Ecologica Montenegrina

ISSN **2336-9744** (online) | ISSN **2337-0173** (print)
**The journal is available on line at www.biotaxa.org/em**

**Research Article**

# *Echinoderes dujardinii* Claparède, 1863 (Kinorhyncha, Cyclorhagida): a new record for the kinorhynch fauna of Turkey

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Received 22 March 2016 | Accepted 18 April 2016 | Published online 21 April 2016.

**Abstract**
Meiobenthic samplings conducted in the framework of a meiobenthos project in the subtidal coastal waters of Sinop Bay, Southern Black Sea revealed the first report of the kinorhynch *Echinoderes dujardinii* for the marine fauna of Turkey.

**Key words**: Echinoderidae, Kinorhyncha, Meiofauna, Sinop Bay, Southern Black Sea.

## Introduction

Representatives of the phylum Kinorhyncha are among the less studied permanent metazoan meiofauna in the world although they have been first recognized in 1841 by Felix Dujardin (Dujardin, 1851). Today, the phylum includes more than 220 described species and 28 genera (Sørensen *et al*. 2015). They are benthic marine organisms, distributed world-wide from the intertidal to the abyssal zones, mostly inhabiting muddy bottoms (Sørensen & Pardos 2008; Yamasaki & Fujimoto 2014).

The occurrence of kinorhynchs in the marine fauna of Turkey has first been reported by Bacescu (1961). The author recorded *Pycnophyes communis* Zelinka, 1908 (Pycnophyidae) at the pre-Bosphoric area of the Black Sea and Çınar (2014) also mentioned the report of this species in his review about the species diversity of several phyla from the coasts of Turkey. Recently, Sönmez *et al*. (2016) recorded and described two echinoderid species, viz. *Echinoderes* aff. *bispinosus* and *Echinoderes* aff. *gerardi* from the Aegean Sea. The present study constitutes the third record of this genus in Turkey and stands as the first report of *Echinoderes dujardinii* Claparède, 1863 from the Turkish coastal waters.

## Material and Methods

Kinorhynch specimens were collected by scuba diving at a location with 4 meters water depth in Sinop Bay, Southern Black Sea (Fig. 1) in November 2015. Sediment samples were obtained from soft bottoms (very fine gravel) of the bay by metal push cores (12.56 $cm^2$ mouth area) and preserved with 75% ethanol on board. In the laboratory, sediments were washed and screened through 500 and 63 µm mesh sieves to separate macrofauna and meiofauna and afterwards stained with Bengal Rose solution. Meiobenthic

organisms were sorted under a Nikon SMZ 745 stereo microscope using modified Bogorov chambers. Specimens belonging to major taxa were collected separately by glass pipettes in 2 ml vials containing 75% ethanol. Kinorhynch specimens were examined and photographed using an Olympus BX51 microscope equipped with differential interference contrast (DIC) optics and an Olympus DP70 camera.

