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The blue spot mullet *Moolgarda seheli* (Forsskål, 1775) a new host for the crustacean parasite *Cymothoa indica*

Ali B. Al-Zubaidy[1], Furhan T. Mhaisen[2]

[1]Department of Biology, Zabid Education College, Hodeidah University, Yemen
[2]Tegnervägen 6B, 641 36 Katrineholm, Sweden

Email address

ali_alzubady2000@yahoo.com (Ali B. Al-Zuaidy), mhaisenft@yahoo.co.uk (F. T. Mhaisen)

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Abstract

The cymothoid isopod *Cymothoa indica* Schioedte and Meinert, 1884 is recorded here for the first time in the present study from the blue spot mullet *Moolgarda seheli* (Forsskål, 1775) from the Yemeni coastal waters of the Red Sea. A total of 46 out of 115 fishes were infected with mature male and female isopods. The parasites are distinguishable from the other species of the genus *Cymothoa* principally by having a poorly developed amphicephalic process, oblong body, pyriform cephalon and presence of well-developed lobe on ischium of pereopod VII. The parasites were found in the buccal and the branchial cavities of the infected fishes. In addition to the infection parameters, some observations on other infection aspects and site specificity were also discussed.

Keywords

Isopoda, *Cymothoa indica*, *Moolgarda seheli*, Red Sea, Yemen

1. Introduction

Among the isopods, the suborder Cymothoida is the largest suborder which includes 11 families, 172 genera and 2629 species (WoRMS, 2014). The family Cymothoidae includes 43 genera and 357 species (WoRMS, 2014). Most cymothoids occur in coastal, shallow-water environments (Bunkley-Williams and Williams, 1998). Cymothoids are obligatory parasites infesting many commercially important fishes. Some cymothoids, forming pouches in the lateral musculature of few freshwater and marine fishes, are highly host and site specific (Brusca, 1981). They are protandrous hermaphrodites and bloodsuckers, living on the skin, gill filaments, or in the mouth of fishes. Usually these are larger parasites of fishes (Costa and Chellappa, 2010) which can cause deleterious effects to their hosts by inflicting large wounds, impairing growth rates and occasionally killing the fishes (Bunkley-Williams and Williams, 1998). They have piercing-sucking mouth parts that are used for parasitic feeding and are capable of causing detrimental effects to their host (Bakenhaster *et al.*, 2006). Ravi and Rajkumar (2007) showed that loss of weight, thickening of gill arch and gill filaments, reduction of gill surface area and the affection of fish swimming capacity are among the effects exerted by *Cymothoa indica* on the gobiid fish *Oxyurichthys microlepis*.

Little is known on the isopods of Red Sea fishes within the coastal waters of Yemen. Among families of the suborder Cymothoida, five families (with eight species) are represented in Yemen waters so far recorded from Red Sea fishes of the Yemeni coastal waters (Al-Zubaidy, 2007; Al-Zubaidy and Mhaisen, 2013, 2014). So, the present study adds a new item to the isopod fauna (*C. indica*) of Yemeni fishes with the record of a new global fish host (*Moolgarda seheli*) for this isopod. *M. seheli* has an ecologically importance as primary consumer at coastal and estuarine food chains and also a representative species for rearing in fish farms (Katsuragawa *et al.*, 2006). It is widely distributed in Indo-Pacific, Red Sea, South Africa, east of Hawaiian and

Marquesan islands, north to southern Japan, south to New Caledonia, Norfolk Island and Tuamotu Islands (Froese and Pauly, 2014). It is one of the important commercial fish species in Yemeni markets.

2. Materials and Methods

A total of 115 specimens of the blue spot mullet *M. seheli* were captured by using trawl, gill nets and a long line fishing net measuring 150 m long and 2.5 m deep, with upper hoop floating apparatus, and mesh size measuring 20, 30 and 35 mm. Sampling was done from the Red Sea at Ras Salif site (15°18'59"N and 42°40'18"E) north of Hodeidah City, Yemeni coastal waters during the period from September 2011 till November 2012. Following their capture, all fishes were brought in cold ice box to the laboratory of the Department of Marine Biology and Fisheries, Hodeidah University and individually inspected for the presence of isopods. Fishes varied from 175 to 210 gm in weight and 19-25 cm in total length.

The recovered parasitic isopods were removed from the mouths and gill chambers of the infected fish. Their sizes were measured after being washed in physiological saline solution and fixed in 70% ethyl alcohol. Parasites were cleared and mounted according to Thatcher (1991). Parasites appendages were dissected out with a fine needle in pure phenol for the study of temporary mounts. The drawings were made by using a camera Lucida and the photographs were made with a Samsung digital camera, 10.1 mega pixels. Froese and Pauly (2014) and WoRMS (2014) were used to check all the scientific names of both the fishes and the parasites which appeared in this article.

The recovered parasites were morphologically identified according to some available literatures (Trilles, 1975; Veerappan and Ravichandran, 2000; Rajkumar *et al.*, 2004, 2005a, b). In addition, some specimens were shipped to Prof. Dr. S. Ravichandran of the Annamalai University, India for confirming the identification.

