

First record of the Indo-Pacific *Cymothoa indica* (Crustacea, Isopoda, Cymothoidae), a Lessepsian species in the Mediterranean Sea

Jean-Paul Trilles¹ and Michel Bariche^{2*}

¹Equipe Adaptation Ecophysiologique et Ontogenèse, UMR 5171 (UM2-IFREMER-CNRS) “Génome, Populations, Interactions, Adaptation”, Université Montpellier 2, CC. 092, Place E. Bataillon, 34095 Montpellier cedex 5, France; ²Department of Biology, Faculty of Arts and Sciences, American University of Beirut, P.O. Box 11-0236 Beirut, Lebanon

Abstract

Cymothoa indica, a typical Indo-Pacific genus and species, is reported for the first time in the eastern Mediterranean Sea. Specimens were found parasitizing mainly barracudas (Sphyraenidae) from Lebanon. Female and male specimens are described on collected materials. To date, the genus *Cymothoa* has not been reported in the Mediterranean Sea although it is widely represented in other areas of the world. It is suggested that *C. indica* should be added to the list of exotic species introduced from the Red Sea and known as Lessepsian migrants.

Key words

Cymothoa indica, Crustacea, Cymothoidae, Lessepsian species, Sphyraenidae, Lebanon

Introduction

Cymothoids (Isopoda, Flabellifera) are a group of crustaceans typically parasitic of teleost fishes. The oldest report dates back to Belon (1553) and one species, probably *Anilocra*, was reported as “*Pediculus marinus*” by Rondelet (1558) in his “Histoire Naturelle des Poissons”. Many studies were later published on these animals (e.g. Trilles 1994, Biju Kumar and Bruce 1997, Williams and Williams 1998, Charfi-Cheikhrouha *et al.* 2000, Horton 2000, Thatcher 2000, Veerapan and Ravichandran 2000, Öktener and Trilles 2004). Despite that, there are still several parts of the world where cymothoid fauna is poorly or completely unknown. This was the situation in the eastern Mediterranean Sea, particularly in Lebanon.

Several studies were published recently. Öktener and Trilles (2004) reported thirteen cymothoid species belonging to six genera (*Anilocra*, *Nerocila*, *Ceratothoa*, *Emetha*, *Livoneca* and *Mothocya*) from Turkey. In the southern Levant, Horton *et al.* (2005) recorded the unusual occurrence of *Ceratothoa steindachneri* Koelbel, 1878, on *Chlorophthalmus agassizi* (Chlorophthalmidae), collected at depths of 300–400 m. From the Lebanese coast, Bariche and Trilles (2005) recently reported seven cymothoid species [*Anilocra physo-*

des (L., 1758), *Nerocila bivittata* (Risso, 1816), *Nerocila* sp., *Ceratothoa italica* Schioedte et Meinert, 1883, *C. oestroides* (Risso, 1826), *C. oxyrhynchaena* Koelbel, 1878 and *C. collaris* Schioedte et Meinert, 1883]. Bariche and Trilles (2006) also described a new species *Anilocra pilchardi* from clupeiform fishes.

Specimens of the genus *Cymothoa* Fabricius, 1793 were collected mainly from barracudas (Sphyraenidae) from Lebanon. These are the first records of this genus from the Mediterranean Sea although it is commonly represented in others areas of the world (e.g. Trilles and Galzin 1969, Avdeev 1979, Brusca 1981, Bowman and Tareen 1983, Rokicki 1986, Trilles 1994, Williams and Williams 1994, Veerapan and Ravichandran 2000). Careful study revealed that they belong to the species *Cymothoa indica* Schioedte et Meinert, 1884 which was first reported from Bangkok and is typical to the Indo-Pacific biogeographic region. These specimens are also consistent with *Cymothoa eremita*? (Brünnich, 1783) (one female, non-ovigerous) reported on *Sphyraena obtusata* from Kuwait (Bowman and Tareen 1983).

The eastern Mediterranean has been invaded by numerous Red Sea species from different taxa since the opening of the Suez Canal (“Lessepsian migration” according to Por 1978).