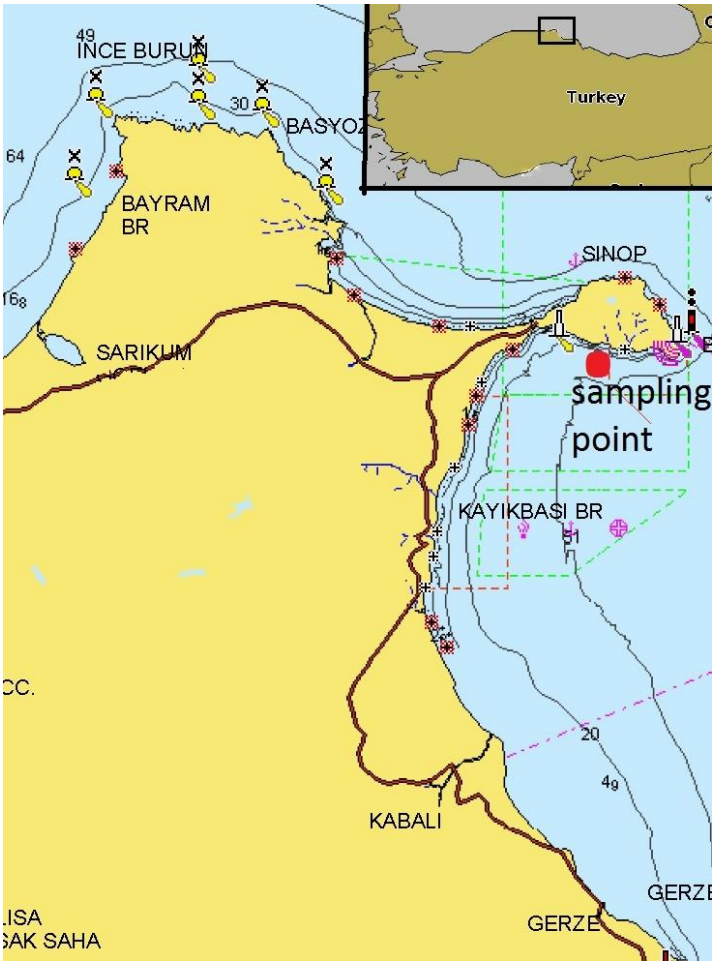


**Figure 1.** Sampling locality.

## Results

## Systematics

Phylum **Kinorhyncha** Dujardin, 1851

Class **Cyclorhagida** (Zelinka, 1896) Sørensen *et al*. 2015

Order **Echinorhagata** Sørensen et al., 2015

Family **Echinoderidae** Zelinka, 1894

Genus ***Echinoderes*** Claparède, 1863

***Echinoderes dujardinii* Claparède, 1863**
(Figures 2-4)

The specimens of the phylum Kinorhyncha obtained at Sinop Bay have been identified beyond doubt as *Echinoderes dujardinii* Claparède, 1863. The body of the adult is divided into introvert, neck and trunk.

**Introvert**. None of the specimens obtained had the introvert extended, so no information can be given on the mouth cone, oral styles and the structure and arrangement of scalids.

**Neck.** The neck is formed by 16 cuticular plates named placids, radially arranged and articulated directly with the first segment of the trunk. All placids have a trapezoid shape and are approximately equal in size, except for the midventral one, wider and slightly extended distally (Figs. 2A, 3A, 4A). Some of the placids bear additional plates, the trichoscalid plates, on which the trichoscalids of the last scalid ring articulate (Fig. 3A). The cuticle between adjacent placids is soft and appears folded, sometimes mistakenly named as interstitial placids.

