

## The First Record of Three Cymothoid Isopods from Red Sea Fishes, Yemeni Coastal Waters

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International Journal of Marine Science, 2013, Vol.3, No.21 doi: 10.5376/ijms.2013.03.0021

Received: 14 Mar., 2013

Accepted: 18 Apr., 2013

Published: 23 Apr., 2013

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Preferred citation for this article:

Al-Zubaidy and Mhaisen, 2013, The First Record of Three Cymothoid Isopods from Red Sea Fishes, Yemeni Coastal Waters, International Journal of Marine Science, Vol.3, No.21 166–172 (doi: 10.5376/ijms.2013.03.0021)

**Abstract** A total of 680 fish specimens belonging to 31 species from the Yemeni coastal waters of the Red Sea were inspected for the poorly studied isopod infestations. Three isopod species of the suborder Cymothoidea, family Cymothoidae were detected. These are *Nerocila orbignyi* (Guérin-Méneville, 1832) from both *Moolgarda seheli* and *Liza aurata*, *Cymothoa exigua* Schioedte and Meinert, 1884 from both *Lutjanus gibbus* and *Chelon macrolepis* and *Ceratothoa capri* (Trilles, 1964) from *C. macrolepis*. All these isopod species are reported here for the first time from the Yemeni coastal waters of the Red Sea.

**Keywords** Isopoda; Cymothoidae; Marine fishes; Red Sea; Yemen; Geographical distribution

### 1 Introduction

Marine isopods play an important role in the food web, in particular in removing decaying material from natural or altered environments and they also represent an important factor of economic unbalance (Espinosa Perez and Hendrickx, 2001). They occur on fish host on the outer body or fins, in the mouth, gill chambers, or nostrils, or occasionally in self-made pockets in the flesh of their hosts (Hoffman, 1998). Isopods cause significant economic losses to fisheries by killing, stunting, or damaging these fishes. They can also kill or impair immature fishes so that they do not survive (Bunkley-Williams et al., 2006). Isopod crustaceans are part of the greatest fish ectoparasite group and are easy to identify due to their size, morphological aspects and because they are easily found on the outer part of fish bodies (Thatcher, 2000). According to WoRMS (2013), the marine species of the order Isopoda are classified into 12 suborders among which the suborder Cymothoidea includes 29 families. Among the families of the suborder Cymothoidea, the family Cymothoidae included 43 genera and 358 species.

The family Cymothoidae includes parasites of numerous families and species of marine, freshwater or brackish water teleost fishes (Brusca, 1981). Members of this family have been recorded from the Mediterranean

Sea, Adriatic Sea, Black Sea and Atlantic Ocean (Trilles, 1991). They are found in various parts of the fish body, including the buccal cavity, gills chamber and fins (Kayis and Ceylan, 2011). They provide portals of entry for other pathogens in fish (Horton and Okamura, 2003). They are haematophagous; feeding on their host blood by producing an anticoagulant substance from their latero-oesophagus glands (Romestand and Trilles, 1976).

Marine isopods are poorly studied animals in many regions of the world and some groups remain completely undescribed (El-Shahawy and Desouky, 2010). This was the situation in the Red Sea (Hiekal and El-Sokkary, 1990), particularly in Yemen, as there is only one published report dealing with the record of the isopod *Gnathia* sp. from one fish species from the Yemeni coast of the Red Sea (Al-Zubaidy, 2007). Therefore, the objective of the present study was to focus on the analyses of the isopoda fish parasitic fauna of the Yemeni coastal waters of the Red Sea.

### 2 Data and Methods

Fishes belonging to 31 different species were examined for ectoparasites. These fish were obtained during the period from October 2009 till May 2010 by spear fishing, gill netting in shallow Yemeni coastal waters

of the Red Sea and some fishes were purchased from Al-Mehwat fish market at Al-Hodeidah city, Yemen. Fishes were freshly brought to the laboratory and their whole body surface, inside the mouth and the gill arches were examined for parasites. Table 1 gives a list of these fishes with their families, numbers and both their range and mean length. Fish scientific

names were checked according to Froese and Pauly (2013). Parasites were removed from their hosts and preserved in 10% seawater formalin. Parasites appendages were dissected out with a needle in pure phenol for the study of temporary mounts. The drawings were made by using a camera Lucida and photographs were made with a Samsung digital camera, 10.1 mega pixels.