*Corresponding author: michel.bariche@aub.edu.lb

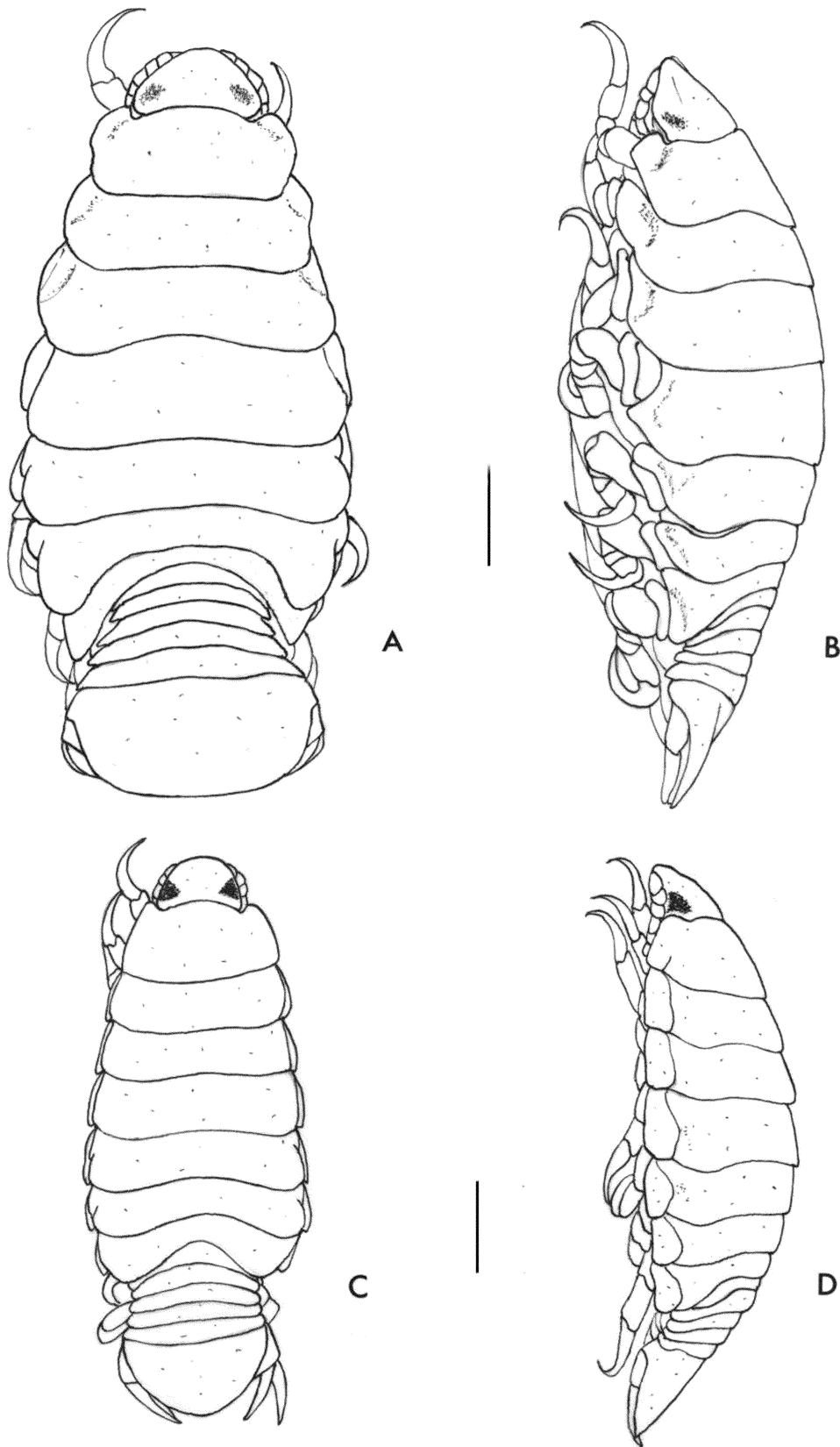


Fig. 1. *Cymothoa indica* Schioedte et Meinert, 1884: **A** and **B** – ovigerous female (AUBM Cr-434); **C** and **D** – male (AUBM Cr-411); **A** and **C** – dorsal view; **B** and **D** – lateral view. Scale bars = 3 mm (A, B); 1.5 mm (C, D)

Recently, Bariche and Trilles (2006) suggested *Anilocra pilchardi* Bariche et Trilles, 2006 as being the first Lessepsian Cymothoidae recorded in the Mediterranean Sea.

