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Marine Tubificidae (Annelida: Clitellata) of the Esperance area, Western Australia

Christer Erséus[1] and Hongzhu Wang[2]

[1] Department of Zoology, Göteborg University, Box 463, SE-405 30 Göteborg, Sweden. Email: christer.erseus@zool.gu.se

[2] State Key Laboratory of Freshwater Ecology and Biotechnology, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, China. Email: wanghz@ihb.ac.cn

Abstract – Eighteen species of Tubificidae are reported from intertidal and shallow-water subtidal habitats in the area near Esperance, on the southern coast of Western Australia. Five species are new to science, while all others were previously known from other parts of Western Australia. *Pirodriloides breviclitellatus* sp. n. differs from *P. albanensis* (Erséus, 1990), the only other member of *Pirodriloides*, by lacking penial papillae and numerous coelomocytes. *Bathydrilus difficilis* sp. n. is partly sympatric with the closely related *B. edwardsi* Erséus, 1984, but has larger spermathecae (and receives a higher number of spermatozeugmata at copulation) than the latter. *Duridrilus globosus* sp. n. has spermathecal pores that are ventral instead of lateral, and the openings of its male ducts are less complex than those of the otherwise similar, Saudi Arabian, *D. tectus* Erséus, 1985. *Limnodriloides solitarius* sp. n. is closely related to the North Pacific *L. macinnesi* Erséus, 1990, discriminated only by details in the male ducts; it has larger atrial ampullae and distinct penial papillae inside their copulatory sacs. Finally, *Smithsonidrilus fecundus* sp. n., known also from Rottnest Island, was previously interpreted as an apomorphic lineage within *S. minusculus* (Erséus, 1983), characterized by the lack of spermathecae; it is now regarded as a separate taxon. Taxonomic notes are given also for most of the other species reported. A total of 95 species of marine Tubificidae have now been recorded from Western Australia.

INTRODUCTION

In previous studies, totally 90 species of marine Tubificidae have been reported from Western Australia (Michaelsen, 1907; Erséus, 1990a, 1993, 1997a, 1998; Erséus and Wang, 2003), making this state one of the best studied areas in the world with regard to this group of clitellate annelids. Still, however, the knowledge about the tubificids occurring along the southern coast is largely based on a single sampling effort in the Albany region (Erséus, 1990a). The international marine biological workshop on “The Marine Flora and Fauna of Esperance, Western Australia”, arranged by the Western Australian Museum, The University of Western Australia, and the Australian Marine Sciences Association (see this volume), provided an opportunity for us to obtain additional material from southern Western Australia, and thus extending the geographical coverage about 400 km further to the east. This paper deals with all the Tubificidae collected around Esperance.

MATERIAL AND METHODS

A range of intertidal and shallow-water subtidal sites in the Esperance area were visited by the second author. At each station, a sediment sample of a few litres was collected by hand. Six additional samples (included in list below) were collected at subtidal stations by SCUBA divers. Each sample was repeatedly (four times or more) stirred in seawater in a bucket, and the suspensions of organic material thus obtained were decanted into a 0.25 mm sieve, after which the sieved material was brought live into the laboratory for further examination. One-hundred and sixteen sexually mature tubificids, present in 21 of the samples, were sorted out under a dissecting microscope. The worms were fixed in Bouin´s fluid for one or two days and then transferred into 75% ethanol.

Later, the individuals were all stained in alcoholic paracarmine, dehydrated through an ethanol/xylene series and mounted whole in Canada balsam. All morphological studies reported herein were performed on these mounted specimens under a light microscope. In the descriptions, specific segments are referred to by Roman numerals. Types and other reference material are deposited in the Western Australian Museum (WAM), Perth, and in the Swedish Museum of Natural History (SMNH), Stockholm. Whole-mounted specimens of *Heterodrilus keenani* and *Bathydrilus edwardsi*, from various Western Australian sites and previously deposited in SMNH, were borrowed and re-examined.

LIST OF STATIONS

All stations in the vicinity of Esperance, Western Australia. The tubificid species found at each station are also listed.

ES03-1B. SW end of Wylie Bay, 33°50.18'S, 121°59.04'E, rocky shore, barely subtidal to lower intertidal, heterogeneous sand with sea stars, 5 February 2003. *Heronidrilus bihamis, Smithsonidrilus fecundus* sp. n.

ES03-4A. N tip of Long Island, 34°02.67'S, 121°58.10'E, subtidal, 11.5 m, medium to coarse sand (coll. A. Longbottom), 6 February 2003. *Heterodrilus decipiens*.

ES03-4B. Same as *ES03-4A*, but fine to medium sand (coll. A. Longbottom), 6 February 2003. *Heterodrilus decipiens*.

ES03-5A. N of New Island, 34°00.84'S, 122°08.52'E, rocky shore, lower intertidal, medium to coarse sand under rocks, 6 February 2003. *Mexidrilus immodicus, Pectinodrilus granifer, Aktedrilus fissilis, Coralliodrilus mirus.*

ES03-15B. Intertidal pool, SE tip of Little Wharton Bay, 33°56.94'S, 122°34.14'E, heterogeneous sand with H_2S smell, 10 February 2003. *Albanidrilus wellsi*.

ES03-15C. Close to *ES03-15B*, but barely subtidal to lower intertidal, very coarse sand, 10 February 2003. *Heterodrilus keenani, Pirodriloides breviclitellatus* sp. n., *Aktedrilus triplex.*

ES03-16A. Unnamed rock islet SW of Duke of Orleans Bay, W of Bay Rock island, 33°55.62'S, 122°34.78'E, lower intertidal, heterogeneous sand with dead seagrass, 10 February 2003. *Heterodrilus keenani, Pectinodrilus granifer.*

ES03-21C. S of New Island, 34°01.35'S, 122°08.33'E, subtidal, 26 m, medium to coarse sand (coll. F. Wells), 12 February 2003. *Heterodrilus decipiens.*

ES03-22B. N of New Island, 34°00.83'S, 122°08.54'E, subtidal, 5.9 m, fine sand with dead grass (coll. A. Brearley), 12 February 2003. *Smithsonidrilus minusculus.*

ES03-24. NE of Long Island, 34°02.74'S, 121°58.47'E, subtidal, 15 m, heterogeneous sand with seaweeds (coll. C. Whisson), 12 February 2003. *Heronidrilus bihamis.*

ES03-25C. SW of Lucky Bay, 33°59.68'S, 122°13.25'E, subtidal, 2 m, coarse sand (coll. S. Shepherd), 13 February 2003. *Heterodrilus keenani*.

ES03-25D. Same as *ES03-25C*, but middle to lower intertidal, medium sand, 13 February 2003. *Pectinodrilus granifer, Aktedrilus fissilis, Coralliodrilus regius*.

ES03-28A. S of Duke of Orleans Bay, near Nares Island, 33°56.16'S, 122°35.44´ E, barely subtidal to lower intertidal, medium to coarse sand, 14 February 2003. *Heterodrilus keenani, Duridrilus globosus* sp. n.

ES03-28B. Same as *ES03-28A*, but subtidal, 0.5 m, coarse sand with soil-like sediment in *Posidonia* grass-mat, 14 February 2003. *Heterodrilus keenani, Bathydrilus difficilis* sp. n., *Limnodriloides agnes, L. solitarius* sp. n., *Smithsonidrilus fecundus* sp. n.

ES03-28C. Same as 28A, but subtidal, 1.5 m, coarse sand, 14 February 2003. *Duridrilus globosus* sp. n., *Bathydrilus edwardsi*.

ES03-28D. Same as *ES03-28A*, but about 10 m away, lower intertidal, medium to coarse sand, 14 February 2003. *Pectinodrilus granifer*.

ES03-28E. Same as *ES03-28B*, but muddy coarse sand, 17 February 2003. *Heterodrilus keenani, Bathydrilus edwardsi, B. difficilis* sp. n., *Limnodriloides agnes, Smithsonidrilus fecundus* sp. n.

ES03-28F. Same as *ES03-28A*, but coarse sand, 17 February 2003. *Heterodrilus keenani*.

ES03-30A. NW of Table Island, 33°54.89'S, 122°35.65'E, middle to lower intertidal, coarse sand with dead seagrass, 15 February 2003. *Duridrilus globosus* sp. n.

ES03-30D. Same as *ES03-30A*, but subtidal, 2 m, heterogeneous sand, 15 February 2003. *Heronidrilus bihamis, Heterodrilus keenani*.

ES03-35B. Same as *ES03-35A*, but 1.5 m, shelly heterogeneous sand, 19 February 2003. *Smithsonidrilus minusculus*.

