

Scuba diving photography: a useful method for taxonomic and ecologic studies on fish parasites (cymothoidae)

Ahmet Öktener¹, Hatice Torcu-Koç², Zeliha Erdoğan² and Jean Paul Trilles³

¹Istanbul Provincial Directorate of Agriculture, İstanbul, Turkey

²University of Balıkesir, Faculty of Science and Art, Department of Biology, Balıkesir, Turkey

³Université de Montpellier 2, France

Abstract

This study emphasizes that underwater photography is useful for taxonomic and ecologic studies on parasitic cymothoidae. So, using this method, it reports potential new hosts for species of the genera *Anilocra* and *Nerocila* from the Sea of Marmara and the Aegean Sea coasts of Turkey. Underwater photographs were taken by scuba divers from 15 different fish hosts. *Anthias anthias*, *Apogon imberbis*, *Gobius bucchichi*, *Symphodus mediterraneus*, *Tripterygion delaisi*, *T. melanurus* and a lessepsian migrant *Pempheris vanicolensis* were identified as new hosts for the genus *Anilocra*. *Nerocila bivittata* was observed on *Sciaena umbra* and *Scorpaena scrofa*. [JMATE. 2010;3(2):3-9]

Keywords: Scuba diving, Cymothoidae, fish host, Turkey

Introduction

Cymothoidae are large ectoparasitic isopods infecting many tropical and temperate fishes worldwide. Adult specimens belonging to the genera *Anilocra* and *Nerocila* are usually attached on the skin or to the fins of fish (5). Some studies reported systematic and biologic data about cymothoid species parasitizing wild and cultured fishes all over the world (22). The Turkish cymothoid fauna comprises 15 species from the Aegean Sea, the Mediterranean Sea, the Sea of Marmara and the Black Sea Coasts of Turkey (14).

Although scuba diving photography gives useful and original data about host preference, sites of parasite attachment and depths where host fishes are living, until now such studies are unusual. The more usual technique involves collection of samples from fishing trawler catches. However, using this technique, parasitic isopods may be accidentally transferred to other host fishes. Therefore, underwater photography is a favourable additional technique useful in ecologic studies on cymothoidae.

Methods

Photographs were taken by 8 scuba divers at a depth ranging from 1 to 32m in the Aegean and Sea of Marmara, using Nikon D300, Nikon D80 and Canon EOS 300D cameras. Identifications of cymothoid genera and species were performed according to Trilles (20, 21).

15 fish species belonging to 11 families were identified: *Serranidae* (*Serranus cabrilla*, *S. scribe*, *Anthias anthias*), *Sparidae* (*Oblada melanura*, *Diplodus vulgaris*), *Labridae* (*Symphodus mediterraneus*), *Pomacentridae* (*Chromis chromis*), *Apogonidae* (*Apogon imberbis*), *Tripterygiidae* (*Tripterygion melanurus*, *T. delaisi*), *Centracanthidae* (*Spicara maena*), *Gobidae* (*Gobius bucchichi*), *Pempheridae* (*Pempheris vanicolensis*), *Scorpaenidae* (*Scorpaena scrofa*), *Sciaenidae* (*Sciaena umbra*) (Figure 1-6). Taxonomy and names of fishes were updated according to Froese and Pauly (9).

Results

The cymothoid fauna of Turkey comprises 15 species from the Aegean Sea, the Mediterranean Sea, the Sea of Marmara and the Black Sea Coasts of Turkey. Among them, specimens belonging to the genera *Anilocra*, *Nerocila*, *Ceratothoa*, *Emetha*, *Mothocya* and *Livoneca* were collected respectively from the body surface, the buccal cavity and the gill chamber of fishes (14) (Table 1). Figure 7 shows the geographical distributions of these genera from Turkish coasts.

