

MARINE TUBIFICIDAE (OLIGOCHAETA) AT HUTCHINSON ISLAND, FLORIDA

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Abstract. — Twenty-five species of marine Tubificidae are recorded from offshore, largely coarse, shelly sediments at Hutchinson Island on Florida's lower central east coast. Nine species are described as new: *Heterodrilus hispidus*, *H. perkinsi* (subfamily Rhyacodrilinae), *Phalldrilus hirsutus*, *Bathydrius ingens*, *B. formosus*, *B. macroprostatu*s, *Coralliodrilus corpulentus*, *Olavius latus* (Phalldrilinae), and *Tubificoides annulus* (Tubificinae). Redescriptions of *Heterodrilus bulbiporus* Erséus, 1981, and *Phalldrilus acochlearis* (Erséus and Loden, 1981), n. comb., are provided. *Heterodrilus bulbiporus*, *H. occidentalis* Erséus, 1981, *H. pentcheffi* Erséus, 1981, and *Adelodrilus magnithecatus* Erséus, 1979, are recorded from Florida for the first time. The Hutchinson Island tubificid fauna comprises a mixture of warm-temperate (American east coast) and tropical (Caribbean) elements.

In 1943, Gates described an intertidal earthworm, *Pontodrilus gracilis* [now regarded as a synonym for *P. litoralis* (Grube, 1855), family Acanthodrilidae; Easton 1984] from the banks of a brackish river at Fort Myers, Florida. However, it was not until the middle of the 1960's that a marine fauna of aquatic oligochaetes was discovered in this part of the southeastern U.S.A. The first, very scanty, records of Tubificidae from marine waters in Florida were given by Brinkhurst (1965, 1966), while Kennedy (1966) used material from off Panama City, Florida, when describing the marine enchytraeid, *Grania americana*.

During a collecting trip to Miami in 1977, the author had the opportunity to gather a rich material of marine oligochaetes in the area just south of the city (largely Biscayne Bay). The Tubificidae dominated this material, and most of the tubificid species have now been accounted for in various taxonomic publications (Erséus 1979a, b, c, 1980a, 1981a, 1982a, b, c, 1983a, 1984b). Additional collections of Tubificidae from other parts of the state have been treated by Erséus (1981b, 1984a), Erséus and Baker

(1982), Erséus and Loden (1981), and Loden (1980). The species thus recorded from Florida to date number 34 (species not asterisked in Table 1).

One enchytraeid species, *Grania monospermathecus* Erséus and Lasserre, 1976, was recently reported from the Miami area by Coates and Erséus (1985), and additional enchytraeid material will be treated elsewhere by the same authors (in preparation).

In 1981, Erséus and Loden reported on a small collection of Tubificidae (four species of the subfamily Phalldrilinae) from subtidal sites off Hutchinson Island on Florida's lower central east coast. The material was obtained in 1976-1977 during a sampling program funded by Florida Power and Light Company (FP&L). The program was a continuation of an earlier, three-year (1971-1974) environmental baseline study conducted in connection with the location of the FP&L St. Lucie Unit No. 1 nuclear power plant on Hutchinson Island. The study was designed to generate a marine ecology data base for the future assessment of possible changes in the environment of the area influenced by the heated effluent

Table 1.—Checklist of marine Tubificidae reported from Florida, with asterisks denoting new records. "Florida only" means species hitherto only reported from Florida. E. = Erséus.

Species	Florida only	Reference
<i>Adelodrilus magnithecatu</i> E., 1979*		present paper
<i>Akteredrilus floridensis</i> E., 1980	x ¹	E. 1980a
<i>Bathydrius adriaticus</i> (Hrabê, 1971)		E. 1979a, 1985
<i>B. formosus</i> , n. sp.*		present paper
<i>B. ingens</i> , n. sp.*		present paper
<i>B. macroprostatus</i> , n. sp.*	x	present paper
<i>Bermudrilus peniatus</i> E., 1979		E. 1984a
<i>Coralliodrilus corpulentus</i> , n. sp.*	x	present paper
<i>Heterodrilus bulbiporus</i> E., 1981*		present paper
<i>H. hispidus</i> , n. sp.*	x	present paper
<i>H. minisetosus</i> E., 1981		E. 1981a; present paper
<i>H. occidentalis</i> E., 1981*		present paper
<i>H. pentcheffi</i> E., 1981*		present paper
<i>H. perkinsi</i> , n. sp.*	x	present paper
<i>Inanidrilus bulbosus</i> E., 1979	x	E. 1979c
<i>I. ernesti</i> E., 1984	x	E. 1984b; present paper
<i>I. extremus</i> (E., 1979)	x	E. 1979b, 1984b
<i>I. mexicanus</i> (E. and Baker, 1982)	x	E. and Baker 1982
<i>I. triangulatus</i> E., 1984	x	E. 1984b
<i>I. vacivus</i> E., 1984	x	E. 1984b, present paper
<i>Kaketio ineri</i> Righi and Kanner, 1979		E. 1980b
<i>Limnodriloides baculatus</i> E., 1982		E. 1982c
<i>L. barnardi</i> Cook, 1974		E. 1982c
<i>L. hastatus</i> E., 1982	x	E. 1982c
<i>L. monothecus</i> Cook, 1974		E. 1982c; present paper
<i>L. rubicundus</i> E., 1982		E. 1982c
<i>L. vespertinus</i> E., 1982		E. 1982c; present paper
<i>Marcusaedrilus hummelincki</i> Righi and Kanner, 1979		E. 1983a
<i>M. luteolus</i> E., 1983		E. 1983a; present paper
<i>Monopylephorus rubroniveus</i> Levinsen, 1884 (= <i>M. helobius</i> Loden, 1980)		Loden 1980; Baker and Brinkhurst 1981

Table 1.—Continued.

Species	Florida only	Reference
<i>Olavius caudatus</i> (E., 1979)	x	E. 1979b, 1984b
<i>O. latus</i> , n. sp.*	x	present paper
<i>O. macer</i> E., 1984	x	E. 1984b
<i>O. tenuissimus</i> (E., 1979)		E. 1979b, 1984b
<i>O. sp. A*</i>	x ²	present paper
<i>O. sp. B*</i>	x	present paper
<i>Parakaketio longiprostatu</i> E., 1982	x	E. 1982b
<i>Phallogdrilus acochlearis</i> (E. and Loden, 1981), n. comb.		E. and Loden 1981; present paper
<i>P. biprostatu</i> (Baker and E., 1979)		E. and Loden 1981; present paper
<i>P. hirsutus</i> , n. sp.*	x	present paper
<i>P. rectisetosus</i> E., 1979		E. 1979b, 1985
<i>P. sabulosus</i> E., 1979		E. 1979b; present paper; E. and Loden 1981
<i>Smithsonidrilus marinus marinus</i> Brinkhurst, 1966	x ³	Brinkhurst 1966; E. 1982a
"? <i>Spiridion insigne</i> Knöllner, 1935" (=indeterminable)	?	Brinkhurst 1965; Brinkhurst and Baker 1979
<i>Tectidrilus bori</i> (Righi and Kanner, 1979)		E. 1982c
<i>T. squalidus</i> Erséus, 1982	x	E. 1982c
<i>Thalassodrilides gurwitschi</i> (Hrabê, 1971)		E. 1981c
<i>Tubificoides annulus</i> , n. sp.*	x	present paper
<i>T. "gabriellae"</i> (not <i>gabriellae</i> Marcus, 1950)	?	Brinkhurst 1965; Brinkhurst and Baker 1979
<i>T. sp.*</i>	?	present paper; Brinkhurst (in preparation)

¹ Known also from Barbados (Erséus unpublished).

² A very similar form, probably the same species, known from Belize (Erséus unpublished).

³ Subspecies *westoni* Erséus, 1982, known from New Jersey, Delaware, Maryland, Virginia, North Carolina, Bermuda, and Bahamas (Erséus 1982a).

discharge of the plant. An introduction to this extensive study was provided by Gallagher and Hollinger (1977), and several reports have been given in *Florida Marine Research Publications* (1977–1979), a series published by the Florida Department of Natural Resources Bureau of Marine Research (FDNR).

During the 1971–1974 sampling program, about 2400 specimens of marine Oligochaeta were collected at five offshore stations within a few kilometers from the FP&L plant site. Through the kind efforts of Mr. Thomas H. Perkins (FDNR), this very large collection was recently made available to the author. However, as a large majority of the specimens proved to be sexually immature and thus very difficult to identify to species in most cases, only those worms with well-developed genital organs, about 400 individuals, were more carefully scrutinized. Almost 90% of the mature oligochaetes examined are members of the Tubificidae, and they are the subject of the present account, which is devoted primarily to the taxonomy of the species. Twenty-two named and three unnamed tubificid species are recognized. Of these, nine are described as new, and four others are reported from Florida for the first time. *Heterodrilus bulbiporus* Erséus, 1981, *H. minisetosus* Erséus, 1981, *Bathydrius ingens*, n. sp., and *B. formosus*, n. sp., are simultaneously reported from the Gulf of Mexico; *B. formosus* is reported also from Belize in Central America.

The enchytraeids in the Hutchinson Island material will be treated separately.

Stations Sampled

The five stations off Hutchinson Island were described by Gallagher and Hollinger (1977), and their sediments more carefully examined by Gallagher (1977). A brief summary is provided here.

Sta 1. 27°22.2'N, 80°14.1'W, at seaward margin of beach terrace, 0.5 km offshore. Depth 6–9 m (mean sampling depth 7.5 m). Gray, hardpacked, fine to very fine sand. *Note:* all oligochaetes here reported from

Sta 1 were from the May 1972 collection, which was taken slightly east (seaward) of the typical Sta 1, in a sediment resembling that of Sta 5 (Gallagher 1977:18).

Sta 2. 27°21.6'N, 80°13.1'W, 1.5 km ENE of Sta 1 in the offshore "trough," approximately midway between the beach terrace and offshore shoal. Depth 9–12 m (mean 11 m). Clean shell hash; very coarse to coarse sand with varying amount of granule-sized shell fraction.

Sta 3. 27°21.9'N, 80°12.4'W, Pierce Shoal, 3 km from Sta 1, in line with Sta 1 and Sta 2. Depth 5–8 m (mean 7 m). Clean, medium sands with very small amount of granule-sized shell.

Sta 4. 27°20.8'N, 80°12.9'W, 1.6 km SSE of Sta 2, 0.6 km W of southernmost tip of Pierce Shoal. Depth 9–12 m (mean 10 m). Shell hash, very similar to sediment of Sta 2, but with lesser amount of large shell.

Sta 5. 27°22.6'N, 80°14.1'W, 2.2 km NNW of Sta 2, 2.1 km E of the beach in similar depth as Sta 4 (9–12 m). Very coarse shell sands with granule-sized shell making up 28–45% of sample, and with some mud.

Material and Methods

Five replicate Shipek grab samples (each 0.04 m²) were taken at each station bi-monthly between September 1971 and July 1973. Samples were preserved in 10% buffered formalin-seawater. For further information on the sampling and sorting procedures, see Gallagher and Hollinger (1977).

Sexually mature tubificids, which occurred in about one-third of the 300 samples, were sorted and separated from the juveniles by the author. A few specimens of *Heterodrilus perkinsi*, n. sp., and *Phalldrilus biprostatus* were longitudinally sectioned and stained with Azan. The remaining worms were all stained in paracarmine and mounted whole in Canada balsam.

Material from other areas included in this study comprises (1) a few worms from offshore localities in the NE Gulf of Mexico, originating from a Bureau of Land Management baseline study by personnel at

Dauphin Island Sea Lab, Alabama (courtesy Dr. M. Susan Ivester); (2) a single specimen of *Bathyrilus ingens*, n. sp., collected by Mr. Michael R. Milligan (Mote Marine Lab, Sarasota, Florida) on the west coast of Florida; (3) a number of specimens of *B. formosus*, n. sp., collected by the late Dr. H. Randall Baker (University of Victoria, B.C., Canada) in the vicinity of Carrie Bow Cay on the barrier reef of Belize in the western Caribbean Sea (courtesy Dr. Ralph O. Brinkhurst). These worms were all studied as whole mounts.

Holotypes of all the new species are deposited at the U.S. National Museum of Natural History (USNM), Washington, D.C.; paratypes (when available) and representative specimens of most of the previously known species are lodged in the Florida Department of Natural Resources Invertebrate Collection (museum prefix FSBC I; = old abbreviation for Florida State Board of Conservation), Bureau of Marine Research, St. Petersburg, Florida.

In descriptions, the following abbreviations are used: sec = sectioned; spm/spms = specimen/specimens; whm = whole-mounted. Length and width measurements refer to fixed, whole-mounted, and slightly compressed specimens. Roman numerals denote segment number.

Abbreviations used in figures are as follows: a, atrium; bs, blind sac; cs, copulatory sac; ep, epidermal pad; fp, flap-like papilla; g, glandular body of unknown function; gs, glands associated with spermathecal seta; m, muscles; mp, male pore; p, penis; pa, papilla; pp, pseudopenis; pr, prostate gland; pr 1, anterior prostate gland; pr 2, posterior prostate gland; ps, penial seta; s, spermatheca; se, seta; ss, spermathecal seta; sz, spermatozeugma; vd, vas deferens.

Descriptions

Subfamily Rhyacodrilinae

Heterodrilus Pierantoni, 1902

Heterodrilus minisetosus Erséus, 1981

Clitellio arenicolus (part).—Lasserre and Erséus, 1976:451–452.

Heterodrilus minisetosus Erséus, 1981a: 113–114, fig. 2.

New material examined.—FSBC I 31852–31853, 2 whm spms from Sta 4 (10 May 1972).—Author's collection: 2 whm spms from Sta 2, 14 from Sta 4; 1 whm spm from NE part of Gulf of Mexico, off Hernando Co., Florida, 28°36'N, 83°30'W, about 25 m, sediment unknown (27 Aug 1977; courtesy M. S. Ivester).

Remarks.—*Heterodrilus minisetosus*, which was described on the basis of extensive material from Bermuda (type locality), Bahamas, Florida (Miami area), North Carolina, and Virginia (Erséus 1981a), was named for the minute penial setae (one at each side of worm) present in most individuals. Specimens from Hutchinson Island lack penial setae (as did most worms from North Carolina and Bahamas in the original material) but otherwise fit the description completely.

Distribution and habitat.—Both coasts of Florida (new record from Gulf coast), North Carolina, Virginia, Bermuda, and Bahamas. Subtidal sands, 0.5–33 mm depth.

Heterodrilus pentcheffi Erséus, 1981

Fig. 1

Clitellio arenicolus (part).—Giere, 1979: 304.

Heterodrilus pentcheffi Erséus, 1981a:121–123, fig. 12.—Erséus, 1984c:196.

Heterodrilus sp.—Erséus, 1981a:123–124, fig. 14.

New material examined.—FSBC I 31854, 3 whm spms from Sta 2 (9 May 1972).—Author's collection: 7 whm spms from Sta 2, 2 from Sta 3, 1 from Sta 4, and 1 from Sta 5.

Remarks.—*Heterodrilus pentcheffi* was originally described on the basis of material from Bermuda, New Jersey, and North Carolina in the Northwest Atlantic, and the Galapagos Islands in the East Pacific (Erséus 1981a; see also Erséus 1984c). The species is characterized by (1) trifid setae in segments II–IX (sometimes –VIII, –X, –XI, or –XII), 2 per bundle, (2) thereafter bifid se-

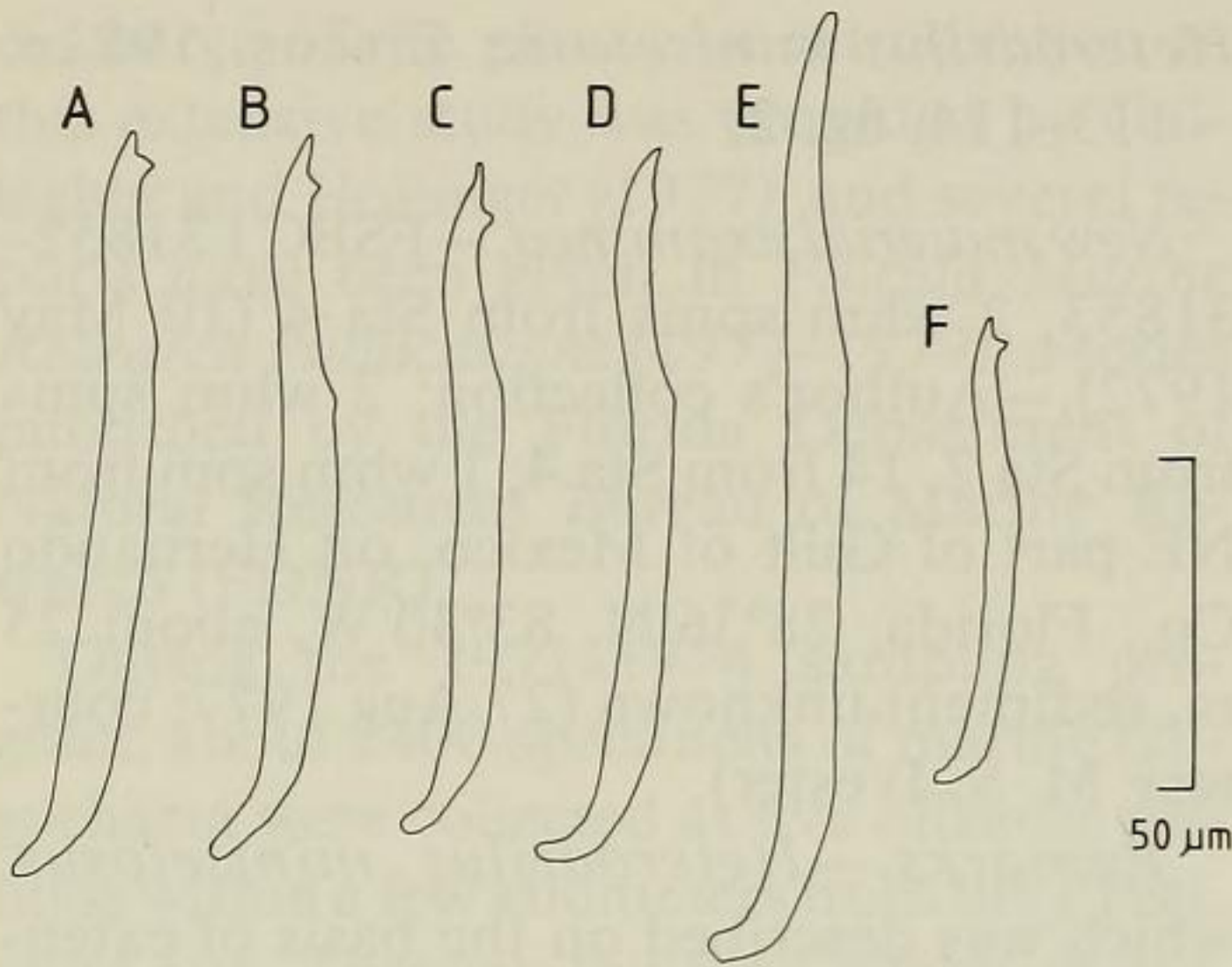


Fig. 1. *Heterodrilus pentcheffi*, postclitellar setae: A, From segment immediately posterior to clitellum; B–E, From various posterior segments; F, From posterior end of worm.

tae, 1 per bundle, with more or less developed lower tooth (cf. Fig. 1), and (3) straight, single-pointed, ectally wide, erect penial setae, 2(3) per bundle. Vasa deferentia are coiled in spirals, and atria are long and cylindrical, generally M-shaped, terminating in simple, somewhat bulbous pseudopenes.

