

THREE NEW SPECIES OF *ADELODRILUS* (OLIGOCHAETA: TUBIFICIDAE) FROM GEORGES BANK (NW ATLANTIC)

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Abstract.—Species of *Adelodrilus* Cook (subfamily Phallodrilinae) are reported from Georges Bank, SE of Massachusetts (U.S.A.). *Adelodrilus inopinatus*, n. sp., *A. correptus*, n. sp. and *A. pilatus*, n. sp. are described, and taxonomic notes are given for *A. anisotosus* Cook, *A. multispinosus* Erséus, and *A. cristatus* Erséus. All six species are interstitial forms inhabiting sublittoral, coarse sands.

In the course of the "Georges Bank Benthic Infauna Monitoring Program," performed by Battelle New England Marine Research Laboratory for the Minerals Management Service, U.S. Department of the Interior, six species of the marine, meiofaunal tubificid genus *Adelodrilus* Cook, 1969 (subfamily Phallodrilinae) were encountered. Three of these are new to science and they are described in the present paper, which also provides taxonomic notes on the other three species found.

Adelodrilus was taxonomically revised by Erséus (1978), and subsequently treated in supplementary works by Erséus (1979, 1983), and Erséus and Loden (1981). With the new forms described here, the list of Northwest Atlantic *Adelodrilus* species is increased to ten (Erséus 1983, fig. 5A).

Material and Methods

The material used in this study was sorted from grab samples collected on Georges Bank, SE of Massachusetts (U.S.A.). The worms were fixed in formalin, subsequently stored in 70% isopropanol, finally stained with paracarmine or haematoxylin and mounted whole in Canada balsam.

A few specimens of *A. inopinatus*, n. sp. were also found in material originating from a Bureau of Land Management baseline marine study undertaken by Virginia Institute of Marine Sciences.

The type-series of the new species are deposited at the U.S. National Museum of Natural History (USNM), Washington, D.C.

Adelodrilus anisotosus Cook, 1969

Adelodrilus anisotosus Cook, 1969:13-15, fig. 3.—Erséus 1978:138-139, fig. 3; 1979, figs. 3F-J.

New material examined.—Authors' collections: two specimens from off Massachusetts (Georges Bank), 40°39.5'N, 67°41.9'W, 75 m, medium to coarse sand (Feb 1983).

Remarks.—*Adelodrilus anisotosus*, which is the type-species of the genus, was previously known only from Cape Cod Bay (Massachusetts) (Cook 1969, 1971).

The new material conforms with the original description with one exception:

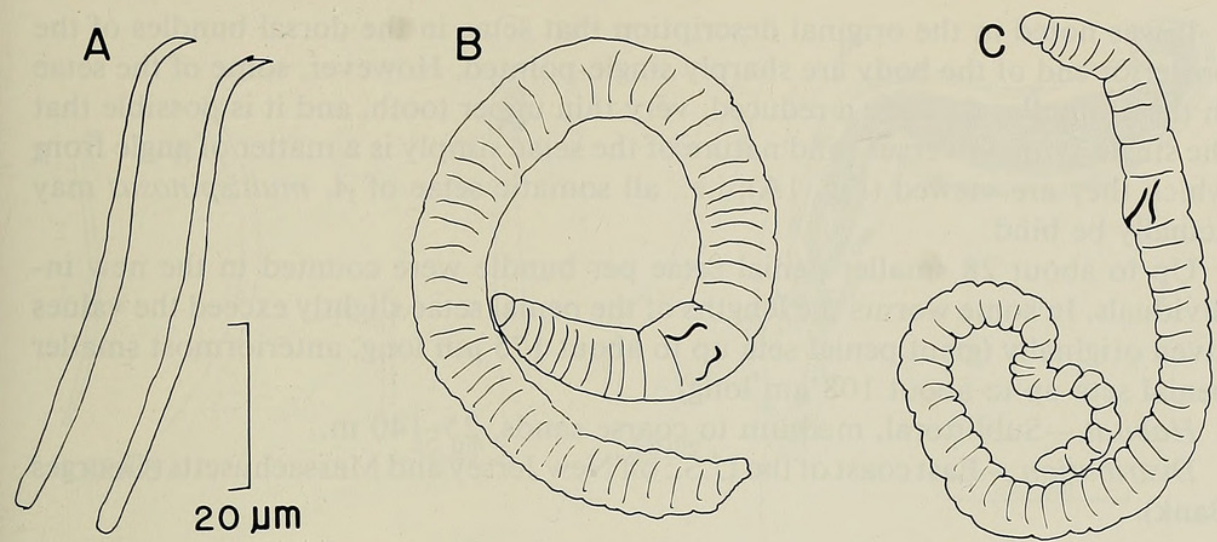


Fig. 1. A–B, *Adelodrilus multispinosus*: A, Dorsal, posterior somatic setae; B, Outline of whole worm (whole-mounted), 4.1 mm long; C, *Adelodrilus inopinatus*, outline of whole worm (whole-mounted), 4.3 mm long.