3. Results and Discussion

Examination of collected *M. seheli* showed that some of them were infected with the isopod *C. indica*. This isopod belongs to the family Cymothoidae, suborder Cymothoida, order Isopoda, class Malacostraca, subphylum Crustacea of the phylum Arthropoda (WoRMS, 2014). However, EOL (2014) spells the suborder Cymothoida as Cymothoidea and ITIS (2014) includes *C. indica* in the suborder Flabellifera. No other parasitic organisms were observed that might be associated with such a crustacean. The following is an account on this isopod.

3.1. *Cymothoa indica* Schioedte and Meinert, 1884 (Figs. 1 and 2)

3.1.1. Materials Examined

Sixty-three specimens of *C. indica* (36 females and 27 males) were collected from 46 out of 115 examined *M. seheli*. The infected fishes were 31 females and 15 males. So, possibly female fishes were more frequently infected than males. This is in agreement with the results of El-Shahawy and Desouky (2010) on the infection of the Pinecone soldierfish *Myripristis murdjan* from the Red Sea, Egypt with *C. indica*. On the other hand, Ravi and Rajkumar (2007) noticed that male *Oxyurichthys microlepis* from the South-east coast of India had higher prevalence of infection with *C. indica* compared with the females.

3.1.2. Description of the Female

Body length 18-22 (19) mm, width 6.5-8.5 (8.0) mm; body oblong, symmetrical, creamy white with faint chromatophores on the dorsal side of cephalon; Cephalon triangular broader rounded, eyes well developed; Pereon narrow anteriorly, Pereopods thick, all the falcate dactylus; Pleon, narrow, triangular, pleopods long, nearly circular, rami unequal.

3.1.3. Description of the Male

Length 9.5-12 (10.5) mm, width 3-5 (4.0) mm; small, parallel-sided, eyes dark.

Fig 1. *Photograph of Cymothoa indica from Red Sea fish Moolgarda seheli, Yemen.*

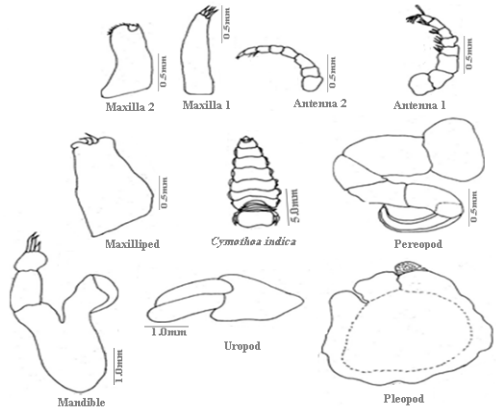

Fig 2. *Camera Lucida drawings of Cymothoa indica from Red Sea fish Moolgarda seheli, Yemen.*

3.1.4. Host

The present host for *C. indica* is the blue spot mullet *Moolgarda seheli* (Forsskål, 1775).

3.1.5. Locality

Red Sea, northern of Hodeidah city, Yemen.

3.1.6. Prevalence of Infection

The overall prevalence of infection was 40%. This is higher than those reported for some cymothoid species by other workers, such as 15-17% for *Lironeca puhi*, which is a synonym of *Ichthyoxenus puhi* on Hawaiian moray eel *Gymnothorax eurostus* (Bowman, 1960), 1.7% for *Livoneca ovalis* on white perch *Morone americana* (Sadzikoswski and Wallace, 1974), 1.5% for *Cymothoa ktiskhani* in *Platycephalus insidiator*, which is a synonym of *P. indicus* (Jayadev Babu and Sanjeevaraj, 1985); 3.6% in *Livoneca* sp. of *Atherinomorus lacunosus* in Red Sea (Colorni *et al.*, 1997), 5.0% for *Mothocya epimerica* infestations in *Atherina boyeri* found in the Sinop coasts of the Black Sea (Özer, 2002), 27.8% for *C. indica* on *Oxyurichthys microlepis* from the south-east coast of India (Ravi and Rajkumar, 2007), 7.4% in *Nerocila bivittata* on *Parablennius sanguinolentus* in the Samsun coast of the Black Sea (Alas *et al.*, 2008), 15.3% and 11.76% for *Cymothoa spinipalpa* on the *Lutjanus synagris* and *Caranx crysos*, respectively from Brazil (de Carvalho-Souza *et al.*, 2009) and 5.9% for *Livoneca redmanii* from *Chloroscombrus chrysurus* (Costa and Chellappa, 2010). On the other hand, the present prevalence of infection with *C. indica* (40%) is lower than that recorded by Panikkar and Aiyar (1937) in Madras (77.7%) in case of *C. indica* from *Etroplus maculatus* and *E. suratensis* and 81.3 % in case of *C. indica* from Red Sea fish *Myripristis murdjan* in Egypt (El-Shahawy and Desouky, 2010).

