

***Carcinothoe haustra* n. gen. n. sp. (Copepoda, Siphonostomatoida, Nicothoidae) Parasitic on the Crab *Portunus sanguinolentus* from Korea**

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ABSTRACT

Carcinothoe haustra n. gen. n. sp. feeding on eggs of the three-spotted swimming crab *Portunus sanguinolentus* is described from Korean waters. *Choniosphaera indica* Gnanamuthu, 1954, which was previously described as copepod parasitic on the same species of the crab from India, is transferred to *Carcinothoe* n. gen. As two significant synapomorphic features in the female of the new genus, the antennule is 5-segmented and the caudal ramus is transformed into an elongate stylet. As other diagnostic features in the female of the new genus, the body is elliptical, unsegmented, and slightly compressed laterally, the urosome is completely fused with the prosome, the caudal rami are fused with abdominal region, the genital region is positioned on the ventral surface and partly covered with a pair of genital plates, the antenna is 4-segmented with two denticulate spines distally, the maxillule bears two setae on the precoxal endite and three apical setae on the unsegmented palp, the maxilla is 2-segmented, and the maxilliped is 4-segmented and tipped with a denticulate spine. *Carcinothoe haustra* n. gen. n. sp. differs from *C. indica* n. comb. in having an anteroventrally protruded buccal region, the antennule which is remotely separated from the buccal region, and no legs.

Keywords: ovivorous copepod parasite, crab host, taxonomy

INTRODUCTION

The three-spotted swimming crab, *Portunus sanguinolentus* (Herbst, 1783), is a commercial crab widely distributed in the Indo-Pacific from East Africa to French Polynesia, tropical to temperate. This crab is easily distinguished from other species by its three significant red to maroon spots on the carapace (Ng, 1998; Yang et al., 2014). From this species of the crab, Gnanamuthu (1954) described the copepod parasite *Choniosphaera indica*, as a new species, feeding on eggs of the crab from India. From the same species of the crab bought at a fish market from an eastern city of Korea, the author found a number of parasitic copepods feeding on eggs of the crab. Since the crab hosts from Korea and India belong to the same species, the copepod parasite found on the crab from Korea was thought to be *C. indica* Gnanamuthu, 1954. However, a careful comparison of the copepod with the description for *C. indica* has revealed that they are not conspecific. Thus, the

copepod parasite from Korea is described herein as a new species. Since the new species and *C. indica* are related to each other and both significantly differ from the other two known species of *Choniosphaera*, a new genus is established to accommodate the two species of copepod parasitic on the three-spotted swimming crab.

MATERIALS AND METHODS

The examined copepod specimens were sorted out from washings of egg masses of the crab host. Most of the copepods were found attached to crab eggs with a sucking disk. The sorted copepod specimens have been preserved in 80% ethanol. Before dissection and microscopic observation, the copepod specimens were immersed in lactic acid for about 10 min. Dissected appendages were observed using the reverse slide method of Humes and Gooding (1964). Drawings were

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made with the aid of a microscope equipped with a drawing apparatus.

Lengths and widths of appendages were measured after dissection. Measured lengths of appendage segments are the averages of the shortest and longest margins.

SYSTEMATIC ACCOUNTS

Order Siphonostomatoida Thorell, 1859
Family Nicothoidae Dana, 1852-1853

¹**Carcinothoe* n. gen.

lsid:zoobank.org:act:2BE3355A-9BFB-4375-8E76-B0D934E79B3E

Diagnosis (female). Body seed-shaped, unsegmented, slightly compressed laterally, consisting of anteroventrally protruded buccal region, fusiform trunk, and short urosomal region. Buccal region tipped with sucking disk. Urosomal region consisting of genital region, short abdominal region, and caudal rami. Genital region bearing paired genital plates, genital apertures, and copulatory pores. Genital plates nearly circular in ventral view, arising from lateral surface of urosome, partly covering ventral surface of genital region. Caudal stylets elongated, divergent, well-sclerotized, and armed with 3 spiniform setae on ventral surface. Antennule small, positioned on lateral surface at base of buccal prominence, apart from buccal region, 5-segmented, with armature formula 1, 0, 0, 5 + aesthetasc, and 4. Antenna 4-segmented, with armature formula 0, 1, 0, and 2 + 2 spines; distal spines denticulated. Sucking disk encircling mouth, bearing membranous outer rim. Mandible consisting of short proximal part and knife-like gnathobase. Maxillule consisting of syncoxa and palp; syncoxa bearing ventrally produced precoxal endite armed with 2 setae; palp clearly articulated from syncoxa, distally armed with 3 unequal, naked seta. Maxilla 2-segmented; proximal segment (syncoxa) unarmed; distal segment (basis) with 1 seta on posterior margin and 8 or 9 teeth along distal margin. Maxilliped 4-segmented, with armature formula 1, 0, 1, and 1 + spine; distal spine denticulated. No legs present.