in the new worms the spermathecal pores are located between the lines of the ventral setae and the lateral lines, not in line with the ventral setae as stated by Cook (1969).

The species shares the feature of sharply single-pointed, somewhat enlarged setae in posterior dorsal bundles with *A. multispinosus* and *A. inopinatus*, n. sp. (both treated below). *Adelodrilus anisosetosus* is distinguished from these two species by the more or less equal size of the smaller penial setae within the bundle (Erséus 1978:fig. 3), as opposed to those of *multispinosus* and *inopinatus*, which are about twice as many (from 15 to about 28 per bundle) and of much varying size within the bundle (Erséus 1979:fig. 2; fig. 3).

Habitat.—Sublittoral, largely coarse sand, 10–79 m.

Distribution.—East coast of the U.S.: Cape Cod Bay and Georges Bank.

Adelodrilus multispinosus Erséus, 1979

Fig. 1A–B

Adelodrilus multispinosus Erséus, 1979:421–423, figs. 2, 3B–E.

New material examined.—Authors' collections: seven specimens from off Massachusetts (Georges Bank): one from 40°35.0'N, 67°11.7'W, 140 m, medium to coarse sand (Jul 1982); one from 40°39.5'N, 67°44.7'W, 72 m, medium to coarse sand (Jul 1982); one from 40°39.6'N, 67°45.8'W, 78 m, coarse sand (May 1983); and four from 40°39.5'N, 67°41.9'W, 75 m, medium to coarse sand (Feb 1983). The junior author checked a large number of additional specimens for consistency regarding body shape and setal characters.

Remarks.—This species was originally described from off New Jersey (Erséus 1979); the new material thus extends the known range northward to off Massachusetts.

The new worms are variable in size (2.5–8.2 mm long, 36–67 segments), but all are uniformly wide throughout their body length (Fig. 1B). The latter feature distinguishes it from the closely related *A. inopinatus*, n. sp. (see below).

It was noted in the original description that setae in the dorsal bundles of the posterior end of the body are sharply single-pointed. However, some of the setae in these bundles do have a reduced, very thin upper tooth, and it is possible that the single-pointed versus bifid nature of the setae simply is a matter of angle from which they are viewed (Fig. 1A); i.e., all somatic setae of *A. multispinosus* may actually be bifid.

Up to about 28 smaller penial setae per bundle were counted in the new individuals. In some worms the lengths of the penial setae slightly exceed the values given originally (giant penial seta up to about 175 μm long, anteriormost smaller penial seta up to about 108 μm long).

Habitat.—Sublittoral, medium to coarse sands, 25–140 m.

Distribution.—East coast of the U.S.: off New Jersey and Massachusetts (Georges Bank).

Adelodrilus inopinatus, new species

Figs. 1C, 2–3

Holotype.—USNM 96056.

Type-locality.—Georges Bank, SE of Massachusetts, U.S.A., 40°39.5'N, 67°46.2'W, 79 m, medium to coarse sand (Feb 1983).

Paratypes.—USNM 96057–96058. Two specimens from type-locality.

Other material examined.—Authors' collections: seven specimens from off Massachusetts (Georges Bank): four from type-locality; one from 40°39.5'N, 67°46.5'W, 72 m, coarse sand (Nov 1981); one from 40°39.0'N, 67°46.1'W, 72 m, medium to coarse sand (Feb 1982); and one from 40°34.2'N, 67°12.3'W, 140 m, coarse sand (May 1982). The junior author checked a large number of additional specimens from Georges Bank for consistency regarding body shape and setal characters. Senior author's collection: seven specimens from off Maryland: five from 38°17.5'N, 74°41.0'W, 29 m, medium to coarse sand (Mar 1976); and two from 38°08.0'N, 74°13.0'W, 53 m, medium to coarse sand (Mar 1976).

Etymology.—The name *inopinatus* (Latin “unexpected”) alludes to the fact that this species was long regarded as a variety of *A. multispinosus* by the senior author.

