

Ceratothoa collaris (Isopoda: Cymothoidae) new to the eastern Mediterranean, with a redescription and comments on its distribution and host specificity

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Ceratothoa collaris is reported for the first time outside its known geographical range, which was restricted to north-western African coasts (from Senegal to Tunisia). Many specimens of different developmental stages were collected off the Lebanese coast in the eastern Mediterranean. In addition to an update of the geographical range, synonymy and host specificity, an accurate redescription of the species is given on the basis of new and old materials.

Keywords: *Ceratothoa collaris*, cymothoid, parasitic isopod, Levantime, basin, Lebanon

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INTRODUCTION

Cymothoids are a family of ectoparasitic isopods found on body, fins, or inside the buccal or branchial cavities of numerous freshwater and marine fish. They are protandrous hermaphrodite. The settling male will first increase in size and, after mating, will change to the female stage (Mayer, 1879; Montalenti, 1941, 1948; Juchault & Legrand, 1965; Trilles, 1969, 1994; Stephenson, 1976; Weinstein & Heck, 1977; Kensley, 1978; Raibaut & Trilles, 1993). For a long time, it has been relatively well known that descriptions made exclusively on juvenile or non-ovigerous females are not recommended as they lead to misidentifications.

The cymothoid fauna of the eastern Mediterranean were relatively poorly known and studies have started only recently in Greece (Papapanagiotou *et al.*, 1999; Papapanagiotou & Trilles, 2001), Turkey (Horton & Okamura, 2001; Öktener & Trilles, 2004; Trilles & Öktener, 2004), Lebanon (Monod, 1931; Bariche & Trilles, 2005, 2006; Trilles & Bariche, 2006) and Israel (Horton *et al.*, 2005).

Out of the eight species reported so far from Lebanon, two were introduced from the Indo-Pacific region. These were *Anilocra pilchardi* Bariche & Trilles, 2006 and *Cymothoa indica* Schioedte & Meinert, 1884 (Bariche & Trilles, 2006; Trilles & Bariche, 2006). The eastern Mediterranean has been invaded by exotic species from the Red Sea via the Suez Canal for more than a century in a process generally known as lessepsian migration (Por, 1978).

Carrying out a large survey on Lebanese cymothoid fauna, we have collected several specimens of *Ceratothoa collaris*,

first identified by Schioedte & Meinert (1883) from Algeria. This species was previously known from the north-western Atlantic (Senegal to Morocco) and Mediterranean (Morocco to Tunisia) coasts of Africa (Trilles, 1994; Horton, 2000). Three morphological forms (*forma typica*, *africana*, and *globuligera*) were distinguished by Monod (1924a, b). However, a meticulous and accurate description of the species was lacking, notably concerning the general features of the female and male, and different appendages and mouth parts.

The present paper reports for the first time the presence of *Ceratothoa collaris* in the easternmost Mediterranean Sea and redescibes the female and male stages, based on the holotype and other materials collected from north-western African coasts and newly collected specimens from Lebanon. It provides also an updated synonymy, geographical distribution and host specificity of the species.

MATERIALS AND METHODS

Material studied was collected from fresh fish landed along the coast of Lebanon from 2003 to 2005 and was deposited at the Natural History Museum of the American University of Beirut (AUBM). It was compared with additional material including the holotype and numerous other specimens from the Atlantic and Mediterranean coasts of Africa, collected by Monod or Dollfus (Trilles, 1972b; Dollfus & Trilles, 1976), and preserved in the Muséum National d'Histoire Naturelle (MNHN), Paris. Drawings were made using a camera lucida attachment and all measurements were made in millimetres. Fish names were updated according to Froese & Pauly (2006).

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SYSTEMATICS

Family CYMOTHOIDAE Leach, 1814

Genus *Ceratothoa* Dana, 1852*Ceratothoa collaris* Schioedte & Meinert, 1883

(Figures 1–5)

Cymothoa oestroides Lucas, 1849: 78, pl. 8, figures 4a–c; *Ceratothoa collaris* Schioedte & Meinert, 1883: 366–368, table XVI (Cym. XXIII), figures 8–9; Carus, 1885: 433; Rokicki, 1984: 1–220, figures 1–68; Rokicki, 1985: 95–122; Trilles, 1986: 617–636; Trilles, 1994: 5–288; Horton, 2000: 1041–1052; Bariche & Trilles, 2005: 53–60; *Meinertia collaris* Monod, 1924a: 31–34; Monod, 1924b: 430–432; Monod, 1925: 103–104; Trilles, 1972b: 1231–1268, pl. I–II; Trilles & Raibaut, 1973: 273–281; Capapé & Pantoustier, 1976: 203; Dollfus & Trilles, 1976: 821–830; Trilles, 1977: 10; Trilles, 1979: 513–526, pl. I–IV; Avdeev, 1979: 48–54.

