Boll. Zool. 59: 487-498 (1992)

Marine gastrotrichs from the Tuscan Archipelago (Tyrrhenian Sea): II. Chaetonotida, with description of three new species

MARIA BALSAMO
M. ANTONIO TODARO*
PAOLO TONGIORGI
Dipartimento di Biologia Animale, Università di Modena, via Università 4, I-41100 Modena (Italy)

ABSTRACT

Twenty-three species of chetonotid gastrotrichs are reported from three islands of the Tuscan Archipelago (Tyrrhenian Sea, Italy). The island of Elba is the largest in the archipelago and has the most sand beaches. It possesses the greatest diversity of gastrotrich fauna, with 17 known species. The island of Capraia ranks second with 12 species, and the island of Giglio is third with 8 species. *Chaetonotus napoleonicus* from the island of Elba and *Chaetonotus aegilonensis* together with *Halichaetonotus marivagus*, both from the island of Capraia, are described as new species. A clarification of the diagnostic characters of *C. atrox*, *C. dispar* and *C. neptuni* is given. *Xenotrichula carolinensis* is synonymized with *X. intermedia*.

KEY WORDS: Gastrotricha - Chaetonotida - Marine meiofauna - Italian fauna - Island of Elba - Island of Capraia - Island of Giglio.

ACKNOWLEDGEMENTS

This research was supported by grants from Ministero della Università e della Ricerca Scientifica e Tecnologica (MURST, 60% and 40% Programme «Popolamento animale del Mediterraneo occidentale»), and Consiglio Nazionale delle Ricerche (89.02851.04, 90.03258.CT04, 91.00673.CT04) to P. Tongiorgi. We wish to thank Prof. W. D. Hummon for his critical reading of the manuscript. We are grateful to Mr. D. Giannetti and Mr. G. Nannini for their technical help.

(Received 12 May 1992 - Accepted 15 July 1992)

* *Current address:* Department of Zoology and Physiology, Louisiana State University, Baton Rouge, Louisiana 70803 - USA.

INTRODUCTION

The gastrotrich species of the peninsular coast of Italy are relatively well known – mostly after the extensive research carried on in the last years by M. Balsamo, W. D. Hummon, M. A. Todaro and P. Tongiorgi (in press and unpublished data) –, unlike those inhabiting the sediments of the small Italian islands. In the attempt to reduce this gap, we investigated three islands of the Tuscan Archipelago: Elba, Giglio and Capraia, during 1990-1992. The first part of the results which concerned the species of the order Macrodasyida, was given in a previous paper in this series (Todaro *et al.*, 1992). This paper deals with members of the order Chaetonotida.

MATERIALS AND METHODS

Sampling and study methods and the list of the collecting sites are described in Todaro *et al.* (1992).

TAXONOMIC ACCOUNT

The sediment from 17 localities (8 from Elba, 3 from Giglio and 6 from Capraia) yielded several hundreds of specimens, all identified. They belong to 23 species in 8 genera (*Aspidiophorus*, *Chaetonotus*, *Draculiciteria*, *Halichaetonotus*, *Heterolepidoderma*, *Heteroxenotrichula*, *Musellifer* and *Xenotrichula*) in two families (Chaetonotidae and Xenotrichulidae). Of the three islands, Elba with 17 species proved to be the richest, followed by Capraia with 12 species, and finally by Giglio, which yielded only 8 species. This difference may in part depend on the greater number of sandy beaches and habitats which characterize the coasts of the island of Elba. *Aspidiophorus mediterraneus*, *Chaetonotus napoleonicus*, *C. variosquamatus*, *H. spinosus*, *Halichaetonotus thalassopais*, *Heterolepidoderma loricatum*, and *Heteroxenotrichula subterranea* have been found only in sediments from the island of Elba. *Chaetonotus siciliensis*, *C. aegilonensis*, *Halichaetonotus decipiens*, *H. marivagus* and *Musellifer delamarei* were reported only from Capraia. *Aspidiophorus polystictos* has been found only on island of Giglio. The other 11 species are common to at least two of the islands.

Family CHAETONOTIDAE Zelinka, 1889

Genus *Aspidiophorus* Voigt, 1904

Aspidiophorus mediterraneus Remane, 1927

Locality - ELBA: Zuccale, XI.1989, SL, 1 ind.

Geographic distribution and ecology - Widespread species: North Sea (Mock, 1979), English Channel (Kaplan, 1958), western coast of Scotland, Black Sea (Valkanov, 1957; Rudescu, 1966), coasts of Somalia (Valbonesi & Luporini, 1987) and Atlantic coast of the

USA (Hummon, 1974a, b, c, 1975; Hummon *et al.*, 1976). In the Mediterranean Sea, it has been reported in France (Swedmark, 1956) and Greece (Hummon & Roidou, in press). In Italy, it has been found along the Tuscan coast (Luporini *et al.*, 1971), the Gulf of Naples (Remane, 1927; Wilke, 1954), Sicily (Todaro & Balsamo, in press), in the central and northern Adriatic Sea (Schrom, 1966, 1972; Balsamo, Hummon & Todaro, unpublished data).

Aspidiophorus mediterraneus prefers fine sand of the littoral and sublittoral zone. Rudescu (1966) reported the species from brackish water (17-18‰, salinity).

Remarks - The only specimen found measured 150 µm in total length, with furcal appendages of 20 µm and pharynx of 31 µm. Unilobate head with a small cephalion and hypostomion. The body was covered with pedunculated scales arranged in about 60 longitudinal columns (30 dorsal). Each column was composed of 35-37 scales. On the trunk, the scales, 3.4 × 2.0 µm, were ovoid, with a marked median keel.

The morphometric features of the specimen from Elba are in agreement with those known for the species. Only the number of the dorsal scale per columns (30 *vs.* 22) and total scale columns (60 *vs.* 45) are greater.

Aspidiophorus parameditterraneus Hummon, 1974

Localities - ELBA: Biodola, V.1990, SL, 2 ind; Cavo, XI.1989, SL, 1 ind; Fetovaia, V.1990, SL, 3 ind; S. Andrea, V.1990, SL, 2 ind; Zuccale, XI.1989, SL, 2 ind; V.1990, SL, 7 ind. GIGLIO, VI.1990: Arenella, SL, 3 ind; Cannelle, SL, 6 ind. CAPRAIA: Torre al Bagno, IX.1990, SL, 6 ind.

Geographic distribution and ecology - Western coast of Scotland and Isles of Scilly (Hummon, 1976; Hummon & Warwick, 1990), French coast of the English Channel and Atlantic Sea (Kisielewski, 1988), Atlantic coast of the USA (Decho *et al.*, 1985; Hummon, 1974a, b) and the coast of Somalia (Valbonesi & Luporini, 1987). In the Mediterranean Sea, *A. parameditterraneus* is present in Greece (Hummon & Roidou, in press) and along the Italian coasts, though, to date, no report is available for the northern Adriatic Sea (Todaro & Balsamo, in press; Balsamo, Hummon & Todaro, unpubl. data).

The species is generally found in fine to coarse sand of the sublittoral zone: its presence does not seem to depend on sediment grain size.

Remarks - The specimens collected from the Tuscan Archipelago closely match the original description (Hummon, 1974a) in body size and shape, keeled scale morphology and pattern of the ventral ciliary bands. Overall, the specimens had 65 longitudinal columns of scales, 33 dorsal. Hummon describes «14-22 tranverse rows of 80-90 scales each, on the dorsal and dorsolateral surfaces and 3-6 transverse rows on the ventrolateral surfaces». This apparent discrepancy can be attributed to the different method used for counting the scales, especially on the sides of the body (Hummon, personal communication).

Aspidiophorus polystictos Balsamo & Todaro, 1987

Locality - GIGLIO: Arenella, VI.1990, SL, 3 ind.

Geographic distribution and ecology - Italian species, first reported from the Ionian coast of Apulia (Balsamo & Todaro, 1987), it has been recently found along the coast of Tuscany, the Adriatic coast of Apulia and along the northwestern coast of the Adriatic sea (Hummon *et al.*, 1990; Balsamo, Hummon & Todaro, unpubl. data).