As illustrated in Fig. 1, bifid (postclitellar) setae of the new material are highly variable. In segments immediately posterior to the clitellar region, the lower tooth of the setae is conspicuous, almost as large as the upper one (Fig. 1A), but the lower tooth generally becomes reduced on more posterior setae (Figs. 1B–D), so much so that setae may appear single-pointed, at least from certain angles (Fig. 1E). At the posterior end of the worm, setae become smaller and their bifid nature generally becomes more pronounced again (Fig. 1F).

In fact, the new material from Hutchinson Island has bifid setae very similar to those of the form described as "*Heterodrilus* sp." from Miami (Florida) by Erséus (1981a). This species was tentatively regarded as separate from *H. pentcheffi*, largely also because of its small size. As the new material contains both large (with posterior setae up to 145 μm long) and small specimens (posterior setae only about 45 μm

long), it is now concluded that "*Heterodrilus* sp." is identical to *H. pentcheffi*, and that the Florida populations differ slightly from the more northern forms in terms of the appearance of the postclitellar setae.

Ranges of body length and segment number of the new material lie within those noted previously, if descriptions of *H. pentcheffi* and *H. sp.* are united (4.1–11.3 mm, 43–88 segments). In one of the new individuals, the penial setae are only about 65 μm long, which extends the length range of these setae for the species to 65–155 μm .

The small "epidermal papilla," which perhaps should be termed an "epidermal pad" and which is located mid-ventrally between the spermathecal pores in "*Heterodrilus* sp." (cf. Erséus 1981a:124), is present also in many of the original specimens of *H. pentcheffi* (Erséus, unpublished) as well as in most specimens from Hutchinson Island.

Distribution and habitat.—East coast of Florida (new record), North Carolina, New Jersey, Bermuda, and Galapagos Islands. Largely coarse sands, 0.5–39 m depth.

Heterodrilus occidentalis Erséus, 1981

Fig. 2

Heterodrilus occidentalis Erséus, 1981a:121, fig. 11.—Davis, 1985:170.

New material examined.—FSBC I 31855–31856, 2 whm spms from Sta 2 (3 Jan and 9 May 1972, respectively).—Author's collection: 3 whm spms from Sta 2, 6 from Sta 4.

Remarks.—This species was originally described from shallow waters in North Carolina and off New Jersey (Erséus 1981a), and was recently reported from Georges Bank off Massachusetts by Davis (1985). It is closely related to *H. pentcheffi* (genitalia and penial setae are virtually identical in the two species), but differs from that species in the appearance of the somatic setae.

In the original material, trifid setae were found only in about the first five setigerous

segments, followed by a few segments with bifid setae (cf. Erséus 1981a:figs. 11A–C); thereafter (segment X and backwards, except a few segments in posterior end), setae are sharply single-pointed (Erséus 1981a:fig. 11D). New specimens from Florida deviate slightly from this pattern. The lower tooth of the trifold setae gradually diminishes posteriorly, but this tooth can generally still be discerned in segments VIII and IX (Fig. 2A). Similarly, “single-pointed” setae, commencing in segment X, initially are actually somewhat bifid; a faint lower tooth can be seen from certain angles (Fig. 2B). Further back, however, most setae are truly single-pointed (Fig. 2C).

Distribution and habitat.—East coast of Florida (new record), North Carolina, New Jersey, and Massachusetts. Coarse sand and gravel, 4.5–138 m depth.

Heterodrilus hispidus, new species

Fig. 3

Holotype.—USNM 98130, whm spm from Sta 2 (15 Sep 1971).

Paratypes.—FSBC I 31857, 2 whm spms from Sta 4 (14 Mar 1972).

Other material examined.—Author’s collection: 5 whm spms from type locality (Sta 2).

Description.—Length (2 complete spms) 13.6–14.8 mm, 82–86 segments; third spm only 4.5 mm long, about 38 segments, but its posterior end regenerating. Width at XI, 0.29–0.41 mm. Clitellum extending over $\frac{1}{2}$ X–XII. Setae 2 per bundle in II–IX, 1 per “bundle” thereafter. Anterior setae (from II to IX) bifid, with teeth of approximately same length and both oriented along long axis of seta (Fig. 3A). Bifids 60–100 μ m long, 2.5–5 μ m thick. Posterior setae (from X to end of worm) stout, sharply single-pointed, and with curved inner end; dorsal ones (Fig. 3C) much larger (95–135 μ m long, 7–9.5 μ m thick) than ventral ones (Fig. 3B; 60–95 μ m long, 3.5–6 μ m thick). Penial setae (Figs. 3D, E, ps) 2 per bundle (bundle “doubled”

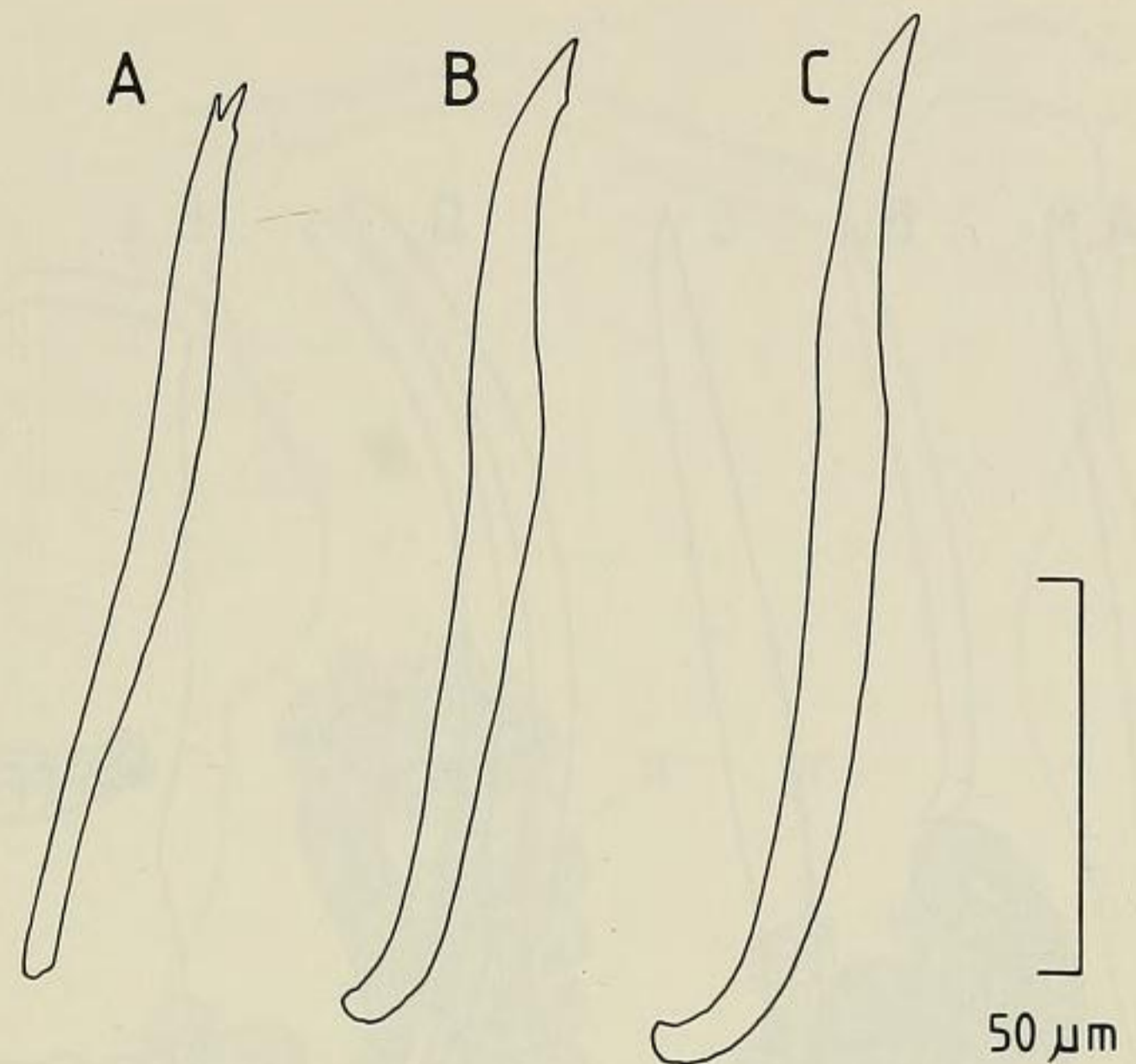


Fig. 2. *Heterodrilus occidentalis*, setae: A, From segment VIII; B, From segment XII; C, From posterior segment.

at one side in one aberrant spm), slender and slightly curved, single-pointed, with inner ends generally somewhat tilted over to posterior. Penials 125–135 μ m long, 4.5–5 μ m thick. Male pores paired, slightly ventral to lines of ventral somatic setae, posteriorly in XI. Spermathecal pores paired, slightly ventral to lines of ventral setae, anteriorly in X.

Pharyngeal glands very poorly developed (absent?). Granulated coelomocytes numerous. Male genitalia (Fig. 3E) paired. Vas deferens 9–12 μ m wide, very long and tightly coiled in spiral. Atrium somewhat C-shaped, about 300 μ m long, 25–35 μ m wide entally, narrower ectally, with thin outer lining and densely granulated inner epithelium; lobes of prostate glands attached to ventral surface of atrium. Ectal part of atrium non-granulated, tapering, opening to exterior through simple pore (possibly a very simple pseudopenis). Spermathecae (Fig. 3E, s) variable in shape and extension, with slender ducts and large ampullae, latter with large mass of sperm in irregular lumen and with large granules of secretion in wall.

Remarks.—Most species of *Heterodrilus* have trifold setae in at least some anterior segments; only *H. subtilis* (Pierantoni, 1917)

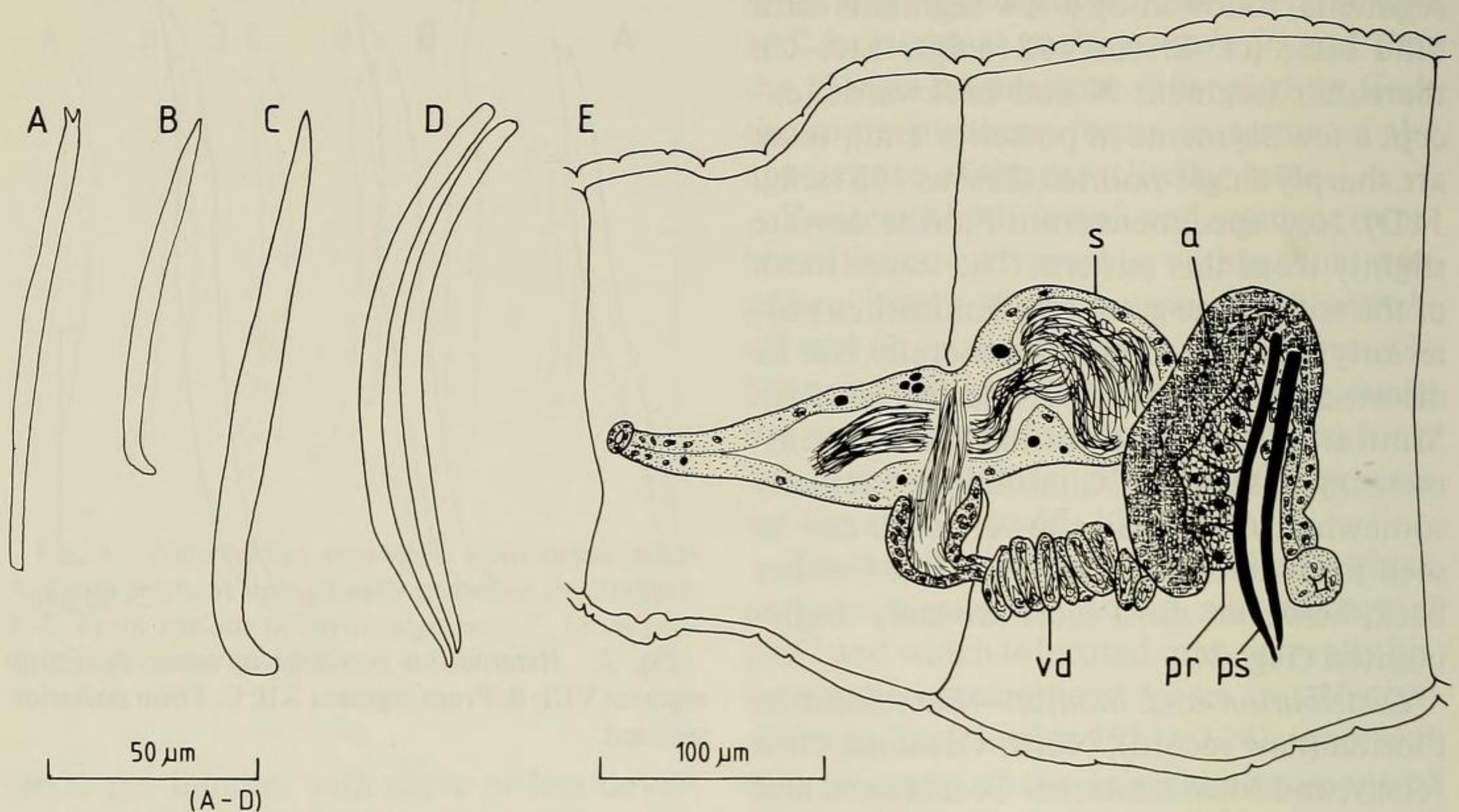


Fig. 3. *Heterodrilus hispidus*, n. sp.: A, Anterior bifid seta; B, Posterior ventral seta; C, Posterior dorsal seta; D, Penial setae; E, Lateral view of spermatheca and male genitalia in segments X–XI.

and this new species lack such setae altogether. *Heterodrilus hispidus* is distinguished from the other Mediterranean and poorly known form by the consistently single-pointed tips of its setae from segment X to the posterior end of the worm (penial setae absent in *H. subtilis*).

The great difference in size between the dorsal and ventral postclitellar setae is a striking feature of *H. hispidus*; a similar case has not been noted for any other species of the genus, and it may thus prove to be a reliable specific character.

In most species of the genus, penial setae are either erect or with inner ends obliquely pointing toward the anterior, but in *H. hispidus* and the aberrant *H. perkinsi*, n. sp., described below, inner ends of penial setae tend to be directed toward the posterior.

Etymology.—The specific name *hispidus* is Latin for “shaggy, rough” and alludes to the appearance of the worm with regard to the very large setae.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Shell hash, 10–12 m depth.

Heterodrilus bulbiporus Erséus, 1981

Fig. 4

Heterodrilus bulbiporus Erséus, 1981a:123, fig. 13.

New material examined.—FSBC I 31858, 2 whm spms from Sta 2 (1 Mar 1972).—Author’s collection: 2 whm spms from Sta 1 (but see note under “Material and methods” above), 18 from Sta 2, 3 from Sta 4, and 21 from Sta 5; 1 whm spm from NE part of the Gulf of Mexico, off Clearwater, Florida, 27°55’N, 83°28’W, 20 m, sediment unknown (26 Aug 1977; courtesy M. S. Ivester).

