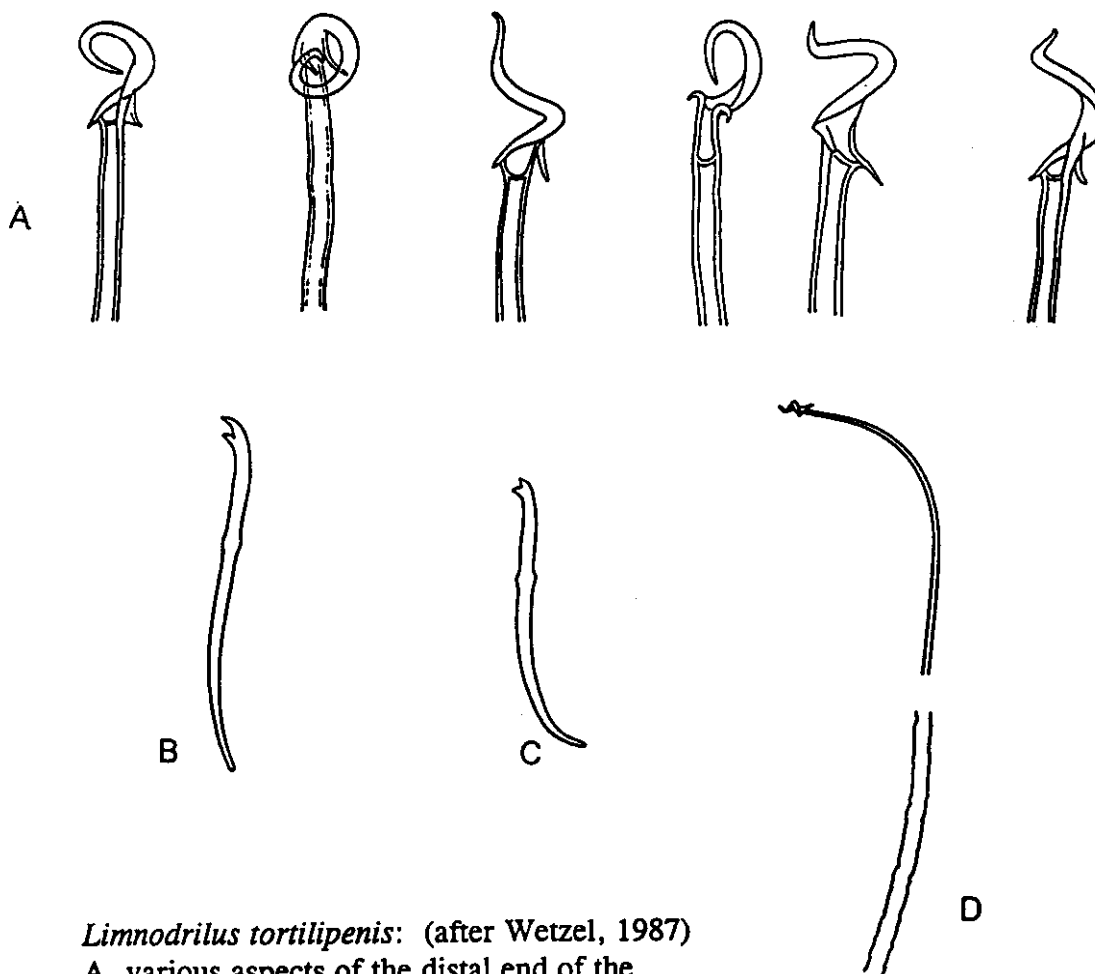
Limnodrilus tortilipenis Wetzel, 1987

Limnodrilus tortilipenis Wetzel, 1987:182-185, Fig. 1-11.

Diagnosis. Length: 15-22 mm; segments: 28-108. All setae bifid, with upper tooth longer and thinner than lower anteriorly; upper tooth equal or subequal to lower posteriorly. Ventral bundles with 6-8 setae anteriorly and 3-4 posteriorly. Penis sheaths extremely elongate, 2,741-4,080 μm , and narrow; base of head resembling a corkscrew, with a finger-like proximal projection directed basally and medially.

Distribution and Habitat. North America (Illinois). Occurs in creeks and small rivers. This species may occur in the southeastern United States.

Remarks. No other species has a penis sheath that remotely resembles that of *L. tortilipenis*.



Limnodrilus tortilipenis: (after Wetzel, 1987)

A, various aspects of the distal end of the penis sheaths; B, seta from VI; C, posterior seta; D, penis sheath.

Limnodrilus udekemianus Claparède, 1862

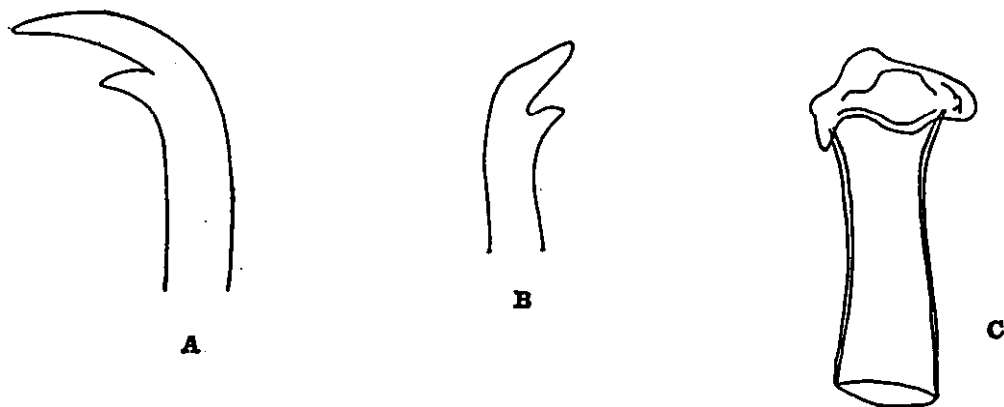
Limnodrilus udekemianus Claparède, 1862:243, Plate I, fig. 4-5, Plate III, fig. 13, 13a, Plate VII, fig. 1

Diagnosis. Length: 20-90; segments: to about 160. All setae bifid, anterior setae with upper tooth much longer and thicker than lower, bent at about 90° to the shaft, 3-8 per bundle; posterior setae with teeth equally long, reduced to 2 per bundle. Penis sheaths short, 1-4 times longer than broad with a simple plate-like hood which may be reflected back over the shaft.

Distribution and Habitat. Cosmopolitan. Widespread throughout the United States and Canada. Occurs in a variety of habitats from organically enriched to oligotrophic; rivers, lakes, ponds, associated with silty and silty-sand substrates. Unlike many species of *Limnodrilus*, this species is rarely abundant.

Remarks. This worm is readily separated, even from immature specimens, based on the very long, thick upper tooth of the anterior ventral setae which is bent at 90° to the shaft.

This species is uncommon in Florida, and can be overlooked if the anterior ventrals are not examined.



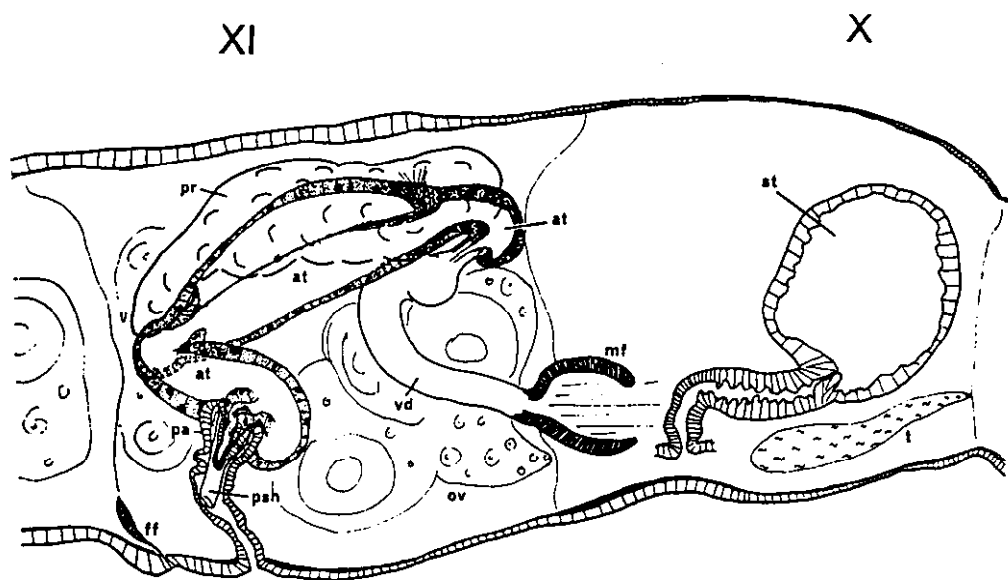
Limnodrilus udekemianus: (after Claparède, 1862) A, anterior ventral seta; (after Brinkhurst, 1965) B, anterior seta; C, penis sheath.

Genus. *Ilyodrilus* Eisen, 1879

Type Species. *Ilyodrilus perrieri* Eisen, 1979:11.

Diagnosis. Dorsal setae include smooth or serrate hairs, and pectinate or bifid crotchets. Ventral setae all bifid. Modified genital setae absent. Cuticular penis sheaths present (or slightly reinforced cuticle without a "true" sheath); ejaculatory ducts short, not well defined; atria elongate, thin-walled, with saccular midsections, narrowing gradually to protrusable penes; large prostates attached to ental region of atria; vasa deferentia relatively broad and moderately short, not much longer than atria, generally of uniform width throughout, constricted ectally immediately prior to the subapical attachment to the atria. Spermatzeugmata unknown from type species.

Remarks. *Ilyodrilus* is similar to *Tubifex*. However, *Ilyodrilus* has a much shorter vasa deferentia, atria are rather wide and sac-like, and penis sheaths are conical, not tub-shaped. According to Brinkhurst (1986) the prostates of *Ilyodrilus* are on the posterior side of the atria instead of the anterior face as in *Tubifex*.