Aspidophorus polystictos inhabits the fine-medium sand of both littoral and sublittoral zone. It is a euryaline species easily culturable. Two of us (Balsamo & Todaro, 1988) have described its life history traits.

Genus *Chaetonotus* Ehrenberg, 1830

Chaetonotus aegilonensis n.sp.
(Figs. 1, 2)

Locality - CAPRAIA, IX.1990: Torre al Bagno, SL, 2 ind.

Diagnosis - Medium size *Chaetonotus* (200 µm), slightly marked five-lobed head (34.5 µm wide), slight neck constriction (31 µm), narrow furcal base (21.5 µm), and a 36 µm long furca. Body covered with a total of 23 (15 dorsal) longitudinal alternating columns of spined scales. The scales, 6 × 5 µm, are rounded with a truncated posterior edge. The spines are simple and short (4-6 µm).

Description - Species with total body length of 200 µm, including the 36 µm long furca (adhesive tubes 18

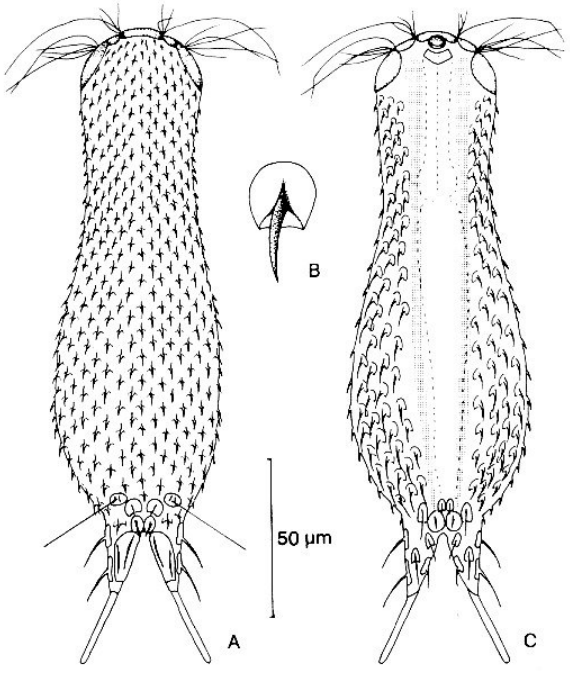

Fig. 1 - *Chaetonotus aegilonensis* n. sp. A, dorsal view; B, dorsal scale; C, ventral view. Dotting mimics the locomotory ciliature.

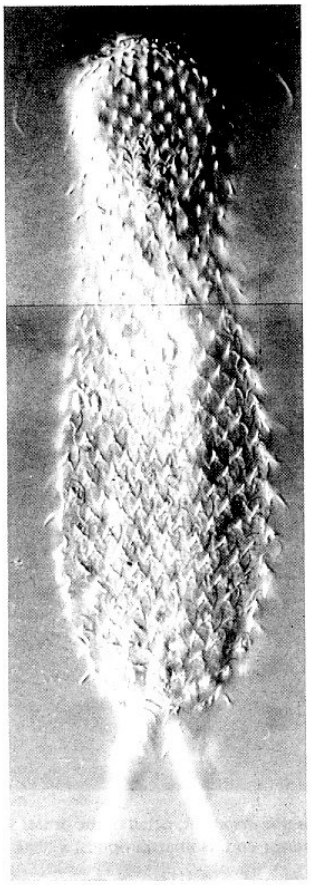

Fig. 2 - *Chaetonotus aegilonensis* n. sp. Dorsal view. Nomarski optics, ×650.

μm long). Head 34.5 μm wide, protected anteriorly by a 13 μm wide cephalion and laterally by two pairs of weak pleuria. The pleuria of the anterior pair are so small that the head gives the false impression of being three-lobed. One tuft of tactile cilia arises between the pleuria of each side. A single cilium from each tuft is particularly long (32 μm). Very short cilia also occur between the cephalion and the anterior pleuria. The neck is 31 μm wide, whereas the trunk measures 50 μm at the point of maximum width, diminishing to 21.5 μm at the furcal base. The furcal appendages are 36 μm long including the 18 μm adhesive tubes. The cuticular body covering is composed of slightly overlapping spined scales, arranged in 23 longitudinal alternating columns (15 dorsal, 2 lateral and 6 ventrolateral) of 23-25 scales each. The scales are rounded with truncated posterior edge. They show three slight keels which join together and rise to form a short simple spine. The size of the scales (4.0-6.5 × 3.0-5.5 μm) and the length of spines (4-8 μm) slightly increase from head to trunk. Additionally, four scales with longer and stiffer spines (11 μm) occur on the lateral margin of the furca and two more with shorter spine (3-4 μm) occur on the medial margin of the furca. The two longitudinal ciliary bands are similar to those of the other congeneric species. The interciliary field is bare, with the exception of the posterior end, where 3 pairs of keeled scales occur. The mouth (6 μm in diameter) leads into a 41 μm long pharynx with one slight enlargement at both ends.

The two specimens studied were in the hermaphroditic phase. Two clusters of commaform sperm and one mature egg were visible laterally and dorsally, respectively, to the mid region of the intestine. Surprisingly no X-organ was detected.

Remarks - *Chaetonotus aegilonensis* resembles *C. apechochaetus* and *C. siciliensis*, and can easily be confused with them. The three species have the same body and pharynx shape, same body size as well as the same shape and distribution of scales on the posterior ventral end. Additionally, *C. aegilonensis* has the same shape and length of spines as *C. apechochaetus*, and has the same shape of scales as *C. siciliensis*. In spite of so many similarities it is possible to keep *C. aegilonensis* distinct from the other two species: it differs from *C. siciliensis* because it has shorter spines (4-8 *vs.* 8.5-20 μm) as well as a higher number of longitudinal columns of scales (22 *vs.* 15-19), a difference that is particularly appreciable on the dorsal side (15 *vs.* 7-9). It then differs from *C. apechochaetus* because of the different shape of the scales (more rounded than in the latter), as well as the lower number of longitudinal columns of scales (up to 30 in *C. apechochaetus*).

Ecology - The specimens were collected at 8-10 m depth, in medium size sand, rich in detritus.

Derivatio nominis - «*aegilonensis*» from Aegilon, the ancient Greek name of the island of Capraia.

Chaetonotus apechochaetus Hummon, Balsamo & Todaro, 1992

Locality - ELBA: Cavo, XI.1989, SL, 1 ind; S. Andrea, V.1990, SL, 7 ind. CAPRAIA, IX.1990: Cala della Mortola, SL, 2 ind; Seno della Perruccia, SL, 2 ind; Torre al Bagno, SL, 7 ind. GIGLIO, VI.1990: Cannelle, SL, 1 ind.

Geographic distribution and ecology - Found with a certain frequency in sublittoral fine sand along the coasts of Tuscany, Campania and in the Archipelago of Campania, it has also been reported from Sicily (*Chaetonotus* sp., Todaro & Balsamo, in press).

Chaetonotus apolemmus Hummon, Balsamo & Todaro, 1992

Localities - ELBA: V.1990: Fetovaia, SL, 1 ind; Zuccale, SL, 1 ind. GIGLIO: Campese, SL, 4 ind. CAPRAIA, IX.1990: Seno della Perruccia, SL, 2 ind; Punta del Recisello, SL, 5 ind; Porto Vecchio, SL, 1 ind.

Geographic distribution and ecology - First found in Italy along the coasts of Latium, Campania, Sicily, Apulia and the Marches, and reported also from Greece (Hummon & Roidou, in press).

Chaetonotus apolemmus has usually been found in fine sand of both littoral and sublittoral zone.

Chaetonotus atrox Wilke, 1954

Localities - GIGLIO: Cannelle, VI.1990, SL, 1 ind. CAPRAIA: Seno della Perruccia, IX.1990, SL, 1 ind.

