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New records of copepods associated with ascidians from Scottish waters, including the description of a new species, *Enterocola ooishiae* n.sp. (Cyclopoida, Ascidicolidae), from a simple ascidian.

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ABSTRACT

New records are presented for over 20 species of copepods associated with ascidians, collected from Scottish waters over the last 20 years. These include nine species of Notodelphyidae, seven of Ascidicolidae, and six of Lichomolgidae. Among these *Bonneriella altera*, *Bonneriella filipes*, *Botryllophilus aspinosus, Lichomolgidium cynthiae, Lichmolgus canui,* and *Zygomolgus didemni* are recorded for the first time from Scottish waters. *Botryllophilus aspinosus* has not been reported anywhere since its type description in 1922. A note of an apparently new species of *Botryllophilus* is provided along with a revised key to the adult female *Botryllophilus* from British seas. A new species of *Enterocola* collected from the Firth of Clyde is described. The genus *Enterocola* is reviewed and the key morphological features of the 21 species are tabulated. A differential diagnosis of the new species, *Enterocola ooishiae*, is given to distinguish it from similar species in the genus. The nomenclature of gender endings within the genus is also discussed.

INTRODUCTION

Copepods have long been known as associates of ascidians. The Italian naturalist Francesco Redi observed such parasites inside ascidians as long ago as 1684 (Damkaer, 2002,p.24-5). Since their initial discovery, a diverse array of species have been described inhabiting the branchial sac or the alimentary tract of both simple and compound ascidians. In many instances the copepods are visible through the body wall of their hosts. Several copepod species may occupy the same individual ascidian, along with other crustacean or bivalve co-habitees, prompting Gotto (1959b) to coin the term ascidian "hotel". In a recent study in the Ionian Sea, Pastore (2001), found 13 copepod species representing five families and eight genera associated with just two species of ascidian.

In his account of the Crustacea of Norway, Sars (1917,1921) presented descriptions and detailed figures of 36 copepod species from ascidian hosts. Most records of copepods from Scottish ascidians stem from the investigations of Thomas Scott for the Fishery Board of Scotland around one hundred years ago, which he summarised in a presentation to the Edinburgh Field Naturalist and Microscopical Society in 1907. Considerable knowledge of the ascidicolous copepods from British waters has since been provided by Viv Gotto who produced the first identification key in 1960 and subsequently added numerous new records to British and Irish waters as well as describing four new species. Gotto's synopsis (1993) of copepods associated with marine invertebrates from the British Isles and surrounding seas included revised keys to over 60 ascidian-infesting species from the area.

The copepods recorded below were collected, mostly by the author, in the course of marine monitoring surveys of benthic sediments. These surveys have already revealed a number of copepods associated with other invertebrates (O'Reilly 1995a,b, 1999, 2000a,b, 2001, O'Reilly *et al.* 2001). Ascidians were recovered from rocks or sediment as an accidental by-catch of sampling by grab or trawl. The ascidians were identified as far as possible using Millar (1970) though specific identification of juvenile specimens was not always possible.

All ascidians were fixed with formalin and subsequently transferred to alcohol prior to laboratory dissection to search for copepods. Copepods were examined in alcohol under a stereo microscope and, where necessary, were mounted in lactic acid and transferred to a compound microscope for more detailed observations. Permanent mounts were made of some specimens in polyvinyl lactophenol. All drawings were done with the aid of a *camera lucida* drawing tube. Accession numbers are shown for material deposited in the National Museum of Scotland, Zoology (NMSZ). Classification used here follows Gotto (1994) although some major revision of ordinal and familial classification of copepods has subsequently been undertaken by Boxshall & Halsey (2004).

New records of ascidicolous copepods

Order Cyclopoida

Family Notodelphyidae

***Notodelphys agilis* Thorell, 1859**

One ovigerous female and five juveniles from two *Ascidiella aspersa,* (also with 22 *Doropygella psyllus*, three *Ascidicola rosea)* collected in Barcaldine Bay, Loch Creran, 21 June 1988, (SEPA Stn.D5, 56°32.22'N, 05°18.63'W, depth 11m).

One mature female (NMSZ:2004.055.0001) found detached from host among sieve debris of grab sample collected at St Abbs sewage disposal grounds, Forth Sea area, 1990 (Stn.1, 56° 06.50'N, 02°07.25'W, depth 50m).

Four ovigerous females and two males (NMSZ:2004.055.0002) from two *Ascidiella aspersa*? (also with 17 *Lichomolgus albens*) collected in Ayr Bay, 29 Sept 1993 (SEPA Stn.1, 55°28.88'N, 04°04.40'W, depth 10m).

Three ovigerous females and four males (NMSZ:2004.055.0003) from *Corella parallelogramma*? (also with one female *Doropygella porcicauda*) collected in Irvine Bay, 28 Oct. 1993 (SEPA Stn.Q2, 55°35.92'N, 04°44.15'W, depth 20m).

N.agilis is widely recorded in British Waters. Scott (1907) highlighted previous records from both the Firths of Clyde and Forth, and from Shetland.

***Notodelphys allmani* Thorell, 1859**

A single ovigerous female (NMSZ:2004.056.0001) from an *Ascidiella sp*?, collected off Ironotter Point, Greenock, 23 April 1992, (SEPA Stn.H1, 55°58.29'N, 04°48.35'W, depth 22m, see O'Reilly *et al.* 1997).

The Greenock specimen has an unusually prominent process on the inside of the seta on the distal extension of basal segment of the fifth leg, and numerous (13-16) spinules on the inner margin (Fig. 1a). These features are very similar to *N.allmani f.spinulosa,* a variety described by Bocquet & Stock (1960), but the elongated first endopodite segment of *"forma spinulosa"* is not evident. Although the specimen would key as *N.rufescens* in Gotto (1993), it is emphasized by Gotto that there may be considerable difficulty in distinguishing different host forms among the "*allmani-rufescens*" complex . Indeed as long ago as 1878 some authors, such as Brady, regarded *N.allmani* and *N.rufescens* as synonymous. Clearly further study in this area is required.

***Notodelphys caerulea* Thorell, 1859**

Twenty one ovigerous females (NMSZ:2004.057.0001) from 16 *Ciona intestinalis* (also with 11 *Lichomolgus furcillatus*) collected in Ayr Bay, 30 Sept 1993 (SEPA Stn.13, 55°27.25'N, 04°40.31'W, depth 19m).

Six ovigerous females (NMSZ:2004.057.0002) from *Ascidiella aspersa* trawled in Irvine Bay, 10 April 2002 (SEPA Stn.H, 55°35.92'N, 04°47.40'W, depth 38m).

In the Ayr Bay specimens the external seta on the caudal ramus is positioned about one-third (rather then two-fifths) from the end. In the Irvine Bay material the brood pouch is distended posteriorly into two pronounced symmetrical lobes (Fig. 1b). In Scottish waters *N.caerulea* is recorded only from Shetland, by Brady (1878), although he did not consider its separation from *N.allmani* well justified. *Ciona intestinalis* appears to be a new host species for *N.caerulea* and the minor setal variation mentioned above may be another example of a host form.

***Doropygella porcicauda* (Brady, 1878)**

One ovigerous female from *Corella parallelogramma?* (see above under *N.agilis*) collected in Irvine Bay, 28 Oct.1993 (SEPA Stn.Q2, 55°35.92'N, 04°44.15'W, depth 20m).

Two ovigerous females and one juvenile female (NMSZ:2004.058.0001) from three *Corella parallelogramma?* trawled in Irvine Bay, 10 April 2002 (SEPA Stn.H, 55°35.92'N, 04°47.40'W, depth 38m). Of these one ovig. female accompanied by a female *Ascidicola rosea* and the single juvenile female accompanied by two male *Lichomolgus canui.*

D.porcicauda is readily identified by the very long flexible caudal rami. In the Irvine Bay specimens these are gently curved (rather than curled as depicted by Sars, 1921) but the copepods exhibit the characteristic dorsal ridges on thoracic segments 1-3. In one specimen these ridges are very pronounced and bent forwards and have numerous stalked ciliate protozoans attached (Fig. 1c). Scott (1900, 1907) cites the occurrence of *D.porcicauda* in Loch Fyne and the Firth of Forth.

