International Journal of Marine Science 2013, Vol.3, No.21, 166-172
http://ijms.sophiapublisher.com

Research Article Open Access

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

A.B. Al-Zubaidy[1], F.T. Mhaisen[2]

1. Department of Marine Biology and Fisheries, Faculty of Marine Science and Environment, Hodeidah University, Yemen
2. Tegnervägen 6B, 641 36 Katrineholm, Sweden
Corresponding author email: mhaisenft@yahoo.co.uk

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

Preferred citation for this article:
Al-Zubaidy et al., 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 Cymothoida, family Cymothoidae were detected. These are *Nerocila orbignyi* (Guérin-Méneville, 1832) from both *Moolgarda seheli* and *Liza aurata*, *Cymothoa exigua* Schioedte & 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

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 Cymothoida includes 29 families. Among the families of the suborder Cymothoida, 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)
Carangidae		
Carangoides bajad (Forsskål, 1775)	33	24.5−33.0 (26.5)
Caranx fulvoguttatus (Forsskål, 1775)	10	19.0−30.0 (25.0)
Caranx sexfasciatus Quoy & Gaimard, 1825	25	22.0−28.5 (24.0)
Serranidae		
Epinephelus fuscoguttatus (Forsskål, 1775)	30	18.0−27.5 (24.3)
Epinephelus guttatus (Linnaeus, 1758)	20	22.5-26.9 (24.2)
Epinephelus polyphekadion (Bleeker, 1849)	27	17.8−25.5 (23.0)
Epinephelus tauvina (Forsskål, 1775)	29	21.0−29.0 (25.0)
Lutjanidae		
Lutjanus argentimaculatus (Forsskål, 1775)	21	23.5−31.9 (28.8)
Lutjanus bohar (Forsskål, 1775)	22	16.5−24.8 (22.8)
Lutjanus gibbus (Forsskål, 1775)	23	19.7−26.5 (23.3)
Haemulidae		
Pomadasys argenteus (Forsskål, 1775)	25	24.8−30.4 (27.9)
Pomadasys commersonnii (Lacepède, 1801)	25	20.8−28.2 (25.4)
Pomadasys multimaculatum (Playfair, 1867)	17	21.5−27.3 (25.9)
Lethrinidae		
Lethrinus lentjan (Lacepède, 1802)	30	25.7−34.6 (29.3)
Lethrinus mahsena (Forsskål, 1775)	20	22.6−27.5 (26.2)
Lethrinus nebulosus (Forsskål, 1775)	20	23.9−29.4 (27.8)
Lethrinus olivaceus Valenciennes, 1830	15	19.5−28.3 (25.7)
Sphyraenidae		
Sphyraena barracuda (Edwards, 1771)	25	35.5−44.4 (39.6)
Sphyraena flavicauda Rüppell, 1838	20	32.8−39.0 (34.0)
Sphyraena jello Cuvier, 1829	20	30.5−38.5 (35.7)
Mugillidae		
Chelon macrolepis (Smith, 1846)	9	17.8−26.5 (24.5)
Liza aurata (Risso, 1810)	13	21.4−28.5 (25.8)
Moolgarda seheli (Forsskål, 1775)	24	24.0−29.4 (27.4)
Balistidae		
Abalistes stellatus (Anonymous, 1798	17	25.7−40.0 (38.5)
Ariidae		
Netuma thalassina (Rüppell, 1837)	20	30.0−36.5 (33.7)
Plicofollis dussumieri (Valenciennes, 1840)	20	32.0−37.5 (33.0)
Scombridae		
Gymnosarda unicolor (Rüppell, 1836)	10	37.0−42.5 (40.6)
Rastrelliger kanagurta (Cuvier, 1816)	30	16.5−24.5 (18.7)
Scomberomorus commerson (Lacepède, 1800)	25	35.5−47.5 (41.8)
Scomberomorus guttatus (Bloch & Schneider,1801)	25	34.8−42.6 (39.0)
Thunnus tonggol (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 Mugillidae as well as *Lutjanus gibbus* (Forsskål, 1775) of the family Lutjanidae. The detected isopods were: *Nerocila orbignyi* (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 orbignyi*, *Cymothoa exigua* and *Ceratothoa capri*. According to WoRMS (2013), all these parasites belong to the family Cymothoidae, superfamily Cymothooidea, suborder Cymothoida, 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 orbignyi* (Guérin-Méneville, 1832)

Materials examined: Two female specimens of *N. orbignyi* 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. orbignyi* 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 truncate, with distomedial point (Figure 1 and Figure 2).