Description (based on material from Georges Bank).—Length (fixed specimens) 3.4–5.1 mm, 45–56 segments; diameter at XI in whole-mounted, slightly compressed specimens, 0.19–0.24 mm. Posterior end of body distinctly narrower than anterior (Fig. 1C). Clitellum extending over $\frac{1}{2}$ X–XII; tall epidermal cells present ventrally and partially extending up lateral sides, anteriorly in X (Fig. 2F). Somatic setae bifid, with upper tooth shorter and thinner than lower tooth (Fig. 2A); in all ventral bundles, and in anterior and mid-body dorsal bundles. Posterior, dorsal setae (Fig. 2B) sharply single-pointed; ectally strongly curved; distinctly larger than bifid setae. Somatic setae 45–75 μm long, 1.5–3.5 μm thick; (2)3–4 per bundle anteriorly, (2)3(4) per bundle posteriorly. Ventral setae of XI highly modified into penial bundles, each containing: (1) one giant, slightly sigmoid seta (Figs. 2E; 3:gs), 130–168 μm long, 8–14 μm wide at middle, with broad inner end and ectal “spoon” ending with single-pointed, but rounded tip; (2) about 5 intermediate, smaller setae (Figs. 2D; 3:ss, Part), largest (anteriormost) about 85–115 μm long (inner end difficult to see), 4–6 μm thick at middle, these setae ectally provided with slightly hooked tips followed by many tiny spines; (3) high number (at least

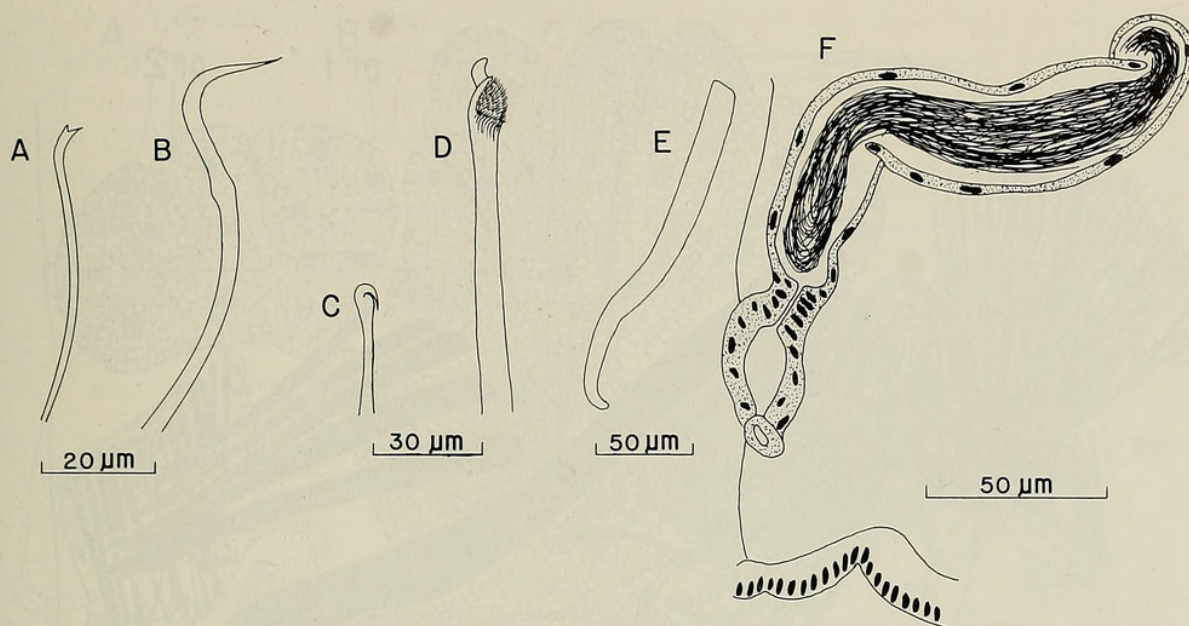


Fig. 2. *Adelodrilus inopinatus*: A, Bifid anterior somatic seta; B, Dorsal, posterior somatic seta; C, Smaller penial seta; D, Intermediate penial seta; E, Giant penial seta (different view than in Fig. 3); F, Spermatheca.