3.1.7. Intensity of Infection

Only one or two parasites were found in each infected fish. A total of 63 specimens of *C. indica* were collected from 46 infected fishes. So, the mean intensity of infection was 1.37 parasites per infected fish. The detected isopods stayed alive as long as 4-5 hours after the death of their host. In most cases, one pair of adult parasite was found but in some cases a single female parasite per host, with larva in its brood pouch, was seen in the buccal cavity.

3.1.8. Abundance

As only 63 specimens of *C. indica* were collected from a total of 115 examined fishes, so the overall abundance was 0.55 parasites per examined fish.

3.1.9. Site of Infection

Buccal cavity and branchial cavity. *C. indica* prefers to infect these sites only. No alternative sites of infection, other than buccal and branchial cavities, could be noticed. However, it was reported from the mouth of the Pinecone soldierfish *Myripristis murdjan* in Egypt (El-Shahawy and Desouky, 2010). Rajkumar *et al.* (2004) observed severe infection with *C. indica* in the buccal cavity of the spot-tail needlefish *Strongylura strongylura* in India. *C. indica* was found mainly in the mouth, occasionally in the branchial cavities and more rarely on the body of *Sphyraena chrysotaenia* from the eastern Mediterranean Sea (Trilles and Bariche, 2006). This preference might be attributed to genetic or environmental differences (Bello *et al.*, 1997).

3.1.10. Distribution

Previous records are entirely from the Indian Ocean; Bangkok, Thailand (Schioedte and Meinert, 1884), India, Chilka Lake (Chilton, 1924); Madras (Panikkar and Aiyar, 1937), the Hooghly estuary, Sundarbans, West Bengal (Misra and Nandi, 1986), Parangipettai coast (Veerappan and Ravichandran, 2000; Rajkumar *et al*., 2004, 2005a, b; Ravi and Rajkumar, 2007); Lebanon (Trilles and Bariche, 2006) and recently from Egypt **(**El-Shahawy and Desouky, 2010). So, the present study adds the coastal waters of Red Sea in Yemen to the distribution of this parasite.

3.1.11. Previous Recorded Hosts

C. indica was originally described on the basis of two specimens collected from the Indian Ocean at Bangkok without a reference to the host (Trilles *et al.*, 2011). Subsequently, it was reported from several fish species such as *Glossogobius giuris* (Chilton, 1924; Panikkar and Aiyar, 1937), *Etroplus maculatus* and *E. suratensis* (Panikkar and Aiyar, 1937), *Sphyraena obtusata* and *Trachinocephalus myops*, which is a synonym of *Synodus myops* (Veerappan and Ravichandran, 2000), *Strongylura strongylura* (Misra and Nandi, 1986; Rajkumar *et al.*, 2004), *Stigmatogobius minima* (Rajkumar and Ravi, 2005), cultured *Mystus gulio* and *Lates calcarifer* (Rajkumar *et al*., 2005a, b), *Sphyraena chrysotaenia* (Trilles and Bariche, 2006), *Oxyurichthys microlepis* (Ravi and Rajkumar, 2007) and *Myripristis murdjan* (El-Shahawy and Desouky, 2010). Rameshkumar and Ravichandran (2010) reported *C. indica* for the first time in the freshwater fish *Tilapia mossambica*, which is a synonym of *Oreochromis mossambicus* from Vellar estuary, Southeast coast of India. However, Trillis *et al.* (2011) stated that these specimens from *T. mossambica* were misidentified as *C. indica*.

In the present study, *C. indica* is recorded for the first time from the Red Sea, Yemen, and *M. seheli* is a new host record for this parasite.

4. Conclusion

C. indica was reported from several fish species which didn't include *M. seheli*. So, *M. seheli* now represents a new host record for this parasite in the world. It is worthwhile to state here that in the sampling site of the present study, five fish species (*Pomadasys argenteus*, *Lethrinus lentjan*, *L. nebulosus*, *Scomberomorus commerson* and *S. guttatus*) were also examined, for other parasitological examination purposes, but no infestation was recorded in these fish species with the isopod *C. indica*. Colorni *et al.* (1997) showed that *Livoneca* sp. infested only *Atherinomorus lacunosus*, while another indigenous species of Red Sea, the

silverside *Hypoatherina temminckii* had no infestation at all.

Previous records of this isopod are entirely from the Indian Ocean. However, it was reported also from Lebanon (Trilles and Bariche, 2006) and from Egypt (El-Shahawy and Desouky, 2010). So, the present study adds the coastal waters of Red Sea in Yemen to the distribution of this parasite.

As for the site of infection, *C. indica* of the present study was reported only from both the buccal cavity and branchial cavity. *C. indica* seems to prefer to infect these sites. Buccal cavity of the infected fishes was filled with excessive mucus. Excessive mucous secretion by the infected fish is a host response evoked to overcome the irritation caused by the parasite. Although no pathological investigation was performed in the present study, dystrophic and deformed filaments (callus-like thickening) were observed in the first gill arch. Similar findings were also noted by Colorni *et al*. (1997) and Özer (2002). The overall prevalence of infection of *M. seheli* with *C. indica* of the present study was 40% while the mean intensity of infection was 1.37 parasites per infected fish and the abundance was 0.55 parasites per examined fish.

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