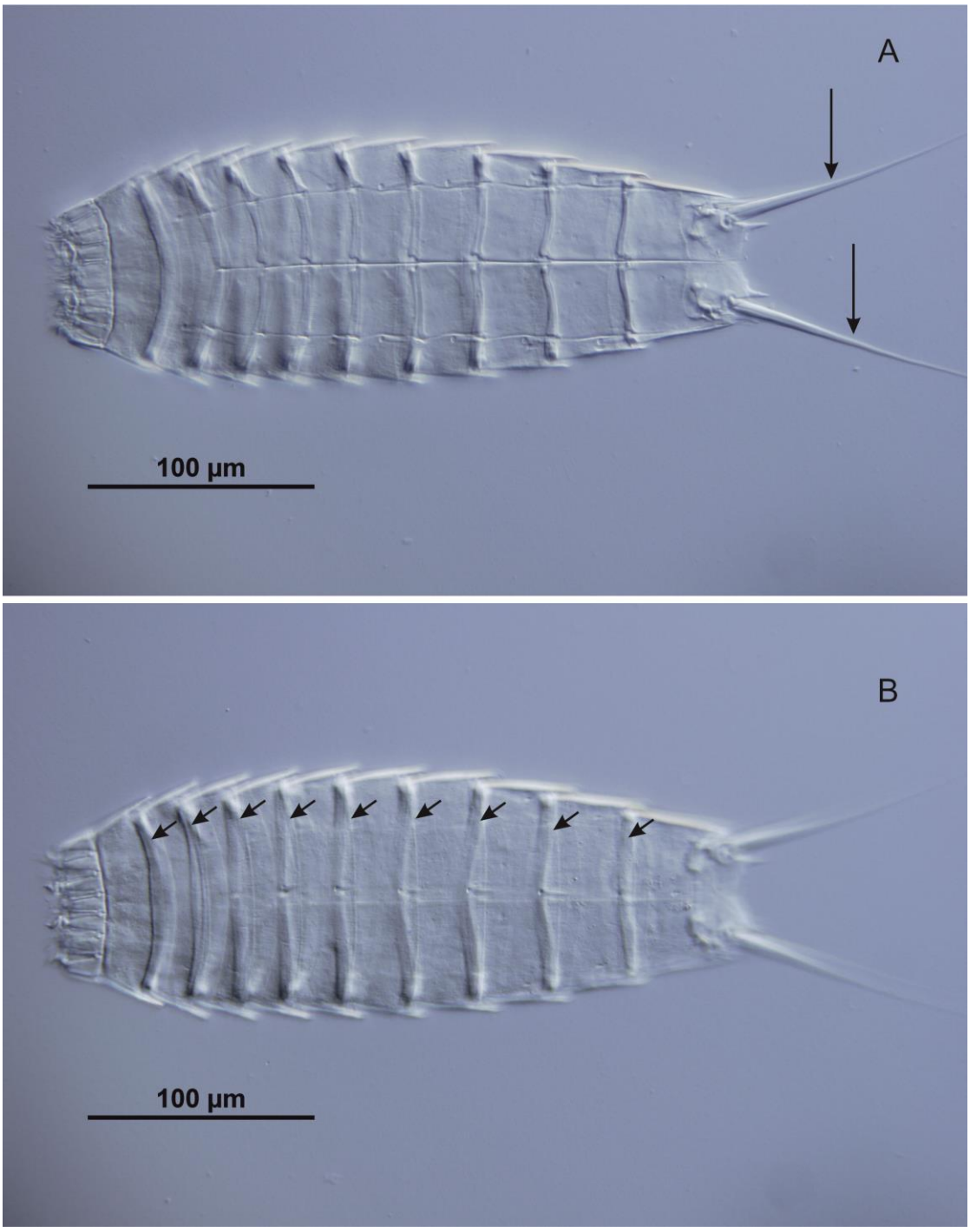


**Figure 2.** *Echinoderes dujardinii*, adult male; introvert retracted, anterior end to the left. **A**, ventral view. Arrows mark the lateral terminal spines. Note the two first segments as cuticular closed rings and the remaining 9 segments with paired sternal plates. **B**, dorsal view. Cuticular thickenings, or pachycycli, reinforce the anterior edge of every segment (arrows).