Type species. *Carcinothoe haustra* n. gen. n. sp.

Other included species. *Carcinothoe indica* (Gnanamuthu, 1954) n. comb. (originally described as *Choniosphaera indica* Gnanamuthu, 1954).

Etymology. From *carcin* (meaning “a crab” in Greek) and *thoe*, the ending of the type genus of the family, *Nicothoe*. Gender feminine.

²**Carcinothoe haustra* n. gen. n. sp. (Figs. 1, 2)

lsid:zoobank.org:act:BACEBAA2-0EED-4824-8F5C-75628160D96D

Type material. Holotype (♀, MABIK CK00257802) and paratypes (40 intact ♀♀, MABIK CK00257803) from egg masses of the crab *Portunus sanguinolentus* (Herbst, 1783) bought at fish market in Gangneung City, Korea, coll. I.-H. Kim, 5 Apr 1995. Type specimens have been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon.

Etymology. The specific name is from the Latin *haust* (= suck), referring to the feeding manner of the new species.

Female. Body (Fig. 1A) seed-shaped, unsegmented, slightly compressed laterally, consisting of anteroventrally protruded buccal region, fusiform trunk, and short urosomal region. Body length (trunk length) 1.38 mm. Maximum dorsoventral depth of trunk 627 µm across near midway of trunk. Buccal region (Fig. 1D) tipped with sucking disk. Urosomal region (Fig. 1B, C) consisting of genital region, short abdominal region, and caudal rami. Genital region bearing paired genital plates, genital apertures, and copulatory pores. Genital plates nearly circular in ventral view, arising from lateral surface of urosome, partly covering ventral surface of genital region. Genital apertures faint, bearing no operculum or armature. Copulatory pores small, positioned ventrally at proximal region of abdomen. Caudal stylets (Fig. 1B, C) divergent, elongated, well-sclerotized, fused with abdominal region basally; each stylet 182 µm long, 14 µm in proximal width, attenuated distally, armed with 3 spiniform setae on ventral surface (2 small proximal ones at base of stylet and 1 larger one at proximal 22% region of ramus length), and ornamented with minute spinules covering all over distal third of ramus.

Antennule (Fig. 1E) 39 µm long, positioned on lateral surface at base of buccal prominence, apart from buccal region, as indicated by arrow in Fig. 1A, 5-segmented, 11 × 12, 5 × 9, 9 × 8, 9 × 12, and 5 × 5 µm, respectively; armature formula 1, 0, 0, 5 + aesthetasc, and 4; seta on first segment much larger than other setae; fourth segment slightly expanded, armed with 2 subdistal and 3 distal setae and 1 aesthetasc; fifth segment distinctly narrower than other segments. Antenna (Fig. 1F) 37 µm long not including distal armatures, positioned dorsally but closely to mouthparts, 4-segmented; each segment 8, 9, 14, and 6 µm long, gradually narrowing from proximal to distal; first and third segments unarmed; second segment with 1 seta; fourth segment armed with 2 spines (1 distal and 1 subdistal) of extremely unequal length and 2 setae; distal spine 17 µm long, with 5 (4–6) teeth at distal region; smaller subdistal spine about 8 µm long, with 2–4 teeth at distal region.

Korean name: ¹*꽃게노벌레속 (신칭), ²*점박이꽃게노벌레 (신칭)