ABBREVIATIONS USED IN THE FIGURES

a, atrium; aa, atrial ampulla; ad, atrial duct; cl, clitellum; cs, copulatory sac; e, eggs; mp, male pore; od, oesophageal diverticula; pc, penial chaetae; pp, penial papilla; ppa, prostatic pad; pr, prostate gland; pr 1, anterior prostate gland; pr 2, posterior prostate gland; s, spermatheca; sb, sperm bundle (indicating location of sperm funnel); sf, sperm funnel; sv, seminal vesicle with developing sperm; sz, spermatozeugma; vd, vas deferens.

LIST OF SPECIES

(All family TUBIFICIDAE)
Subfamily RHYACODRILINAE

Heronidrilus bihamis Erséus and Jamieson, 1981
Heterodrilus keenani Erséus, 1981
Heterodrilus decipiens Erséus, 1997

Subfamily PHALLODRILINAE

Albanidrilus wellsi (Erséus, 1990)
Mexidrilus immodicus Erséus, 1993
Pectinodrilus granifer (Erséus, 1990)
Pirodriloides breviclitellatus sp. n.
Aktedrilus fissilis Erséus, 1990
Aktedrilus triplex Erséus, 1990
Bathydrilus edwardsi Erséus, 1984
Bathydrilus difficilis sp. n.
Duridrilus globosus sp. n.
Coralliodrilus mirus Erséus, 1990
Coralliodrilus regius Erséus, 1990

Subfamily LIMNODRILOIDINAE

Limnodriloides agnes Hrabe, 1967
Limnodriloides solitarius sp. n.
Smithsonidrilus minusculus (Erséus, 1983)
Smithsonidrilus fecundus sp. n.

SYSTEMATIC ACCOUNT

Family TUBIFICIDAE

Subfamily RHYACODRILINAE

Genus *Heronidrilus* Erséus and Jamieson, 1981

Heronidrilus bihamis Erséus and Jamieson, 1981

Heronidrilus bihamis Erséus and Jamieson, 1981: 107–108, figure 3; for other citations, see Erséus, 1997a: 394.

New material

WAM V 4399, one specimen from Station ES03-30D, and SMNH Main Coll. 77623-77624, two specimens, one from Station ES03-1B and one (partially mature) from Station ES03-24.

Remarks

This species is widely distributed in the Indo-Pacific area and was previously recorded from

Albany, Rottnest Island and the Montebello Islands in Western Australia (Erséus, 1990a, 1993, 1997a), and it is also known from Victoria (Erséus, 1990b). Two of the new specimens from Esperance show full sexual maturity and conform well with previous descriptions; e.g., they have penial chaetae, two per bundle (and here 65–75 µm long), with the "heel-to-heel" arrangement so characteristic for *Heronidrilus bihamis* (see Erséus and Jamieson, 1981: figure 3B). The third specimen has developing gonads in segments X–XI and rudimentary spermathecae (in X), but it lacks male ducts and penial chaetae.

Distribution and habitat

Australia (known from Western Australia, Northern Territory, Queensland, Victoria), China, Hawaii. Intertidal and subtidal sands, to at least 70 m depth.

Genus *Heterodrilus* Pierantoni, 1902

Heterodrilus keenani Erséus, 1981

Heterodrilus keenani Erséus, 1981: 117–118, figure 7; 1984: 140–142, figure 4; 1990a: 48; 1990c: 273; 1993: 339; 1997b: 104; Erséus and Davis, 1989: 76, figures 1C–E.

New material

WAM V 4400 through V 4404, five specimens from Station ES03-15C. SMNH Main Coll. 77625-77641, 17 specimens: five from Station ES03-15C, four from Station ES03-30D, three from Station ES03-16A, and one from each of Stations ES03-25C, ES03-28A, ES03-28B, ES03-28E and ES03-28F.

Material re-examined

SMNH Main Coll. 30162, 30164-30169, 30172, 30809-30887, 74512-74514 (new nos. replacing old cat. no. 1347; see Erséus, 1990a), and 74515-74517 (replacing old cat. no. 1376; see Erséus, 1993): 93 specimens from Albany and Rottnest Island, previously studied by Erséus (1990a, 1993, 1997a).

Remarks

Heterodrilus keenani, originally described from the Great Barrier Reef (Erséus, 1981), is a variable but at the same time rather plain species, without features that clearly separates it from other members of the genus. Without doubt, however, the new material from Esperance is the same species as the many specimens identified as this taxon and recorded from Albany and Rottnest Island (Erséus, 1990a, 1993), most of which were re-examined in the present study.

The Esperance worms have penial chaetae that are 90–120 µm long, which somewhat extends the previously known range for this species: 55–115 µm long (Erséus, 1981, 1984, 1990a, Erséus and Davis, 1989).

Distribution and habitat

Queensland, Northern Territory, Western Australia (new record from Esperance), southern China, Hawaii. Intertidal and subtidal sands, to at least 70 m depth.

Heterodrilus decipiens Erséus, 1997

Heterodrilus claviatriatus (*partim*); Erséus, 1993: 341–342, figure 3; not *Heterodrilus claviatriatus* Erséus, 1981.

Heterodrilus decipiens Erséus, 1997a: 396–398, figure 2; Erséus and Wang, 2003: 372.

"*Heterodrilus* sp. (near *H. decipiens*)"?; Erséus, 1997a: 398–400.

New material

WAM V 4405 through V 4407, three specimens from Station ES03-4A. SMNH Main Coll. 77642-77650, nine specimens: three from Station ES03-4A, five from Station ES03-4B, and one from Station ES03-21C.

Remarks

Heterodrilus decipiens, although first identified as *H. claviatriatus* (see Erséus, 1993), is already known from other parts of Western Australia (Erséus, 1993, 1997a; Erséus and Wang, 2003). In the new specimens, the penial chaetae are 72–85 µm long, which is within the total range (36–90 µm) previously noted for this species.

Moreover, in the Esperance worms, the atrial musculature varies from barely discernible (less than 1 µm thick) to being about 2 µm thick. This strengthens the support for the tentative suggestion (by Erséus, 1997a) that some specimens with thin atrial muscles, collected in the Northern Territory and also first referred to as *H. claviatiatus* (by Erséus, 1997b), indeed are *H. decipiens*.

Distribution and habitat

Western Australia (new record from the Esperance area), and probably also Northern Territory. Intertidal and subtidal sand, to at least 24 m depth.

Subfamily PHALLODRILINAE

Genus *Albanidrilus* Erséus, 1992(a)

Albanidrilus wellsi (Erséus, 1990)

Phallodrilus wellsi Erséus, 1990a: 57–59, figure 6.

Albanidrilus wellsi; Erséus, 1992a: 17–18, figure 6F; 1993: 345–346, figure 6; 1997a: 412; 1997b: 109–110.

New material

SMNH Main Coll. 77651, one specimen from Station ES03-15B.

Remarks

Albanidrilus wellsi was originally described from Albany in south-western Western Australia (Erséus, 1990a), and subsequent reports of this species extend from Darwin in the Northern

Territory (Erséus, 1997b) to all around the coast of Western Australia (Erséus, 1993, 1997a). The Esperance specimen represents the eastern-most record along Australia's south coast. The new worm conforms well to previous descriptions, but its postclitellar chaetae are up to five per bundle; maximally four per bundle were noted in the earlier accounts (Erséus 1990a, 1993). Moreover, its penial chaetae are 72–77 µm long, which is intermediate between the 60–70 µm noted for the Albany material (Erséus, 1990a) and the 85–115 µm for the Rottnest Island material (Erséus, 1993).

As in all other Western Australian specimens of *A. wellsi*, the new worms have their spermathecal pores located just ventral to the lateral lines, whereas the individuals collected in Darwin had the corresponding pores located in line with the ventral chaetae (see Erséus, 1997b).

Distribution and habitat

Western Australia (new record from the Esperance area) and Northern Territory. Intertidal and subtidal sand, to at least 11 m depth.

Genus *Mexidrilus* Erséus, 1992(a)

Mexidrilus immodicus Erséus, 1993

Mexidrilus immodicus Erséus, 1993: 349–351, figure 8.

New material

WAM V 4409, one specimen, and SMNH Main Coll. 77652-77653, two specimens, all from Station ES03-5A.

Remarks

Mexidrilus immodicus was originally described from Rottnest Island, off Perth in Western Australia, where it was found in shallow-water sand associated with calcareous algae (Erséus, 1993). It is a small phallodriline, one complete specimen from Esperance being only 2.8 mm long and containing 29 segments (the single complete worm in the type series was 2.9 mm long with 39 segments), and it is further characterized by the lack of penial chaetae, and the possession of heavily muscular male ducts and numerous secretory granules in the walls of the spermathecal ampullae. The new individuals conform well with the Rottnest Island material, but their somatic chaetae are somewhat larger: 30–50 µm long, up to 1.5 µm thick, as opposed to only 25–35 µm long, about 1 µm thick, in the Rottnest worms. Moreover, the chaetae are up to four in preclitellar bundles; chaetae were maximally three per bundle in the Rottnest worms. Finally, the musculature enclosing a major (outer) part of the vasa deferentia, plus the atria, is thicker in the new material, making the vasa deferentia up to 26 µm wide (in Rottnest worms, width maximally 18 µm), the atria up to 29 µm wide (in Rottnest worms, width maximally 17 µm). In the Esperance specimens, the atria are also somewhat longer (72–77 µm) than those of the Rottnest material (55–70 µm).