The cymothoid and host fish name, the site of attachment, the cymothoid stage and sex when obvious, the locality and date of the collect, the name of the scuba diver are given with every underwater photograph (Figures 1-6). At least two species belonging to the genus *Anilocra* (*A. frontalis* and *A. physodes*) and



Parasite	Host	Locality	Reference
<i>Anilocra physodes</i>	<i>Scomber japonicus, Dicentrarchus labrax, Boops boops, Sparus aurata, Sciaena umbra, Labrus merula, Dentex macrophthalmus, Spicara smaris, Pagellus erythrinus, Serranus scriba, Diplodus annularis, Diplodus vulgaris, Diplodus sargus, Spondylisoma cantharus, Oblada melanura, Spicara maena, Trachurus trachurus, Lithognathus mormyrus, Sphyræna chrysotaenia, Liza aurata, Belone belone, Chromis chromis, Conger conger, Dentex dentex</i>	Mediterranean Sea, Aegean Sea, Sea of Marmara	Öktener and Trilles (2004) İnnal et al., (2007)
<i>Anilocra frontalis</i>	<i>Symphodus tinca, Oblada melanura, Lithognathus mormyrus, Boops boops</i>	Black Sea, Mediterranean Sea	İnnal et al., 2007
<i>Nerocila bivittata</i>	<i>Pagellus erythrinus, Pagellus sp, Labrus merula, Gobius niger, Sciaena umbra, Dentex macrophthalmus, Symphodus tinca, Parablennius sanguinolentus, Scorpaena scrofa</i>	Mediterranean Sea, Sea of Marmara, Aegean Sea, Black Sea	Öktener and Trilles (2004)
<i>Nerocila orbigny</i>	<i>Dicentrarchus labrax, Liza aurata</i>	Aegean Sea, Black Sea	Öktener and Trilles (2004)
<i>Nerocila maculata</i>	Not identified host	Mediterranean Sea	Öktener et al., (2009)
<i>Ceratothoa oestroides</i>	<i>Scomber japonicus, Spicara maena, Boops boops, Spicara filexiosa, Raja alba, Zeus faber, Trachurus mediterraneus, Sparus aurata, Dicentrarchus labrax, Mullus surmuletus, Diplodus annularis, Spicara smaris, Sardina pilchardus, Helicolenus dactylopterus dactylopterus, Pomatomus saltatrix</i>	Mediterranean Sea, Aegean Sea, Sea of Marmara	Öktener and Trilles (2004)
<i>Ceratothoa parallela</i>	<i>Boops boops, Spicara smaris, Sparus aurata, Zeus faber, Diplodus annularis</i>	Aegean Sea, Sea of Marmara	Öktener and Trilles (2004)
<i>Ceratothoa capri</i>	<i>Spicara smaris, Boops boops</i>	Aegean Sea	Öktener and Trilles (2004)
<i>Ceratothoa italica</i>	<i>Dicentrarchus labrax, Spicara maena</i>	Aegean Sea, Sea of Marmara	Öktener and Trilles (2004)
<i>Ceratothoa steindachneri</i>	<i>Chlorophthalmus agassizi, Serranus cabrilla</i>	Mediterranean Sea, Aegean Sea	Öktener and Trilles (2004)
<i>Emetha audouini</i>	<i>Spicara filexiosa, Spicara maena, Spicara smaris</i>	Aegean Sea, Sea of Marmara	Öktener and Trilles (2004)
<i>Mothocya epimerica</i>	<i>Atherina boyeri</i>	Black Sea	Öktener and Trilles (2004)
<i>Mothocya taurica</i>	<i>Alosa fallax, Helicolenus dactylopterus dactylopterus, Trisopterus minutus</i>	Black Sea, Aegean Sea, Sea of Marmara	Öktener and Trilles (2004)
<i>Mothocya belonae</i>	<i>Belone belone</i>	Black Sea	Öktener and Trilles (2004)
<i>Livoneca sinuata</i>	<i>Raja clavata, Argentina sphyræna</i>	Black Sea, Aegean Sea	Öktener et al., (2009)

Table 1. - Cymothoids reported from marine fishes of Turkey

Nerocila (*N. bivittata*) were distinctly identifiable. In some observed host-parasite associations, if the genus is undoubtedly sure, the species is only provisionally identified.

