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New host findings of two parasitic isopods (Flabellifera: Cymothoidae) found on some fish caught in the Dardanelles Strait (Çanakkale, Turkey)

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Abstract

Seven cymothoid species are identified in parasitological studies conducted in the Dardanelles Strait between May 2018- May 2020. The Cymothoids identified are as follows: Mothocya epimerica Costa, 1851, Nerocila bivittata (Risso, 1816), Anilocra frontalis H. Milne Edwards, 1840, Ceratothoa oestroides (Risso, 1826), Ceratothoa parallela (Otto, 1828), Ceratothoa italica Schiödte & Meinert, 1883, Emetha audouini (H. Milne Edwards, 1840). A. frontalis and C. italica are found for the first time from Sciaena umbra Linnaeus, 1758 and Boops boops (Linnaeus, 1758) respectively. Although several reports of these parasites have been given from Turkey, the morphological characters of three species have not been given. The drawings, descriptions of the mouthparts, pereopods, and pleopods of N. bivittata, A. frontalis, C. italica are given in this study.

Keywords: *Turkey, cymothoid, Dardanelles Strait, Anilocra, Ceratothoa, Nerocila*

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Çanakkale Boğazı' nda (Çanakkale, Türkiye) yakalanan bazı balıklarda bulunan iki parazitik izopod türünün (Flabellifera: Cymothoidae) yeni konak bulguları

Öz

Çanakkale Boğazı' nda yedi cymothoid türü Mayıs 2018- Mayıs 2020 tarihleri arasında teşhis edilmiştir. Teşhis edilen parazit türleri şunlardır: Mothocya epimerica Costa, 1851, Nerocila bivittata (Risso, 1816), Anilocra frontalis H. Milne Edwards, 1840, Ceratothoa italica Schiödte & Meinert, 1883, Ceratothoa parallela (Otto, 1828), Ceratothoa oestroides (Risso, 1826), Emetha audouini (H. Milne Edwards, 1840). A. frontalis ve C. italica sırasıyla ilk kez eşkina balığından, Sciaena umbra Linnaeus, 1758 ve kupez balığından, Boops boops (Linnaeus, 1758) bulunmuştur. Türkiye' de her ne kadar bu parazitlerin çeşitli raporları verilmekle birlikte, üç türün morfolojik karakterleri verilmemiştir. Bu çalışmada N. bivittata, A. frontalis, C. italica' nın ağız parçaları, pereopod ve pleopodlarının tanımlamaları ve çizimleri verilmiştir.

Anahtar kelimeler: *Türkiye, cymothoid, çanakkale boğazı, Anilocra, Ceratothoa, Nerocila*

1. Introduction

The members of the family Cymothoidae (Crustacea, Isopoda) are ectoparasites living on marine fishes. They are mostly reported on the body surface, fins of fishes (*Anilocra* Leach, 1818, *Nerocila* Leach, 1818); in the buccal cavity of fishes (*Ceratothoa* Dana, 1852, *Emetha* Schioedte & Meinert, 1883), and in the gill cavity of fishes (*Mothocya* Costa in Hope, 1851, *Elthusa* Schioedte & Meinert, 1884). They are rarely reported in a pouch of fishes [1, 2].

Cymothoids are mostly known as tongue-biters. There are various comparative taxonomic studies on the presence of cymothoids on wild fish [3-6]. In addition, there are also records of parasitic isopods from fish farms and several studies on the effects of parasites on the host fish. Bragoni et al. [7] examined the effects of *Nerocila orbignyi* (Guérin-Méneville, 1832) on farmed sea bass in Corsica. They identified that the decrease in the body condition of fishes and increase in blood urea on sea bass infested with the parasite. They found significant differences in the blood parameters of the host fish. Čolak et al. [8] searched the effects of *Ceratothoa oestroides* on cultured meagre in Croatian. They found that fish infested with cymothoid is smaller than non-infested fish. Horton and Okamura [2] examined the hematology parameters of farmed sea bass infested by *C. oestroides* in Turkey. They mentioned that infested fish had lowered erythrocyte counts, hematocrit, and hemoglobin values and significantly increased leucocyte counts. Papapanagiotou and Trilles [9] observed serious lesions on farmed sea bream infested with *Ceratothoa parallela* (Otto, 1828) in Greece.

Although there are various reports about cymothoids that are presented only with photographs in Turkey, the studies on their morphology are quite a few. It can sometimes be difficult to reach studies on the morphology of Cymothoids in the

Mediterranean and the Black Sea. Cymothoids are not only found in parasitological studies. For example, researchers studying fish systematics and population dynamics can find these parasites in the field or the laboratory. As a result, more research into cymothoid biology is needed to better understand parasite relationships. The aim of this study is to update the morphological features and make diagnosis easier. New hosts for *C. italica*, *A. frontalis*, are also described in the study.

2. Material and method

Fish samples were obtained from the commercial fisherman at the landing, Çanakkale Strait, Sea of Marmara during May 2018 – May 2020. Cymothoid samples were preserved in 70% alcohol and dissected using a stereomicroscope. The drawings of extremities of parasites were done with a microscope drawing tube. Measurements were given in millimeters (mm). Species names and synonyms were controlled with an online database [10]. The ecological characters (feeding, habitat, etc) of the host were examined according to Fishbase [11]. Identifications of cymothoids were carried out according to Trilles [3], Bruce [4], Horton [5], Hadfield [6], Aneesh et al. [12].

3. Results

In this parasitological study, seven species of cymothoid isopods from Çanakkale Strait were identified (Table 1).