Table 1 List of fishes from the Yemeni waters of the Red Sea examined for isopods

Fish families and species	No. fishes examined	Range and (mean) of fish length (cm)
<b>Carangidae</b>		
<i>Carangoides bajad</i> (Forsskål, 1775)	33	24.5–33.0 (26.5)
<i>Caranx fulvoguttatus</i> (Forsskål, 1775)	10	19.0–30.0 (25.0)
<i>Caranx sexfasciatus</i> Quoy & Gaimard, 1825	25	22.0–28.5 (24.0)
<b>Serranidae</b>		
<i>Epinephelus fuscoguttatus</i> (Forsskål, 1775)	30	18.0–27.5 (24.3)
<i>Epinephelus guttatus</i> (Linnaeus, 1758)	20	22.5–26.9 (24.2)
<i>Epinephelus polyphkadion</i> (Bleeker, 1849)	27	17.8–25.5 (23.0)
<i>Epinephelus tauvina</i> (Forsskål, 1775)	29	21.0–29.0 (25.0)
<b>Lutjanidae</b>		
<i>Lutjanus argentimaculatus</i> (Forsskål, 1775)	21	23.5–31.9 (28.8)
<i>Lutjanus bohar</i> (Forsskål, 1775)	22	16.5–24.8 (22.8)
<i>Lutjanus gibbus</i> (Forsskål, 1775)	23	19.7–26.5 (23.3)
<b>Haemulidae</b>		
<i>Pomadasys argenteus</i> (Forsskål, 1775)	25	24.8–30.4 (27.9)
<i>Pomadasys commersonii</i> (Lacepède, 1801)	25	20.8–28.2 (25.4)
<i>Pomadasys multimaculatum</i> (Playfair, 1867)	17	21.5–27.3 (25.9)
<b>Lethrinidae</b>		
<i>Lethrinus lentjan</i> (Lacepède, 1802)	30	25.7–34.6 (29.3)
<i>Lethrinus mahsena</i> (Forsskål, 1775)	20	22.6–27.5 (26.2)
<i>Lethrinus nebulosus</i> (Forsskål, 1775)	20	23.9–29.4 (27.8)
<i>Lethrinus olivaceus</i> Valenciennes, 1830	15	19.5–28.3 (25.7)
<b>Sphyraenidae</b>		
<i>Sphyraena barracuda</i> (Edwards, 1771)	25	35.5–44.4 (39.6)
<i>Sphyraena flavicauda</i> Rüppell, 1838	20	32.8–39.0 (34.0)
<i>Sphyraena jello</i> Cuvier, 1829	20	30.5–38.5 (35.7)
<b>Mugilidae</b>		
<i>Chelon macrolepis</i> (Smith, 1846)	9	17.8–26.5 (24.5)
<i>Liza aurata</i> (Risso, 1810)	13	21.4–28.5 (25.8)
<i>Moolgarda seheli</i> (Forsskål, 1775)	24	24.0–29.4 (27.4)
<b>Balistidae</b>		
<i>Abalistes stellatus</i> (Anonymous, 1798)	17	25.7–40.0 (38.5)
<b>Ariidae</b>		
<i>Netuma thalassina</i> (Rüppell, 1837)	20	30.0–36.5 (33.7)
<i>Plicofollis dussumieri</i> (Valenciennes, 1840)	20	32.0–37.5 (33.0)
<b>Scombridae</b>		
<i>Gymnosarda unicolor</i> (Rüppell, 1836)	10	37.0–42.5 (40.6)
<i>Rastrelliger kanagurta</i> (Cuvier, 1816)	30	16.5–24.5 (18.7)
<i>Scomberomorus commerson</i> (Lacepède, 1800)	25	35.5–47.5 (41.8)
<i>Scomberomorus guttatus</i> (Bloch & Schneider, 1801)	25	34.8–42.6 (39.0)
<i>Thunnus tonggol</i> (Bleeker, 1851)	30	45.5–56.7 (49.3)

Specimens were identified according to Bruce (1987), Kensley and Schotte (1989) and Trilles et al. (1989). In addition, some specimens were sent for identification to Prof. Dr. N. L. Bruce of the University of Copenhagen and Prof. Dr. S. Ravichandran of the Annamalai University, India.