According to scuba-divers' photographs, *Anilocra* specimens are often in pairs, comprising a large female and a small male. 10 cymothoid females were seen attached on the body surface of host fish,

4 females on the head and 1 female on the body surface while 5 males were observed on the body surface, 4 on the head and one on the caudal fin. This study clearly shows that *Anthias anthias*, *Apogon imberbis*, *Gobius bucchichi*, *Symphodus mediterraneus*, *Tripterygion delaisi*, *Tripterygion melanurus* and *Pempheris vanicolensis* are first recorded hosts for *Anilocra* Mediterranean species.



Figure 1 - *Anilocra frontalis* female on *Serranus scriba* from differing locations: a) midlateral aspect of fish from Tüllüce Island photographed by Şenok in 2006 and b) with male on lateral caudal region of fish from Ayvalık photographed by Göksel in 2008



Figure 2 - *Anilocra* sp. female (possibly allied to *A. apogonae*) on *Apogon imberbis* from differing locations: a) lateral caudal aspect of fish from Bodrum photographed by Saltık in 2008 and b) lateral caudal aspect of fish from Kemer photographed by Konuk in 2008

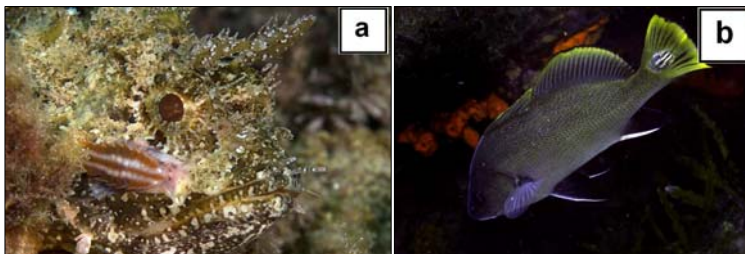


Figure 3 - *Nerocila bivittata* found on 2 differing species of fish: a) on the head of *Scorpaena scrofa* from Saros Bay photographed by Göksel in 2007 and b) on the caudal fin of *Sciaena umbra* from Tüllüce Island photographed by Gökalp in 2006

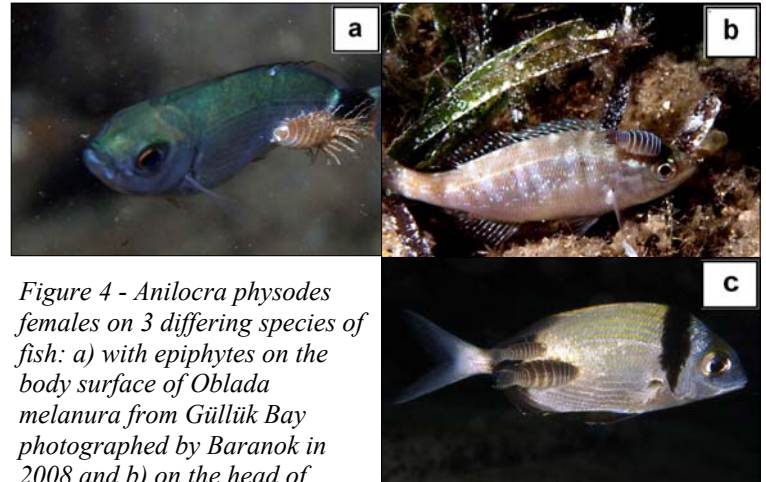


Figure 4 - *Anilocra physodes* females on 3 differing species of fish: a) with epiphytes on the body surface of *Oblada melanura* from Güllük Bay photographed by Baranok in 2008 and b) on the head of *Spicara maena* from undisclosed location photographed by Çokdeğer in 2008 and c) on the body surface of *Diplodus vulgaris* also seen with female is male parasite of same species from Kemer photographed by Konuk in 2008