20 in many specimens) of small, ectally hooked setae (Figs. 2C; 3:ss, Part), 30–45 μm long, 1–1.5 μm thick. Small penial setae generally erect; giant and intermediate penial setae more or less parallel to long axis of worm. Ectal ends of penial setae located within deeply folded and complex copulatory sacs. Male pores paired, in line with ventral somatic setae posteriorly in XI. Spermathecal pores paired, in line with ventral setae in X near intersegmental furrow IX/X.

Pharyngeal glands in (IV)V–VII. Male genitalia (Fig. 3) paired. Vas deferens thin-walled and broadly dilated; longer than atrium, up to about 20 μm wide; filled with spermatozoa; entering atrium subapically. Atrium oval; 45–70 μm long, 27–32 μm wide; with thin outer lining and thick, granulated inner epithelium; cilia not observed; opening into inner end of copulatory sac. Anterior prostate gland large, consisting of many lobes; attached to ental end of atrium, near junction with vas deferens. Posterior prostate smaller, attached by long stalk to ectal end of atrium. Spermathecae (Fig. 2F) with ducts 45–60 μm long, 12–25 μm wide, ectally dilated and entally narrow lumen; ampullae up to about 200 μm long, 12–30 μm wide, slender and thin-walled, sperm as random masses.

Remarks.—*Adelodrilus inopinatus* is similar and very closely related to *A. multispinosus*; the penial bundles of both species each contain one giant, somewhat spoon-shaped seta, and a row of about 20–25, gradually smaller setae. However, there are morphological differences between the two, differences which proved to be consistent when the junior author checked hundreds of specimens for body shape, spined versus non-spined intermediate penial setae, and shape of posterior dorsal somatic setae. *Adelodrilus inopinatus* is always tapered toward its posterior end, not as stout as *A. multispinosus* (Fig. 1B–C); its intermediate penial setae have spines ectally; and its posterior, dorsal setae are ectally much more curved and pointed than those of *A. multispinosus* (Figs. 1A, 2B).