### 3 Results

#### 3.1 Inventory of parasites collected

A total of 680 fish specimens belonging to 10 families and 31 fish species were examined. Among these fishes, only four species were infected with three species of isopods. The infected fishes were: *Chelon macrolepis* (Smith, 1846), *Liza aurata* (Risso, 1810) and *Moolgarda seheli* (Forsskål, 1775) of the family Mugilidae as well as *Lutjanus gibbus* (Forsskål, 1775) of the family Lutjanidae. The detected isopods were: *Nerocila orbigny* (Guérin-Méneville, 1832), *Cymothoa exigua* Schioedte and Meinert, 1884 and *Ceratothoa capri* (Trilles, 1964). Detailed information on these isopods and their particular hosts together with the site of infection and the infection rate for each isopod species will be shown in the subheadings (3.3-3.5).

#### 3.2 Taxonomy of isopod species

Inspection of the collected fishes revealed the occurrence of three isopod species. These are *Nerocila orbigny*, *Cymothoa exigua* and *Ceratothoa capri*. According to WoRMS (2013), all these parasites belong to the family Cymothoidae, superfamily Cymothoidea, suborder Cymothoidea, order Isopoda, superorder Peracarida, subclass Malacostraca and subphylum Crustacea of the phylum Arthropoda.

The following is a brief account on the site and rate of infection of the fish hosts from the Red Sea with these isopods, description and synonyms of concerned parasites as well as the geographical distribution of the known hosts for such parasites in the world.

#### 3.3 *Nerocila orbigny* (Guérin-Méneville, 1832)

Materials examined: Two female specimens of *N. orbigny* were found attached to the base of the pectoral fin of two mugilid fishes; one (out of 24) specimen of *Moolgarda seheli* and one (out of 13) specimen of *Liza aurata*. So, the infection rate of these two fishes with *N. orbigny* was 4.2% and 7.7%, respectively. Length of the infected fishes was 24.8 cm and 26.5 cm, respectively and their weight was

105 gm and 150 gm, respectively.

Description: Based on two specimens. Body size of the parasite 10.5-11.5 (11.0) mm long and 5.0-5.4 (5.2) mm wide. Cephalon anterior margin within distinct medial point; eyes small. Pereonites 1-4 posterolateral angles not produced; pereonites 5-7 posterolateral angles produced, acute. Pleonite 1 longest ventrolateral margins of pleonites 1 and 2 posteriorly directed, extending to, or beyond pleonite 5; pleonites 3-5 lateral margins weakly produced, narrowly rounded. Pleotelson lateral margins angled, then converging to caudomedial point. Antennule articles 1 and 2 partly fused; antenna with 11 articles. Pereopod dactyli without nodules. Pleopod 2 appendix masculina about 0.5 length of endopod; pleopod 5 endopod with 2 large folds. Uropod exopod curving medially; endopod straight, distal margin obliquely truncate, with distomedial point (Figure 1 and Figure 2).



Figure 1 A: *Nerocila orbigny* attached to the base of the pectoral fin of *Moolgarda seheli*. B: *Nerocila orbigny*, dorsal view

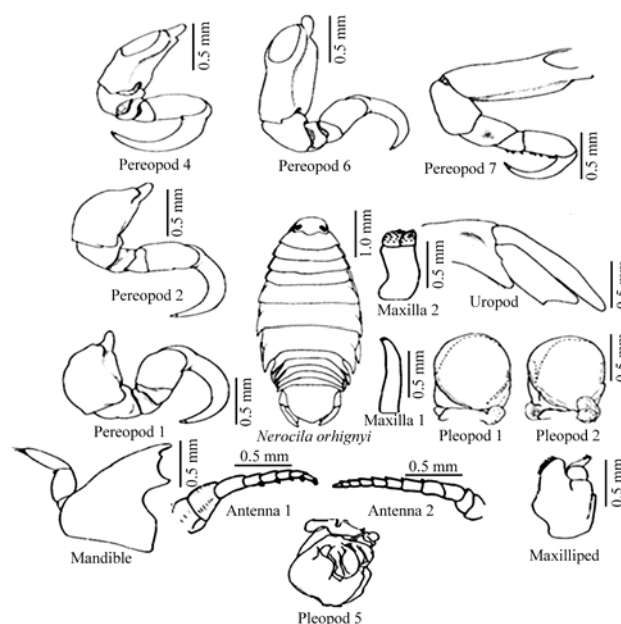


Figure 2 Camera Lucida drawings of *Nerocila orbigny* from the Red Sea, Yemen coast

### 3.4 *Cymothoa exigua* Schioedte and Meinert, 1884

Materials examined: One female specimen of the tongue-eating louse *C. exigua* was found on the gill of one (out of 23) *Lutjanus gibbus* whose length and weight was 23 cm and 110 gm, respectively. A second female specimen of *C. exigua* was found attached in the mouth of one (out of nine) *Chelon macrolepis* whose length and weight was 20.5 cm and 75 gm, respectively. So, the infection rate of these two fishes with *N. orbigny* was 4.3% and 11.1%, respectively.