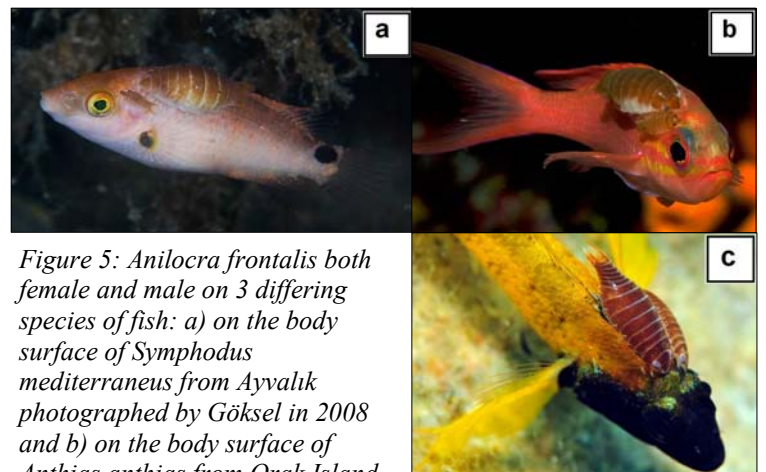


Figure 5: *Anilocra frontalis* both female and male on 3 differing species of fish: a) on the body surface of *Symphodus mediterraneus* from Ayvalık photographed by Göksel in 2008 and b) on the body surface of *Anthias anthias* from Orak Island, Bodrum photographed by Göksel, 2005 and c) on the head of *Tripterygion delaisi* from Çatal Island photographed by Gökalp in 2006