Distribution and habitat

Known only from southwestern Western Australia (new record from Esperance). Intertidal and barely subtidal sand.

Genus *Pectinodrilus* Erséus, 1992(a)

Pectinodrilus granifer (Erséus, 1990a)

Phallodrilus granifer Erséus, 1990a: 54–56, figure 4.

Pectinodrilus granifer; Erséus, 1992: 36.

New material

WAM V 4410 and V 4411, two specimens from Station ES03-25D. WAM V 4412 through V 4414, three specimens from Station ES03-28D. SMNH Main Coll. 77654-77662, nine specimens: seven from Station ES03-5A, one from each of Stations ES03-16A and ES03-25D.

Remarks

This species was originally described as a member of *Phallodrilus* Pierantoni, 1902 (from Albany, Western Australia; Erséus, 1990a), but was later transferred to *Pectinodrilus* (Erséus, 1992a). The new material from Esperance conforms well with the previous description, one specimen being somewhat longer (4.4 mm) than the Albany worms (3.1–4.2 mm). Further, the new specimens extends the range of variation in the number of somatic chaetae (anterior chaetae are up to six per bundle; postclitellar chaetae up to five per bundle).

Distribution and habitat

Known only from the southern coast of Western Australia (new record for Esperance). Intertidal sand and gravel.

Genus *Pirodriloides* Erséus, 1992

Pirodriloides breviclitellatus sp. n.

Figure 1

Holotype

WAM V 4415, whole-mounted specimen.

Type locality

Western Australia, Esperance area, SE tip of Little Wharton Bay (Station ES03-15C).

Description

Length 2.3 mm, 34 segments. Width at XI, 0.30 mm. Prostomium distinctly smaller than, and set off from, peristomium. Clitellum short, extending over only XI–½XII. Chaetae (Figure 1A) bifid, with rather slender teeth, upper tooth thinner and somewhat shorter than lower. Bifids 30–36 µm long, 1–1.5 µm thick, three to five per bundle anteriorly, three (occasionally two) per bundle in postclitellar segments. Male pores paired in line with ventral chaetae, located posterior to middle of XI. Spermathecal pores paired in line with ventral chaetae, in most anterior part of X.

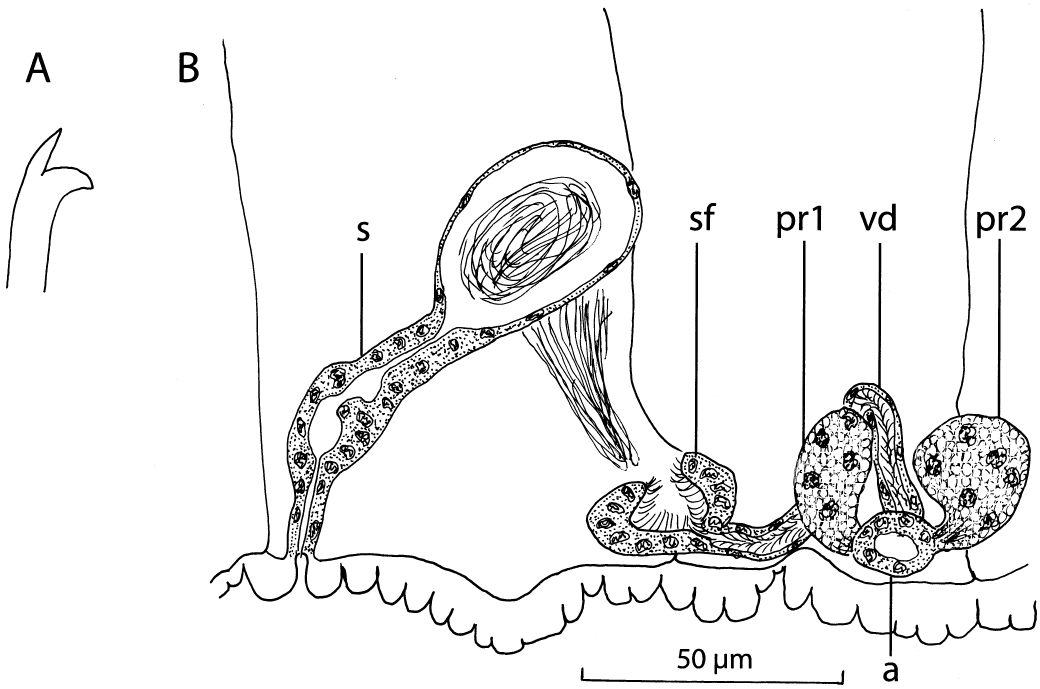

Figure 1 *Pirodriloides breviclitellatus* sp. n., A: Free-hand drawing of chaeta; B: Somewhat oblique view of spermatheca and male genitalia in segments X–XI. Note that atrium is visible only as an optical cross-section.

Pharyngeal glands in IV–V. [Numerous coelomocytes not observed, and oesophagus not enlarged in IX; see Remarks.] Male genitalia (Figure 1B) paired. Vas deferens hardly discernible, but appears almost as wide as atrium and to enter latter apically or somewhat subapically. Atrium small, oval, erect, only about 25 µm long, about 15 µm wide, with simple histology; details not clear, but neither inner epithelial granulation nor outer muscular layer developed. Prostate glands small, two per atrium, attached by small stalks to opposite (anterior and posterior) sides of atrium, at some distance from apical inner end. Atrium opening directly to exterior; no particular copulatory organ present. Spermathecae (Figure 1B: s) somewhat club-shaped, totally about 65–85 µm long, with short, indistinct ducts and thin-walled elongate ampullae, latter maximally 24–29 µm wide; sperm somewhat bundled in ampullae but not forming any cemented packages (i.e., spermatozeugmata not formed).

Etymology

Named *breviclitellatus* (*brevis* is Latin for *short*) for its short clitellum.

Remarks

This new taxon is tentatively placed in *Pirodriloides*, as it resembles the type and only other species of this genus, *P. albanensis* (Erséus, 1990). The latter, known from Albany (Erséus, 1990a), Rottnest Island (Erséus, 1993) and Houtman Abrolhos Islands (Erséus, 1997a) in

Western Australia, is also a minute phallodriline lacking penial chaetae, and possessing small erect atria bearing prostate glands that open opposite to each other (see Erséus, 1990a: figure 5C). *Pirodriloides breviclitellatus*, however, lacks penial papillae as well as numerous coelomocytes, two striking traits of *P. albanensis*. As noted by Erséus (1997a), in *P. albanensis* the coelomocytes may proliferate from a dorsal thickening of the oesophagus in segment IX, but such a thickening was not observed in the new species. Moreover, the chaetae appear slightly thinner (1–1.5 µm) and bearing more slender teeth in *P. breviclitellatus* than in *P. albanensis* (1.5–2 µm thick; see Erséus, 1990a: figure 5A). Finally, this new species appears to have an unusually short clitellum. In the holotype, clitellar cells are developed only over segment XI and the anterior part of XII, while in most other Phallodrilinae the clitellum covers the posterior part of X and all through segments XI–XII.

Distribution and habitat

Known only from type locality at Esperance, Western Australia. Coarse sand at low water mark.

Genus *Aktedrilus* Knöllner, 1935

Aktedrilus fissilis Erséus, 1990

Aktedrilus fissilis Erséus, 1990a: 62–63, figure 9; 1997a: 415.

New material

WAM V 4416 and V 4417, two specimens from Station ES03-5A. SMNH Main Coll. 77663-77665, three specimens from Station ES03-25D.

Remarks

This species was originally described from Albany (Erséus, 1990a), and was subsequently found also in the Houtman Abrolhos Islands (Erséus, 1997a). The new Esperance worms fit the first description well, although they are all notably wider in the clitellar region (compressed on slides, width 0.26–0.40 mm, as opposed to 0.12–0.22 mm for the Albany type series), and none of them has sperm in their spermathecae (which appear partly developed only). Moreover, their chaetae are up to about 50 µm long, and in postclitellar segments, they have up to five chaetae per bundle (chaetae maximally 40 µm, posterior bundle with up to four chaetae, in Albany material). In fact, the number of chaetae is a useful character for discriminating *A. fissilis* from *A. triplex* (see Remarks for latter below). Finally, in a few of the new specimens, some scattered small (unicellular) epidermal glands are indeed present both anterior and posterior of the clitellum; such glands were not observed in the Albany material (see Erséus, 1990a).