Table 1. Cymothoid species found and their hosts

Cymothoid Species	**Host**	**Examined Fish**	**Number of fish samples examined**	**Site of Infestation**	**Prevalence (%)**
Mothocya epimerica (Figure 1a)	Big-scale sand smelt, *Atherina boyeri* Risso 1810	132	4	Gill cavity	3
Nerocila bivittata) (Figure 1b)	Red scorpionfish, *Scorpaena scrofa* Linnaeus 1758	42	3	Body surface	7
Anilocra frontalis (Figure 1c,1d,1e)	Brown meagre, *Sciaena umbra* Linnaeus 1758	24	2	Body surface	8.3
Ceratothoa oestroides	Bogue, *Boops boops* (Linnaeus 1758)	171	23	Buccal cavity	13
Ceratothoa oestroides	Blotched picarel, *Spicara maena* (Linnaeus 1758)	90	18	Buccal cavity	20
Ceratothoa oestroides	Atlantic horse mackerel, *Trachurus trachurus*	325	1	Buccal cavity	0.3
Ceratothoa parallela	Bogue, *Boops boops* (Linnaeus 1758)	171	14	Buccal cavity	8
Ceratothoa parallela	Blotched picarel, *Spicara maena* (Linnaeus 1758)	90	24	Buccal cavity	26
Ceratothoa italica (Figure.1f, 1g)	Bogue, *Boops boops* (Linnaeus 1758)	171	2	Buccal cavity	1.1
Emetha audouini	Blotched picarel, *Spicara maena* (Linnaeus 1758)	90	5	Buccal cavity	5.5

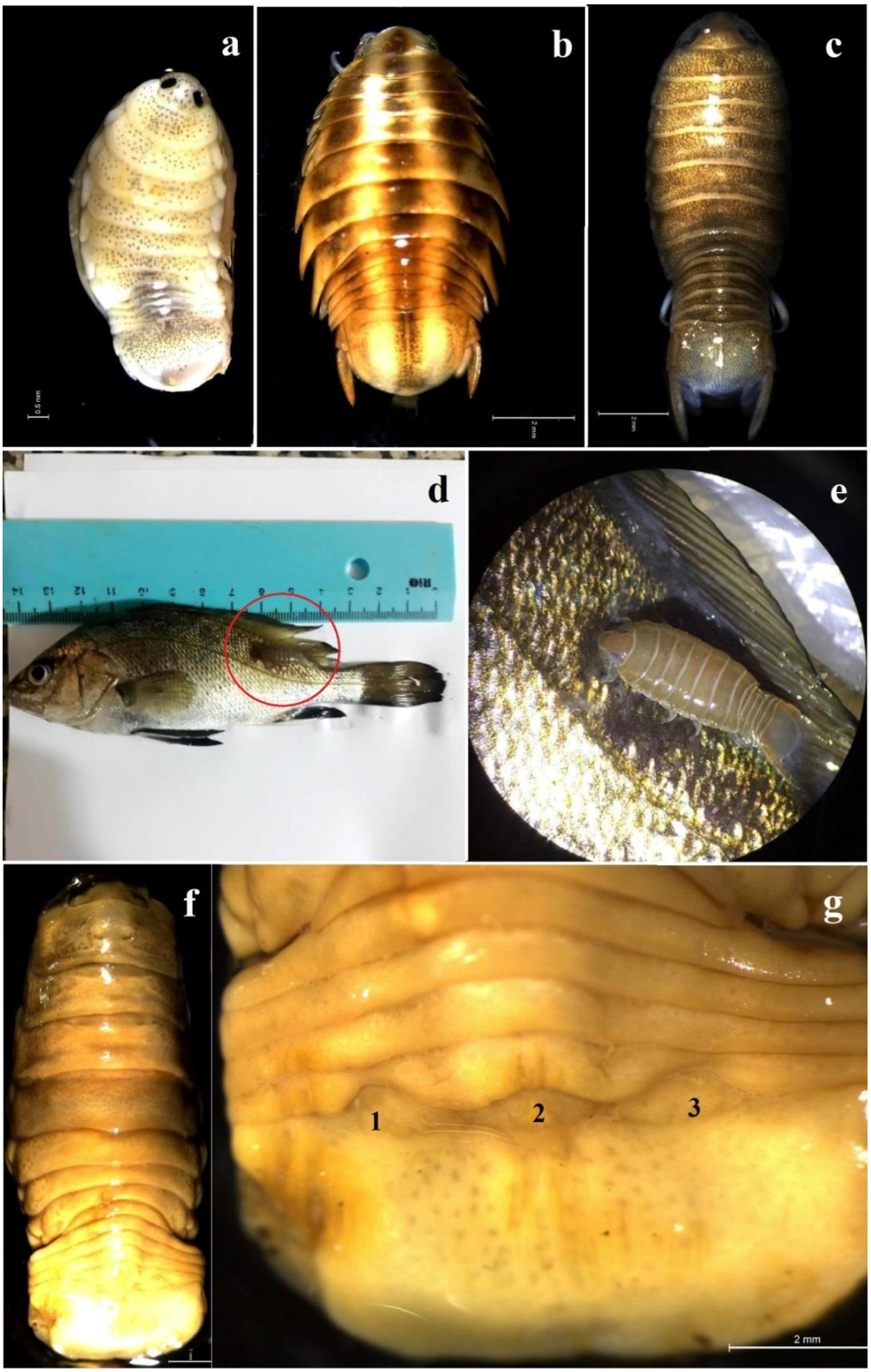

Figure. 1. a. *Mothocya epimerica*, b. *Nerocila bivittata*, c. *Anilocra frontalis*, d. *A. frontalis* on *Scianea umbra*, e. Attachment of *A. frontalis* on the body surface, f. *Ceratothoa italica*, g. fifth pleonite of *Ceratothoa italica*

Cymothoidae Leach, 1818 (Isopoda)
Nerocila Leach, 1818
Nerocila bivittata (Risso, 1816) (Figures 1b, 2, 3)

Female: Length 10.9 mm, width 6.3 mm. Body length is 1.7 times its width. The widest and narrowest of pereonites are 5 and 1, respectively. Cephalon dome-shaped and visible, cephalon length is 0.5 times the width. Eyes well developed; one eye 0.2 times width of the cephalon, 0.4 times length of the cephalon.

Pereonites increased gradually and slightly from 1 to 5; decreasing progressively from 5 to 7 in width. Pereonites progressively increased from 1 to 5 except pereonite 2, and later decreased from 5 to 7 in length. Pereon widest at pereonite 4, the narrowest at pereonite 7. Pereonites 5 longest, pereonite 2 shortest. Coxae 1-4 partly visible in dorsal view; posteroventral angles of coxae 1-4 extending beyond posterior pereonites. Coxae 5-7 are slightly visible. Pleonite 1 slightly visible and partly concealed by pereonite 7, other pleonites visible; pleonites lengths increased progressively; pleonite 5 longest; pleonite 1 shortest. Pleonite on widest at pereonite 5, the narrowest at pereonite 1 in width. Pleotelson length is 0.65 times the width, lateral and posterior margins slightly rounded.

Antennula and antennula consist of eight and eleven articles, respectively. Mandible palp article 1 largest, article 2 and 3 same length; article 3 with 9 setae on distolateral margin decreasing in size from longest distal seta, article 2 with 2 setae. Maxillula with four terminal robust setae. Maxilliped distal palp with five apical recurved setae. Lateral and medial lobes of maxilla with 2 setae.