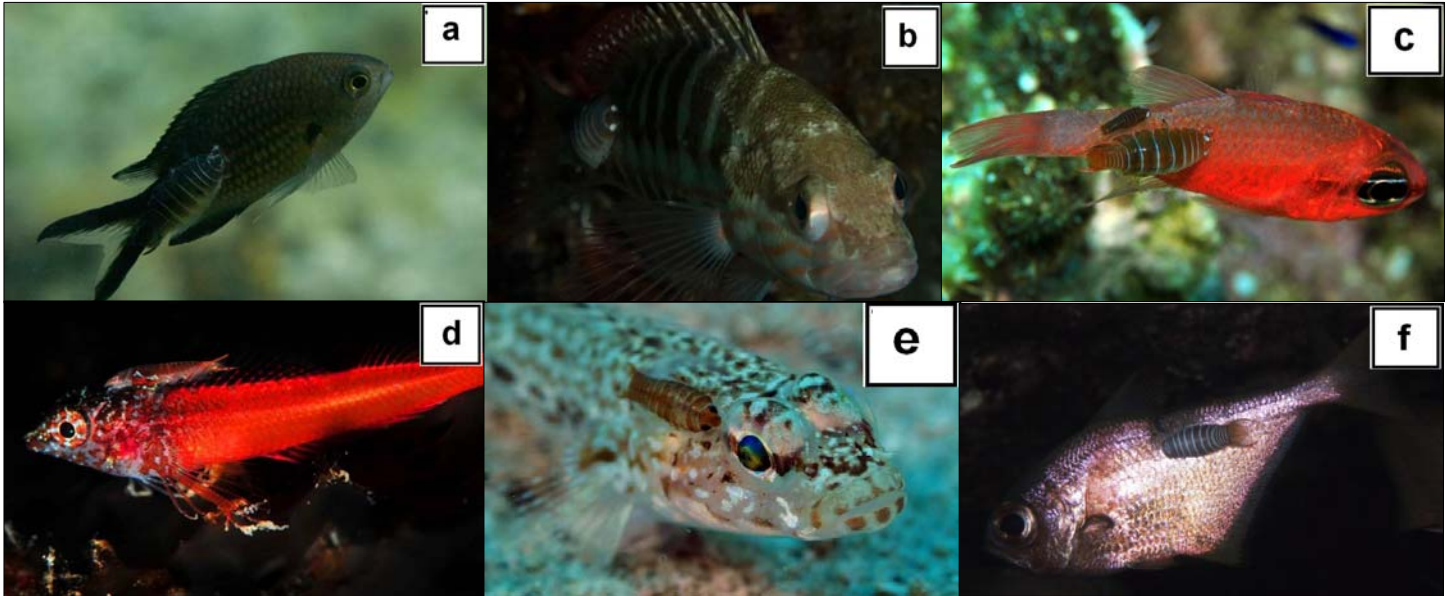


Figure 6 - *Anilocra* sp. on 6 differing species of fish: a) female and maybe closely allied to *Anilocra chromis* on the body surface of *Chromis chromis* from Ayvalık photographed by Göksel in 2008 and b) female maybe *A. frontalis* (photo not enough clear) on the body surface of *Serranus cabrilla* from Delikli Cave, Bodrum photographed by Göksel in 2006 and c) female and male (maybe or closely allied to *A. apogonae*) on the body surface of *Apogon imberbis* from undisclosed location photographed by Gökalp in 2006 and d) young stage female on the head of *Tripterygion melanurus* from Tüllüce Island photographed by Gökalp in 2006 and e) male (probably *A. frontalis*) on the head of *Gobius bucchichi* from Kaş photographed by Ceylanoğlu in 2009 and f) male (probably *A. physodes*) on the body surface of *Pempheris vanicolensis* from Kemer photographed by Konuk in 2008