Description: Based on two specimens. Body length 11-14 (13.0) mm and width 6.0-9.0 (7.3) mm. Cephalon, posterior border not trisinuate; weakly to moderately immersed into pereonite 1. Eyes well developed. Antennae 1 of 7-9 articles, extended to or falling short of anterior third of pereonite 1. Antennae 2 of 7-10 articles, extended to anterior 1/3 to 1/2 of pereonite 1. Maxilliped with 4-7 spines on distal article. Maxilla 1 with 4 (rarely 5) terminal spines. Maxilla 2 with denticles along margins and semilunar pectinate scales on medial surfaces. Mandible palp articles 1 and 2 sub-equal in length; article 3 small, without setae. Pereon: Pereonite 1 longest; 2-4 sub equal in length; 5-7 decreasing in length posteriorly; 7 shortest. Pereonites 5-6 widest. All coxae fail to reach posterior margins of their respective segments; Pereopods 1-7 without spines; increasing in length posteriorly; 4-7 with carinae on basis, increasing in size posteriorly. Pleon: Pleonites 1-5 with medial elevation; 4-5 widest; 5 longest. All pleopods with lateral accessory lamella on basis, increasing in size posteriorly. Endopods of pleopods 1-5 with medioproximal accessory lamella, increasing in size posteriorly. Pleopod 2 with appendix masculinum, variable in size. Pleopods 3-4 usually with a single fold or pocket on medioproximal surface of endopod. Pleotelson wider than long; posterior margin concave in larger individuals. Uropodal rami narrow and elongate, but not extended beyond posterior border of pleotelson (Figure 3 and Figure 4).

### 3.5 *Ceratothoa capri* (Trilles, 1964)

Materials examined: Females of *C. capri* were found in the buccal cavity of two (out of nine) specimens of the mugilid fish *Chelon macrolepis*. So, the infection rate was 22.2%. Length of these infected fishes was 20.5 cm and 22 cm, respectively and their weight was 98 gm and 110 gm, respectively.

Description: Based on two specimens. Body very stocky,

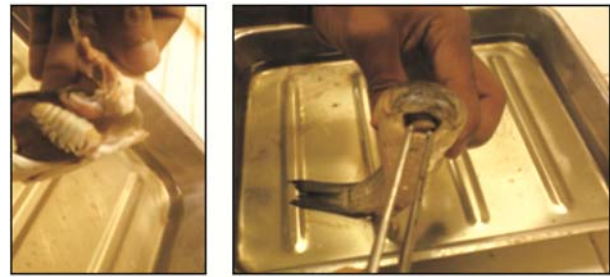


Figure 3 Photograph of *Cymothoa exigua* attached in the buccal cavity of *Chelon macrolepis* from the Red Sea, Yemen

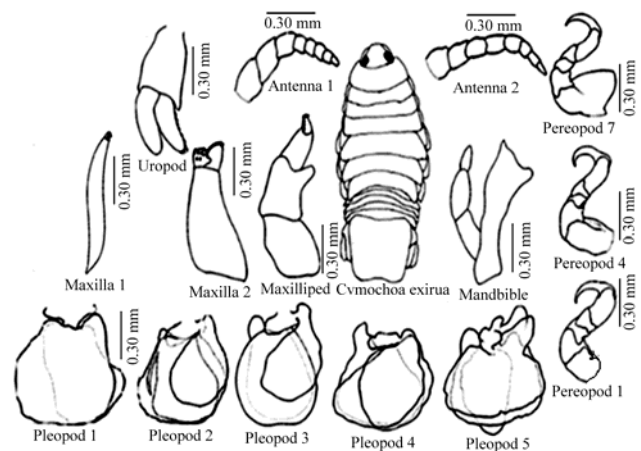


Figure 4 Camera Lucida drawings of *Cymothoa exigua* from the Red Sea, Yemen coast

distinctly elliptical, oval to rounded. Length 15-18 mm; width 7-9 mm with greatest at pereonite 4. Expansions on the pereopods 6-7 on the lower edge only. Antennules, extending to middle of the eyes, composed of 7 articles. Maxillule simple. Pereonite 1 with anterolateral angles extended to anterior margins of the eyes. Pereopods 1-3 increasing gradually in size. Pleopods simple and decreasing in size posteriorly. Uropod extending or slightly beyond posterior margin of the pleotelson if stretched out. Exopod of ramus shorter and wider than endopod of ramus (Figure 5).