Ilyodrilus perrieri: (after Holmquist, 1985) genital organs.

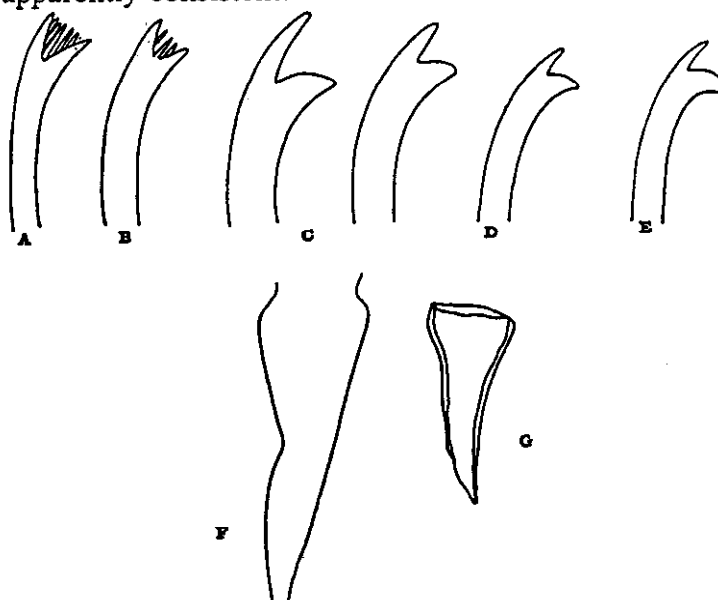
Ilyodrilus templetoni (Southern 1909)

Tubifex templetoni Southern, 1909:140-141, Plate VIII, fig. 6a-e.

Diagnosis. Length: 10-30 mm; segments: 120. Dorsal bundles with 1-4 hairs and 3-4 pectinate setae with well developed intermediate teeth. Ventral setae all bifid, 3-4 per bundle, those of II and possibly III-VII with upper tooth much longer and thinner than lower; thereafter both teeth are approximately equal in length; ventrals of XI absent. Penis sheath sharply conical with irregular disto-lateral opening.

Distribution and Habitat. Europe, Asia, North America. Widely distributed throughout North America in lakes and rivers. May be abundant in enriched environments. Frequently sympatric with *L. hoffmeisteri*.

Remarks. The distinctively shaped conical penis sheath with the disto-lateral margin which has a torn-like appearance, and lack of genital setae, dorsal hairs and pectinates distinguish it from all congeners expected to occur in Florida. Brinkhurst and Jamieson (1971) state that dorsal bundles may be composed of only bifid setae. Although a great deal of intraspecific setal variation may occur within this species, the long, thin upper tooth of the ventrals in II (III) is apparently consistent.



Ilyodrilus templetoni: (after Brinkhurst and Jamieson, 1971) A, dorsal seta from V; B, dorsal seta from VIII; C, ventral setae of VII; D, ventral seta of XV; E, ventral seta of XXIII; F (?complete), penis sheath; G, typical penis sheath.

Genus. *Varichaetadrilus* Brinkhurst and Kathman, 1983

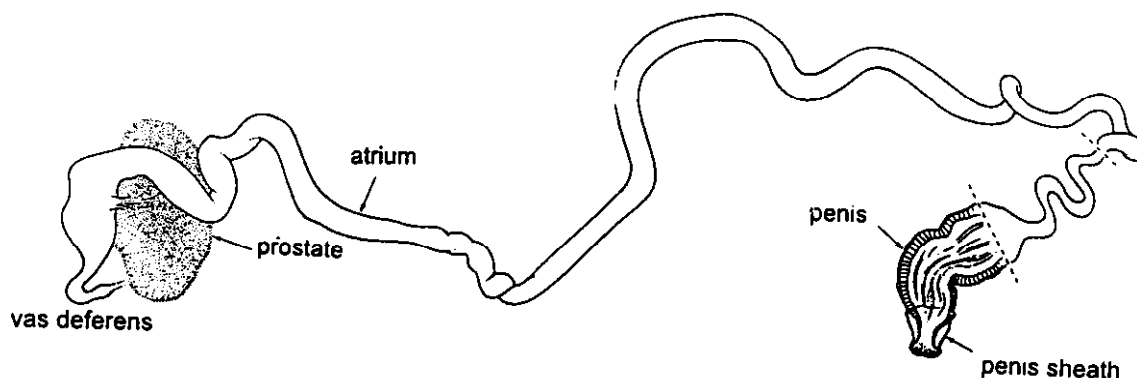
Type Species. *Varichaeta pacifica* Brinkhurst, 1981.

Diagnosis. Dorsal setae may include smooth hairs and pectinate or bifid setae. Ventral setae all bifid. Slightly modified penial setae may be present. Cuticular penis sheaths present; ejaculatory ducts absent; atria tubular very long and winding, with small stalked prostates located entally; vasa deferentia of variable length. Spermatozeugmata well developed.

Remarks. The very long tubular atria of uniform width, relatively short vasa deferentia, lack of ejaculatory ducts and cuticular penis sheaths are diagnostic for this genus. There is no interspecific uniformity of dorsal setal types.

Three species of *Varichaetadrilus* can be expected to occur in Florida. All of which are unique within this genus because they possess only bifid setae dorsally.

Brinkhurst (1981) established the genus *Varichaeta* to accommodate *V. pacifica* and transferred 2 additional species into it. Brinkhurst and Kathman (1983) renamed the genus *Varichaetadrilus* because the former name was preoccupied by a dipteran taxon.



Varichaetadrilus pacifica; (after Brinkhurst, 1981) male reproductive system.

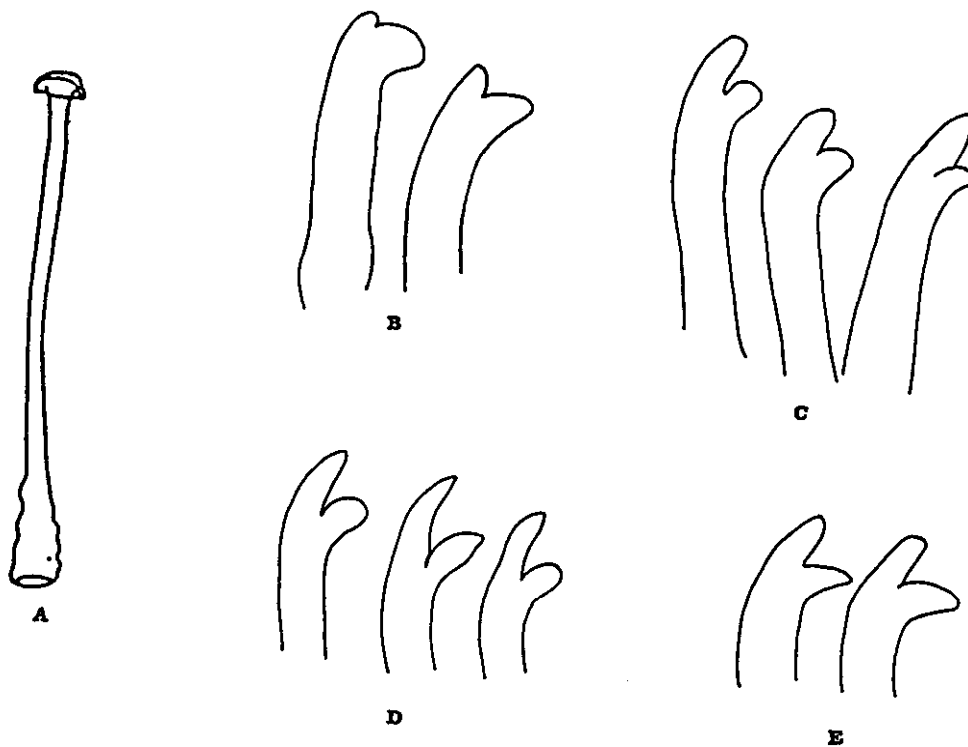
Varichaetadrilus angustipenis (Brinkhurst and Cook, 1966)

Limnodrilus angustipenis Brinkhurst and Cook, 1966:15.

Diagnosis. Length: 10-15 mm; segments: 25-50. All setae bifid, teeth variable, lower tooth usually thicker than upper. Penis sheaths each with a broad (frequently crumpled) basis abruptly narrowing into the shaft; head set at right angles slightly reflected over shaft.

Distribution. North America (Great Lakes, Alabama, Louisiana, Florida, North Carolina, Tennessee, New Brunswick, Ontario, Manitoba).

Remarks. The variation of somatic setae is considerable. The only definable character is the morphology of the male genitalia. The penis sheath which has a broad base, which is frequently crumpled and distinctly separated from the narrow shaft, distinguishes this species from those of *Limnodrilus* and other *Varichaetadrilus*. Brinkhurst (1989) transferred this species to *Varichaetadrilus* because of the lack of distinction between the atrium and ejaculatory duct, very long atrium, lack of spiral muscles in the sac enclosing the penis sheath, and the ental position of the prostate on the atrium.



Limnodrilus angustipenis: (after Brinkhurst and Cook, 1966) A, penis sheath; (after Brinkhurst, 1989) B, dorsal setae from II; C, ventral setae from VI; D, dorsal setae from VI; E, posterior ventral setae.

Varichaetadrilus fulleri Brinkhurst and Kathman, 1983

Varichaetadrilus fulleri Brinkhurst and Kathman, 1983:302-304, Fig. 1.

Diagnosis. Length: to 50 mm; segments: greater than 200. Setae all bifid, upper tooth shorter than lower in II (III), 2-3 (4,5) per bundle, upper tooth longer than the lower in the rest of preclitellar segments; upper tooth shorter and thinner than the lower posteriorly 1 (2) per bundle. Modified genital setae absent. Penes very large, erectile, with cuticular hourglass-shaped sheaths on distal ends only; ejaculatory ducts S-shaped; atria very long, tubular each with an entally attached small, stalked prostate; vasa deferentia very elongate.