Geographic distribution and ecology - North Sea (Mock, 1979), English Channel (Swedmark, 1955; Dragesco, 1960; d'Hondt, 1970; Kisielewski, 1988), British Isles (Boaden, 1963a, b; Hummon & Warwick, 1990), Bay of Bengal (Ganapati & Chandrasekhara Rao, 1967; Chandrasekhara Rao & Ganapati, 1968; Chandrasekhara Rao, 1969, 1972, 1975, 1980). In the Mediterranean Sea, it is known from the Gulf of Marseilles (Swedmark, 1956) and from the coasts of Tuscany, Campania, Apulia and Molise (Wilke, 1954; Luporini & Tongiorgi, 1972; Luporini *et al.*, 1973; Balsamo, Hummon & Todaro, unpubl. data).

This species is always found in small numbers in sand of various grain size, in both littoral and sublittoral zones.

Remarks - The specimens from the Tuscan Archipelago could surely be assigned to C. *atrox* on the basis of scale and spine morphology (Fig. 3). Total length 120-130 μm; furca length 18-20 μm; adhesive tubes 11.6 μm. Head width 23.5-29.7 μm, with small sized cephalion, pleuria and hypostomion. Neck width 18.5-26.0 μm, trunk width 29-30 μm, furcal base width 14.7-16.0 μm. Eleven longitudinal columns (5 dorsal), each containing 15-18 spined scales. The horse-shoe shaped scales of the head becoming triangular on the trunk. They bore 10-12 μm long spines, with two accessory points at about 3/4 of their length. The scales on the posterior dorsal area are only keeled. Each side presented three long and narrow scales posterior and medial to each bristle scale. Lateral scales with spines similar but longer than the dorsal ones (max 18 μm). Ventrolateral columns of heart-shaped scales with spines apparently bearing a single accessory point. Distal to the insertion of the accessory point the thickness of all the spines diminished abruptly, becoming a thin filament. The interciliary area had 5-6 longitudinal columns of keeled and/or spined scales. The posterior end presented three pairs of large scales bearing spines: those of the terminal scales extended into the intrafurcal space. Pharynx 30-32 μm in length with two bulbs.

Fig. 3 - *Chaetonotus atrox*. Detail of the dorsal scales covering.

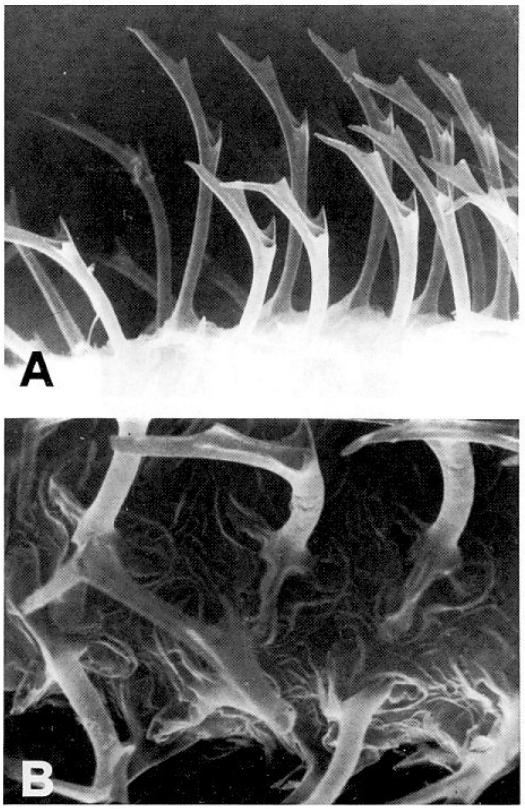

Fig. 4 - *Chaetonotus dispar*. A, detail of the dorsal spines; B, scales of the dorsal posterior end. Nomarski optics, ×2000.

Chaetonotus dispar Wilke, 1954

Localities - ELBA: Biodola, V.1990, SL, 1 ind; Fetovaia, V.1990, SL, 1 ind; Marina di Campo, V.1990, SL, 1 ind; S. Andrea, V.1990, SL, 3 ind; Zuccale, XI.1989, SL, 1 ind; V.1990, SL, 2 ind; Cavo, XI.1989, SL, 2 ind. GIGLIO: Cannelle, VI.1990, SL, 1 ind. CAPRAIA, IX.1990: Cala della Mortola, SL, 2 ind; Torre al Bagno, SL, 2 ind; Seno della Perruccia, SL, 1 ind; Punta del Recisello, SL, 2 ind; Punta della Civitata, I.1992, SL, 1 ind.

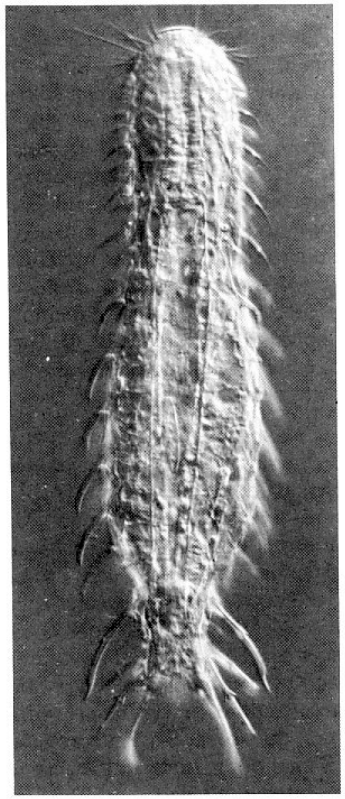

Fig. 5 - *Chaetonotus neptuni*. Habitus. Nomarski optics, ×450.

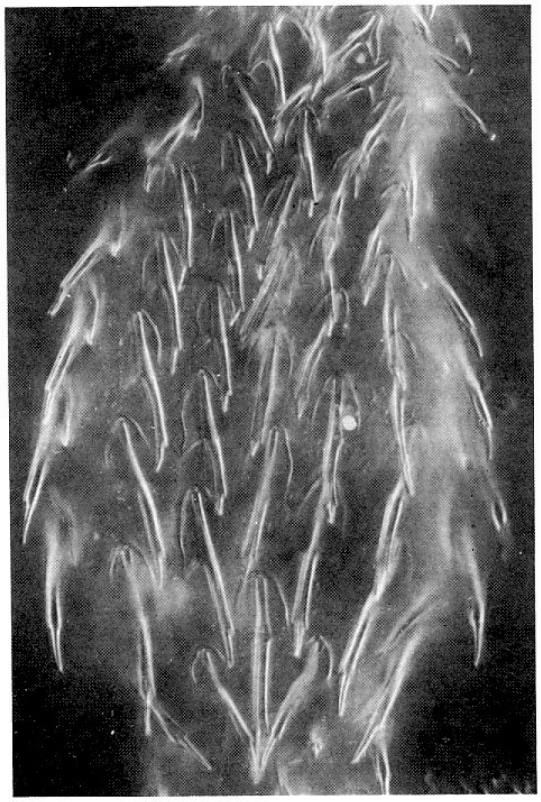

Fig. 6 - *Chaetonotus neptuni*. Detail of the dorsal cuticular covering. Nomarski optics, ×1200.

Geographic distribution and ecology - Coasts of Sweden (Swedmark & Teissier, 1967); Roscoff (Swedmark, 1955). In the Mediterranean Sea, it is known along the coasts of France (Swedmark, 1956) and Croatia (Schrom, 1972). Numerous records from the Italian littoral, from the coast of Tuscany to the mouth of the Isonzo River in the northern Adriatic (Wilke, 1954; Luporini *et al.*, 1973; Todaro & Balsamo, in press; Balsamo, Hummon & Todaro, unpubl. data).

Chaetonotus dispar is frequent in fine to coarse sublittoral substrates.

Remarks - Due to the shape of the scales and the presence of the third accessory point in the dorsal and dorsolateral spines (Fig. 4), our specimens could be assigned with certainty to this species. Body 141-188 µm in length, covered by 11 longitudinal columns (5-7 dorsal) of spined scales: head spines 5.0-7.5 µm; neck spines 15 µm; trunk spines 15-23 µm. Furca 20-29 µm long. Pharynx 29-35 µm in length.

