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The genus *Euchone* (Polychaeta, Sabellidae) in the Mediterranean Sea, addition of two new species and discussion on some closely related taxa

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Abstract

Mediterranean sabellid material preserved in the private collection of the Zoological Laboratory of Lecce University has been examined in order to revise all the specimens belonging to *Euchone* and related genera (Annelida: Polychaeta: Sabellinae). The description of two new species, *E. pararosea* n. sp. and *E. pseudolimnicola* n. sp., is given together with the re-description of *E. rosea*. The record of *E. southernii* and *E. capensis* previously reported for the Mediterranean Sea, as well as some taxa showing intermediate features among *Euchone*, *Chone*, and *Amphicorina* are discussed, focusing on the thoracic uncini shape. Cladistic analysis was also performed in order to clarify the systematic position of the newly described taxa.

Keywords: Mediterranean Sea, Polychaeta, Sabellinae, *Euchone*, *Chone*, cladistic analysis

Introduction

The genus *Euchone* Malmgren, 1866 (Polychaeta: Sabellidae) is defined by the presence of an anal depression formed by a variable number of prepygidial chaetigers clearly demarcated and in most of the taxa bordered by lateral wings. The number of chaetigers forming this anal depression and the number of the pre-depression abdominal chaetigers can be used in distinguishing species within the genus (Fitzhugh 2002).

Within the subfamily Sabellinae the genus *Euchone*, together with the closely related genera *Chone* Krøyer, 1856, *Amphicorina* Quatrefages, 1866, and *Jasmineira* Langerhans, 1880, represents the least solved group from a phylogenetic point of view (Fitzhugh 1989; Cochrane 2003). More particularly, there exist several taxa in a “grey area” between *Euchone*, *Chone*, and *Amphicorina* that make difficult their “placement” if using purely intuitive taxonomy.

The similarity of the posterior abdominal uncini in *Chone*, *Euchone* and *Amphicorina* genera, as well as their variability depending on location within a given region of the

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abdomen or within the same fascicle, were firstly highlighted by Banse (1972), and later confirmed by Fitzhugh (1989). Recently, Bick and Randel (2005), studying a large population of *E. analis* (Krøyer, 1856), stated a size-dependent increase in the number of chaetae and uncini, as well as in the number of teeth in thoracic and abdominal uncini. These assumptions led these authors to consider *Amphicorina liefdeffjordensis* Plate, 1995 as a juvenile form of *E. analis*, and to warn about intraspecific variability for evaluating the importance of some features at the generic level.

In her recent cladistic analysis, Cochrane (2003) noticed that the posterior enlarged faecal groove and dorso-ventral compression present in some *Chone* and *Amphicorina* species can be confused with *Euchone* anal depression. A transitional state of this last feature is found within the same *Euchone* genus, considering the anal depression lacking lateral wings in *E. limnicola* Reish, 1960. Cochrane (2003) also showed that *Euchone* is paraphyletic on account of morphological differences observed among taxa traditionally attributed to this genus concerning the pinnule disposition on radioles in the branchial crown and the number of chaetigers forming the anal depression. In some of the examined taxa the branchial crown shows a “snowflake” structure (*sensu* Cochrane 2003) and the anal depression includes only three chaetigers. The name *Chiade* was proposed for this group (clade) by Cochrane (2003), who also suggested employing it as a generic name, even if at present it still remains an informal name. At least four of the formally described species belong to this group, and probably also *Euchone* sp. from Thailand reported by Fitzhugh (2002). The generic name *Euchone* was instead maintained for species with a “feather-duster” branchial crown structure (*sensu* Cochrane 2003) and a higher number of chaetigers forming the anal depression.

Until now the genus *Euchone* includes about 25 recognized species, of which only four have been reported for the Mediterranean area (Giangrande 1989), all showing the feather-duster crown structure.

In the present paper we revise all the Mediterranean *Euchone* and *Chone* specimens preserved in the private collection of the Zoological Laboratory of Lecce University (DiSTeBA) inclusive of material coming from several areas in the Mediterranean Sea. Although previous studies on Mediterranean material relative to some Sabellinae groups have already been carried out (Giangrande 1992; Giangrande et al. 1999), they only dealt with *Chone* and *Amphicorina*, while the genus *Euchone* has never been revisited.

Methods

All the examined material comes from ecological studies conducted along the Italian coasts since 1989. Holotypes are preserved at the MNCN (Museum Nacional de Ciencias Naturales de Madrid). The abbreviation PCZL refers to the private Collection of the Laboratory of Zoology of Lecce.

In addition to optical microscopy, scanning electron microscopy (SEM) was also used to examine the fine structures of uncini. Methyl green staining follows Hofsommer (1913).

Phylogenetic analysis was carried out on the matrix computed by Cochrane (2003) after adding some of the taxa described here (total of 50 taxa) and one additional character (total of 53 characters).

The Fabriciinae (*sensu* Fitzhugh 1989) has been defined as an outgroup, being the sister group to the Sabellinae. The data matrix and tree diagrams were created using MacClade version 3.08 (Maddison and Maddison 1999). Tree selection and compilation of consensus tree were carried out using PAUP version 4.0b8 (Swofford 1999). Searching for the most parsimonious trees was carried out by a heuristic search using the default settings of PAUP

(Tree-bisection-reconnection (TBR) branch-swapping, MULTREES and COLLAPSE options in effect). A random stepwise addition sequence of 100 replicates was used with a starting seed of 1. A strict consensus tree using the accelerated transformation principle (ACCTRAN) was compiled of all minimum length trees retained.

Taxonomy

Family SABELLIDAE Latreille, 1825
Subfamily SABELLINAE, Latreille, 1825
Euchone Malmgren, 1866

Type species: *Euchone analis* (Krøyer, 1856).

Euchone analis (Krøyer, 1856)
 (Figure 1)

Examined material

One specimen USNM 333, Greenland (locality unknown, leg. H. Krøyer), material kindly furnished by Maria Ana Tovar-Hernández, El Colegio de la Frontera Sur, Chetumal, Quintana Roo, México.

Addition to description

The staining pattern shows a quite homogeneous coloration of the ventral shields in the thorax (Figure 1A) less evident in the abdomen (Figure 1E). The first chaetiger seems not separated from the preceding and following segments by non-staining lines, nor is the intrasegmental furrow distinct. Dorsally the thorax and the anterior chaetigers of the abdomen are essentially free of stain-accepting cells. Dorsal lips extending from the inner, dorsal margin of the branchial lobes and terminating just dorsal to mouth, slightly elongate with radiolar mid-rib (Figure 1C). Ventral lips rounded as long as wide, up to eight ventral radiolar appendages about the same length as the branchial crown (Figure 1C). Radioles with radiolar flanges as distal continuation of the palmate membrane until a small free distal ends (Figure 1D). Abdominal uncini of predepression and depression chaetigers quite similar (Figure 1G, H).

Remarks

Chaetiger and radiolar number, shape of the collar and posterior abdominal depression (Figure 1B, F) all correspond well to the original description by Krøyer (1856), as well as the description reported by Banse (1972) for material from Alaska, and Bick and Randel (2005) for material from Spitzbergen.

The examination of internal structures of the branchial crown seems to confirm the presence of dorsal radiolar appendages in the genus *Euchone*, even though extension of radiolar skeleton was not detected. However, dorsal radiolar appendage assessment produced a lot of misinterpretation both in *Euchone* and *Chone*. Histological analysis seems to indicate the presence of radiolar appendages and skeleton in *E. analis* (Bick and Randel 2005), by contrast Cochrane (2003), in her cladistic analysis, considers *Euchone* lacking this

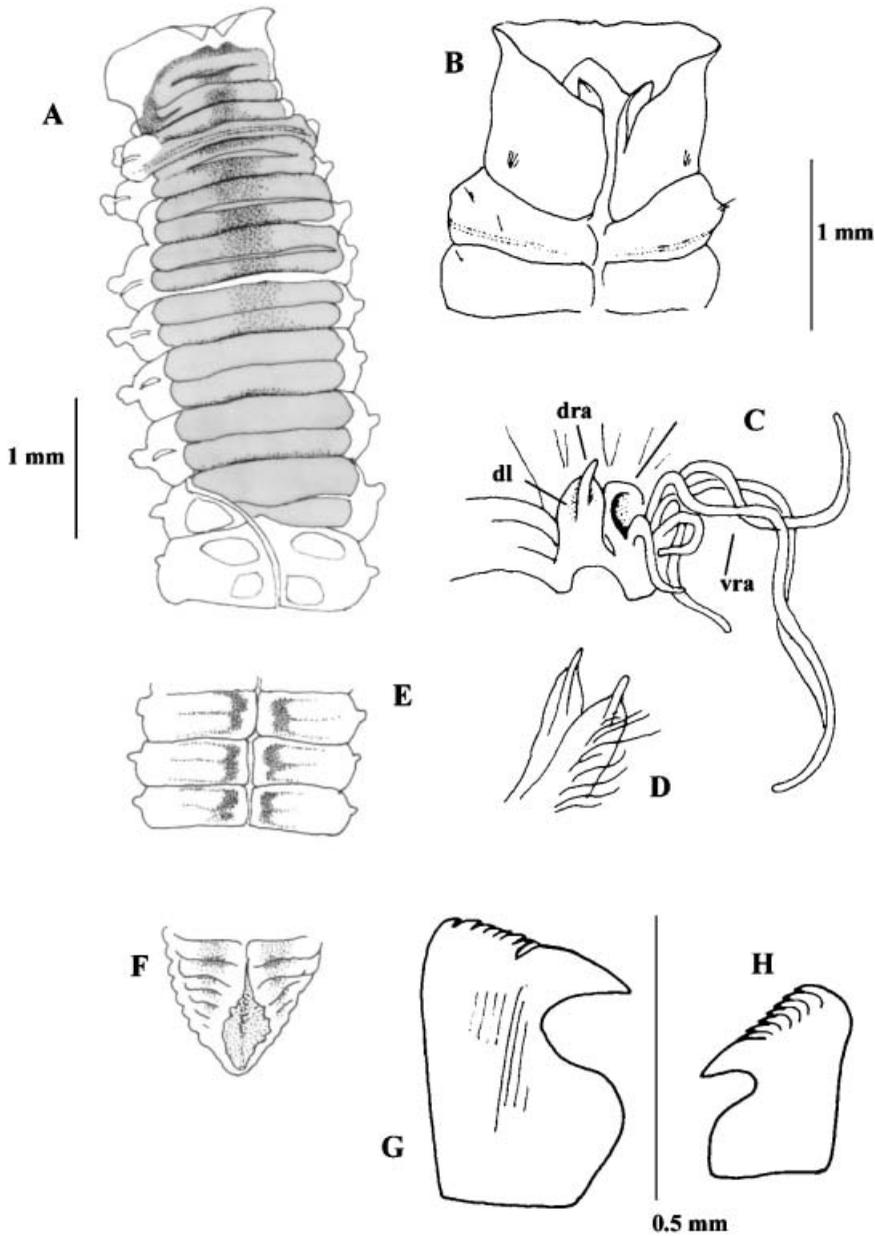


Figure 1. *Euchone analis*. (A) Staining pattern of the anterior end, ventral view; (B) collar, dorsal view; (C) internal structure of branchial crown after dissection; (D) tip of radioles; (E) staining pattern of abdominal chaetigers, ventral view; (F) anal depression; (G) abdominal uncinus from the first abdominal chaetiger; (H) abdominal uncinus from the anal depression region. dl, dorsal lip; vl, ventral lip; dra, dorsal radiolar appendage; vra, ventral radiolar appendages.

structure. Recently Tovar-Hernández (2005), redescribing the type material of *Chone infundibuliformis*, stated the absence of mid rib or dorsal radiolar appendages in the dorsal lips for the genus *Chone* by the absence of radiolar skeleton support. In this scenario, Fitzhugh (2002) detached the presence of radiolar appendages from the presence of

branchial skeleton extension, stating that “the only gross morphological criteria, other than general shape, that can be used to identify radiolar appendages is the presence of the radiolar skeleton when present, or the combined presence of supporting sheath tissue, a blood vessel and the coelom”. He considers *Chone* without radiolar appendages, and *Euchone* with radiolar appendages, but without branchial skeleton extension.