Distribution and Habitat. North America (Kentucky; from the Green River associated with the tributaries of Mammoth Cave; Louisiana). Brinkhurst and Kathman (1983) believe this species has been overlooked in many previous collections, and is most likely part of a lower Mississippi fauna, and may be very tolerant of organic pollution.

Remarks. The extremely elongate male ducts are characteristic of *Varichaetadrilus*. The species which may occur in Florida differ from other species within this genus by having only bifid dorsal setae. The shape of the penis sheaths can differentiate these taxa. *Varichaetadrilus fulleri* has hourglass-shaped penis sheaths without a flattened head plate.



Varichaetadrilus fulleri: (after Brinkhurst and Kathman, 1983) A, ectal portion of male duct; B, setae.

Varichaetadrilus psammophilus (Loden, 1977)

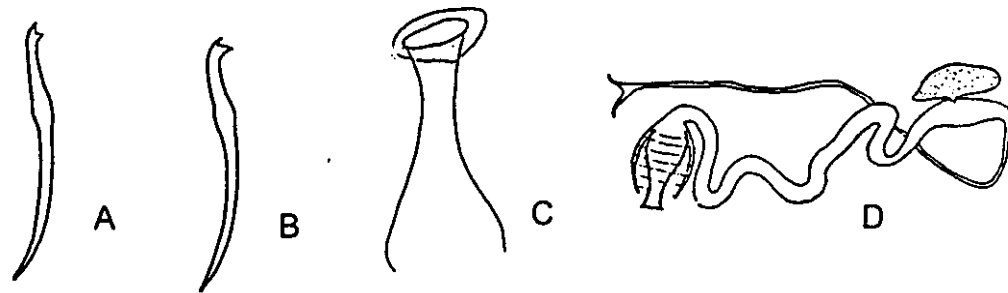
Limnodrilus psammophilus Loden, 1977:322-324, Fig. 1-4.

Diagnosis. Length: about 100 mm; segments: 95-125. Setae all bifid, anterior setae with upper tooth slightly longer and thinner than lower, 3-5 (4) per bundle; posterior setae with upper tooth shorter and thinner than lower, 1-3 per bundle. Penis sheaths present, somewhat flask-shaped, enlarged basally with a distal head plate set at 90° to the shaft of the penis; length-width ratio 1.2-2.6; muscle bands of penis sacs appearing circular. Ejaculatory ducts very elongate joining long tubular atria, each with a small stalked prostate. Vasa deferentia very long of undetermined length.

Distribution and Habitat. North America (Florida, Louisiana, Tennessee). This species occurs in streams with a sand and gravel substrate, hence the etymology, "sand-loving". Distribution is widespread throughout the southeastern United States.

Remarks. The shape of the penis sheath distinguishes it from its congeners and species of *Limnodrilus* with which it was originally associated. Brinkhurst transferred this species to *Varichaetadrilus* in 1986. Although this emendation was referred to in the abstract of the 1986 publication, it was not mentioned in the text and no reason was given for the new combination.

Holmquist (1985) states that an ejaculatory duct is absent in this genus. The reference given by Loden (1977) and Brinkhurst and Kathman (1983) to the very long ejaculatory ducts of the respective species is a matter of interpretation since the atria of *Varichaetadrilus* are relatively long and more or less undifferentiated from the "ejaculatory duct". The circular muscle fibers of the penis sac described for *V. psammophilus* may have been the basis for Brinkhurst (1986) to exclude it from *Limnodrilus* which have elongate, spiral muscle fibers. The very long vasa deferentia may have also been a contributing factor.



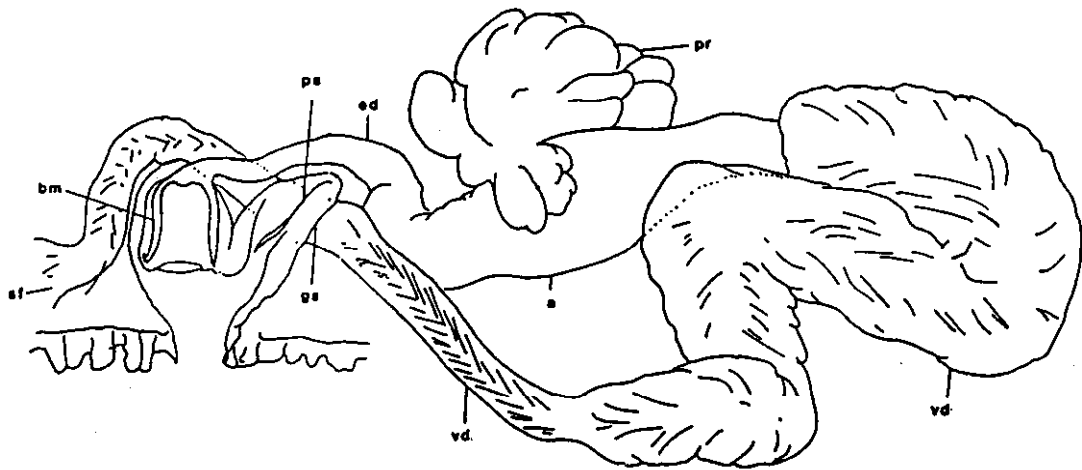
Varichaetadrilus psammophilus: (after Loden, 1977) A, anterior seta; B, posterior seta; C, penis sheath; D, male reproductive system.

Genus. *Haber* Holmquist, 1978

Type Species. *Tubifex speciosus* Hrabé, 1931.

Diagnosis. Dorsal setae include smooth or serrate hairs, and bifid or pectinate crotchets. Ventral setae all bifid. Modified spermathecal and penial setae present: thin and hollow-tipped. Cuticular penis sheaths absent, but a thick basal membrane resembling a penis sheath is present lining the internal canal of each penis; narrow ejaculatory ducts present. Prostates generally attached to atria medially. Vasa deferentia generally bipartite, each composed of a wide ectal and narrow ental section entering atrium apically. Spermatzeugmata well developed.

Remarks. *Haber speciosus* is the only species of this genus represented in North America, and has only been collected from coastal Atlantic states. It is the only North American oligochaete with hollow-tipped spermathecal and penial setae, and a thickened penial membrane resembling a cuticular penis sheath.



Haber speciosus: (after Milligan, 1986) male genital system.

***Haber speciosus* (Hrabe, 1931)**

Tubifex speciosus Hrabe, 1931:22-24.

Diagnosis. Length: 10-15 mm; segments: 40-107. Anterior dorsal bundles comprised of 1-3 (4) smooth or serrate hairs, and 1-4 (5) pectinate setae with lateral teeth of equal length and up to 8 intermediate teeth. Posterior dorsal bundles with 1 (2) hairs about twice as long as the body width, and 1 (2,3) bifid or pectinate setae. Ventral setae all bifid with upper tooth about as long as, but thinner than, lower, 3-8 per bundle anteriorly and 1-3 posteriorly. Spermathecal and penial setae present; thin and hollow-tipped, 1 per "bundle". Penis with short cylindrical thickened membrane resembling a cuticular penis sheath.

Distribution and Habitat. Europe, North America (New York, Maryland, South Carolina, Florida). The North American material was all collected from streams with a high conductivity.

Remarks. The hollow-tipped spermathecal and penial setae, thickened short cylindrical penial membrane and long hairs in the posterior segments differentiate this species from all other tubificids. Milligan (1986) reviewed this genus. Two "forms" were delineated for the North American fauna. The "fluminialis" form was described based on specimens from New York, Maryland, and South Carolina. The "simsi" form was based on material from Florida and England. The distinction is based on number and morphology of the anterior pectinate and ventral bifid setae: pectinations are more distinct and the upper tooth of the ventrals are stouter in "simsi".

This species is common throughout Florida, generally collected in conjunction with *Psammoryctides convolutus*. Immature specimens of *Haber* are readily separated from most other tubificids with hair setae because of their very long posterior hairs.