Chaetonotus neptuni Wilke, 1954

Localities - ELBA: Zuccale, XI.1989, SL, 8 ind; V.1990, SL, 3 ind. CAPRAIA, IX.1990: Torre al Bagno, SL, > 10 ind; Punta del Recisello, SL, 1 ind; Porto Vecchio, SL, 1 ind.

Geographic distribution and ecology - First reported in the Gulf of Naples (Wilke, 1954) and subsequently along the southern coasts of Italy in Apulia (Balsamo, Hummon & Todaro, unpubl. data). The species also seems to be present (see below) along the Atlantic coast of the USA (Thane-Fenchel, 1970; Hummon, 1974b).

Chaetonotus neptuni is found in grey sand, fine *Amphioxus* sand and carbonaccous sand of medium grain size.

Remarks - The morphology and general size of the body allowed us to assign our specimens with certainty to *C. neptuni* (Fig. 5). Total body length 200-289 µm; furca 32.0-41.5 µm. The scutiform scales extended their keel into a spine (Fig. 6) and were arranged in 9-11 longitudinal columns, 5 of which were dorsal. Head scales 5.5 µm in length, neck scales 9.8 µm and trunk scales 12-14 µm. The spine morphology, typical of the «*schultzei*» group and in agreement with the original description, varied with location on the body. Spines measured 11 µm on the head, 13 µm on the neck, and 18-20 µm on the trunk. The lateral spines were longer and measured 32.5-37.5 µm. The interciliary area was bare except at the posterior end where 6 spined scales similar in shape and arrangement to those of *C. atrox* and *C. dispar* were visible. Pharynx 50-54 µm long.

In 1954, Wilke described three new, quite similar

species: *C. atrox, C. dispar*, and *C. neptuni*. These were assigned to the *schultzei* group on the basis of spine morphology, i.e. bearing two accessory points. The close similarity among the three species and the discrepancies among subsequent descriptions cast doubts on the identification criteria. The finding of the three species in the same geographic area allows us to propose more precise differential characters. *C. dispar* differs from the other species in scale morphology, it being clearly three-lobed with lobes of the same size, and by the presence of a third accessory point on the dorsal spines of the trunk. *C. atrox* differs from *C. neptuni* in the shape of the trunk dorsal scales (triangular *vs.* scutiform). *C. neptuni*, the largest species, presents two strong, 30-50 μm long, lateral spines in the posterior region of the trunk, which are absent in the other two species.

The assignment of the specimens collected by Thane-Fenchel (1970) in Florida to *C. neptuni* seems dubious due to the different shape of the dorsal scales.

Chaetonotus napoleonicus n.sp.

(Figs. 7, 8)

Locality - ELBA: Cavo, XI.1989, SL, 3 ind; V.1990, SL, 2 ind.

Diagnosis - Medium sized species, 115-135 μm in length, with 17.5-21.0 μm furca. Cuticular covering formed by subtriangular scales bearing a short simple spine. The scales are arranged in 17-19 (11 dorsal) longitudinal columns containing 25-27 scales each. One pair of large, 7.5 × 3.0 μm, keeled scales on the dorsal base of the furca, and numerous small, 2.8 μm, round, keeled scales on the ventral base of the furca. Five to six longitudinal columns of round spined scales in the ventral interciliary area. Pharynx posteriorly flared, 30-32 μm in length.

Description - Total length ranging from 115 to 135 μm. The head is rounded, with a small cephalion and apparently no pleuria. It is 24.5-31.0 μm wide and bears two tufts of about 10 tactile cilia, 6.0-24.6 μm. The hypostomion is present: it is trapezoidal and bears two conical spurs on the anterior margin. The width of the body changes slightly diminishing to 18.5-25.3 μm at the neck, increasing to a maximum of 28-37 μm at the trunk and narrowing once again at the furcal base, where it measures only 16.0-18.5 μm. The caudal appendages are 17.5-21.0 μm long. The basal segment and corresponding adhesive tube are equal in length. The cuticular covering extends over the entire body and includes the furcal base; it is composed overall of 17-19 longitudinal columns (9-11 dorsal), containing about 25-27 scales each. Every column is composed of subtriangular scales, whose dimensions increase from 2.7 × 2.5 μm on the head to 4.8 × 2.7 μm on the trunk. Two round scales on the dorsal posterior region of the body, each bearing a tactile bristle, are followed by two 7.5 × 3.0 μm scales with simple keels. Except for the latter, all the other scales bear a simple, slightly curved spine, whose length increases from 2.6 μm on the head to 4.2 μm on the trunk. Lateral spines are slightly tricker than the dorsal ones and on average 2-3 μm longer: the posterior spines can reach 7-8 μm in length. Scales and ventrolateral spines are similar to the dorsal ones in shape and size. The ventral interciliary area, from about the mid pharyngeal region, is covered with 5-6 longitudinal columns of roundish scales (2.8 μm in diameter) bearing a simple spine, 2.2 μm. At its end, two narrow and long (7.5 × 2.2 μm) keeled plates occur. Two spined scales at the intrafurcal margin. Numerous keeled scales (2-3 μm in diameter) cover the ventral base of the furca. Mouth opening (10 μm in diameter) is apical. The pharynx is 30-32 μm long and flared at both ends. The observed specimens were in the parthenogenetic phase.

Remarks - *Chaetonotus napoleonicus* is similar to *C. siciliensis, C. apechochaetus* and *C. aegilonensis* in many respect. These include: a) overall body shape, b) cuticular covering formed by simple spined scales, c) keeled scales on the dorsal posterior end. *C. siciliensis* can be clearly distinguished from *C. napoleonicus* by the hemielliptical shape, and greater scale size, and greater spine length. *C. apechochaetus* essentially differs from *C. napoleonicus* in 1) the greater overall number of longitudinal columns of scales (30-40 *vs.* 19); 2) the presence of two pairs of stiff parafurcal spines (which are absent in *C. napolenicus*); 3) the absence of numerous keeled scales on the ventral base of the furca; 4) the absence of spined scales on the ventral interciliary field, and 5) the presence of two pairs *vs.* one pair of keeled scales on the dorsal posterior region of the trunk. *C. aegilonensis* differs from the new species in the following main characters: 1) the shape of the scales (rounded in *C. aegilonensis* triangular in *C. napoleonicus*), 2) the naked ventral interciliary field (whereas there are spined scales in the Elba species), 3) a higher number of scales (6 *vs.* 2) at the end of the ventral interciliary field, and 4) the absence of keeled scales on the ventral base of the furca.

Ecology - In the type locality, *C. napoleonicus* lives in sublittoral fine sandy sediment.

Derivatio nominis - «*napoleonicus*», after the French Emperor Napoleon Bonaparte, who was held in exile on the island of Elba.

Chaetonotus siciliensis Hummon, Balsamo & Todaro, 1992

Locality - CAPRAIA: Torre al Bagno, IX.1990, SL, 2 ind.

Geographic distribution and ecology - Rare species, to date known only from Italy, in Apulia and in Sicily (*Chaetonotus* sp., Todaro & Balsamo, in press).

Chaetonotus variosquamatus Mock, 1979

Locality - ELBA: Biodola, V.1990, SL, 2 ind.

Geographic distribution and ecology - North Sea (Mock, 1979), French coasts of the English Channel and

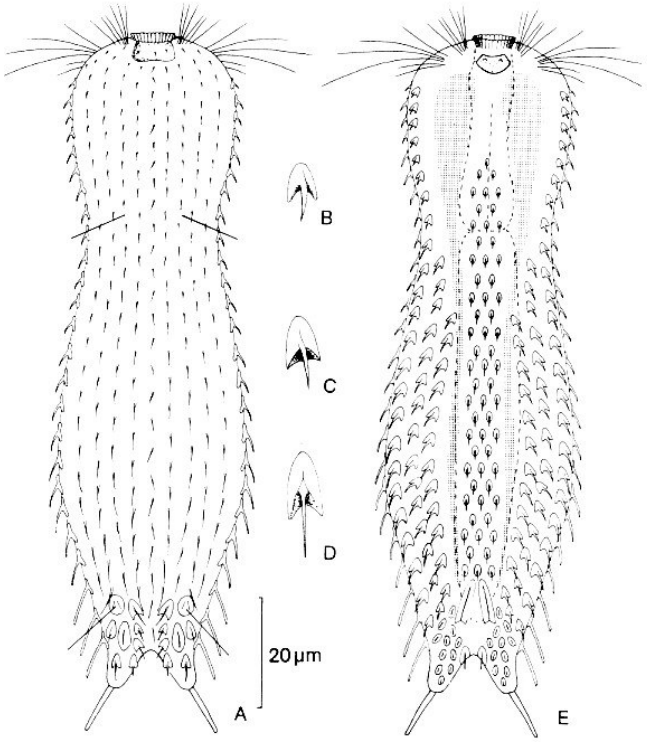

Fig. 7 - *Chaetonotus napoleonicus* n. sp. A, dorsal view; B, C and D, dorsal scales; E, ventral view. Dotting mimics the locomotory ciliature.