## 4 Discussion and Conclusion

### 4.1 *Nerocila orbigny* (Guérin-Méneville, 1832)

The genus *Nerocila* is a large genus which includes 42 species (WoRMS, 2013). *N. orbigny* is an ectoparasite that attaches to the skin and fins of fish and generally infects fishes of the family Mugilidae (Kayis and Ceylan, 2011). According to Brusca (1981), inflammation and bacterial or fungal infections are often observed around feeding wounds caused by this ectoparasite. However, no inflammation or secondary infections were

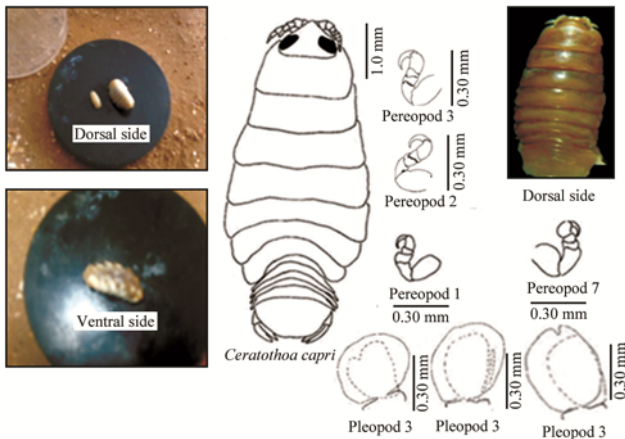


Figure 5 Photographs and Camera Lucida drawings of *Ceratothoa capri* from the Red Sea, Yemen coast

grossly evident at the sites where *N. orbigny* was attached to both *M. seheli* and *L. aurata* of the present investigation.

*N. orbigny* settles preferentially on members of the family Mugilidae (Trilles, 1994; Öktener and Trilles, 2004). According to Trilles and Raibaut (1973), *N. orbigny* has been collected from *Alosa agone* (Scopoli, 1786) (reported as *Alosa fallax nilotica*), *Mugil cephalus* (Linnaeus, 1758), *Liza aurata* (reported as *Mugil auratus*), *Liza ramada* (Risso, 1827) (reported as *Mugil capito* Cuvier, 1829), *Chelon labrosus* (Risso, 1827) (reported as *Mugil chelo* Cuvier, 1829) and *Chelon labrosus* (Risso, 1827) (reported as *Mugil labrosus*). Charfi-Cheikrouha et al. (2000) reported *N. orbigny* from *Liza ramada*, *Liza saliens* (Risso, 1810), *L. aurata*, *Dicentrarchus labrax* (Linnaeus, 1758), *Solea solea* (Linnaeus, 1758), *Serranus scriba* (Linnaeus, 1758), *Chelon labrosus* and *Diplodus annularis* (Linnaeus, 1758). However, *N. orbigny* has also been reported from several other fishes such as *Chimaera* sp. by Hale (1926), *Halobatrachus didactylus* (Bloch & Schneider, 1801) and *Solea senegalensis* (Kaup, 1858) by Dollfus and Trilles (1976), *Callorhynchus milii* Bory de Saint-Vincent, 1823, *Acanthopagrus australis* (Günther, 1859), *Pagrus auratus* (Forster, 1801) (reported as *Chrysophrys auratus*), *Pseudocaranx dentex* (Bloch & Schneider, 1801), *Mola mola* (Linnaeus, 1758), *Sillago bassensis* Cuvier, 1829, *Pomatomus saltatrix* (Linnaeus, 1766) *Girella tricuspidata* (Quoy & Gaimard, 1824), *Chelidonichthys kumu* (Cuvier, 1829) and *Dactyloptena orientalis* (Cuvier, 1829) by Bruce (1987), *Trigla lyra*

Linnaeus, 1758 and *Symphodus tinca* (Linnaeus, 1758) by Ramdane et al. (2007) and *Sarotherodon galilaeus* (Linnaeus, 1758) (reported as *Tilapia galilaea*) by Wunder (1961).