Distribution and habitat

Western Australia (new record for Esperance). Intertidal sand.

Aktedrilus triplex Erséus, 1990

Aktedrilus triplex Erséus, 1990a: 63–65, figure 10; 1993: 348–349; 1997a: 414.

New material

WAM V 4418, one specimen, and SMNH Main Coll. 77666, one specimen: both from Station ES03-15C.

Remarks

As for *A. fissilis* (see above), *A. triplex* was also first described from Albany (Erséus, 1990a), and it has later been found in other parts of Western Australia: Rottnest Island (Erséus, 1993) and Houtman Abrolhos Islands (Erséus, 1997a). *Aktedrilus triplex* differs from *A. fissilis* in important details in the male ducts and spermatheca, but an even more striking difference is that while the latter has up to four or five chaetae in each bundle (see Remarks for *A. fissilis* above), *A. triplex* is characterized by fewer chaetae: each bundle typically with only three chaetae. One of the new Esperance specimens is complete; it is 3.9 mm and consists of 33 segments, i.e., it is somewhat longer than any of the previously studied worms of *A. triplex*. Otherwise, the new material conforms well to the original description.

Distribution and habitat

Western Australia (new record for Esperance). Intertidal and barely subtidal, largely coarse, sand.

Genus *Bathydrilus* Cook, 1970

Bathydrilus edwardsi Erséus, 1984

Bathydrilus edwardsi Erséus, 1984: 143–45, figure 6; Erséus, 1990a: 70; Erséus, 1990b: 276–277; Erséus *et al*., 1990: 112–113, figure 2I–J; Erséus, 1993: 361; Erséus, 1997a: 418–419.

New material

WAM V 4419 and V 4420, two specimens from Station ES03-28E. SMNH Main Coll. 77667-77669, three specimens: one from Station ES03-28C, two from Station ES03-28E.

Material re-examined

SMNH Main Coll. 16978-17015, 30127-30138, 30140-30146, 30148-30151, 30902-30930, 74518-74519 (new nos. replacing old cat. no. 1360; see Erséus, 1990a), and 74520-74521 (replacing old cat. no. 1394; see Erséus, 1993): 94 specimens from various Western Australian localities (at Albany, Houtman Abrolhos Islands, and Rottnest Island), previously studied by Erséus (1990a, 1993, 1997a).

Brief description of new material

Two complete specimens (both) 4.9 mm long, with about 45 and about 50 segments, respectively (posterior end not fully differentiated). Width at XI, 0.31–0.41 mm. Clitellum extending over ½X–XII(½XIII). Bifid chaetae 36–53 µm long, 2–3 µm thick, two to three per bundle anteriorly, generally two (sometimes one) per bundle in postclitellar segments. Penial chaetae absent. Spermathecal pores in lateral lines, immediately posterior to intersegmental

furrow IX/X. Pharyngeal glands in III–VIII(IX). Atria erect, spindle-shaped, 90–120 µm long, 30–48 µm wide. Spermathecae with short ducts and more or less globular ampullae; latter about 50–70 µm in diameter. In post-copulatory specimens, sperm as one (or a few?) roundish spermatozeugma in each spermathecal ampulla.

Remarks

At Esperance, this species, earlier recorded from other parts of Western Australia (Erséus, 1990a, 1993, 1997a), co-occurs with a somewhat larger, but similar species, here described as *B. difficilis* sp.n. (see below). To make sure that none of the previous records were based on a mixture of these two taxa, 94 Western Australian worms labeled "*Bathydrilus edwardsi*" in the SMNH were re-examined. They all conform to the general dimensions and other features of *B. edwardsi*: e.g., atria are 85–130 µm long, spermathecae are round or oval and 35–90 µm wide/long, and spermatozeugmata are generally one, sometimes two or three, in each spermathecae.

Distribution and habitat

Western Australia (new record from Esperance area) and China. Intertidal and subtidal sand, to at least 13 m depth.

***Bathydrilus difficilis* sp. n.**

Figure 2

Holotype

WAM V 4421, whole-mounted specimen.

Type locality

Western Australia, Esperance area, S of Duke of Orleans Bay, near Nares Island (Station ES03-28B).

Paratypes

WAM V 4422 through V 4425, four specimens, and SMNH Type Coll. 6092-6094, three specimens: all from type locality.

SMNH Type Coll. 6095-6096, two specimens from Station ES03-28E (same site as type locality, but habitat different than that of ES03-28B).

Description

Length (six complete specimens), 5.9–7.7 mm, about 57 to 68 segments (some specimens with posterior end not fully differentiated). Width at XI, 0.31–0.48 mm. Prostomium more or less triangular, generally about as long as wide. Clitellum extending over ½X–XII (sometimes ventrally extending also into anterior part of XIII). Chaetae (Figures 2A,B) bifid, generally 55–62 µm long, 2.5–3.5 µm thick (in anteriormost and posteriormost segments smaller, down to about 35 µm long, about 2 µm thick), two or (more often) three per bundle in preclitellar segments, two (occasionally one or three) per bundle in postclitellar segments. All bifids with

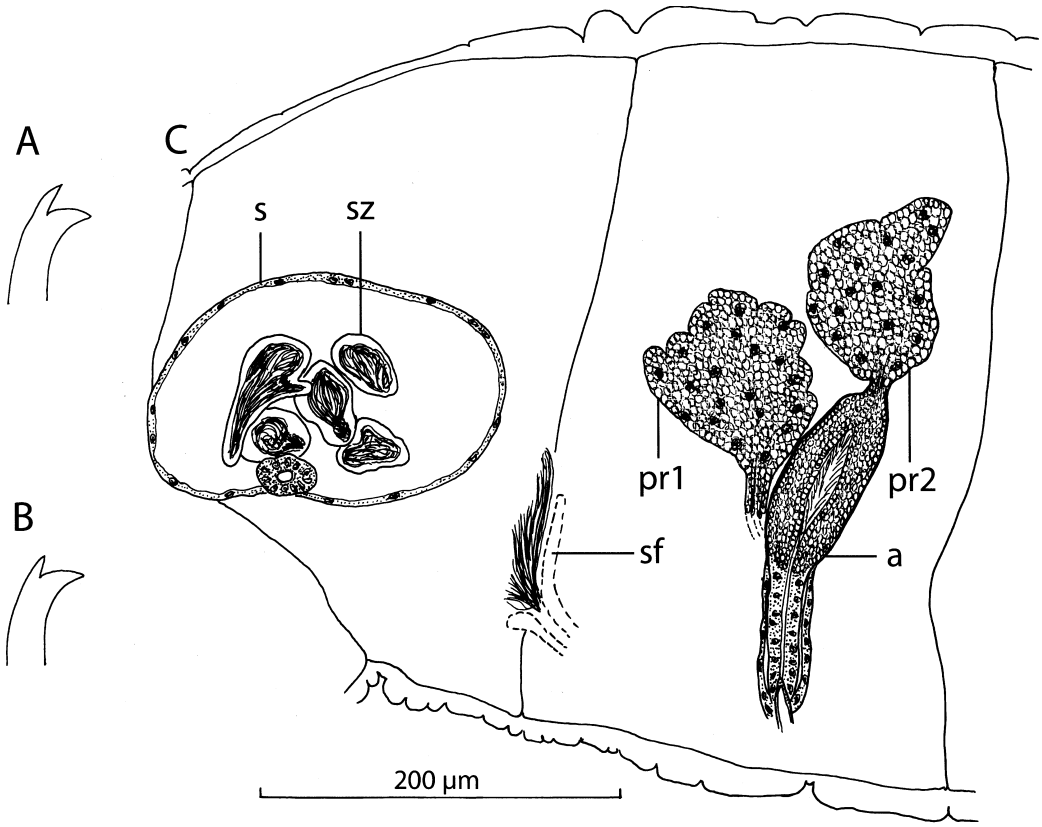

Figure 2 *Bathydrilus difficilis* sp. n., A: Free-hand drawing of anterior chaeta; B: Free-hand drawing of postclitellar chaeta; C: Lateral view of spermatheca and male genitalia in segments X–XI.

upper tooth thinner and shorter than lower, more pronouncedly so in postclitellar chaetae (Figures 2B). Penial chaetae absent. Male pores paired, in line with ventral chaetae, posterior to middle of XI. Spermathecal pores paired in lateral lines, in most anterior part of X.