***Doropygella psyllus* (Thorell, 1859)**

Twenty ovigerous females, two males and 11 juveniles (NMSZ:2004.059.0001) from three *Ascidiella aspersa?,* (also with four *Ascidicola rosea* and six *N.agilis)*, collected in Barcaldine Bay, Loch Creran, 21 June 1988, (SEPA Stn.D5, 56°32.22'N, 05°18.63'W, depth 11m).

Two ovigerous females (NMSZ:2004.059.0002) from *Ascidiella aspersa* collected at Poll na Gile, Shuna Island, Loch Melfort, May 94.

Three ovigerous females from *Ascidiella sp.*, collected at Tobermory, Mull, Aug. 2001 (also with one ovigerous female *Ascidicola rosea*.)

Three ovigerous females from *Ascidiella aspersa* collected at Linne Mhurich, Loch Sween, November 2005.

In Scotland *Doropygella psyllus* is known only from a single record (see Gotto, 1957). The record derives from *A.aspersa* collected by Dr R.B.Pike from Loch Sween, Kintyre in August 1946 (Gotto, *pers.com.*). Superficially *Doropygella psyllus* closely resembles *Doropygus pulex* which has been recorded in Scotland from Shetland, Oban, Loch Fyne, and Millport (Scott, 1907). The diagnostic feature distinguishing the two species is the presence in the former of six setae (rather than two) on the endopodite of the maxillule (Mx.1) as figured by Sars (1921). However the *D.psyllus* from Loch Creran appear to differ in that the endopodite of the maxillule is two-segmented with a total of seven setae and the basis has only three (rather than four) inner setae (Fig. 1d). In practice *D.psyllus* can be more readily separated from *D.pulex*, without examination of the mouthparts, by the rounded (not pointed) brood pouch, and by the minute (rather than prominent) terminal claw on the second antennae.

Hamond (1973) provided a brief description of a new *Doropygus*-like copepod which he called "Haplostome A" collected from *Sidnyum turbinatum*, from West Runton, Norfolk in 1957. Although the description is incomplete the cephalic and thoracic appendages are quite different from both *Doropygus* and *Doropygella*. It is more primitive than most haplostomes and probably represents a new genus. As the single specimen no longer exists, its systematic position will remain uncertain until new material is discovered. However the postulate that it might be the (then unknown) female of the genus *Agnathaner* now seems very unlikely (see discussion below under *Pachypygus gibber*).

***Pachypygus gibber* (Thorell, 1859)**

One mature female (NMSZ:2004.060.0001) from *Ciona intestinalis* collected off Ironotter Point, Greenock, 23 April 1992. (SEPA Stn.H1, 55°58.29'N, 04°48.35'W, depth 22m, see O'Reilly *et al.* 1997).

The only previous Scottish record is from Tarbert Bank, Loch Fyne (Scott, 1900). In a study of morphological variation of *P.gibber* males, Hipeau-Jacquotte (1980) realised that the atypical male form was identical to *Agnathaner minutus* Canu, 1892.

The genus *Agnathaner* was established by Canu in 1891 for *A.typicus*, and he added *A.minutus* the following year. Both were based on male specimens recovered from ascidians at Boulonnais, France. Hamond's *A.freemani*, collected from Norfolk, was also based on a male which closely resembled *A.typicus*. It seems probable that these and other *Agnathaner* records represent unknown males of various notodelphyids. Although the validity of the genus is doubtful, it has been retained by some authors until the status of the various forms is clarified (see Holmes & Gotto, 2000).

***Botachus cylindratus* Thorell, 1859**

Sixteen gravid females, 10 immature females (NMSZ: 2006.111.0001), from *Ascidiella aspersa* collected in Invasion Bay, Loch Sunart, 2003. Copepods found by P. Garwood.

Widely distributed in Scottish waters. Scott (1907) cites its occurrence in Shetlands, Orkneys, Oban, and Loch Fyne.

***Bonnierilla altera* Stock, 1967**

Twenty four gravid females and 10 copepodites (NMSZ:2004.061.0001) in *Pyura microcosmus*, 1 gravid female and 40 copepodites in a second *P.microcosmus* (along with two *Lichomolgidium cynthiae* copepodites, see below), and 33 copepodites (NMSZ:2004.061.0002) in a third *P.microcosmus*. All collected from South Shian, Loch Creran, Aug. 2001 (SEPA Stn. 100m Sth., 56°31.25'N, 05°23.86'W, depth 7m).

In British waters *B.altera* is known only from the west of Ireland (Holmes & Gotto, 1987). *P.microcosmus* is a new host species.

***Bonnierilla filipes* Stock, 1967**

One ovigerous female (NMSZ:2004.062.0001) from a *Dendrodoa grossularia* collected off Dipple, Girvan, Oct 2002 (SEPA Stn. LSO, 55 °17.25'N, 04°51.12'W, depth 15m). The host ascidian was examined shortly after fixation in formalin. The bright orange ova in the brood sac of the copepod made it clearly visible through the wall of the ascidian. The orange colour faded after a few days.

This species was initially described and figured from the Mediterranean by Illg & Dudley (1961), who erroneously referred it to the African/Australian species "*B.armata* Schellenberg, 1922". Stock (1967) realised that the Mediterranean copepods were in fact a new species which he named *B.filipes*. It was subsequently discovered on the west coast of Ireland by Holmes & Gotto (1987). The Girvan specimen is the first Scottish record. Although the eggs of the Girvan specimen were orange, Illg & Dudley described the embryos in the brood sac as green.

Family Ascidicolidae

***Ascidicola rosea* Thorell, 1859**

Five females (NMSZ:2004.063.0001) from several *Ascidiella sp?* collected at Bell Rock sewage disposal grounds, Forth Sea area, 27 Nov. 1987 (Stn.13 & Stn.C, see O'Reilly *et al.*, 2001).

Three females and one juvenile (NMSZ:2004.063.0002) from three *Ascidiella aspersa?,* (also with 30 *D.psyllus* and six *N.agilis,* see above), collected in Barcaldine Bay, Loch Creran, 21 June 1988, (SEPA Stn.D5, 56°32.22'N, 05°18.63'W, depth 11m).

One female (NMSZ:2004.063.0003) from *Ascidiella sp*?, collected off Ironotter Point, Greenock, 23 April 1992, (SEPA Stn.H1, 55°58.29'N, 04°48.35'W, depth 22m, see O'Reilly *et al.* 1997).

Three females (NMSZ:2004.063.0004) from *Ascidiella scabra* trawled in Ayr Bay, 30 Sept. 1992.

One female (NMSZ:2004.063.0005) from *Ascidiella aspersa,* Loch Spelve, Mull, 1996

One female (NMSZ:2004.063.0006) separated from host in sieve debris, Braer Survey, St. Magnus Bay, Shetland, collected 4 May 1993 (Stn.3, 60°23.44'N, 01°33.84'W, depth 146m) by Sue Hamilton.

One female (NMSZ:2004.063.0007) from *Ascidiella sp.* (also with 1 *Lichomolgus albens*), Bogany Point, Rothesay, Isle of Bute, 6 June 2001, (SEPA Stn. 5, 55°50.71'N, 05°01.81'W, depth 15m).

One female ovigerous from *Ascidiella sp.*, Tobermory, Mull, Aug. 2001 (also with three *D.psyllus*).

One female ovigerous (NMSZ:2004.063.0008) from *Ascidiella sp.,* collected off Dipple, Girvan, Oct 2002 (SEPA Stn. LSO, 55°17.25'N, 04°51.12'W, depth 15m).

Thirteen ovigerous females from 38 *Ascidiella aspersa*, five ovigerous females from 37 *Ascidiella scabra*, and one female from *Corella parallelogramma?,* all trawled in Irvine Bay, 10 April 2002 (SEPA Stn.H, 55°35.92'N, 04°47.40'W, depth 38m).

Three ovigerous females (NMSZ:2004.063.0009) from *Ascidiella aspersa* collected by C.Milner, 0.8km north of Port a Bheachan, Loch Craignish, 13 August 2003.

Ascidicola rosea is one of the most widespread of the ascidicolous copepods occurring in a variety of hosts. Scott (1907) mentioned its presence in Orkney (Scapa Flow), Shetland, the Firth of Forth, and on the west coast at Oban and in Loch Fyne. A detailed re-description of the female is provided by Ooishi (2007a).