In this article, we describe the female and male stages of *C. indica* from Lebanese specimens.

Materials and methods

All specimens were collected from fresh fish landed along the Lebanese coast during a large-scale survey in Lebanon (February 2003 – September 2005). All collected specimens were immediately fixed in 70% ethanol and labelled. They were deposited in the Natural History Museum collection of the American University of Beirut (AUBM), Lebanon. *Cymothoa indica* was identified according to Schioedte and Meinert (1884), Pillai (1954), Trilles (1975), Veerapan and Ravichandran (2000) and Rajkumar *et al.* (2004, 2005a). When needed, fish names were updated according to Froese and Pauly (2005). Fish hosts were recorded as *Sphyraena* spp. when we were not able to identify the fish to the species level.

Results

Family Cymothoidae Leach, 1814

Genus *Cymothoa* Fabricius, 1793

Cymothoa indica Schioedte et Meinert, 1884 (Figs 1–3)

Cymothoa indica Schioedte and Meinert (1884): 250–253, tab. VIII (Cym. XXVI) figs 1–4. Chilton (1924): 887. Hale (1926): 212, fig. 8a–k. Panikkar and Aiyar (1937): 429–430. Trilles (1975): 981–982, pl. I, fig. 6 and 7. Avdeev (1978): 282. Avdeev (1979): 53. Misra and Nandi (1986): 229–231. Veerapan and Ravichandran (2000): 13, figs 5 and 6, pls 1 and 2. Rajkumar, Santhanam and Perumal (2004): 113–114. Rajkumar, Kumaraguru, Perumal and Trilles (2005a): 269–272. Rajkumar, Perumal and Trilles (2005b): 87–90. *Cymothoa eremita*? (Brünnich, 1783) Bowman and Tareen (1983): 25–28 (partly). *Cymothoa asymmetrica*? Pillai (1954): 15. Not *Cymothoa indica* Nierstrasz (1981): 133–135, fig. 1 (p. 134), pl. X (figs V–VIII).

Female (Figs 1A–B, 2A–L and 3A–G): Body stout, dorsum vaulted, about 2.3 times as long as wide, widest at pereonite 6, bilaterally symmetrical. Cephalon 2.5 times as wide as long, nearly pyriform and broadly truncate anteriorly in dorsal view; anterior margin slightly fluxed ventrally between bases of antenna 1; not distinctly immersed in pereonite 1; eyes small, moderately distinct. Pereonite 1 indistinct or very little produced on each antero-lateral side. Coxal plates of pereonites 2–3 inconspicuous, those of 4–7 visible in dorsal view. Pereon widest at fifth and sixth pereonites; first segment much longer than any of the others except fourth nearly equal in length; second and third pereonites subequal in length, fifth shorter than fourth (ratio 1:1.5) and longer than sixth (ratio 1:0.5) which is longer than seventh segment (ratio 0.5:0.2), the latter being significantly the shortest of all. All pleonites visible, becoming progressively wider posteriorly, fifth pleonite distinctly wider than first, 1–4 subequal in length, fifth

slightly longer. Pleotelson 1.9–2 times as wide as long, slightly wider than fifth pleonite, posterior margin broadly rounded. Antennule stouter and subequal in length to antenna, with 8 articles, extending to anterior margin of pereonite 1, first three articles slightly wider than others; antenna with 9 articles decreasing gradually in width, article 9 with few terminal aesthetascs. Mandible palp without setae, third article distinctly shorter than others; maxillule with 4 terminal spines; maxilla lateral lobe with 1 spine, medial 2; maxilliped of ovigerous female with oostegial lobe and a palp with 2 small apical recurved spines on article 3; 5 apical recurved spines on article 3 of non-ovigerous female. Pereopods gradually increasing in size, all without spines; 1–6 similar to each other; pereopod 7 with basis enlarged and a characteristic distinctive lobe produced on postero-distal angle of ischium. Pleopods not distinctly visible in dorsal view; peduncles without retinacula; endopod of pleopod 4 with small folds; endopod of pleopod 5 massively folded. Uropods reaching almost distal margin of pleotelson; rami subequal in length, curved and apically rounded.