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

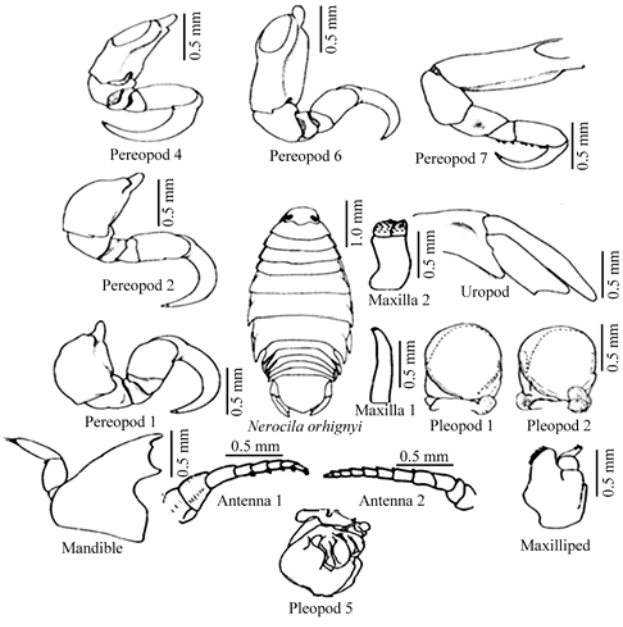

Figure 2 Camera Lucida drawings of *Nerocila orbignyi* from the Red Sea, Yemen coast

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 9) *Chelon macrolepis* whose length and weight was 20.5 cm and 75 gm, respectively. So, the infection rate of these two fishes with *N. orbignyi* 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; Pereopods1-7 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 macroleps*. 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

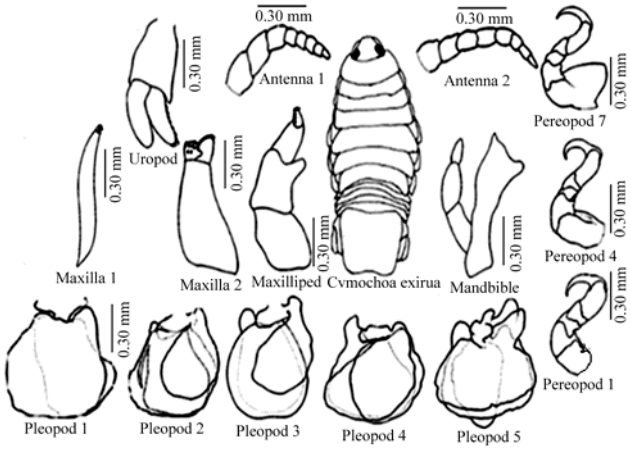

Figure 4 Camera Lucida drawings of *Cymothoa exigua* from the Red Sea, Yemen coast

stocky, 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 orbignyi* (Guérin-Méneville, 1832)

The genus *Nerocila* is a large genus which includes 42 species (WoRMS, 2013). *N. orbignyi* is an ectoparasite that attaches to the skin and fins of fish and generally infects fishes of the family Mugillidae (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