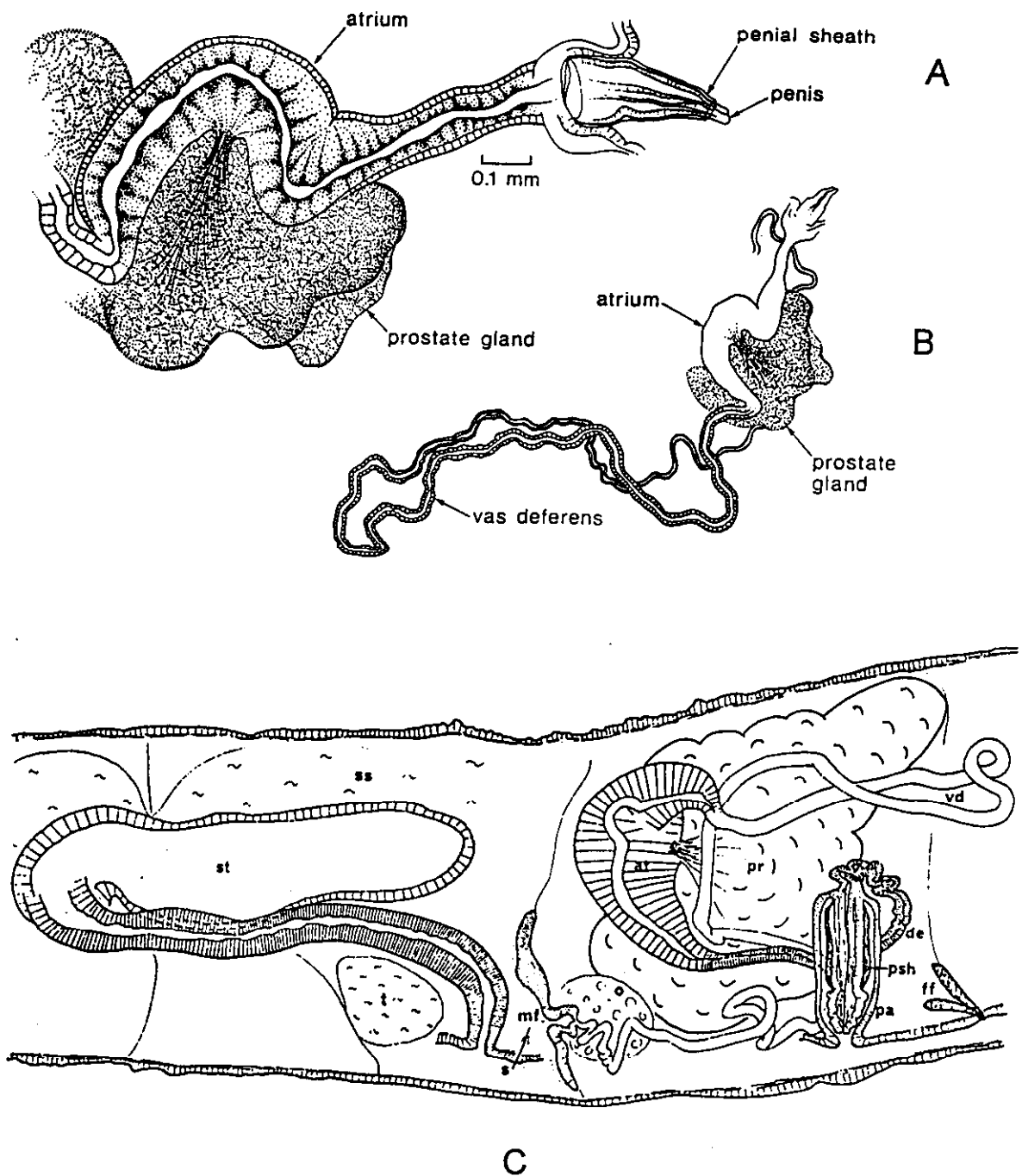
Haber speciosus: (after Brinkhurst, 1981) A, thickened basement membrane of penis; B, anterior dorsal setae; C, anterior ventral setae; D, posterior ventral setae; (after Milligan, 1986) E, penial/spermathecal seta.

Genus. *Spirosperma* Eisen, 1879

Type Species. *Spirosperma ferox* Eisen, 1879:10.

Diagnosis. Prostomium retractable. Body wall with circles of large sensory papillae on each segment, with or without attached foreign matter. Dorsal setae include broad, sabre-like hairs and bifid or pectinate crotchets, the latter frequently lyre-shaped. Ventral setae usually bifid but may be simple-pointed in some or all bundles. Modified spermathecal setae with hollow-tips may be present. Penes elongate in large sacs. Thin cuticular penis sheaths may be present; ejaculatory ducts variable; atria large, crescent-shaped, each with a large prostate attached medially, vasa deferentia long, often differentiated into a narrow ental portion and wide ectal region.

Remarks. This genus was originally part of the large *Peloscolex* Leidy, 1851 complex which was critically revised based on Holmquist's (1978) extensive scrutiny. Holmquist included only those species with a "cutaneous cover and strong head retractors", dorsal setae including hairs and pectinates, ventral setae all bifid, and thin cuticular penis sheaths. Brinkhurst (1981) expanded the diagnosis of *Spirosperma* to include those species with simple-pointed ventral setae, modified spermathecal setae and crescent-shaped atria with elongate ejaculatory ducts with or without cuticularized penis sheaths. As a result the genera *Embolocephalus* Randolph, 1892 and *Orientodrilus* designated by Holmquist (1978) were reduced to the subgenus *Spirosperma* (*Embolocephalus*). The 3 species expected to occur in Florida represent both subgenera established by Brinkhurst (1981). *Spirosperma* sensu stricto includes *S. (S.) ferox* and is defined by lacking simple-pointed ventrals and modified spermathecal setae; dorsal setae include hairs and pectinates; cuticular papillation variable; penis sheaths present. *Spirosperma* (*Embolocephalus*) represented by *S. (E.) carolinensis* and *S. (E.) nikolskyi* is defined by the presence of simple-pointed ventral setae, modified spermathecal setae, and bifid or pectinate crotchets and hair setae present in dorsal bundles; cuticular penis sheaths are absent (as defined by Brinkhurst [1981]; however, they are present in both species listed herein [see Brinkhurst, 1986]). *Spirosperma* (*E.*) *nikolskyi* is represented in North America, but not expected to occur in Florida because it primarily inhabits cold, oligotrophic profundal habitats (uncommon in Florida). But it has been reported from Alabama, Georgia, Mississippi, Louisiana, and Tennessee (Klemm, 1985). These reported distributions may have been the result of misidentifications. To eliminate that possibility, the species description of *S. (E.) nikolskyi* is presented and included in the present key .



Spirosperma nikolsky: (after Brinkhurst, 1981) A and B, genital organs; (after Holmquist, 1978) C, genital organs of *Spirosperma ferox*

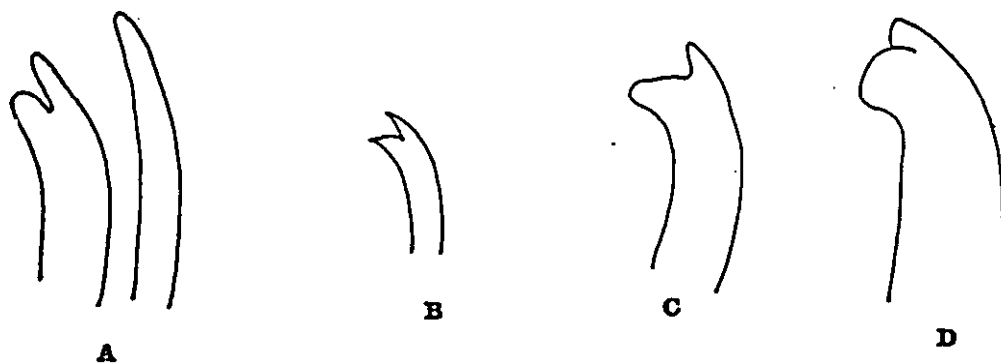
***Spirosperma carolinensis* (Brinkhurst, 1965)**

Peloscolex carolinensis Brinkhurst, 1965:137-138, Fig. 6K-6N.

Diagnosis. Length: 15 mm; segments: 60. Prostomium and I retractable. Body wall closely covered with papillae. Dorsal bundles composed of 3-6 hairs anteriorly (up to 8 posteriorly) and 1-2 bifids with minute tips. Ventral setae of II-VIII or IX with 1 simple-pointed and 1-2 bifid setae with upper tooth longer than lower; from IX or X, 1 seta per "bundle" with upper tooth shorter and much thinner than the broad lower tooth. Modified spermathecal setae present, hollow-tipped. Thin penis sheaths present.

Distribution and Habitat. North America (North and South Carolina). Commonly occurs in moderately polluted habitats where it can be abundant, but rarely found in oligotrophic and grossly polluted environments.

Remarks. This species belongs to the group of former *Peloscolex* species with a retractable prostomium, cuticular papillae, hairs, and penis sheaths. The presence of modified spermathecal setae and simple-pointed anterior ventrals separates it from *S. ferox*. It is separable from *S. nikolskyi* by having simple-pointed ventrals in II-VIII (or IX) instead of just II-III or IV as in the latter. See remarks for the genus for a more comprehensive discussion.



Spirosperma carolinensis: (after Brinkhurst, 1965) A, ventral setae from VII; B, ventral seta of X (immature); C, ventral seta of XII; D, ventral seta of XV.

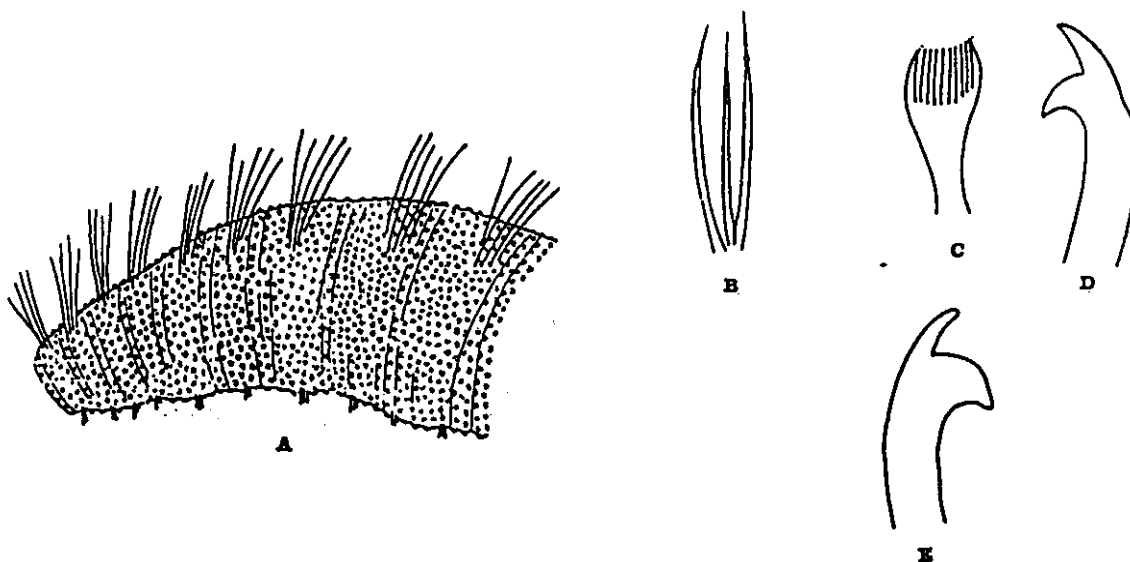
Spirosperma ferox Eisen, 1889

Spirosperma ferox Eisen, 1879:10.