Pereopods 1-5 without seta. Propodus with three setae, carpus with two setae of pereopod 6. Propodus with 10 setae; carpus with five setae and merus with three setae of pereopod 7. Pereopods 5-7 longer 1-4 similar in size. Pereopod 1 basis length 1.6 times the widest; ischium length 0.4 times basis length; propodus length 1.5 times width; dactylus length 1.9 times propodus length and 4 times basal width. Pereopod 7 basis length 2.8 times widest; ischium length 0.3 times basis length; merus length 0.75 times width and 0.3 times ischium; carpus 0.8 times width and 0.8 times ischium; propodus 1.8 times width and 1.1 times ischium; dactylus 1.1 times propodus and 3 times basal width. Pleopods gradually decreases from 1 to 5; pleopods 1-2 and 3-5 are similar in size. Endopod of all pleopods shorter than exopod. Pleopod 1 exopod 1.3 times width, lateral and medial margins rounded; endopod 1.5 times width, medial and lateral margin straight, distally rounded; peduncle 3 times length.

Protopod medial margin of pleopods 1-5 with four coupling hooks. Appendix masculina o pleopod 2 about 0.4 times endopod length. Proximomedial lobes of pleopods 3-5 well developed. Pleopods 3-5 with folds.

Pleotelson length 0.7 times anterior width; dorsal surface of pleotelson smooth; length 0.7 times pleotelson anterior width; margins of lateral and posterior slightly rounded. Endopod shorter than exopod of uropod; posterior margin of pleotelson extends beyond endopod. Endopod 1.8 times the greatest width; median and lateral margins slightly rounded; apice without seta. Exopod extends beyond to apice of endopod; 4 times greatest width, medial and lateral margins straight; apices with two setae. Apices of exopod and endopod rounded. Uropod peduncle with one seta apically.

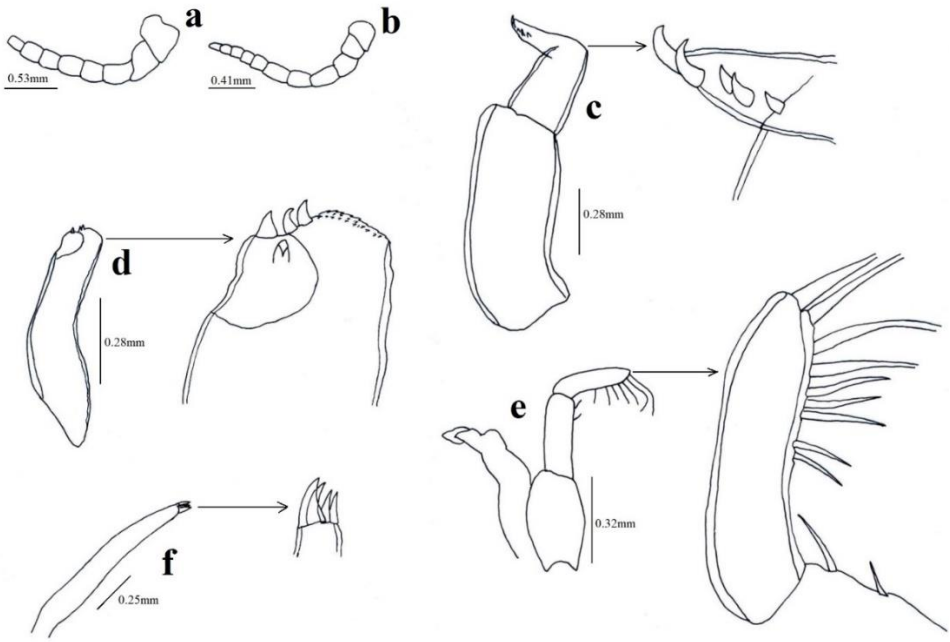

Figure 2. *Nerocila bivittata*, female a. antennula, b. antenna, c. maxilliped, d. maxilla, e. mandible, f. maxillule

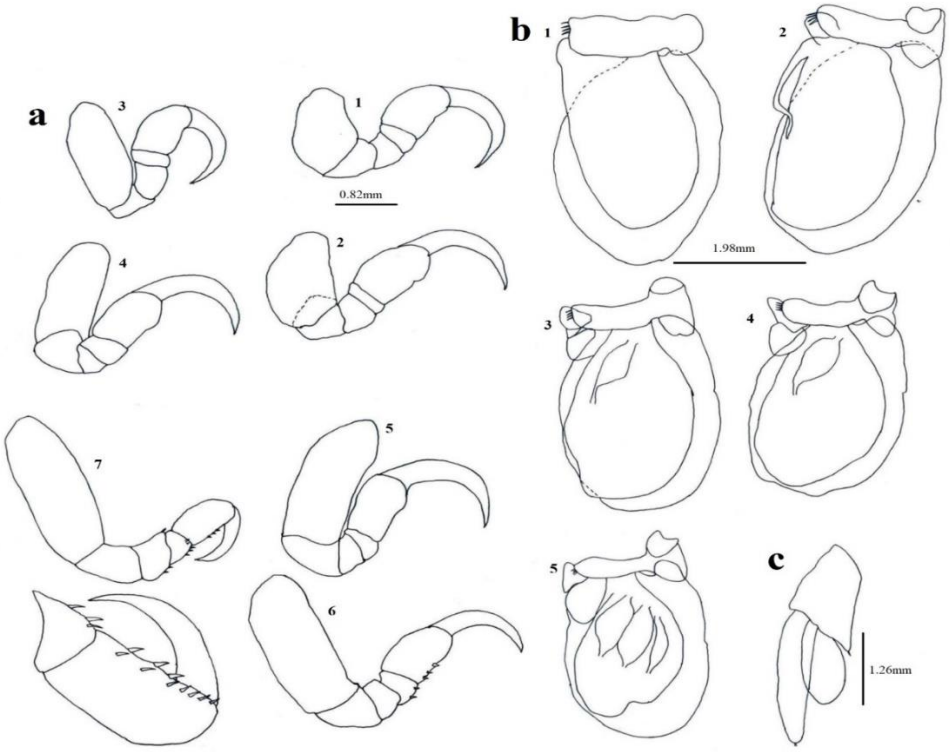

Figure 3. *Nerocila bivittata*, female a pereopods, b. pleopods, c. Uropod

***Remarks*:** *Nerocila bivittata* was described by Risso [13]. The redescription of this species was made only by Trilles [14] and Öktener et al. [15]. The mouthparts (maxilliped, maxilla, maxillule, mandible), pereopods, and pleopods found in this study are compatible with Trilles [14] and Öktener et al. [15]'s findings.