***Haplostoma eruca* (Norman, 1869)**

Two mature females from two *Ciona intestinalis* collected off Ironotter Point, Greenock, 23 April 1992. (SEPA Stn.H1, 55°58.29'N, 04°48.35'W, depth 22m, see O'Reilly *et al.* 1997).
H.eruca is a rarely recorded copepod initially described from Shetland and subsequently found in the Firth of Forth by T. & A. Scott (1892) and in southern Norway by Sars (1921). Gotto (1959a) recovered a single specimen from Strangford Lough, Northern Ireland, and discussed some of the taxonomic confusion surrounding this species. The Clyde material is the first record in Scottish waters for 100 years and forms the basis of a re-description by Ooishi & O'Reilly (2004). Three other *Haplostoma* species from British waters have been re-described by Ooishi (1994, 2004a,b).

***Botryllophilus aspinosus* Schellenberg, 1922**

Three mature females and two juveniles from five specimens of *Polycarpa sp*? collected in Bay of Puldrite, (approx. 59°02.7'N, 03°00.2'W, around 15 m deep), north of Kirkwall, Orkney Isles, June 2003 . The copepods were recovered by P.R. Garwood.

B.aspinosus was originally recovered from *Polycarpa pomaria* collected in Plymouth and also from *Styela hupferi* from Angola. It is rather poorly described and has never been seen since. Hence it was excluded from Gotto's synopsis (1993). However, Illg & Dudley (1980), considered it well characterised and regarded it as a valid species, although a modern redescription is needed. The discovery of new material has confirmed their supposition and provided an opportunity to present a full description. This will be the subject of a future publication.

***Botryllophilus macropus* Canu, 1891**

One mature female and two juveniles (copepodids) from a solitary tunicate (*Molgula complanata*?) collected at Bell Rock sewage disposal grounds, Forth Sea area, Nov.1987 (Stn.13, 56°25'N, 02°10'W, depth 56m). The only previous record of *B.macropus* from British waters is from Langstone Harbour, Hampshire (Schmidt, 1984). The Forth Sea specimens are the first from Scotland and were described in detail by Ooishi (1996).

***Botryllophilus norvegicus* Schellenberg, 1921**

One mature female found among sieve debris from a grab sample collected at St.Abbs sewage disposal grounds, Forth Sea area, Jun. 1988, (Stn.27, 56°05.91'N, 02°04.72'W, depth 52m). Both of the known hosts, *Pelonaia corrugata* and *Polycarpa fibrosa,* were present in the sample. One specimen of the former ascidian had been torn open during sampling and may have been the actual host in this case. *B.norvegicus* is known from Norway, Greenland, eastern Canada and U.S.A., and Alaska. The Forth Sea specimen is the first record from the British Isles and

was illustrated, along with *B.macropus,* by Ooishi (1996).

***Botryllophilus ruber* Hesse, 1864**

One mature female found among sieve debris from a grab sample collected in the Sound of Jura, Jun. 2007 (SEPA Stn. SJ1, 55°50.507'N, 05°46.829'W, around 10 km east of the Small Isles, depth 174m). *B.ruber* was comprehensively re-described by Ooishi (1999) based on new material collected at Roscoff, in Brittany, and morphological differences between females of *B.ruber* and *B.macropus* were clarified for the first time. The definitive hosts of *B.ruber* are the botryllid ascidians *Botryllus schlosseri* and *Botrylloides leachi.* Ooishi considered the *B. ruber* records of Scott (1901) from Loch Fyne and the Moray Firth, and that of Gotto (1954) from Strangford Lough, as reliable. In the second edition of his synopsis Gotto (2004) reviewed other British *Botryllophilus* records and ascribed those from botryllid hosts, lacking true developed eyes, and with mauve eggs to *B.ruber.* This included records from Devon (Norman & Scott, 1905), Norfolk (Hamond, 1973) and Mayo, West Ireland (Holmes & Gotto, 2000).

***Botryllophilus* n.sp.?**

One mature female, 1.5mm long, removed from a small (4mm diameter) solitary ascidian, (*Molgula sp*?), from a grab sample collected in the Sound of Jura, Jun. 2007 (SEPA Stn. SJ1, 55°50.507'N, 05°46.829'W, around 10 km east of the Small Isles, depth 174m). The single female appears to be attributable to the genus in the form or the cephalic appendages, asymmetric legs 1-4, and five-segmented urosome. However leg five which, in this genus, is usually narrow and lanceolate, is in this specimen very large, broad, and lamellate. A full description of this new species is planned for a future publication.

The genus *Botryllophilus* Hesse, 1964 has been the subject of considerable confusion. Illg & Dudley (1980) reviewed the status of all named species and dismissed many as indeterminable. Much of the confusion surrounding the genus *Botryllophilus* in European waters has been resolved by detailed studies of Ooishi (1988, 1996, 1999, 2002b, 2006). In addition to the four species above, one other species is now known to occur in British waters.

This species, *B.sarsi* Ooishi, 2002, was formerly known as "*B. brevipes* Sars, 1921". As Gotto (1993) noted, the name "*B.brevipes*" had previously been used by Brément, in 1909, for a different Mediterranean species, and a new name was required for Sars' species. Ooishi (2002b) provided the new name, *B.sarsi*, and a detailed redescription of new material from the clavelinid ascidian *Polycitor vitreus* collected at Lofoten, Norway. In Gotto's synopsis (2004), British *Botryllophilus* records from various aplousobranchiate ascidians, with eggs not coloured mauve (but usually greenish) were ascribed to *B.sarsi.* These included records from Strangford Lough (Gotto, 1954), Sheephaven, County Donegal (Gotto, 1961a), Norfolk (Hamond, 1973) as well as some from east and south-west Scotland.

A revised key to *Botryllophilus* females from waters around the British Isles can be constructed:

1. Urosome 5-segmented, exopods of leg pairs 1-4 strongly asymmetric 2
   Urosome 8-segmented, exopods of leg pairs 1-4 weakly asymmetric 3
2. Fifth leg narrow, long, curved, hook-like .....*B.norvegicus*
   Fifth leg narrow, short, straight.....*B.sarsi* (syn. *B.brevipes* Sars,1921)
   Fifth leg broad, long, lamellate .....*Botryllophilus* n.sp?
3. Fifth leg strongly curved, hook-like .....*B.aspinosus*
   Fifth leg gently curved, but not hooked 4
4. Fifth leg short, less than 1/2 urosome length, legs 1-4 exopods shorter than endopods.....*B.ruber*
   Fifth leg long, more than 3/4 urosome length, legs 1-4 exopods longer than Endopods .....*B.macropus*

Order Poecilostomatoida

Family Lichomolgidae

***Lichomolgidium cynthiae* (Brian, 1924)**

Two copepodites (NMSZ:2004.065.0001-2) from one *Pyura microcosmus* (also with 41 *B.altera)* collected from South Shian, Loch Creran, Aug.2001 (SEPA Stn. 100m Sth., 56°31.25'N, 05°23.86'W, depth 7m).

The immature copepodites were just under 1mm in length. They appear to be different stages as one had the second and third segments of the leg rami fused while the rami in the other specimen were clearly three-segmented. The second antennae and maxilliped appear similar to the adult although the caudal rami are much shorter. The fine spinulation on the posterior ventral margin of the urosomal segments and the peculiar structure of the outer principal caudal seta (*ie.* weakly sclerotized on the inner side) illustrated by Humes & Stock (1973, Fig.24) were observed on the copepodites.

L.cynthiae has only been recorded once before in British waters from *Styela clava* collected at Plymouth (Gotto,1961b). The genus *Lichomolgidium* was transferred from the Sabelliphilidae to the Lichmolgidae by Humes & Boxshall (1996).

***Lichomolgus albens* Thorell, 1859**

Seventeen females (11 ovigerous) and one male (NMSZ:2004.066.0001) from two *Ascidiella aspersa*?

(also with six *N.agilis*) collected in Ayr Bay, 29 Sept 1993 (SEPA Stn.1, 55°28.88'N, 04°04.40'W, depth 10m).

Seven females (five ovigerous) from one *Ascidiella scabra* collected in Ayr Bay, 30 Sept 1993, (SEPA Stn.13, 55° 27.25'N, 04°40.31'W, depth 19m).

One female from *Ascidiella sp.*, (also with one *A.rosea*), Bogany Point, Rothesay, Isle of Bute, June 2001, (SEPA Stn. 5, 55°50.71'N, 05°01.81'W, depth 15m).

One immature female? from *Ascidiella sp.*, collected off Dipple, Girvan, Oct 2002 (SEPA Stn. LSO, 55°17.25'N, 04°51.12'W, depth 15m).