Lastly, the presence of some peristomial structures observed by Tovar-Hernández (personal communication), and referred to as “glandular tubular organs” must be noticed. These circular cameras situated dorsally in each side of the peristomium have already been detected in *Chone princei* (= *Jasmineira*) (McIntosh, 1916), and in the genus *Fabrisabella* (Fitzhugh, 1989). However, in most specimens they are not easily discernible. In here-examined specimen of *E. analis*, for example, they were not detected.

***Euchone pararosea* n. sp.**

(Figure 2)

as *Euchone rosea* in Giangrande (1989).

Holotype: Gulf of Policastro (South Tyrrhenian Sea), 1987, 15 m depth on sand bottom, MNCN 16.01/10328. Paratypes: two specimens from the same locality, PCZL.

Description

Holotype complete with eight thoracic and 14 abdominal chaetigers (Figure 1A, B) of which six form the anal depression. Branchial crown 1.5 mm, total thorax-abdomen length 4 mm; maximum width 0.5 mm. Branchial lobes each with six fully developed radioles with palmate membrane developed for the entire length leaving only a filiform tip free (Figure 2C). Dorsal lips pointed, dorsal radiolar appendages not detected. Ventral lip very low, several pairs (four to five) of ventral radiolar appendages (Figure 2G). Collar high, regularly crenulated, of similar height ventrally and dorsally, with about the same length as branchial base, and with very small ventral pointed lappets (Figure 2A, D). Glandular ridge on chaetiger 2. Staining pattern showing a ventral collar shield very dark and a peculiar double eight-shaped pattern in the thorax (Figure 2A), ventral shields visible also without coloration (Figure 2B). Notopodial fascicle from the first chaetiger bearing five elongate narrowly hooded chaetae; chaetigers 2–8 with superior group of four elongate narrowly hooded chaetae and inferior group with three paleate chaetae posteriorly and three bayonet-type anteriorly (Figure 2I, L). Paleate chaetae narrow and with short tip. Neuropodial uncini six per torus, with small teeth of similar size over the main fang (Figure 2H). Abdominal neuropodial fascicles with modified, elongate narrowly hooded chaetae. Notopodia with 11–12 avicular uncini, with main fang surmounted by few rows of small teeth, breast rectangular, not extending beyond distal end of proximal tooth, handles absent (Figure 2M). Intratorus variation present. Uncini of the anal depression different from the pre-depression ones, in being rasp-shaped with more and smaller teeth over the main fang (Figure 2N). Anal depression formed by six chaetigers; with large wings forming a complete medial gap in the anterior margin (Figure 2E). Tube incrustated with sand.

Etymology

The species was named after its apparent similarity to *E. rosea*.

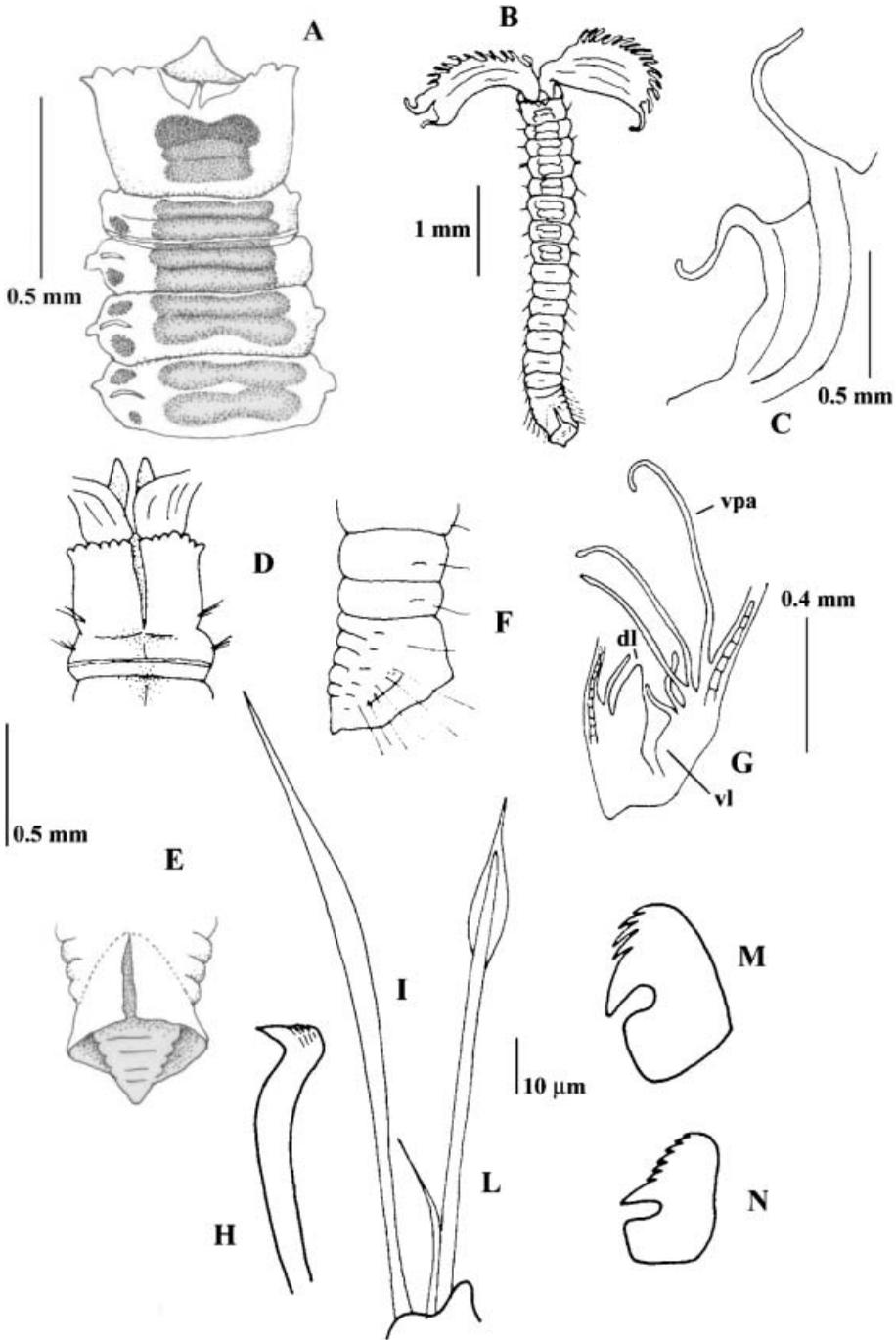


Figure 2. *Euchone pararosea* n. sp. (A) Staining pattern of the anterior end, ventral view; (B) entire worm; (C) detail of radioles showing the palmate membrane and radiolar tip; (D) collar, dorsal view; (E) frontal view of the anal depression showing lateral wings; (F) lateral view of the anal depression; (G) internal structure of branchial crown after dissection; (H) thoracic uncinus; (I) thoracic superior notochaeta; (L) thoracic inferior paleate chaeta; (M) abdominal uncinus, profile view of anterior abdominal chaetiger; (N) abdominal uncinus from chaetigers of the anal depression. dl, dorsal lip; vl, ventral lip; vpa, ventral pinnular appendage.

Remarks

Euchone pararosea is only apparently similar to *E. rosea* which it has been firstly confused with. It is distinguished from this species by the crenulated collar showing ventral lappets, the more developed palmate membrane extending for the entire length of radioles, and lastly, for the anal depression morphology even though formed by the same number of chaetigers. Concerning this last character, the higher development of the membranous margin and the presence of a complete anterior medial gap makes *E. pararosea* different not only from *E. rosea* but also from most of the other *Euchone* species. Similar features are present in *E. cochranae* Fitzhugh, 2002 and in *E. heterochaeta* Rullier, 1972, where, however, the anal depression is formed by eight chaetigers and the margin of the gap has a pair of elongate flaps, in *E. velifera* Banse, 1972, which have the anterior membranous margin entire, and in *E. trilobata* (Banse, 1970), which probably belongs now to the new group *Chiade* (Cochrane, 2003). The crenulation of the collar is up to now unique within the genus *Euchone*.

Habitat

Shallow sand bottom.

***Euchone pseudolimnicola* n. sp.**
(Figure 3)

Holotype: South Coast of Ustica Island, 50 m depth, 38°41'500"N, 13°09'780"E, on soft-bottom mainly composed of medium sand, biogenic and volcanic particles together with a significant amount of red calcareous algae, MNCN 16.01/10327. Paratypes: six specimens from the same locality of holotype; one specimen from Gulf of Policastro, 1987, Tyrrhenian Sea, 40 m depth, PCZL; two specimens from Brindisi, 1989, Adriatic Sea, 40 m depth, PCZL.

Description

Holotype complete with eight thoracic and 28 abdominal chaetigers (Figure 3A, B), of which nine form the anal depression. Branchial crown length 2.3 mm; total thorax–abdomen length 4 mm; maximum width 0.3 mm. Branchial lobes each with six fully developed radioles with palmate membrane for about half of their length; radiolar flanges present distal to palmate membrane; radioles terminating as extra long filaments (Figure 3F). Dorsal lips pointed with internal blood vessel, dorsal radiolar appendage as long as enlarged basal dorsal lip length (Figure 3G). Ventral lips not detected, four pairs of ventral radiolar appendages about three-quarters length of the radioles (Figure 3A). Collar high, slightly higher ventrally, irregularly crenulated except dorsally, with two very long ventral lappets and a mid-dorsal narrow gap (Figure 3A, C); ventral lobe of anterior peristomial ring covered by collar margin. Ventral shield visible only after staining. Very uniform staining pattern degrading towards the end of the thorax (Figure 3A) and reduced to only small spots in the abdomen (Figure 3D). Glandular ridge present on chaetiger 2. Notopodia in chaetiger 1 with six narrowly hooded chaetae. Notopodial fascicle from chaetigers 2–8 with superior group of four elongated narrowly hooded chaetae (Figure 3N) and inferior group with two paleate chaetae posteriorly and two bayonet-type anteriorly. Paleate chaetae with long tip (Figure 3O). Neuropodial uncini eight per torus, with teeth of