Genus Anilocra Leach, 1818
Anilocra frontalis H. Milne Edwards, 1840 (Figure 1c, 1d, 1e, 4, 5)

Male: Length 12 mm, width 4 mm. Body elongate, length is 3 times its width. The widest and narrowest of pereonites are 4 and 7, respectively. Cephalon triangle-shaped and visible, length 0.57 times width. Eyes very developed; one eye 0.3 times cephalon width, 0.5 times cephalon length.

Pereonites increased gradually and slightly from 1 to 4; decreasing progressively from 5 to 7 in width. Pereonites progressively increased from 1 to 5 and later decreased from 5 to 7 in length. Pereon widest at pereonite 4, the narrowest at pereonite 7. The longest and shortest of pereonites are 5 and 7, respectively. Coxae 2-7 partially visible in dorsal, posteroventral angles of coxae 2-7 not extending beyond posterior pereonites.

Pleonite 1 is slightly visible in the dorsal. Pleonite 1 partly concealed by pereonite 7, other pleonites visible; pleonites lengths increased progressively; pleonite 5 longest; pleonite 1 shortest, pleonites 2-3 subequal in length. Pleonite 1 is slightly visible and pereonite 7 partially covers it. Pleonite on widest at pereonite 5, the narrowest at pereonite 1 in width. Pleotelson length 0.7 times width, dorsal surface smooth; posterior and lateral margins slightly rounded.

Antenna longer than antennula. Antennula and antenna include 8 and 9 articles, respectively. Maxilliped distal palp with three apical recurved setae. Mandible palp article 1 largest, article 2 and 3 same in length; article 3 with 14 setae on distolateral margin decreasing in size from longest distal seta; article 2 with 1 seta. Maxillula with four terminal robust setae. Lateral and medial lobes of maxilla with 2 recurved setae.

Pereopods with seta except pereopod 1. Pereopod 2-6 with one seta on the anterior margin of merus. Pereopods 5-6 with two setae on the posterior margin of propodus. Pereopod 7 with 27 setae on posterior margin of propodus; carpus with 17 setae and merus with seven setae. Pereopod 1 basis length 2 times greatest width; ischium 0.5 times basis; propodus 2.1 times width; dactylus slender, 1.5 times propodus, 2.1 times basal width. Pereopod 7 basis 2 times greatest width; ischium 0.7 times basis; merus 2 times width, 0.7 times ischium; carpus 1.5 times width, 0.6 times ischium length; propodus length 2.9 times width0, as long as ischium; dactylus slender 1.1 times propodus, 3.6 times basal width.

Pleopods gradually decrease from 3 to 5; pleopods 1-3 and 4-5 are similar in size. Pleopod exopods are longer than endopods. Pleopod 1 exopod 1.4 times width, medial margin convex; endopod 1.7 times width, medial margin straight; peduncle 3 times as wide as long. Distal and lateral margins of exopod and endopod are slightly rounded. Protopod medial margin of pleopods with four coupling hooks. Appendix masculina of second pleopod 0.6 times endopod length. Proximomedial lobes of pleopods 3-5 well developed.

Pleotelson 0.7 times anterior width, posterior and lateral margins slightly rounded. Endopod shorter uropod exopod, endopod extending beyond posterior margin of pleotelson. Endopod 2.5 times width, lateral and medial margin slightly rounded, all of the margins without seta. Exopod extending to end of endopod, 5.2 times width, lateral

and medial margin straight, apices without seta. Distal of endopod and exopod rounded. Uropod peduncle margins with a seta.

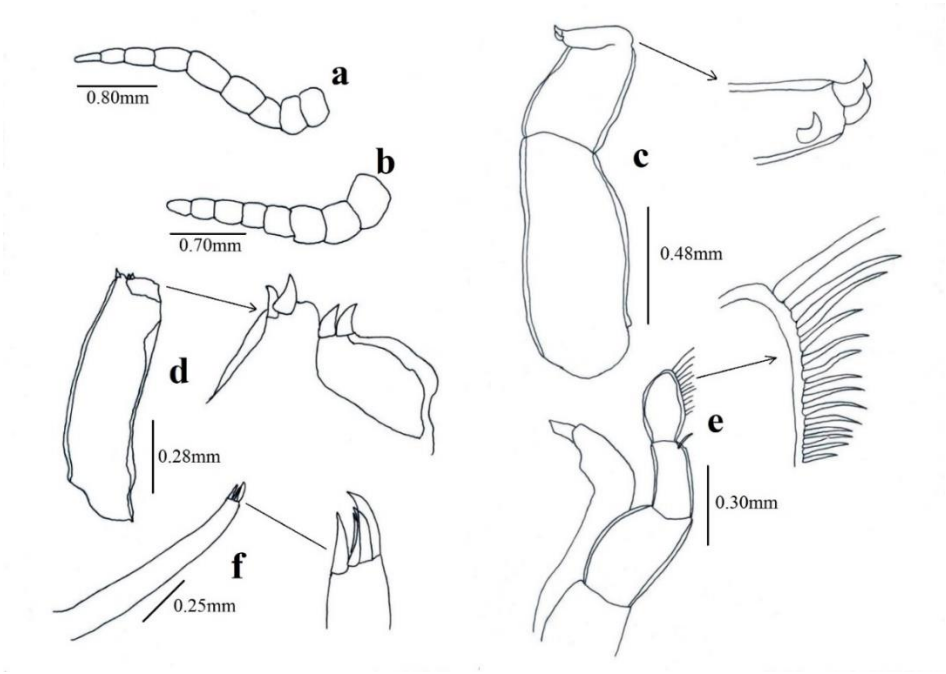

Figure 4. *Anilocra frontalis* male, a. antenna, b. antennula, c. maxilliped, d. maxilla, e. mandible, f. maxillule