MATERIAL

Female (ovigerous 38 mm), Algeria, Lucas 1849 (Schioedte & Meinert, 1883; Trilles, 1972b), host unknown (holotype, MNHN-Is 40); female (ovigerous 40 mm), Algiers, Algeria, Lucas 1849 (misidentified as *Cymothoa oestroides*), host unknown (MNHN-Is 41); female (ovigerous 30 mm) and male (15 mm), Antelias, Lebanon, 12 July 2003, on *Pagrus* sp. (AUBM-Cr 227); male (9.5 mm), Antelias, 18 February 2005, on *Pagellus acarne* (AUBM-Cr 712); male (15 mm), Maameltein, 2 January 2005, on *Pagellus erythrinus* (AUBM-Cr 510); female (ovigerous 30 mm), Tripoli, 27 February 2005, on *Epinephelus aeneus* (AUBM-Cr 984); female (ovigerous 26 mm), Antelias, 18 January 2005, on *P. erythrinus* (AUBM-Cr 623); female (non-ovigerous 33 mm), Maameltein, 1 January 2005, on *P. erythrinus* (AUBM-Cr 506); female (ovigerous 32 mm), Antelias, 30 January 2005, on *P. erythrinus* (AUBM-Cr 743); female (ovigerous 27 mm), Maameltein, 3 January 2005, on *P. erythrinus* (AUBM-Cr 534); female (non-ovigerous 30 mm), Antelias, 6 September 2004, on *P. erythrinus* (AUBM-Cr 466); female (ovigerous 32 mm), Antelias, 19 September 2004, on *P. erythrinus* (AUBM-Cr 491); female (ovigerous 33 mm), Antelias, 3 May 2004, on *P. erythrinus* (AUBM-Cr 400); female (ovigerous 32 mm), Antelias, 15 May 2004, on *P. erythrinus* (AUBM-Cr 0417); female (ovigerous 30 mm), Maameltein, 24 April 2004, on *P. erythrinus* (AUBM-Cr 0408); male (14 mm), Antelias, April 2004, host unknown (AUBM-Cr 0399); male (15 mm), Antelias, 24 April 2004, on *P. erythrinus* (AUBM-Cr 396); female (ovigerous 30 mm), Antelias, 18 June 2004, on *Pagrus caeruleostictus* (AUBM-Cr 441); female (ovigerous 25 mm), Antelias, 25 April 2004, on *Pagellus erythrinus* (AUBM-Cr 401); female (ovigerous 28 mm), Antelias, on *Dicentrarchus labrax* (AUBM-Cr 263); female (ovigerous 30 mm), Bouar, Kesserwan, 18 April 2004, on *Dentex macrophtalmus* (AUBM-Cr 356); male (14 mm), Bouar, Kesserwan, 18 April 2004, on *D. macrophtalmus* (AUBM-Cr 357); female (ovigerous 33 mm), Bouar, Kesserwan, 2 April 2004, on *D. macrophtalmus* (AUBM-Cr 364); females (2 ovigerous 37 and 31 mm; 1 non-ovigerous 28 mm) and male (16 mm), Antelias, 19 April 2004, on *D. macrophtalmus* (AUBM-Cr 372).

One hundred and twelve specimens (81 females and 31 males) held in the MNHN and collected along the coasts of

Africa. Detailed lists are recorded in Trilles (1972b) and Dollfus & Trilles (1976).

DESCRIPTION OF FEMALE (FIGURES 1A–D, 2A–K & 3A–H) The general morphology of non-ovigerous females is rather different from the ovigerous ones.

The ovigerous female is stout, with dorsum moderately vaulted, about two times as long as wide, widest at pereonites 4–5 or 5–6, ratio width pereonite 1/width pereonite 6 = 1/1.4; non-ovigerous female is more slender, with a pereon vaguely triangular in shape, widest at pereonite 6, ratio width pereonite 1/width pereonite = 1/1.7.

Cephalon 1.25–1.5 as wide as long, nearly triangular, anterior margin acute in dorsal view, moderately immersed in pereonite 1; eyes distinct but often partly hidden by antennae.

Pereonite 1 moderately produced on antero-lateral sides; antero-lateral angles extended to posterior margins of eyes, auriform with internal surface partly conspicuous, or with a globular protuberance, or narrow and moderately acute (respectively forma typica, globuligera and africana according to Monod (1924a, b)). Pereonite 1 longest; pereonites 2–4 slightly shorter according to the condition of the female (ovigerous or non-ovigerous) and nearly equal in length; pereonites 5–7 distinctly shorter, progressively more rounded and concave posteriorly. Coxal plates of pereonites 3–7 visible in dorsal view.

All pleonites visible, becoming wider towards posterior side, sub-equal in length; pleonites 1–2 distinctly less wide than others; pleonite 1 the least wide; pleonite 5 wider than preceding pleonites with a sinuate distal margin. Width of pleotelson slightly variable; pleotelson more or less wide than pereon, distinctly wider than long (average 2.05–2.6 as wide as long; mean 2.35), widest at base, distal margin always bisinuate but with irregular features.