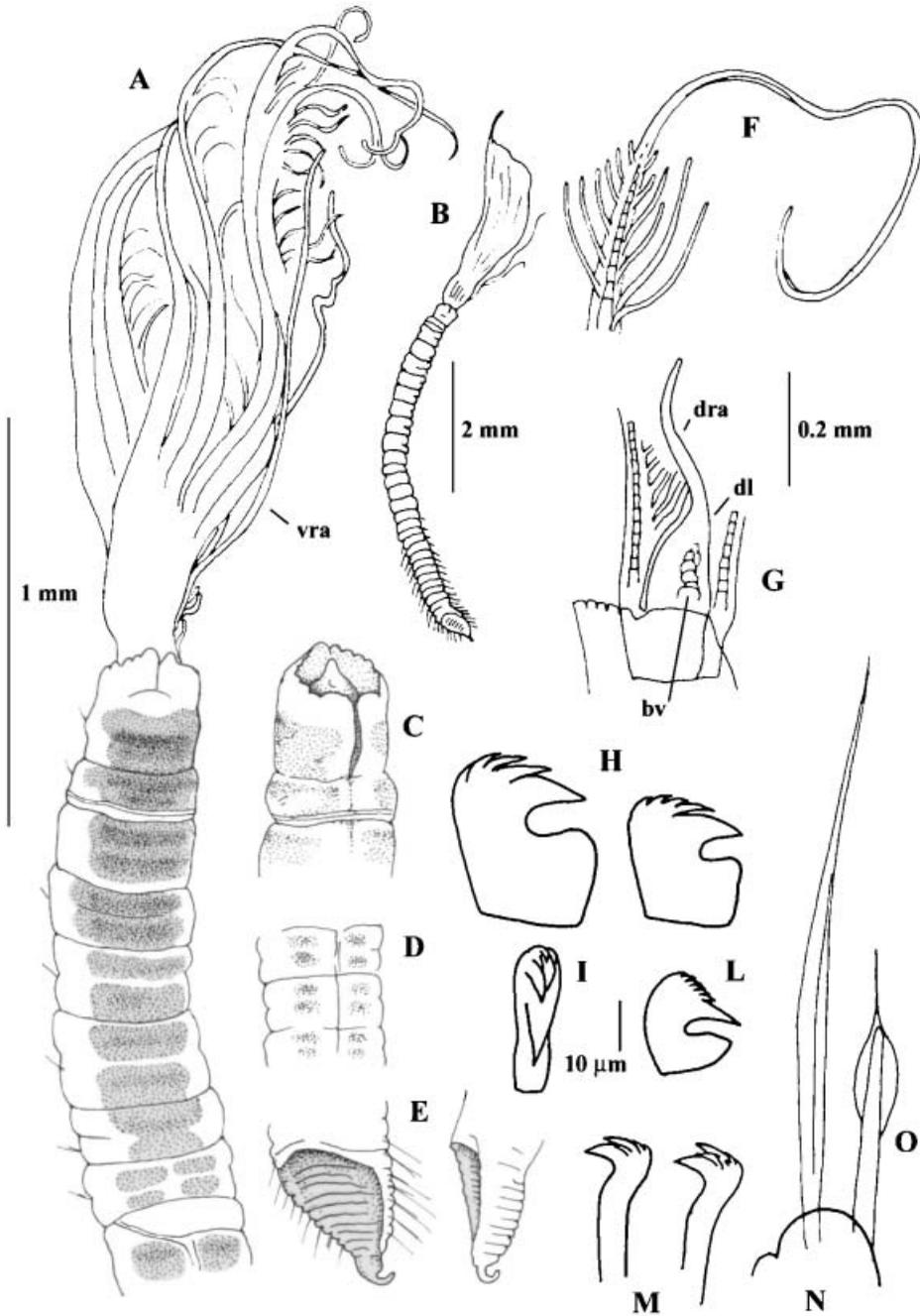


Figure 3. *Euchone pseudolimnicola* n. sp. (A) Staining pattern of the anterior end, ventral view; (B) entire worm; (C) collar, dorsal view; (D) staining pattern of abdominal chaetigers, ventral view; (E) ventral and lateral views of the anal depression; (F) tip of eadioles; (G) internal structure of branchial crown after dissection; (H) abdominal uncini in profile; (I) abdominal uncinus, the first abdominal chaetiger, frontal view; (L) abdominal uncinus from the anal depression region; (M) thoracic uncini; (N) thoracic superior notochaeta; (O) thoracic inferior paleate chaeta. dra, dorsal radiolar appendage; dl, dorsal lip.

different sizes over the main fang, one of which very developed (Figure 3M). Abdominal neuropodial fascicles with modified, elongate narrowly hooded chaetae. Notopodia with 9–10 avicular uncini, with main fang surmounted by three or four rows of teeth of different size as in the thorax uncini (Figure 3H, L). Intratorus variation absent. Uncini of the anal depression not highly modified, but with more teeth of similar size over the main fang (Figure 3I). Anal depression formed by nine chaetigers, with a distinct ridge present only in the uppermost part. Pygidium rounded showing in most of the specimens a filiform appendix (Figure 3E). Tube incrustated with detritus and sand.

Etymology

The species is named after the similarity to the very peculiar anal depression of *E. limnicola*.

Remarks

Euchone pseudolimnicola is similar to *E. limnicola* Reish, 1960 in having the anal depression without wings, but showing a distinct ridge marking the anterior edge. However, a lot of characters make the first species different from the latter: the crenulated margin of the collar; the less development of palmate membrane; the higher number of abdominal chaetigers; the shape of thoracic uncini with teeth of unequal size above the main fang; the lower number of abdominal uncini; the absence of ventral shields.

The holotype, which has been chosen for the best preservation of the branchial crown, lacks pygidial appendage, which, however, has been detected in most of the paratypes, underlining that this structure can be easily lost. Lastly, the dentition pattern of both thoracic and abdominal uncini appears very peculiar, with a second highly developed and asymmetric tooth over the main fang.

Habitat

Deep detritic bottom.

***Euchone* sp.** (Figure 4)

as *Euchone southerni* in Giangrande (1989).

Examined material

Two specimens from Tyrrhenian Sea, 55 m, detritic substratum, 2000, PCZL.

Description

Small species with eight thoracic and 15 abdominal chaetigers (Figure 4A) of which five form the anal depression. Total length 6 mm; maximum width 0.3 mm. Branchial lobes each with four fully developed radioles with palmate membrane for about half of their length; radiolar flanges present distally to palmate membrane; radioles with filiform tip. Dorsal lips and radiolar appendages not observed because of the poor preservation of the crown. Two ventral radiolar appendages. Ventral lips not observed. Collar high, slightly higher ventrally, with a very small ventral incision (Figure 4B, C). Collar terminating at

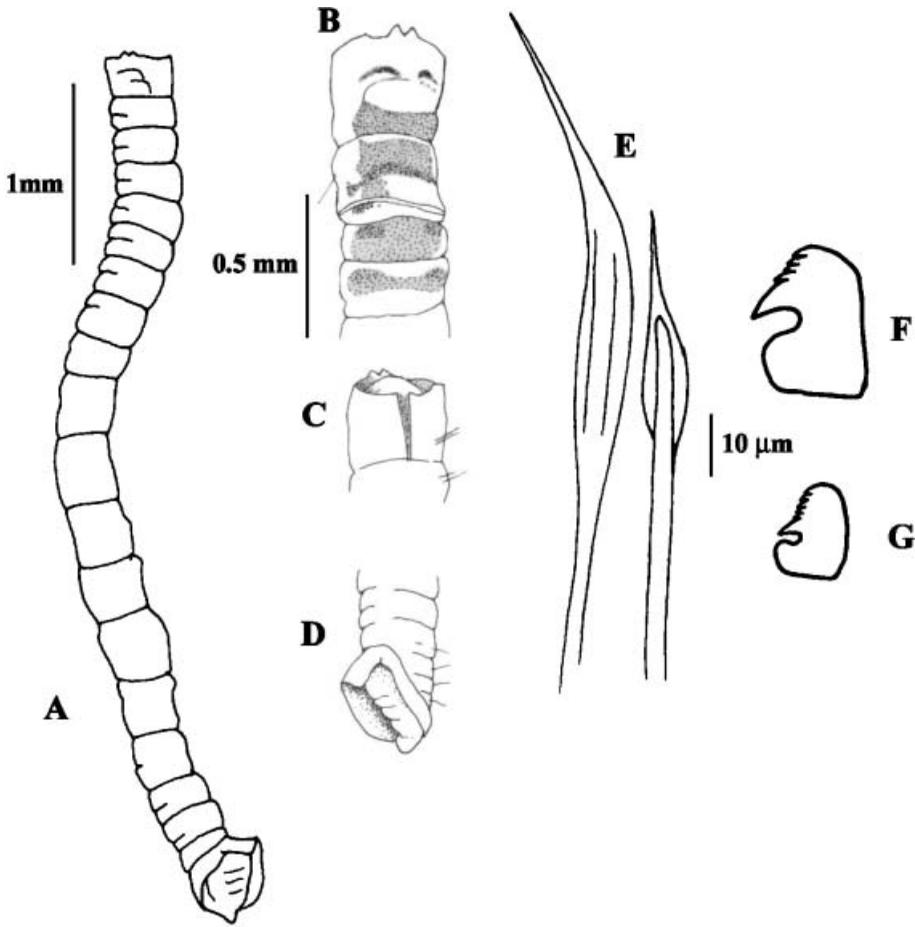


Figure 4. *Euchone* sp. (A) Entire worm without crown; (B) staining pattern of the anterior end, ventral view; (C) collar, dorsal view; (D) lateral view of the anal depression; (E) thoracic superior notochaeta and thoracic inferior paleate chaeta; (F) abdominal uncinus from an anterior abdominal chaetiger; (G) abdominal uncinus from chaetigers of the anal depression.

about the same level of the insertion of branchial lobes. Staining pattern showing a peculiar shape in the collar, with only two semicircular spots (Figure 4B). Glandular ridge on chaetiger 2. Notopodial fascicle from chaetigers 2–8 with superior group of four elongated largely hooded chaetae and inferior group with two paleate chaetae posteriorly and two bayonet-type anteriorly. Paleate chaetae narrow and with long tip (Figure 4E). Neuropodial uncini six per torus, with small teeth of similar size over the main fang. Abdominal neuropodial fascicles with modified, elongate narrowly hooded chaetae. Notopodia with eight avicular uncini, with main fang surmounted by four rows of small teeth (Figure 4F). Intratorus variation absent. Uncini of the anal depression rasp-shaped (Figure 4G). Anal depression formed by five chaetigers, with large and entire wings (Figure 4D).

Remarks

This taxon was firstly identified as *E. southerni*, for the low number of chaetigers forming the anal depression. Giangrande (1989) recorded *E. southerni* in the Mediterranean

(Adriatic Sea) from coralligenous habitat. Unfortunately, the bad preservation of this material does not allow a re-examination. However, the specimens examined here from the Tyrrhenian Sea differ from the descriptions of *E. southerni* by Southern (1914) and Banse (1970) in having the collar higher ventrally with a more evident incision, even though not so deep as in *E. southerni incisa* (Banse 1970) and for the higher number of pre-depression abdominal chaetigers. *Euchone* sp. is a species larger than *E. southerni* and with more elongate abdominal chaetigers. Unfortunately the bad preservation of the crown does not allow the description of a new taxon.

Habitat

Deep detritic bottom.

Euchone rosea Langerhans, 1884

(Figure 5)

Examined material

Seven individuals from Brindisi, 25 m depth, on coralligenous deposits, PCZL.