In connection with the geographical distribution, *N. orbigny* is widely distributed in the Mediterranean, Black Sea, Aegean Sea along the Turkish coasts (Öktener and Trilles, 2004), Morocco (Dollfus and Trilles, 1976), Tunisia (Trilles and Raibaut, 1973; Charfi-Cheikrouha et al., 2000), Italy (Merella and Garippa, 2001), Algeria (Ramdane et al., 2007), Mediterranean, Northwest Africa, Red Sea in Egypt and New Zealand (Trilles, 1994), Southern Western Australian coasts (Bruce, 1987) and Portugal (Marques et al., 2005). As no previous record of *N. orbigny* existed from the Red Sea of Yemen, the present study provides the first record of this isopod from fishes of the Red Sea within the Yemeni coastal waters.

#### 4.2 *Cymothoa exigua* Schioedte and Meinert, 1884

Female of *C. exigua* attaches to the tongue and the male attaches on the gill arches beneath and behind the female. It extracts blood through the claws on its front causing the tongue to atrophy from lack of blood. The parasite then replaces the fish tongue by attaching its own body to the muscles of the tongue stub. The fish is able to use the parasite just like a normal tongue. It appears that the parasite does not cause any other damage to the host fish (Brusca and Gilligan, 1983). According to WoRMS (2013), there are 47 species of *Cymothoa* but among these species, only *C. exigua* is known to consume and replace the tongue of its host (Thatcher et al., 2007). It is believed that *C. exigua* is not physically harmful to humans unless picked up alive, in which case they can bite as some customers in Puerto Rico claimed to have been poisoned by eating an isopod cooked inside a snapper. This case, however, was dropped stating that isopods are not poisonous to humans and some are even consumed as part of a regular diet (Williams and Bunkley-Williams, 2003).

According to Brusca (1981), *C. exigua* is known to parasitize *Orthopristis reddingi* Jordan & Richardson, 1895, *Leuresthes sardina* (Jenkins & Evermann, 1889), *Cynoscion othonopterus* Jordan & Gillbert, 1882, *Lutjanus peru* (Nichols & Murphy, 1922), *Lutjanus guttatus* (Steindachner, 1869), *Micropogonias*

*megalops* (Gilbert, 1890), *Menticirrhus nasus* (Günther, 1868) and *Pomadasyds maculatus* (Bloch, 1793) (reported as *Lutjanus maculatus*). To the above list, Williams and Bunkley-Williams (2003) added *Lutjanus colorado* Jordan and Gilbert, 1822 and *Lutjanus jordani* (Gilbert, 1898).

In connection with the geographical distribution, *C. exigua* is of interest because it is shipped all over the world in commercial catches of snappers from the Eastern Pacific. It has a Panamic distribution extending from the Gulf of California south to just north of the Gulf of Guayaquil, Ecuador (Williams and Bunkley-Williams, 2003). Literature concerning its distribution includes Williams and Bunkley-Williams (1978), Brusca (1981), Ruiz and Madrid (1992), Alvarez and Flores (1997) and Williams and Bunkley-Williams (2003). So, the present study provides the first record of *C. exigua* from the Red Sea fishes within the Yemeni coastal waters.

#### 4.3 *Ceratothoa capri* (Trilles, 1964)

According to Öktenen and Trilles (2004) and Kirkim et al. (2008), *C. capri* has been found parasitizing *Boops boops* (Linnaeus, 1758), *Diplodus annularis*, *Diplodus puntazzo* (Walbaum, 1792), *Sparus aurata* Linnaeus, 1758 and *Spicara smaris* (Linnaeus, 1758).

In connection with the geographical distribution, *C. capri* was reported from Aegean coast of Turkey (Öktenen et al., 2010) and from the Mediterranean coast of Turkey (Innal and Kirkim, 2012). According to Horton (2000), *C. capri* is distributed in the Mediterranean (Nouvelle, France) and Tunisia (La Galite, Tabarka). So, the present study documents the first record of *C. capri* from the Red Sea fishes within the Yemeni coastal waters.

#### Acknowledgements

The authors wish to express their hearty thanks to Prof. Dr. Niel L. Bruce, Museum of Tropical Queensland, Queensland Museum, Townsville, Australia and Prof. Dr. S. Ravichandran, Parasitology Lab Center of Advanced Study in Marine Biology, Annamalai University, Parangipettai, India, for identification of species and providing helpful comments.

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