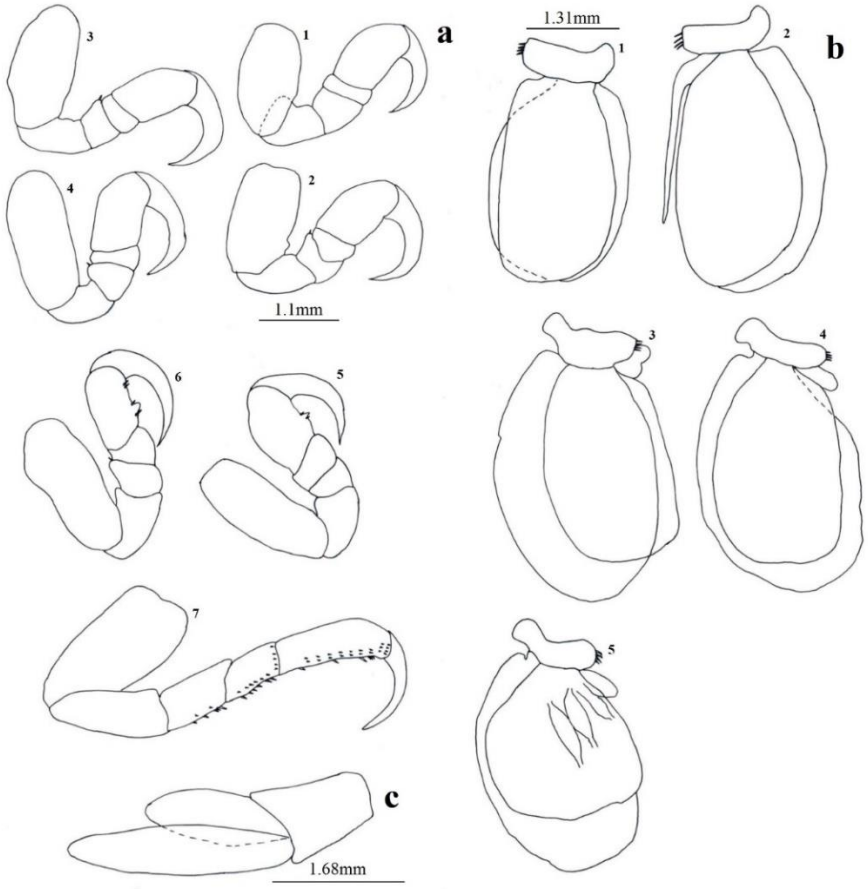

Figure 5. *Anilocra frontalis* male, a pereopods, b. pleopods, c. Uropod

Remarks: *Anilocra frontalis* was described by Milne Edwards [16]. The redescription of this species was made only by Trilles [14]. The number of seta on maxilliped, maxilla, maxillule, mandible found in this study is compatible with Trilles [14] 's findings. The number of articles on the antenna in this study is compatible with Trilles [14], but the number of articles on antennule is different which was found by Trilles [14]. The dispersion and sequence of spines on pereopods articles and coupling hooks on pleopods found in this study are compatible with Trilles [14]. The male of *A. frontalis* resembles *A. physodes*. *A. frontalis* can be separated from *A. physodes* redescribed by Trilles [14], by the lateral lobe of maxilla with 2 setae; medial lobe with 2 large setae (two robust setae on lateral lobe and one robust seta on medial lobe in *A.physodes*), mandible palp second article with 3 setae and third article with 11-13 setae (9 setae on the distolateral margin of articles 3 respectively in *A. physodes*); pleopods and pleotelson without setae (posterior side of pleopods and pleotelson with setae in *A. physodes*).

Genus Ceratothoa Dana, 1852

Ceratothoa italica Schiödte & Meinert, 1883 (Figure 1f, 1g, 6, 7, 8, 9)

Female: Length 22.14 mm, width 8.2 mm. Body elongate, 2.7 times width. The widest and narrowest of pereonites are 4 and respectively. Cephalon triangle-shaped, and visible, cephalon length 0.4 times the width. Eyes well developed; one eye 0.23 times cephalon width, 0.5 times cephalon length.

Pereonites increased gradually and slightly from 1 to 4; decreasing progressively from 5 to 7 in width. Pereonites progressively increased from 2 to 4 and later decreased from 5 to 7 in length. Pereon widest at pereonite 4, the narrowest at pereonite 7. Pereonite 1 longest, pereonite 7 shortest. Coxae 4-7 partly visible in dorsal view; posteroventral angles of coxae 4-7 extending beyond posterior pereonites.

Pleonites are visible in the dorsal. Pleonites lengths increased progressively (except 4); pleonite 5 longest; pleonite 1 shortest. Pleonite on widest at pereonite 3, the narrowest at pereonite 1 in width. Pleotelson 0.47 times anterior width; posterior and lateral margins slightly rounded.

Antenna slightly longer than antennula, consisting of 7 articles. Antennula consists of 6 articles. Maxilliped distal palp with three apical recurved setae on article 3. Mandible palp article 1 largest, article 1 shortest, article 3 with 3 setae on distolateral margin. Maxillula with four terminal robust setae. Lateral and medial of maxilla with 9 and 5 robust setae.

Pereopods without seta. Pereopod 1 basis 1.7 times greatest width; ischium 0.6 times basis; propodus 1.1 times width; dactylus slender, 1.2 times propodus, 1.1 times basal width. Pereopod 7 basis 1.5 times greatest width; ischium 0.6 times basis; merus 0.5 times width, 0.4 times ischium; carpus 0.4 times width, 0.3 times ischium; propodus 1.1 width, 0.5 times ischium; dactylus slender 1.1 times propodus, 1.8 times basal width.

Pleopods gradually decrease from 3 to 5; pleopod 1 biggest and pleopod 5 smallest. Endopod of all pleopods shorter than exopod. Pleopod 1 exopod 1.1 times width, endopod 1.2 times width. Distal, lateral margin of exopod and endopod slightly

rounded, medial margin strongly convex. Peduncle 2.3 times as width as length. Pleopods without coupling hooks on protopod medial margin. Pleopods without folds.

Pleotelson 0.5 times anterior width; lateral margins straight; posterior margin slightly rounded. Uropod exopod slightly shorter than endopod; endopod not extending beyond posterior margin of pleotelson. Endopod, apically rounded, 5 times as long as greatest width. Exopod extending to end of endopod, 4.4.5 times width. Medial, lateral margins of endopod and exopod slightly straight, margins and apices without seta. Uropod peduncle margins without seta.