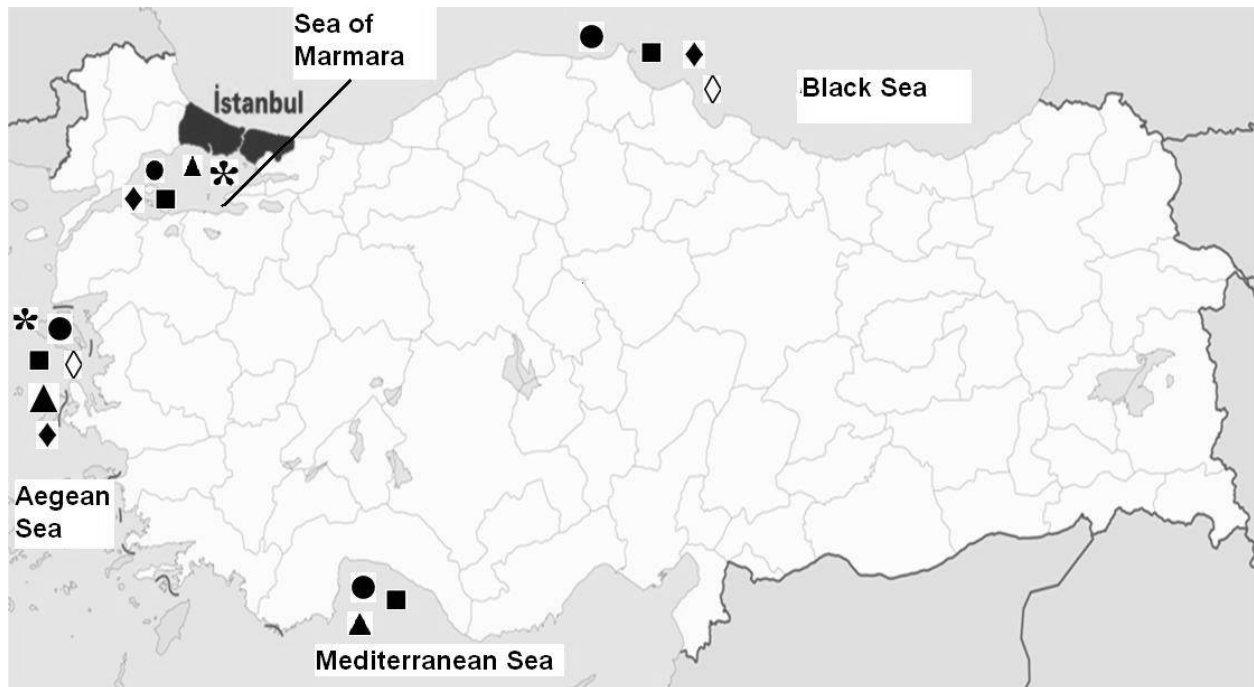


Figure 7 - Geographical distributions of ▲*Ceratothoa*, ■*Nerocila*, ●*Anilocra*, ◆*Mothocya*, ◇*Livoneca*, **Emetha* from Turkish Seas

Discussion

In the Mediterranean, *Anilocra physodes* is a ubiquitous species, usually attached on the body surface of the host, which has been recorded on several fish families, mainly Sparidae. Sparidae has especially the most fish species among 26 fish families parasitized by *Anilocra physodes* (1, 6, 11, 13, 14, 16, 17, 19, 21, 22). 19 of these host fishes are demersal, 14 are benthopelagic, 10 are pelagic-neritic, 10 are oceanic and 4 are reef-associated (9). In Turkey, *Anilocra physodes* has been founded on several fish families, such as Sparidae, Centracanthidae, Scombridae, Serranidae, Sciaenidae, Labridae, Carangidae, Mugilidae, Belonidae, Pomacentridae, Sphyraenidae, and Congridae in Turkey. *Anilocra physodes* studies were focused in the Sea of Marmara, Aegean and Mediterranean Sea. This species is still unknown from the Black Sea (14) (Table 1).

Anilocra frontalis has been found, attached behind the head of the host fish, especially Labridae. Two families, Labridae and Sparidae have the most fish species which have been previously studied for infestation by *Anilocra frontalis* (11, 14, 17, 18, 22). Among these host species, 14 are demersal, 11 are reef-associated and 7 are benthopelagic (9). In Turkey, *Anilocra frontalis* was recorded from the Black Sea and the Mediterranean but not from the Sea of Marmara and the Aegean Sea (14) (Table 1).

In Turkey, three species belonging to the genus *Nerocila* were reported parasitizing several fish families from the Aegean Sea, the Mediterranean Sea, the Sea of Marmara and the Black Sea (14) (Table 1).

Until now, some exotic cymothoids, such as both Lessepsian migrants *Cymothoa indica* and *Anilocra pilchardi*, *Ceratothoa collaris* exotic from the Atlantic Ocean and two unidentified *Nerocila* have been recorded from Lebanon (1, 2, 3, 23). However, with the exception of *Anilocra physodes* parasitizing *Siganus luridus* and *Nerocila bivittata* collected on *Siganus rivulatus* and *Siganus luridus* from Libyan Coasts, Mediterranean (19), no native Mediterranean cymothoid were reported on a Lessepsian immigrant fish.

Two lessepsian fish have previously been reported as host for a parasitic copepod and cymothoid in Turkey. Öktener and Trilles (15) reported *Ergasilus nanus* on the gills of *Liza haemotachilus* (synonymy of *Mugil so-iuy*) from Sırakarağaçlar Stream, Sinop, Black Sea. İnnal et

al. (11) recorded *Anilocra physodes* on *Sphyraena chrysotaenia* from Antalya Gulf, Mediterranean. In the present study, one male belonging to the genus *Anilocra* was observed on the body surface of *Pempheris vanicolensis* (Figure 6f). Thus, this is may be the third record of a likely native cymothoid parasitizing a lessepsian immigrant fish in Turkish Coasts.