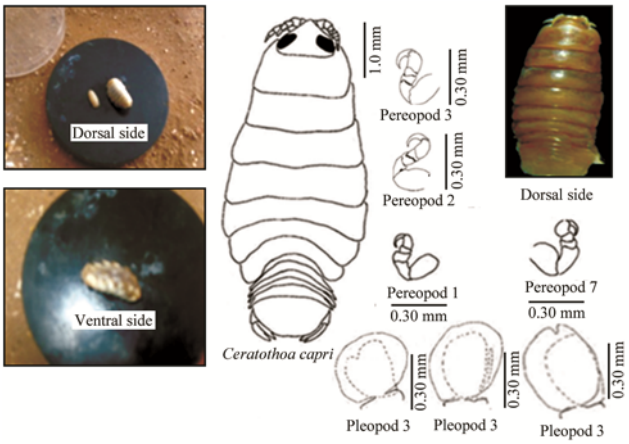

Figure 5 Photographs and Camera Lucida drawings of *Ceratothoa capri* from the Red Sea, Yemen coast

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

N. orbignyi settles preferentially on members of the family Mugillidae (Trilles, 1994; Öktener and Trilles, 2004). According to Trilles and Raibaut (1973), *N. orbignyi* 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. orbignyi* from *Liza ramada*, *Liza saliens* (Risso, 1810), *L. auratua*, *Dicentrarchus labrax* (Linnaeus, 1758), *Solea solea* (Linnaeus, 1758), *Serranus scriba* (Linnaeus, 1758), *Chelon labrosus* and *Diplodus annularis* (Linnaeus, 1758). However, *N. orbignyi* has also been reported from several other fishes such as *Chimaera* sp. by Hale (1926), *Halobatrachus didactylus* (Bloch and Schneider, 1801) and *Solea senegalensis* (Kaup, 1858) by Dollfus and Trilles (1976), *Callorhinchus 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 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. orbignyi* 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. orbignyi* 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 customer 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-Willliams, 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 *Pomadasys maculatus* (Bloch, 1793) (reported as *Lutjanus naculatus*). To the above list Williams and Bunkley-Willliams (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-Willliams, 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-Willliams (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 Öktener 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 (Öktener 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.

References

Alvarez F., and Flores M., 1997, *Cymothoa exigua* (Isopoda: Cymothoidae) Parasitando al *Pargo Lutjanus peru* (Pisces: Lutjanidae) em Manzanillo, Colima, México, Revista de Biologia Tropical, 45: 397-394

Al-Zubaidy A.B., 2007, New Record of *Gnathia* sp. (Crustacea: Isopoda: Gnathiidae) in the Fish *Lethrinus lentjan* (Lacepede, 1802) from the Yemeni Coast of the Red Sea, African Journal of Biological Sciences, 3(1): 29-34

Bruce N.L., 1987, Australian Species of *Nerocila* Leach, 1818 and *Creniola* n. gen. (Isopoda: Cymothoidae), Crustacean Parasites of Marine Fishes, Records of the Australian Museum, 39(6): 355-412
http://dx.doi.org/10.3853/j.0067-1975.39.1987.174

Brusca R.C., 1981, A monograph on the Isopod Cymothoidae (Crustacea) of the Eastern Pacific, Zoological Journal of the Linnean Society, 73(2): 117-199
http://dx.doi.org/10.1111/j.1096-3642.1981.tb01592.x

Brusca R.C., and Gilligan M.R., 1983, Tongue Replacement in a Marine Fish (*Lutjanus guttatus*) by a Parasitic Isopod (Crustacea: Isopods), Copeia, 3: 813-816
http://dx.doi.org/10.2307/1444352

Bunkley-Williams L., Williams J.H. Jr., and Bashirullah A.K.M., 2006, Isopods (Isopoda: Aegidae, Cymothoidae, Gnathiidae) Associated with Venezuelan Marine Fishes (Elasmobranchii, Actinopterygii), Revista de Biología Tropical, 54 (Suppl. 3): 175-188

Charfi-Cheikrouha F., Zghidi W., Ould Yarda L., and Trilles J.P., 2000, Les Cymothoidae (Isopodes Parasites de Poissons) des Côtes Tunisiennes: Écologie et Indices Parasitologiques, Systematic Parasitology, 46: 146-150