It should be noted that the genitalia of one of the worms from Georges Bank

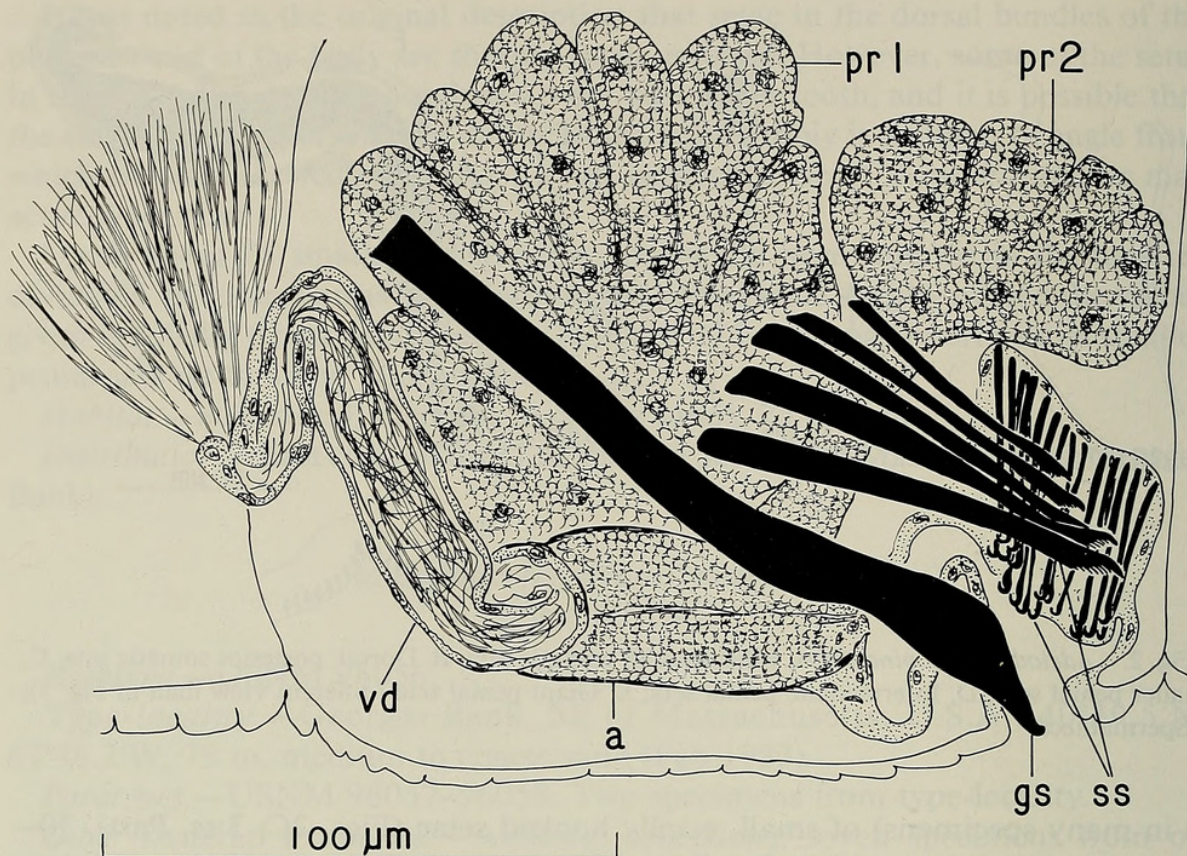


Fig. 3. *Adelodrilus inopinatus*, lateral view of male genitalia in segment XI. a, atrium; gs, giant penial seta; pr 1, anterior prostate gland; pr 2, posterior prostate gland; ss, smaller penial seta; vd, vas deferens.

area shifted forwards to segments VI–VII. This is a very unusual position for the genital organs of a tubificid, and it must be considered an intra-specific anomaly without taxonomic implications.

The material of *A. inopinatus* from off Maryland differs from the above description only in some dimensional features.

Habitat.—Sublittoral, largely coarse sands, 29–140 m.

Distribution.—East coast of the U.S.: off Maryland and Massachusetts (Georges Bank).

Adelodrilus correptus, new species

Fig. 4

Holotype.—USNM 96059.

Type-locality.—Georges Bank, SE of Massachusetts, U.S.A., 40°39.6'N, 67°45.8'W, 78 m, coarse sand (May 1983).

Paratypes.—USNM 96060–96061. Two specimens from off Massachusetts (Georges Bank), 40°39.5'N, 67°45.4'W, 78 m, coarse sand (May 1983).

Other material examined.—Authors' collections: three specimens from off Massachusetts (Georges Bank): one from type-locality, and two from 40°39.8'N, 67°46.1'W, 78 m, coarse sand (May 1983).

Etymology.—The name *correptus* is Latin for “pronounced short”; this is a very small species of *Adelodrilus*.