Pharyngeal glands in III–VIII. Male genitalia (Figure 2C) paired. Vas deferens not observed in its full length in any specimen, but appears to be up to about 15 µm wide, and entering middle-to-ectal part of anterior face of atrium. Atrium erect, spindle-shaped, 145–210 µm long, 38–58 µm wide, with thin (about 1–2 µm) outer muscular layer, and granulated and heavily ciliated inner epithelium. Atrium ectally tapering, opening to exterior through simple pore; copulatory sac absent. Prostate glands somewhat lobed, anterior one attached to atrium at entrance of vas deferens; posterior one attached more or less apically (at inner end of atrium). Spermathecae (Figure 2C: s) consisting of short, hardly discernible duct, and large oval ampulla, 90–170 µm long, 70–120 µm wide; exact shape and size of latter difficult to see in some specimens. In post-copulatory specimens, sperm as conspicuous, round or somewhat comma-shaped, spermatozeugmata (Figure 2C: sz) in spermathecal ampullae; these spermatozeugmata between three and nine in each ampulla. Ampullar walls sometimes containing large globules of secretion.

Table 1 Dimensional comparisons between *Bathydrilus edwardsi* (from Esperance and China; Erséus, 1984; Erséus *et al*., 1990) and *B. difficilis* sp. n.

Character	***edwardsi* (China)**	***edwardsi* (Esperance)**	***difficilis* sp. n. (Esperance)**
Body length	5.1–10.5 mm	4.9 mm	5.9–7.7 mm
Body width	0.23–0.47 mm	0.31–0.40 mm	0.31–0.48 mm
Segment number	39–60	45–50	57–68
Chaetal length	40–55 µm	36–53 µm	55–62 µm
Chaetal width	2–2.5 µm	2–3 µm	2.5–3.5 µm
Atrial length	80–125 µm	90–125 µm	145–210 µm
Atrial width	27–38 µm	30–48 µm	38–58 µm
Spermathecal size	37–105 µm diameter	50–70 µm diameter	90–170 x 70–120 µm
Spermatozeugmata	1 or a few	1 or a few	3–9

Etymology

Named *difficilis*, Latin for *difficult*, alluding to the difficulty in separating this species from *B. edwardsi* (see Remarks below).

Remarks

Bathydrilus difficilis sp. n. is deceptively similar to, and partly sympatric with, *B. edwardsi* (reported above). These species are two of the few shallow-water species of *Bathydrilus* that lack penial chaetae, and they also share features such as the number and shape of the somatic chaetae, the shape of the atria, the lack of copulatory sacs, and the general outline of spermathecae and spermatozeugmata. However, with regard to some dimensional traits except perhaps body size itself (see Table 1), the new taxon is consistently larger than *B. edwardsi*, and the single-most striking characteristics of it is the much larger spermathecae with the more numerous spermatozeugmata (cf. Figure 2C with Erséus, 1984: figure 6b; and Erséus *et al*., 1990: figure 2J).

Distribution and habitat

Known only from the Esperance area, Western Australia. Barely subtidal muddy coarse sand, 0.5 m depth.

Genus *Duridrilus* Erséus, 1983

Duridrilus globosus sp.n.

Figure 3

Duridrilus sp.; Erséus, 1990a: 72.

Holotype

WAM V 4426, whole-mounted specimen.

Type locality

Western Australia, Esperance area, seashore NW of Table Island (Station ES03-30A).

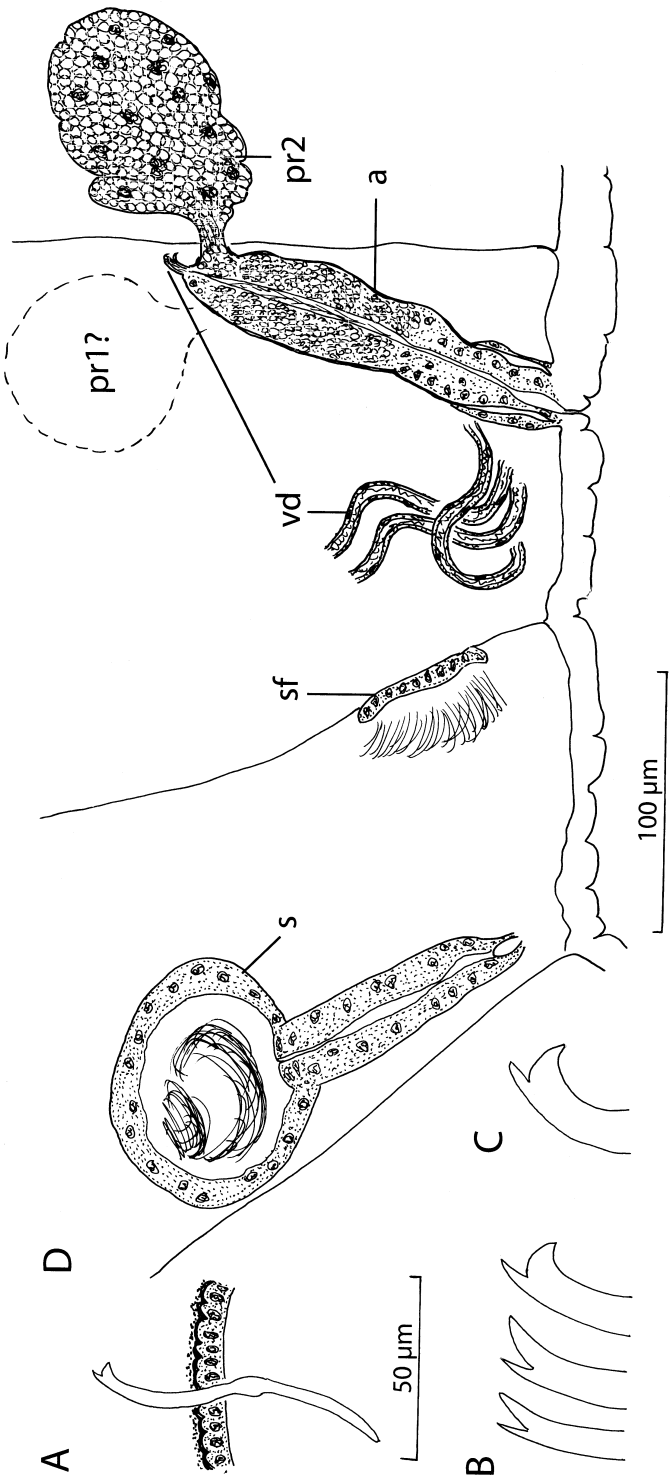

Figure 3 *Duridrilus globosus* sp. n., A: Detail of body wall, showing chaeta and cuticular ornamentation; B: Free-hand drawing showing variation of anterior chaetae; C: Free-hand drawing of postclitellar chaeta; D: Lateral view of spermatheca and male genitalia in segments X–XI.

Paratypes

WAM V 4427 and V 4428, two specimens (one immature, one partially mature) from Station ES03-28A. SMNH Type Coll. 6097-6098, two specimens: one from type locality, one from Station ES03-28C.

Description

Single complete specimen (holotype) 7.4 mm long, consisting of about 60 segments, but posteriormost segments poorly differentiated (not fully grown at time of fixation). Width at XI, 0.38–0.46 mm. Prostomium rounded, retractable within peristomium. Body wall with scattered small particles on cuticle (Figure 3A), at least in postclitellar segments; in postclitellar segment also, cuticle sometimes bearing numerous minute projections, but particles not condensed to form discrete papillae on these. Clitellum extending over ½X–XII. Chaetae (Figures 3A–C) bifid, variable in shape but with upper tooth clearly shorter than lower (less so in segment II–III than in all other segments; see left chaeta in Figure 3B), 58–85 µm long, 2.5–4 µm thick, two per bundle in segments II–IX(X), one representing each bundle thereafter; however, chaetae totally absent from XI. Male pores paired, inconspicuous, in line with ventral chaetae in posterior part of XI. Spermathecal pores paired, in line with ventral chaetae, in anteriormost part of X.

Pharyngeal glands in (III)IV–VI, often reaching also into VII. Male genitalia (Figure 3D) paired. Vas deferens thin-walled, densely ciliated, about 6–7 µm wide, exceedingly long (only parts shown in Figure 3D) and coiled, entering apical (inner) end of atrium. Atrium club-shaped, erect, 95–155 µm long, maximally 34–48 µm wide, with apical end obliquely directed towards posterior. Inner about two thirds of atrium with granulated inner epithelium and thin but distinct outer layer of muscles. Outer end of atrium a tapering, less granulated and less muscular duct leading to male pore. Prostate glands lobed and stalked, of somewhat variable size and shaped, two per atrium, attached to inner end of latter more or less opposite to each other. Spermathecae (Figure 3D: s) with slender, somewhat muscular ducts, about 120 µm long, about 30 µm wide, and well set-off, more or less globular ampullae, 70–80 µm in diameter. In holotype (the only post-copulatory specimen), sperm as irregular masses in spermathecal ampullae; i.e., spermatozeugmata do not appear to be formed.