Diagnosis. Length: 15-40 mm; segments; about 50. Prostomium and I retractable. Body wall with or without close papillation. Dorsal bundles composed of up to 7 sabre-shaped hairs and up to 5 lyre-shaped pectinate setae. Ventral setae all bifid, anterior setae with upper tooth slightly longer than lower, up to 7 per bundle; posteriorly, upper tooth shorter and much thinner than the broad lower tooth. Modified genital setae absent. Thin penis sheaths present but difficult to discern if papillae are present.

Distribution and Habitat. Holarctic. May be abundant in moderately enriched habitats, but uncommon in oligotrophic or grossly polluted environments. Reported from the Great Lakes to Louisiana in the eastern United States. Relatively uncommon, but may occur in the Panhandle.

Remarks. The lack of modified spermathecal setae and simple-pointed ventrals distinguish this species from the other former *Peloscolex* species expected in Florida. Papillae may be shed; therefore, some specimens may occasionally be collected without this cuticular covering, but the retractable prostomium is a very distinctive character for most species with papillae, and is always evident. The anterior ventral setae may have a small intermediate tooth. See remarks for the genus for a more complete discussion.



Spirosperma ferox: (after Hrabe, 1954) A, anterior region of body; (after Brinkhurst, 1965) B, dorsal hair setae; (after Brinkhurst and Jamieson, 1971) C, dorsal pectinate seta; (after Hrabe, 1954) D, anterior ventral seta; (after Brinkhurst, 1986) E, posterior ventral seta.

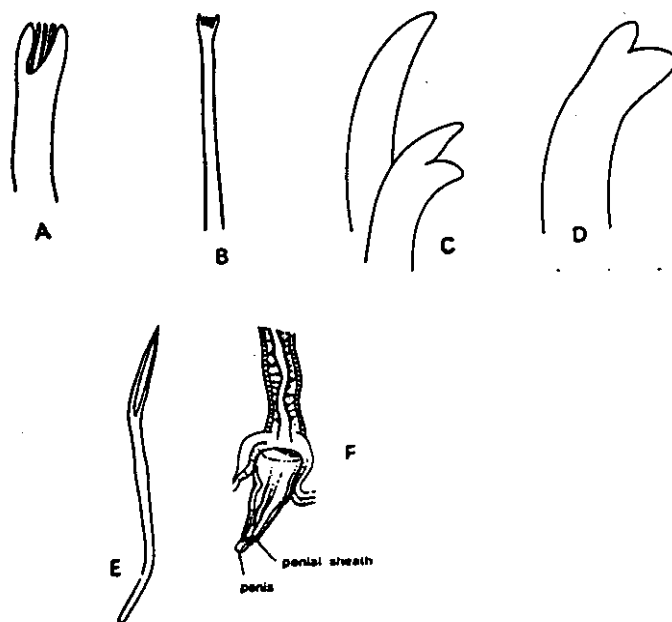
Spirosperma nikolskyi (Lastockin and Sokolskaya, 1953)

Peloscolex nikolskyi Lastockin and Sokolskaya, 1953:409, Fig. 1.

Diagnosis. Length: 20-40 mm; segments: more than 32. Prostomium retractable. Body wall closely covered with papillae. Dorsal bundles comprised of 2-4 hairs and 2-4 hair-like setae with minute bifid or pectinate tips. Ventral setae of II-III or IV with 1-2 simple-pointed setae and 1-2 bifid setae with upper tooth longer than lower; from IV or V one seta per "bundle" which may have a longer upper tooth than lower or the upper tooth may become progressively shorter and thinner than the broad lower tooth. Modified spermathecal setae present, hollow-tipped. Thin penis sheaths present.

Distribution and Habitat. Widespread. Uncommon throughout North America (Great Lakes, Alabama, Alaska, Pennsylvania, Georgia, Louisiana, Mississippi, North Carolina, Oregon, Tennessee, Washington). May be abundant in cold, oligotrophic profundal regions.

Remarks. See Remarks for the genus for further information. None of the species of *Spirosperma* has been reported from Florida waters to date.



Spirosperma nikolskyi: (after Brinkhurst, 1981) A, anterior dorsal pectinate; B, posterior dorsal pectinate; C, anterior ventral setae; D, posterior ventral seta; E, spermathecal seta; F, distal portion of male duct.

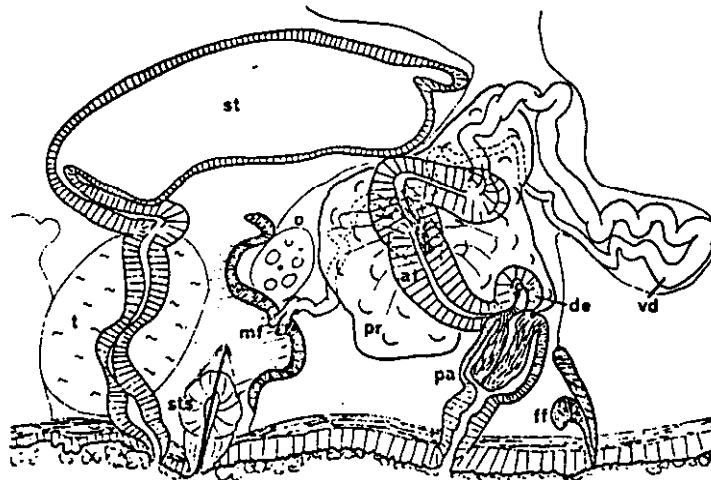
Genus. *Quistadrilus* Brinkhurst, 1981

Type Species. Embolocephalus multisetosus Smith, 1900.

Diagnosis. Prostomium and I retractable. Circlets of prominent papillae and small papillae on body wall. Dorsal bundles composed of numerous hairs and pectinates. Modified genital setae absent. Penis sheaths absent; ejaculatory ducts absent; atria are broad and curved over the entally-attached prostates; vasa deferentia long and winding of uniform width, attached apically to atria.

Distribution and Habitat. Common in large rivers throughout eastern North America (St. Lawrence, Great Lakes, Mississippi River, Ohio River). Occurs in greatest densities in organically enriched habitats. Found in the Panhandle in Florida.

Remarks. The male efferent ducts are distinctive and distinguish *Quistadrilus* from other genera in this complex. *Quistadrilus* differs from the closely related *Spirosperma* by having very large papillae and more numerous dorsal setae. Although these characters are shared by one species of *Spirosperma*, *S. stankovici* (Hrabe, 1931), *Quistadrilus* lacks spermathecal setae, penis sheaths, simple-pointed ventral setae, and the prostate is attached to the atrium entally rather than medially. This combination of characters, in addition to body wall papillae, readily separates this taxon from all others.



Quistadrilus multisetosus: (after Holmquist, 1978) genital organs.

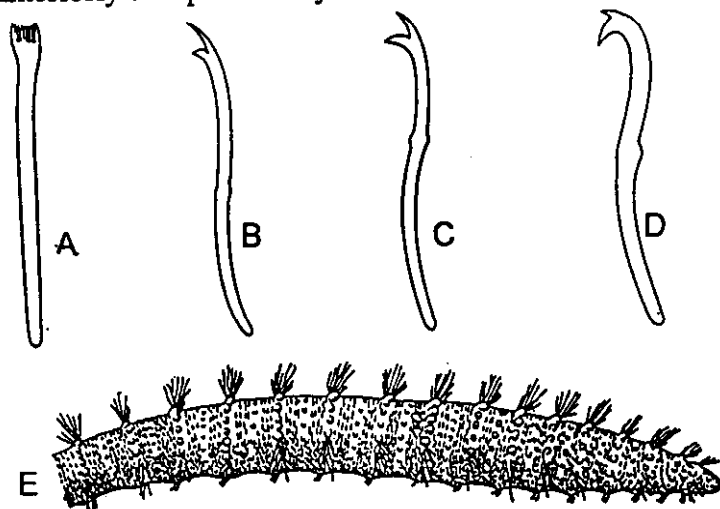
Quistadrilus multisetosus (Smith, 1900)

Embolocephalus multisetosus Smith, 1900a:452, Plate XXXIX, fig. 1-5.

Diagnosis. Length: 19-25 mm; segments: 49-106. Prostomium and I retractile. Body wall covered with a sheath of papillae; papillae in 2 rows, a row of large sensory papillae, or "tubercles" around the body in the line of the setae, and a second row in between the setal rows, the latter row consists of small papillae anteriorly. Dorsal bundles composed of 3-14 hairs and 1-5 pectinate lyre-shaped setae with fine intermediate teeth. Ventral setae all bifid with upper tooth longer and thinner than lower anteriorly (and posteriorly in the longidentata form), 2-3 per bundle; posteriorly with upper tooth reduced and lower tooth becoming strongly recurved. Modified genital setae and penis sheaths absent.

Distribution and Habitat. Common in large rivers throughout eastern North America (St. Lawrence, Great Lakes, Mississippi River, Ohio River, and British Columbia). Occurs in greatest densities in organically enriched habitats. Recently found in the Panhandle of Florida.

Remarks. Retractable prostomium, rows of large encircling sensory papillae, numerous dorsal setae, ventral setae all bifid and lack of modified genital setae, and penis sheaths identify this species. This genus was divided into 2 subspecies by Brinkhurst and Cook (1966) based on the morphology of the posterior ventral setae:
Q. multisetosus multisetosus has a recurved lower tooth and reduced upper tooth. *Q. multisetosus longidentata* has a longer upper tooth anteriorly and posteriorly.



Quistadrilus multisetosus: (after Stimpson et al, 1982) A, anterior pectinate seta; B, posterior ventral seta (in var. *longidentata*); C, anterior ventral seta; D, posterior ventral seta (typical); (after Brinkhurst and Jamieson, 1971) E, anterior end of worm.