Redescription (based on the new material).—Length (5 worms measured) 6.5–11.3 mm, 48–65 segments (original material: 5–12 mm, 38–58 segments). Width at XI, 0.31–0.56 mm. Clitellum extending over ½X–XII. Setae 2 per bundle in II–IX, 1 per “bundle” thereafter. Anterior setae (in II–IX) trifid (Fig. 4A), with upper and middle teeth pointed and basally narrow, lower tooth basally much wider. Trifids 75–125 μm long, 4.5–7 μm thick (original material: 40–115

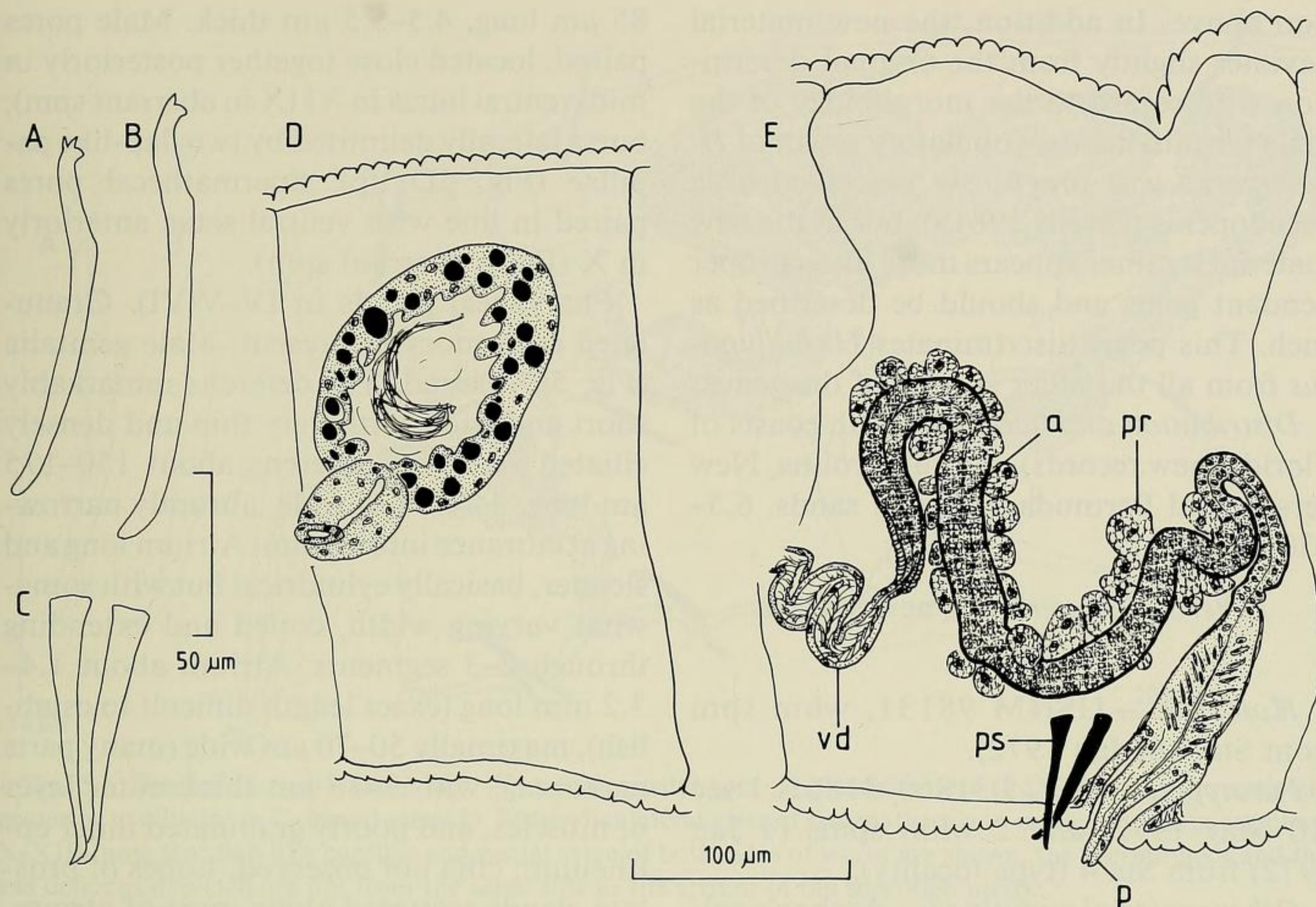


Fig. 4. *Heterodrilus bulbiporus*: A, Anterior trifid seta; B, Posterior seta; C, Penial setae; D, Spermatheca in segment X; E, Lateral view of male genitalia in segment XI.

μm , 3–5 μm). Posterior setae (from X and backwards) bifid (Fig. 4B), with upper tooth slightly thinner than lower, both teeth basally wide. Bifids 65–140 μm long, 4.5–9 μm thick (original material: 50–115 μm , 4–7 μm). Penial setae (Figs. 4C, E, ps) 2 per bundle, erect, single-pointed, 80–95 μm long (original material: 95–125 μm), about 7 μm thick at middle, 12–13 μm wide at ental end. Male pores paired in line with ventral setae, posteriorly in XI. Spermathecal pores paired, slightly ventral to lateral lines, anteriorly in X.

Pharyngeal glands in IV–V, but poorly developed. Granulated coelomocytes numerous. Male genitalia (Fig. 4E) paired. Vas deferens 16–21 μm wide (original material: 7–13 μm), long and coiled. Atrium cylindrical, slender, about 0.8 mm long (original material: 0.4–1.0 mm), 25–40 μm wide, with 2–4 μm thick outer muscular lining (original material: up to 5 μm thick), and granulated

inner epithelium along most of its length; narrow ectal portion of atrium not granulated, but containing numerous nuclei. Atrium ectally terminating in bulbous copulatory apparatus, consisting of inner widened part (most ectal part of atrium) and outer, narrow, tapering penis, latter enclosed in copulatory sac (whole complex probably somewhat eversible; cf. Erséus 1981a:fig. 13C). Small lobes of prostate glands present along granulated part of atrium. Spermathecae (Fig. 4D) consisting of short but broad ducts and large, more or less oval ampullae, latter with thick walls containing large granules of secretion and irregular lumen containing large bundles of sperm.

Remarks.—*Heterodrilus bulbiporus* was originally described from Bermuda, New Jersey, and North Carolina. Some dimensional differences between the old and the new material are indicated in the redescr-

tion above. In addition, the new material deviates slightly from the original description with regard to the morphology of the male terminalia; the copulatory organ of *H. bulbiporus* was previously perceived as a pseudopenis (Erséus 1981a), but in the new material it rather appears more like a proper pendant penis and should be described as such. This penis discriminates *H. bulbiporus* from all the other species of the genus.

Distribution and habitat.—Both coasts of Florida (new records), North Carolina, New Jersey, and Bermuda. Subtidal sands, 6.5–130 m depth.

Heterodrilus perkinsi, new species

Fig. 5

Holotype.—USNM 98131, whm spm from Sta 4 (4 Jan 1972).

Paratypes.—FSBC I 31860–31861, 1 sec (10 May 1972) and 2 whm spms (4 Jan 1972) from Sta 4 (type locality).

Other material examined.—Author's collection: 2 sec and 16 whm spms from Sta 2; and 1 sec and 24 whm spms from Sta 4 (type locality).

Description.—Length (5 complete spms measured) (5.7)8.9–11.2 mm, (42)58–72 segments; smallest spm still growing posteriorly. Width at XI 0.41–0.50 mm. Clitellum extending over $\frac{1}{2}$ X–XII. Somatic setae 2 per bundle in II–IX (–VIII in single spm with genitalia shifted one segment forward), 1 per “bundle” thereafter. Anterior setae (from II to IX) trifid (Fig. 5A), with upper tooth smaller than other two, middle tooth longer than upper and lower teeth. Trifids 65–110 μ m long, 4–7 μ m thick. Posterior setae (from X to end of worm) bifid (Fig. 5B), with lower tooth slightly larger than upper, both teeth with broad bases. Bifids 60–120 μ m long, 4.5–9.5 μ m thick. Penial setae (Figs. 5C, D, ps) small and straight, (1)2 per bundle, often retracted into copulatory sac and with inner ends generally directed obliquely toward posterior; ectal ends single-pointed and hooked. Penials 60–

85 μ m long, 4.5–5.5 μ m thick. Male pores paired, located close together posteriorly in mid-ventral bursa in XI (X in aberrant spm); bursa laterally delimited by two flap-like papillae (Fig. 5D, fp). Spermathecal pores paired in line with ventral setae anteriorly in X (IX in aberrant spm).

Pharyngeal glands in IV–V(VI). Granulated coelomocytes present. Male genitalia (Fig. 5D) paired. Vas deferens remarkably short and wide, with very thin and densely ciliated wall; vas deferens about 150–175 μ m long, 34–45 μ m wide, abruptly narrowing at entrance into atrium. Atrium long and slender, basically cylindrical but with somewhat varying width, coiled and extending through 2–3 segments. Atrium about 1.4–3.2 mm long (exact length difficult to establish), maximally 50–70 μ m wide (many parts narrower), with 9–15 μ m thick outer layer of muscles, and poorly granulated inner epithelium; cilia not observed. Lobes of prostate glands scattered along most of atrium. Atrium tapering ectally, terminating in somewhat pointed, conical penis. Penis 45–80 μ m long, basally 23–37 μ m wide, with thin cuticular lining, located in hollow inner part of deep copulatory sac. Spermathecae (Fig. 5D, s) with elongate, thick-walled ducts, and ampullae of variable shape, latter containing at least one large bundle of sperm in postcopulatory spms; ampullae often dislocated into IX.

Remarks.—The most striking feature of *Heterodrilus perkinsi* is its extremely long and muscular atria, which discriminate the species from all its congeners. Noteworthy, and somewhat paradoxical, is that the vasa deferentia are among the shortest in the genus, measuring only about one-tenth or less of the atrial length.

Etymology.—This species is named for Mr. Thomas H. Perkins, who placed the Hutchinson Island Oligochaeta at my disposal and provided most valuable information, moral support, and assistance during the preparation of this paper.

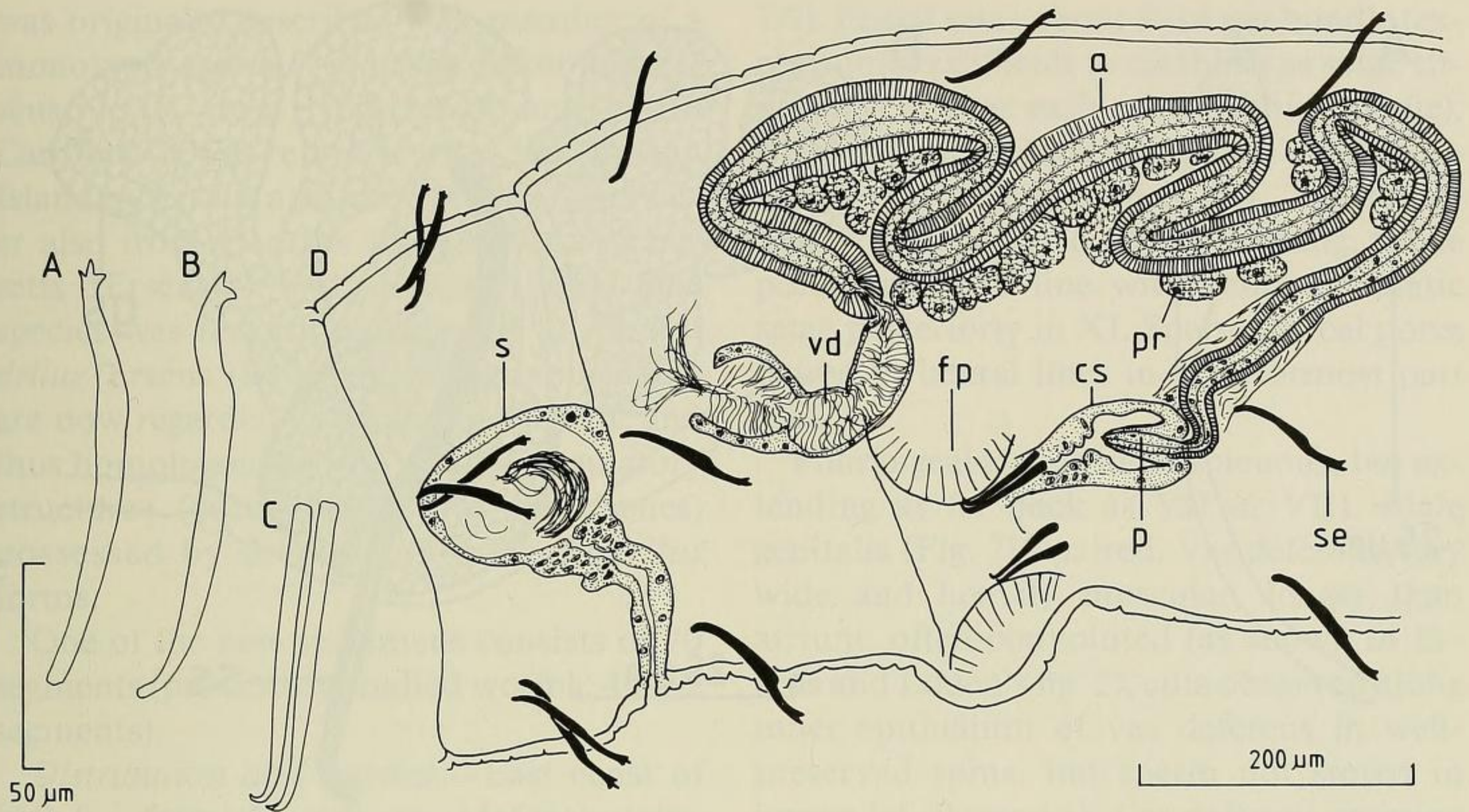


Fig. 5. *Heterodrilus perkinsi*, n. sp.: A, Anterior trifid seta; B, Posterior seta (from segment immediately posterior to clitellum); C, Penial setae; D, Somewhat lateral view of spermatheca and male genitalia in segments X–XIII (note that flap-like papillae and penial setae of both sides of worm are shown; the spermatheca and the vas deferens depicted are not from the same side as the atrium in the specimen used).

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Shell hash, 10–12 m depth.

Subfamily Phallodrilinae

Phallodrilus Pierantoni, 1902

Phallodrilus sabulosus Erséus, 1979

Fig. 6

Phallodrilus sabulosus Erséus, 1979b:188–189, figs. 1–2.—Erséus and Loden, 1981: 820–821, fig. 1A.—Erséus, 1984d:813.

New material examined.—FSBC I 31862, 3 whm spms from Sta 4 (14 Mar 1972).—Author's collection: 2 whm spms from Sta 2, 9 from Sta 4, and 1 from Sta 5.

Remarks.—*Phallodrilus sabulosus* was first described from a coral reef off Miami (Erséus 1979b), but as the two type specimens were both precopulatory, the mature spermathecae of the species were not described until new material was recovered from off Hutchinson Island by Erséus and

Loden (1981). Recently *P. sabulosus* was found off New Jersey, further north along the North American east coast (Erséus 1984d).

The new material from Hutchinson Island is highly variable in terms of overall size: length 2.8–9.0 mm, segments 22–63 (previously studied individuals 5.5–6.1 mm long, 44–61 segments).

According to the original description, bifid setae either have an upper tooth that is slightly longer than the lower one (anterior bundles) or the two teeth are equally long (posterior bundles). In the present material, however, many posteriormost setae have a lower tooth which is clearly longer than the upper one (Fig. 6A); in fact, the lower tooth appears prolonged as compared to that of anterior setae.

The most striking feature of this species is the possession of both penial and spermathecal setae. Penial setae (illustrated by Erséus 1979b:figs. 1–2) are stout, somewhat

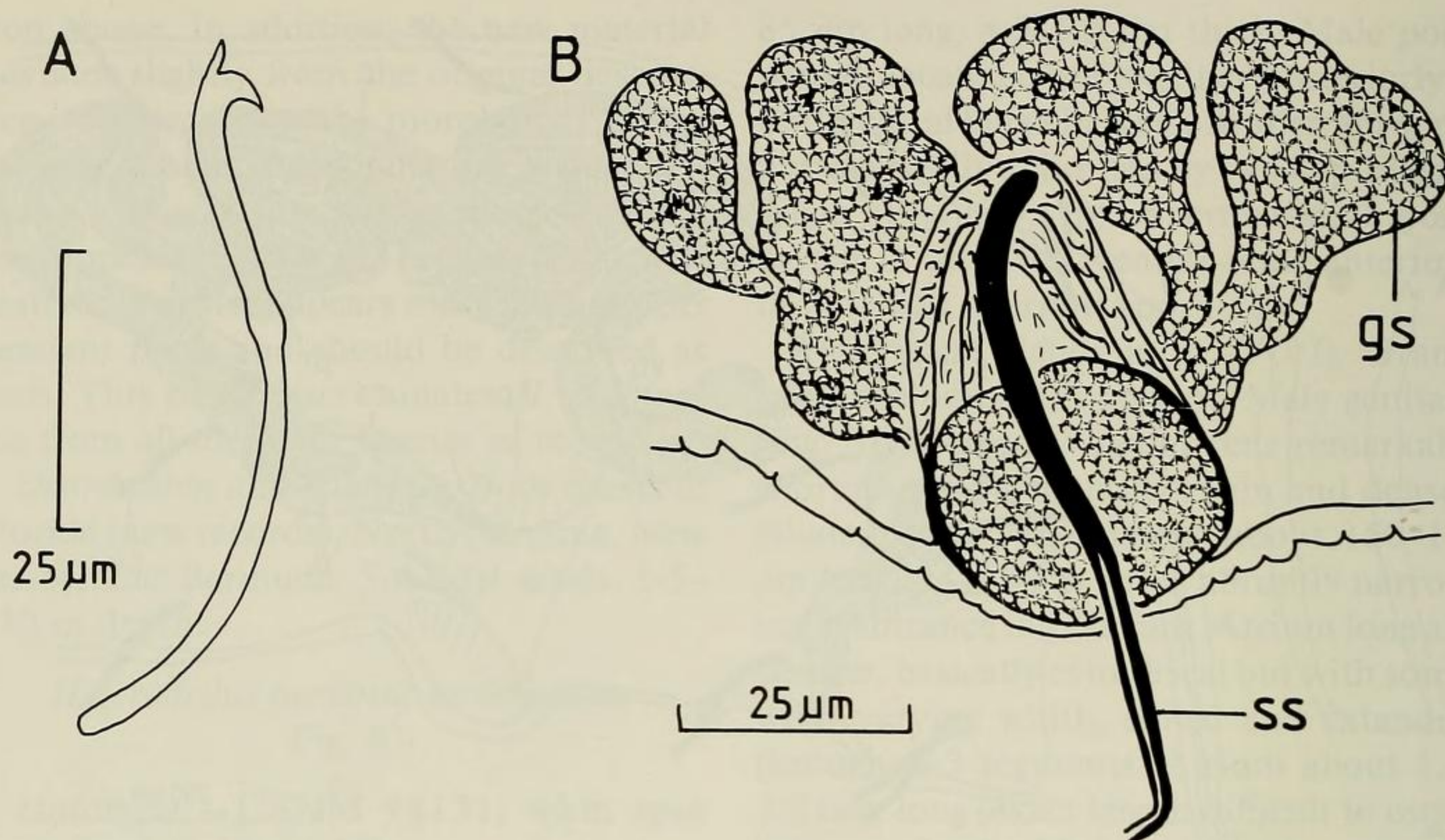


Fig. 6. *Phalldrilus sabulosus*: A, Seta from one of posteriormost segments; B, Spermathecal seta with associated glands.

spoon-shaped, always one per "bundle," and located near the atrial openings in segment X. These setae are 60–80 μm long and up to 7 μm wide in the present material.