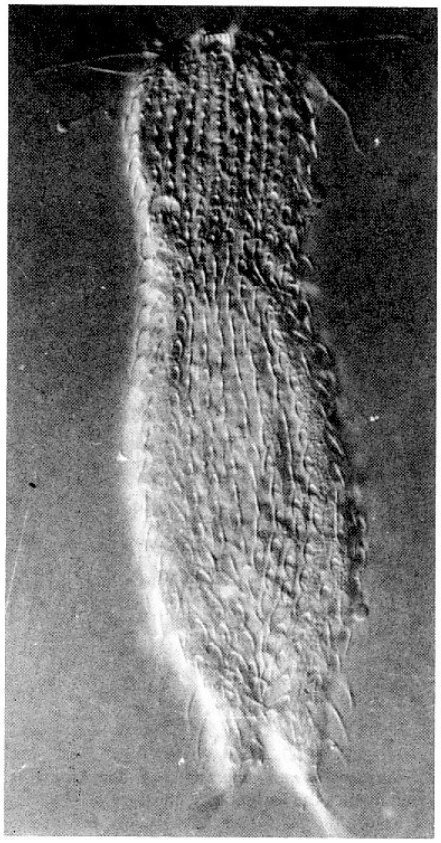

Fig. 8 - *Chaetonotus napoleonicus* n. sp. Habitus. Nomarski optics, ×900.

Atlantic Ocean (Kisielewski, 1988). In the Mediterranean Sea, it is reported for Greece (Hummon & Roidou, in press) and in Italy along the coasts of Campania, Basilicata, Apulia and Sicily (Todaro & Balsamo, in press; Balsamo, Hummon & Todaro, unpubl. data).

Chaetonotus variosquamatus has been found in fine, medium as well as coarse sandy sediments, in the littoral and sublittoral zone.

Remarks - Morphological characters of our specimens are in full agreement with descriptions of this species. Total length 148-150 µm; furca 22-24 µm long; pharynx 32 µm long.

Genus *Halichaetonotus* Schrom, 1972

Halichaetonotus decipiens (Remane, 1929)

Locality - CAPRAIA: Punta del Recisello, IX.1990, SL, 1 ind.

Geographic distribution and ecology - Baltic Sea and North Sea (Remane, 1926; Mock, 1979); English Channel (Kaplan, 1958; d'Hondt, 1968a); Atlantic coast of France (Levi, 1950; d'Hondt, 1968b, 1971); Atlantic coast of USA (Hummon, 1974); Black Sea (Valkanov, 1957; Rudescu, 1966). In the Mediterranean Sea, it has been reported from the Gulf of Naples (Wilke, 1954) and from the northernmost Adriatic coast of Apulia (Balsamo, Hummon & Todaro, unpubl. data).

This species has always been found, in a small number of specimens, in fine littoral sand.

Remarks - The specimen from Punta del Recisello measured 94 µm in total length, including the 15.6 µm long furca (adhesive tubes 10.5 µm long). The cuticular covering consisted of elliptic keeled scales arranged in 9-11 longitudinal alternating columns containing 17 scales on the dorsal side, of hydrofoil scales arranged in two ventrolateral columns and of spined scales arranged in 2-3 ventral columns between each locomotor ciliary band and the column of hydrofoil scales. Three pairs of scales, similar in shape and arrangement to those reported for the North Sea specimens by Mock (1979), occurred at the posterior end of the interciliary field. The mouth was subterminal, and the 24-µm-long pharynx had a bulbous enlargement at both ends.

Although this is the first time spined scales have been reported for specimens of this species, the correspondence of all the other specific characters confirms the affiliation of our specimen to *H. decipiens*. The small size of this species (only Mock, 1979 reports specimens

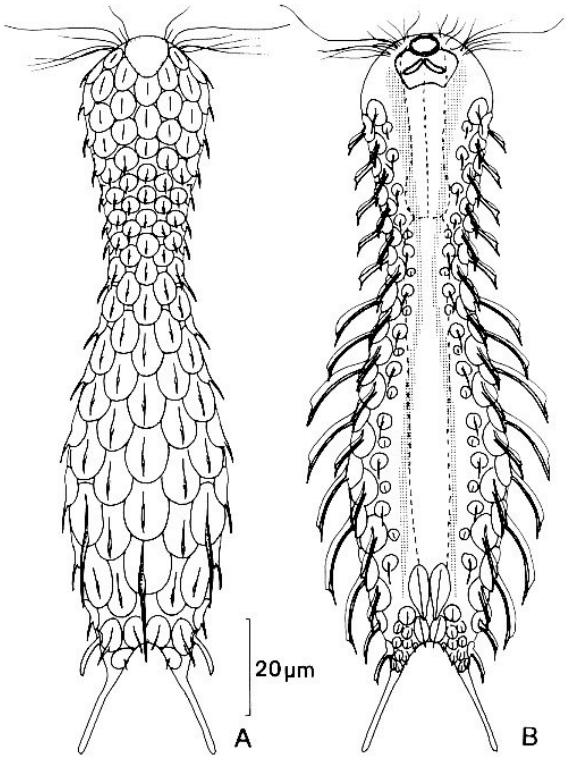

Fig. 9 - *Halichaetonotus marivagus* n. sp. A, dorsal view; B, ventral view. Dotting mimics the locomotory ciliature.

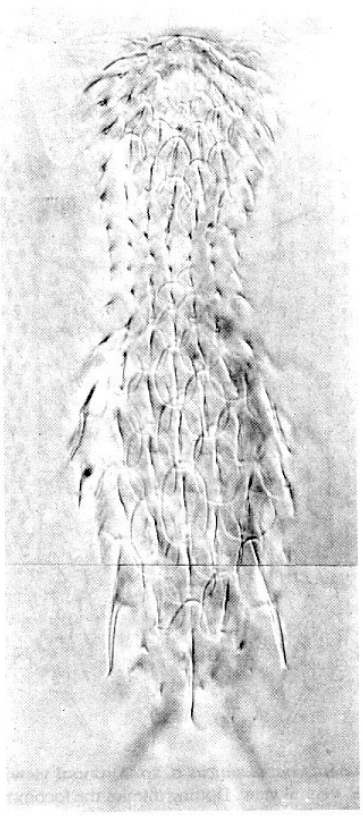

Fig. 10 - *Halichaetonotus marivagus* n. sp. Habitus. Nomarski optics, ×750.

bigger than 100 µm) may have led previous authors to overlook the spined scales.

Halichaetonotus margaretae Hummon, Balsamo & Todaro, 1992

Localities - ELBA, V.1990: Fetovaia, SL, 1 ind; Zuccale, SL, 1 ind. CAPRAIA, IX.1990: Cala della Mortola, SL, 1 ind; Seno della Perruccia, SL, 1 ind. GIGLIO: Campese, V.1990, SL, 4 ind.

Geographic distribution and ecology - Mediterranean species observed in Greece (Hummon & Roidou, in press) and in numerous sites along the coasts of Italy, from the Tyrrhenian Sea to the northern Adriatic Sea (Hummon *et al.*, 1992).

The species prefers biogenic or siliceous sediments of fine to medium grain size, mostly in the sublittoral zone.