Antennule slightly stouter and shorter to antenna; both with seven articles, extending generally to or beyond posterior margin of eyes; first four articles of antennule and antenna wider than others. Mandible palp without setae or spines, third article distinctly smaller than others; maxillule with three terminal spines; maxilla lateral lobe with 23 spines and medial lobe with 8–10 spines and very small setae; maxilliped of ovigerous female with oostegial lobe bordered with plumose setae and a palp with eight apical recurved spines on article 3; ten apical recurved spines on article 3 of non-ovigerous female.

Pereopods gradually increasing in size, all without spines or setae; 1–6 almost similar to each other; pereopod 7 distinct with a carina very expanded on basis and a distinctive lobe produced on merus. Pleopods simple, not distinctly visible in dorsal view; peduncles without retinacula; endopods often crumpled in alcohol but without accessory folds. Uropods often varying in shape, usually more or less extended along the pleotelson, rarely beyond; rami unequal in length, apices acute, exopod usually shorter than endopod.

DESCRIPTION OF MALE (FIGURES 4A–I & 5A–E)

Body oval, stocky, 2.4 times as long as wide, bilaterally symmetrical; dorsum vaulted nearly as in female. Cephalon triangular, slightly immersed in pereonite 1, anterior margin smoothly acuminate in dorsal view. Eyes distinct and more

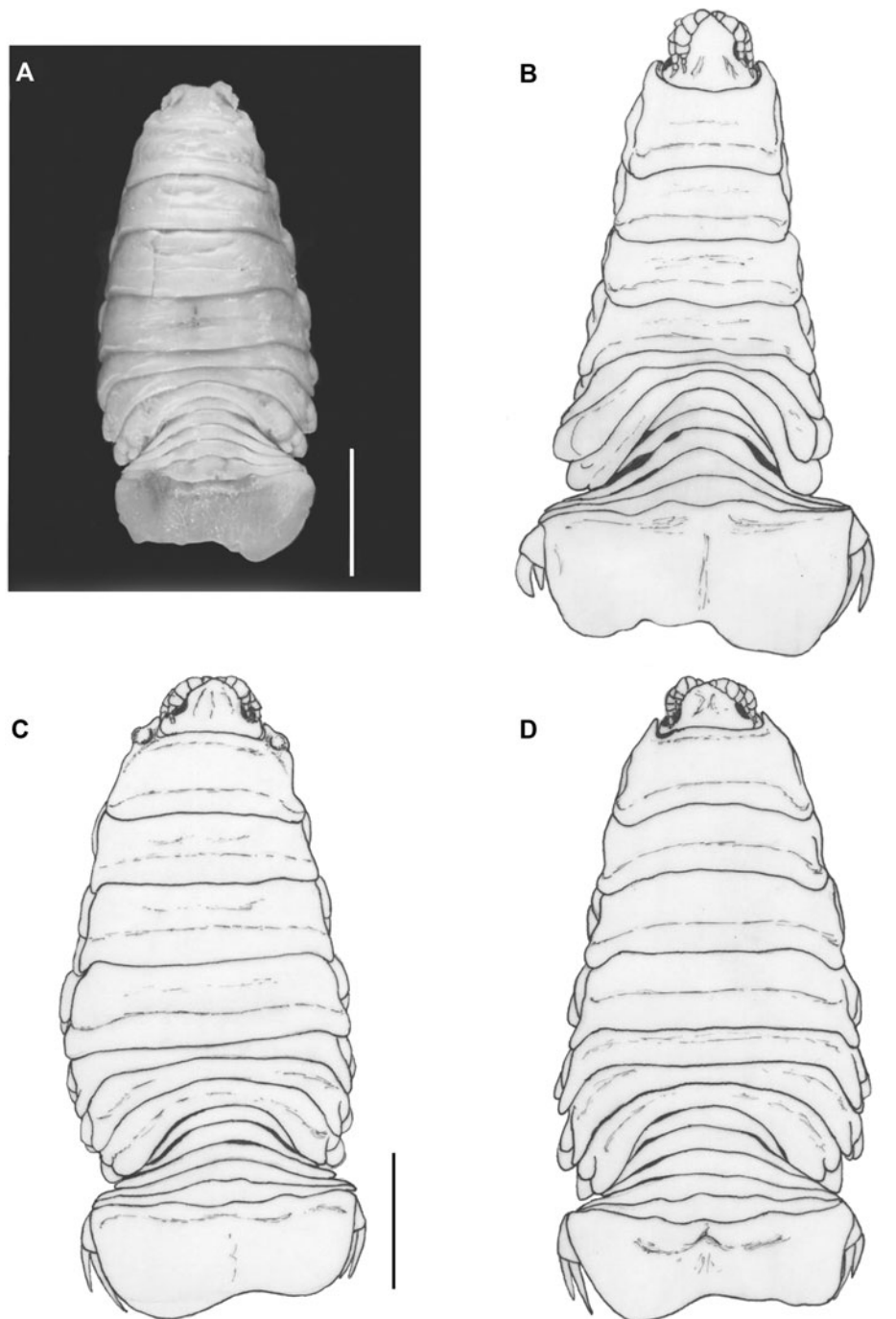


Fig. 1. *Ceratothoa collaris* Schioedte & Meinert, 1883, adult female, dorsal view: (A) ovigerous female, 38 mm, typical form (Holotype, MNHN-Is 40); (B) non-ovigerous female, 30 mm, typical form (AUBM Cr-227); (C) ovigerous female, 32 mm, globuligera form (AUBM Cr-417); and (D) ovigerous female, 35 mm, africana form (MNHN-45). Scale bars: A, 10 mm; B–D, 7 mm.

visible than female particularly because not hidden by antennae.