Male (Fig. 1C–D): A single male paired with an ovigerous female (AUBM Cr-411), not dissected. Body bilaterally symmetrical, 2.5 times as long as wide, dorsum vaulted nearly as in female. Cephalon not immersed in pereonite 1, anterior margin more or less broadly rounded, eyes relatively larger and more visible than in female. Pereon wider at sixth pereonite, first segment much longer than any of the others, as in females; second and third pereonites subequal, fourth much longer than third and fifth, seventh segments decreasing progressively in length. All coxae conspicuous in dorsal view. All pleonites visible but lateral margins of pleonite 1 partly concealed by pereonite 7; pleonites first and fifth subequal in width and length, rather wider and longer than the others subequal in length; pleopod 2 with appendix masculina well developed. Pleotelson subtriangular about 1.6 wider than long; uropod rami extending slightly beyond posterior of pleotelson; rami subequal in length; apices acute.

Colour: Female and male display a pale tan with some very sparse chromatophores over dorsal surface whether alive or preserved.

Size: Ovigerous female, 19–27 mm; non-ovigerous female, 17–20 mm; male, 8–16 mm.

Type material: We have been unable to examine type specimens (female and male) of *Cymothoa indica* Schioedte et Meinert, 1884. These specimens have been lost, according to Dr O. Coleman, Curator of Crustacean Collection, Museum für Naturkunde, Berlin (8 December 2005). Neither are they held in the Universitetes Zoologiske Museum of København, Denmark, according to Dr J. Olesen, Curator of Crustacean Collection. These specimens were already reported as “male conservata” by the authors (Schioedte and Meinert 1884).

Type locality: Bangkok, Thailand (Schioedte and Meinert 1884).

Type host: Unknown.

Hosts: Lebanese specimens were collected on *Sphyraena chrysotaenia* and other Sphyraenidae not specifically identi-