Halichaetonotus marivagus n.sp. (Figs. 9-10)

Locality - CAPRAIA: Punta del Recisello, IX.90, SL, 1 ind.

Diagnosis - Medium size *Halichaetonotus* (150 µm) with unilobed head and a 24.5 µm long furca. Seven dorsolateral columns of large ovoidal scales with short spined processes. Three strong spines on the posterior part of the dorsum. Two ventrolateral columns of hydrofoil scales and two ventral columns of small spined scales per side. Two pairs of keeled scales, different in shape and size, at the ventral posterior end. Two-bulbous pharynx, 30.5 µm long.

Description - The body, 150 µm in length, is rather slender and characterized by a unilobed head (26 µm wide), well marked neck constriction (15 µm wide), trunk 31.2 µm wide, and U-shaped 24.5 µm long furca. The head bears a dorsal cephalion, large ventral hypostomion, and two tufts of tactile cilia. The furca has a 20-µm-wide base with adhesive tubes 18.3 µm in length. The body is covered with scales arranged in 13 longitudinal columns made up of 14-16 scales each. Five columns are dorsal, two are lateral and six are ventrolateral. On the head and on the trunk the scales both of dorsal and lateral columns are ovoidal in shape, on the neck they are round. Like in other *Halichaetonotus*, scale size decreases from head (4.5-9.0 µm) to neck (4.5-5.0 µm), and then increases remarkably to 12.0-14.5 µm × 6.5-10.0 µm on the trunk. The keel of the dorsal scales extends into a short (1-3 µm) spined process, which is

especially visible on the head and neck scales. On the posterior region of the trunk, the fourteenth scale of the median column and that of the two external columns bear a robust spine 13.5-15.0 µm long. A spined process, 3-10 µm long, also occurs on the scales of the lateral columns. Ventrolaterally, from the ciliary band to the external margin, are one (two) column(s) of rounded scales (about 3 µm in diameter) each with a short simple spine (about 5 µm) and two columns of hydrofoil scales whose spines are 10-16 µm long. Ventrally, the interciliary field appears bare, with the exception of the two pairs of keeled plates located at its posterior end. The two anterior plates are tear-shaped, 15.0 × 6.5 µm, the posterior ones are elliptic and smaller, 7.5 × 3.5 µm. Numerous (8-10) small rounded scales cover the furcal base. The mouth ring (9.5 µm in diameter) is almost apical. The pharynx is 31.5 µm long and bears a bulb at each end. Two strong cuticular rods are visible within the anterior bulb. The observed specimen was in the parthenogenetic phase.

Remarks - The shape of the hydrofoil scales approaches *H. marivagus* to *H. aculifer* and *H. pleuracanthus*, which also bear a similar dorsal scale pattern. However, these two species have only one column of hydrofoil scales per side and dorsal scales without spines. For these reasons, we assigne the examined specimens to the new taxon *Halichaetonotus marivagus*.

Ecology - The species was found in a sample of medium coarse sand collected at 5 m depth.

Derivatio nominis - Composed word from the Latin words *«mare»* and *«vagus»*, i.e. roaming in the sea.

Halichaetonotus spinosus Mock, 1979

Localities - ELBA: Biodola, V.1990, SL, 2 ind. CAPRAIA: Punta del Recisello, IX.1990, SL, 2 ind.

Geographic distribution and ecology - North Sea (Mock, 1979) and Atlantic coasts of France (d'Hondt, 1966, 1971). In the Mediterranean Sea, *H. spinosus* is known from Sicily (Todaro & Balsamo, in press) and from the Tuscan coast (Balsamo, Hummon & Todaro, unpubl. data).

This species inhabits the fine loose sand of both littoral and shallow sublittoral zone.

Remarks - The specimens from Elba matched the description and the illustrations given by Mock (1979) for the specimen from the North Sea. One of our specimens measured 110 µm in total length, including the 20 µm long furca (adhesive tubes 13.8 µm long). Dorsally, the cuticular covering was constituted by elliptic keeled scales, each bearing a very short spine. The scales were arranged in 9-11 longitudinal columns of 17 scales each. Two columns of hydrofoil scales were present on the ventrolateral margins of the body. Spined scales, arranged in 2-3 columns, occurred on the ventral side. Three pairs of scales, similar in shape and arrangement to those reported for the North Sea specimens by Mock (1979), occurred at the posterior end of the interciliary field. The 28-µm-long pharynx had a bulbous enlargement at both ends.

This species closely resembles *H. decipiens*, the principal difference being the spined scales (only keeled in *H. decipiens*) on the dorsal side of the body.

Halichaetonotus thalassopais Hummon, Balsamo & Todaro, 1992

Localities - ELBA: Cavo, XI.1989, L, 1 ind; SL, 1 ind; Zuccale, V.1990, SL, 1 ind.

Geographic distribution and ecology - Mediterranean species found in Sicily (including *Halichaetonotus* sp., Todaro & Balsamo, in press), in Corsica, and along the coasts of Liguria, Tuscany, Latium, Campania, Apulia and the Marches.

This species dwells in fine sand in both the littoral and sublittoral zones.

Genus *Heterolepidoderma* Remane, 1927

Heterolepidoderma loricatum Schrom, 1972

Localities - ELBA, V.1990: Biodola, SL, 1 ind.; Nisporto, SL, 1 ind.

Geographic distribution and ecology - Initially known only from the coasts of Italy (Schrom, 1972; Todaro, 1992; Todaro & Balsamo, in press; Balsamo, Hummon & Todaro, unpubl. data), it has, recently, also been found in Greece (Hummon & Roidou, in press).

The species lives in fine sand, generally in shallow sublittoral areas.

Remarks - The examined specimens had the following morphometric parameters: total body length 105-120 µm, furca 14-20 µm; head width 25 µm; trunk width 30-40 µm. Cuticular armature consisting of 13 longitudinal columns (9 dorsal, 2 lateral and 2 ventral) of keeled scales. Pharynx 31-32 µm long.

Genus *Musellifer* Hummon, 1969

Musellifer delamarei (Renaud-Mornant, 1968)

Locality - CAPRAIA: Torre al Bagno, IX.1990, SL, 2 ind.

Geographic distribution and ecology - First reported from the Gulf of Naples by Renaud-Mornant (1968), and again by Balsamo, Hummon & Todaro (unpubl. data) from near Santa Maria di Leuca (Apulia) in coarse sand with organic detritus at 5 m depth.

Remarks - This species, originally included in the genus *Polymerurus*, because of the long furcal appendage, was recently transferred to the genus *Musellifer* (Hummon *et al.*, 1992). Total length of the only

specimen measured was 173 µm; furca 53 µm; adhesive tubes 20 µm. Head, neck and trunk width 30.5, 26.0, and 38.3 µm, respectively. The mouth opened apically on the rounded head, at the top of a conical protuberance. Dorsolaterally to the mouth, two polygonal areas free of scales bore a dense coat made of short cilia. The entire body, except the ventral surface of the head – the only ciliated area – was covered by rounded, clearly overlapping scales bearing thin, simple spines. Trunk covered by 30 longitudinal columns of scales (20 on the head), equally subdivided between the dorsal and ventral sides. Median dorsal longitudinal column of 38-40 scales. Pharynx, 40.3 µm, posteriorly flared. The anus opened ventrally about 10 µm from the furcal margin. The measured specimen was in the hermaphroditic phase, and two large eggs and two masses of thread-like spermatozoa were visible along the sides of the intestine.

Family XENOTRICHULIDAE Remane, 1927

Genus *Draculiciteria* Hummon, 1974

Draculiciteria tesselata (Renaud-Mornant, 1968)

Localities - ELBA: Zuccale, V.1990, SL, 2 ind. CAPRAIA: Cala della Mortola, IX.1990, SL, 1 ind; Punta della Civitata, SL, 1 ind.