Re-description

Small worms with eight thoracic and 14 abdominal chaetigers of which six form the anal depression. Branchial crown length 1.5 mm; total thorax–abdomen length 5 mm; maximum width 0.5 mm. Branchial lobes each with five fully developed radioles with palmate membrane for about three-quarters of their length; radiolar flanges present distal to palmate membrane; radioles terminating as flanged filaments (Figure 5A). Dorsal lips pointed (Figure 5A). Radiolar appendages not observed. Ventral lips not observed; several pairs of ventral radiolar appendages. Collar high, with a slight ventral incision and a mid-dorsal gap (Figure 5A, B). Collar terminating at about the same level of the insertion of branchial lobes. Only the collar and first chaetiger stained (Figure 5A). Notopodia in chaetiger 1 with six narrowly hooded chaetae. Notopodial fascicles from chaetigers 2–8 with superior group of three elongate narrowly hooded chaetae and inferior group with five paleate chaetae posteriorly and five bayonet-type anteriorly. Paleate chaetae with long tip (Figure 5F). Neuropodial uncini five per torus, with small teeth of similar size over the main fang (Figure 5D). Abdominal neuropodial fascicles with modified, elongate narrowly hooded chaetae. Notopodia with seven avicular uncini, with main fang surmounted by few rows of small teeth (Figure 5G); uncini of the anal depression 10 in number and with a larger number of teeth over the main fang (rasp-shaped) (Figure 5H). Intratorus variation present. Anal depression formed by six chaetigers, with wings fully developed with quite raised medial margin, slightly incised in the uppermost part (Figure 5C).

Remarks

This is one of the two *Euchone* species listed in Fauvel (1927), but at that time not yet recorded in the Mediterranean Sea. Our material corresponds well to the original description of specimens from Madeira (Langerhans 1884). In the Mediterranean Sea the species has been reported by Albertelli et al. (1983) for the Ligurian Sea and by Cantone

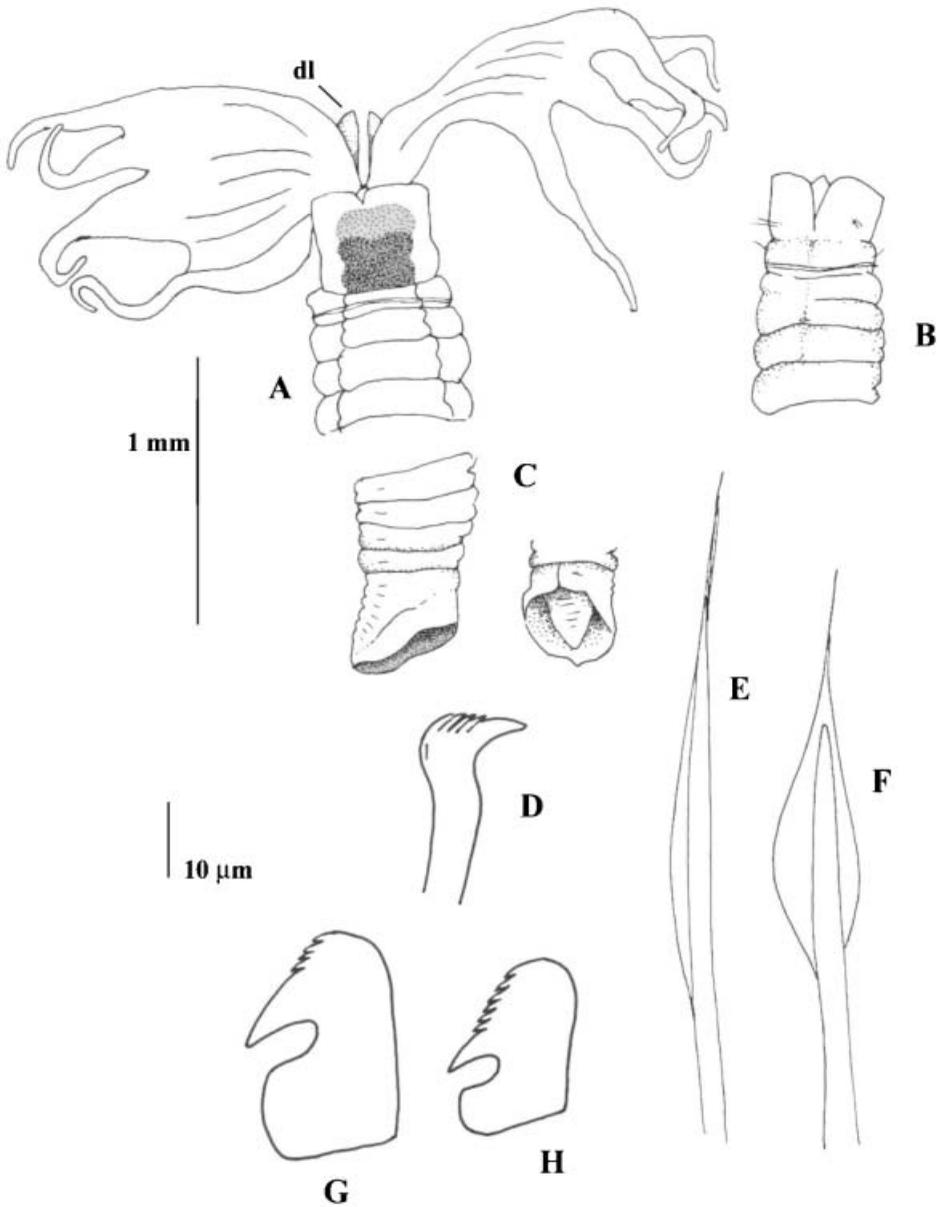


Figure 5. (A–D, F–H) *Euchone rosea*: (A) staining pattern of the anterior end, ventral view; (B) ventral view of the anterior end; (C) lateral and ventral views of the anal depression; (D) thoracic uncinus; (F) thoracic inferior paleate chaeta; (G) abdominal uncinus from the anterior abdominal chaetiger chaetiger; (H) abdominal uncinus from the anal depression region. (E) *Euchone rubrocincta*: thoracic inferior notochaeta.

and Fassari (1982) for the Gulf of Catania (Ionian Sea). All the published data relate to soft sediments. By contrast, Fauvel (1927) reports the species as typical of coralligenous habitats. Only the specimens present in our collection, coming from the South Adriatic Sea and here re-described, have been collected from coralligenous habitats, thus it is possible that the other records represent a different taxon.

Habitat

Coralligenous deposits.

Distribution

Atlantic (Madeira), Ireland coasts, Mediterranean Sea.

***Euchone rubrocincta* Sars, 1861**

Chone rubrocincta Sars 1861.

Remarks

This taxon is the only *Euchone* species reported by Fauvel (1927) for the Mediterranean area. The first record in the Mediterranean was that of Lo Bianco (1893) for the Gulf of Naples. The taxon was successively reported by Vatova (1949), Katzmann (1973), and Pozar-Domac (1978) for the Adriatic Sea, and by Albertelli et al. (1983) for the Ligurian Sea. The specimens present in our personal collection, from the Gulf of Salerno (Tyrrhenian Sea), are very badly preserved and cannot be re-described. According to the original description, the species should be easily recognizable on account of the narrow hooded inferior thoracic notochaetae similar to the superior ones (Figure 5E), and the anal depression formed by 11 chaetigers.

Habitat

Fine sand substrata.

Distribution

North Sea, Atlantic (Ireland), Mediterranean Sea.

Euchone (Chiade sensu Cochrane) sp.

(Figure 6)

as *Euchone southerni* in Giangrande (1989).

Examined material

One specimen from Brindisi, 40 m depth.

Description

A small-sized taxon measuring 2 mm in length with eight thoracic chaetigers and 10 abdominal ones of which four form the anal depression (Figure 6A–C). Four pairs of flanged radioles per lobe, with few pinnules arranged alternately and longest in the mid-radiolar region (snowflake organization). Collar well developed with a narrow dorsal gap and slightly higher ventrally, margin entire ventrally and dorsolaterally crenulated (Figure 6D, E). Dorsal and ventral lips not observed. Ventral lobe of anterior peristomial

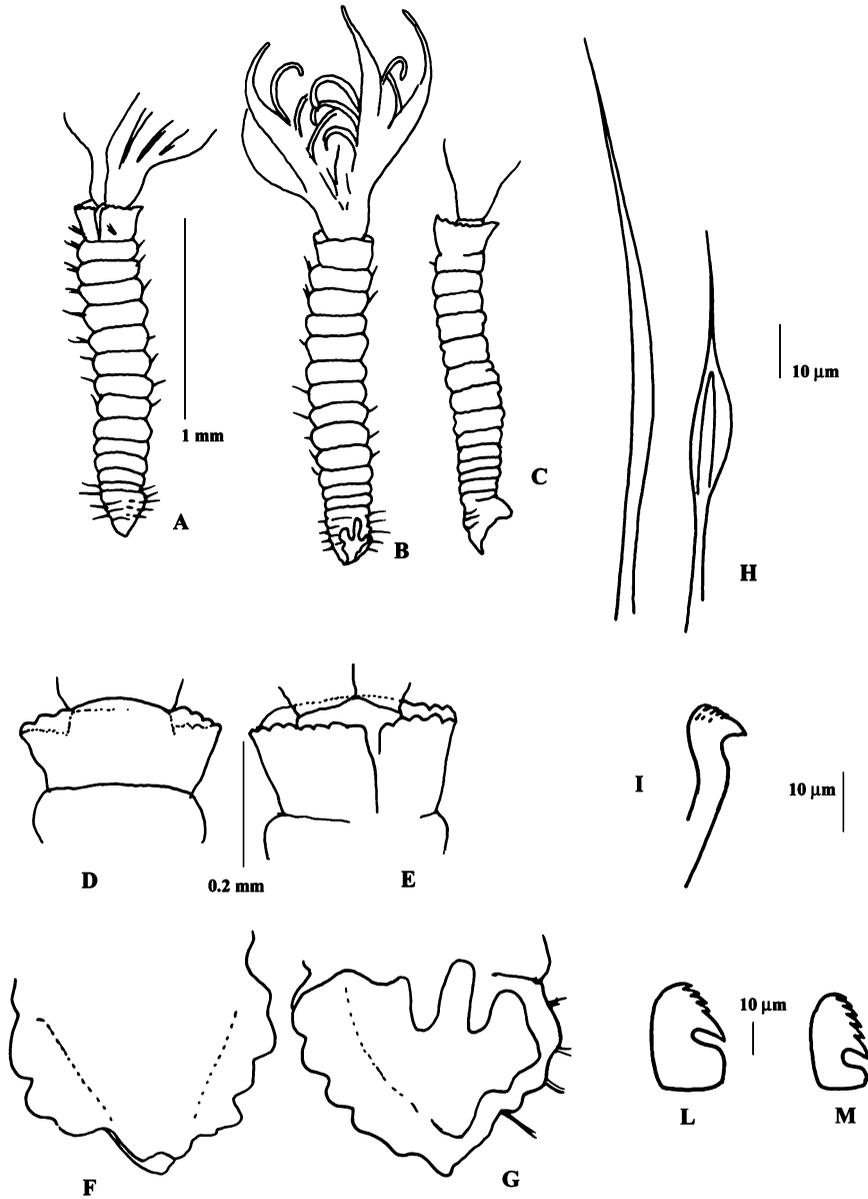


Figure 6. *Euchone (Chiade)* sp. (A) Entire worm, dorsal view; (B) entire worm, ventral view; (C) entire worm, lateral view; (D) collar, ventral view; (E) collar, dorsal view; (F) anal depression, dorsal view; (G) anal depression, ventral view; (H) thoracic superior notochaeta and thoracic inferior paleate chaeta; (I) thoracic uncinus; (L) abdominal uncinus from an anterior abdominal chaetiger; (M) abdominal uncinus from chaetigers of the anal depression.

ring covered by collar margin. Notopodia in chaetiger 1 with five narrowly hooded chaetae. Notopodial fascicle from chaetigers 2–8 with superior group of four elongated narrowly hooded chaetae (Figure 6H) and inferior group with three paleate chaetae posteriorly and three bayonet-type anteriorly. Paleate chaetae narrow with long tip (Figure 6H). Neuropodial uncini six to seven per torus, with teeth of similar size over the main fang,

main fang short and blunt (Figure 6I). Abdominal neuropodial fascicles with four elongate narrowly hooded chaetae. Notopodia with seven avicular uncini, with main fang surmounted by four rows of small teeth (Figure 6L). Intra-torus variation absent. Anal depression formed by four chaetigers with uncini more quadrangular in shape (rasp-shaped) (Figure 6M). Anal depression with very developed membranous frilly margin and a medial gap forming a pair of elongate flaps (Figure 6F, G).