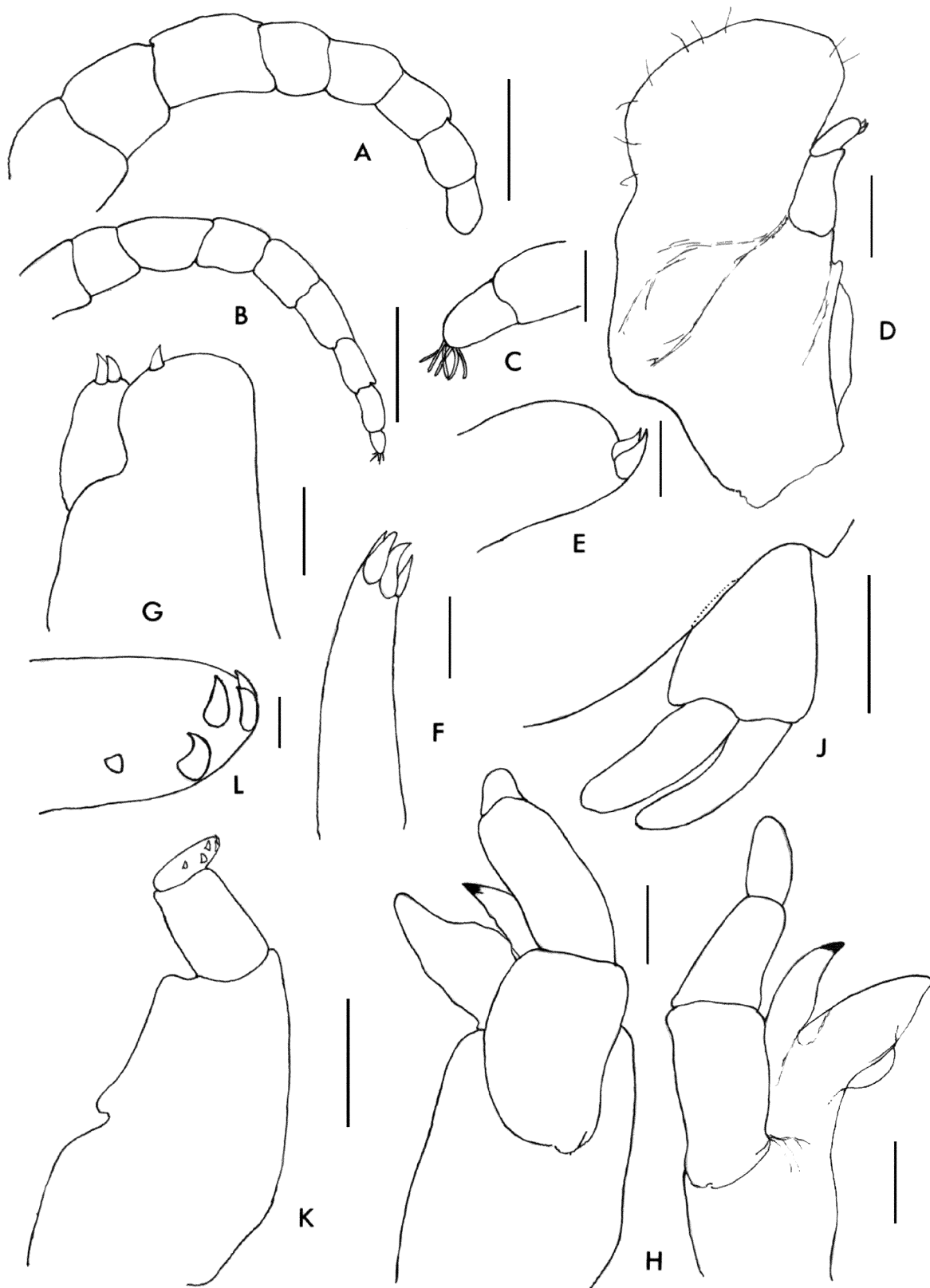


Fig. 2. *Cymothoa indica* Schioedte et Meinert, 1884: **A–J** – ovigerous female (AUBM Cr-443); **K** and **L** – non-ovigerous female (AUBM Cr-452); **A** – antennule; **B** – antenna; **C** – antenna, distal article; **D** – maxilliped; **E** – maxilliped palp, distal article; **F** – maxillule; **G** – maxilla; **H** and **I** – left and right mandibles; **J** – uropod; **K** – maxilliped; **L** – maxilliped apex. Scale bars = 0.5 mm (A, B, D, H, I, J, K); 0.1 mm (C, F, G); 0.05 mm (E)



Fig. 3. *Cymothoa indica* Schioedte et Meinert, 1884: **A-G** – ovigerous female (AUBM Cr-443); **A** – pereopod 1; **B** – pereopod 4; **C** – pereopod 7; **D** – pleopod 1; **E** – pleopod 2; **F** – pleopod 4; **G** – pleopod 5. Scale bar = 1 mm (A–G)

fied. In India, *Cymothoa indica* were reported from Cichlidae: *Etroplus maculatus*, *E. suratensis* (Panikkar and Aiyar 1937); Gobiidae: *Glossogobius giurus* (Chilton 1924, Panikkar and Aiyar 1937); Sphyraenidae: *Sphyraena obtusata* and Synodontidae: *Trachinocephalus myops* (Veerapan and Ravichandran 2000); Belonidae: *Strongylura strongylura* (Misra and Nandi 1986, Rajkumar *et al.* 2004) and from cultured *Mystus gulio* (Bagridae) and *Lates calcarifer* (Latidae) (Rajkumar *et al.* 2005a, b). In Australian waters, this species was apparently collected from a Mugilidae and a "whiting" (Hale 1926), but these records require verification.

Site of infection: Mainly in mouth, sometimes in the branchial cavities and more rarely on the body.