Spermathecal setae (Fig. 6B, ss) are more slender than penial setae, ectally deeply forked (now established; cf. statement by Erséus 1979b:189), one or two per bundle and located either posterior to spermathecal pores in segment X (in 13 of the 16 present worms), or anterior to these pores, posteriorly in segment IX (in the remaining three worms). The middle part of each seta is enclosed in a glandular body, which bears a few lobes of external glands (Fig. 6B, gs), which are somewhat reminiscent of prostate glands; these external glands were not noted in the original description. Spermathecal setae are 60–100 μm long.

Male efferent ducts of the new material conform to the original account, although the length range of the atrium is now extended to 60–140 μm . Spermathecae are variable in size and shape but basically conform to the description provided by Erséus

and Loden (1981:fig. 1); they are very slender, consisting of (1) a long duct, which is ectally distended and often contains sperm, and (2) an oval, thin-walled ampulla, generally with very dense mass of sperm.

Distribution and habitat.—East coast of the U.S.A., from Florida to New Jersey. Largely coarse sands, 3–15.5 m depth.

Phalldrilus biprostatus
(Baker and Erséus, 1979)

Peosidrilus biprostatus Baker and Erséus, 1979:506–508, figs. 1–2.—Erséus and Loden, 1981:819–820.

Phalldrilus biprostatus.—Erséus, 1984d: 819–820.—Davis, 1985:table 1.

New material examined.—FSBC I 31863–31864, 3 whm spms from Sta 2.—Author's collection: 1 sec and 12 whm spms from Sta 2, 2 whm spms from Sta 3, 2 sec and 19 whm spms from Sta 4, and 1 whm spm from Sta 5.

Remarks.—This species, which occurred at several stations in the present material,

was originally described as a member of a monotypic genus *Peosidrilus* Baker and Erséus, 1979, from New Jersey and North Carolina. It was reported from Hutchinson Island by Erséus and Loden (1981), and later also from Georges Bank off Massachusetts (Erséus 1984d; Davis 1985). The species was recently transferred to *Phalldrillus* (Erséus 1984d); its voluminous penes are now regarded as an elaboration of, and thus homologous to, the smaller copulatory structures (pseudopenes and true penes) possessed by several other *Phalldrillus* forms.

One of the new specimens consists of 70 segments (previously studied worms: 44–62 segments).

Distribution and habitat.—East coast of U.S.A., from Florida to Massachusetts. Largely coarse sands, 5.5–73 m depth.

Phalldrillus acochlearis
(Erséus and Loden, 1981),
new combination

Fig. 7

Adelodrillus acochlearis Erséus and Loden, 1981:821–823, figs. 1B–C, 2.—Erséus, 1983b:77–78.

New material examined.—FSBC I 31865, 2 whm spms from Sta 4 (4 Jan 1972).—Author's collection: 7 whm spms from Sta 4.

Redescription (modified after Erséus and Loden 1981).—Length 2.5–3.9 mm, 27–39 segments. Width at XI, 0.15–0.25 mm. Clitellum extending over $\frac{1}{2}$ X–XII. Somatic setae bifid, 3–5 per bundle anteriorly, (2)3–4(5) per bundle in postclitellar segments. Anterior dorsal setae and all ventral setae with upper tooth shorter and much thinner than lower. Several setae in dorsal bundles of most posterior segments modified with lower tooth extremely long, curved downwards and parallel to setal shaft (Erséus and Loden's fig. 1C). Bifids 42–62 μ m long, 1.5–2.5 μ m thick. Penial setae straight, 30–50 μ m long, 0.5–1 μ m thick at middle, each with ectal "club" bearing apical hook (Fig.

7A). Penial setae about 8–14 per bundle (exact number difficult to establish as setae situated very near each other within bundle), with ectal ends protruding into small copulatory sac (sac everted in Fig. 7B) immediately posterior to atrial opening. Male pores paired in line with ventral somatic setae posteriorly in XI. Spermathecal pores paired in lateral lines in anteriormost part of X.

Pharyngeal glands inconspicuous, but extending as far back as VII or VIII. Male genitalia (Fig. 7B) paired. Vas deferens very wide and heavily muscular, longer than atrium, often convoluted (as shown in Erséus and Loden's fig. 2); cilia observed along inner epithelium of vas deferens in well-preserved spms, but sperm not stored in lumen (cf. Remarks). Vas deferens entering atrium sub-apically together with anterior prostate gland. Atrium 58–82 μ m long, 35–43 μ m wide, divided into two histologically different portions; ental portion with granulated and ciliated inner epithelium, ectal portion neither granulated nor ciliated but eversible to form bulbous pseudopenis (everted in Fig. 7B; cf. also Erséus and Loden's fig. 2); muscular lining of atrium thin. Prostate glands moderately large, both sub-apical on atrium, with attachments more or less opposite to each other. Spermathecae (Fig. 7B, s) consisting of short ducts and slender ampullae, latter 90–180 μ m long, maximally 33–44 μ m wide and variable in shape, with sperm in random masses.

Remarks.—This species was originally described on the basis of specimens from a site very near that of the present material. One additional individual was subsequently reported from shallow inshore water of North Carolina (Erséus 1983b).

The new material has necessitated a re-description of the species, as the true appearance of its vasa deferentia was not previously recognized; the vasa deferentia are ciliated, but they do not store sperm as initially conceived, and thus the species does not qualify for inclusion in the genus *Ade-*

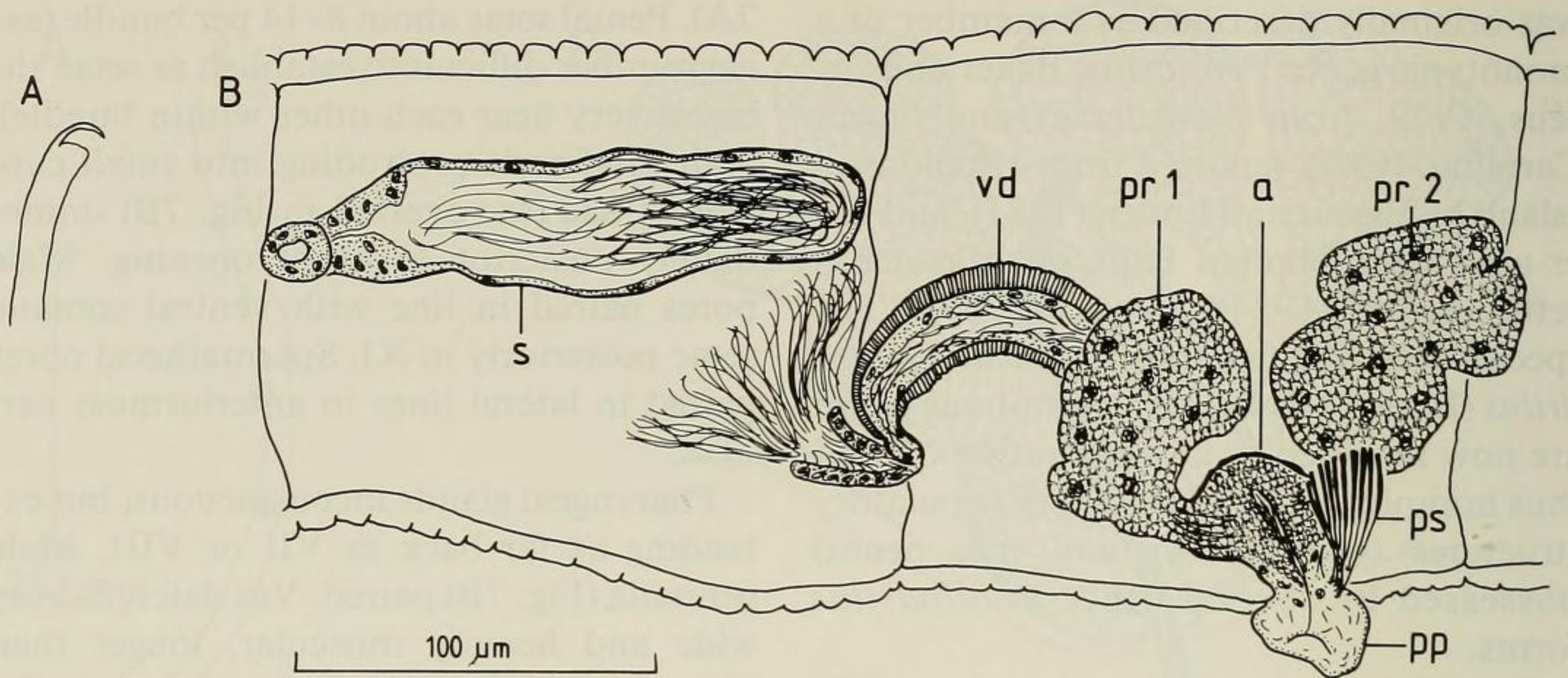


Fig. 7. *Phalldrilus acochlearis*, n. comb.: A, Tip of penial seta; B, Lateral view of spermatheca and male genitalia in segments X–XI.

lodrilus, where it was originally placed. Instead it should be assigned to *Phalldrilus* as defined by Erséus (1984d).

The revised description of *P. acochlearis* shows that the species is closely related to another North American east coast form, *P. boeschi* Erséus, 1984, which has posterior dorsal setae (with prolonged lower teeth; cf. Erséus 1984d:fig. 2B), penial setae, atria, and spermathecae that are very similar to those of *P. acochlearis*. However, the latter species is easily distinguished from *P. boeschi* by its conspicuously muscular vasa deferentia, its more elaborate pseudopenes and even longer lower teeth of the posterior dorsal setae (cf. Erséus and Loden 1981:fig. 1C).

Distribution and habitat.—East coast of Florida and North Carolina. Very coarse sands, 5.5–11 m depth.

Phalldrilus hirsutus, new species

Fig. 8

Holotype.—USNM 98132, whm spm from Sta 2 (5 Mar 1973).

Paratype.—FSBC I 31866, 1 whm spm from Sta 5 (5 Jan 1973).

Description.—Length of holotype (paratype not complete) 16.1 mm, 86 segments.

Width at XI, 0.44 mm. Clitellum extending over $\frac{1}{2}$ X–XII. Somatic setae 2 per bundle in II–IX(X), 1 per “bundle” thereafter. Anterior setae (Fig. 8A) bifid, with upper tooth reduced; these setae 70–140 μ m long, 3.5–10 μ m thick. Setae from about X and backwards straight and single-pointed (occasionally bifid, similar to anterior setae); these setae dorsally (Fig. 8A) 140–165 μ m long, 12–13 μ m thick, ventrally (Fig. 8C) 85–95 μ m long, about 7 μ m thick. Ventral setae of XI modified into penial setae (Figs. 8D, F, ps), 4–6 per bundle, more or less straight, ectally single-pointed and hooked; in holotype (Fig. 8D), tips of penial setae obliquely pointing toward posterior; in paratype (Fig. 8F), penial setae and male genitalia somewhat distorted and dislocated. Male pores paired in line with ventral setae in XI. Spermathecal pores paired in lateral lines, anteriorly in X.

Pharyngeal glands in IV–VI. Male genitalia paired. Vas deferens 16–19 μ m wide, longer than atrium, entering apical end of latter. Atrium (Fig. 8F, a) somewhat spindle-shaped and curved, about 105 μ m long, about 40 μ m wide, with very thin outer lining, and thick, granulated outer epithelium. Prostate glands (Fig. 8F, pr 1–2) very large

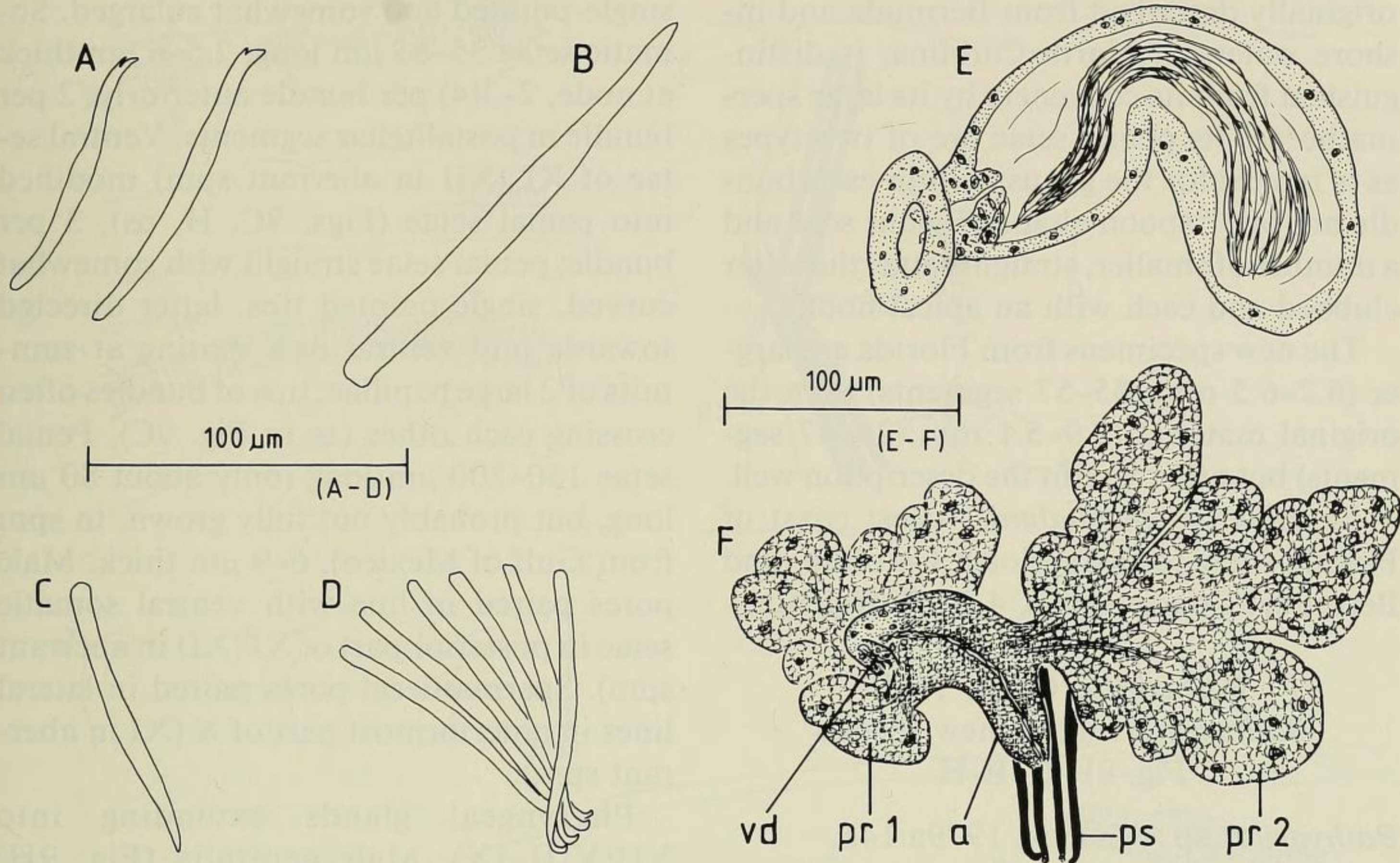


Fig. 8. *Phalldrilus hirsutus*, n. sp.: A, Anterior setae; B, Posterior dorsal seta; C, Posterior ventral seta; D, Penial setae; E, Spermatheca; F, Male genitalia.

and lobed, anterior one subapical on atrium, posterior one attaching to posterior face of atrium, at some distance from atrium opening. Copulatory sac apparently present, but details not clear in available spms. Spermathecae (Fig. 8E) elongate, consisting of indistinct ducts and long, thin-walled ampullae, latter somewhat constricted at middle, and containing large bundle of sperm.

Remarks.—This very large species of *Phalldrilus* is distinguished from all other members of the genus by its very large and modified setae. In particular, the postclitellar dorsal (single-pointed) setae (Fig. 8B) are very conspicuous and make the species superficially very similar to *Heterodrilus hispidus* described above, and also the NW European species *Bathydrilus rarisetis* (Erséus, 1975) (cf. Erséus 1975; 1979a:fig. 7). The latter form also inhabits very coarse sand and gravel, and it appears likely that the convergent evolution of very stiff and

large setae in different groups of marine Tubificidae (including many other species of *Heterodrilus*) is explained by their functional advantage in such coarse substrates.

Etymology.—The specific name *hirsutus* is Latin for “shaggy, bristly, rough” and alludes to the conspicuous setation.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Coarse, clean or somewhat muddy, sands, 10–11 m depth.

Adelodrilus Cook, 1969
Adelodrilus magnithecatus
 Erséus, 1979

Adelodrilus magnithecatus Erséus, 1979d: 419–421, fig. 1.