Description.—Length (fixed specimens) 2.2–2.9 mm, 25–32 segments; diameter

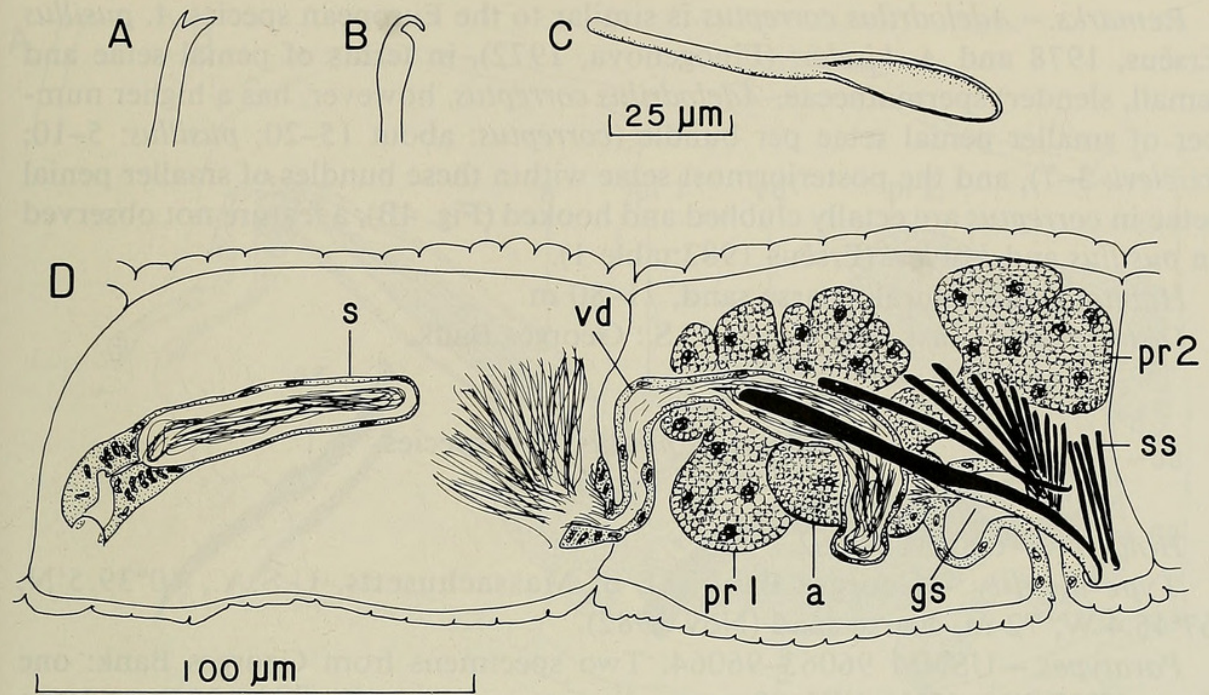


Fig. 4. *Adelodrilus correptus*: A, Free-hand drawing of somatic seta; B, Free-hand drawing of tip of smaller penial seta; C, Giant penial seta; D, Lateral view of spermatheca and male genitalia in segments X–XI. s, spermatheca; other abbreviations as for Fig. 3.

at XI in whole-mounted, slightly compressed specimens, 0.11–0.16 mm. Clitellum extending over $\frac{1}{2}$ X–XII. Somatic setae bifid, with upper tooth thinner and shorter than lower tooth (Fig. 4A); 35–50 μm long, 1–1.5 μm thick; (2)3–4(5) per bundle anteriorly, (2)3–4 per bundle in post-clitellar segments. Ventral setae of XI modified into penial bundles, each containing: (1) one giant, slender, spoon-shaped seta (Figs. 4C; D:gs), with single-pointed, somewhat hooked tip, with ectal blade comprising slightly more than $\frac{1}{3}$ of seta; (2) a row of about 15–20 smaller setae (Fig. 4D:ss), single-pointed and slightly hooked (anteriormost and larger ones), or somewhat clubbed with an apical tooth (posterior, smallest ones; Fig. 4B). Giant seta 65–85 μm long, 3.5–4.5 μm wide at middle (blade wider). Largest of smaller penial setae 45–60 μm long, about 2 μm thick; smallest penial setae about 25–30 μm long, about 1 μm thick. Ectal ends of penial setae located within thin-walled, folded copulatory sacs. Male pores paired, in line with ventral somatic setae, posteriorly in XI. Spermathecal pores paired, in line with ventral setae in X near intersegmental furrow IX/X.

Pharyngeal glands in IV–VI. Male genitalia (Fig. 4D) paired. Vas deferens thin-walled and broadly dilated; longer than atrium, 15–20 μm wide; filled with spermatozoa or at least in middle and ectally; entering atrium sub-apically. Atrium oval or ovoid; 28–35 μm long, 21–28 μm wide; with thin outer lining and thick, granulated and ciliated inner epithelium; opening into inner end of copulatory sac. Anterior prostate gland large, attached to apical end of atrium. Posterior prostate smaller, attached by long stalk to middle-to-ectal part of atrium, somewhat opposite to entrance of vas deferens. Spermathecae small and slender (but not always as narrow as the one depicted in Fig. 4D); ducts 18–23 μm long, 14–19 μm wide; ampullae thin-walled, 44–57 μm long, 10–25 μm wide; sperm as random masses or compact bundle.

Remarks.—*Adelodrilus correptus* is similar to the European species *A. pusillus* Erséus, 1978 and *A. kiselevi* (Finogenova, 1972), in terms of penial setae and (small, slender) spermathecae. *Adelodrilus correptus*, however, has a higher number of smaller penial setae per bundle (*correptus*: about 15–20; *pusillus*: 5–10; *kiselevi*: 3–7), and the posteriormost setae within these bundles of smaller penial setae in *correptus* are ectally clubbed and hooked (Fig. 4B), a feature not observed in *pusillus* and *kiselevi* (Erséus 1983:table 1).

Habitat.—Sublittoral, coarse sand, 71–80 m.

Distribution.—East coast of the U.S.: Georges Bank.

Adelodrilus pilatus, new species

Fig. 5

Holotype.—USNM 96062.

Type-locality.—Georges Bank, SE of Massachusetts, U.S.A., 40°39.5'N, 67°45.4'W, 72 m, coarse sand (Nov 1982).

Paratypes.—USNM 96063–96064. Two specimens from Georges Bank: one from 40°39.0'N, 67°46.1'W, 80 m, medium to coarse sand (Nov 1982); and one from 40°38.5'N, 67°46.1'W, 78 m, heterogeneous coarse sand (Nov 1982).