Material examined: Female (ovigerous, 23 mm), Beirut, May 2004, from *Sphyraena chrysotaenia* (Sphyraenidae) (AUBM Cr-434). Female (ovig., 23 mm) and male (8 mm), Beirut, May 2004, from *Sphyraena* spp. (AUBM Cr-411). Female (ovig., 20 mm), Beirut, August 2004, from *S. chrysotaenia* (AUBM Cr-444). Female (non-ovig., 17 mm), Beirut, August 2004, from *S. chrysotaenia* (AUBM Cr-452). Two females (ovig., 19–26 mm), Beirut, July 2004 (AUBM Cr-443) and May 2004 (AUBM Cr-428) from *S. chrysotaenia*. Eight females (ovig., 19–27 mm), Beirut, May 2004 (AUBM Cr-416; 412; 414; 418; 419; 420; 422) from *Sphyraena* spp. Female (ovig., 23 mm), Beirut, May 2004, from *Pagellus erythrinus* (Sparidae) (AUBM Cr-417). Female (non-ovig., 20 mm), Beirut, July 2004, from *S. chrysotaenia* (AUBM Cr-450). Two females (non-ovig., 18–19 mm), Beirut, from *Sphyraena* spp., May 2004 (AUBM Cr-414; 421). *Cymothoa indica*: Seven females (3 ovig., 15–18 mm; 4 non-ovig., 10–12 mm), Vellar estuary (11°29'N, 79°49'E), Parangipettai, Southeast India, October 2005, from *Sphyraena obtusata* (Sphyraenidae) and *Trachinocephalus myops* (Synodontidae) (coll. M. Rajkumar). *Cymothoa frontalis*: Female (ovig., 24 mm, holotype; non-ovig., 18 mm), Indian Sea ("Mer des Indes"), 1840, (MNHN Is 268 – Muséum National d'Histoire Naturelle in Paris); female (damaged, not measurable), Bangkok (Schioedte and Meinert 1884) (MNHN Is 465).

Distribution: Previous reliable records are entirely from the Indian Ocean: Bangkok, Thailand (Schioedte and Meinert 1884), and India, Chilka Lake (Chilton 1924); Madras (Panikkar and Aiyar 1937); Parangipettai (Veerapan and Ravichandran 2000; Rajkumar *et al.* 2004, 2005a, b). There is also mention from Australia (Hale 1926) but this record is to be verified.

Discussion

Species of the genus *Cymothoa* can generally be divided in two groups according to the size and shape of the amphicephalic processes of pereonite 1. About 27 nominal *Cymothoa* species present moderately or strongly wide amphicephalic processes of pereonite 1. These species are *C. borbonica* Schioedte et Meinert, 1884; *C. brasiliensis* Schioedte et Meinert, 1884; *C. bychowskyi* Avdeev, 1979; *C. carangi* Avdeev, 1979; *C. caraibica* Bovallius, 1885; *C. elegans* Bo-

vallius, 1885; *C. epimerica* Avdeev, 1979; *C. eremita* (Brünich, 1783); *C. excisa* Perty, 1830; *C. exigua* Schioedte et Meinert, 1884; *C. eximia* Schioedte et Meinert, 1884; *C. gadorum* Brocchi, 1877; *C. gerris* Schioedte et Meinert, 1884; *C. globosa* Schioedte et Meinert, 1884; *C. ianuarii* Schioedte et Meinert, 1884; *C. liannae* Sartor et Pires, 1988; *C. limbata* Schioedte et Meinert, 1884; *C. oestrum* (L., 1758); *C. parupenei* Avdeev, 1979; *C. plebeia* Schioedte et Meinert, 1884; *C. propria* Avdeev, 1979; *C. pulchrum* Lanchester, 1902; *C. rhina* Schioedte et Meinert, 1884; *C. rotunda* Avdeev, 1979; *C. selari* Avdeev, 1978; *C. truncata* Schioedte et Meinert, 1884; and *C. vicina* Hale, 1926. It is important to specify that *C. lanceolata* Say, 1818 and *C. marginata* Bleeker, 1856 do not belong to the genus *Cymothoa* and their generic position remains uncertain. Furthermore, the validity of other species listed must be considered questionable.

The remaining five other nominal species are characterized by poorly developed or undeveloped amphicephalic processes of pereonite 1. These species are *Cymothoa asymmetrica* Pillai, 1954; *C. curta* Schioedte et Meinert, 1884; *C. frontalis* Milne Edwards, 1840; *C. indica* Schioedte et Meinert, 1884 and *C. slusarskii* Rokicki, 1986. A single specimen of *C. asymmetrica* was collected and briefly described by Pillai (1954) from the buccal cavity of *Sphyraena jello* from Travancore (India). *C. curta* was described by Schioedte and Meinert (1884) on the gills of *Anablepis tetraphthalmi* but from an unknown locality; *C. curta* was afterward collected by Avdeev (1978) in the buccal cavity of *Velifer hypselopterus* from the Arafura Sea. *C. frontalis* was collected from the Indian Ocean (Milne Edwards 1840, White 1847), Singapore (Heller 1868), Bangkok (Schioedte and Meinert 1884) and west Australia (Avdeev 1978) from the gills of *Cyclopterus* (White 1847). *C. slusarskii* was reported from the mouth of *Dentex macrophthalmus* (Sparidae) from Africa (the western Saharan coast).