Dollfus R.P., and Trilles J.P., 1976, Collection of R.P. Dollfus on Cymotoids Collected on Teleost Fish in Marocco and Alger, Bulletin du Muséum national d'Histoire naturelle, 3: 390 (Zool. 272): 1-821

El-Shahawy I.S., and Desouky A.R.Y., 2010, *Myripristis murdjan* (Beryciformes: Holocentridae) a New Host Record for Cymothoa indica (Crustacea, Isopoda, Cymothoidae), Acta adriatica, 51(1): 103-110

Espinosa Perez M.C., and Hendrickx M.E., 2001, A New Species of Exosphaeroma Stebbing (Crustacea: Isopoda: Sphaeromatidae) from the Pacific Coast of México, Proceedings of the Biological Society of Washington, 114(3): 640-648

Froese R., and Pauly D., eds, 2013, FishBase. http://www.fishbase.org, Accessed March 2013

Hale H.M., 1926, Review of Australian Isopods of the Cymothoid Group. Part II, Transactions of the Royal Society of South Australia, 50: 201-234

Hiekal F.A., and El-Sokkary M.Y., 1990, Morphology of *Telotha* spp. (Crustacea: Isopoda) from El Kahla Fish *Oblada melanura* in Alexandria, Assiut Veterinary Medical Journal, 22(44): 75-97

Hoffman G.L., 1998, Parasites of North American freshwater fishes, 2nd ed., Cornell Univ. Press, Ithaca, pp.325

Horton T., 2000, *Ceratothoa steindachneri* (Isopoda: Cymothoidae) New to British Waters with a Key to North-east Atlantic and Mediterranean *Ceratothoa*, Journal of the Marine Biological Association of the United Kingdom, 80: 1041-1052
http://dx.doi.org/10.1017/S0025315400003106

Horton T., and Okamura B., 2003, Post-haemorragic Anaemia in Sea Bass, *Dicentrarchus labrax* (L.), Caused by Blood Feeding of *Ceratothoa oestroides* (Isopoda: Cymothoidae), Journal of Fish Diseases, 26: 401-406
http://dx.doi.org/10.1046/j.1365-2761.2003.00476.x PMid:12946009

Innal D., and Kirkim F., 2012, Parasitic Isopods of Bogue [*Boops boops* (Linnaeus, 1758)] from the Antalya Gulf (Turkey), Kafkas Universitesi Veteriner Fakultesi Dergisi, 18(Suppl. A): 13-16

Kayis S., and Ceylan Y., 2011, First Report of *Nerocila orbigyni* (Crustacea, Isopoda, Cymothoidae) on *Solea solea* (Teleostei, Soleidae) from Turkish Sea, Turkish Journal of Fisheries and Aquatic Sciences, 11: 169-171
http://dx.doi.org/10.4194/trjfas.2011.0123

Kensley B., and Schotte M., 1989, Marine isopod crustaceans of the Caribbean, Smithsonian Institution Press, Washington, pp.169-183
http://dx.doi.org/10.5962/bhl.title.10375

Kirkim F., Kocatas A., Katagan T., and Sezgin M., 2008, A Report on Parasitic Isopods (Crustacea) from Marine Fishes and Decapods Collected from the Aegean Sea (Turkey), Acta Parasitologica Turcica, 32(4): 382-385
PMid:19156617

Marques J.F., Santos M.J., Costa J.L., Costa M.J., and Cabral H.N., 2005, Metazoan Parasites as Biological Indicators of Population Structure of

Halobatrachus didactylus on the Portuguese Coast, Journal of Applied Ichthyology, 21: 220-224
http://dx.doi.org/10.1111/j.1439-0426.2005.00655.x

Merella P., and Garippa G., 2001, Metazoan Parasites of Grey Mullets (Teleostea: Mugilidae) from the Mistras Lagoon (Sardinia, Western Mediterranean), Scientia Marina, 65(3): 201-206