Anilocra apogonae was reported on *Apogon cooki*, *Apogon fasciatus* and *Cheilodipeturus quinquelineatus* from Moreton Bay, Queensland, and Papua New Guinea (4). *Anilocra* sp. was collected on *Apogon kallopterus* from the Amboin Bay, Indonesia (12). Fogelman and Grutter (7) studied the life history and host-specificity of manca larvae of *Anilocra apogonae* and their effect on the growth and survival of young cardinal fishes, *Apogon trimaculatus*, *Apogon nigrofasciatus* and *Cheilodipeturus quinquelineatus* in the laboratory conditions from Great Barrier Reef.

Some Apogonidae such as *Apogon pharaonis* and *Apogon queketti* are Mediterranean lessepsian immigrant to Turkish coasts from the Red Sea (8) while *Apogon imberbis* is a native species. Underwater photographs produced in the present study (Figure 2, 6c) show that *Apogon imberbis* is a potential host for a species belonging to the genus *Anilocra*. So, the native *Anilocra physodes* and *Anilocra frontalis*, or the indo-Pacific species *Anilocra apogonae*, are maybe parasitic on fishes belonging to the family Apogonidae along the Turkish Coasts.

Cymothoid samples reported from the previous parasitological studies in Turkish seas were collected from wild fishes using trawl, gill nets, fishing line and sometimes cultured fishes. The method using underwater observations is useful because it shows the parasite- host associations in natural states. It gives original information about the specific host. Some incorrect associations may be prevented. So, for example, *Ceratothoa oestroides* usually occurs on mouth cavity of fishes but Gökpinar et al (9) reported it on caudal peduncle of black seabram (*Spondyliosoma cantharus*). This is obviously an accidental attachment.

It is clear that the scuba diving with underwater photography may be useful, as additional technique, in taxonomic and ecologic studies about parasitic isopods attached to the body surface of the host such as those belonging to the genus *Anilocra* and *Nerocila*.

Acknowledgements

The authors are very thankful to Turkish Scuba Divers Fehmi Şenok, Göker Göksel, Mert Gökbalp, Alp Baranok, Cenk Ceylanoğlu, Levent Konuk, Ozan Çokdeğer, Aziz Saltık for the loan of underwater photographs, and Cem Dalyan for identification of fishes.