New material examined.—FSBC I 31867, 1 whm spm from Sta 2 (3 Nov 1971).—Author’s collection: 1 whm spm from Sta 2.

Remarks.—*Adelodrilus magnithecatus*,

originally described from Bermuda and inshore waters of North Carolina, is distinguished from its congeners by its large spermathecae. Its penial setae are of two types as is typical for the genus; within each bundle are one "spoon-shaped" giant seta and a number of smaller, straight setae, the latter clubbed and each with an apical hook.

The new specimens from Florida are larger (6.2–6.5 mm, 55–57 segments) than the original material (2.9–5.1 mm, 26–47 segments) but otherwise fit the description well.

Distribution and habitat.—East coast of Florida (new record), North Carolina, and Bermuda. Coarse sands, 4.5–17 m depth.

Bathydrius Cook, 1970

Bathydrius ingens, new species

Fig. 9B–C, E–H

Bathydrius sp.—Erséus, 1979a:146.

Holotype.—USNM 98133, whm spm from Sta 2 (2 Nov 1972).

Paratype.—FSBC I 31868, 1 whm spm from type locality (2 Nov 1972).

Other material examined.—Author's collection: 1 whm spm from Sta 4; 1 whm spm from NE Gulf of Mexico, 1 mile off Withlacoochee River mouth, Florida, 28°58'48"N, 82°48'27"W, 3–4 m, shell hash (Nov 1984; courtesy M. R. Milligan); 2 whm spms from between Carrot Island and Middle Marsh, near Beaufort, North Carolina, 34°42'06"N, 76°37'13"W, 5 m, shells and shell gravel with some coarse sand (19 Oct 1977; cf. Erséus 1979a).

Description.—Length (2 complete spms) 25.6–27.0 mm, from about 127 (posterior end not fully differentiated) to 139 segments. Width at XI, 0.26–0.42 mm. Epidermal glands (Fig. 9B) as continuous dorsal band along most of body, starting few segments anterior to clitellum. Clitellum extending over $\frac{1}{3}$ X–XII. Somatic setae of 2 types. Anterior and some posterior ones bifid (Fig. 9E), with upper tooth smaller than lower; many posterior ones (particularly those in dorsal bundles; Fig. 9F), however,

single-pointed and somewhat enlarged. Somatic setae 35–85 μ m long, 2.5–6 μ m thick at node, 2–3(4) per bundle anteriorly, 2 per bundle in postclitellar segments. Ventral setae of XI (XII in aberrant spm) modified into penial setae (Figs. 9C, H, ps), 3 per bundle; penial setae straight with somewhat curved, single-pointed tips, latter directed towards mid-ventral line, exiting at summits of 2 large papillae; tips of bundles often crossing each other (as in Fig. 9C). Penial setae 150–200 μ m long (only about 80 μ m long, but probably not fully grown, in spm from Gulf of Mexico), 6–9 μ m thick. Male pores paired in line with ventral somatic setae in posterior part of XI (XII in aberrant spm). Spermathecal pores paired in lateral lines in anteriormost part of X (XI in aberrant spm).

Pharyngeal glands extending into VII(VIII–IX). Male genitalia (Fig. 9H) paired. Vas deferens about 7 μ m wide (full length not seen in available material), entering anterior face of ectal-to-middle part of atrium together with anterior prostate gland. Atrium with ental end obliquely directed towards posterior, often extending into next segment. Atrium elongate, spindle-shaped, about 220–270 μ m long (difficult to measure), 30–90 μ m wide, with about 2 μ m thick outer lining of muscles, and granulated and ciliated inner epithelium. Atrium opening at outer end of deep blind sac, atrial opening hidden behind lateral fold of body wall; whole complex forming elaborate pseudopenis. Posterior prostate gland large, attached to apex of atrium. Spermathecae (Fig. 9G) consisting of short, triangular ducts and large elongate, somewhat bilobed ampullae; former opening into middle of latter. Sperm as rhomboid or elongate spermatozeugmata, as bundles, or as loose masses, in ampullae of postcopulatory spms.

Remarks.—One specimen from Hutchinson Island has its sexual organs shifted backwards to occupy segments XI–XII instead of X–XI.

Bathydrius ingens is a very large species,

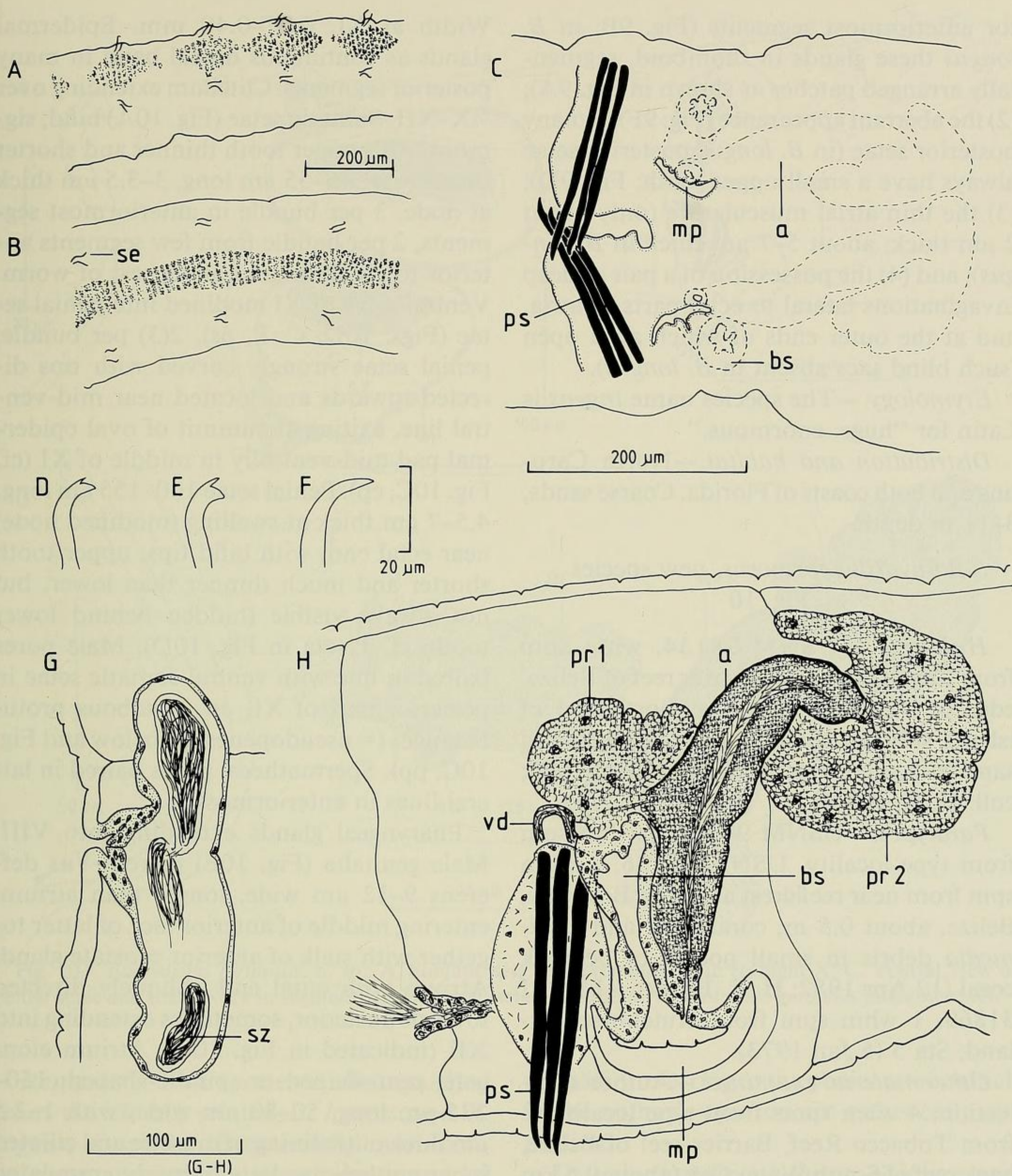


Fig. 9. *Bathydriilus longus* (A, D) and *B. ingens*, n. sp. (B, C, E-H): A and B, Patterns of dorsal epidermal glands (shown for a few successive segments in postclitellar part of body); C, Ventral view of penial setae and male pores in segment XI (*ingens*); D, Posterior dorsal seta (*longus*); E, Anterior seta (*ingens*); F, Posterior dorsal seta (*ingens*); G, Spermatheca (*ingens*); H, Lateral view of male genitalia in segment XI (*ingens*).

a feature shared with the very similar *B. longus* Erséus, 1979, reported from deeper (70–165 m) stations off New Jersey (Erséus 1979a) and Massachusetts (Davis 1985). Both species have two or three very con-

spicuous, straight penial setae per bundle. The new, southern form is distinguished from *B. longus* by four important characters: (1) the dorsal epidermal glands form a continuous dorsal band along body except

for anteriormost segments (Fig. 9B; in *B. longus* these glands in rhomboid, segmentally arranged patches as shown in Fig. 9A); (2) the aberrant appearance (Fig. 9F) of many posterior setae (in *B. longus* posterior setae always have a small upper tooth; Fig. 9D); (3) the thin atrial musculature (only about 2 μm thick; about 5–7 μm thick in *B. longus*); and (4) the possession of a pair of deep invaginations lateral to ectal parts of atria, and at the outer ends of which atria open (such blind sacs absent in *B. longus*).

Etymology.—The species name *ingens* is Latin for “huge, enormous.”

Distribution and habitat.—North Carolina and both coasts of Florida. Coarse sands, 3–11 m depth.

Bathydriulus formosus, new species

Fig. 10

Holotype.—USNM 98134, whm spm from Carrie Bow Cay, Barrier reef of Belize, edge of *Thalassia* bed near north end of island, subtidal shallow water, mixed coral sand with some organic debris (6 Apr 1982; coll. H. R. Baker).

Paratypes.—USNM 98135, 1 whm spm from type locality. USNM 98136, 1 whm spm from near reef crest at Carrie Bow Cay, Belize, about 0.5 m, coral sand and *Hali-media* debris in small pocket of bedrock coral (12 Apr 1982; H. R. Baker).—FSBC I 31869, 1 whm spm from Hutchinson Island; Sta 5 (5 Jan 1973).

Other material examined.—Author's collection: 4 whm spms from type locality; 2 from Tobacco Reef, Barrier reef of Belize, back reef of South Water Cay (about 0.5 km N of the cay), 1 m, small patch of coral sand (9 Apr 1982; H. R. Baker).—1 from Carrie Bow Cay, Belize, *Thalassia* bed very near Research Station, barely subtidal, coral sand with some organic debris (12 Apr 1982; H. R. Baker).—1 whm spm from NE Gulf of Mexico, off Clearwater, Florida, 27°55'N, 83°28'W, 20 m, sediment unknown (26 Aug 1977; courtesy M. S. Ivester).

Description.—Length (only 3 complete spms) 15.9–18.0 mm, 84–108 segments.

Width at XI, 0.27–0.40 mm. Epidermal glands as continuous dorsal band in many posterior segments. Clitellum extending over $\frac{1}{3}$ X–XII. Somatic setae (Fig. 10A) bifid, sigmoid, with upper tooth thinner and shorter than lower; 45–55 μm long, 3–3.5 μm thick at node, 3 per bundle in anteriormost segments, 2 per bundle from few segments anterior to clitellum and along rest of worm. Ventral setae of XI modified into penial setae (Figs. 10D, C, E, ps), 2(3) per bundle; penial setae strongly curved with tips directed towards and located near mid-ventral line, exiting at summit of oval epidermal pad mid-ventrally in middle of XI (cf. Fig. 10C, ep). Penial setae 100–155 μm long, 4.5–7 μm thick at swelling (modified node) near ectal end, with bifid tips; upper tooth shorter and much thinner than lower, but not always visible (hidden behind lower tooth; cf. 1 seta in Fig. 10D). Male pores paired in line with ventral somatic setae in posterior part of XI, on 2 bulbous protuberances (= pseudopenes; cf. below and Fig. 10C, pp). Spermathecal pores paired in lateral lines in anteriormost X.

Pharyngeal glands extending into VIII. Male genitalia (Fig. 10E) paired. Vas deferens 9–12 μm wide, longer than atrium, entering middle of anterior face of latter together with stalk of anterior prostate gland. Atrium with ental end obliquely directed towards posterior, sometimes extending into XII (indicated in Fig. 10C). Atrium elongate, pear-shaped or spindle-shaped, 150–235 μm long, 50–80 μm wide, with 1–2.5 μm thick outer lining of muscles and ciliated inner epithelium, latter densely granulated except for most ectal part. Atrium terminating ectally into bulbous and muscular pseudopenis, latter more or less protruded in all spms available. Prostate glands moderately developed, anterior one attached to middle of atrium, ectal one to apex of atrium. Spermathecae (Fig. 10B, s) consisting of short, triangular ducts and large, extremely thin-walled ampullae; latter containing roundish, rhomboid or elongate spermatozeugmata in postcopulatory spms.

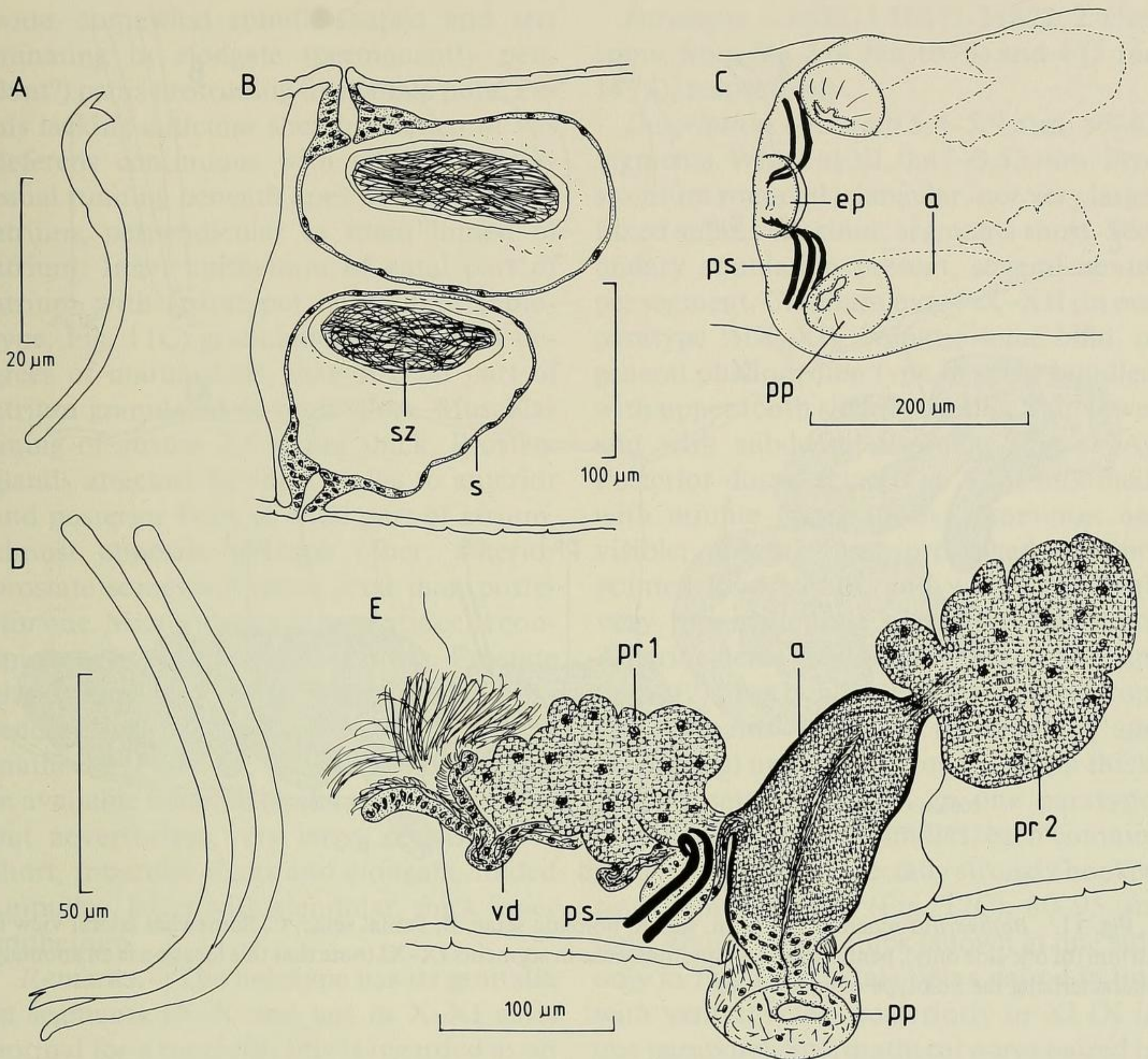


Fig. 10. *Bathydrilus formosus*, n. sp.: A, Somatic seta; B, Spermathecae in segment X; C, Ventral view of penial setae and male pores in segment XI; D, Penial setae; E, Lateral view of male genitalia in segment XI.

Remarks.—This species is distinguished from the closely related *B. longus* and *B. ingens*, n. sp., by its externally more conspicuous and bulbous pseudopenes and by its curved penial setae. In addition, *B. formosus* is the only species within the genus known to possess bifid penial setae; in all congeners, penial setae (when present) are described as single-pointed. [Note, however, that Baker (1983) reported that in a single specimen of the NE Pacific *B. litoreus* Baker, 1983, penial setae in one bundle were bifid.]

Etymology.—The species name *formosus* is Latin for “finely formed, beautiful”; here

primarily referring to the penial setae, which in the author’s opinion are esthetically appealing.

Distribution and habitat.—Belize and both coasts of Florida. Subtidal sands, 0.5–11 m depth.

Bathydrilus macroprostatus, new species
Fig. 11

Holotype.—USNM 98137, whm spm from Sta 2 (15 Sep 1971).