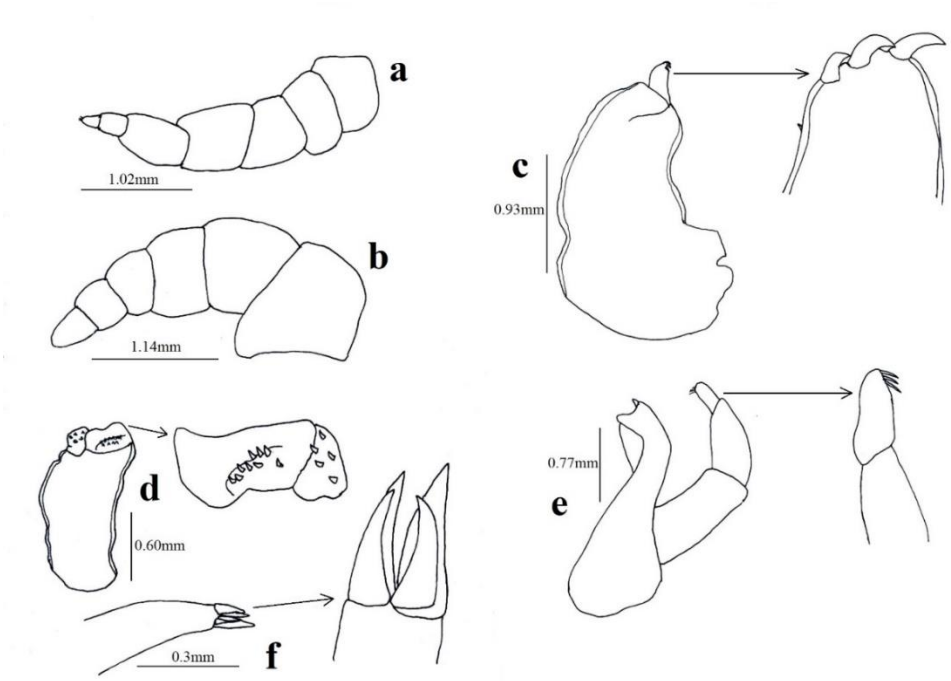

Figure 6. *Ceratothoa italica* female, a. antenna, b. antennule, c. maxilliped, d. maxilla, e. mandible, f. maxillule

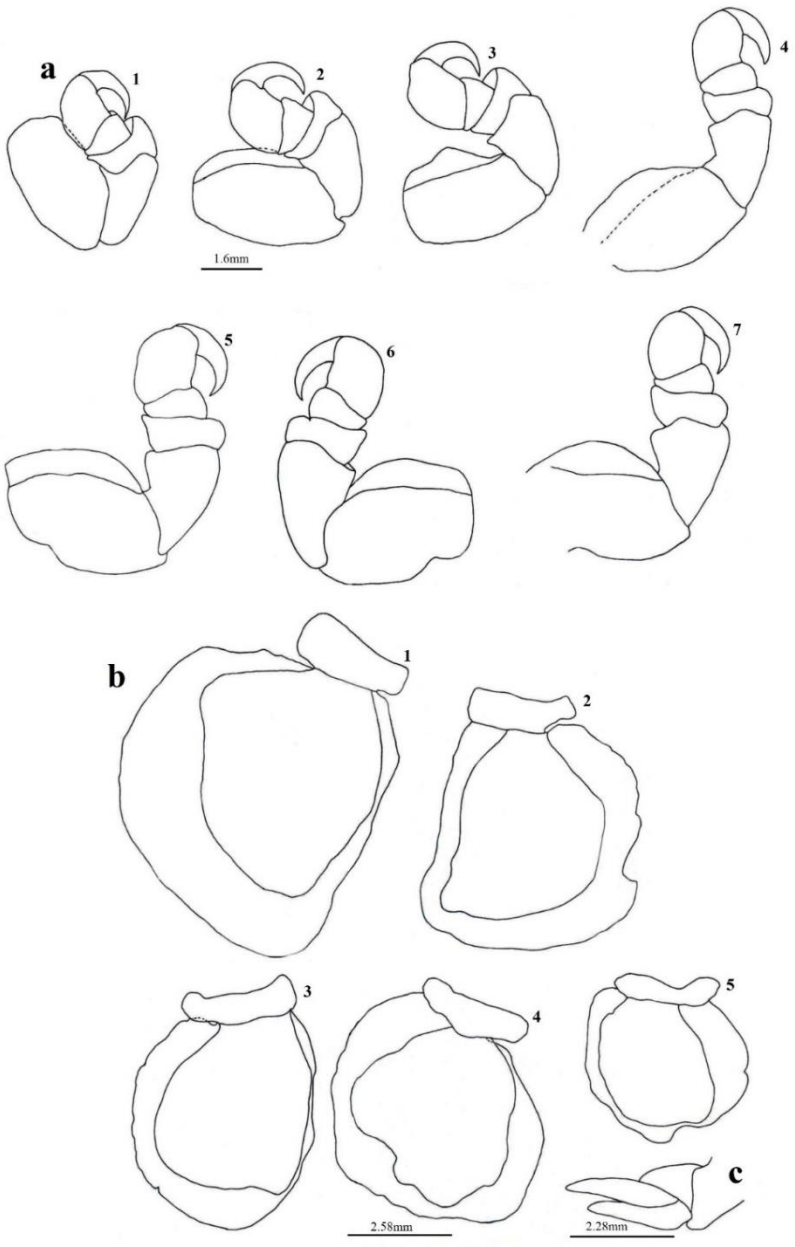

Figure 7. *Ceratothoa italica* female, a pereopods, b. pleopods, c. uropod

Male: Length 8.5 mm, width 3.28 mm. Body elongate, 2.6 times width. The widest and narrowest of pereonite are 5 and 7 respectively. Cephalon triangle-shaped, visible, 0.45 times longer than width. Eyes developed; one eye 0.36 times cephalon width and 0.8 times length of the cephalon.

Pereonites increased gradually and slightly from 1 to 5; decreasing progressively from 5 to 7 in width. Pereonites progressively increased from 2 to 4 and later decreased from 5 to 7 in length. The widest and narrowest of pereonite are 5 and 1, respectively. The longest and shortest of pereonites are 1 and 7 respectively. Coxae 4-7 partly visible in dorsal view; posteroventral angles of coxae 4-7 slightly extending beyond posterior pereonites.

Pleonite 1 is slightly visible in the dorsal. Pereonite 7 partially covers pleonite 1. Pleonites lengths increased progressively; pleonite 5 longest; pleonite 2 shortest in

length. Pleonite on widest at pereonite 3, the narrowest at pereonite 1 in width. Pleotelson 0.47 times anterior width, posterior and lateral margins slightly rounded.

Antennula consists of 7 articles. Antenna consists of nine articles. Maxilliped distal palp with three apical recurved setae on article 3. Mandible palp article 1 largest, article 2 shortest, article 3 with 12 setae on distolateral margin; article 2 with 6 setae. Maxillula with four terminal robust setae. Lateral and medial of maxilla with 3 recurved robust setae.