Etymology

Named *globosus*, Latin from *spherical*, alluding to the globular shape of the spermathecal ampullae.

Remarks

The juvenile specimens from subtidal habitats near Albany identified as "*Duridrilus* sp." by Erséus (1990a) were most probably conspecific to the present material.

With regard to spermathecal proportions, as well as chaetal pattern and male duct morphology, *D. globosus* resembles the Saudi Arabian *D. tectus* Erséus, 1985. In the latter species, however, the spermathecal pores are located close to the line of the dorsal chaetae (not ventrally as in the new species), and the atria open into small eversible pseudopenes (not directly to the exterior through inconspicuous pores as in *D. globosus*).

Duridrilus globosus is the fourth member of *Duridrilus* recorded from Western Australia; the

others are *D. pastoralis* Erséus, 1990(a) (from Albany and Rottnest Island; Erséus 1990a, 1993), *D. kimi* Erséus, 1993 (Rottnest Island; Erséus, 1993), and *D. piger* Erséus, 1984 (Montebello Islands and Dampier; Erséus, 1997a; Erséus and Wang, 2003). It differs from *D. pastoralis* and *D. kimi* by the morphology of its spermathecae (with long ducts leading to small globular ampullae); the spermathecae of the latter two taxa have short ducts, and voluminous ampullae filling a great part of segment X. Moreover, *D. pastoralis* has single-pointed, strikingly prolonged chaetae in many postclitellar segments, and distinct body wall papillae. *Duridrilus piger*, a tropical species, is also papillated, but it possesses chaetae that are similar to those of *D. globosus*. On the other hand, it is characterized by conspicuous muscular fibers in the body wall forming an oval ring that encircles the area of the two male openings in segment XI (see Erséus, 1984: figs. 13e–f), a structure observed in no other species of *Duridrilus*.

Distribution and habitat

Known only from the Esperance and Albany areas in Western Australia. Intertidal and subtidal, medium to coarse sand, to at least 4 m depth.

Genus *Coralliodrilus* Erséus, 1979

Coralliodrilus mirus Erséus, 1990

Figure 4

Coralliodrilus mirus Erséus, 1990a: 50–51, figure 2.

New material

WAM V 4429 through V 4432, four specimens, and SMNH Main Coll. 77670-77675, six specimens: all from Station ES03-5A.

Description of new material

A single complete specimen 3.8 mm long, 40 segments; all other specimens incomplete. In more or less intact worms, width at XI, 0.26–0.37 mm; a few specimens wider, but damaged (by compression under coverslip) in this region. Prostomium somewhat triangular in shape. Clitellum extending over ½X–XII. Somatic chaetae bifid, with upper tooth thinner and shorter than lower. Bifids 29–48 µm long, about 1–1.5 µm thick, three to four (occasionally five) per bundle anteriorly, two or (more generally) three per bundle in postclitellar segments. Penial chaetae (ventrals of XI) modified (Figure 4: ps) into a tight bundle of about six to twelve (exact number difficult to establish in most cases), straight or somewhat curved chaetae, each 35–55 µm long, about 1 µm thick; tips of penial chaetae thin and hooked (but details unclear). Male pores paired in posterior part of XI, located approximately in line with ventral chaetae. Spermathecal pores paired, immediately ventral to lateral lines, in most anterior part of X.

Pharyngeal glands in IV–V(VI), but inconspicuous. Male genitalia (Figure 4) paired. Vas deferens about 7–10 µm wide, coiled, but seldom well visible (e.g., length unknown), entering apical end of atrium. Atrium slender, much variable, but typically divided into inner broad part (“ampulla”) and outer narrow part (“duct”). Atrial ampulla up to 110 µm long, 14–36 µm wide, with thick, ciliated and somewhat granulated, inner epithelium; outer muscular layer thin. Atrial duct also up to about 110 µm long, but maximally only up to 12 µm wide, with thin walls;

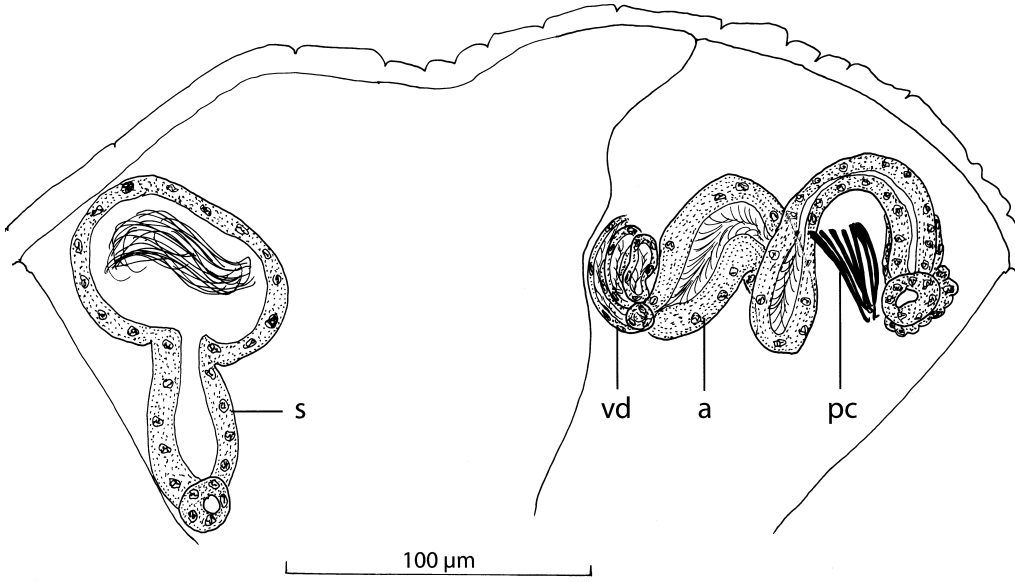

Figure 4 *Coralliodrilus mirus* Erséus: Lateral view of spermatheca and male genitalia in segments X–XI. Note that the whole cavity shown in the spermatheca is interpreted as that of the ampulla; the proper spermathecal duct is short and indistinct.

ciliation inside (if present at all) not seen. In a few specimens, narrow bundle of sperm present in lumen of atrium. Atrial duct opening more or less directly to the exterior; a distinct copulatory sac not observed. Prostate glands absent. Spermathecae (Figure 4: s) variable, normally with an oval, pear- or club-shaped, inner ampulla, 85–145 µm long, 50–70 µm wide, and an outer, much shorter, indistinct duct (duct virtually absent in specimen shown in Fig. 4). In post-copulatory specimens, sperm as broad bundle in each spermathecal ampulla.

Remarks

Coralliodrilus mirus was originally described on the basis of a single, evidently precopulatory, specimen (the holotype) from Albany in Western Australia (Erséus, 1990a). It differed from the new material in several dimensional features, but considering the wide ranges (e.g., in size of chaetae, atria and spermathecae) noted in the present specimens, the two lots are regarded as representing the same species. One discrepancy, however, is noteworthy. In the original description, this species was supposed to have "a rather complex copulatory sac", although this could not be clearly illustrated (see Erséus, 1990a, figure 2C). It nows seems that, for the holotype, this may have been a misinterpration of folds in the outer part of the male duct.

Coralliodrilus mirus is easily separated from the closely related *C. regius* reported below by its lateral rather than ventral spermathecal pores, and its lack of penial chaetae.

Distribution and habitat

Known only from the southern coast of Western Australia (new record from Esperance). Intertidal sand and gravel.

Coralliodrilus regius Erséus, 1990

Coralliodrilus regius Erséus, 1990a: 51–52, figure 3.

?*Clitellio abjornseni* Michaelsen, 1907 (*partim*): 124–126 ; see Erséus, 1998: 145–146.

New material

SMNH Main Coll. 77676, specimen from Station ES03-25D.

Brief description of new material

Length more than 1.3 mm, more than 16 segments (specimen incomplete). Width at XI, 0.24 mm. Bifid chaetae 25–35 µm long, 1–1.5 µm thick, 3–4 per bundle anteriorly, 2–3 per bundle in post-clitellar segments. Penial chaetae absent. Male and spermathecal pores in line with ventral chaetae. [No papillae associated with male pores.] Vasa deferentia not well visible, but at least as long as atrial ampullae. Atrial ampullae about 55 µm long, about 20 µm thick; atrial ducts about 35 µm long, 17 µm wide, opening directly to exterior. Spermathecae elongate, 60–65 µm long, 17–24 µm wide, with short ducts and containing sperm.

Remarks

Coralliodrilus regius was previously known only from one site at Albany, Western Australia, and it was described on the basis of five specimens (Erséus, 1990a). The Esperance worm conforms well to the original description in most features, but its postclitellar chaetae are somewhat fewer, only two to three per bundle, than those of the Albany material (with three to four chaetae per bundle).