Habitat

Coralligenous deposits.

Remarks

The paucity of Mediterranean material (only one specimen) did not allow description at the specific level, additional material is needed especially for the examination of crown internal structure.

The Mediterranean specimen represents an important record because, taking into consideration the structure of the branchial crown and the low number of chaetigers (four) forming the anal depression, it could belong to the *Chiade* group. Although Cochrane (2003) reports the genus having only three chaetigers in the anal depression, the species *E. trilobata* (Banse, 1957) has four chaetigers as well. The same statement can be inferred also for the number of radioles, since Cochrane (2003) reports the genus with only three pairs, whilst *E. hancocki* has four pairs (Banse 1970) as well as the Mediterranean specimen. The Mediterranean taxon is very similar to *E. trilobata* also in the shape of the anal depression, but it differs in the branchial crown structure without flanges. The peculiarity of the crown and the presence of rasp-shaped uncini in the abdomen (a feature present in other small *Euchone* species), led Banse (1970) to describe the species as belonging to *Desdemonia* genus.

The main difference between the Mediterranean specimen and the other *Euchone* species belonging to the *Chiade* group is in the absence of rasp-shaped abdominal uncini.

A peculiar shape of thoracic uncini is instead present in this taxon as well as in some small *Euchone* species. Based on Banse's drawing (1970), this type of uncinus is surely present in *E. hancocki* and *E. incolor*, and probably in *E. trilobata*, placed by Cochrane (2003) in the *Chiade* clade.

The recognition of this peculiar shape of the thoracic uncinus leads to some considerations: the genera *Euchone* and *Chone*, having thoracic uncini with long handles, have always been considered as having teeth of similar size over the main fang (type 1, Figure 7A). This last feature distinguished these genera from *Amphicorina*, having teeth of unequal size above the main fang (type 4, Figure 7D). However, taxa with teeth of unequal size above the main fang (type 3, Figure 7C) can be found also in *Euchone* (see *E. pseudolimnicola*) and *Chone* (Tovar-Hernández 2005). The difference in the thoracic uncini among *Euchone*, *Chone*, and *Amphicorina* must be referred not only to the dentition pattern above the main fang, but also to other features such as the shape and length of the main fang, the orientation of the handle, and development of the breast (Figure 7E, F).

The uncinial type found in the Mediterranean small *Euchone* specimen is intermediate between *Chone*–*Euchone* and *Amphicorina*. These uncini (type 2, Figure 7B) have teeth of similar size over the main fang, but the main fang is shorter and blunt in comparison to that found in *Chone* and *Euchone*, and more similar to the *Amphicorina* type. The ratio between length of the main fang and total length of uncinial head is 0.2 in small *Euchone* and

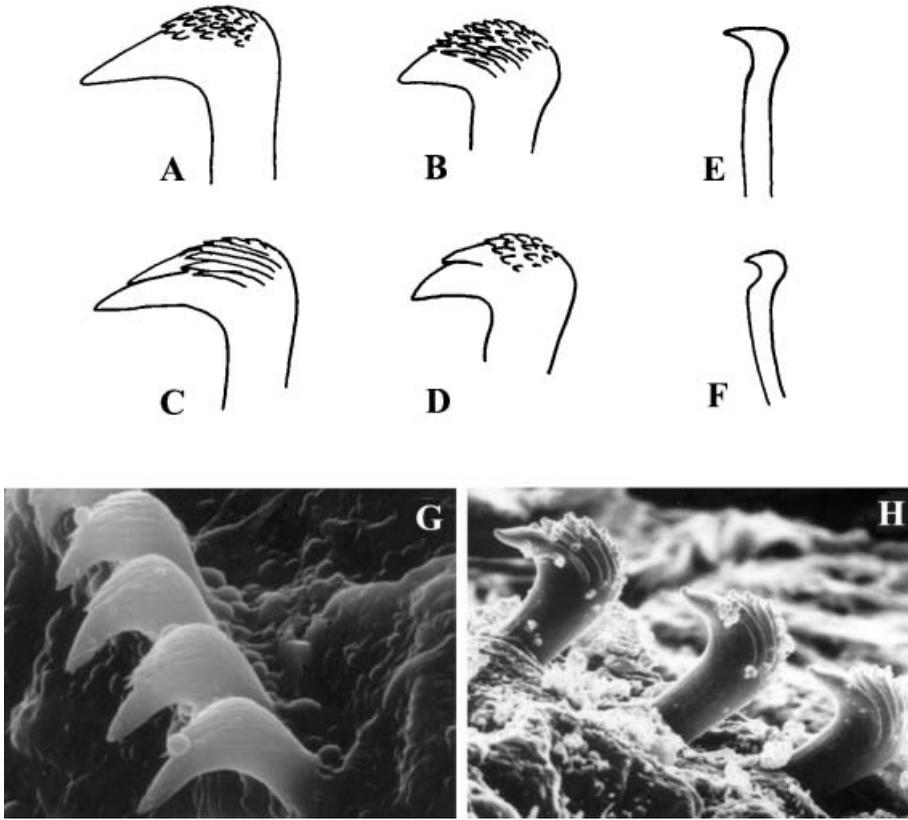


Figure 7. Comparison of thoracic uncini structure in some related sabellin genera having long handle. (A) Type 1 (from *Chone dumeri*); (B) type 2 (from *Chone* sp.); (C) type 3 (from *Chone americana*); (D) type 4 (from *Amphicorina armandi*); (E) scheme of handle orientation found in uncini of types 1–3; (F) scheme of handle orientation found in uncini of types 2–4; (G) SEM photograph of uncini type 1; (H) SEM photograph of uncini type 2.

Amphicorina and 0.4 in *Chone* and *Euchone*. This is revealed especially by the SEM analysis (Figure 7G, H).

Thoracic uncini type 2 are also present in another Mediterranean taxon, which in the present paper is ascribed to the genus *Chone* and discussed below.

***Chone* Krøyer, 1856**

Type species: *Chone infundibuliformis* Krøyer, 1856.

***Chone* sp.**
(Figures 8, 9)

as *Oriopsis armandi* in Castelli (1982).

Material examined

Twenty specimens from Follonica (Tyrrhenian sea), 6 m depth on sand bottom, 1981, PCZL; eight specimens, Ligurian Sea (Zoagli), 10 m depth on sand bottom, 1990, PCZL;

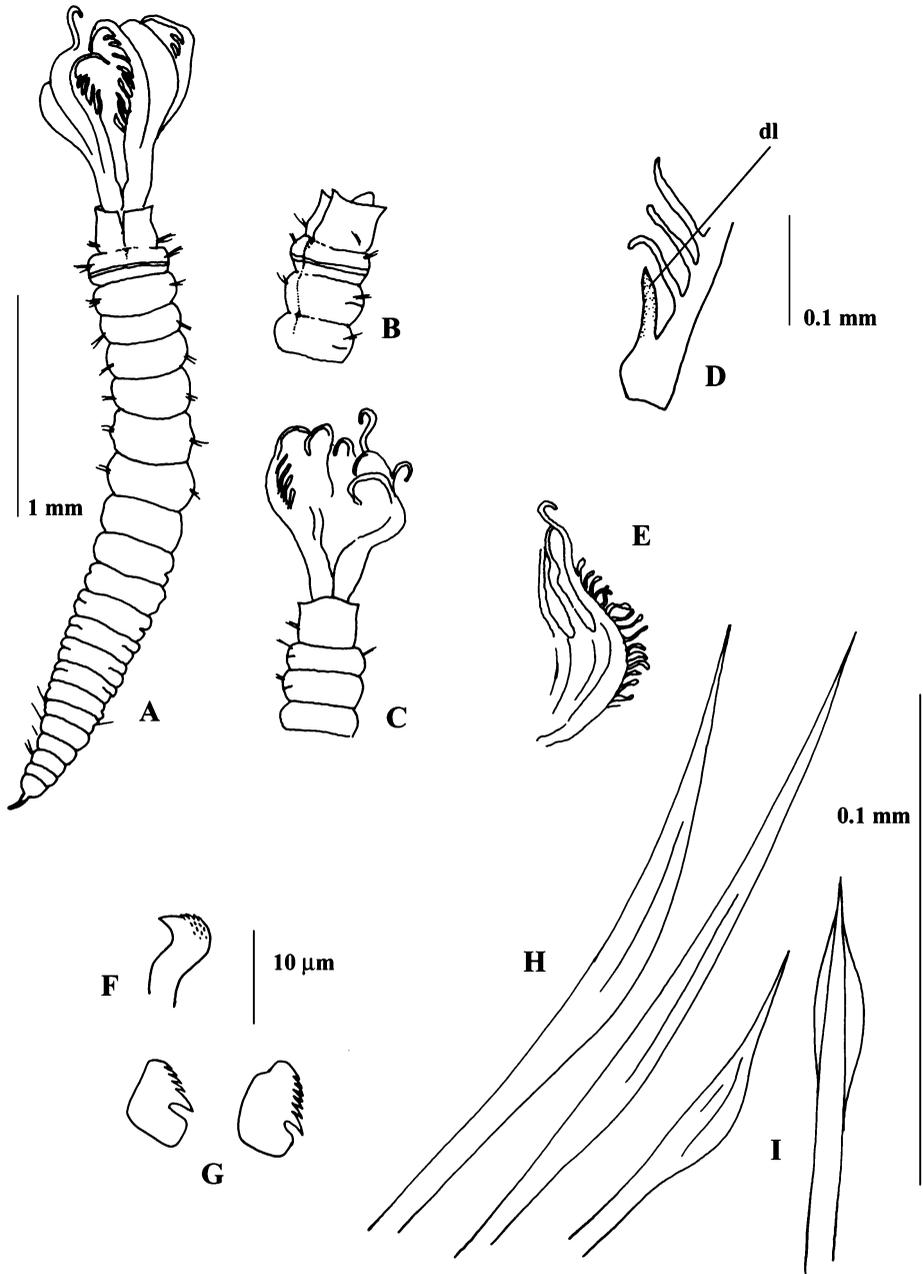


Figure 8. *Chone* sp. (A) Entire worm; (B) lateral view of the anterior end; (C) dorsal view of the anterior end; (D) detail of the internal crown structures; (E) radioles showing the development of palmate membrane; (F) thoracic uncinus; (G) abdominal uncini, first chaetigers on the left, last chaetigers on the right; (H) superior thoracic notochaetae; (I) inferior paleate thoracic notochaetae. dl, dorsal lip.

two specimens, Adriatic Sea (Brindisi), 0.5 m depth, 1989, on detritic hard bottom, PCZL; two specimens Fiumicino (Tyrrhenian sea), 25 m depth, 1991 on muddy sand, PCZL.