Paratype.—FSBC I 31870, 1 whm spm from type locality (3 Jan 1972).

Description.—Length more than 5.7 mm, more than 25 segments (no complete spm

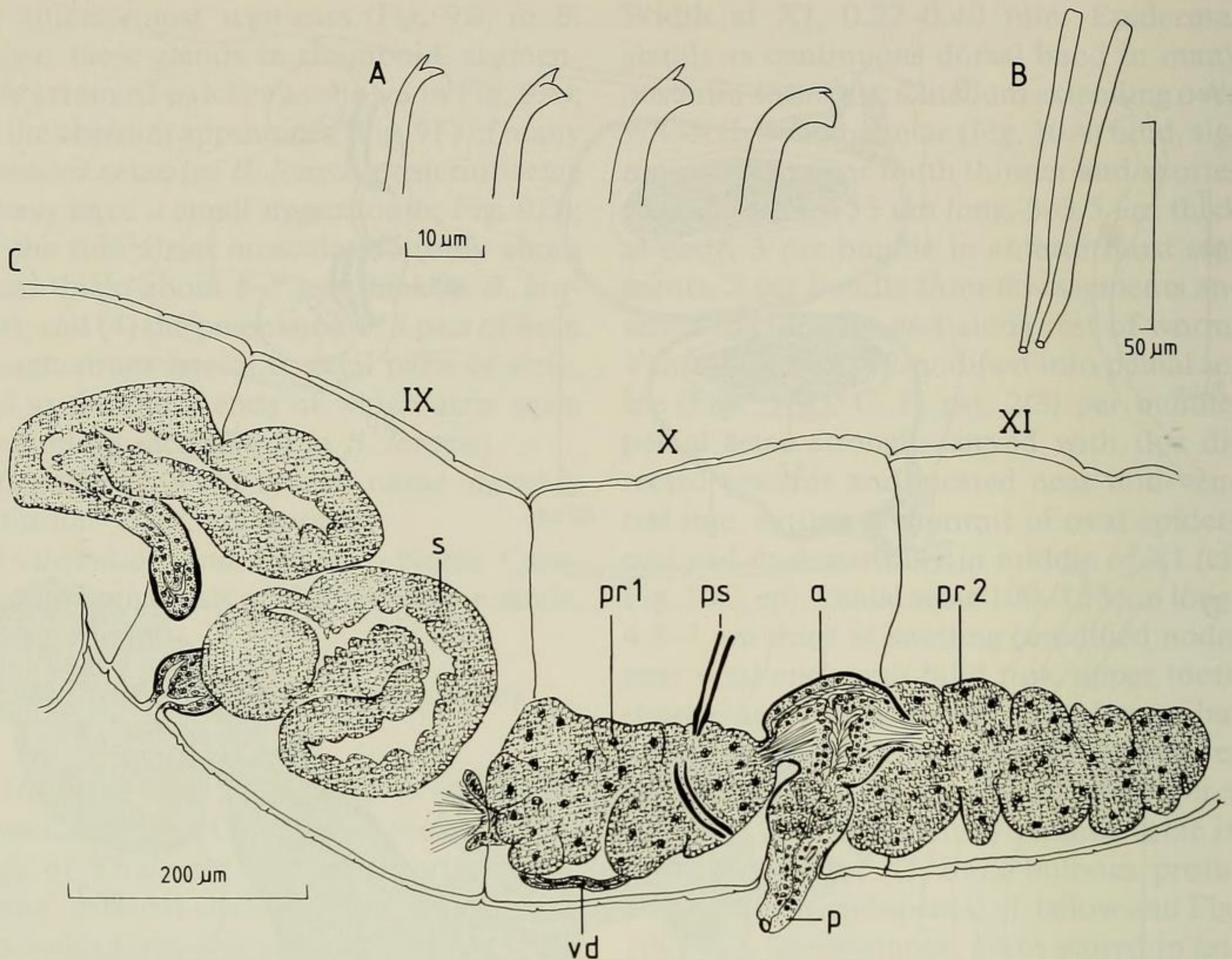


Fig. 11. *Bathydrilus macroprostatus*, n. sp.: A, Somatic setae; B, Penial setae; C, Somewhat lateral view of atrium (of one side only), penial setae and spermathecae in segments IX–XI (note that this location is an anomaly, characterizing the holotype only; see text).

available). Width at male pores, 0.37–0.47 mm. Epidermal glands not observed. Clitellum extending over $\frac{1}{2}$ X–XII in paratype, not developed in holotype. Somatic setae (Fig. 11A) bifid, slender in most anterior segments, only 50–55 μ m long, about 2.5 μ m thick at node, thereafter stouter and larger, 70–85 μ m long, 4–6 μ m thick at node; teeth variable, but upper tooth always smaller than lower. Bifids 2–3(4) per bundle anteriorly, 2 per bundle in postclitellar segments. Ventral setae of XI (X in holotype) modified into penial setae (Fig. 11B), 2 per bundle, with tips directed towards and located near mid-ventral line (cf. Fig. 11C). Penial setae straight to somewhat curved, 70–90 μ m long, 4–5 μ m thick at swelling (modified node) near ectal end, with flat, hooked

tips. Spermathecal and male pores paired in line with ventral somatic setae, former in most anterior part of X (IX in holotype), latter in posterior part of XI (X in holotype).

Pharyngeal glands extending into VIII. Male genitalia (Fig. 11C) paired. Vas deferens thin, 8–9 μ m wide, longer than atrium, but whole length not visible in available material. Vas deferens entering anterior face of ental part of atrium together with anterior prostate gland (indicated by ciliation inside atrium), but exact position of entrance not ascertained. Atrium erect or somewhat tilted over to posterior, totally (including penial organ) 230–245 μ m long, separated into two main parts by constriction: ental part 115–140 μ m wide with broad, somewhat rounded, truncate apex, ectal part 70–85 μ m

wide, somewhat spindle-shaped and terminating in elongate (permanently pendant?) penis protruding from male pore. Penis lacking cuticular sheath. Lumen of vas deferens continuous with ciliated narrow canal running beneath apex of ental part of atrium, perpendicular to main lumen of atrium. Inner epithelium of ental part of atrium with (paratype) or without (holotype; Fig. 11C) granulation (=different degrees of maturation), that of ectal part of atrium granulated in both spms. Muscular lining of atrium 2.5–4 μm thick. Prostate glands attached by thick stalks to anterior and posterior faces of ental part of atrium, almost opposite to each other, anterior prostate somewhat more ectal than posterior one. Microtubules of prostatic cells conspicuous at entrances into atrium. Prostate glands large and lobed, posterior gland extending into XII (XI in holotype). Spermathecae (Fig. 11C, s) not fully developed in available material (spms pre-copulatory), but nevertheless very large, consisting of short, muscular ducts and elongate, folded ampullae, latter with glandular, thick inner epithelium.

Remarks. — The holotype has its genitalia in segments IX–X and not in X–XI as is normal for a tubificid; this is regarded as an anomaly of this particular specimen.

The atrial morphology (bipartite, erect atrium terminating in an elongate penis) and the very large prostate glands and spermathecae distinguish *B. macroprostatus* from other species of the genus.

Etymology. — This species has very large prostate glands; hence the name *macroprostatus*.

Distribution and habitat. — Known only from off Hutchinson Island, east coast of Florida. Shell hash, 10–11 m depth.

Coralliodrilus Erséus, 1979

Coralliodrilus corpulentus, new species

Fig. 12

Holotype. — USNM 98138, whm spm from Sta 4 (4 Jan 1972).

Paratypes. — FSBC I 31871–31872, 2 whm spms, from Sta 2 (4 Jan 1973) and 4 (5 Jan 1973), respectively.

Description. — Length 5.4–5.9 mm, 56–63 segments. Width at XI, 0.47–0.53 mm. Protopharynx rounded triangular, not very large. Fixed spms very stout; segments short. Secondary annulation present, several annuli per segment. Clitellum over $\frac{1}{2}$ X–XII (in one paratype $\frac{1}{2}$ IX–XI). Somatic setae bifid, of general phallo-driline type in most bundles, with upper tooth slightly smaller than lower and with subdental ligament (Fig. 12A). Posterior dorsal setae (Fig. 12B) modified, with minute upper tooth (sometimes not visible; absent?) and prolonged, sharply pointed lower tooth, and without or with very inconspicuous subdental ligament. Anterior setae 55–70 μm long, 1.5–3 μm thick, (2)3 per bundle. Posterior setae (from few segments posterior to clitellum and backwards) up to 80 μm long, 3–5 μm thick. Ventral setae of XI (X in one paratype) modified into penial bundles, each containing about 12 straight, ectally strongly hooked single-pointed setae (Fig. 12C), 80–95 μm long, about 2.5 μm thick (shown at one side only in Fig. 12D). Male pores paired in line with ventral setae, posteriorly in XI (X in one paratype). Spermathecal pores paired in lateral lines, in most anterior part of X (IX in one paratype).

Pharyngeal glands poorly developed in (III)IV–VI. Male genitalia (Fig. 12D) paired. Vas deferens not observed in complete length, but appearing short; ectally about 20 μm wide with strong circular muscles. Atrium spindle-shaped, somewhat sigmoid, 210–290 μm long, 55–80 μm wide at middle, with 3.5–12 μm thick outer layer of muscles, in which fibers arranged in somewhat spiral pattern; inner epithelium of atrium ciliated and for most parts granulated. Atrium tapering ectally into short, narrow duct surrounded by very strong muscles; duct terminating in simple, minute male pore (only that of 1 side shown in Fig. 12D). Spermathecae (Fig. 12D, s) consisting

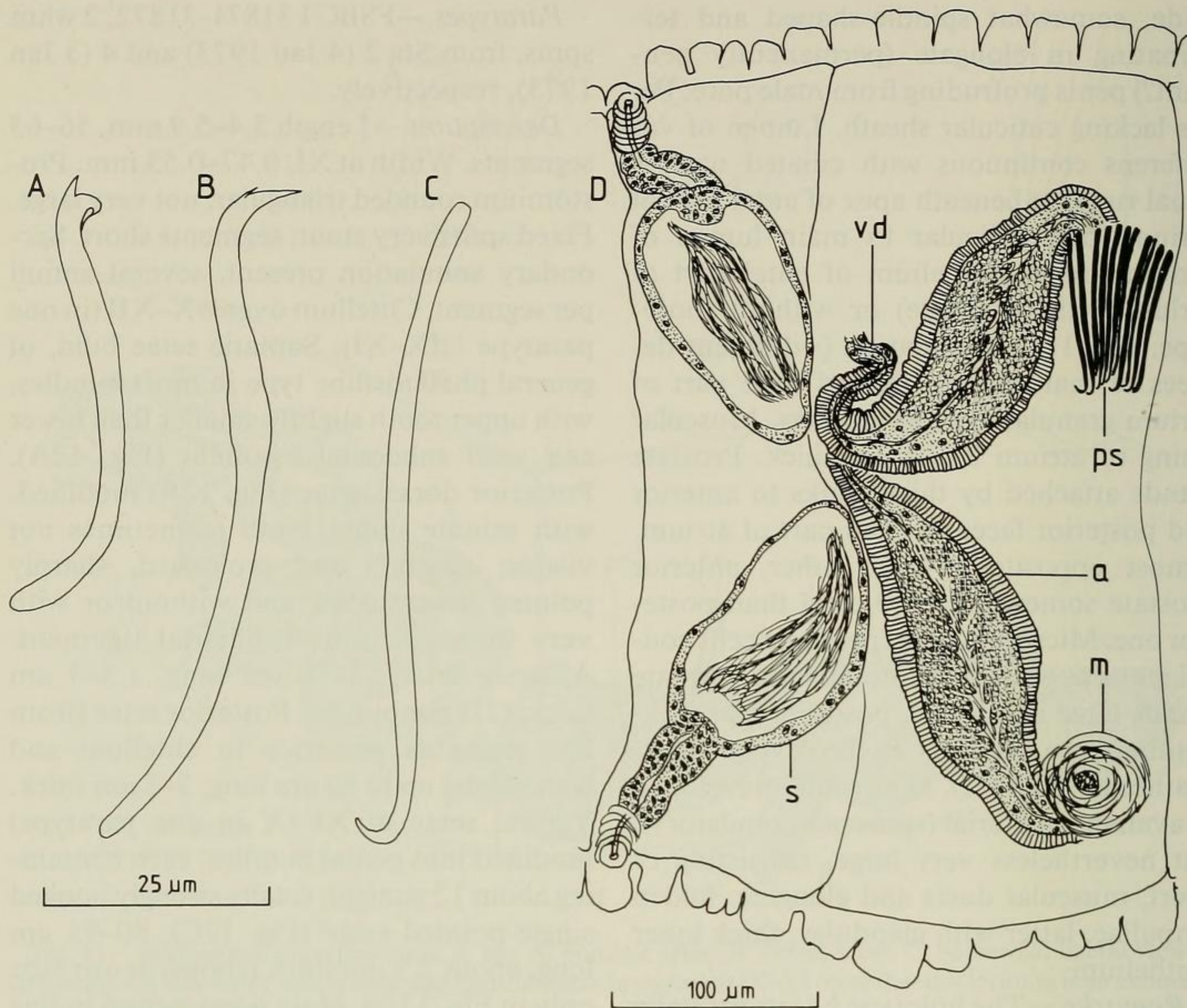


Fig. 12. *Coralliodrilus corpulentus*, n. sp.: A, Somatic seta; B, Posterior dorsal seta; C, Penial seta; D, Ventral view of spermathecae and male genitalia in segments X–XI (note that musculature is shown at one of the two male openings, penial setae at the other).

of ducts about $80\ \mu\text{m}$ long, entally about $25\ \mu\text{m}$ wide, ectally strongly muscular and narrower, and oval, thin-walled ampullae, $130\text{--}140\ \mu\text{m}$ long, about $75\ \mu\text{m}$ wide; latter containing large bundle of sperm.

Remarks.—In one paratype, the clitellum and the genitalia are shifted forward to occupy segments IX–X, not X–XI which is the normal position for the Tubificidae.

Coralliodrilus corpulentus is distinguished from all its shallow-water congeners by its very thick atrial muscles, and is unique within the genus in having modified bifid setae in the posterior dorsal bundles. The atrium of the new species is somewhat similar to that of the South Atlantic deep-sea

species *C. longiductus* Erséus, 1983 (Erséus 1983c), but the latter lacks the voluminous muscular mass around the ectal part of the atrial duct which characterizes *C. corpulentus*, and has only five to seven penial setae per bundle.

It should be noted that the gutless species described as *Coralliodrilus avisceralis* by Erséus (1981b), which also has heavily muscular atria, is now regarded as a member of the genus *Olavius* Erséus, 1984 (subgenus *Coralliodriloides* Erséus, 1984; see Erséus 1984b).

Etymology.—The species name *corpulentus*, which is Latin for “stout, corpulent,” refers to the shape of the fixed specimens.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Shell hash, 10–11 m depth.

Inanidrilus Erséus, 1979

Inanidrilus ernesti Erséus, 1984

Phallodrilus sp.—Erséus and Loden, 1981: 821.

Inanidrilus ernesti Erséus, 1984b:251, fig. 14.

New material examined.—FSBC I 31873, 2 whm spms from Sta 2 (9 May 1973).—Author's collection: 5 whm spms from Sta 2, 5 from Sta 4.

Remarks.—The gutless species *Inanidrilus ernesti* was described (Erséus 1984b) on the basis of four specimens found in another collection of oligochaetes from off Hutchinson Island, provided by Applied Biology, Inc., first to M. S. Loden (Louisiana State University) (cf. Erséus and Loden 1981), subsequently to the author. The new material conforms to the original description.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Coarse sediments, 10–12 m depth.

Inanidrilus vacivus Erséus, 1984

Inanidrilus vacivus Erséus, 1984b:249–250, fig. 12.

Holotype.—USNM 96540, whm spm from Sta 2 (3 Jan 1972).

Paratype.—FSBC I 31263, 1 whm spm from Sta 4 (6 Jul 1972).

Remarks.—*Inanidrilus vacivus* is described elsewhere (Erséus 1984b) on the basis of two specimens in the present material.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Shell hash, about 10 m depth.

Olavius Erséus, 1984

Olavius latus, new species

Fig. 13

Holotype.—USNM 98139, whm spm from Sta 2 (7 Sep 1972).

Description.—Length 9.5 mm, 80 segments. Width at XI, 0.40 mm. Body flat with elongate prostomium and with pygidium possessing long filiform caudal process (Fig. 13A). Secondary annulation indistinct (this may be a preservation artifact of the only spm at hand). Epidermal glands scattered over most of body surface (the fact that they are visible may be due to the preservation method used and should not be regarded as a specific character). Clitellum well developed over $\frac{1}{2}$ X–XII. Somatic setae (Fig. 13B) bifid, but variable, with upper tooth thinner and shorter than lower, and with conspicuous subdental ligament; upper tooth not always visible (oblique view?). Bifids 3–4 per bundle anteriorly, 2–3 per bundle in postclitellar segments. Penial setae (Figs. 13C, D, ps) 5–6 per bundle, more or less parallel and somewhat spread out within bundle, about 35 μ m long, entally about 2 μ m thick, ectally much thinner, single-pointed and curved. Male pores paired in line with ventral setae posteriorly in XI. Spermathecal pores paired between lateral lines and lines of dorsal setae, anteriorly in X.