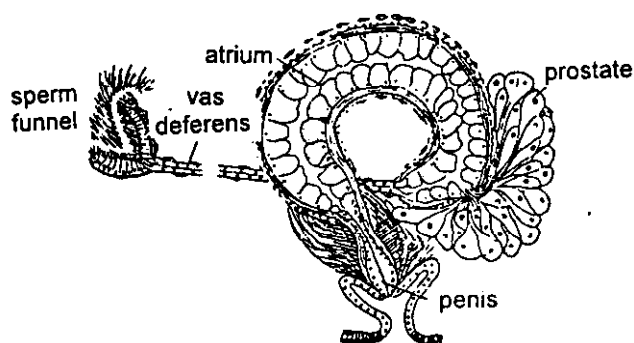
Genus. *Aulodrilus* Bretscher, 1899

Type Species. *Aulodrilus limnobius* Bretscher, 1899.

Diagnosis. Dorsal setae variable, bundles may include hairs, pectinates, bifids, or oar-shaped setae. Modified penial setae spoon-shaped or absent. True penes present lacking penis sheaths; ejaculatory ducts absent; atria elongate, cylindrical with stalked prostates; vasa deferentia short or very short. Sperm not organized as spermatzeugmata, but are in loose bundles.

Remarks. Many species within this genus can be identified by the uniquely shaped dorsal setae. Species of *Aulodrilus* reproduce asexually, and frequently have reproductive organs relocated anteriorly 1 or 2 segments.

Five species of *Aulodrilus* may occur in Florida, but only *A. pigueti* is widespread and may be the dominant benthic invertebrate in many aquatic habitats.



Aulodrilus limnobius: (after Chekanovskaya, 1962) genital organs.

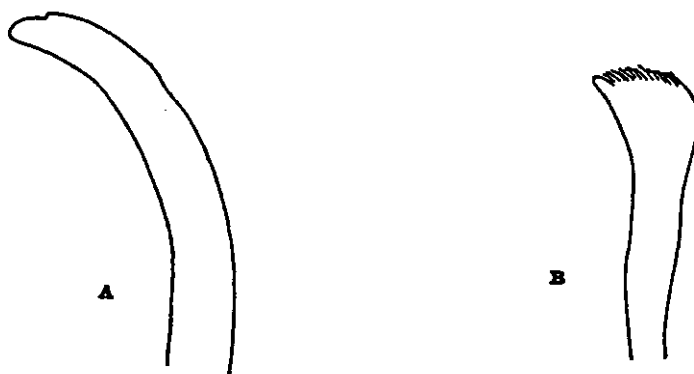
***Aulodrilus americanus* Brinkhurst and Cook, 1966**

Aulodrilus americanus Brinkhurst and Cook, 1966:19, Fig. 7R-7S.

Diagnosis. Length: 10-15 mm; segments: about 100. Anterior bundles composed of up to 10 more or less simple-pointed setae which may have a rudimentary tooth or teeth. From VI, all setae palmate with a series of small distal teeth, about 8 per bundle, reduced in number posteriorly. Modified genital setae absent.

Distribution and Habitat. North America (generally eastern United States, but has been reported from British Columbia to Quebec, and the Great Lakes to the Panhandle of Florida.) Occurs in lakes and rivers and can tolerate some organic enrichment. Uncommon in Florida, but specimens have been collected from Escambia County in the Panhandle.

Remarks. This species is readily distinguished from its congeners by the lack of hair setae and distinctive palmate dorsals.



Aulodrilus americanus: (after Brinkhurst and Cook, 1966) A, anterior seta; B, posterior seta.

***Aulodrilus limnobius* Bretscher, 1899**

Aulodrilus limnobius Bretscher, 1899:388.

Diagnosis. Length: 12-15 mm; segments: 80. Anterior bundles composed of up to 10 bifid setae with the upper tooth shorter and thinner than lower; setae of anterior-most segments shorter, thicker and more strongly curved than the rest. All setae of mid and posterior segments with lateral wings at right angles to the plane of the teeth, which are reduced. Modified genital setae absent.

Distribution and Habitat. North and South America, Africa. North American distribution includes Alabama, Louisiana, North and South Carolina, Tennessee, and Wisconsin. Florida distribution is generally limited to north of Lake Okeechobee. Lives in tubes.

Remarks. The lack of hair setae, but presence of uniquely shaped winged setae of the mid and posterior region distinguishes this species. The lateral wings are easily overlooked when viewed laterally, but the anterior setae with the reduced upper tooth are characteristic.



Aulodrilus limnobius: (after Brinkhurst and Cook, 1966) A, side view of seta from a median segment; B, face view of seta from a median segment.

Aulodrilus paucichaeta Brinkhurst and Barbour, 1985

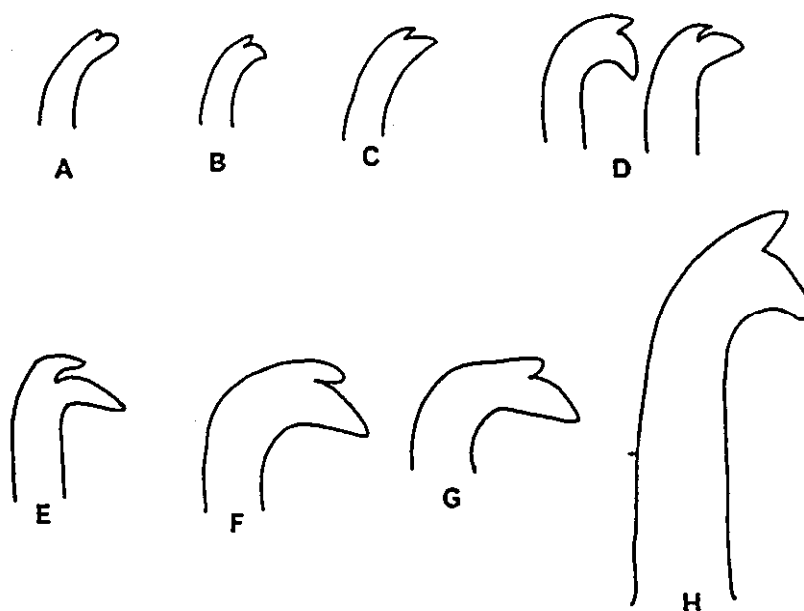
Aulodrilus paucichaeta Brinkhurst and Barbour, 1985:931-934, Fig. 1.

Diagnosis. Length: more than 50 mm; segments: more than 100. Anterior setae bifid with upper tooth shorter and thinner than lower; setae progressively enlarging to IX, 2-3 per bundle; postclitellar setae each with a short upper tooth and a thick recurved lower tooth, 1 per "bundle". Genital setae absent.

Distribution and Habitat. North America. Known only from type locality, a creek near Washington, D.C., and possibly from North Carolina.

Remarks. The lack of hairs and gradually enlarging setae posteriorly, developing a recurved lower tooth distinguishes this species.

This is a very uncommon worm, but its possible presence (indicated by immature specimens) in North Carolina suggests the possibility, however remote, of it being collected from northern Florida.



Aulodrilus paucichaeta: (after Brinkhurst and Barbour, 1985)
setae from (all the same scale): A, II; B, III; C, IV; D, V; E,
VII; F, IX; G, XI; H, posterior seta.

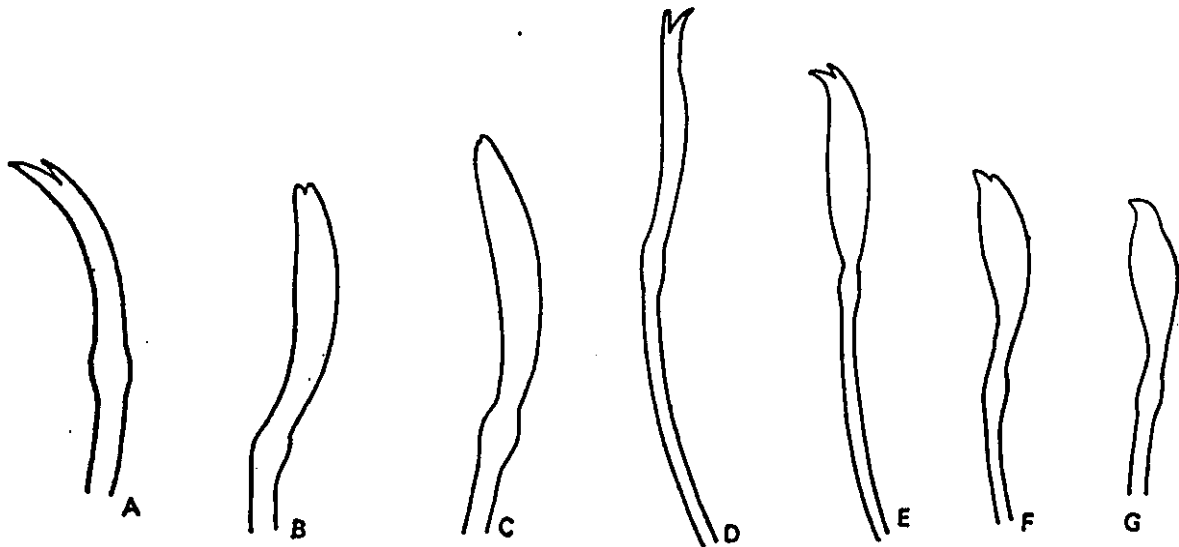
Aulodrilus pigueti Kowalewsky, 1914

Aulodrilus pigueti Kowalewsky, 1914:25, Fig. 12.

Diagnosis. Length: 2-28 mm; segments: 100. Dorsal bundles of II-VII usually with 4-5 (up to 10) bifid setae with upper tooth shorter and thinner, hair setae absent; from about VI, 2-5 hairs and about 4-5 oar-shaped bifids with very reduced teeth. Ventral setae all bifid, similar to anterior dorsals, 4-7 per bundle anteriorly, 5 per bundle posteriorly. Modified penial setae present: hollow, spoon-shaped; 2 per bundle.