Examination of the caudal rami is perhaps the easiest way to distinguish the various *Lichomolgus* species from ascidians. *L.albens* is characterised by peculiar truncated apical seta. The ovisacs of fixed specimens are rather fragile and often break up as the copepod is extracted from its host. The ovisacs of one of the above females were measured (through the host body wall prior to extraction) as 1.1 mm long, extending well beyond the caudal rami. These are much longer that those illustrated by Sars (1917) and superficially resemble, in size and shape, the ovisacs figured by Gotto (1961b) for *L.diazonae* Gotto, 1961. The only previous record of *L.albens* in Scottish waters is that mentioned by Scott (1907) from Otter Spit, Loch Fyne.

***Lichmolgus canui* Sars, 1917**

Ten females (five ovigerous) (NMSZ:2004.067.0001) collected from 38 *Ascidiella aspersa* and two males (NMSZ:2004.067.0002) from *Corella parallelogramma?* (also with *D.porcicauda)* trawled in Irvine Bay, 10 April 2002 (SEPA Stn.H, 55°35.92'N, 04°47.40'W, depth 38m).

Two females (ovigerous) from *Ascidiella aspersa* collected near Lappock Rock, Irvine Bay, 16 April 2004 (SEPA Stn.100m u/s IVS, 55°34.98'N, 04°41.46'W, depth 10m).

Two ovigerous females, one mature female, and one male from the non-native ascidian, *Styela clava*, collected in Ardrossan harbour, Firth of Clyde, April 2006.

L.canui is new to Scotland. Around the British Isles it has only been recorded from the southern North Sea (*i.e.* The Netherlands, Stock, 1960) and Irish waters (Gotto,1961b, Holmes & Gotto,1992). The male is figured by Costanzo (1968) and the female has recently been re-described by Conradi & López-González (1994).

***Lichomolgus forficula* Thorell, 1859**

Two ovigerous females, two mature females, and three males (NMSZ:2006.112.0001) from *Ascidiella aspersa* Invasion Bay, Loch Sunart, 2003. The copepods were found by P. Garwood.

Widely distributed in Scottish waters. Scott (1907) cited its occurrence in Shetlands, Orkneys, Oban, and Loch Fyne.

***Lichomolgus furcillatus* Thorell, 1859**

Three ovigerous females, and eight juveniles (NMSZ:2004.068.0001) from 16 *Ciona intestinalis* (also with 21 *N.caerulea*) collected in Ayr Bay, 30 Sept 1993, (SEPA Stn.13, 55° 27.25'N, 04°40.31'W, depth 19m).

The relatively short and stout caudal rami help distinguish *L.furcillatus* from other species of *Lichomolgus* in British waters. In Scotland there are several records from Scott: from Shetland, from Inchkeith and the Isle of May in the Firth of Forth, and from Inverary, Loch Fyne (for record details see Humes & Stock, 1973, p.193).

***Zygomolgus didemni* (Gotto, 1956)**

One ovigerous female (NMSZ:2004.069.0001) from *Diplosoma listerianum* colonies scraped off fish farm nets in Loch Kishorn, April 2002, by Sally Davies.

At present, this species is known only from its type locality in Strangford Lough, Northern Ireland. *D.listerianum* represents a new host species for this copepod but the same ascidian may also act as a host to an allied species, *Z.tenuifurcatus* (Sars, 1917), known from Norway and Ireland.

Description of a new copepod species from the genus *Enterocola* van Beneden, 1860, Family Ascidicolidae.

***Enterocola ooishiae* n.sp.**

Material examined: one ovigerous female (Holotype) removed from intestinal tract of a juvenile *Ascidiella sp?* (ascidian about 1cm long), collected off Ironotter Point , Greenock, May 1995 (SEPA Stn.H750, 55°57.99'N, 04°48.71'W, depth 20m). Specimen in vial deposited in National Museum of Scotland (NMSZ:2004.064.0001-2) with some cephalic appendages mounted separately on a slide.

Etymology: The new species is named in honour of my colleague Shigeko Ooishi, of the Friday Harbour Laboratory, Washington State, USA, in recognition of her considerable contribution to the study of ascidicolous copepods over many years.

Description:

Female (Fig. 2a-d): Body 2.4mm total length from anterior of cephalosome to end of caudal rami. Body comprising cephalosome with antennae and mouthparts, four-segmented metasome with sclerotized plates dorsally and four pairs of legs ventrally, and urosome with pair of conspicuous lateral lamellae on first segment and terminating in two simple caudal rami.

Cephalosome (Fig. 3b) about 0.5mm broad, without rostrum.
Antennules (A.1) (Fig. 3b,c) - elongate, cylindrical, perhaps 2-3 segmented but articulation obscured, about three times as long as wide, of uniform width throughout with rounded end, anterior edge with six setae, distally with three setae and three small setules.
Antenna (A.2) (Fig. 3a,b) two-segmented, basal segment unarmed, apical segment elongate armed with short seta on inner margin, three long terminal setae in group, and two long setae on outer margin.
Labrum (La) (Fig. 3b) – semi-circular plate with spinulose palps extending posteriorly from lateral corners.
Maxillule (Mx.1) (Fig. 3b,d) – proximal portion forming large, heavily sclerotized, blunt tooth, and armed on anterior surface with seta and tiny accompanying setule. Distal palp extends ventrally, with five stout spinulose setae distally, and single seta on outer margin.

Maxilla (Mx.2) (Fig. 3b,e) – two-segmented with massive proximal segment, bearing at distal medial corner an articulated digitiform, spinulose endite. Distal segment narrower, heavily sclerotized, bifid distally with anterior process shorter that the posterior one. Irregular unsclerotized area on posterior surface with small spine.

Legs 1-4 (Fig 4a-d) - two-segmented protopodite and 1-segmented rami. First segment of protopodite (coxopodite) broad, without ornamentation. Second segment (basipodite) broadly conical, armed with pair of minute setae laterally, surmounted laterally with exopodite and terminally with endopodite. Exopodites with granular protuberances laterally at base, and about midway along length. Exopodites of first, second, and fourth legs terminate with pointed dome-like element. Exopodite of third leg terminates with smooth styliform process. Endopodites longer than exopodites, around twice as long as broad, armed with two terminal setae. Endopodite setae well spaced apart, outer generally a little longer than inner and longer than endopodite segment. Well developed plates present between each pair of legs projecting posteriorly. Simple plate between first pair, but plate between second, third, and fourth legs distinctly bilobed to form two mammiform processes (Fig. 2b).

Urosome with pediform projections on first segment comprising pair of curved lateral lamellae each with two tiny setules on posterior margin (Fig. 2d). Lamellae almost hemi-sphaerical, enclosing pair of dorsal protuberances to which ovisacs attach. Ovisacs, strongly curved, 2.7mm long, multiseriate (Fig. 2c). Remainder of urosome relatively short, possibly with four segments, articulation obscure and difficult to distinguish joints from wrinkles. Caudal rami clearly articulated with urosome, cylindrical, without ornamentation.

Enterocola ooishiae is known only from the single female holotype specimen. The male remains to be discovered.

Review of the genus *Enterocola*

Illg & Dudley (1980) in their review of the Ascidicolidae treated *Enterocola* in some detail, describing developmental stages, the form of the male, as well as some intra-specific morphological variation of females from different hosts. They accepted 15 named species as valid and figured ten species in all, five of them new. They provided a key to the females of all 15 named species, the males being excluded as they were known for only four species. Since 1980, two species have been added from the Straits of Gibraltar; *E.gottoi* Conradi *et al.*1992 and *E.africanus* López-González *et al.*1993, and more recently another three species; *E.dicaudatus*, *E.monnioti* and *E.parapterophorus* have been described by Marchenkov & Boxshall (2005) from Tanzania, Bahrain, and Djibouti respectively. Ooishi (2007b) presented a detailed re-description of the type species, *E.fulgens* van Beneden, 1860, and provided new insight regarding its morphology. She synonymised *E.megalova* Gotto, 1964 with *E.fulgens*.

All, except five, of the 20 named *Enterocola* species occur in European waters and (excepting *E.ooishiae*) their distribution in Europe is summarised by López-González *et al.* (1992). *E.africanus* described from the African side of the Straits of Gibraltar can effectively be regarded as European.