Alimentary canal absent. Male genitalia (Fig. 13D) paired. Vas deferens longer than atrium, up to 10 μ m wide, but whole length not visible in available spm. Atrium somewhat comma-shaped, 50–60 μ m long, 25 μ m wide, with thin outer lining and thick inner epithelium, but details of lumen not clear. Atrium tapering ectally into short duct opening at inner end of very complex, folded and deep penial sac; one “fold” of sac appearing as somewhat granulated and pendant(?) papilla. Prostate glands two per atrium, large and lobed; posterior one attached by long stalk to ectal part of atrium. Pair of glandular bodies of unknown function located anterior to male pores near body wall. Spermathecae (Fig. 13D, s) consisting of inconspicuous ducts, about 20 μ m long, about 15 μ m wide, and bipartite ampullae, 135–165 μ m long; parts of each ampulla separated from each other by constriction, ectal part 30–35 μ m wide and devoid of

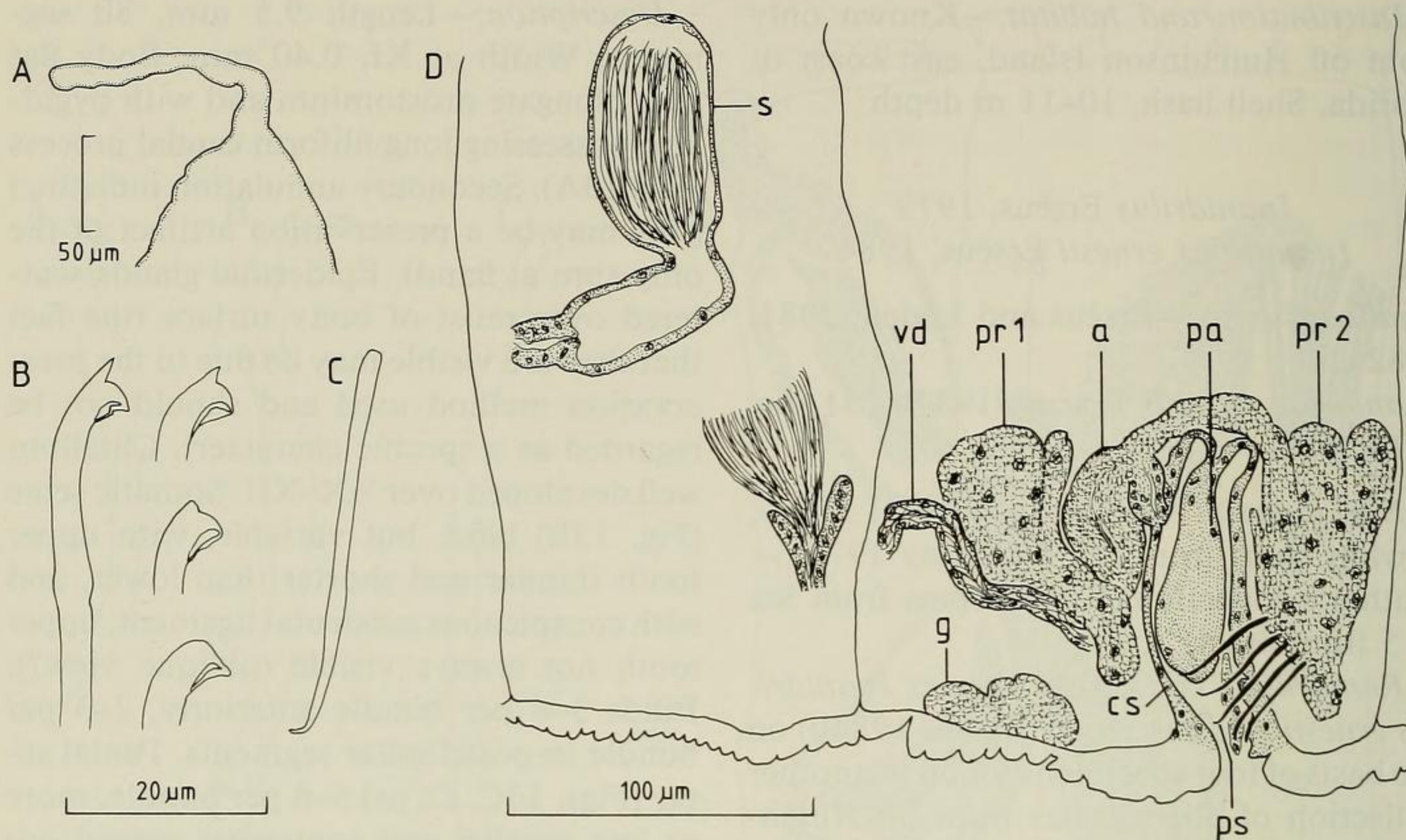


Fig. 13. *Olavius latus*, n. sp.: A, Pygidium with caudal process; B, Somatic setae; C, Penial seta; D, Lateral view of spermatheca and male genitalia in segments X-XI.

sperm, ental part 35–45 μm wide and containing broad bundle of sperm.

Remarks.—This species appears closely related to *O. planus* (Erséus, 1979) from Bermuda, another large species of *Olavius* characterized by a flat body shape and possession of a long caudal process (Erséus 1979b). However, the new species has a more complex penial sac than has *O. planus*, and its penial setae are single-pointed, not bifid as in the other species.

Etymology.—The species name *latus* is Latin for “broad, wide,” and refers here to the flattened shape of the worm.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Shell hash, 11 m depth.

Olavius sp. A

Material.—Author’s collection: 1 whm spm from Sta 2.

Remarks.—This single specimen is very similar to *O. latus* described above, but lacks penial setae and is probably a separate species. However, it is not considered ap-

propriate to describe it as such until additional material becomes available.

Olavius sp. B

Material.—Author’s collection: 2 whm spms from Sta 2.

Remarks.—This large, most probably new, gutless species is briefly characterized as follows: body wide and flat; pygidium rounded, without filiform appendage; penial setae 6–10 per bundle. Unfortunately, male genital organs are not clearly visible in the two specimens at hand.

Subfamily Limnodriloidinae

Limnodriloides Pierantoni, 1903

Limnodriloides vespertinus Erséus, 1982

Limnodriloides vespertinus Erséus, 1982c: 215–216, fig. 2.

New material examined.—FSBC I 31874, 1 whm spm from Sta 4 (10 May 1972).

Remarks.—This species was described from near Miami, Florida, and from Andros Island, Bahamas, by Erséus (1982c). The

single specimen from Hutchinson Island has poorly developed spermathecae and its posterior end is not fully grown (specimen only 3.5 mm long, consisting of about 36 segments), but otherwise it fits the original description.

Distribution and habitat.—East coast of Florida and Bahamas. Subtidal, generally somewhat muddy sands, down to 11 m depth.

Limnodriloides monotheucus Cook, 1974

Limnodriloides monotheucus Cook, 1974: 131–132, fig. 2.—Brinkhurst and Baker, 1979:1664.—Erséus, 1982c:250–253, figs. 28–29.

Bohadschia monotheuca Hrabě, 1975:112–114, figs. 1–3.

New material examined.—FSBC I 331875, 1 whm spm from Sta 2 (2 Nov 1972).—Author's collection: 2 whm spms from Sta 2.

Remarks.—This species is widely distributed in North America (including the Pacific coast) and the Caribbean area (cf. Erséus 1982c:fig. 14B for map), and it has been reported also from the Mediterranean Sea (as *Bohadschia monotheuca* Hrabě, 1975, which is regarded as both a synonym and a homonym for *L. monotheucus*). The new material largely conforms to the previous descriptions, but a slight deviation from the latter regarding some setal characteristics (cf. Erséus 1982c:table 1) should be noted. In the present specimens, preclitellar setae are up to four (occasionally five) per bundle, which is more than the two to three previously stated, and ventral setae are present in X in two of the three worms (these setae absent in both X and XI of previously studied material). In one specimen, the spermatzeugmata are short and stout as noted for material from Barbados by Erséus (1982c), but in the other two individuals they are of the “normal,” very slender type.

Distribution and habitat.—Pacific coasts of British Columbia, California, and Mexico; Atlantic coast of Florida through New

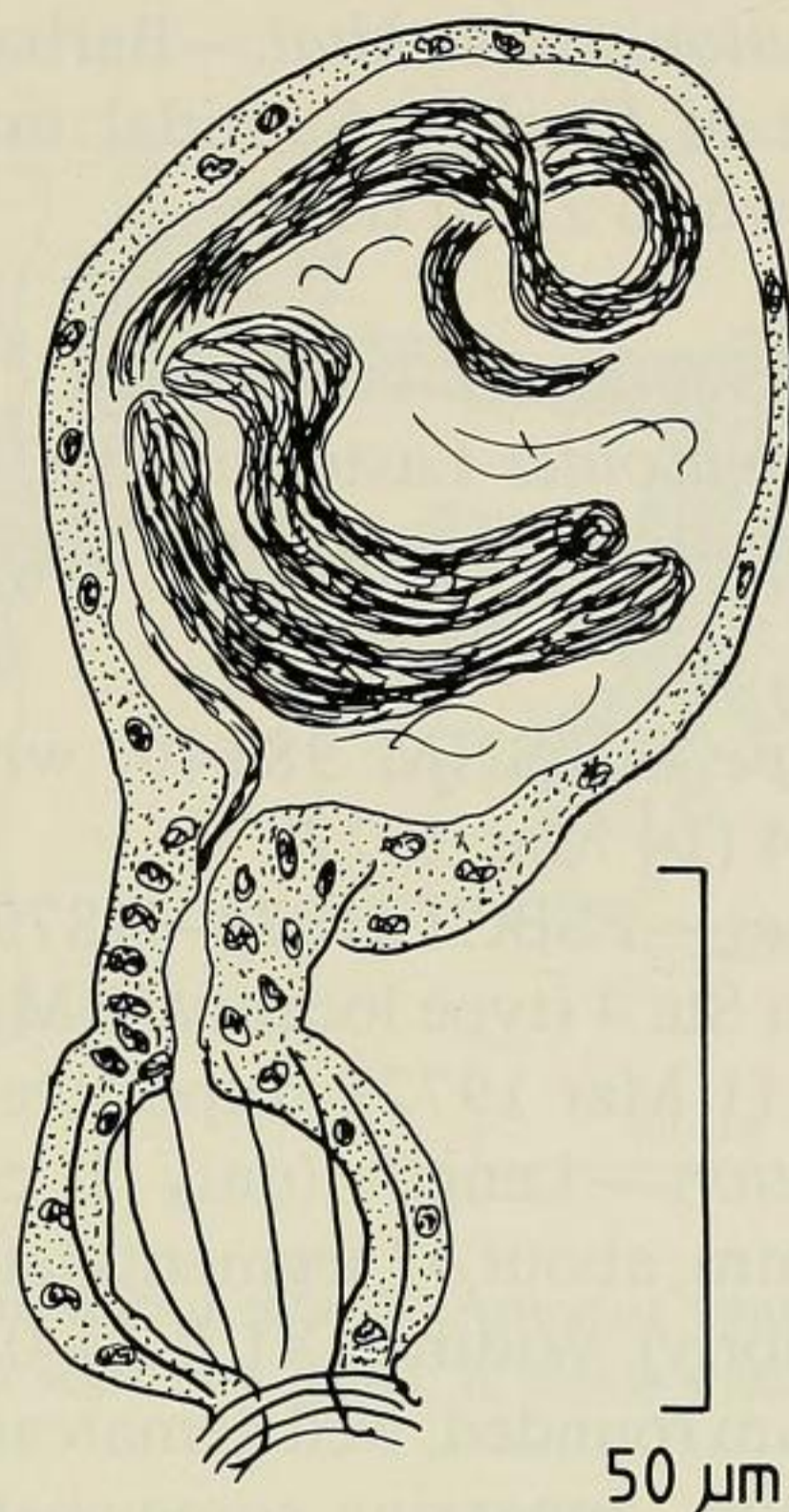


Fig. 14. *Marcusaedrillus luteolus*, spermatheca.

Jersey; Gulf coast of Florida; Bermuda; Barbados; Yugoslavia. Euryoecious, occurring also in brackish water; in various kinds of sand and silt, generally with rich organic material, down to 370 m depth.

Marcusaedrillus Righi and Kanner, 1979

Marcusaedrillus luteolus Erséus, 1983

Fig. 14

Marcusaedrillus luteolus Erséus, 1983a:27–29, fig. 3.

New material examined.—FSBC I 31876–31877, 2 whm spms, from Sta 2 (2 Nov 1972) and Sta 5 (10 May 1972), respectively.—Author's collection: 4 whm spms from Sta 2, 2 from Sta 4, and 45 from Sta 5.

Remarks.—*Marcusaedrillus luteolus* was described on the basis of material from Barbados and from near Miami, Florida (Erséus 1983a). New specimens are consistently larger (12.6–15.7 mm long, 77–88 segments) than the original material (6.1–6.9 mm, 53–68 segments), and spermathecae of all individuals from Florida (see Fig. 14) are larger than those of the original material from Barbados (Erséus 1983a:29, fig. 3D).

Distribution and habitat.—Barbados and east coast of Florida. Subtidal muds and sands, down to 21 m depth.

Subfamily Tubificinae

Tubificoides Lastockin, 1937

Tubificoides annulus, new species

Fig. 15

Holotype.—USNM 98140, whm spm from Sta 4 (14 Mar 1972).

Paratypes.—FSBCI 31878–31879, 2 whm spms from Sta 4 (type locality; 6 Mar 1973) and Sta 5 (1 Mar 1972), respectively.

Description.—Length (only 1 complete spm) 7.8 mm, about 47 segments (still growing posteriorly). Width at XI, 0.20–0.22 mm. Prostomium rounded, well demarcated from peristomium, appearing somewhat retractile within latter. Body wall smooth, without adhering foreign particles, but cuticle thick and finely ridged. Clitellum poorly developed over XI– $\frac{1}{2}$ XII. Anterior dorsal bundles with 1–2 single-pointed setae (possibly bifid with teeth very close together) and 1–2 hair setae; single-pointed setae (Fig. 15A) 35–55 μ m long, hair setae 85–150 μ m long. Anterior ventral bundles with 40–50 μ m long bifid setae (Fig. 15B), with upper tooth thinner and slightly shorter than lower. Dorsal and ventral bundles in postclitellar segments each represented by 1 bifid seta (Fig. 15C), similar to anterior bifids but generally more curved entally. Ventral setae absent in XI. Male pores paired in line with ventral setae, posteriorly in XI. Spermathecal pores paired immediately anterior to ventral setae in X.

Pharyngeal glands in IV–V. Part of esophagus enlarged and somewhat glandular in IX. Male genitalia (Figs. 15D–E) paired. Vas deferens 11–18 μ m wide, thin-walled and densely ciliated, at least 5 times as long as atrium, entering latter sub-apically. Atrium about 200 μ m long, cylindrical and curved, entally (at caecum) about 30 μ m wide, at middle about 20 μ m wide. Atrium with wide, distinct outer layer of muscles, 1–2 μ m thick,

arranged in circles around long axis; muscles more developed in ental than in ectal part. Inner epithelium of atrium histologically bipartite; inner part (caecum and area with entrances of vas deferens and prostate gland) with glandular, discrete bodies, lumen wide and containing few cilia near entrance of vas deferens; outer part evenly granulated, lumen not observed. Prostate gland attached by short stalk to atrium, clearly more ectal than, but on opposite side to, that of entrance of vas deferens. Penial sheath short (only about 15 μ m long), somewhat ring-shaped, but with inner end somewhat wider (about 20 μ m) than outer. Spermathecae (Fig. 15D, s) with very slender ducts and oblong ampullae; sperm trap indistinct but appearing to be present. Spermatozeugmata slender with rounded tips, but not very long (as compared to most congeners).

Remarks.—The characteristic shape of penial sheaths distinguishes *T. annulus* from the other species of the genus. Sheaths are reminiscent of those of *T. brevicoleus* Baker, 1983, a littoral form from the Pacific coast of Canada, which also possesses hair setae and very long vasa deferentia. *Tubificoides brevicoleus*, however, bears hair setae in postclitellar segments as well as anteriorly (hairs restricted to anterior segments in *T. annulus*) and papillae along most of the body (naked in *T. annulus*).

Etymology.—The name *annulus*, which is Latin for “ring,” alludes to the shape of the penial sheaths in this species.

Distribution and habitat.—Known only from off Hutchinson Island, east coast of Florida. Coarse, clean or somewhat muddy, sands, 10–11.5 m depth.

Tubificoides sp.

Material examined.—Author’s collection: 4 whm spms from Sta 1 (but see note under ‘material and methods’ above), 23 from Sta 2, 6 from Sta 4, and 23 from Sta 5.