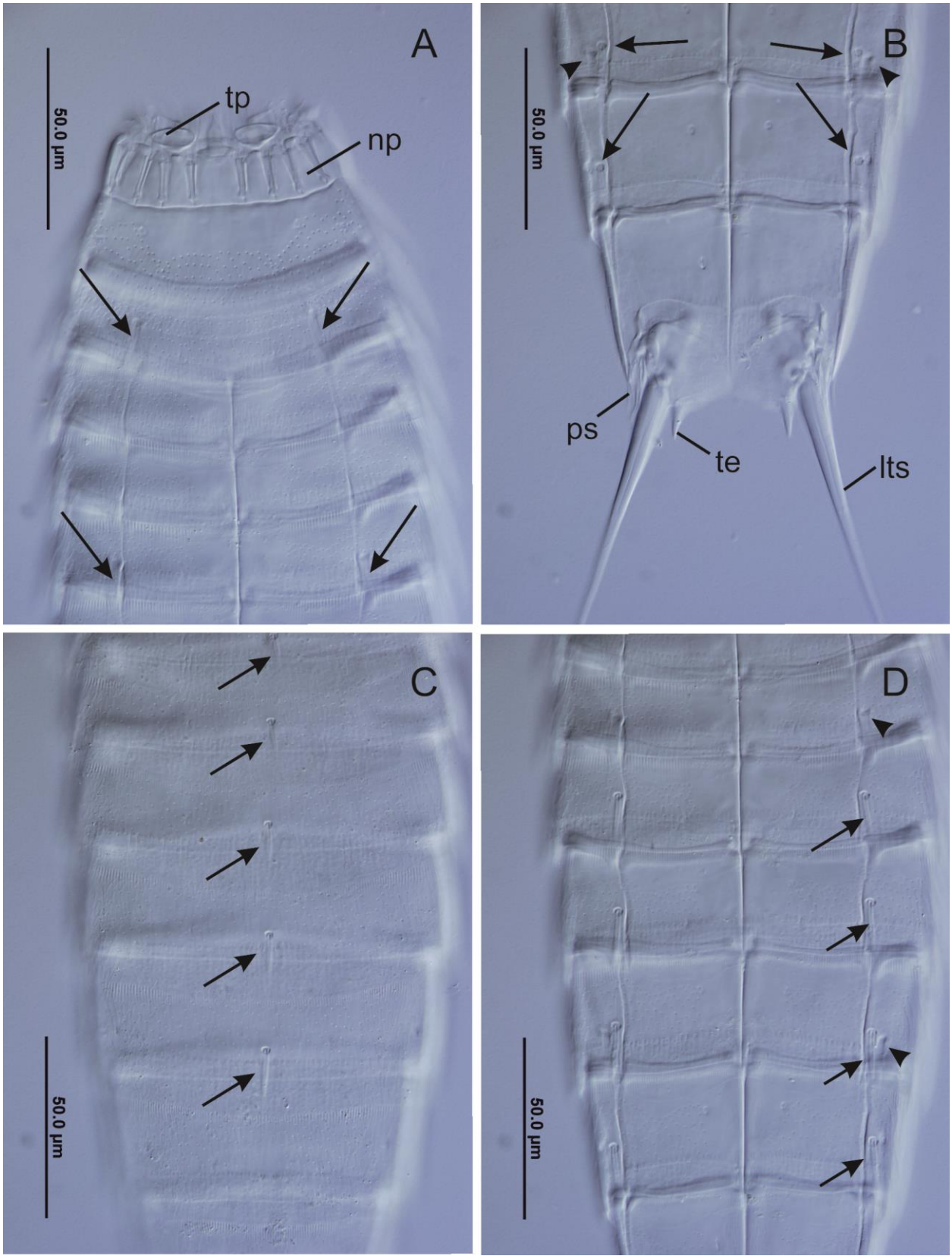


**Figure 3.** *Echinoderes dujardinii*. Adult male. **A**, Ventral view, segments 1-5. tp, trichoscalid plate; np, neck placid. Arrows mark lateroventral tubes on segments 2 and 5. **B,** Ventral view, segments 8-11. lts, lateral terminal spine; ps, penile spine; te, tergal extension. Arrows mark lateroventral spines on segments 8 and 9. Arrowheads point to lateral accessory tubes on segment 8. **C,** Dorsal view, segments 5-9. Arrows mark middorsal spines on segments 4-8. **D,** Ventral view, segments 5-9. Arrows point to lateroventral spines on segments 6-9. Arrowheads mark lateroventral tube on segment 5 and lateral accessory tube on segment 8.