In their assessment of some older species which have at some stage been attributed to *Enterocola*, Illg & Dudley (1980) dismissed as indeterminable *Biocryptus flavus* and *B.roseus* both Hesse, 1865 and *B.calthaeus* Hesse 1872, all from the French coast. The status of the "*Enterocola* sp." briefly described by Claus (1875) without a given locality (but possibly from European waters) and "*Enterocola* sp.A Chatton & Brément, 1909" from Naples (originally referred to *E.fulgens* van Beneden, 1860 by della Valle,1883), remains uncertain as the original descriptions and figures are of poor quality.

Scott (1900) figured "*Enterocola* (?) *fulgens* van Beneden" from the Firth of Clyde. While he realised that his specimens differed somewhat from van Beneden's he preferred to regard them as a variety of *E. fulgens* rather than a new species. However, Chatton & Brément (1909) regarded Scott's *Enterocola*

as a distinct entity and referred to it as "*Enterocola* sp.B", a view re-iterated by Illg & Dudley (1980). However, Scott's description and figures lack sufficient detail to establish a new species and a full re-description is required based on new material. Another inadequately described species *Enterocola beaumonti* Scott & Scott, 1895, from Valentia, Ireland has long since been transferred to *Haplostomides,* and more recently Ooishi (2002a, 2005) has indicated it should be regarded as synonymous with *H.scotti* Chatton & Harant (1924).

The genus *Enterocola* is poorly represented in British waters with only scant records. Of the seven species in Gotto's synopsis (1993) only four actually occur within the British Isles (one of which has since been submerged as a synonym); the others being recorded from the Channel coast of France. Apart from "*Enterocola* sp.B" mentioned above the only other records from Scottish waters are an unpublished record derived in 1901 from the Millport Marine Station for *E.fulgens* in the intestines of small ascidians dredged at Tarbert Bank (Loch Fyne), and Gotto's citation of *E.fulgens* (1960) from the Isle of Jura.

Almost all the known hosts of *Enterocola* species are compound ascidians with the exception of *E.laticeps* Illg & Dudley 1980, from western USA and Canada, one of the most primitive species in the genus, which was found in a simple ascidian. *Enterocola* species have been observed in the pharynx, stomach, or intestine of their hosts. Brément (1911) provided various illustrations of the orientation of *E.pterophorus* Chatton & Brément, 1909 within the stomach of its compound ascidian host.

The key morphological characters of the 20 *Enterocola* species (plus "*Enterocola* sp.B") are summarised in Table 1. They are derived from published descriptions but should be used as a guide only as some features, such as the setal arrangement of the antenna (A2), and the setal lengths of the leg endopodites may show intra-specific variation in different hosts.

The distinguishing features of the new species *E.ooishiae* are; elongate cylindrical antennule (A1), antenna (A2) with apical group of 3 long setae, mammiform processes at the base of legs 2-4 (leg 1 with plate but no processes), leg endopods with long, unequal, well spaced setae (of which the outer are longer than the endopod), and cylindrical caudal rami which clearly articulate with the urosome.

The antennule (A1) in most *Enterocola* species is usually rather short, unsegmented or vaguely bimerous, often bulbous with a sharply tapered tip. The elongate antennule of *E.ooishiae* is unusual being of uniform width and with a rounded end. It bears some resemblance to that of two Mediterranean species. Of these *E. pterophorus* appears to have a shorter antennule with fewer setae, and in *E. mammiferus* Chatton & Harant, 1922 the antennule is devoid of setae. *E.laticeps* Illg & Dudley 1980 from Washington and British Columbia also has a similar antennule to *E.ooishiae* but with more numerous setae.

The antenna (A2) of *E.ooishiae* has a fairly typical 2-segmented spatulate structure. However, the possession of a distinct terminal group of 3 setae is shared only with *E. petiti* Guille,1964 and *E.fertilis* Illg & Dudley, 1980 both from the Mediterranean, and also *E. brementi* Illg & Dudley, 1980 from the Channel coast of France.

The oral appendages are of little taxonomic value in *Enterocola*. It has generally been assumed that mandibles are absent but Marchenkov & Boxshall (2005) described a pair of setulose elements concealed beneath the labral palps in all three of their new species which they considered as representing mandibles. Ooishiae (2007b) figured similar appendages in her recent study of *E.fulgens*, but regarded them as paragnaths. No attempt has been made to locate such structures in *E.ooishiae* in order to avoid damage to the holotype specimen.

The occurrence of mammiform processes only between legs 2-4 in *E.ooishiae* is also exhibited by *E.clavelinae* Chatton & Harant, 1924 from France, *E.precarius* Illg & Dudley, 1980 from Naples, Italy, and *E.africanus* from the Straits of Gibraltar.

The basic leg structure in *E.ooishiae* with the dome-like elements on exopods of legs 1, 2, and 4, is similar to most other species. However, the endopod terminal setae are well separated on all legs (compared with several other species where they are closely adjacent), the setae are relatively long (*i.e.* much longer than length of the endopod), and the outer seta is consistently longer than the inner. This combination of characteristics is unusual within the genus, with only *E.bilamellatus* Sars, 1921, from Norway, appearing to be similar. In *E.hessei* Chatton & Harant , 1924, the setae are spaced and long but both inner and outer setae are around the same length.

The possession of cylindrical, articulated, caudal rami in *E.ooishiae* is shared with 10 other species, the remainder have conical or lobed rami usually fused with the last urosome segment.

E.ooishiae keys out to couplet 7 (in the Illg & Dudley key) or couplet 4 (in Gotto's synopsis key) but proceeds no further as the choice is for an apical group of 2 or 4 (or more) setae on the antennae (A2), whilst *E.ooishiae* has an apical group of three setae. Of the species described since Illg & Dudley's review, *E.gottoi* is distinguished from *E.ooishiae* by its short bulbous antennule, antenna with 2 apical setae, mammiform processes between all the legs, adjacent subequal endopod setae, and conical caudal rami fused with urosome. *E.africanus* has some features in common with *E.ooishiae* but has a short bulbous antennule, antenna with apical row of four setae, and

closely adjacent endopod setae. *E.dicaudatus* and *E.parapterophorus* differ in the structure of the antennae and antennules, and have very short closely adjacent endopod setae. *E.monnioti* has different antennae, antennules, endopod setae, and caudal rami and lacks processes or plates between the legs.

Conradi *et al.* (1992) recommended that any new species of *Enterocola* is based on numerous specimens, to avoid confusion by variable host forms. However, Marchenkov & Boxshall (2005) suggested that the host forms previously described for *E. pterophorus* may represent a species complex. In the case of *E.ooishiae,* the combination of several distinct morphological features appears to be sufficient to allay such concerns and warrants the establishment of a new species.

Nearly all the species of *Enterocola* have been recovered from compound ascidians. The occurrence of *E.ooishiae* in a simple ascidian is of interest as only one species, *E.laticeps*, has previously been observed in a solitary ascidian. The hosts of *E. bilamellatus* from Norway and *E.setiferus* Hansen, 1923 from Iceland are unknown but Illg & Dudley (1980) suggested that as these share some ancestral features with *E.laticeps* (such as multi-segmented antennules) they may also utilise simple ascidians as hosts. It is not clear whether "*Enterocola* sp.B" of Scott, 1900 is from a solitary ascidian but Scott's subsequent (1907) comment that "only one copepod was noticed in each single ascidian" implies that a solitary ascidian may be involved. Moreover the multi-articulated ancestral form of both the antennules and antennae depicted by Scott appears to be unique within the genus. Although *E.ooishiae* and "*Enterocola* sp.B" may occupy similar hosts within the same geographical area, they are very different morphologically. Re-descriptions of some of the poorly known *Enterocola* species would greatly aid understanding of morphological variation within the genus. It seems likely that diligent searching of ascidians will reveal further new species of *Enterocola* both in British waters and elsewhere.

Nomenclatural footnote

The names of six of the *Enterocola* species have recently changed their endings from feminine form to masculine. To fully understand the etymology of scientific names and some recent discussion on the correct form of species names within *Enterocola* requires delving into the rather esoteric world of zoological nomenclature. The Code of Zoological Nomenclature (ICZN, 1999) states that generic names derived from greek or latin words should maintain the gender of the original word, or where this word is of common gender then the genus name should be considered as masculine, unless treated otherwise by the original author. The gender of specific names should, as adjectives, generally follow that of the genus although there are exceptions to this such as species named after a person which utilize the gender ending appropriate to that person, and personal names can be regarded as nouns in apposition.