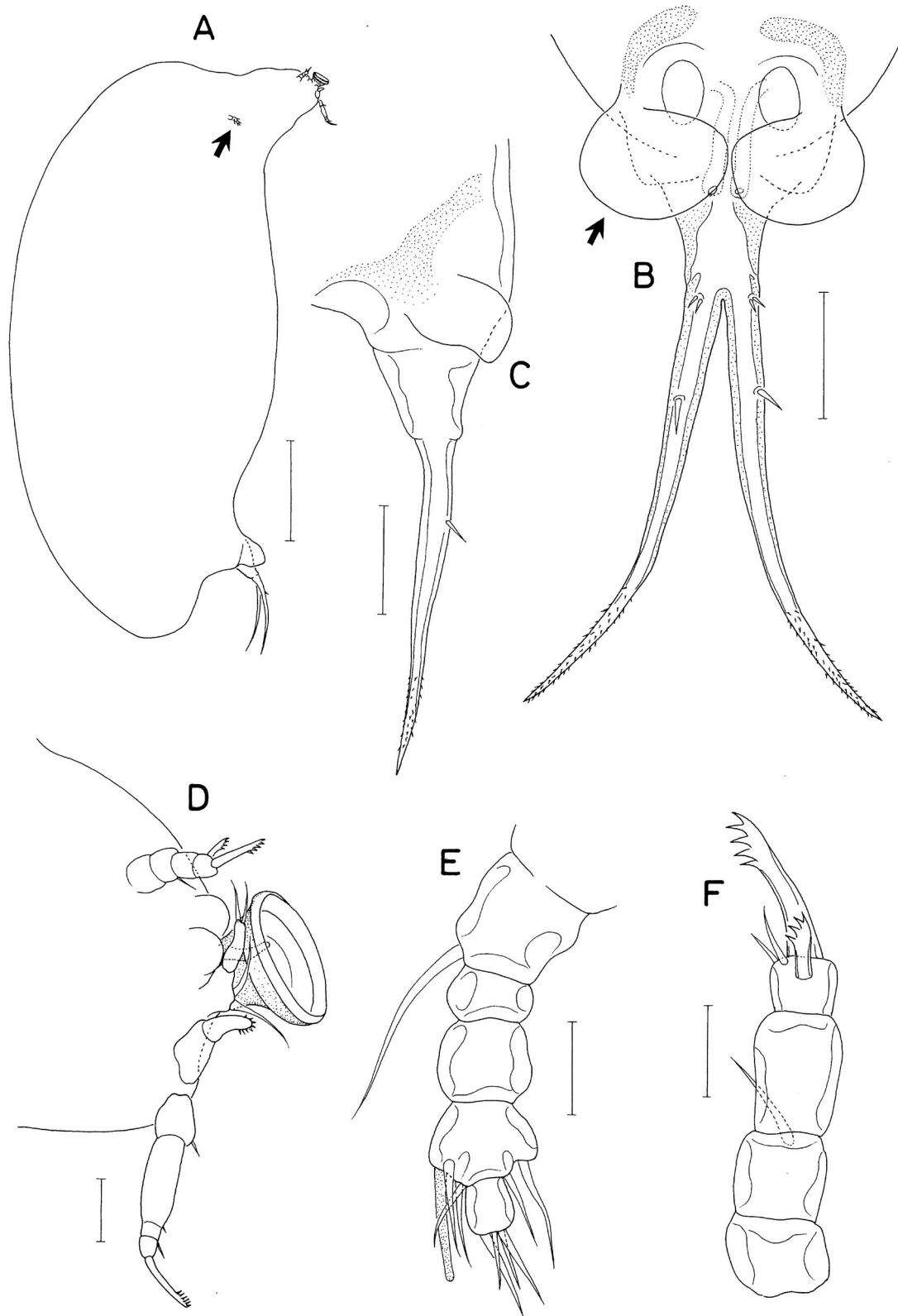


Fig. 1. *Carcinothoe haustra* n. gen. n. sp., female. A, Habitus, right (antennule indicated by arrow); B, Urosomal region, ventral (abdominal plates indicated by arrow); C, Urosomal region, right; D, Buccal region, right; E, Antennule; F, Antenna. Scale bars: A=0.2 mm, B, C=0.05 mm, D=0.02 mm, E, F=0.01 mm.