Another taxon described from southwestern Western Australia, *Clitellio abjornseni* Michaelsen, 1907, has been supposed to be closely related to *Coralliodrilus regius* (Erséus, 1990a); Erséus (1998) even proposed that syntypes (two juvenile specimens) of *Clitellio abjornseni* located in the Museum für Naturkunde, Humboldt-Universität Berlin, may in fact be conspecific to *C. regius*; i.e., that Michaelsen's description was based on a mixture of species. Michaelsen (1907) apparently never designated a holotype among his original material, the rest of which was stored in the museums of Perth (WAM) and Hamburg, and unfortunately, the only two sexually mature specimens in his type series have been lost. Michaelsen´s description mentions the presence of male copulatory papillae and that the vasa deferentia are very short, which are two features seen neither in the original material of *C. regius* (see Erséus, 1990a) nor in the new Esperance specimen (see above).

Distribution and habitat

Known only from the southern coast of Western Australia (new record from Esperance). Intertidal medium to coarse sediment.

Subfamily LIMNODRILOIDINAE

Genus *Limnodriloides* Pierantoni, 1903

Limnodriloides agnes Hrabe, 1967

Limnodriloides agnes Hrabe, 1967: 339–344, figures 13–24; Erséus, 1984: 168–169, figure 22; for several other references, see Erséus, 1997a: 444–445.

Limnodriloides agnes agnes; Erséus, 1982: 243–245, figures 22–23.

New material

WAM V 4433 and V 4434, two specimens from Station ES03-28B, and SMNH Main Coll. 77677-77679, three specimens from Station ES03-28E.

Remarks

This widespread species is already known from the south and west coasts of Western Australia (Erséus, 1990a, 1993, 1997a), and the new specimens from Esperance conform well with previous descriptions of the species.

Distribution and habitat

Western Australia (new record from the Esperance area), China, Canary Islands, Mediterranean and Black Seas. Intertidal and subtidal sand, to at least 6 m depth; also know from brackish water (Erséus, 1990a, 1992b).

Limnodriloides solitarius sp. n.

Figure 5

Holotype

WAM V 4435, whole-mounted specimen.

Type locality

Western Australia, Esperance area, seashore S of Duke of Orleans Bay, near Nares Island (Station ES03-28B).

Description

More than 4.5 mm long, more than 43 segments (posterior end missing). Width at XI, 0.36 mm. Prostomium much shorter than wide, not well set off from peristomium. Clitellum extending over 2/3X–XII. Chaetae bifid with upper tooth somewhat shorter and thinner than lower (Figure 5A), 28–42 µm long, 1.5–2 µm thick, two to three per bundle anteriorly, two (occasionally one) per bundle in postclitellar segments. Male pores on a pair of bulbous swellings, in line with ventral chaetae in about middle of XI. Spermathecal pores (and spermathecae) absent.

Pharyngeal glands in IV–V. Oesophageal diverticula in XI, large, extending forwards from middle (or possibly somewhat posterior to middle) of segment, to anterior septum. Male genitalia (Figure 5B) paired. Vas deferens ciliated, up to about 12 µm wide, entering apical end of atrium. Atrium consisting of voluminous, muscular inner ampulla, and curved, slender outer duct. Atrial ampulla pear-shaped, 85–105 µm long, maximally 60–80 µm wide, with muscular layer up to about 10 µm thick. Prostatic pad embedded as a sharply delineated oval body in ventral epithelium of outer half of ampulla; prostate gland communicating with this pad lobed, but not fully observed. Atrial duct 130–150 µm long, entally about 25 µm wide, with granulated inner epithelium and distinct outer layer of muscles (this layer thinner than but continuous with that of atrial ampulla), ectally duct tapering and without granulation and distinct muscular layer.

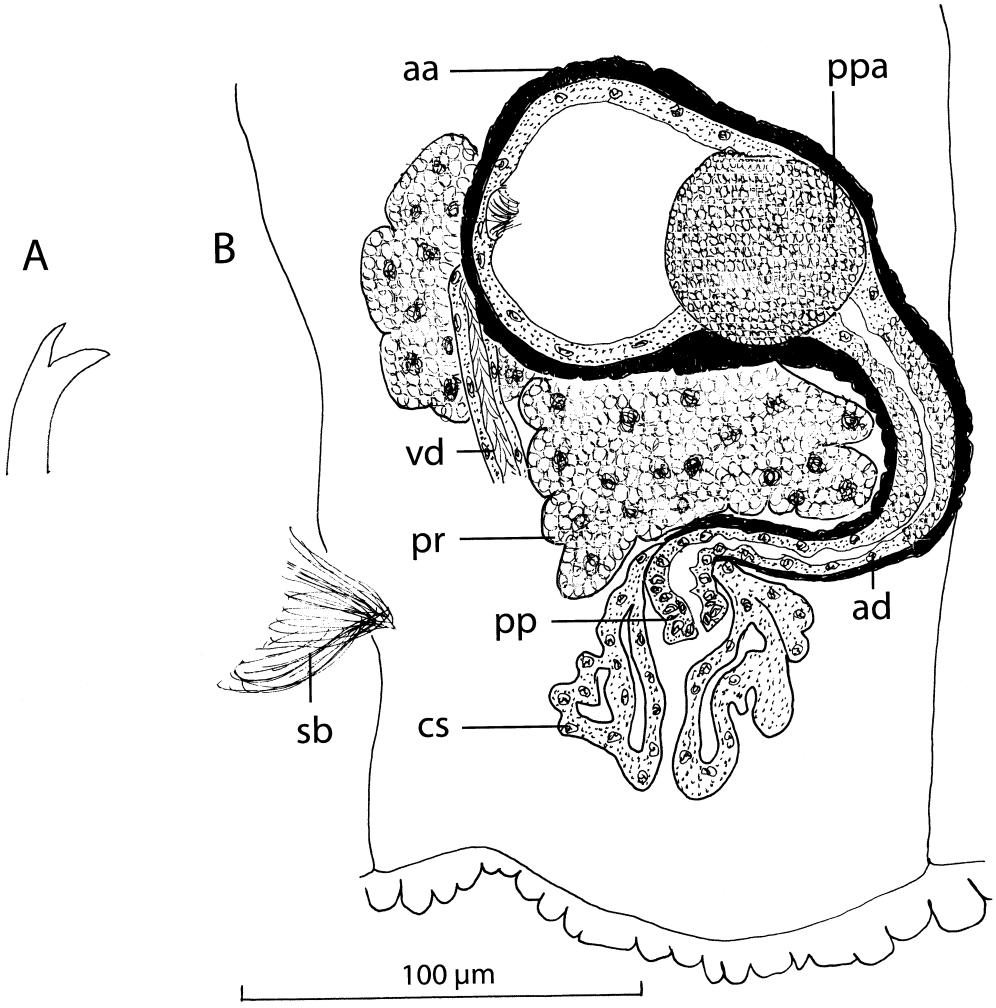

Figure 5 *Limnodriloides solitarius* sp. n., A: Free-hand drawing of chaeta; B: Lateral view of male genitalia in segment XI.

Atrial duct terminating in small (about 15 µm long), conical penial papilla at inner end of rather complex, about 60 µm deep, copulatory sac.

Etymology

Named *solitarius*, Latin for *who lives alone*, here alluding to that only a single specimen of this new species is available.

Remarks

Limnodriloides solitarius is closely related to *L. macinnesi* Erséus, 1990, known from Southern China and Hawai'i (Erséus, 1990c; Erséus and Davis, 1989; in latter study, however,

erroneously referred to as "*L. macinnesi* Erséus, 1988"). Both species have heavily muscular atria terminating in folded copulatory sacs and lack spermathecae. The new taxon from Esperance is distinguished from *L. macinnesi* by having distinct penial papillae at inner ends of the copulatory sacs (Figure 5B: pp); in *L. macinnesi*, the atrial ducts enter directly into the folded copulatory sacs, and the points of junction is not at the inner ends but rather midway up the sacs (see Erséus, 1990c: figure 13). Moreover, the atrial ampullae of *L. solitarius* (admittedly observed only in the single available specimen) are more voluminous (85–105 by 60–80 µm) than those of *L. macinnesi* (55–80 by 40–60 µm); however, additional material is needed to confirm that this is a taxonomically reliable difference.

Distribution and habitat

Known only from the Esperance area in Western Australia. Barely subtidal coarse sediment with *Posidonia*.

Genus *Smithsonidrilus* Brinkhurst, 1966

Smithsonidrilus minusculus (Erséus, 1983)

Marcusaedrilus minusculus Erséus, 1983b: 30–31, figure 5, table I; 1990a: 78–79, figure 17.