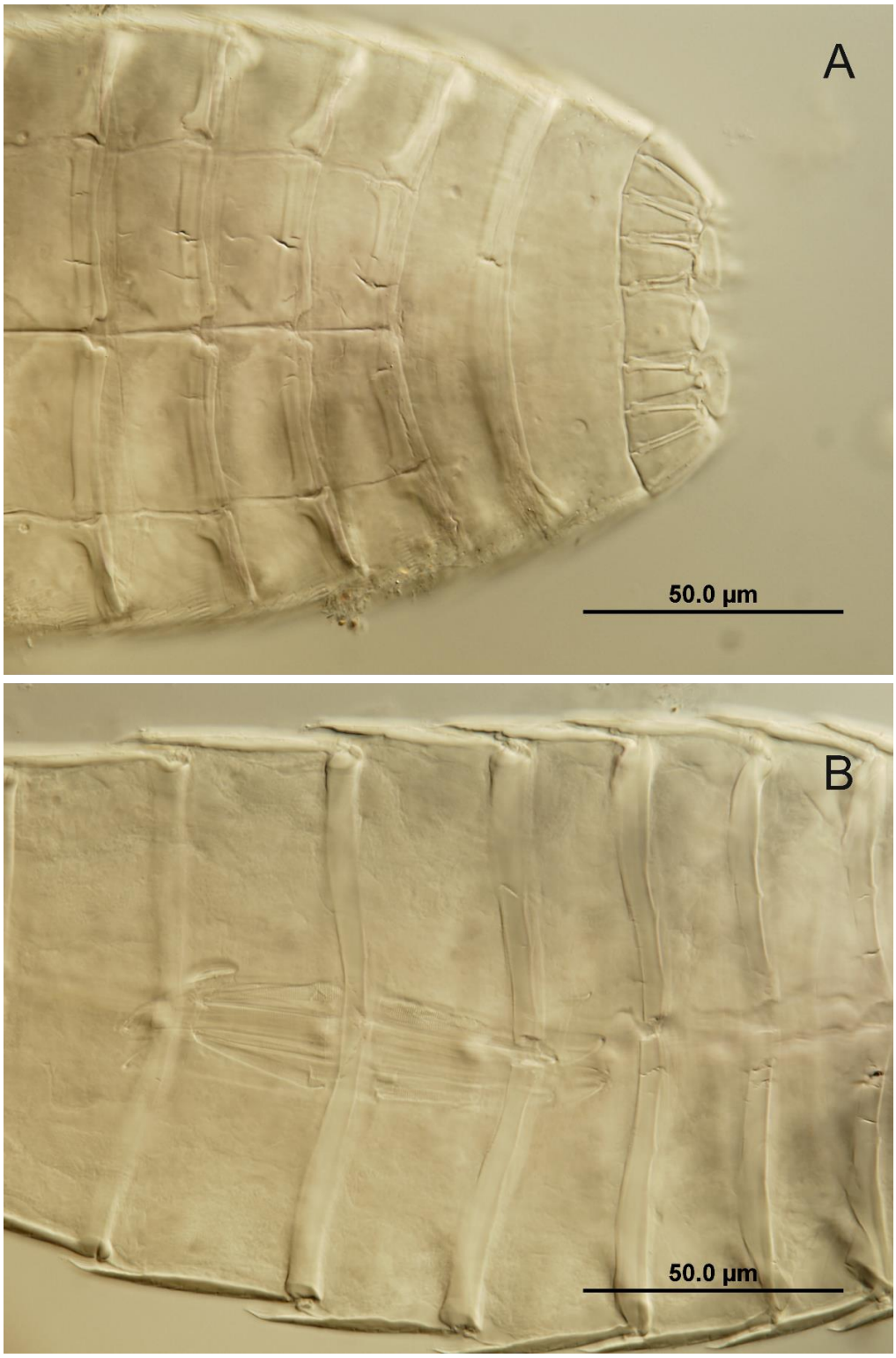


**Figure 4.** *Echinoderes dujardinii.* Adult female. **A,** ventral view, segments 1-6. **B,** dorsal view. Note the dorsal pachycycli and the diatom shells inside the gut.