Other material examined.—Authors' collections: seven specimens from Georges Bank: three from type-locality; two from 40°39.6'N, 67°47.6'W, 72 m, medium to coarse sand (Nov 1981); one from 40°39.5'N, 67°46.2'W, 78 m, medium to coarse sand (Feb 1983); and one from 40°40.6'N, 67°46.1'W, 77 m, medium to coarse sand (Nov 1982).

Etymology.—The name *pilatus* is Latin for “armed with a heavy javelin,” and refers here to the much enlarged, sharply single-pointed seta in the ventral bundles of segment X in this species.

Description.—Length (fixed specimens) 2.4–3.7 mm, 26–35 segments; diameter at XI in whole-mounted, slightly compressed specimens, 0.10–0.17 mm. Clitellum extending over $\frac{1}{2}$ X–XII. Most somatic setae bifid, with upper tooth thinner and shorter than lower tooth (Fig. 5A); 30–50 μ m long, 1–1.5 μ m thick; 3–4 per bundle anteriorly, 2–3 per bundle posteriorly. Ventral setae of IX and X sharply single-pointed and enlarged, those of X (Fig. 5B:se) larger than those of IX; 2–3 per bundle in IX, 2 per bundle in X. One of two setae in each ventral bundle of X larger, 65–80 μ m long, 3.5–7 μ m thick at node; smaller seta in each ventral bundle of X and ventral setae of IX 50–65 μ m long, 2.5–3 μ m thick at node. Ventral setae of XI highly modified into penial bundles, each containing: (1) one giant, slightly sigmoid, ectally flattened and widened seta (Fig. 5B:gs), 115–140 μ m long, 7–9 μ m thick at middle (much wider ectally); (2) two or three intermediate setae, largest 40–65 μ m long, 3–4 μ m thick, more or less single-pointed and slightly curved ectally; (3) about 5 to 9 (exact number difficult to establish) thin, small setae (Fig. 5B:ss), ectally clubbed and with small apical hooks; 20 μ m long, about 1 μ m thick. Giant seta and intermediate setae parallel or somewhat oblique to long axis of worm; smaller penial setae generally erect. Ectal ends of penial setae located within thin-walled, folded copulatory sacs. Male pores paired, located close to each other, posteriorly and ventrally in XI. Spermathecal pores paired, in line with ventral setae in X near intersegmental furrow IX/X.