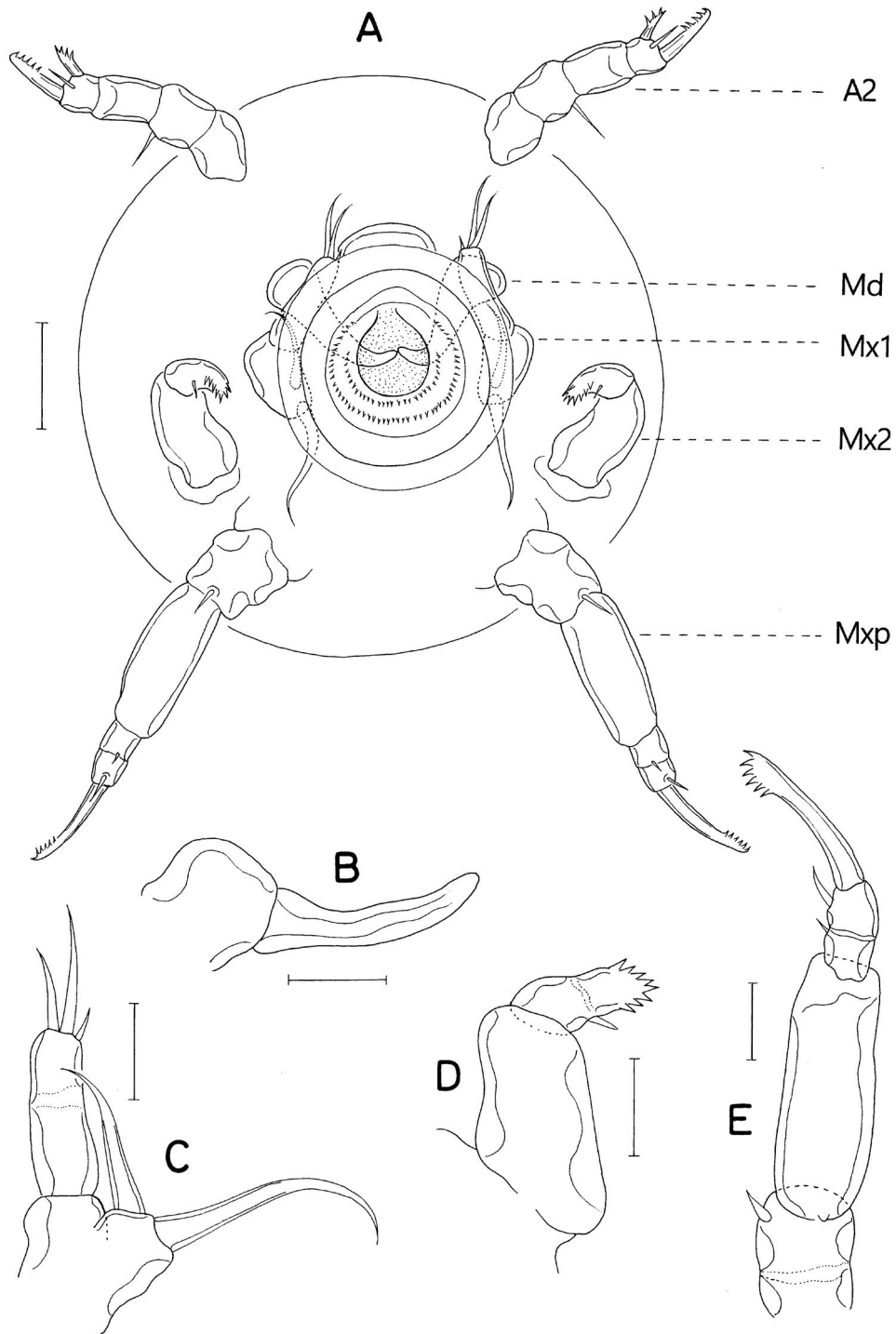


Fig. 2. *Carcinotloe haustra* n. gen. n. sp., female. A, Buccal region, frontal (A2, antenna; Md, mandible; Mx1, maxillule; Mx2, maxilla; Mxp, maxilliped); B, Mandible; C, Maxillule; D, Maxilla; E, Maxilliped. Scale bars: A=0.02 mm, B-E=0.01 mm.

Sucking disk (Figs. 1D, 2A) 43 μ m in diameter, encircling mouth, bearing 2 circular rows of minute spinules and membranous outer rim. Mandible (Fig. 2B) consisting of short

proximal part and distal, knife-like gnathobase articulated from proximal part. Maxillule (Fig. 2C) consisting of syncoxa and palp; syncoxa bearing ventrally produced precoxal