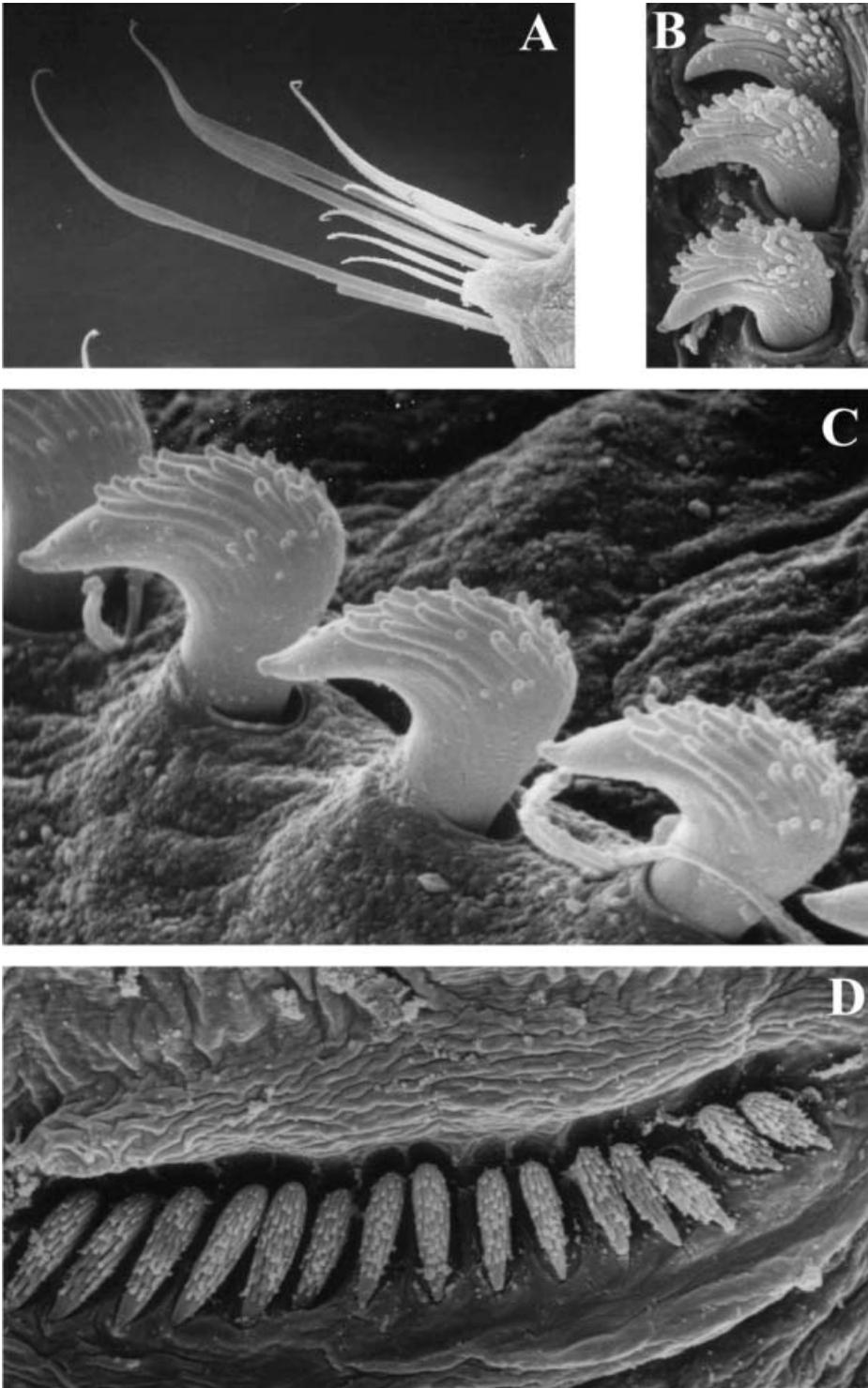


Figure 9. *Chone* sp. SEM analysis. (A) Notochaetae from the second chaetiger; (B, C) thoracic uncini from the second chaetiger; (D) abdominal uncini from the third abdominal chaetiger.

Description

Small worm with eight thoracic and 10 abdominal chaetigers (Figure 8A). Total branchial crown length 1 mm. Total thorax–abdomen length 2.5 mm, maximum width 0.4 mm at chaetiger 7. Branchial lobe each with four fully developed radioles; feather-duster structure with numerous paired pinnules. Palmate membrane present for about half of the radiolar length (Figure 8E). Outer surface of radioles slightly rounded. Radiolar flanges present. Sub-distal ends of radioles long filiform (Figure 8E). Radiolar eyes absent. Dorsal lips pointed, longer than wide (Figure 8D), dorsal radiolar appendages not detected. Ventral lip not detected. Ventral margin of anterior peristomial ring as triangular lobe (Figure 8B), extending slightly beyond the collar. Peristomial collar membranous, well developed with narrow dorsal gap (Figure 8B), ventral margin slightly higher than dorsal (Figure 8C). Collar margin entire. Notopodial fascicles with six elongate narrowly hooded chaetae in chaetiger 1. Chaetigers 2–8 with superior elongate narrowly hooded chaetae, three to four per fascicle (Figure 8H); inferior notochaetae arranged as four bayonet-type anteriorly and four to five posterior short and broadly hooded chaetae (Figure 8I, 9A); neuropodial acicular uncini in chaetigers 1–8 with a short and blunt main fang surmounted by a series of small teeth starting in profile very deeply (Figures 8F, 9B), eight uncini per torus. Abdominal neuropodia each with single transverse row of four narrowly hooded chaetae. Abdominal notopodia with uncini rasp-shaped, rectangular, and with teeth of equal size over a poorly developed main fang not extending beyond breast, last abdominal chaetigers with uncini showing a more developed dentate region (Figure 8G), 13–15 uncini per torus showing intratorus variation (Figure 9D). Pygidium rounded with long cirrus (Figure 8A). Eggs in the thorax. Tube unknown.

Remarks

Chone sp. is distinguished from all the other *Chone* species in having thoracic uncini type 2 (Figure 7B). In this feature it is more similar to *Amphicorina* genus (type 4, Figure 7D), from which, however, it is distinguished for several other features such as the organization of the branchial crown (snowflakes in *Amphicorina*) and the presence of only two types of thoracic chaetae in *Amphicorina*. As already stated, thoracic uncini type 2, very similar to those present in *Chone* sp., can be found in some small *Euchone* species (*Chiade sensu* Cochrane), which are clearly distinguishable from *Chone* sp. in having an *Amphicorina*-like organization of the branchial crown (snowflake) and the presence of the anal depression.

All the other features of the here-described Mediterranean taxon are clearly typical of the genus *Chone*, therefore, at present, it has been assigned to this genus.

After the first record in the North Tyrrhenian Sea (Gulf of Follonica), the same taxon was found at different sites along the Italian coasts. All the material agrees with the present description, except for that from Fiumicino, which has a higher number of abdominal uncini.

Habitat

Shallow sandy habitats.

Cladistic analysis

Phylogenetic analysis produced a total of 3656 equally parsimonious, minimum length trees, each with a tree length of 171 steps. The following descriptive indices were obtained

for all the trees: CI=0.40, RI=0.77, and RCI=0.30, where CI is the consistency index, RI the retention index, and RCI the rescaled consistency index. Similar values were obtained for the strict consensus tree.

The analysed taxa are the same as the Cochrane (2003) analysis, with the addition of the Mediterranean taxa here described, except for *Euchone* sp. from the Tyrrhenian Sea, which has not been considered due to the poor preservation of the material. Therefore the *Euchone* sp. appearing in the matrix is referred to as *Euchone* (*Chiade sensu* Cochrane) sp.

The analysed characters are the same as those utilized by Cochrane (2003) (Table I), with the addition of character 53 which refers to the length of the main fang of thoracic uncini, where 0 was the presence of short main fang (types 2–4) and 1 the presence of long main fang (types 1–3) (see Figure 7). In addition, some small changes were made to the character code utilized by Cochrane (2003) concerning character 46 referring to the dentition pattern above the main fang in the thoracic uncini: Cochrane considered the Fabriciinae (outgroup) as having small teeth above the main fang, whilst the more common morphology, and probably the plesiomorphic condition in the Fabriciinae, is the presence of a large tooth over the main fang (Fitzhugh 1998).

Although the uncinal dentition is considered quite uniform at genus level within the subfamily Fabriciinae (Fitzhugh, 1998), it has never been considered as a discriminating character within *Chone* and related genera. In the present analysis, however, only two states of dentition were considered because this character, better evidenced only by SEM analysis, is not yet known for all the species.

Another important feature relates to character 44 (development of thoracic uncini breast). Cochrane (2003) considered only the breast present in the genus *Potamethus*, whilst in our opinion the breast can be differently developed within different genera, being for instance more developed in *Amphicorina* than in *Chone* (see Figure 7E, F). However, in the present analysis we did not change the state of this character because of the lack of good iconographic support for most of the species. It is a matter of fact that *Potamethus* breast development is peculiar so we can agree with Cochrane's considerations. Further analysis will clarify this point.

Lastly, character 12 (presence or absence of dorsal radiolar appendages) has been here coded absent for most of the species, according to Cochrane's matrix (2003), even though, as discussed before, Fitzhugh (2002) reported *Euchone* as having radiolar appendages. This is because in our opinion the actual presence of radiolar appendages must be carefully examined in all the species belonging to *Euchone*. Therefore, although present observations suggest the presence of radiolar appendages in both *E. analis* and *E. pseudolimnicola*, in the matrix their state has been indicated as a question mark.

The adding of the here-described taxa and the small changes made on Cochrane's matrix (2003), however, did not change the topology of the tree obtained by this author, so demonstrating the strength of her analysis.