Distribution and Habitat. Cosmopolitan. Europe, Asia, North and South America. Next to *Limnodrilus hoffmeisteri*, this is the most common tubificid in Florida. Occurs in a wide variety of habitats. Lives in tubes.

Remarks. Anterior setae with reduced upper tooth, and hairs and oar-shaped setae beginning about VI distinguish this species from the other species of *Aulodrilus*. This species has a characteristic stubby prostomium, the setae are arranged in fan-shaped bundles, and the body surface frequently has scattered particles of silt adhering to the surface.



Aulodrilus pigueti: (after Kowalewsky, 1914) A, ventral seta of XXI; B, C, oar-shaped setae of XXV; D, E, F, G, variations of dorsal setae from XV.

Aulodrilus pluriseta (Piguet, 1906)

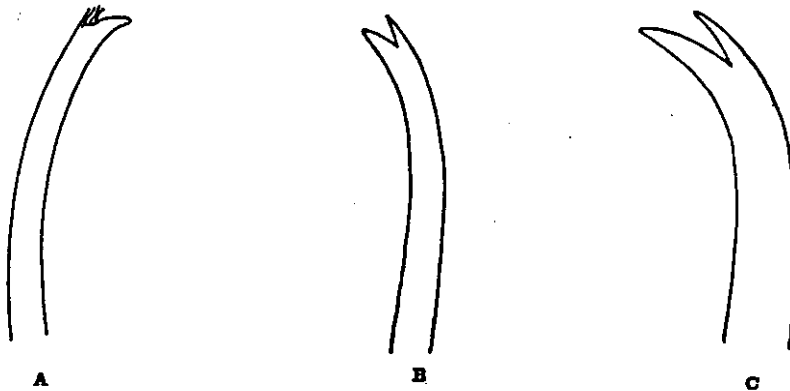
Naidium pluriseta Piguet, 1906:218.

Diagnosis. Length: 10-25 mm; segments: 65-105. Anterior dorsal bundles with up to 8 short, bayonet-shaped hair setae and up to 10 bifid setae which may have 1 or more short, thin upper teeth. Ventral setae all bifid with upper tooth shorter and thinner than lower, up to 16 per bundle. Genital setae absent.

Distribution and Habitat. Cosmopolitan. Europe, Asia, North America. Occurs in a wide variety of habitats, but most abundant in enriched environments with silty substrates. Not yet reported from Florida, but has been reported south to Mexico.

Remarks. The numerous hairs and bifids which may have an intermediate tooth comprising the dorsal bundles, and up to 16 bifids in the ventral bundles separate this species from other *Aulodrilus* species. Hrabe (1981) has also reported *Aulodrilus japonicus* with an occasional dorsal tooth on the dorsal crotchets, however, the male pores are on VII in *A. pluriseta*, whereas they are on X in *A. japonica*.

If the posterior end is missing, this species may be confused with *Branchiura sowerbyi*, but the upper tooth of *A. pluriseta* is much thinner than that of *B. sowerbyi*.



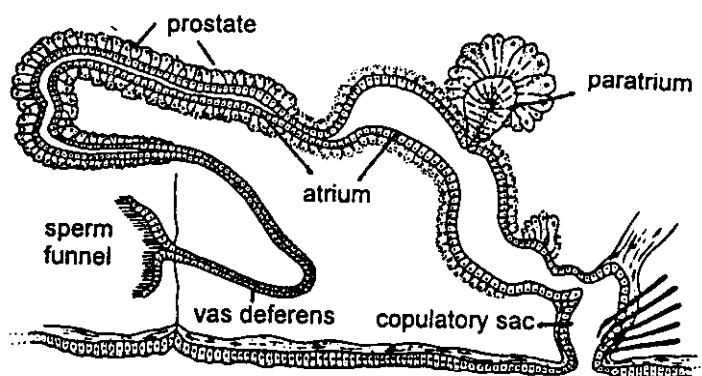
Aulodrilus pluriseta: (after Brinkhurst and Jamieson, 1971) A, dorsal seta from median segment; (after Hrabe, 1954) B, dorsal seta from II; C, ventral seta from IV.

Genus. *Bothrioneurum* Štolc, 1888

Type Species. *Bothrioneurum vej dovskyanum* Štolc, 1888.

Diagnosis. Prostomium with a mid-dorsal pore opening into a sensory pit. Coelomocytes large, abundant. Hair setae absent, all setae bifid with upper tooth longer than lower in anterior segments. Penial setae present or absent. Right and left atria discharge into a common copulatory sac which opens exteriorly through an unpaired male genital chamber (pores may be separate), eversible pseudopenes present, blind tubular glands (paratria) also open into copulatory sac; atria tubular, covered proximally with diffuse prostate cells; vasa deferentia very short. Spermathecae absent; spermatophores attached externally.

Remarks. The prostomial sensory pit is unique to this genus. All setae are bifid which suggested to Brinkhurst (1965) that *Bothrioneurum* is most probably frequently confused with *Limnodrilus*. The median male genital pore, external spermatophores, modified penial setae, abundant coelomocytes, and lack of spermathecae further distinguish *Bothrioneurum* from all other genera.



Bothrionurum sp.: (after Baker and Brinkhurst, 1981) male genitalia.

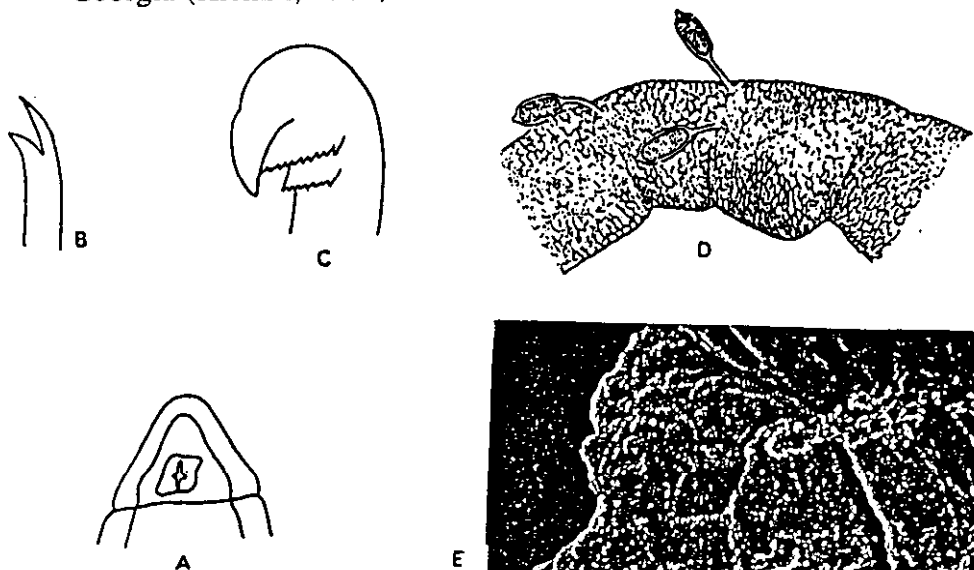
Bothrioneurum vej dovskyanum Štolc, 1888

Bothrioneuron vej dovskyanum Štolc, 1888:43, Plate I, fig. 8,9, Plate II, fig. 5,9, Plate IV fig. 6-11,13e.

Diagnosis. Length: 28-35; segments: to 140. Prostomium with mid-dorsal ciliated sensory pit. Coelomocytes abundant. Anterior setae all bifid with upper tooth longer and thinner than lower, 3-4 per bundle; teeth of equal length in mid and posterior body, 3 per bundle in mid-region and 2 per bundle posteriorly. Penial setae with highly falcate distal end bearing 2 rows of denticles. Single median male pore. External spermatophores attached to genital segments.

Distribution and Habitat. Asia, Europe, Africa, North America (Great Lakes, Indiana, Illinois, New York, Ohio, Wisconsin, British Columbia, Quebec). Most abundant in large rivers with a coarse sand substrate.

Remarks. This species is very similar to *B. americanum* which is a South American species. The latter species lacks penial setae, has 4-8 setae per bundle anteriorly and the male pores are separate. These differences may be insufficient to differentiate the 2 on a specific level, and they are considered possible synonyms by Brinkhurst (1986) and Brinkhurst and Marchese (1987). *Bothrioneurum americanum* Beddard, 1894 has been reported from Louisiana and Georgia (Klemm, 1985).



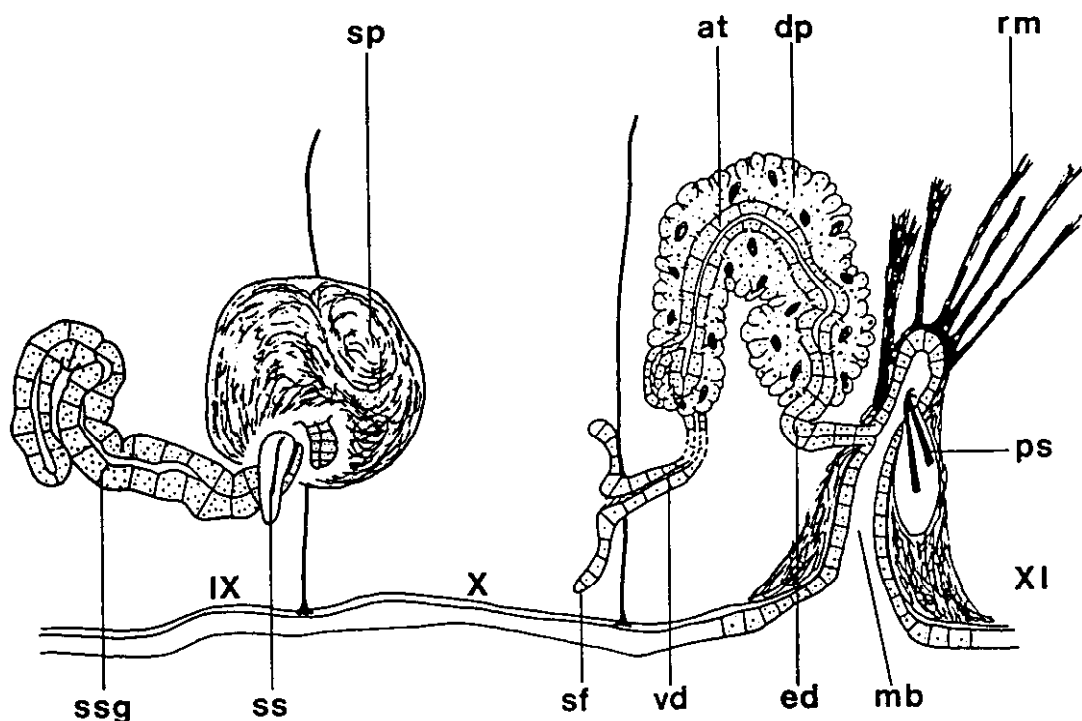
Bothrioneurum vej dovskyanum: (after Brinkhurst and Jamieson, 1971) A, anterior end of worm with prostomial pit; (after Chen, 1940) B, anterior seta; C, distal end of penial seta; D, anterior body region with spermatophores adhering to cuticle; (after Brinkhurst, 1986) E, anterior end of worm with prostomial pit.