Öktener A., and Trilles J.P., 2004, Report on the Cymothoids (Crustacea, Isopoda) Collected from Marine Fishes in Turkey, Acta Adriatica, 45(2): 145-154

Öktener A., Torcu- Koç H., Erdoğan Z., and Trilles J.P., 2010, Scuba Diving Photography: A Useful Method for Taxonomic and Ecologic Studies on Fish Parasites (Cymothoidae), Journal of Marine Animals and Their Ecology, 3(2): 3-9

Ramdane Z., Bensouilah M.A., and Trilles J.P., 2007, The Cymothoidae (Crustacea, Isopoda), Parasites on Marine Fishes from Algerian Fauna, Belgian Journal of Zoology, 137(1): 67-74

Romestand B., and Trilles J.P., 1976, Au Sujet d'Une Substance à Activité Antithrombinique, Mise en Évidence Dans les Glandes Latéro-oesophagiennes de *Meinertia oestroides* (Risso, 1826) (Isopoda, Flabellifera, Cymothoidae; parasite de poissons). Zeitschrift für Parasitenkunde, 50(1): 87-92
http://dx.doi.org/10.1007/BF00389936 PMid:961005

Ruiz A., and Madrid J., 1992, Studies on the Biology of the Parasitic Isopod *Cymothoa exigua* Schioedte and Meinert, 1884 and its Relationship with the Snapper *Lutjanus peru* (Pisces: Lutjanidae) Nichols and Murphy, 1922 from Commercial Catch in Michoacán, Ciencias Marinas, 18(1): 19-34

Thatcher V.E., 2000, The isopod parasites of South American fishes, In: Salgado-Maldonado G., Aldrete A.N.G., and Vidal-Martinez V.M., (eds.), Metazoan parasites in the Neotropics: A systematic and ecological perspective, Universidad Nacional Auto'noma de Me'xico Press, pp.193-226

Thatcher V.E., de Araujo G.S., de Lima J.T.A.X., and Chellappa S., 2007, *Cymothoa spinipalpa* sp. nov. (Isopoda, Cymothoidae) a Buccal Cavity Parasite of the Marine Fish, *Oligoplites saurus* (Bloch and Schneider) (Osteichthyes, Carangidae) of Rio Grande do Norte State, Brazil, Revista Brasileira de Zoologia, 24(1): 238-245
http://dx.doi.org/10.1590/S0101-81752007000100032

Trilles J.P., 1991, Present Researches and Perspective on Isopoda (Cymothoidae and Gnathiidae) Parasites of Fishes (Systematics, Faunistics, Ecology, Biology and Physiology), Wiadomosci Parazytologiczne, 37: 141-143
PMid:1823477

Trilles J.P., 1994, Les Cymothoidae (Crustacea, Isopoda) du Monde (Prodrome pour une Faune), Studia Marina, 21/22: 1-288

Trilles J.P., and Raibaut A., 1973, Cymothoids (Isopods, Flabellifera) Fish Parasites from Tunis, 2nd Note, Bulletin du Muséum national d'Histoire naturelle, 3:144 (Zool. 88): 273-281

Trilles J.P., Radujkovic B.M., and Romestand B., 1989, Parasites des Poissons Marins du Monténégro: Isopodes, Acta Adriatica, 30(1/2): 279-306

Williams E. H. Jr., and Bunkley-Williams L., 1978, Cymothoid Isopods of some Marine Fishes from the Northern Gulf of Mexico, Northeastern Gulf Science, 2: 122-124

Williams E. H. Jr. and Bunkley-Williams L., 2003, New Records of Fish-parasitic Isopods (Cymothoidae) in the Eastern Pacific (Galápagos and Costa Rica), Noticias De Galápagos, 62: 21-23

WoRMS, 2013, http://www.marinespecies.org, Accessed March 2013

Wunder W., 1961, *Nerocila orbignyi* ein Proterandrischer Hermaphrodit und Parasitischer Isopode auf, *Tilapia galilaea* in See Borullus in Agypten, Zoologischer Anzeiger, 25: 140 -151