Remarks.—This species, which occurred

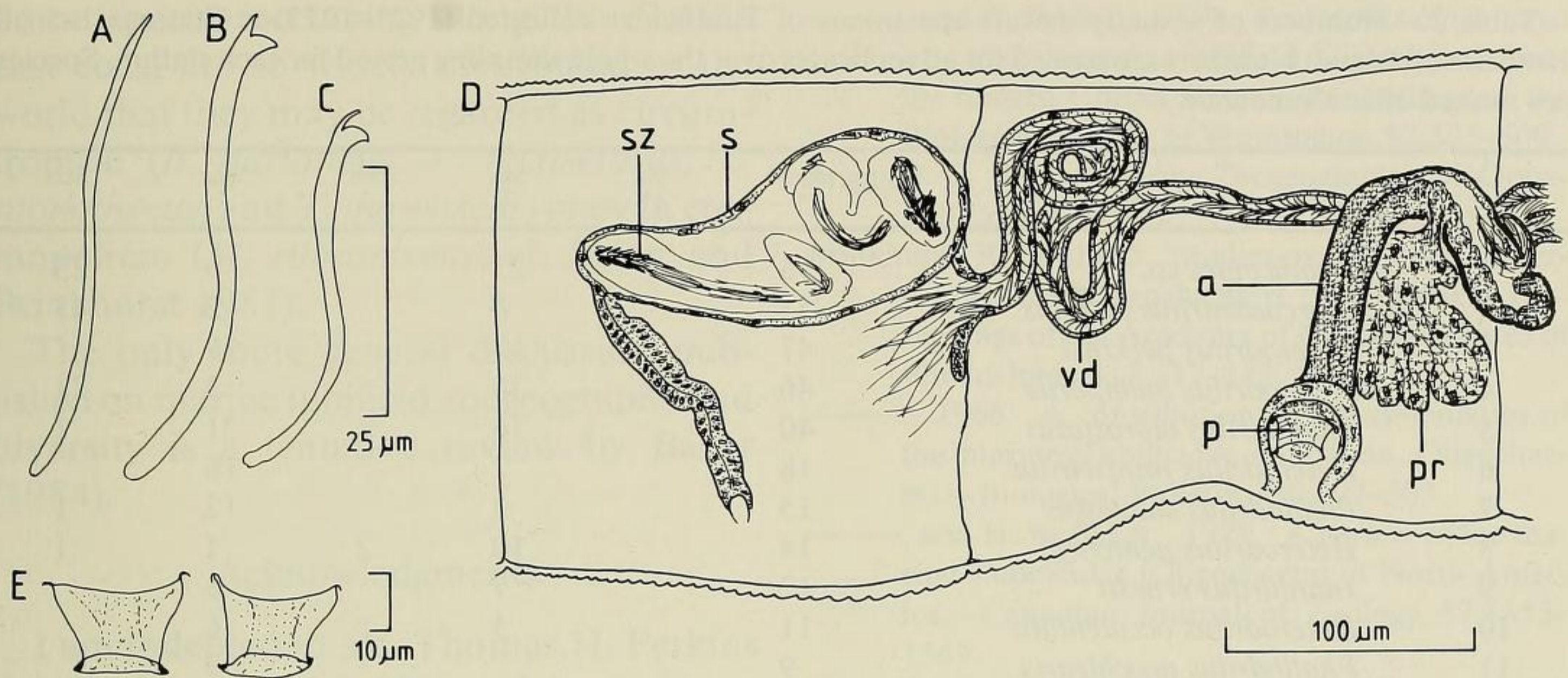


Fig. 15. *Tubificoides annulus*, n. sp.: A, Anterior, single-pointed, dorsal seta; B, Anterior ventral seta; C, Posterior seta; D, Lateral view of spermatheca and male genitalia in segments X-XI; E, Penis sheaths.

at four of the stations, belongs to a complex of species within *Tubificoides* lacking hair setae. The complex is currently under revision by Dr. R. O. Brinkhurst in Canada, and, therefore, the species will not be further treated here. It appears closely related to *T. wasselli* Brinkhurst and Baker, 1979.

Discussion

Summarized data on the local distribution of the Hutchinson Island Oligochaeta show that all but one of the 25 species occurred at either Sta 2 or Sta 4, or, for most of the species, at both stations (Table 2). Specimens from these two stations clearly dominate the material, although the sampling effort was the same for all stations. The overwhelming similarity between Sta 2 and Sta 4, in terms of distance from shore, depth, sediment composition (very coarse, shell hash), and oligochaete fauna, appears to suggest that they can be "united" for a total characterization of the particular trough in which they are located. Thus, it can be concluded that the benthic community of the coarse, shelly bottom of this trough includes an association of at least 24 interstitial, tubificid species. This is a remarkably high figure, as it outnumbers all other sim-

ilar oligochaete associations that have been more carefully examined to date; for instance, only eight coarse-sand tubificids were found in Cape Cod Bay, Massachusetts (Cook 1971), and the corresponding species were only four in some Norwegian fjords studied by Erséus (1976). In a recent paper on the Oligochaeta of Georges Bank off Massachusetts, Davis (1985) noted that when sampling in some medium-to-coarse-sand habitats, as many as 20 species could occur in the same sample, but this figure also includes some species belonging to families other than the Tubificidae. High diversity of interstitial tubificids will also be reported from medium to coarse sands off Virginia (approximately midway between Massachusetts and Florida) (Diaz et al., in press), but nowhere reaching the level recorded at Hutchinson Island.

By adding nine species new to science and a further four (named) species new to the state's fauna, the Hutchinson Island material has considerably increased our knowledge about the marine Tubificidae of Florida. The present checklist now comprises 50 species (Table 1). It should be noted that several additional records of estuarine and offshore species along the Gulf of Mexico

Table 2.—Numbers of sexually mature specimens of Tubificidae collected (1971–1973) at Stations 1–5 off Hutchinson Island. Numbers are pooled for all replicates over the whole sampling period for each station. Species are ranked after abundance.

Rank	Species	Total n	Sta 1*	Sta 2	Sta 3	Sta 4	Sta 5
1	<i>Tubificoides</i> sp.	56	4	23		6	23
2	<i>Marcusaedrillus luteolus</i>	53		6		2	45
3	<i>Heterodrilus perkinsi</i>	47		18		29	
4	<i>Heterodrilus bulbiporus</i>	46	2	20		3	21
5	<i>Phallodrilus biprostatus</i>	40		16	2	21	1
6	<i>Heterodrilus minisetosus</i>	18		2		16	
7	<i>Phallodrilus sabulosus</i>	15		2		12	1
8	<i>Heterodrilus pentcheffi</i>	14		10	2	1	1
9	<i>Inanidrilus ernesti</i>	12		7		5	
10	<i>Heterodrilus occidentalis</i>	11		5		6	
11	<i>Phallodrilus acochlearis</i>	9				9	
12	<i>Heterodrilus hispidus</i>	8		6		2	
13	<i>Bathydrius ingens</i>	3		2		1	
14	<i>Corallidrilus corpulentus</i>	3		1		2	
15	<i>Limnodriloides monotheucus</i>	3		3			
16	<i>Tubificoides annulus</i>	3				2	1
17	<i>Adelodrilus magnithecatus</i>	2		2			
18	<i>Bathydrius macroprostatus</i>	2		2			
19	<i>Inanidrilus vacivus</i>	2		1		1	
20	<i>Phallodrilus hirsutus</i>	2		1		1	
21	<i>Olavius</i> sp. B	2				2	
22	<i>Bathydrius formosus</i>	1					1
23	<i>Olavius latus</i>	1		1			
24	<i>Limnodriloides vespertinus</i>	1		1			
25	<i>Olavius</i> sp. A	1		1			

All samples: 355

* For habitat purposes, this should be regarded as Sta 5 (cf. "Material and methods" section).

coast will soon be available (M. R. Milligan, pers. comm.).

The east coast of Florida has been recognized as a transitional zoogeographic zone for shallow-water marine invertebrates (see review by Briggs 1974). The area at Hutchinson Island is characterized by an overlap of warm-temperate and tropical faunal elements (e.g., Work 1969; Camp et al. 1977); in the terminology of Valentine (1973) and Dobzhansky et al. (1977), the area is at the border between the Carolinian and Caribbean provinces. The present material and previous records of Florida east coast Tubificidae (cf. Table 1) seem to support this view, although the distribution of marine oligochaetes is still not very well known, as indicated by the fact that about 40% of the

species known from Florida are known from nowhere else.

Heterodrilus bulbiporus, *H. occidentalis*, *H. pentcheffi*, *L. barnardi*, *L. rubicundus*, *O. tenuissimus*, *P. prostatus*, and *P. sabulosus* appear to be warm-temperate species, present as they are along a great part of the U.S. east coast, several even as far north as off Massachusetts. *Adelodrilus magnithecatus*, *B. ingens*, and *P. acochlearis* are possibly more restricted to the southeastern states (the first species known also from Bermuda). Caribbean forms include *B. formosus*, *M. luteolus*, *M. hummelincki*, *K. ineri*, and *T. bori*. None of the latter has been taken north of Florida on the U.S. east coast, but the last three are present at Bermuda, which can be regarded as a Caribbean "satellite."

Some species occurring along the Florida east coast are so widely distributed in the world that they may be regarded as circum-tropical (*B. adriaticus*, *P. rectisetosus*, *L. monotheucus*, and *T. gurwitschi*) or even cosmopolitan (*M. rubroniveus*; cf. Baker and Brinkhurst 1981).

The only more general discussion published on marine tubificid zoogeography and diversity is a tentative review by Baker (1984).

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Literature Cited

- Baker, H. R. 1983. New species of *Bathydrilus* Cook (Oligochaeta; Tubificidae) from British Columbia.—*Canadian Journal of Zoology* 61:2162–2167.
- . 1984. Diversity and zoogeography of marine Tubificidae (Annelida, Oligochaeta) with notes on variation in widespread species.—*Hydrobiologia* 115:191–196.
- , and R. O. Brinkhurst. 1981. A revision of the genus *Monopylephorus* and redefinition of the subfamilies Ryacodrilinae and Branchiurinae (Tubificidae: Oligochaeta).—*Canadian Journal of Zoology* 59:939–965.
- , and C. Erséus. 1979. *Peosidrilus biprostatus* n.g., n. sp., a marine tubificid (Oligochaeta) from the eastern United States.—*Proceedings of the Biological Society of Washington* 92:505–509.
- Briggs, J. C. 1974. *Marine Zoogeography*. McGraw-Hill Book Company, New York. 475 pp.
- Brinkhurst, R. O. 1965. Studies on the North American aquatic Oligochaeta II. Tubificidae.—*Proceedings of the Academy of Natural Sciences of Philadelphia* 117:117–172.
- . 1966. A contribution to the systematics of the marine Tubificidae (Annelida, Oligochaeta).—*Biological Bulletin* 130:297–303.
- , and H. R. Baker. 1979. A review of the marine Tubificidae (Oligochaeta) of North America.—*Canadian Journal of Zoology* 57:1553–1569.
- Camp, D. K., N. H. Whiting, and R. E. Martin. 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971–1974. V. Arthropods.—*Florida Marine Research Publications* 25:1–63.
- Coates, K., and C. Erséus. 1985. Marine enchytraeids (Oligochaeta) of the coastal northwest Atlantic (northern and mid U.S.A.).—*Zoologica Scripta* 14:103–116.
- Cook, D. C. 1971. The Tubificidae (Annelida, Oligochaeta) of Cape Cod Bay. II: Ecology and systematics, with the description of *Phalldrilus parviatriatus* nov. sp.—*Biological Bulletin* 141:203–221.
- . 1974. The systematics and distribution of marine Tubificidae (Annelida: Oligochaeta) in the Bahía de San Quintín, Baja California, with descriptions of five new species.—*Bulletin of the Southern California Academy of Sciences* 73:126–140.
- Davis, D. 1985. The Oligochaeta of Georges Bank (NW Atlantic), with descriptions of four new species.—*Proceedings of the Biological Society of Washington* 98:158–176.
- Diaz, R. J., C. Erséus, and D. F. Boesch. In press. Distribution and ecology of Middle Atlantic Bight Oligochaeta.—*Hydrobiologia*.
- Dobzhansky, T., F. J. Ayala, G. L. Stebbins, and J. W. Valentine. 1977. *Evolution*. W. H. Freeman and Company, San Francisco, 572 pp.
- Easton, E. G. 1984. Earthworms (Oligochaeta) from islands of the southwestern Pacific, and a note on two species from Papua, New Guinea.—*New Zealand Journal of Zoology* 11:111–128.
- Erséus, C. 1975. *Peloscolex amplivasatus* sp. n. and *Macroseta rarisetis* gen. et sp. n. (Oligochaeta, Tubificidae) from the west coast of Norway.—*Sarsia* 58:1–8.
- . 1976. Marine subtidal Tubificidae and Enchytraeidae (Oligochaeta) of the Bergen area, western Norway.—*Sarsia* 62:25–48.

- . 1979a. Taxonomic revision of the marine genera *Bathydrilus* Cook and *Macroseta* Erséus (Oligochaeta, Tubificidae), with descriptions of six new species and subspecies.—*Zoologica Scripta* 8:139–151.
- . 1979b. Taxonomic revision of the marine genus *Phalldrilus* Pierantoni (Oligochaeta, Tubificidae), with descriptions of thirteen new species.—*Zoologica Scripta* 8:187–208.
- . 1979c. *Inanidrilus bulbosus* gen. et sp. n., a marine tubificid (Oligochaeta) from Florida, USA.—*Zoologica Scripta* 8:209–210.
- . 1979d. *Bermudrilus peniatus* n.g., n. sp. (Oligochaeta, Tubificidae) and two new species of *Adelodrilus* from the Northwest Atlantic.—*Transactions of the American Microscopical Society* 98:418–427.
- . 1980a. Taxonomic studies on the marine genera *Aktedrilus* Knöllner and *Bacescuella* Hrabě (Oligochaeta, Tubificidae), with descriptions of seven new species.—*Zoologica Scripta* 9:97–111.
- . 1980b. Two new records of the Caribbean marine tubificid *Kaketio ineri* Righi and Kanner (Oligochaeta).—*Proceedings of the Biological Society of Washington* 93:1220–1222.
- . 1981a. Taxonomic revision of the marine genus *Heterodrilus* Pierantoni (Oligochaeta, Tubificidae).—*Zoologica Scripta* 10:111–132.
- . 1981b. Taxonomic studies of Phalldrilineae (Oligochaeta, Tubificidae) from the Great Barrier Reef and the Comoro Islands with descriptions of ten new species and one new genus.—*Zoologica Scripta* 10:15–31.
- . 1981c. Taxonomy of the marine genus *Thalassodrilides* (Oligochaeta: Tubificidae).—*Transactions of the American Microscopical Society* 100:333–344.
- . 1982a. Revision of the marine genus *Smithsonidrilus* Brinkhurst (Oligochaeta, Tubificidae).—*Sarsia* 67:47–54.
- . 1982b. *Parakaketio longiprostatus* gen. et sp. n., a marine tubificid (Oligochaeta) from Florida, U.S.A.—*Zoologica Scripta* 11:195–197.
- . 1982c. Taxonomic revision of the marine genus *Limnodriloides* (Oligochaeta: Tubificidae).—*Verhandlungen des naturwissenschaftlichen Vereins in Hamburg (Neue Folge)* 25:207–277.
- . 1983a. Taxonomic studies of the marine genus *Marcusaedrilus* Righi & Kanner (Oligochaeta, Tubificidae), with descriptions of seven new species from the Caribbean area and Australia.—*Zoologica Scripta* 12:25–36.
- . 1983b. New records of *Adelodrilus* (Oligochaeta, Tubificidae), with descriptions of two new species from the Northwest Atlantic.—*Hydrobiologia* 106:73–83.
- . 1983c. A new bathyal species of *Coralliodrilus* (Oligochaeta: Tubificidae) from the Southeast Atlantic.—*Proceedings of the Biological Society of Washington* 96:272–275.
- . 1984a. A record of *Bermudrilus peniatus* (Oligochaeta: Tubificidae) from the Gulf of Mexico.—*Gulf Research Reports* 7:381.
- . 1984b. Taxonomy and phylogeny of the gutless Phalldrilineae (Oligochaeta, Tubificidae), with descriptions of one new genus and twenty-two new species.—*Zoologica Scripta* 13:239–272.
- . 1984c. Interstitial Fauna of Galapagos. XXXIII. Tubificidae (Annelida, Oligochaeta).—*Microfauna Marina* 1:191–198.
- . 1984d. Taxonomy of some species of *Phalldrilus* (Oligochaeta: Tubificidae) from the Northwest Atlantic, with description of four new species.—*Proceedings of the Biological Society of Washington* 97:812–826.
- . 1985. Annelida of Saudi Arabia. Marine Tubificidae (Oligochaeta) of the Arabian Gulf Coast of Saudi Arabia.—*Fauna of Saudi Arabia* 6:130–154.
- , and H. R. Baker. 1982. New species of the gutless marine genus *Inanidrilus* (Oligochaeta, Tubificidae) from the Gulf of Mexico and Barbados.—*Canadian Journal of Zoology* 60:3063–3067.
- , and M. S. Loden. 1981. Phalldrilineae (Oligochaeta: Tubificidae) from the east coast of Florida, with description of a new species of *Adelodrilus*.—*Proceedings of the Biological Society of Washington* 94:819–825.
- Gallagher, R. M. 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971–1974. II. Sediments.—*Florida Marine Research Publications* 23:6–24.
- , and M. L. Hollinger. 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971–1974. I. Introduction and rationale.—*Florida Marine Research Publications* 23:1–5.
- Gates, G. E. 1943. On some American and oriental earthworms. Part II. Family Megascolecidae.—*Ohio Journal of Science* 43:99–116.
- Giere, O. 1979. Studies on marine Oligochaeta from Bermuda, with emphasis on new *Phalldrilus* species (Tubificidae).—*Cahiers de Biologie Marine* 20:301–314.
- Hrabě, S. 1975. Second contribution to the knowledge of marine Tubificidae (Oligochaeta) from the Adriatic Sea.—*Vestník Československé Společnosti Zoologické* 39:111–119.
- Kennedy, C. R. 1966. A taxonomic revision of the genus *Grania* (Oligochaeta: Enchytraeidae).—*Journal of Zoology* 148:399–407.
- Lasserre, P., and C. Erséus. 1976. Oligochètes marins des Bermudes. Nouvelles espèces et remarques sur la distribution géographique de quelques

Tubificidae et Enchytraeidae.—Cahiers de Biologie Marine 17:447-462.

Loden, M. S. 1980. A new euryhaline species of *Monopylephorus* (Oligochaeta: Tubificidae) from the southeastern United States.—Bulletin of Marine Science 30:600-603.

Pierantoni, U. 1917. Sull' *Heterodrilus arenicolus* Pierant. e su di una nuova species del genere *Clitellio*.—Bollettino della Societa di Naturalisti i Napoli 29:82-91.

Valentine, J. W. 1973. Evolutionary paleoecology of

the marine biosphere. Prentice-Hall, Englewood Cliffs, New Jersey.

Work, R. C. 1969. Systematics, ecology and distribution of the mollusks of Los Roques, Venezuela.—Bulletin of Marine Science 19:614-711.

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