Figure 10 shows one of the equally parsimonious trees retained. In this tree the two new Mediterranean *Euchone* are placed in the genus, whose clade appears well characterized in the middle of the tree, except for the small species of *Euchone* (*Chiade sensu* Cochrane) inserted in a clade more closely related to *Amphicorina*. The analysis therefore confirms the paraphyly for *Euchone* as shown in Cochrane's analysis (2003). The two new Mediterranean species appear very close to each other, sharing the presence of some features such as the crenulate collar (character 22) that is never found in all the other *Euchone* species. This feature is homoplastic, being distributed within the tree in some other species belonging to other genera. In Figure 10A the distribution of character 53

Table I. Character state distribution for 53 characters and 51 taxa used in the present study (character states are given in the Appendix)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53						
Fabriciinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	?	?	0	0	0	0	0	0	0	0	0	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
<i>A. androgynae</i>	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	2	1	1	0	1	0	0	0	1	0	0	1	0	0	0	?	?	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0				
<i>A. annae</i>	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	2	1	1	0	1	1	0	1	1	0	1	0	0	0	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0				
<i>A. bicoloris</i>	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	2	2	1	0	0	0	0	0	1	0	0	1	0	0	0	?	?	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0				
<i>A. brevicollaris</i>	1	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	2	1	0	1	1	0	0	0	1	0	0	1	0	0	0	?	?	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0				
<i>A. dentata</i>	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	2	2	1	0	1	0	0	0	1	0	0	1	0	0	?	?	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0					
<i>A. michaelseni</i>	1	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	2	1	0	1	1	0	0	0	0	0	0	1	0	0	0	?	?	0	1	0	0	0	0	?	0	0	0	0	0	?	0	1	0	0	0	0	0	0					
<i>A. mobilis</i>	1	1	1	1	0	0	0	1	1	0	0	0	0	0	1	1	2	2	1	0	0	0	0	0	1	0	0	1	0	0	0	?	?	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0					
<i>A. paramobilis</i>	1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	1	2	1	0	0	1	0	1	0	1	0	1	0	0	0	?	?	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0				
<i>C. infundibuliformis</i>	1	1	1	1	0	1	1	1	4	1	1	0	1	0	1	2	1	2	0	0	0	0	0	1	1	1	1	1	0	0	0	?	?	1	1	0	0	0	0	1	3	0	0	0	1	0	1	2	0	0	0	0	1						
<i>C. duneri</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	2	1	1	0	1	0	0	0	1	1	1	1	1	0	0	0	?	?	1	1	0	0	0	0	1	3	0	0	0	1	0	1	2	0	0	0	0	1						
<i>C. filicaudata</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	2	1	2	0	0	0	0	0	0	1	1	1	1	0	0	0	?	?	1	1	1	0	0	0	1	1	0	0	0	1	0	1	2	0	0	0	0	1						
<i>C. longocirrata</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	2	1	1	0	0	0	0	1	0	1	1	1	1	0	0	0	?	?	1	1	0	0	0	0	1	1	0	0	0	1	0	1	2	0	0	0	0	1						
<i>C. paucibranchiata</i>	1	1	1	1	0	1	1	0	4	1	0	0	1	0	1	2	1	1	0	0	0	0	1	0	1	1	1	1	0	0	0	?	?	1	1	0	0	0	0	1	3	0	0	0	1	0	1	2	0	0	0	0	1						
<i>Chone y</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	2	1	1	0	1	0	0	0	1	1	1	1	1	0	0	0	?	?	1	1	0	0	0	0	1	2	0	0	0	1	0	1	2	0	0	0	0	1						
<i>C. magna</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	3	1	2	0	0	0	0	0	1	1	1	1	1	0	0	0	?	?	1	1	0	0	0	0	1	3	0	0	0	1	0	1	2	0	0	0	0	1						
<i>D. ornata</i>	1	1	1	1	0	0	0	0	0	1	0	0	1	0	1	1	0	1	0	1	0	1	1	0	?	0	1	0	0	1	0	0	?	?	0	0	0	0	0	0	0	?	2	0	0	0	0	0	1	1	0	0	0	0					
<i>E. analis</i>	1	1	1	1	0	1	1	1	3	1	1	?	1	0	1	3	1	2	1	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	2	0	0	0	0	1					
<i>E. alicaudata</i>	1	1	1	1	0	1	1	1	2	1	1	0	1	0	1	3	1	2	1	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	2	1	0	1	1						
<i>E. arenae</i>	1	1	1	1	0	1	0	1	2	1	0	0	1	0	1	3	1	2	0	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	1	0	0	1	1					
<i>E. bansei</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	1	1	2	0	0	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	1	2	0	0	0	1			
<i>E. capensis</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	3	1	2	1	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	2	0	0	0	0	1				
<i>E. elegans</i>	1	1	1	1	0	1	1	1	3	1	1	0	1	0	1	3	1	2	1	0	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	2	1	0	1	1
<i>E. hancocki</i>	1	1	1	1	0	0	0	0	1	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	1	0	0	1	0			
<i>E. incolor</i>	1	1	1	1	0	0	0	0	1	0	0	0	0	0	1	2	1	1	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0				
<i>E. limnicola</i>	1	1	1	1	0	1	1	1	2	0	0	0	1	0	1	3	1	2	0	0	0	0	0	1	1	1	1	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	2	0	0	0	1	1				
<i>E. pallida</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	3	1	2	1	1	0	0	1	1	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	2	0	0	0	1
<i>E. papillosa</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	3	1	2	1	1	0	0	1	1	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	0	0	1	3	0	0	0	1	0	1	2	1	0	0	0	1				
<i>E. rosea</i>	1	1	1	1	0	1	1	1	4	1	0	0	1	0	1	3	1	2	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	1	0	1	2	1	0	0	0	1			
<i>E. rubrocincta</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	3	1	2	0	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	2	1	0	0	0	1				
<i>E. scotiarum</i>	1	1	1	1	0	0	0	0	1	0	0	0	0	0	1	2	1	1	?	1	0	0	0	0	1	0	0	1	0	0	0	?	?	0	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0				
<i>E. southerni</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	3	1	2	1	0	0	0	1	1	1	1	1	0	0	1	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	1	2	0	0	0	1	0				
<i>E. trilobata</i>	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0	0	1	0	0	1	?	?	0	1	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	
<i>E. undulocincta</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	3	1	1	1	0	0	0	1	1	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	0	0	0	1	3	0	0	0	1	0	1	2	0	0						

Table I. (Continued.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53			
<i>E. velifera</i>	1	1	1	1	0	1	1	1	3	1	0	0	1	0	1	3	1	2	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	1	0	1	2	0	0	0	1	
<i>f. bermudensis</i>	1	1	1	1	0	?	?	?	0	0	?	?	0	?	0	1	3	1	1	1	0	0	0	?	1	1	0	1	0	0	0	?	?	1	1	0	0	0	0	0	1	2	0	0	0	1	0	1	4	1	0	0	1			
<i>E. pararosea</i>	1	1	1	1	0	1	1	1	4	0	0	?	1	0	1	3	1	2	1	1	0	1	1	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	0	2	3	3	0	0	0	1	0	1	2	0	0	1	1			
<i>E. pseudolimicola</i>	1	1	1	1	?	1	1	1	3	1	0	?	1	0	1	3	1	2	1	1	0	1	0	0	1	1	1	0	1	0	1	1	0	1	1	1	0	0	2	3	3	0	0	0	0	0	1	2	0	0	1	1				
<i>Euchone</i> sp.	1	1	1	?	?	0	0	1	1	1	0	?	1	0	?	1	1	2	0	0	0	1	0	0	?	0	0	1	0	1	0	1	1	0	1	0	0	0	0	0	1	3	0	0	0	1	0	1	2	0	0	1	0			
<i>f. elegans</i>	1	1	1	1	0	1	1	1	0	0	0	0	1	1	1	3	1	2	1	0	0	0	0	0	1	1	0	1	0	0	0	?	?	1	1	0	0	0	0	0	1	3	0	0	0	1	0	1	4	2	0	0	1			
<i>f. candela</i>	1	1	1	?	?	1	1	1	0	0	0	1	1	0	1	1	2	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	?	?	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	3	1	0	0	1
<i>f. caudata</i>	1	1	1	1	0	1	1	1	0	0	0	0	1	1	1	3	1	1	1	0	0	0	0	0	1	1	0	1	0	0	0	?	?	1	1	1	0	0	0	0	1	2	0	0	0	1	0	1	4	2	0	0	1			
<i>f. oculata</i>	1	1	1	?	?	1	1	1	0	0	0	1	1	0	1	1	2	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	?	?	0	0	0	0	0	0	1	1	0	0	0	1	0	1	3	1	0	0	1	
<i>f. filiformis</i>	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	3	1	1	1	1	0	0	0	0	1	1	0	1	0	0	0	?	?	1	1	0	0	0	0	1	1	0	0	0	1	0	1	4	2	0	0	1				
<i>Pa. africana</i>	1	1	1	1	1	1	1	0	0	?	?	?	?	0	1	?	1	1	1	0	0	?	0	1	0	?	1	0	0	0	?	?	1	0	0	1	1	0	0	1	3	0	0	0	1	1	1	3	0	0	0	1				
<i>F. vasculosa</i>	1	1	2	0	1	1	1	1	1	0	1	1	0	1	1	1	?	?	?	?	0	0	?	?	1	1	?	1	0	0	0	?	?	1	0	0	0	0	0	0	?	3	0	0	0	1	0	1	4	2	0	0	1			
<i>Po. spathiferus</i>	1	1	2	1	0	1	1	1	0	0	0	?	0	0	1	?	?	?	?	0	0	?	?	1	1	0	1	0	0	0	?	?	1	0	0	0	1	0	0	3	4	0	1	1	1	1	4	2	0	0	1					
<i>Chone</i> sp.	1	1	1	1	?	1	1	1	3	1	0	0	1	0	1	1	2	2	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	1	0	1	3	0	0	0	0			
<i>Euchone</i> x	1	1	1	1	0	0	0	1	0	0	0	0	0	1	2	1	1	0	1	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	1	



Figure 10. One of the equally parsimonious minimum length trees retained. (A) Distribution of character state 53; (B) distribution of character state 6.

concerning the development of the main fang in the thoracic uncini is shown. The shortness of the main fang in *Chone* sp. is plesiomorphic with respect to the small *Eucheone* species (*Chiade sensu* Cochrane) and *Amphicorina*. *Eucheone* sp. from the Mediterranean is not inserted within the *Chiade* group, but is closely related to it, while *Chone* sp. appears more closely related to the *Chone* group, but not inserted within. The taxon lacks clear apomorphies, therefore, at present, it remains included in the genus *Chone*. The position of *Eucheone* sp. is also due to the radiolar structure (character 6) with the alternating arrangement of the pinnules along the radioles (Figure 10B).

The strict consensus of all the trees retained (Figure 11) shows a topology quite in agreement with the individual tree, but with a completely unsolved polytomy of *Chone*–*Jasmineira* and other related genera, including *Chone* sp. The position of *Eucheone* (*Chiade*) sp. remained unvaried.

Discussion of all the other characters in the matrix is available in Cochrane (2003).