Geographic distribution and ecology - North Sea (Mock, 1979); coasts of Scotland (Hummon, 1976); Atlantic coasts of the USA (Hummon, 1974b, c, 1975; Ruppert, 1979); Japan (Sudzuki, 1977). In the Mediterranean Sea, it is known from Greece (Hummon & Roidou, in press), and in Italy from Tuscany, Campania, Apulia and the Marches (Luporini *et al.*, 1971, 1973; Renaud-Mornant, 1968; Balsamo, Hummon & Todaro, unpubl. data).

Species characteristic of, but not restricted to, intertidal zones of high energy fine sand.

Remarks - The total length of the only measured specimen reached 212 µm, of which 54 µm belonged to the furca. the head was typically pentagonal in shape, with a maximum width of 45.6 µm and minimum of 37.5 µm. Neck width 25 µm; trunk width 28 µm. Thirty hydrofoil scales per side. One pair of parafurcal spines, 18 µm in length.

Genus *Heteroxenotrichula* Wilke, 1954

Heteroxenotrichula squamosa Wilke, 1954

Localities - ELBA: Biodola, XI.1989, SL, 1 ind; V.1990, L, 3 ind, SL, >10 ind; Cavo, XI.1989, L, >10 ind. CAPRAIA: Seno della Perruccia, IX.1990, SL, 1 ind.

Geographic distribution and ecology - North Sea (Mock, 1979); English Channel and Atlantic coasts of France (Kisielewski, 1988); western Scotland (Hummon, 1976) and Atlantic coasts of the USA (Hummon, 1974b, 1975; Ruppert 1979). In the Mediterranean Sea, it is present on the coast of Marseilles (Swedmark, 1956), Greece (Hummon & Roidou, in press) and along the Tyrrhenian, Ionian and southern Adriatic Seas (Wilke, 1954; Luporini *et al.*, 1973; Todaro & Balsamo, in press; Balsamo, Hummon & Todaro, unpubl. data).

Common and sometimes abundant in fine and semifine sand, in both the littoral and shallow sublittoral zone.

Remarks - The size and morphology of the observed specimens agree with descriptions of the species.

Heteroxenotrichula subterranea Remane, 1934

Locality - ELBA: Cavo, XI.1989, L, >10 ind.

Geographic distribution and ecology - Baltic Sea (Remane, 1934), English Channel (d'Hondt, 1968a), North Wales (Boaden, 1963a), Atlantic coasts of France (Ruppert, 1979), coasts of Somalia (Valbonesi & Luporini, 1987), India (Chandrasekhara Rao & Ganapati, 1967). In the Mediterranean Sea, it is present in Italy along the coasts of Apulia and Tuscany (De Zio & Grimaldi, 1964; Luporini *et al.*, 1971).

Species found in fine and coarse sand in the littoral zone.

Remarks - The morphometric parameters of the specimens from Elba fall within the range of variability for the species, more closely resembling those reported by Ruppert (1979).

Genus *Xenotrichula* Remane, 1927

Xenotrichula intermedia Remane, 1934

Xenotrichula carolinensis Ruppert 1979, syn. n.

Localities - ELBA: Cavo, XI.1989, L, >10 ind; Marina di Campo, V.1990, L, 1 ind. GIGLIO: Cannelle, VI.1990, SL, 2 ind.

Geographic distribution and ecology - Frequently found along the coasts of Europe. Its geographic range also includes the Atlantic coasts of the USA (Hummon, 1967, 1974b, 1975; Hummon & Hummon, 1977), Kenya (Balsamo & Todaro, unpubl. data) and India (Ganapati & Chandrasekhara Rao, 1967; Chandrasekhara Rao & Ganapati, 1968). In the Mediterranean Sea, it has been recorded from Greece (Hummon & Roidou, in press) and in Italy from Tuscany, Calabria, Abruzzi, the Marches and Veneto (Gerlach, 1953; Wilke, 1954; Luporini *et al.*, 1973; Balsamo, Hummon & Todaro, unpubl. data).

Cosmopolitan species, inhabiting littoral fine sand.

Remarks - Our specimens were in agreement with descriptions and morphometric parameters of the species. As with other specimens collected from Italian localities and along the coasts of Kenya, those from Tuscany showed a series of ventral scales posterior to the anus, quite similar to those described by Ruppert (1979) for *X. carolinensis*. This finding and the general overlap of morphometric parameters have led us to consider *X. carolinensis* synonymous with *X. intermedia*.

CONCLUSIONS

Because of the richness of environments, related to the variety of substrata and coastal exposure, these small islands were expected to show a high diversity in gastrotrich fauna. This diversity may be favoured by the low pollution there, which can be contrasted with the higher pollution in other peninsular localities (cf. Hummon *et al.*, 1990). The variety of chetonotids found in the Tuscan Archipelago (which is true as well for macrodasyids, cf. Todaro *et al.*, 1992) is consistent with that hypothesis. As in other investigations (Todaro, 1992; Todaro & Balsamo, in press; Balsamo, Hummon, Todaro & Tongiorgi, unpubl. data), the present research found the sublittoral sediment to be richer both in species and number of individuals than the littoral sediment, and sediments made up of medium-fine sands to be richer than coarse sand ones.

REFERENCES

Balsamo M., Todaro M. A. D., 1987 - *Aspidiophorus polystictos* a new marine species (Gastrotricha, Chaetonotida) and its life cycle. Boll. Zool., *54*: 147-153.

Balsamo M., Todaro M. A. D., 1988 - Life history traits of two chaetonotids (Gastrotricha) under different experimental conditions. Int. J. Invertebr. Reprod., *14*: 161-176.

Boaden P. J. S., 1963a - Marine Gastrotricha from the interstitial fauna of some North Wales beaches. Proc. Zool. Soc. London, *140*: 485-502.

Boaden P. J. S., 1963b - The interstitial fauna of some North Wales beaches. J. mar. Biol. Ass. U.K., *43*L 79-96.

Chandrasekhara Rao G., 1969 - The marine interstitial fauna inhabiting the beach sands of Orissa coast. J. zool. Soc. India, *21*: 89-104.

Chandrasekhara Rao G., 1972 - On the geographical distribution of interstitial fauna of marine beach sand. Proc. Indian natl. Sci. Acad., *38* (B): 164-178.

Chandrasekhara Rao G., 1975 - The interstitial fauna in the intertidal sands of Andaman and Nicobar group of islands. J. mar. Biol. Ass. India, *17*: 116-128.

Chandrasekhara Rao G., 1980 - On the zoogeography of the interstitial meiofauna of the Andaman and Nicobar islands, Indian Ocean. Rec. Zool. Surv. India, 7: 153-178.

Chandrasekhara Rao G., Ganapati P. N., 1968 - The interstitial fauna inhabiting the beach sands of Waltair coast. Proc. natl. Inst. Sci., B, *67*: 35-53.

Decho A. W., Hummon W. D., Fleeger J. W., 1985 - Meiofauna-sediment interactions around subtropical seagrass sediment using factor analysis. J. mar. Res., *43*: 237-255.

De Zio S., Grimaldi P., 1964 - Analisi comparativa del mesopsammon di due spiagge pugliesi in rapporto ad alcuni fattori ecologici. Arch. bot. biogeogr. ital., *40*, ser. 4, *IX*: 357-367.

Dragesco J., 1960 - Ciliés mésopsammiques littoraux. Trav. Stn. biol. Roscoff, (N.S.), *12*: 335 pp.

Ganapati P. N., Chandrasekhara Rao G., 1967 - On some marine interstitial gastrotrichs from the beach sands of Waltair coast. Proc. Indian Acad. Sci., *66*: 214-225.

Gerlach S. A., 1953 - Gastrotrichen aus dem Küstengrundwasser des Mittelmeeres. Zool. Anz., *150*: 203-213.

d'Hondt J.-L., 1966 - Chaetonotoides marins et d'eau douce de la région d'Arcachon. Act. Soc. linn. Bordeaux, ser. A, *103*: 1-22.

d'Hondt J.-L., 1968a - Gastrotriches et Halammohydrides des côtes Flamandes et Picardes. Bull. Mus. natl. Hist. nat., Paris, *40*: 214-227.

d'Hondt J.-L., 1968b - Contribution à la connaissance des Gastrotriches intercotidaux du Golfe de Gascogne. Cah. Biol. mar., *9*: 387-404.

d'Hondt J.-L., 1970 - Gastrotriches, Kinorhynques, Rotifères, Tardigrades. Inv. Faune Marine de Roscoff. Edit. de la Station Biologique de Roscoff, 29 pp.

d'Hondt J.-L., 1971 - Gastrotricha. Oceanogr. mar. Biol. annu. Rev., *9*: 141-192.