Pereopods with one seta on the anterior margin of merus. Pereopod 1 basis 1.5 greatest width; ischium 0.5 times basis; propodus 1.8 times width; dactylus 0.9 times propodus, 2.2 times basal width. Pereopod 7 basis 1.6 times greatest width; ischium 0.7 times basis; merus 0.6 times width, 0.3 times ischium; carpus 0.6 times width, 0.3 times ischium; propodus 1.6 times width, 0.7 times ischium; dactylus slender 0.8 times propodus, 1.6 times basal width.

Pleopods gradually decrease from 3 to 5; pleopods 1-2 and 3-5 are similar in size. Endopod of all pleopods shorter than exopod. Pleopod 1 exopod 1.1 times width, distal and medial margins slightly rounded, lateral margin strongly convex; endopod 1.6 times width, distal and medial, lateral margin slightly rounded and medial margin straight; peduncle 2.3 times as wide as long. Protopod medial margin of pleopods 1-5 with four coupling hooks. Pleopods 1 with well-developed proximomedial lobe. Pleopods without folds.

Pleotelson 0.5 times anterior width; lateral slightly convex; posterior slightly rounded. Uropod endopod slightly shorter than exopod; endopod not extending beyond posterior margin of pleotelson. Endopod 4.5 times the greatest width; exopod extending to end of endopod, 4.4 times the greatest width. Medial, lateral, distal margins of exopod and endopod slightly rounded, medial margins straight. Margins and apices of exopod and endopod without seta. Uropod peduncle margins with two setae.7

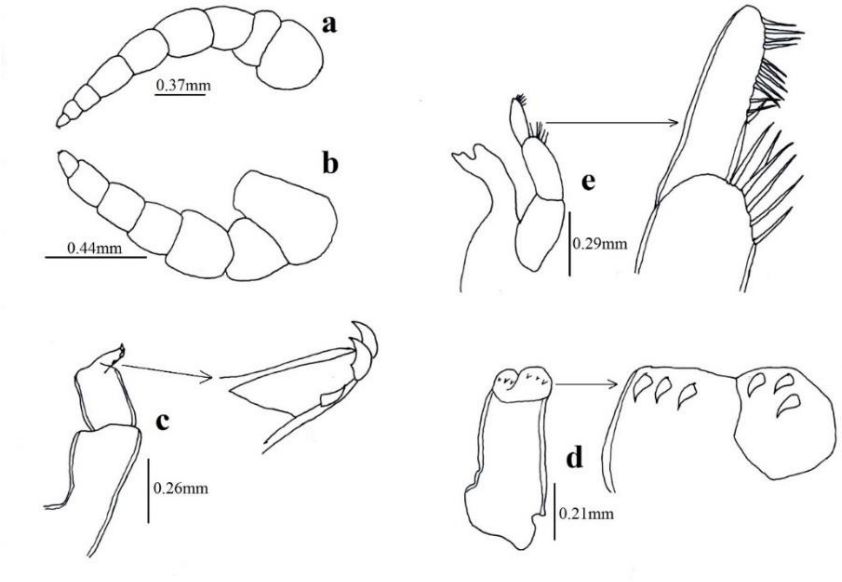

Figure 8. *Ceratothoa italica* male, a. antenna, b. antennule, c. maxilliped, d. maxilla, e. mandible

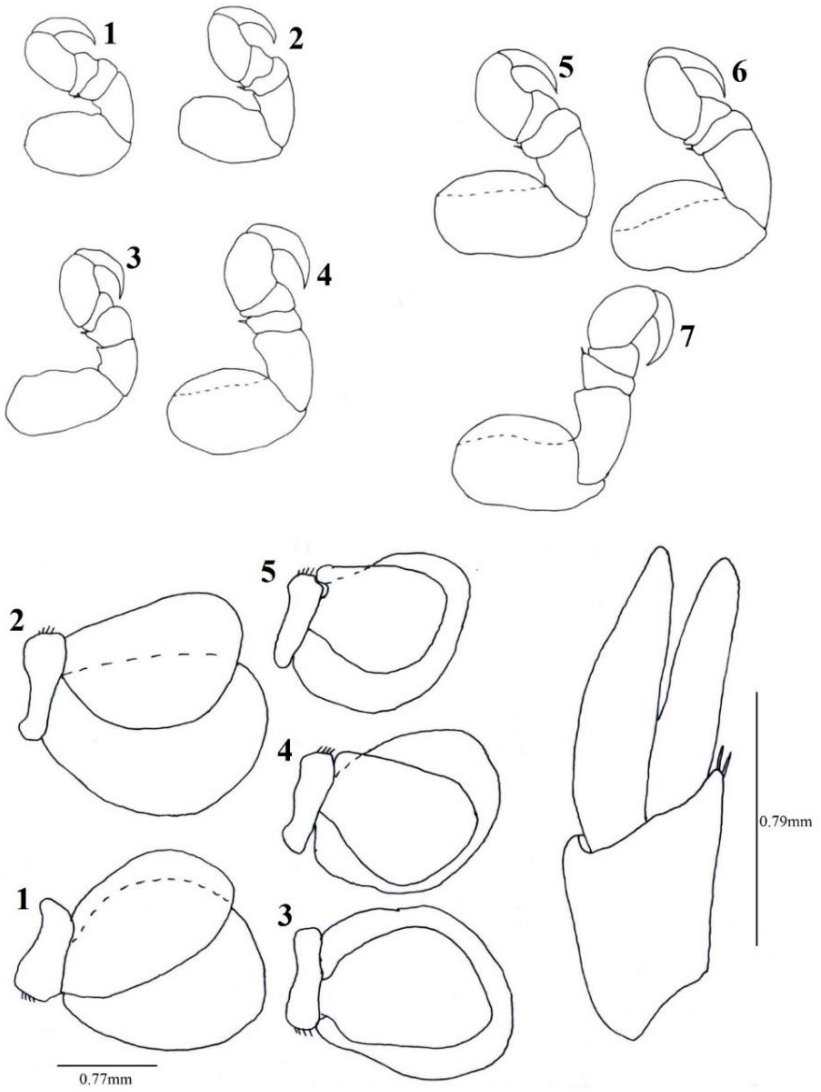

Figure 9. *Ceratothoa italica* male, a pereopods, b. pleopods, c. Uropod

Remarks: The female and second pullus stage of *Ceratothoa italica* was described by Schiödte and Meinert [17], except males. Horton [5] redescribed seven species of *Ceratothoa* genus. Schiödte and Meinert [17] and Horton [5]'s descriptions do not include all of the mouthparts of females and males. The antennule with six articles and antenna with nine articles of females found in the present study is different from the antennule with eight articles and antenna with nine articles found by Schiödte and Meinert [17]. Pereopod morphological characters of *Ceratothoa italica* were given in a key to the *Ceratothoa* genus prepared by Horton [5] as "Pleotelson much wider than long and as wide or wider than pereonite VII. Prominent merus expansions on pereopods I-III, less prominent on pereopods V-VII". Pereopod characters found in this study are compatible with Horton [5]. Neither the mouthparts of the female nor the morphologies of the male of *C. italica* are given in Schiödte and Meinert [17] and Horton [5]. Therefore, no comparison has been made in this study.