Pereon widest at pereonite 5; as in female, pereonite 1 longer than any others; 2–5 sub-equal and 6–7 decreasing in length. Coxae conspicuous in dorsal view.

Pleonites 2–5 sub-equal in length and width; pleonite 1 partly concealed by pereonite 7, narrower than any others. Pleotelson wider than long (average 2.2 times as wide as long), widest at base and posterior margin broadly rounded.

Antennule extending to middle of eye, composed of seven articles, slightly stouter than antenna, article 1 widest and distal margin with an isolated seta, others decreasing in width progressively; antenna extending to posterior margin of cephalon, comprising seven articles decreasing in width progressively, article 4 with sometimes a plumose seta on the postero-distal margin. Last article of mandible palp with four serrate setae on distal margin; maxillule with four terminal spines; maxilla lateral lobe with nine recurved spines and medial lobe with six; maxilliped with four apical recurved spines on article 3.

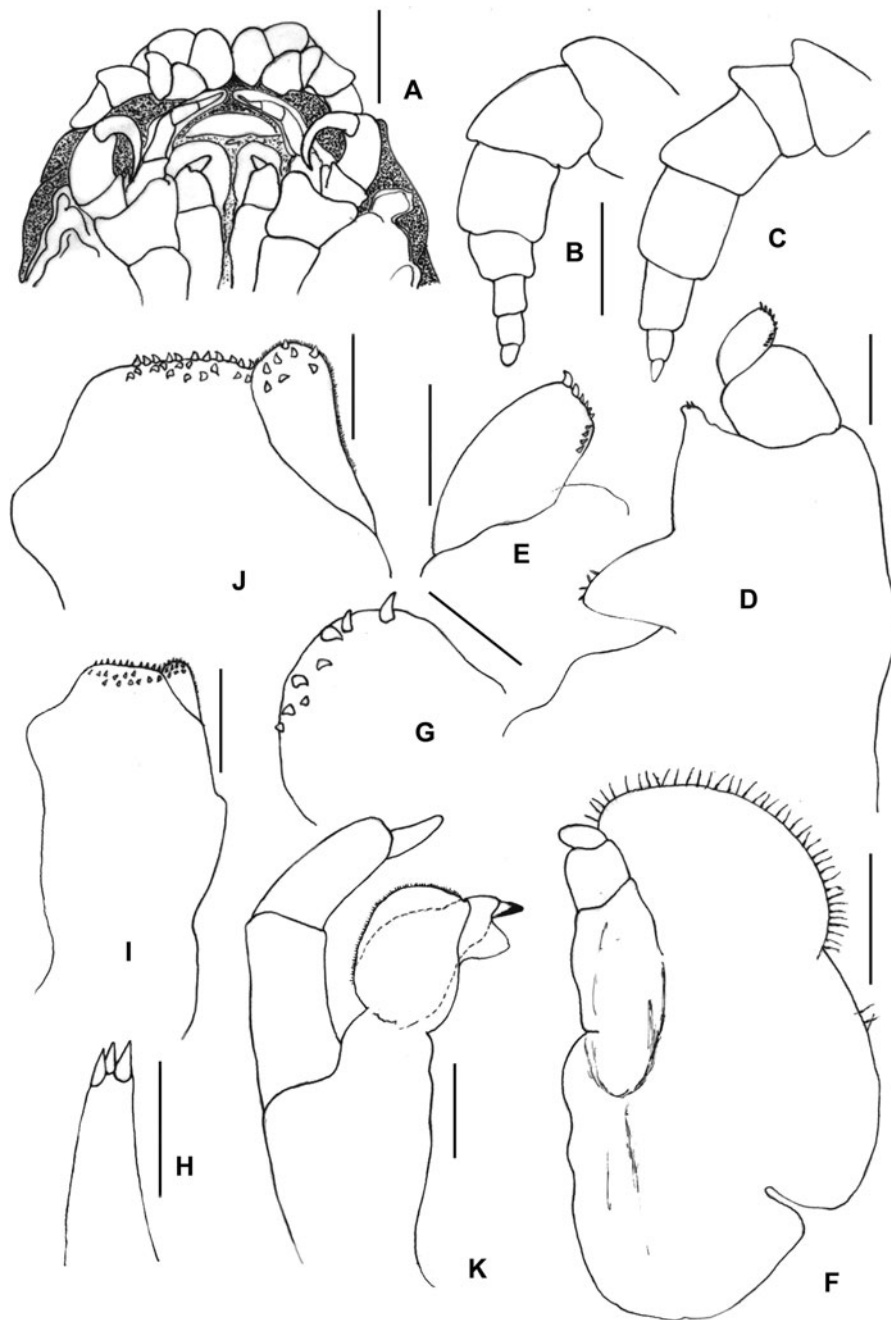


Fig. 2. *Ceratothoa collaris* Schioedte & Meinert, 1883, adult female: (A) cephalon, ventral view; (B) antennule; (C) antenna; (D) maxilliped, non-ovigerous female; (E) maxilliped article 3 apex, non-ovigerous female; (F) maxilliped, ovigerous female; (G) maxilliped article 3 apex, ovigerous female; (H) maxillule; (I) maxilla; (J) maxilla apex; and (K) mandible. Scale bars: A, 5 mm; B, C, F, 1 mm; D, E, I, 0.6 mm; J, 0.4 mm; G, H, K, 0.2 mm.

Pereopods gradually increasing in length, all without spines; pereopod 7 slightly distinct with a carina on basis and a lobe on merus but less expanded than in female. Pleopods rather similar to female except pleopod 2 with appendix masculinum well developed on endopod and pleopods 3–4 with few retinaculae on peduncle. Uropods extending beyond posterior margin of pleotelson; rami usually sub-equal, apices acute.

COLOUR

Female and male, alive or in alcohol, present a pale tan with few sparse chromatophores.

SIZES

Ovigerous females: 20–40 mm; non-ovigerous females: 18–40 mm; males: 9.5–16 mm.

SITE OF INFECTION

Females are usually in the buccal cavity; males are more erratic and can be found in mouth, branchial chamber and rarely on body.

TYPE LOCALITY

Algeria (Schioedte & Meinert, 1883).