**Trunk.** The trunk is divided into 11 segments. As a diagnostic character of the genus, the two first segments are closed rings of cuticle (Fig. 4A). Segments 3 to 11 are formed by a dorsal tergal plate articulated with two ventral sternal plates (Fig. 4A). Hence a ventral view of the animal shows the sternal plates plus a narrow lateral strip of the tergal plate, the so-called lateroventral area. Every segment has an anterior cuticular thickening, the pachycyclus (Figs. 2B, 4B) and a posterior edge specialized as a fringe of cuticular

tips, the pectinate fringe that overlaps the anterior edge of the next segment. The sizes of the whole trunk and the individual segments agree with the ones reported in the descriptions of the species. The cuticular surface is covered by minute hairs, arising from perforations arranged following characteristic patterns. Other cuticular specializations include sensory spots, glandular cell outlets and cuticular scars marking attachment sites for the underlying musculature. The most important taxonomic feature is the presence, nature and distribution of cuticular appendages, namely spines and tubes (Figs. 3A-D).

Tubes occur in lateroventral positions on segment 2; in lateroventral position on segment 5 (Fig. 3A) and in lateral accessory position on segment 8, very close to the lateroventral spine on that segment (Figs. 3B, D). Additionally a laterodorsal tube occur on segment 10. Short middorsal spines occur on segments 4 to 8, slightly increasing in length posteriorly. Spines are located in lateroventral positions on segments 6-9 (Fig. 3D).

Segment 11 (Fig. 3B) bears a pair of big lateral terminal spines, about 150 µm long (Fig. 2A). Additionally, females present one pair of lateral terminal accessory spines nearly 50 µm long. Males have three pairs of flexible penile spines instead. Tergal plate of segment 11 projected posteriorly as one pair of short and pointed tergal extensions.

## Discussion

The diversity of the cyclorhagid genus *Echinoderes*, with more than 80 species, is higher compared to the other kinorhynch genera (Yamasaki & Fujimoto 2014). Species of *Echinoderes* are commonly found in muddy sediments but they may be observed on algae, sponges and weeds and in sediments containing mud to coarse sand, gravel and shell fragments as well (Sørensen & Pardos 2008, Neuhaus 2013). *Echinoderes dujardinii* was the first kinorhynch species recorded in the world (Higgins 1983). Originally it was described by Claparéde (1863) and later redescribed by Zelinka (1928) and Higgins (1977). Remane (1928) provided the complex synonymies of the species. The first SEM photos were provided by Sanchez-Tocino et al. (2011).

*Echinoderes dujardinii* was initially reported from many places all over the world as a mistaken identification of different species of *Echinoderes*, however its distribution seems to be large covering the Mediterranean and part of the Atlantic Sea.

Sanchez-Tocino *et al*. (2011) reported the species from Mediterranean coast of the Iberian Peninsula. The study of Sanchez *et al*. (2012) extended the distribution of the species to the Atlantic coasts (South Galicia) of Spain. According to the aforementioned study, the species was found in shallow waters (1.6-18 m) from different sediment types such as shell gravel, coarse sand, sandy mud and mud. Recent comprehensive review of Kinorhyncha by Neuhaus (2013) provides detailed information on the distribution records of the species described from adult stage (Table 1).

**Table 1**. Distribution and biogeographical information *of E. dujardinii* described from adult specimens (from Neuhaus, 2013).