4. Discussion

Species belonging to the genera *Nerocila* (*Nerocila bivittata* (Risso, 1816), *Nerocila orbignyi* (Guérin-Méneville, 1832), *Nerocila milesensis* Öktener, Trilles, Tuncer, 2020), *Anilocra (Anilocra physodes* (Linnaeus, 1758), *Anilocra frontalis* H. Milne Edwards, 1840), *Mothocya* (*Mothocya epimerica* Costa, 1851, *Mothocya belonae* Bruce, 1986, *Mothocya taurica* (Czerniavsky, 1868)), *Elthusa* (*Elthusa poutassouiensis* (Penso, 1939), *Elthusa sinuata* (Koelbel, 1879)), *Ceratothoa* (*Ceratothoa parallela* (Otto, 1828), *Ceratothoa capri* (Trilles, 1964), *Ceratothoa italica* Schiödte & Meinert, 1883, *Ceratothoa oestroides* (Risso, 1826), *Ceratothoa oxyrrhynchaena* Koelbel, 1878), *Emetha* (*Emetha audouini* (H. Milne Edwards, 1840)) have been reported from marine fish in Turkey [15, 18].

Mothocya epimerica is a typical parasite of Atherinidae family. This species was only reported from *Atherina boyeri* Risso 1810 (syn. *Atherina mochon*, *Atherina rissoi*), and *Atherina hepsetus* Linnaeus 1758 [1, 19]. It is known from the Mediterranean, Black Sea, Adriatic Sea, and Atlantic Ocean [1, 19, 20]. In this study, this parasite is found only on *Atherina boyeri*.

Ceratothoa italica is a parasite that typically settles in the buccal cavity of fish. It prefers especially fish belonging to the family Sparidae such as *Lithognathus mormyrus* (Linnaeus 1758), *Pagellus erythrinus* (Linnaeus 1758), *Oblada melanura* (Linnaeus 1758), *Sargus* sp, *Diplodus sargus* (Linnaeus 1758), *Diplodus annularis* (Linnaeus 1758) [1, 21, 22]; rarely reported from *Spicara maena* (Linnaeus 1758), *Dicentrarchus labrax* (Linnaeus 1758) [18, 23]. This species has already been recorded in the Mediterranean, Adriatic Sea, and Sea of Marmara [1]. *Boops boops* (Linnaeus 1758) belonging to the family Sparidae has been found as a new host for *C. italica*. The fact that this parasite was previously reported from sparids confirms our finding.

Anilocra frontalis is a typical external parasite, especially prefers body surfaces and fins of fish. This species was especially reported on the Labridae (*Labrus bergylta* Ascanius 1767 (syn. *Labrus maculatus*), *Labrus mixtus* Linnaeus 1758 (syn. *Labrus vetula*), *Labrus merula* Linnaeus 1758, *Symphodus melops* (Linnaeus 1758) (syn. *Labrus melops*), *Symphodus cinereus* (Bonnaterre 1788) (syn. *Crenilabrus cinereus*), *Symphodus ocellatus* (Linnaeus 1758) (syn. *Crenilabrus ocellatus*), *Symphodus rostratus* (Bloch 1791) [1].

Anilocra frontalis has also been recorded from the other fish families such as *Pollachius pollachius* (Linnaeus 1758) (syn. *Merlangus pollachius*), *Lipophrys pholis* (Linnaeus 1758) (syn. *Blennius pholis*), *Taurulus bubalis* (Euphrasen 1786) (syn. *Cottus bubalis*), *Redigobius bikolanus* (Herre 1927) (syn. *Gobius flavescens*), *Gobius paganellus* Linnaeus 1758, *Pomatoschistus minutus* (Pallas 1770) (syn. *Gobius minutus*), *Gaidropsarus mediterraneus* (Linnaeus 1758) (syn. *Onos mustella*), *Spinachia spinachia* (Linnaeus 1758) (syn. *Spinachia vulgaris*), *Boops boops* (Linnaeus 1758), *Spondyliosoma cantharus* (Linnaeus 1758), *Sarpa salpa* (Linnaeus 1758) [1], *Mullus barbatus* Linnaeus 1758, *Umbrina canariensis* Valenciennes 1843, *Pagellus acarne* (Risso 1827), *Diplodus annularis* (Linnaeus 1758), *Lithognathus mormyrus* (Linnaeus 1758), *Solea solea* (Linnaeus 1758) (syn. *Solea vulgaris*) [22], *Umbrina cirrosa* (Linnaeus 1758), *Argyrosomus regius* (Asso, 1801) (syn. *Sciena aquila*) [24].

It is known in the Mediterranean, Atlantic Ocean, and Adriatic [1]. *Sciaena umbra* Linnaeus 1758 is a new host for *A. frontalis*. *Sciaena umbra* belongs to Sciaenidae. This parasite was reported from *Umbrina canariensis* Valenciennes 1843 (Sciaenidae) by Ramdane et al. [22] and from *Umbrina cirrosa*, *Argyrosomus regius* by Ramdane and Trilles [24].

Nerocila bivittata is recorded from Labridae, Sparidae, and Scorpaenidae in the Mediterranean [1]. Host selectivity confirms the finding in this study. It is reported for the first time from in the Dardanelles Strait.

Ceratothoa oestroides is known from North Atlantic Ocean, the Mediterranean Sea. Hosts of this parasite constitute mainly Sparidae and Centracanthidae families [1]. In the present study, the parasite was frequently found in blotched picarel, bogue.

Ceratothoa parallela is mostly distributed in the Mediterranean and Atlantic Ocean. It like *C. oestroides* has been reported from many host species of Sparidae [1].

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