The Lebanese specimens undoubtedly belong to the second group of *Cymothoa* since they present poorly developed/undeveloped amphicephalic processes of pereonite 1. Lebanese *Cymothoa* can be readily distinguished from *C. curta* due to having the body less stocky (1.8 times as long as wide for *C. curta*), pyriform cephalon (trapezoid), posterior margin of pleonite 5 unsinuate (trisinuate), and posterior margin of pleotelson broadly rounded (bisinuate). *C. slusarskii* is also distinct, with a body clearly more elongated (2.38 as long as wide), poorly developed processes of pereonite 1 distinctly acute, cephalon abruptly narrowed at the level of the antennae, posterior margin of pleonite 5 bisinuate, pleotelson with a notch at the distal margin, and pereopod 7 without lobe on postero-distal angle of ischium. *C. frontalis* is rather similar to the Lebanese specimens but it differs mainly with a less stocky body (2.66 as long as wide), pleon distinctly narrower than the pereon, the pleotelson fairly less wide (1.5 times as wide as length) with a notch at the distal margin and pereopod 7 without lobe on ischium.

It seems that *C. asymmetrica* is probably synonymous with *C. indica*. According to Pillai (1954), *C. asymmetrica* differs only by "the slightly asymmetrical nature of the body".

However, this character may be accidental on the unique specimen collected.

On the other hand, *C. indica* from Lebanon are similar to the single non-ovigerous female reported by Bowman and Tareen (1983) from *Sphyræna obtusata* from Doha (Kuwait) and provisionally assigned to *Cymothoa eremita*? (Brünnich, 1783). Both species can be distinguished by having the anterior processes of pereonite 1 not well developed, cephalon pyriform not immersed in the first pereonite and anterior margin broadly truncate, width regularly increased from first pereonite to sixth and from first pleonite to fifth, pleotelson distinctly wider than long and pereopod 7 with a well developed lobe on ischium.

This is the first report of the genus *Cymothoa* from the Mediterranean Sea. In Lebanon, *C. indica* was collected mainly from barracudas. From the four species of barracudas found in the eastern Mediterranean, two species are Lessepsian immigrants (Golani *et al.* 2002). *Sphyræna chrysotaenia* is very common in the landings while only a few specimens of *S. flavicauda* were recorded in the Mediterranean (Golani *et al.* 2002). Fish host was labelled *Sphyræna* spp. every time a cymothoid was collected from barracudas but where proper identification to the species level was not possible. It is thus possible that *C. indica* could also be parasitizing the native barracudas (*S. sphyræna* and *S. viridensis*). One specimen was also collected on the native *Pagellus erythrinus* (Sparidae) (AUBM Cr-417).

Although *S. chrysotaenia* has been recorded in the Mediterranean since Spicer (1931), it cannot be suggested that *C. indica* was introduced attached to the Lessepsian barracuda since other Lessepsian fishes could have been the vector. Nevertheless, it is certain that *C. indica* is another Lessepsian species, besides being the first representative of genus *Cymothoa* to be added to the list of alien species in the Mediterranean Sea.

Acknowledgements. We are grateful to the University Research Board (URB) of the American University of Beirut for funding this research (DDF 111030/588112), to Prof. Gérard Lefranc for transporting specimens between our two laboratories, to Dr Danielle Defaye (Muséum National d'Histoire Naturelle, Paris), Dr Charles Oliver Coleman (Museum für Naturkunde, Berlin) and Dr Jorgen Olesen (Universitetes Zoologiske Museum, København) for their help in our research for types, to Dr Mayalagu Rajkumar (Annamalai University, Parangipettai, India) for providing us with additional material from India. Thanks also to Mr. Joseph Chahwan and the Lebanese fishermen for their help in collecting the specimens, and to Ms. Karen Zahorchak for correction of English.

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(Accepted May 23, 2006)