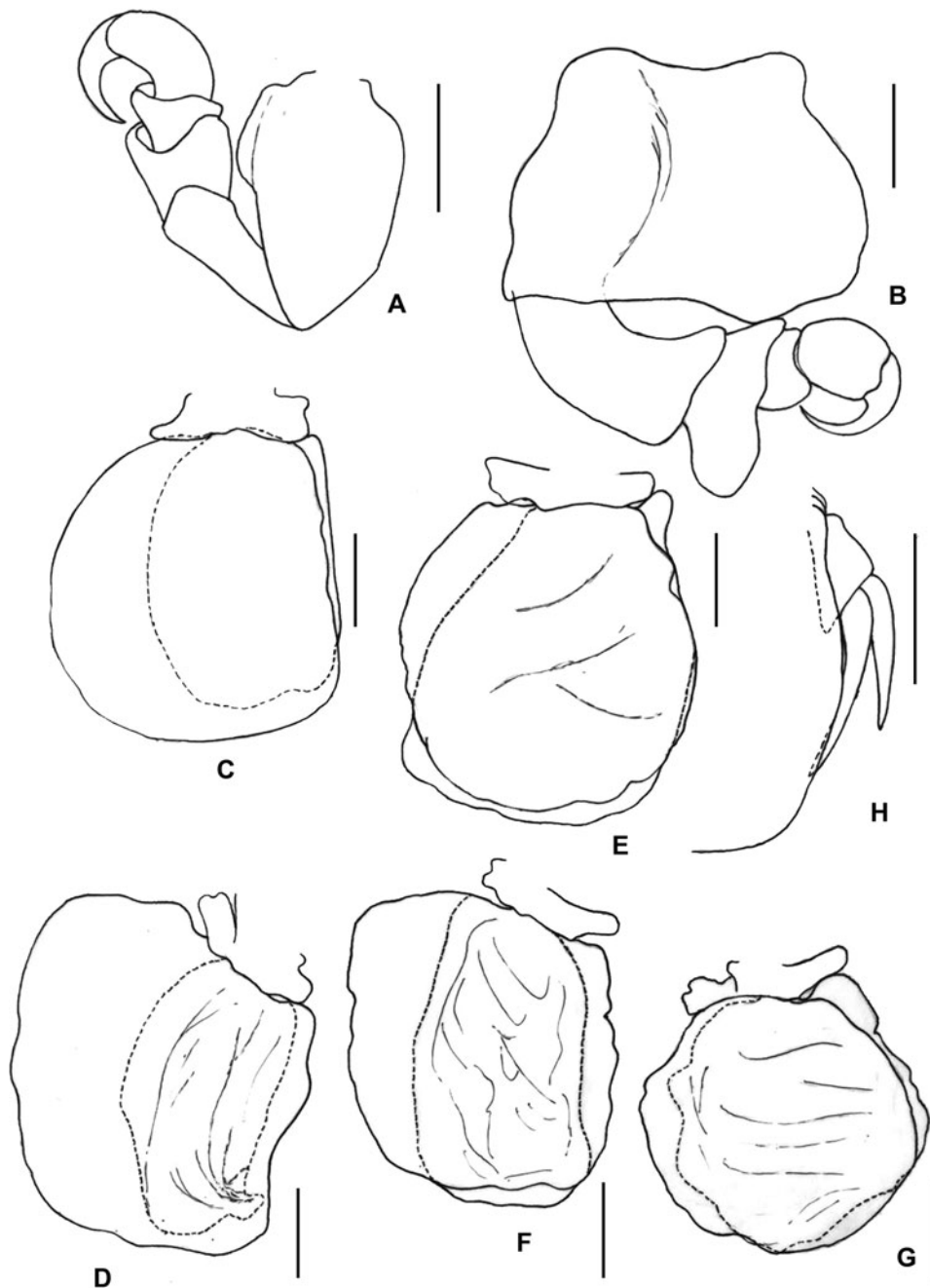


Fig. 3. *Ceratothoa collaris* Schioedte & Meinert, 1883, adult female: (A) pereopod 1; (B) pereopod 7; (C–G): pleopods 1–5, ventral view; and (H) uropods. Scale bars: A–G, 2 mm; H, 3 mm.

TYPE HOST

Not specified on the label enclosed with the holotype. Lucas (1849) reported that this species live on various fish.

HOSTS

Lebanese specimens were collected mainly on *Pagellus erythrinus*, less frequently on other Sparidae such as *Dentex macrophthalmus*, *Pagellus acarne*, *P. caeruleostictus*, *Pagrus* sp., and rarely on *Dicentrarchus labrax* (Moronidae) and *Epinephelus aeneus* (Serranidae). Previous records are from Africa (Trilles, 1994; Horton, 2000) and were reported on Sparidae: *Dentex dentex*, *D.*

maroccanus (Trilles & Raibaut, 1973), *D. gibbosus* (syn. *D. filosus*; Monod, 1924a, b, 1925; Trilles, 1972b; Trilles & Raibaut, 1973), *D. macrophthalmus* (Rokicki, 1984); *Pagellus acarne* (Trilles, 1972b; Dollfus & Trilles, 1976), *P. bogaraveo* (Dollfus & Trilles, 1976), *P. erythrinus* (Monod, 1924a, b, 1925; Dollfus & Trilles, 1976), *Diplodus sargus* (syn. *Sargus sargus*; Dollfus & Trilles, 1976); Centranchidae: *Spicara* sp., *Smaris* sp. (Trilles & Raibaut, 1973) and *Spicara smaris* (syn. *Smaris vulgaris*; Trilles, 1979); Sciaenidae: *Corvina cameronensis* (Trilles, 1977); and two Elasmobranchs: *Raja miraletus* (Rajidae) (Trilles & Raibaut, 1973) and *Torpedo marmorata* (Torpedinidae) (Capapé & Pantoustier, 1976).