López-González *et al* (1999) commented on the nomenclature in the genus *Enterocola*. Although they realised that *Enterocola* had traditionally been treated as feminine they proposed that the genus should be regarded as masculine and that those species names with feminine endings (*e.g. E.pterophora, E.bilamellata, E.mammifera, E.setifera, E.precaria, E.ianthina*) should be amended to a masculine form (*i.e. E.pterophorus, E.bilamellatus, E.mammiferus, E.setiferus, E.precarius, E.ianthinus*).

They argued that generic names of other parasitic copepods with the suffix "*-icola*" (such as *Doridicola* Leydig, 1853, *Modiolicola* Aurivillius,1882 and *Synapticola* Voigt, 1892) have been regarded as masculine and hence *Enterocola* should be considered in the same manner.

However, on the grounds of maintaining nomenclatural stability, the Code also allows the form of a generic name to be conserved if there has been a long tradition of use of the name in a particular form, even if the original construction is later shown to be erroneous. This would certainly be the case with *Enterocola* which has generally been treated as feminine by almost all authors for well over 100 years. There seems to be only a few exceptions; in a resumé of parasitic copepods from Southern Africa (Barnard, 1955) transgendered the name *E. bilamellata* to *E. bilamellatus,* and *E.africanus* was constructed in a masculine form by López-González *et al.* (1993). However, Marchenkov & Boxshall (2005) in a brief mention of *E.pterophora* changed the gender ending to *E.pterophorus,* bluntly stating that the genus *Enterocola* is masculine and that such a change is mandatory. Hence they also used masculine endings for their three new species, *E.dicaudatus, E.monnioti*, and *E.parapterophorus*. More recently Ooishi (2007b) followed suit and treated the genus as masculine.

Some light can be cast on the proposal of López-González *et al* (1999) and the statement of Marchenkov & Boxshall (2005) if the original description of *Enterocola* is re-examined. The first described species of the genus *Enterocola* was *E. fulgens* van Beneden, 1860. The genus name *Enterocola* is derived from *Enteron* (Greek for gut) combined with the latin suffix *–cola* (meaning inhabitant). *Enteron* is neuter (*i.e.* common gender form which may be either masculine or feminine depending on the context). The suffix *-cola* is masculine or common gender and the species epithet *fulgens* (meaning shining or gleaming) is also neuter. Grammatically the stem of the word *Enteron* is *Enter-* and in combination with *-cola* the vowal 'i' is normally inserted to make the name more rhythmic or pronouncable. Hence the name ought to have been "*Entericola*". However, on this point at least, there is

no imperative under the Code to amend such a trivial grammatical error.

The type species *Enterocola fulgens* is thus constructed in common gender form and there is no explicit indication within the original decription of how the author regarded the gender of the new genus. Evidently van Beneden only had female specimens and tells us that the name "shining" refers to the brilliant purple appearance of the ovisacs. With a specific name based on a female holotype and referring to a specifically female feature it might be inferred that he effectively treated the genus as feminine when it was established. However names are constructed strictly according to word gender and not sex of specimens. Sex and word gender are entirely different concepts. Hence the suggestion of López-González *et al* (1999) that no gender was inferred and that the genus should default to a male gender seems reasonable at first.

However, it is also worth noting that the masculine examples presented by López-González *et al* (1999); *Doridicola*, *Modiolicola*, and *Synapticola*, are all named after their respective hosts (the Sea Slug, *Doris* Linnaeus, 1758, the Horse Mussel *Modiolus* Lamarck, 1799, and the Sea Cucumber *Synapta* Eschscholtz, 1829) which themselves were all of feminine form. (The Horse Mussel was called *Modiola* in the 1880's but has since reverted to its original masculine form *Modiolus*). Thus the corresponding copepod genera should perhaps also have been treated as feminine. Nevertheless, if there is now a long history of treating them otherwise then this could be continued on the grounds of maintaining nomenclatural stability.

Similarly with *Enterocola*, its long historical treatment as a feminine genus warrants, to some extent, the maintenance of subsequent specific names as feminine. Against this is the argument for rigid application of the Code and defaulting to masculine forms. The latter option was chosen by López-González *et al* (1999), by Marchenkov & Boxshall (2005), and was followed by Ooishi (2007b). This option has now also been adopted here, albeit with some reluctance.

It is interesting from a socio-historical viewpoint that the Code of Nomenclature displays a male gender bias in that names should be regarded as masculine by default. This may be appropriate to some of the major vertebrate groups where males may be physically dominant or may display more distinctive morphology or coloration. However, in many crustacean groups, and among parasitic copepods in particular, females tend to dominance in body size and longevity. The males are often short-lived and of diminutive size. Indeed for a considerable number of species the males remain unknown. In practice this means that females are more frequently observed and the type descriptions are generally based on female holotypes. Hence, in parasitic copepods at least, the code rule to default to an assumed male gender may seem quite inappropriate. Nevertheless the Code must be applied consistently to all fauna and there the debate must rest.

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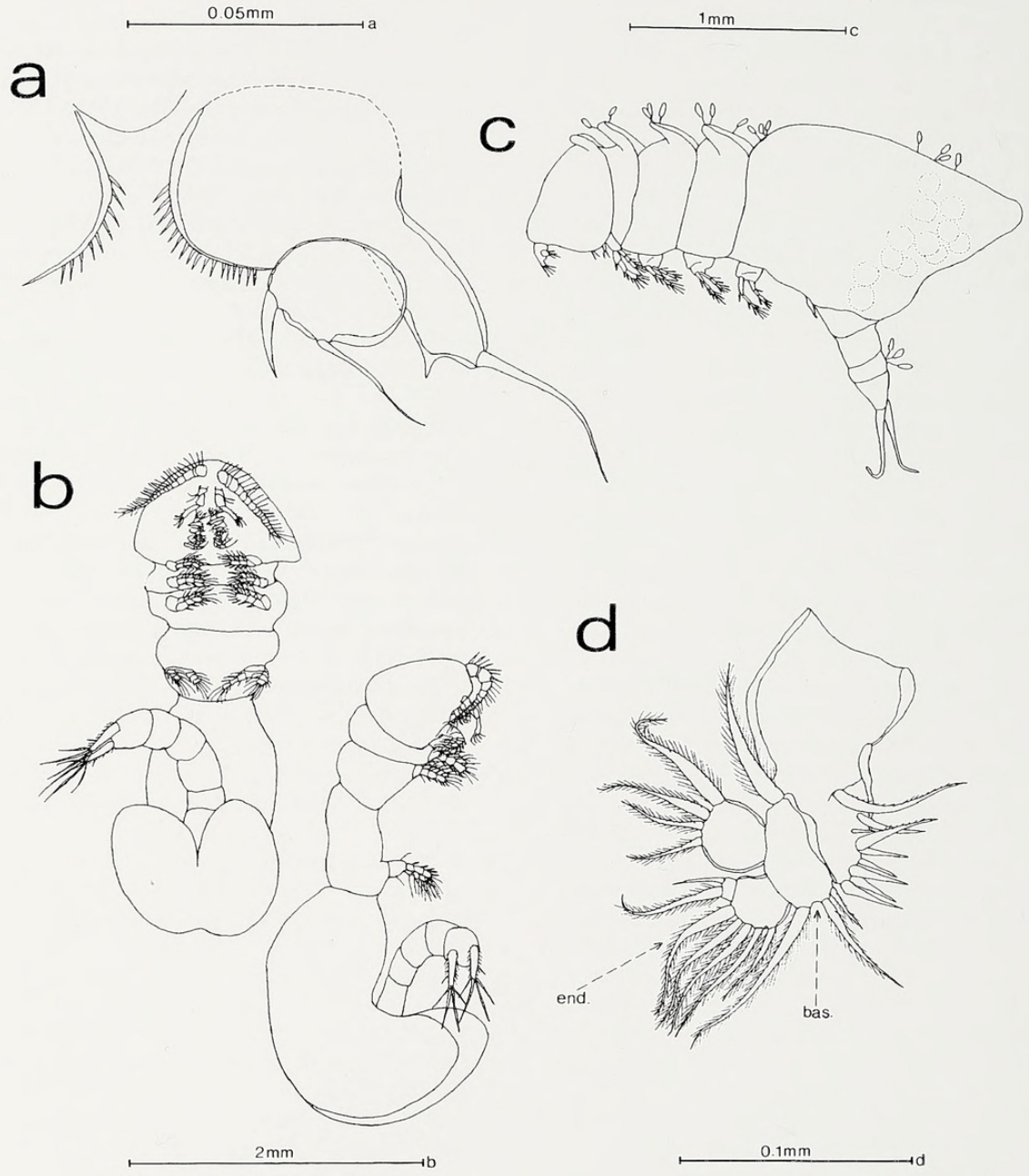

Fig. 1: a) *Notodelphys allmani* – female left fifth leg and inner margin of basal segment of right fifth leg. b) *Notodephys caerulea* – ovigerous female, ventral and lateral views showing bilobed brood pouch. c) *Doropygella porcicauda* – ovigerous female lateral, showing pronounced thoracic dorsal ridges and attached stalked ciliates. d) *Doropygella psyllus* – female maxillule. end.- endopodite with 7 setae, bas. – basis with 3 inner setae.