| Original description, Synonomy, Notes | Type locality, Distribution, Habitat, Depth | References |
|---|---|---|
| *E. Dujardinii* Claparede, 1863: pp. 90–92, Pl. 16: Figs 7–13;<br>"*l'Echinodère*" of Dujardin 1851: p. 158–160, Pl. 3: Figs 1–5;<br>Higgins 1964a: listed as type species;<br>Neuhaus (2013): designated as type species;<br>probably not *E. dujardinii* of Tokioka (1949) and of Sudzuki (1976);<br>for details of highly complex synonomy refer to Remane (1928: pp. 76, footnote 81–82; 1936: pp. 332–333, Fig. 273),<br>Zelinka (1928: pp. 228–235, Pl. 3: Figs 1–2, 14–17, Pl. 10: Figs 1–5, 7–23, redescription; pp. 248–250. Pl. 4: Figs 1–2, juvenile stage),<br>Higgins (1977a: pp. 4–13, Figs 1–13, Tab. 1, redescription; 1985: pp. 797–799, Fig. 4),<br>Adrianov & Malakhov (1999a: pp. 129–130);<br>Sanchez-Tocino et al. 2011: pp. 180–183, Figs 1–4, emended description. | **NE Atlantic Ocean**: France: St. Vaast la Hougue (type locality), St. Malo, Roscoff: sandy mud, Ireland: Clew Bay: from weeds 4–7 m, Blacksod Bay, The Netherlands: Scheveningen: intertidal sand; NE Atlantic Ocean: W Baltic Sea: Bay of Kiel, North Sea: Helgoland, Western coast of Sweden: Gullmar Fjord: <20 m, Norway: Bergen, Bay of Biscay: NW Spain: shell gravel 2 m;<br>**Mediterranean Sea**: Southern Spain: Andalusia to Murcia: mud to coarse sand or on algae *Stypocaulon scoparium* 5–30 m, SE Spain: Denia: mud 15 m, Mallorca: Porto-Pi, Italy: Salerno, Bay of Naples: 1–35 m or *Caulerpa* -mud 4–5 m or from algae 1 m,<br>**Adriatic Sea**: Croatia: Rovinj, Slovenia: Portoroz: from algae 3 m, Italy: Gulf of Trieste: 3–22 m,<br>Brindisi, Gulf of Venice: Chioggia: from sponge *Hymeniacidon sanguinea*. | Metschnikoff, E.M. 1865, 1869;<br>Pagenstecher, H.A. 1875;<br>Panceri, P. 1878;<br>Schepotieff, A. 1907a, 1907b;<br>Southern, R. 1914;<br>Remane, A. 1936;<br>Zaneveld, J.S. 1938;<br>Nyholm, K.-G. 1947a;<br>Mari, M. & Morselli, I. 1987;<br>Sánchez, N., Herranz, M., Benito, J. & Pardos, F. 2012 |

The Black Sea kinorhynch fauna is represented by 10 species including *Centroderes spinosus* (Reinhard, 1881), *Echinoderes agigens* Bacescu, 1968, *Echinoderes dujardinii* Claparède, 1863, *Kinorhynchus paraneapolitanus* Sheremetevskij, 1974, *Pycnophyes communis* Zelinka, 1908, *Pycnophyes dentatus*

(Reinhard, 1881), *Pycnophyes kielensis* Zelinka, 1928, *Pycnophyes ponticus* (Reinhard, 1881), *Semnoderes ponticus* Bacescu & Bacescu, 1956, and *Semnoderes armiger* Zelinka, 1928 (Bacescu 1961; Bacescu *et al*. 1971). Sergeeva (2003) reported the occurrence of several kinorhynch species from Crimean waters as well. The previous reports of *E. dujardinii* from the Black Sea are by Bacescu *et al*. (1963, 1971), Marinov (1964) and Bacescu (1968) although considered questionable (Higgins 1983) because of the lack of details or descriptions. Bacescu et al. (1971) mentioned that the habitat of the species was upper infralittoral rocky substrate, occupying a niche within the sediments mixed with diatoms and cyanophyceans that cover the rocky substrate as well as the muddy sands from the Danube mouth.

The known kinorhynch fauna of Turkey is scarce mainly due to just recently conducted surveys of meiofauna (Ürkmez *et al*. 2016) or the fact that only a few researchers around the world deal with these organisms. Moreover, meiobenthic sampling techniques generally result in obtaining just a few individuals; collecting the number of specimens needed for taxonomic research requires specific sampling procedures and locations targeting the members of this phylum (Pardos F. pers comm; Sørensen & Landers 2014).

**Acknowledgements**

This research was supported by the project "Meiofauna as an environmental bio-indicator in marine ecosystems of Turkish and Montenegro" (project no 114Y376) sponsored by TÜBİTAK (The Scientific and Technological Research Council of Turkey) and MoS (The Ministry of Science of Montenegro). The authors wish to acknowledge the anonymous reviewers for their helpful comments to the manuscript.

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