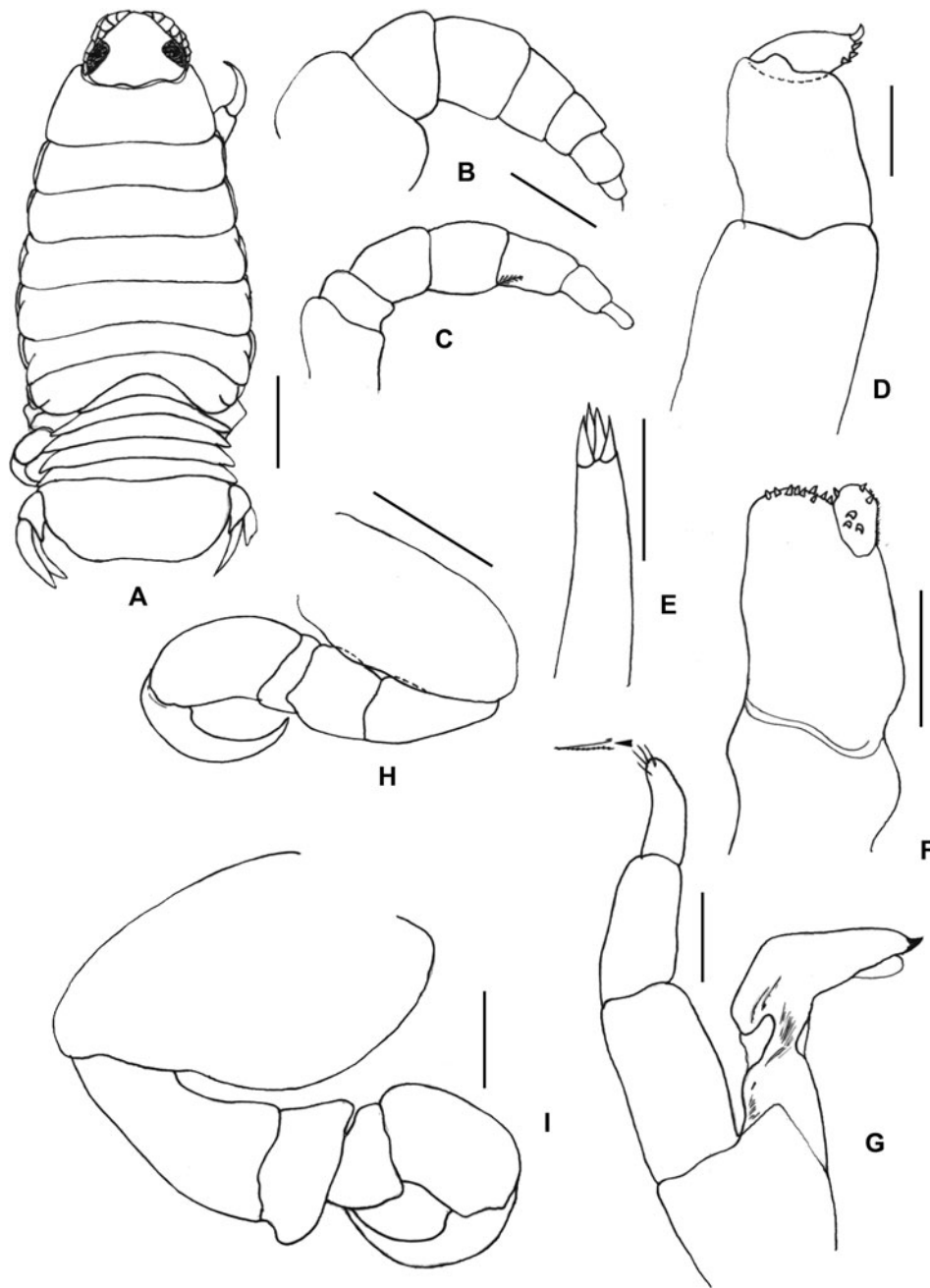


Fig. 4. *Ceratothoa collaris* Schioedte & Meinert, 1883, adult male: (A) adult male, 15 mm (AUBM Cr-227), dorsal view; (B) antennule; (C) antenna; (D) maxilliped; (E) maxillule; (F) maxilla; (G) mandible; (H) pereopod 1; (I) pereopod 7. Scale bars: A, 2.5 mm; B, C, 0.4 mm; D, E, G, 0.2 mm; F, 0.35 mm; H, I, 1 mm.

REMARKS

Cymothoa collaris was first collected by Lucas in the Mediterranean (Algeria, Alger) but misidentified as *C. oestroides* (Lucas, 1849). Schioedte & Meinert (1883) later briefly described this species from a single specimen (ovigerous female) collected by Lucas.

Three different forms, *Meinertia collaris* forma typica, *M. collaris* forma africana and *M. collaris* forma globuligera were originally distinguished by Monod (1924a, b) according to some morphological differences of the cephalon and antennae but without any other descriptions of the species' main features. In this study, we have observed no distinctive morphological

variations between the specimens collected off Lebanon and those found in Africa. Indeed, similar variations of the first pereonite (typica, africana, and globuligera forms according to Monod, 1924a, b) are seen in both African and Lebanese samples. In the same way, variations in the body shape connected to the sexual and reproductive stages, or in the width and shape of the pleotelson and uropods, were common throughout the geographical range (Africa and Lebanon) of the species. Similar variations can be seen in other species such as *Ceratothoa steindachneri* (Horton, 2000). It is clear that such variations are common in a wide range of cymothoids and can be found on cephalon but also elsewhere.