endite armed with 2 large, naked setae; dorsal seta directed dorsally; ventral seta directed ventrally, longer than dorsal seta; palp clearly articulated from syncoxa, 2.5 times longer than wide, with rudiment of articulation, and distally armed with 3 unequal, naked setae. Maxilla (Fig. 2D) 2-segmented; proximal segment (syncoxa) about $18 \times 12 \mu\text{m}$, unarmed; distal segment (basis) about $14 \times 7 \mu\text{m}$, obliquely inserted into proximal segment, with rudiment of articulation near middle, 1 seta on posterior margin, and 8 (or 9) teeth along convex distal margin. Maxilliped (Fig. 2E) 4-segmented, consisting of syncoxa, basis, and 2-segmented endopod; first segment (syncoxa) $16 \mu\text{m}$ long, with rudiment of articulation at proximal third of segment, armed with 1 small seta subdistally; second segment (basis) $28 \mu\text{m}$ long, unarmed; first and second endopodal segments narrow, 5 and $6 \mu\text{m}$ long, respectively, with 1 seta on first segment and 1 seta plus 1 spine on second segment; spine on second endopodal segment large, about $20 \mu\text{m}$ long, bearing row of 6 (5–7) teeth at distal region.

No legs present.

Male. Unknown.

Remarks. Most individuals of this copepod species were found attached to host eggs with the sucking disk.

DISCUSSION

Carcinothoe haustra n. gen. n. sp. is carefully compared with *Choniosphaera indica* Gnanamuthu, 1954 known from South India, as both copepods were found parasitic on the same species of the crab host, *Portunus sanguinolentus* (Herbst, 1783). These two copepod species are related to each other in sharing the elliptical body in the female, the elongated spiniform caudal stylets, abdominal plates (indicated by arrow in Fig. 1B), and the same number of segments in the antennule, antenna, maxilla, and maxilliped. Nevertheless, the two species cannot be considered to be conspecific, because *Choniosphaera indica* has a buccal region that is not projected, the antennule positioned close to the antenna, and three pairs of legs represented by “thoracic plates” (Gnanamuthu, 1954).

The genus *Choniosphaera* was established by Connolly (1929) to accommodate *Choniosphaera cancrorum* Connolly, 1929 found on three species of the crab genus *Cancer* Linnaeus, 1758 from the Atlantic coast of North America. Another species of the genus, *Choniosphaera maenadis* (Bloch and Gallien, 1933), was described from the crab *Carcinus maenas* (Linnaeus, 1758) from the Atlantic coast of France (originally described as *Lecithomyzon maenadis* Bloch and Gallien, 1933). *Choniosphaera cancrorum* and *Ch. maenadis* are closely related to each other, considering that females of both species have a globular body, no abdomen, a ventrally

positioned buccal region, an 11- or 12-segmented antennule, a normal caudal ramus armed with four or five setae, and two pairs of legs bearing a 2-segmented exopod and a 1-segmented endopod (Connolly, 1929; Bloch and Gallien, 1933). Thus, the two Atlantic copepod parasites are definitely congeneric. However, *Choniosphaera indica* does not coincide with the two Atlantic species, but is closer to the new species from Korean waters. The close relationship between the latter two species and their significant difference from the two Atlantic species have led to the establishment of *Carcinothoe* n. gen. in the present paper to accommodate *Carcinothoe haustra* n. gen. n. sp. and *Carcinothoe indica* (Gnanamuthu, 1954) n. comb.

The family Nicothoidae consists of 22 known genera that are parasitic on crustaceans. Boxshall and Lincoln (1983) grouped the genera of the Nicothoidae into three groups: the *Nicothoe* group, the *Sphaeronella* group, and the *Rhizorhina* group. They included five genera parasitic on decapod crustaceans into the *Nicothoe* group: *Nicothoe* Audouin and Milne Edwards H., 1826, *Paranicothoe* Carton, 1970, *Hadrothoe* Humes, 1975, *Choniomyzon* Pillai, 1962, and *Choniosphaera*. Later, Boyko (2009) established the genus *Vunicothoe* in this group to accommodate the male of *Paranicothoe cladocera* Carton, 1970 (the female of *Paranicothoe cladocera* has turned out to be an isopod). Although *Carcinothoe* n. gen. is parasitic on the decapods, this new genus differs from the *Nicothoe* group in having the 5-segmented antennule (cf. 10–12 segmented antennule in the *Nicothoe* group) and the caudal stylet (a transformed caudal ramus), both being the distinctive synapomorphies of the new genus. *Carcinothoe* n. gen. and *Choniosphaera* are parasitic on crabs, while *Nicothoe* and *Choniomyzon* are parasitic on lobsters, *Hadrothoe* on shrimps, and *Paranicothoe* and *Vunicothoe* on isopods (Boyko, 2009; Boxshall and Lincoln, 1983).

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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