Pharyngeal glands in IV–VI. Male genitalia (Fig. 5B) paired. Vas deferens thin-

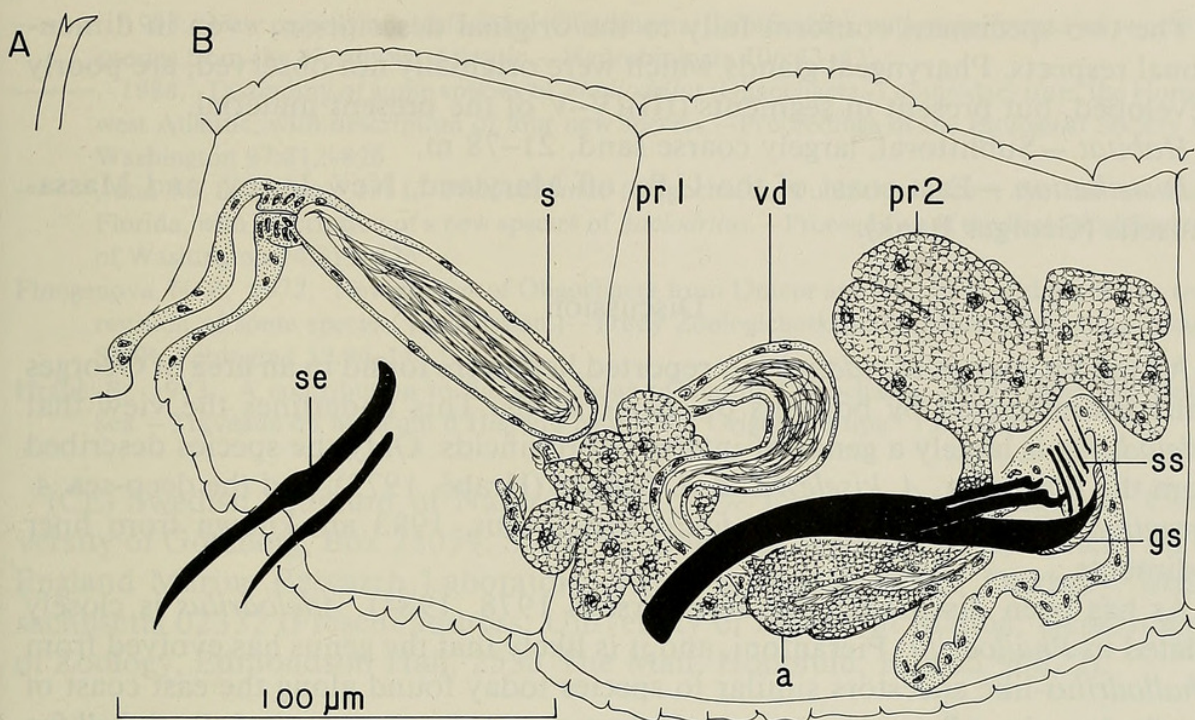


Fig. 5. *Adelodrilus pilatus*. A, Free-hand drawing of somatic seta; B, Lateral view of spermatheca and male genitalia in segments X–XI. se, ventral seta of X; other abbreviations as for Fig. 4.

walled and broadly dilated; about $15\ \mu\text{m}$ wide; containing sperm in large bundle; entering close to apex of atrium. Atrium ovoid; $40\text{--}55\ \mu\text{m}$ long, $20\text{--}30\ \mu\text{m}$ wide; with thin outer lining and thick, granulated and ciliated inner epithelium; opening into inner end of copulatory sac. Anterior prostate gland attached by stalk to apex of atrium, at entrance of vas deferens. Posterior prostate attached by long stalk to ectal part of atrium. Spermathecae (Fig. 5B:s) slender; ducts long and hollow, about $50\text{--}60\ \mu\text{m}$ long, $15\text{--}20\ \mu\text{m}$ wide; ampullae thin-walled and elongate, $75\text{--}100\ \mu\text{m}$ long, $25\text{--}35\ \mu\text{m}$ wide, sperm as random masses or compact bundle.

Remarks.—This species is closely related to the European *A. cooki* Erséus, 1978, in having single-pointed setae in the ventral bundles of segments X and XI. However, in *A. cooki* these setae are far less enlarged than those of *A. pilatus* and they are not appreciably thicker than the normal, bifid setae. In addition, the anteriormost of the intermediate penial setae in *A. pilatus* is much stouter than the corresponding seta in the penial bundles of *A. cooki* (Fig. 5B; Erséus 1978: fig. 2D).

Habitat.—Sublittoral, largely coarse sand, 71–80 m.

Distribution.—East coast of the U.S.: Georges Bank.

Adelodrilus cristatus Erséus, 1983

Adelodrilus cristatus Erséus, 1983:78–79, fig. 4.

New material examined.—Authors' collections: two specimens from Georges Bank, $40^{\circ}39.8'\text{N}$, $67^{\circ}46.1'\text{W}$, 78 m, coarse sand (May 1983).

Remarks.—This species was recently described from off Maryland and New Jersey (Erséus 1983); the new material thus extends the known range northward to off Massachusetts.

The two specimens conform fully to the original description, even in dimensional respects. Pharyngeal glands which were originally not observed, are poorly developed, but present in segments (III)IV–V of the present material.

Habitat.—Sublittoral, largely coarse sand, 21–78 m.

Distribution.—East coast of the U.S.: off Maryland, New Jersey, and Massachusetts (Georges Bank).

Discussion

All the six species of *Adelodrilus* reported here were found in an area of Georges Bank characterized by bottoms of coarse sands. This underlines the view that *Adelodrilus* is largely a genus of interstitial tubificids. Only the species described from the Black Sea, *A. kiselevi* and *A. borceai* (Hrabě, 1973), and the deep-sea *A. voraginus* (Cook, 1970) and *A. fimbriatus* Erséus, 1983 are known from finer sediments.

As has been discussed elsewhere (Erséus 1978, 1984), *Adelodrilus* is closely related to *Phallodrilus* Pierantoni, and it is likely that the genus has evolved from *Phallodrilus*-like ancestors similar to species today found along the east coast of North America (*P. coeloprostatum*, *P. boeschi*, *P. biprostatum* and *P. flabellifer*; see Erséus 1984). The very high species diversity of *Adelodrilus* along this coast, including complexes of very closely related forms (*anisosetosus-multispinosus-inopinatus* and *voraginus-fimbriatus*) is noteworthy, and it can be expected that additional species are yet to be encountered in the area.

Acknowledgments

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