Limnodriloides claviger (*partim*) Erséus, 1982: 221–222 (*not* figure 6); Erséus and Davis, 1989: 92–93, figure 12.

Smithsonidrilus minusculus; Erséus, 1990d: 289–291, figure 32; 1992c: 174–175, figure 12A,B; 1997b: 121–122.

Not *Smithsonidrilus minusculus*; Erséus, 1993: 379–380, figure 24 (see Remarks, and *S. fecundus* sp.n. below).

New material

WAM V 4436, one specimen from Station ES03-22B. SMNH Main Coll. 77680, one specimen from Station ES03-35B.

Remarks

Smithsonidrilus minusculus has been widely reported in the world, including records from Albany and one site near Perth in Western Australia (Erséus, 1990a). However, specimens subsequently identified and described as this species from Rottnest Island and another, mainland, locality at Perth, were characterized by the lack of spermathecae, and they were interpreted as an apomorphic lineage, possibly with a uniparental mode of reproduction (Erséus, 1993). This aberrant form, including new specimens from Esperance, is now established as a separate species, *S. fecundus* sp. n., treated below.

Two new worms from Esperance, however, possess spermathecae and conform also in all other aspects to previous descriptions of *S. minusculus s. str*. (see, e.g., Erséus, 1990a). As noted before, the clitellum of this species is short and in the Esperance individuals, it covers only segment XI and about 2/3 of XII; just as in the first specimen found near Perth (Erséus, 1990a). In the Albany material, the clitellum reached the end of segment XII, but as already indicated (op. cit.: 79) this variation may be a matter of developmental stage.

Distribution and habitat

Western Australia (new record for Esperance), Northern Territory, Queensland, China, Hawaii, Bermuda, Belize. Intertidal and subtidal sands, to at least 15 m depth.

***Smithsonidrilus fecundus* sp. n.**

Figure 6

Smithsonidrilus minusculus (*partim*); Erséus, 1993: 379–380, figure 24.

Holotype

WAM V 4437, whole-mounted specimen.

Type locality

Western Australia, Esperance area, S of Duke of Orleans Bay, near Nares Island (Station ES03-28E).

Paratypes

WAM V 4438 through V 4441, four specimens from type locality.

SMNH Type Coll. 6099-6101, three specimens from Station ES03-28B. SMNH Type Coll. 6102, one specimen from Station ES03-1B.

Description

Length (four complete specimens) 2.8–4.5 mm, 32 to over 42 segments (one specimen, 3.8 mm long, contains 42 segments, but posterior end missing). Width at XI, 0.24–0.43 mm. Prostomium generally shorter than wide, with rounded apex and not well set off from peristomium. Clitellum extending over XI–XII (XI–2/3XII in some of the partly mature specimens). Chaetae (Figure 6A) bifid, with upper tooth shorter and thinner than lower. Bifids 30–45 µm long, 1.5–2 µm thick, two to three (occasionally four) per bundle anteriorly, two (occasionally one) per bundle in postclitellar segments; ventral chaetae absent from XI (appear to be lost even from X in fully mature specimens). Male pores paired in line with ventral chaetae, in about middle of XI. Spermathecal pores (and spermathecae) absent.

Pharyngeal glands in IV–V. Oesophageal diverticula (Figure 6B: od) in IX, generally slender, originating at about middle of segments and extending forwards to anterior septum. Male genitalia paired. Vas deferens not observed, but mature sperm present at sperm funnel in fully mature specimens. Atrium (Figure 6C) elongated, club-shaped, generally curved; but only fully developed in a few of the available specimens. Atrial ampulla about 50 µm long, about 25 µm wide, but barely noticable and details unclear. Prostatic pad and prostate gland probably small. Atrial duct about 50 µm long, 14–17 µm wide, granulation inside inconspicuous. Atrial terminating in small pseudopenial papilla inside a small copulatory sac. In three specimens, large eggs occupy all of coelomic cavity in 4–6 segments, within segments X–XV (Figure 6B: e); however, individual eggs difficult to distinguish.

Etymology

Named *fecundus* (Latin for *fertile, productive*) for the large number of mature eggs present in several specimens.

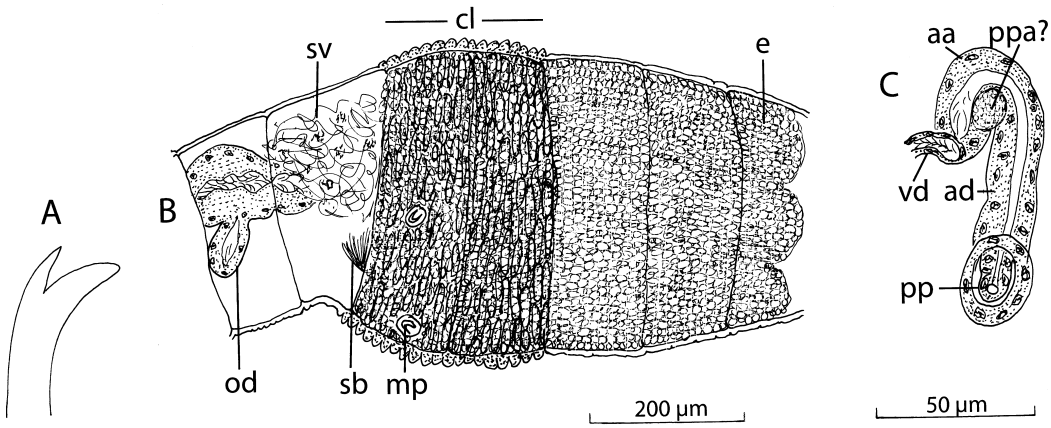

Figure 6 *Smithsonidrilus fecundus* sp. n., A: Free-hand drawing of chaeta; B: Ventro-lateral view of body, segments IX–XV, showing oesophageal diverticula (in IX), extension of clitellum (XI–XII), and extension of large mature eggs (reaching XV); C: Lateral view of a part of male genital duct.

Remarks

Smithsonidrilus fecundus, here established as a new taxon, is with all probability the same species as eleven specimens described by Erséus (1993) from Rottnest Island. It was then regarded as an apomorphic, possibly uniparental lineage within *Smithsonidrilus minusculus*, and the two taxa are undoubtedly closely related. However, as they live sympatrically, in the Perth/Rottnest Island area as well as at Esperance, and yet consistently different, it now seems more appropriate to formally treat them as two different species. *Smithsonidrilus fecundus* is easily separated from *S. minusculus* by its lack of spermathecae. Moreover, the conspicuous eggs present simultaneously in high numbers makes *S. fecundus* a rather atypical member Limnodriloidinae.

Distribution and habitat

Known only from south-western Western Australia (Rottnest Island and Esperance area). Known from the low-water mark to 6 m depth, sandy sediments including seagrass beds.

DISCUSSION

Previous studies have shown that Western Australia harbours a speciose fauna of marine Tubificidae [data summarized by (Erséus, 1997a), supplemented by Erséus and Wang (2003)]. The present study has added five new species to the list, which thus now contains a total of 95 species. It may be noted that 53 (56%) of these have not so far been recorded from outside the state.

Among the 18 species of Tubificidae reported from the Esperance area, *Heterodrilus keenani* was the most commonly found; it occurred at eight of the 21 stations. This species is widely distributed in Australia, and known also from China and Hawaii (references given in systematic account above). Less frequent were *Pectinodrilus granifer*, noted at four stations, and *Heronidrilus bihamis*, *H. decipiens*, *Duridrilus globosus* and *Smithsonidrilus fecundus*, each at three stations, respectively. Of these, only *Heronidrilus bihamis* is widely distributed and

repeatedly recorded from about the same area as that of *Heterodrilus keenani* (see Erséus, 1997a). The remaining 12 species were recorded only at one or two different sites each, and among them, only three have been found outside Australia: *Bathydrilus edwardsi* (also in China; Erséus, 1984, 1990c; Erséus *et al*., 1990), *Limnodriloides agnes*, and *Smithsonidrilus minusculus* (latter two circumtropical, see Erséus, 1997a).

As expected due to the geographical proximity, Esperance shares a majority (15 or 83%) of its recorded 18 tubificid species with Albany (see Erséus, 1990a) and/or Rottnest Island (see Erséus 1993). It is difficult to conclude which of these taxa are strictly endemic to the southern coast of the Western Australia, but at this point, *Pirodriloides breviclitellatus* sp. n., *Bathydrilus difficilis* sp. n., *Duridrilus globosus* sp. n., *Coralliodrilus mirus*, *C. regius*, *Inanidrilus asagittatus* Erséus, 1990a, and *Limnodriloides solitarius* sp. n. are the only taxa known exclusively from the Albany through Esperance region.

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