Concluding remarks

Eucheone species recorded in the Mediterranean Sea before the present paper were *E. rubrocincta*, *E. rosea*, *E. capensis* Day, 1972, and *E. southerni*. The species more commonly reported for the Mediterranean area is *E. rubrocincta*, followed by *E. rosea* (Lo Bianco 1893; Vatova 1949; Katzmann 1973; Pozar-Domac 1978; Cantone and Fassari 1982; Albertelli et al. 1983; Gambi et al. 1989). These two taxa are also the only ones listed in Fauvel (1927), which was the text most utilized to identify species in ecological works. The presence of *E. capensis* and *E. southerni* in the investigated area remains dubious. The first species, distributed in South Africa, has been reported only once by Cognetti-Varriale (unpublished data), but the material has never been available for examination. The latter

Strict

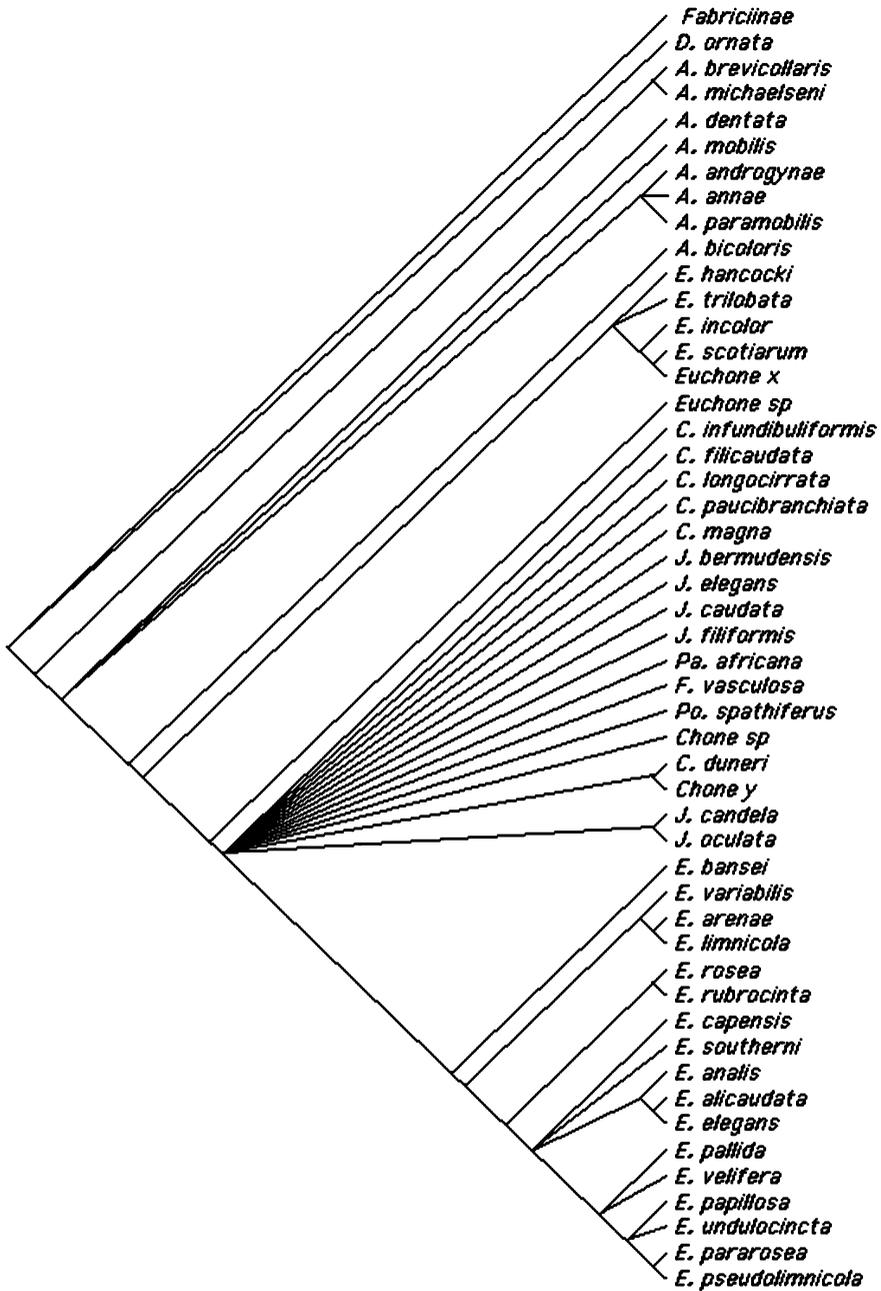


Figure 11. Strict consensus tree.

species, described from Ireland, has been previously reported for the Mediterranean area (Giangrande 1989). Although most of this material was unidentifiable, one specimen has been proved to belong to the *Euchone* (*Chiade sensu* Cochrane) group, and the others,

clearly distinguished from *E. southerni*, remained unnamed due to the poor condition of the branchial crown.

Two new species were added to *Euchone*: *E. pararosea* and *E. pseudolimnicola*, increasing the Mediterranean record to six species.

The presence of radiolar appendages is confirmed in the type species of the genus as well as in one of the two new species. However, considering the importance of this feature in defining the genus, a revision of all *Euchone* species is needed.

A peculiar shape of thoracic uncini (type 2), different from the typical uncini of *Chone* and *Euchone* (type 1), and *Amphicorina* (type 4), was found in two Mediterranean taxa, one attributed to the previously cited *Euchone* (*Chiade sensu* Cochrane) group, and another to *Chone*.

The variability concerning the shape of thoracic uncini leads to some considerations. The anomalies in the uncinal shape, both in the thorax and abdomen within the *Chone* and *Euchone* groups, are found in some taxa placed in an “intermediate area” between *Chone–Euchone* and *Amphicorina* genera. It is clear that more knowledge of this variation and intermediate characters within these genera is needed to determine the extent to which variation can be included in generic diagnoses. This appears relevant also considering the ontogenetic or size-dependent character variability underlined by Bick and Randel (2005). The variation in shape of abdominal uncini, for instance, seems to be clearly size-dependent, with rasp-shaped morphology resembling *Amphicorina*, present in small *Chone* and *Euchone*. However, although the small *Chone* sp. has abdominal rasp-shaped uncini, the small *Euchone* sp. here described has abdominal uncini typical of large *Chone–Euchone* species. As for the thoracic uncini, the intermediate uncinal type 2 is present in the small *Euchone* species placed in the clade *Chiade* on the bases of the snowflake organization of the branchial crown (Cochrane 2003), as well as in the Mediterranean taxon. By contrast, *Chone* sp. has a feather-duster crown organization like *Chone* from which it is distinguished only by the presence of thoracic uncini type 2, a feature appearing rather down in the phylogenetic tree.

According to Bick and Randel (2005), the branchial crown organization could also be size-dependent, with an increase in the number of radioles with increasing size of the worm, even though the structure of the branchial crown has been used by Cochrane (2003) to distinguish the two different morphological forms within *Euchone*, with small forms reminiscent of the Fabriciinae, and large forms more resembling Sabellinae. In this context the presence of *Amphicorina*-like type 2 uncini in small *Chone* and *Euchone* can also be an indication of juvenile stages.

However, from these observations an evolution of small sabellin forms by heterochrony can be hypothesized. This process has been already proposed for evolution of some interstitial forms belonging to several other polychaete families (Westheide 1985). Small sabellid forms can show the above-mentioned features (snowflake branchial structure, abdominal uncini rasp-shaped, thoracic uncini *Amphicorina*-like type 2), because they are juveniles or because they are paedomorphic adults. This remains an unsolved problem. Only the presence of germinal products that often in these small forms are detected in the thorax, see for example *Amphicorina* and some small *Euchone* and *Chone*, can give support for character considerations.

It must be stressed that in the examined population of *Chone* sp., some specimens had eggs but maintain the thoracic type 2. Moreover, we personally observed juveniles of some *Euchone* species with the typical *Chone–Euchone* thoracic uncinal type. The figure from Bick and Randel (2005) relating to the juvenile of *E. analis*, previously identified as *Amphicorina*

liefdeffjordensis, shows thoracic uncini typical of *Chone* and *Euchone* as well, thus corroborating our observation. Therefore, it is possible that the shape of thoracic uncini is a good character in distinguishing among *Chone*, *Euchone*, and *Amphicorina* within the “intermediate area” also without egg detection.

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Appendix. List of characters and character states

- | | | |
|----|---|---|
| 1. | Branchial hearts
0: present
1: absent | 1: absent |
| 2. | Branchial lobes
0: separate
1: fused dorsally | 6. Pinnules
0: alternating
1: paired |
| 3. | Radiolar skeleton
0: absent or single
1: two cells
2: four or more | 7. Pinnule length
0: longest mid-radiole
1: not longest mid-radiole |
| 4. | Dorsal lips
0: without appendage (rounded)
1: with appendage (elongate) | 8. Radioles
0: three only
1: more than three |
| 5. | Ventral lips
0: present | 9. Membrane
0: absent
1: less than quarter
2: quarter to third
3: half
4: two-thirds to three-quarters |

- | | |
|---|---|
| <p>10. Flange
0: absent
1: present</p> <p>11. Radiole tips
0: filiform
1: tapering or broad
2: appendages</p> <p>12. Appendages
0: absent
1: present</p> <p>13. Tip length
0: not longer
1: longer</p> <p>14. Breaking plane
0: absent
1: present</p> <p>15. Ventral cirri
0: absent
1: present</p> <p>16. Anterior peristomial ring projection
0: collar or flap
1: triangular 2: bilobed
3: absent</p> <p>17. Posterior peristomial ring projection
0: absent
1: attached collar
2: free collar</p> <p>18. Anterior peristomium
0: fully exposed
1: partially exposed
2: covered</p> <p>19. Ventral incision
0: absent
1: present</p> | <p>20. Angle collar
0: level
1: oblique</p> <p>21. Dorsal lip
0: narrow, attached
1: wide, free</p> <p>22. Crenulated collar
0: absent
1: present</p> <p>23. Ventral shields
0: undifferentiated
1: differentiated</p> <p>24. Biannulate
0: absent
1: at least in the thorax</p> <p>25. Thoracic girdle
0: absent
1: present</p> <p>26. Groove
0: absent
1: present</p> <p>27. Notopodial lips
0: absent
1: present</p> <p>28. Abdominal segments
0: three only
1: more than three</p> <p>29. Abdominal girdle
0: absent
1: present</p> <p>30. Pygidial depression
0: absent
1: present</p> |
|---|---|

31. Pre-pygidial depression
0: absent 1: present
1: present
1: bayonet
2: short swollen limbate
3: elongate narrow swollen
4: spine-like
32. Anterior margin
0: absent
1: present
33. Lateral wings
0: absent
1: present
34. Abdominal growth
0: fixed segment number
1: pre-pygidial growth
35. Pygidial eyes
0: present
1: absent
36. Pygidial filament
0: absent
1: present
37. Collar fascicles
0: similar to other
1: elongate row
38. Collar chaetae
0: elongate
1: spine-like
39. Superior notochaetae
0: elongate, narrow
1: other
40. Notochaetae arrangement
0: straight
1: spiral
2: rows
41. Anterior inferior notochaetae
0: pseudospatulate
42. Posterior inferior notochaetae
0: absent
1: short swollen
2: pseudospatulate
3: spatulate
4: elongate swollen
43. Thoracic uncini handles
0: long
1: short
2: medium
44. Thoracic uncini breast
0: reduced
1: marked
45. Thoracic uncini hood
0: present
1: absent
46. Thoracic uncini second tooth
0: small
1: large
47. Companion chaetae thorax
0: absent
1: present
48. Abdominal uncini basal tooth
0: similar to rest
1: larger
49. Abdominal uncini breast
0: as manubrium
1: hooked
2: square
3: rounded
4: reduced

50. Abdominal uncini handle
0: absent
1: short
2: long

52. Variation within torus
0: absent
1: present

51. Abdominal neurochaetae
0: elongate narrow
1: other

53. Thoracic uncini main fang length
0: short
1: long