Hummon W. D., 1967 - Interstitial marine gastrotrichs from Wood Hole, Massachusetts. Biol. Bull., *133*: 452.

Hummon W. D., 1974a - Gastrotricha from Beaufort, North Carolina, U.S.A. Cah. Biol. mar., *15*: 431-446.

Hummon W. D., 1974b - SH: A similarity index based on shared species diversity, used to assess temporal and spatial relations among intertidal marine Gastrotricha. Oecologia (Berl.), *17*: 203-220.

Hummon W. D., 1974c - Some taxonomic revisions and nomenclatural notes concerning marine and brackish-water Gastrotricha. Trans. Am. Microsc. Soc., *93*: 194-205.

Hummon W. D., 1975 - Habitat suitability and the ideal free distribution of Gastrotricha in a cyclic environment. *In*: H. Barnes (ed.), Proc. 9th Europ. mar. Biol. Symp., Aberdeen Univ. Press, Aberdeen, pp. 495-525.

Hummon W. D., 1976 - Seasonal changes in secondary production, faunal similarity and biological accommodation, related to stability among the Gastrotricha of two semi-enclosed Scottish beaches. *In*: G. Personel & E. Jaspers (eds), Proc. 10th Europ. mar. Biol. Symp., Universa, Wetteren, Belgium, vol. 1, pp. 309-336.

Hummon W. D., Hummon M. R., 1977 - Meiobenthic subcommunity structure: spatial vs. temporal variability. *In*: B. F. Keegan, P. O. Ceidigh & P. J. S. Boaden (eds), Biology and benthic organisms. Pergamon Press, London and New York, pp. 339-347.

Hummon W. D., Roidou E., (in press) - Marine Gastrotricha of Greece: a preliminary report. Proc. 5th Int. Congr. on the Zoogeography and Ecology of Greece and adjacent region. Iraklion, Crete, 1990.

Hummon W. D., Warwick R. M., 1990 - The marine flora and fauna of the Isles of Scilly - Gastrotricha. J. nat. Hist., *24*: 519-525.

Hummon W. D., Balsamo M., Todaro M. A., 1992 - Italian marine Gastrotricha: I. Six new and one redescribed species of Chaetonotida. Boll. Zool., *59*: 499-516.

Hummon W. D., Fleeger J. W., Hummon M. R., 1976 - Meiofauna-macrofauna interactions: I. Sand beach meiofauna affected by maturing *Limulus* eggs. Chesapeake Sci., *17*: 297-299.

Hummon W. D., Todaro M. A., Balsamo M., Tongiorgi, P., 1990 - Effect of pollution on marine Gastrotricha in the northwestern Adriatic Sea. Mar. Pollut. Bull., *21*: 241-243.

Kaplan G., 1958 - Premières observations sur les Gastrotriches psammophiles des côtes du Calvados. Arch. Zool. exp. gén., *96*: 27-37.

Kisielewski J., 1988 - New records of marine Gastrotricha from the French coasts of Manche and Atlantic. II Chetonotida, with description of four new species. Cah. Biol. mar., *29*: 187-213.

Levi C., 1950 - Contribution à l'étude des Gastrotriches de la région de Roscoff. Arch. Zool. exp. gén., *87*: 31-42.

Luporini P., Magagnini G., Tongiorgi P., 1970 - Gastrotrichi Macrodasioidei delle coste della Toscana. Pubbl. Staz. zool. Napoli, *38*: 267-288.

Luporini P., Magagnini G., Tongiorgi P., 1971 - Contribution à la connaissance des Gastrotriches des côtes de Toscane. Cah. Biol. mar., *12*: 433-455.

Luporini P., Tongiorgi P., 1972 - Observation au microscope à balayage de quelques Gastrotriches Chaetonotoides. Cah. Biol. mar., *13*: 299-303.

Luporini P., Magagnini G., Tongiorgi P., 1973 - Chaetonotoid gastrotrichs of the Tuscan coast. Boll. Zool., *40*: 31-40.

Mock H., 1979 - Chaetonotoidea (Gastrotricha) der Nordseeinsel Sylt. Mikrofauna Meeresbodens, *78*: 1-107.

Remane A., 1926 - Marine Gastrotrichen aus der Ordnung der Chaetonotoidea. Zoll. Anz., 66: 243-252.

Remane A., 1927 - Gastrotricha. *In*: G. Grimpe (ed.), Die Tierwelt der Nord und Ostsee. 7d, pp. 1-56.

Remane A., 1934 - Die Gastrotrichen des Küstengrundwassers von Schilksee. Schr. naturw. Ver. Schlesw.-Holst., *20*: 473-478.

Renaud-Mornant J., 1968 - Présence du genre *Polymerurus* en milieu marin, description de deux espèces nouvelles (Gastrotricha, Chaetonotidae). Pubbl. Staz. zool. Napoli, *36*: 141-151.

Rudescu L., 1966 - Gastrotrichi voi pentra Marea Neagra (Sistematica, ecologia si Zoogeografia grupului). Hidrobiologia, *7*: 103-130.

Ruppert E. E., 1979 - Morphology and Systematics of the Xenotrichulidae (Gastrotricha, Chaetonotida). Mikrofauna Meeresbodens, *76*: 1-56.

Schrom H., 1966 - Gastrotrichen aus Feinsanden der Umgebung von Venedig. Boll. Mus. civ. Stor. nat. Venezia, *17*: 31-45.

Schrom H., 1972 - Nordadriatische Gastrotrichen. Helgoländer Wiss. Meeresunters., *23*: 286-351.

Sudzuki M., 1977 - Recent portraits of wild biota in Japan. III. A man-made sandy beach constructed in the bay of Tokio. Obun Ronsô, *8*: 221-239.

Swedmark B., 1955 - Gastrotriches marins de la région de Roscoff. Arch. Zool. exp. gén., *87*: 22-24.

Swedmark B., 1956 - Étude de la microfaune des sables marins de la région de Marseille. Arch. Zool. exp. gen., *93*: 70-95.

Swedmark B., Teissier G., 1967 - Structure et adaptation d'*Halammobydra adherens*. Cah. Biol. mar., *8*: 63-74.

Thane-Fenchel A., 1970 - Interstitial gastrotrichs in some South Florida beaches. Ophelia, *7*: 113-137.

Todaro M. A., 1992 - Contribution to the study of the Mediterranean meiofauna: Gastrotricha of the Island of Ponza, Italy. Boll. Zool., *59*: 321-333.

Todaro M. A., Balsamo M., (in press) - First observation on marine gastrotrichs from Sicily (Italy). Proc. 5th Int. Congr. on the Zoogeography and Ecology of Greece and adjacent region. Iraklion, Crete, 1990.

Todaro M. A., Balsamo M., Tongiorgi P., 1992 - Marine gastrotrichs from the Tuscan Archipelago (Tyrrhenian Sea): I. Macrodasyida, with description of three new species. Boll. Zool., *59*: 471-485.

Todaro M. A., Tongiorgi P., Balsamo M., 1990 - Gastrotrichi dell'arcipelago toscano. 53rd Congress U.Z.I., Palermo. (abstract)

Valbonesi A., Luporini P., 1987 - Researches on the coast of Somalia. Gastrotricha Chaetonotoidea. Monit. zool. ital. (N.S.), Suppl. XXII, *14*: 235-261.

Valkanov A., 1957 - Erster Versuch zur Erforschung der Gastrotrichen des Schwarzen Meeres. Ann. Univ. Sofia, *50*: 383-399.

Wilke U., 1954 - Mediterrane Gastrotrichen. Zool. Jahrb., Abt. Syst., *82*: 497-550.