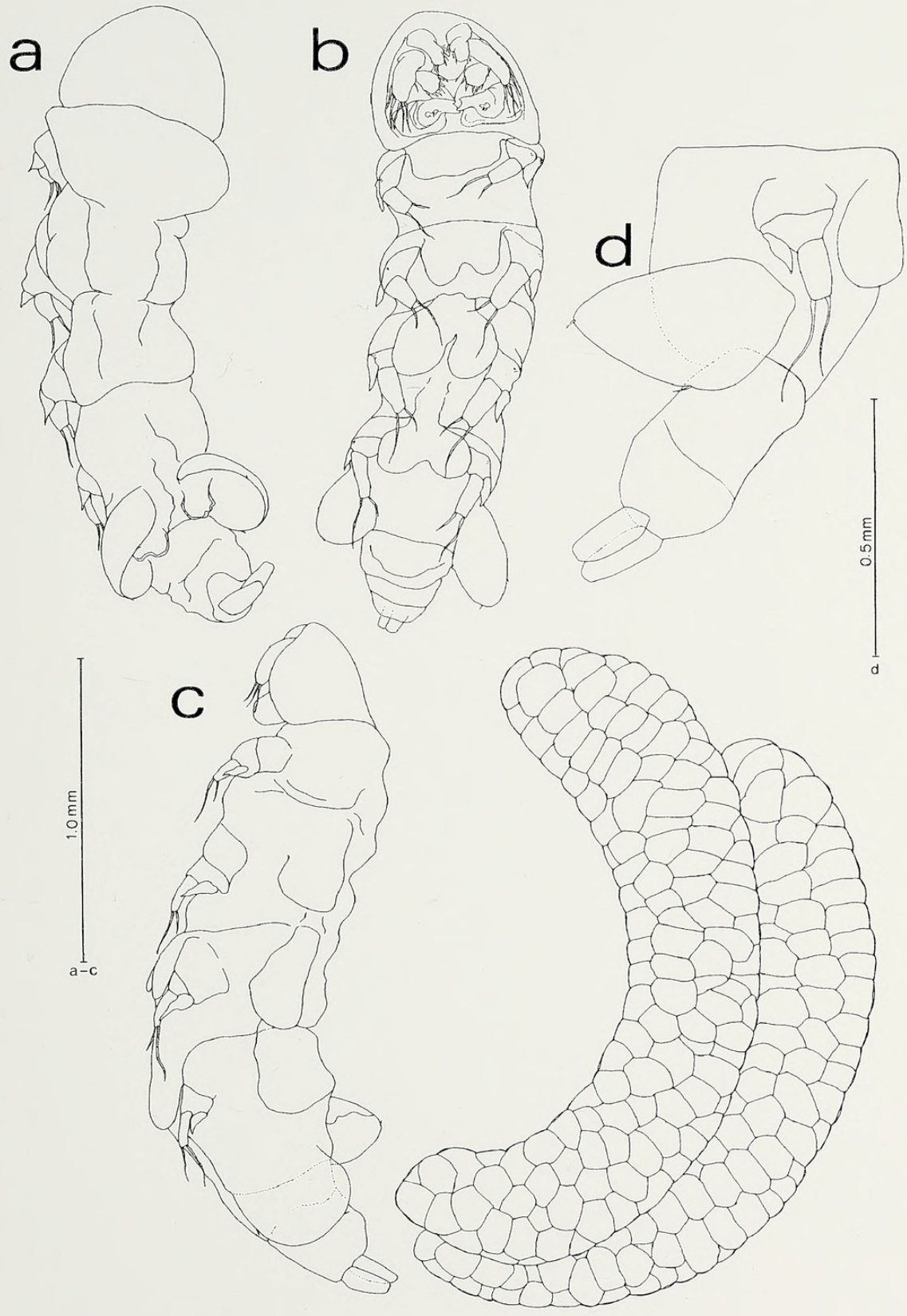

Fig. 2: *Enterocola ooishiae* n.sp. female holotype. a) *habitus* - dorsal view. b) *habitus* - ventral view. c) *habitus* – lateral view with detached ovisacs. d) lateral aspect of posterior metasome segment with 4th leg and urosome with lateral lamella and paired caudal rami.

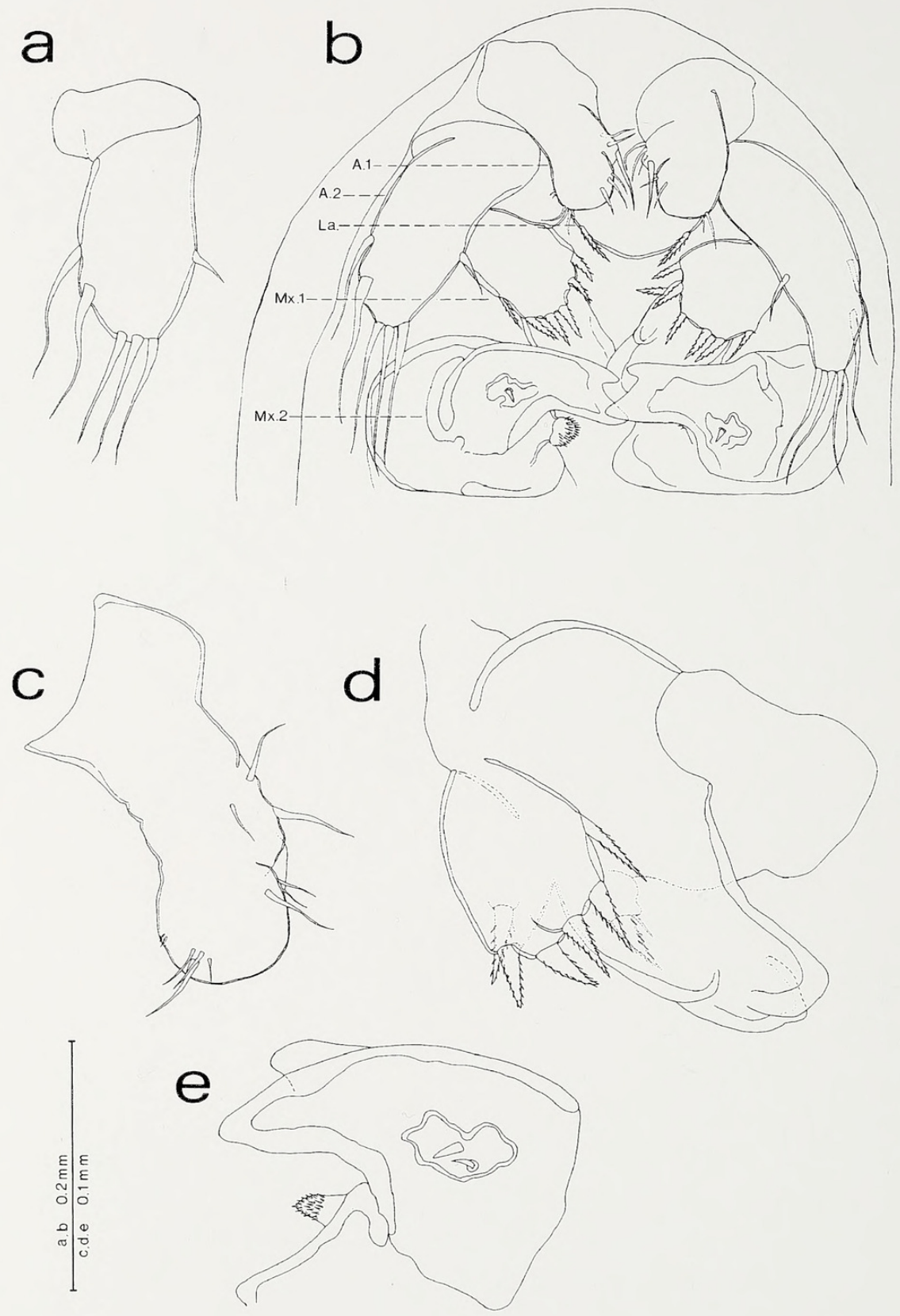

Fig. 3: *Enterocola ooishiae* n.sp. female holotype. a) right antenna (A.2). b) Cephalosome showing antennule (A.1), antenna (A.2), Labrum (La.), maxillule (Mx.1), and maxilla (Mx.2). c) right antennule (A.1). d) right maxillule (Mx.1). e) left maxilla (Mx.2) apical segment and spinulose endite of basal segment.