Genus. *Rhizodrilus* Smith, 1900

Type Species. *Rhizodrilus lacteus* Smith, 1900.

Diagnosis. Coelomocytes large and abundant. Anterior setae all bifid, posterior setae bifid or simple-pointed. Modified spermathecal and/or penial setae present. Male genitalia terminating in either a pair of ejaculatory ducts which exit on the inner aspect of large ventrolateral papillae, into a median copulatory bursa or as 2 eversible pseudopenes opening into a median copulatory bursa; atria tubular with diffuse prostates; vasa deferentia very short entering atria apically or subapically. Spermathecae at least partially occupying IX, as well as, or instead of, X. Sperm as loose bundles.

Remarks. *Rhizodrilus* was re-established by Baker and Brinkhurst (1981) as 1 of the 3 genera previously comprising *Monopylephorus* Levinsen, 1884. *Monopylephorus* differs from *Rhizodrilus* by lacking modified genital setae. *Rhizodrilus lacteus* is the only representative of this genus in North America and an unconfirmed specimen has reportedly been collected in Florida.



Rhizodrilus lacteus: (after Baker and Brinkhurst, 1981) male genitalia.

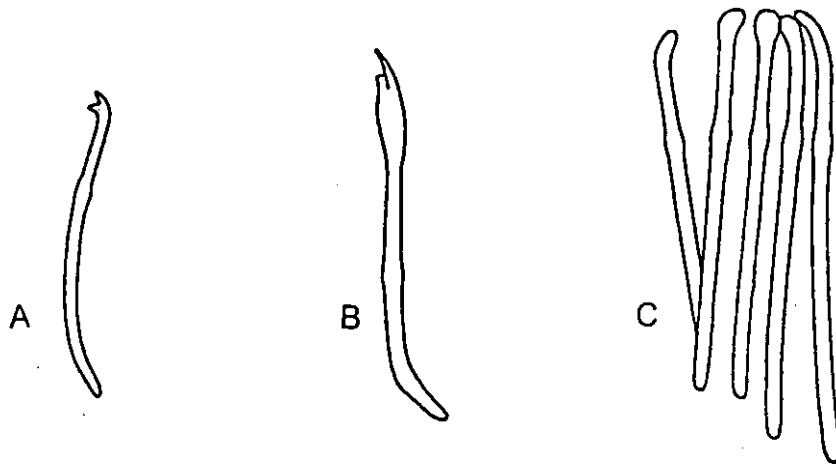
***Rhizodrilus lacteus* Smith, 1900**

Rhizodrilus lacteus Smith, 1900a:444, Plate III, fig. 45, Plate XL, fig. 6-8.

Diagnosis. Coelomocytes abundant. Setae all bifid; dorsals and ventrals similar in size, shape and number, 5-6 per bundle anteriorly, 1-4 posteriorly; lower tooth broader than upper. Ventral setae of IX simple-pointed, large, spatulate; ventrals of X normal or modified as in IX; 4-6 penial setae per bundle in XI with thickened, rounded tips. Paired male genitalia terminate in ejaculatory ducts which penetrate the walls of a median copulatory bursa. Spermathecal pores small, paired, in setal line of IX/X.

Distribution and Habitat. North America (Illinois, South Carolina). This is a very uncommon species which may have been collected in central Florida.

Remarks. This species is unique having the spermathecal setae shifted forward to IX, and the large number of penial setae.



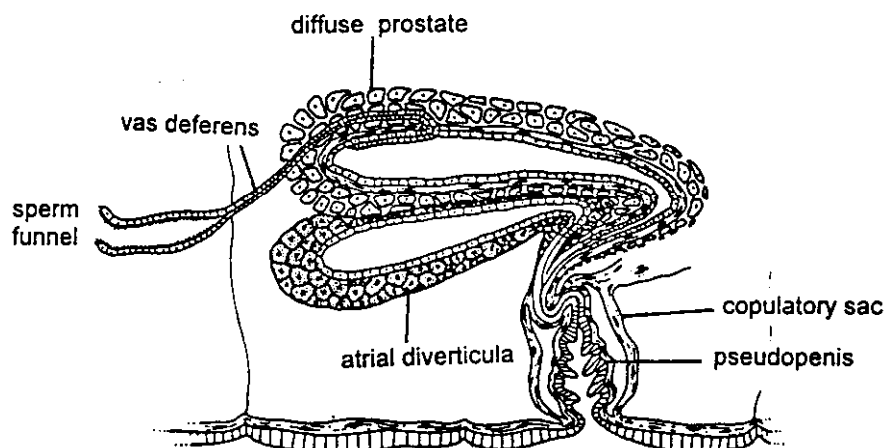
Rhizodrilus lacteus: (after Smith, 1900a) A, ordinary seta; B, spermathecal seta; C, penial setae.

Genus. *Branchiura* Beddard, 1892

Type Species. *Branchiura sowerbyi* Beddard, 1892.

Diagnosis. Gills present on posterior segments. Dorsal setae include hairs and bifids which may have a rudimentary lower tooth appearing simple-pointed, or single intermediate tooth. Eversible pseudopenes present; ejaculatory ducts present; atria covered with prostate cells, atrial diverticulae present; short vasa deferentia present. Spermathecae paired.

Remarks. This monospecific genus is unique among the tubificids. No other tubificid has dorsal and ventral gills.



Branchiura sp.: (after Baker and Brinkhurst, 1981) male genitalia.

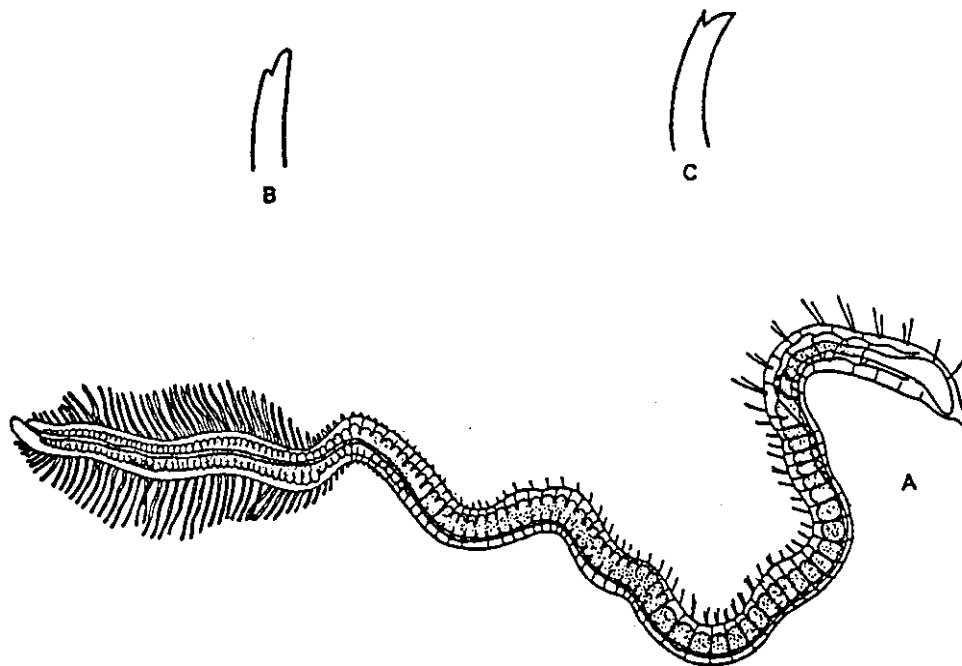
***Branchiura sowerbyi* Beddard, 1892**

Branchiura sowerbyi, Beddard, 1892:325, Plate XIX, fig. 1-15.

Diagnosis. Length: 38-185 mm; segments, 74-270. Dorsal and ventral gill filaments present on posterior segments. Dorsal anterior bundles comprised of 1-3 short hair setae and 11-12 bifid setae which may have a single intermediate tooth or the upper tooth may be rudimentary or absent. Ventral bundles with 10-11 bifid setae which also show a tendency toward the simple-pointed condition. Genital setae absent.

Distribution and Habitat. Cosmopolitan. Europe, South Africa, Australia, South and North America. Generally inhabiting rivers and known to thrive in heated effluents in Europe.

Remarks. This is a large worm easily recognized by the short hairs, numerous bifid setae which lend toward a simple-pointed condition, and the obvious dorsal and ventral posterior gill filaments. If the posterior end with the associated gill filaments is not present, this species may be mistakenly identified as *A. pluriseta*. See Remarks for *A. pluriseta* for additional information.



Branchiura sowerbyi: (after Beddard, 1892) A, entire worm; (after Chen, 1940) B, anterior seta; C, posterior seta.

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