References

1. Bariche M, Trilles JP. Preliminary check-list of cymothoids (Crustacea, Isopoda) from Lebanon, parasitizing on marine fishes. *Zoology in the Middle East* 34:5-12. 2005.
2. Bariche M, Trilles JP. *Anilocra pilchardi* n. sp., a new parasitic cymothoid isopod from off Lebanon (Eastern Mediterranean). *Systematic Parasitology* 64:203-214. 2006.
3. Bariche M, Trilles JP. *Ceratothoa collaris* (Isopoda: Cymothoidae) new to the eastern Mediterranean, with a redescription and comments on its distribution and host specificity. *Journal of the Marine Biological Association of the United Kingdom* 88: 85-93. 2008.
4. Bruce NL. Australian *Pleopodias* Richardson, 1910, and *Anilocra* Leach, 1818 (Isopods: Cymothoidae), crustacean parasites of marine fishes. *Records of the Australian Museum* 39:85-130. 1986.
5. Brusca RC. A monograph of the Isopoda Cymothoidae (Crustacea) of the eastern Pacific. *Zoological Journal of the Linnean Society* 73:117-199. 1981.
6. Charfi-Cheikrouha F, Zghidi W, Ould Yarda L, Trilles JP. Les Cymothoidae (Isopodes parasites de poissons) des côtes tunisiennes: ecologie et indices parasitologiques. *Systematic Parasitology* 46:146-150. 2000.
7. Fogelman RM, Grutter AS. Mancae of the parasitic cymothoid isopod, *Anilocra apogonae*: early life history, host-specificity, and effect on growth and survival of preferred young cardinal fishes. *Coral Reefs* 27:685-693. 2008.
8. Fricke R, Bilecenoğlu M, Sarı HM. Annotated checklist of fish and lamprey species (Gnathostomata and Petromyzontomorphi) of Turkey, including a Red List of threatened and declining species. *Stuttgarter Beitr. Naturk. Ser. A* Nr. 706 169 p. 2007.
9. Froese R, Pauly D. Fish Base. World Wide Web electronic publication. www.fishbase.org, version (10/2009). 2009.
10. Gökpinar S, Özgen EK, Yıldız K. Ege Denizi'nin Kuzeyinden Yakalanan Bir Sarıgöz Balığında *Ceratothoa* 11. oestroides (Risso, 1826) (Isopoda: Cymothoidae). *Türkiye Parazitoloji Dergisi* 33:188-190. 2009.
11. İnnal D, Kırkım F, Erk'akan F. The parasitic isopods, *Anilocra frontalis* and *Anilocra physodes* (Crustacea; Isopoda) on some marine fish in Antalya Gulf, Turkey. *Bulletin of the European Association Fish Pathologists* 27:239-241. 2007.
12. Monod T. Expedition Rumphius II (1975) Crustacean parasites, commensaux, etc. Monod et R. Serene (Edit). III. Crustacean Isopodes (1ère partie: Corallanidae, Anilocridae, Cymothoidae). *Bulletin du Muséum national d'Histoire Naturelle de Paris* 273: 853-870. 1976.
13. Oğuz MC, Öktener A. Four Parasitic Crustacean Species from marine fishes of Turkey. *Acta Parasitologica Turcica* 31:79-83. 2007.
14. Öktener A, Trilles JP. Report on the Cymothoids (Crustacea, Isopoda) collected from marine fishes in Turkey. *Acta Adriatica* 45:145-154. 2004.
15. Öktener A, Trilles JP. Three New Parasitic Copepod Species for the Parasite Fauna of Marine Fishes of Turkey. *Journal Black Sea/Mediterranean Environment* 10:71-80. 2004.
16. Öktener A, Trilles JP, Alaş A, Solak K. New hosts for species belonging to the genera *Nerocila*, *Anilocra*, *Ceratothoa*, *Mothocya* and *Livoneca* (Crustacea, Isopoda, Cymothoidae). *Bulletin of the European Association Fish Pathologists* 29:49-54. 2009.
17. Ramdane Z, Bensouilah MA, Trilles JP. The Cymothoidae (Crustacea, Isopoda), parasites on marine fishes, from Algerian fauna. *Belgian Journal of Zoology* 137:67-74. 2007.
18. Ramdane Z, Trilles JP. Cymothoidae and Aegidae (Crustacea, Isopoda) from Algeria. *Acta Parasitologica* 53:173-178. 2008.
19. Shakman E, Kinzelbach R, Trilles JP, Bariche M. First occurrence of native cymothoids parasites on introduced rabbitfishes in the Mediterranean Sea. *Acta Parasitologica* 54:380-384. 2009.

20. Trilles JP. *Recherches sur les isopodes Cymothoidae des côtes françaises* I. Thèse d'Etat, Université de Montpellier, France, 1968, p181.
21. Trilles JP. Les Cymothoidae (Isopoda, Flabellifera) des côtes françaises. II. Les Anilocridae Schioedte et Meinert, 1881. Genres *Anilocra* Leach, 1818, et *Nerocila* Leach, 1818. *Bulletin du Muséum National 'Histoire Naturelle, Paris* 200:303-346. 1975.
22. Trilles JP. Les Cymothoidae (Crustacea, Isopoda) du Monde (Prodrome pour une Faune). *Studia Marina* 21/22:1-288. 1994.
23. Trilles JP, Bariche M. First record of the Indo-Pacific *Cymothoa indica* (Crustacea, Isopoda, Cymothoidae), a Lessepsian species in the Mediterranean Sea. *Acta Parasitologica* 51:223-230. 2006.