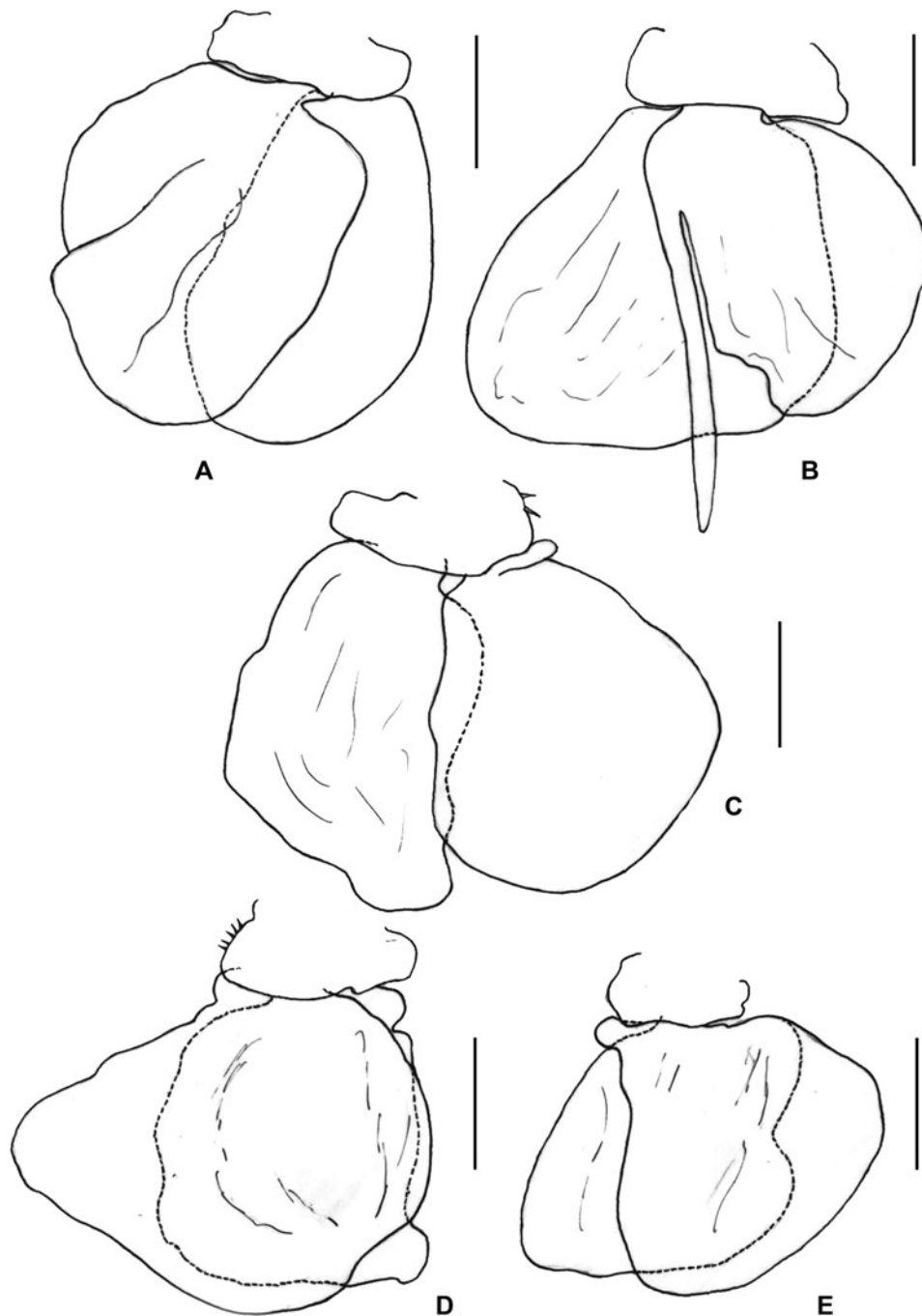


Fig. 5. *Ceratothoa collaris* Schioedte & Meinert, 1883, adult male: (A–E) pleopods 1–5, ventral view except pleopod 2, dorsal view. Scale bars: A–E, 1 mm.

Lucas (1849) considered *Cymothoa collaris* as a ubiquitous cymothoid, characterized by an euryxenic specificity and thus able to infect several species of fish. However, it appears that this species has a clear preference for Sparidae, more particularly *P. erythrinus*, which was the most common parasitized fish in Lebanon and Africa.

DISTRIBUTION

Eastern Atlantic: Arguin Bank, Port Etienne, Mauritania; Joal, Senegal (Monod, 1924a, b, 1925; Trilles, 1972b, 1977, 1979; Rokicki, 1984). Mediterranean: Algiers, Castiglione (now Bou-Ismaïl), Oran, Algeria (Lucas, 1849; Schioedte & Meinert, 1883; Carus, 1885; Monod, 1924a, b; Trilles, 1972b,

1979; Dollfus & Trilles, 1976); Gulf of Tunis, Kelibia, Tabarka, La Galite, Tunisia (Trilles & Raibaut, 1973; Capapé & Pantoustier, 1976); Agadir (Baie de Ouaouzeguedelt), Casablanca, Safi, Morocco (Monod, 1924a, b, 1925; Trilles, 1972b; Dollfus & Trilles, 1976). The geographical range of the species is now extended to the Levantine basin as numerous specimens were collected from Beirut, Kesserwan, and Tripoli along the Lebanese coast.

To date, this species has been commonly reported from the North Atlantic coast of Africa and seemed uncommon in the Mediterranean. Monod (1924a) wrote: 'La découverte, en grande abondance, de cette espèce sur la côte occidentale d'Afrique, prouve que c'est là son habitat normal et que sa

présence en Méditerranée est exceptionnelle' [The high number of specimens from this species along the western coasts of Africa, attest that this is its normal habitat and its presence in the Mediterranean is exceptional]. Moreover, this species was never collected from north-western Mediterranean countries despite recent studies (e.g. Montalenti, 1948; Trilles, 1972a, 1994; Trilles *et al.*, 1989; Rodriguez-Sánchez *et al.*, 2001; Junoy & Castelló, 2003). Although the species normal distribution might have included the entire southern coast of the Mediterranean Sea and the Levant, no specimens were ever collected from Libya, Egypt or Israel. This might be explained by less scientific attention in the area but also by a recent range expansion of the species, since many tropical Atlantic organisms have contributed many new elements to the Mediterranean biota (Galil *et al.*, 2002; Golani *et al.*, 2002; Zenetos *et al.*, 2003).

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