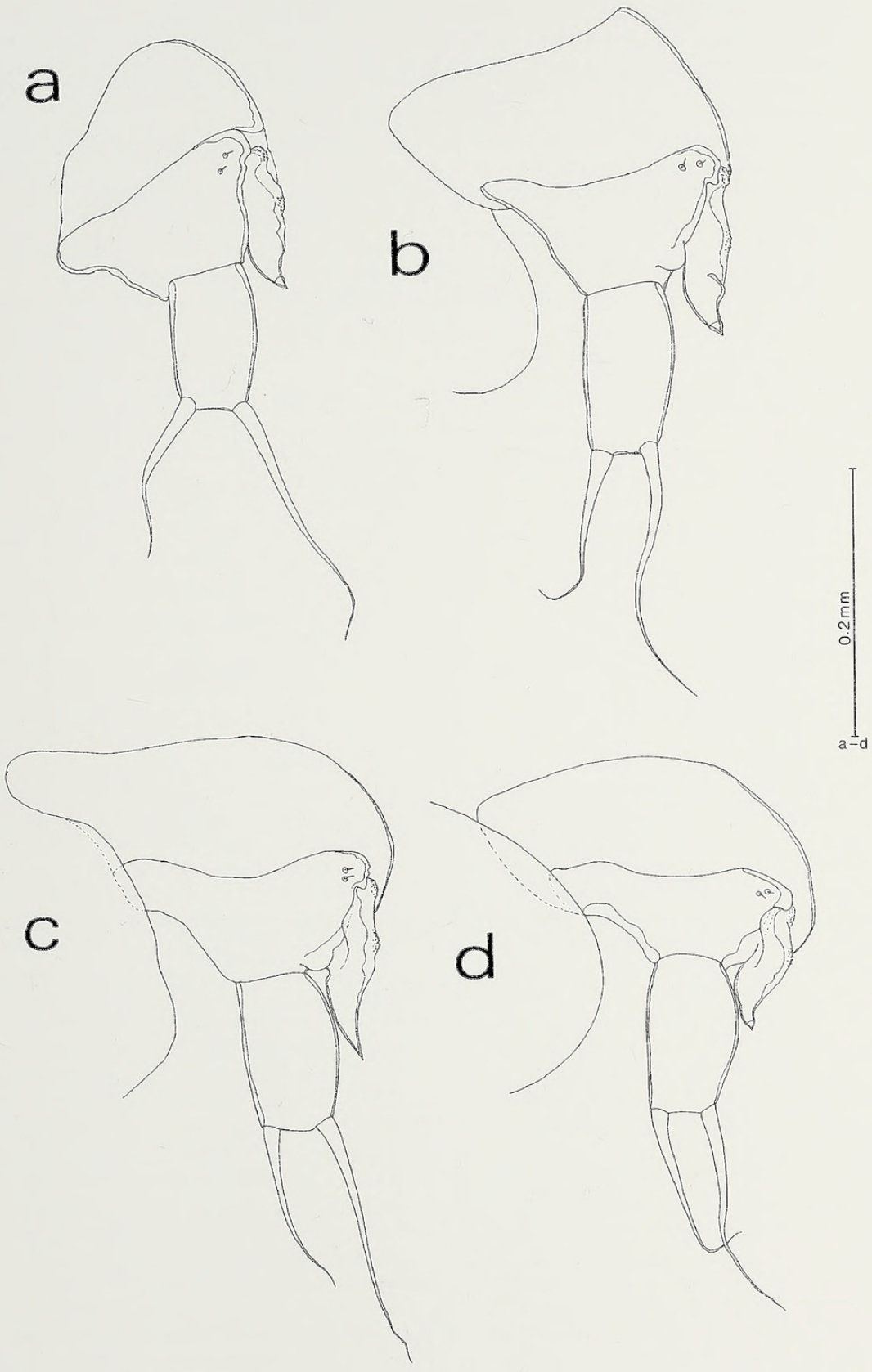

Fig. 4: *Enterocola ooishiae* n.sp. female holotype. Anterior views of legs; a) left leg 1. b) left leg 2. c) left leg 3. d) left leg 4.

Guide to key morphological characters of *Enterocola* females

Antennule (A.1) shape: short and bulbous or elongate and tapered (or cylindrical), number of segments (if more than 2).
Antenna (A.2) ornamentation: setal arrangement, outer to inner, maximum setal length compared to length of distal segment and number of segments (if more than 2).
Mammiform processes: number of pairs and legs on which they occur.
Legs 1-4, endopodite: Proximity of terminal setae (ie. close to each other or spaced well apart) and maximum setal length compared to endopodite length.
Caudal Rami: shape and articulated or fused with urosome.

Species	Antennule A.1	Antenna A.2	Mammiform processes	Legs 1 - 4 Endopod setae	Caudal rami
E. fulgens	Short,bulbous	2,3,1 shorter	1 or 2 pairs (3 or 3,4)	Close, shorter	Cylindrical, articulated
"*E. sp.*B" Scott, 1900	Elongate, tapered, 4 segments	1,1,1 longer, 4 segments	?	Close, subequal	Cylindrical, articulated
E. pterophorus	Elongate, tapered	3,1,1,1 - variable?, shorter	None	Close, shorter	Cylindrical or conical, fused?
E. bilamellatus	Short, bulbous	1,1,4,1 shorter	4 pairs (1-4)	Spaced, longer	Cylindrical, articulated
E. mammiferus	Elongate, tapered	1,2,2,1 shorter	4 pairs (1-4)	Spaced, subequal	Conical, fused.
E. setiferus	Elongate, tapered, 3 segments	Spine & 2 short setae, 3 segments	??	Close, short spines	Cylindrical, articulated
E. hessei	Short, bulbous	3,2,1 longer	2 pairs (3,4)	Spaced, longer	Cylindrical, articulated
E. sydnii	Short, bulbous	1,1,1,1,1 Shorter	4 pairs (1-4)	Close, subequal	Conical, fused
E. petiti	Short, bulbous	1,1,3,1 shorter	4 pairs (1-4)	Close, longer	Conical, fused
E. clavelinae	Short, bulbous	3,2,1 longer	3 pairs (2-4)	Spaced, longer	Conical, fused
E. precarius	Short, bulbous	1,1,1,1,1 shorter	3 pairs (2-4)	Close, shorter	Conical, fused
E. ianthinus	Short, bulbous	1,4,1 subequal	2 pairs (2,3)	Close, longer	Cylindrical, articulated
E. brementi	Short, bulbous	1,1,3,1 short	4 pairs (1-4)	Spaced, subequal	Conical, fused
E. fertilis	Short, bulbous	1,1,3,1 shorter	4 pairs (1-4)	Close, longer	Conical, articulated
E. laticeps	Elongate, cylindrical, 3 segments	1 longer + 4 shorter, all terminal.	None	Close, shorter, endopod with 2 segments	Cylindrical, articulated, with distal spine
E. gottoi	Short, bulbous?	3,2,1,1 shorter	4 pairs (1-4)	Close, subequal	Conical, fused
E. africanus	Short, bulbous	1,4,1 longer	3 pairs (2-4)	Close, longer outer setae	Conical, articulated
E. dicaudatus	Short, bulbous	2,4, 3 segments	4 pairs (1-4)	Close, shorter	Cylindrical, articulated
E. monnioti	Short, bulbous	5,1 shorter	None	Close, outer seta minute	Minute lobes
E. parapterophorus	Short, bulbous	2,2,1 shorter	4 pairs (1-4)	Close, shorter	Cylindrical, articulated
E. ooishiae	Elongate, cylindrical, 2-3 segments?	1,1,3,1 longer	3 pairs (2-4)	Spaced, longer outer setae	Cylindrical, articulated