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MARGOLISIUS ABDITUS N. GEN., N. SP. (COPEPODA: LERNAEOPODIDAE) FROM GILL LAMELLAE OF A REMORA (*REMORA REMORA*) COLLECTED IN THE GULF OF CALIFORNIA

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ABSTRACT: *Margolisius abditus* n. gen., n. sp. (Copepoda: Lernaeopodidae) is described from female specimens collected from gill lamellae of a remora, *Remora remora* (L.), captured in the Gulf of California near Punta Arena, Baja California. Comparison of this species with 13 lernaeopodid genera with which it shares (a) absence of posterior trunk processes; (b) presence of a relatively long cylindrical cephalothorax, usually reflected along the dorsal surface of the trunk; and (c) a marine habitat showed that it cannot be placed in any of them, thus necessitating establishment of a new genus. *Margolisius abditus* n. sp. is the smallest known lernaeopodid species, its ovigerous females measuring about 0.5 mm in total length.

Consisting of 45 genera and, at present count, 294 nominal species, Lernaeopodidae is rivaled within Siphonostomatoida (Copepoda) only by Caligidae regarding number and diversity of species. Lernaeopodids are known from all of the world's oceans, from the abyss through the spray zone. Some 38 species (6 genera) are able to complete their life cycles only in fresh water (Kabata, 1969b, 1979). Lernaeopodids have been collected from teleosts and chondrichthyans, on which they have been found attached to virtually all external body surfaces, including the gills, spiracles, olfactory sacs, mouths, eyes, claspers, and fins (e.g., see Kabata, 1979). Typically, they exhibit a high degree of host and attachment site specificity (see Yamaguti, 1963; Kabata, 1979, 1981).

In this report we describe a new lernaeopodid genus and species, found on gill lamellae of a remora, *Remora remora* (L.), captured in the Gulf of California.

MATERIALS AND METHODS

The host was fixed in the field in 10% buffered formalin, and in the laboratory its gills were removed and examined for parasites, using a stereoscope. Small pieces of gills with copepods attached were studied using bright-field and phase-contrast microscopy and the wooden slide technique of Humes and Gooding (1964). Prior to these examinations, samples were cleared in lactic acid in which a pinch of lignin pink had been dissolved. Several specimens were studied using scanning electron microscopy (SEM). These specimens were prepared for sputter-coating (gold–palladium) by placing them in 100% ethanol (2 changes, 1 hr each) followed by immersion in a small volume of hexamethyldisilazane (15 min). Before mounting on metal stubs with 2-sided sticky tape, drying was achieved by placing the specimens under a slight vacuum to remove the hexamethyldisilazane. Some text drawings were made with the aid of a camera lucida, while others were produced free-hand with the aid of a graticule. Drawings of the antennae and the first maxilla were made from SEM photomicrographs and required some interpretation. Measurements mentioned in the text were made either from individuals prepared for light microscopy, using an ocular micrometer, or from individuals prepared for SEM, using an electronic scale bar. Morphological terminology used herein conforms mostly to that of Kabata (1979).

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DESCRIPTION

Margolisius n. gen.

Diagnosis: Lernaeopodidae. Female: cephalothorax cylindrical, about as long as and reflected along dorsal surface of trunk. Latter subquadrangular, slightly depressed, devoid of posterior processes. First antenna unsegmented, second antenna with sympod–endopod longitudinal axis and reduced exopod. First maxilla without exopod. Second maxillae moderately long, separate. Egg sacs uniseriate, eggs subspherical. Male: unknown.

Type and only species: Margolisius abditus n. sp.

Margolisius abditus n. sp.

(Figs. 1, 2)

Description: Mature females (Fig. 1A, B) so small and transparent as to be almost invisible in situ. Overall body length (tips of second maxillae to posterior extremity of trunk) of typical individual 0.52 mm. Three major body components (cephalothorax, second maxillae, and trunk) arranged in a type-C pattern (after Kabata, 1979). Cephalothorax (Figs. 1A, B, 2A) relatively long, cylindrical, reflected along dorsal surface of trunk in most observed specimens, extending to, or just beyond, posterior end of trunk. Latter (Fig. 1A, B) much longer than wide, subquadrangular, without posterior processes; blunt ventral swelling present near center of posterior margin (Fig. 2B). Egg sacs (Fig. 1A, B) uniseriate, containing 6 subspherical eggs each, attached to ventrolateral orifices of oviducts.

First antenna (Figs. 1C, 2C) of typical individual about 12 μm long, apparently unsegmented, surmounted by 3 setiform processes of uncertain homology; longest process round-tipped, second longest apparently bifid, third and shortest acuminate. Second antenna (Figs. 1D, E, 2C) of typical individual about 25 μm long, with sympod–endopod longitudinal axis, segmentation obscure; endopod armature consisting of hook (1), tubercle (2), prominent ventrally situated process (4), and double tubercular process (5); exopod much shorter than endopod, apparently bilobed at apex. Mandibles very small, but visible within mouth cone, dental formula not determined. Mouth cone (Fig. 2G) with fringe of setules around margin of labium. First maxilla (Figs. 1F, 2C) apparently unsegmented; endopod with 2 apical processes, dorsal process twice as long as ventral process, both acuminate, without terminal setae; exopod absent. Second maxillae (Fig. 1A, B) cylindrical, separate but closely applied to each other along their entire lengths, about as long as cephalothorax, structure of bulla not determined, but manubrium short (Figs. 1G, 2E). Maxillary gland orifices (Fig. 2D, F) each with pore and 2 cuticular flaps atop swellings at ventral side of bases of second maxillae. Maxilliped (Fig. 1H, I) subchelate; corpus maxillipedis subquadrate, with denticulated, cuplike prominent myxa; subchela indistinctly divided into shaft and claw, distal third of shaft finely denticulated, claw unarmed.

Male unknown.

Data regarding specimens

Record of specimens: Thirty-four adult females, collected from a single host captured in the Gulf of California near Punta Arena, Baja California,

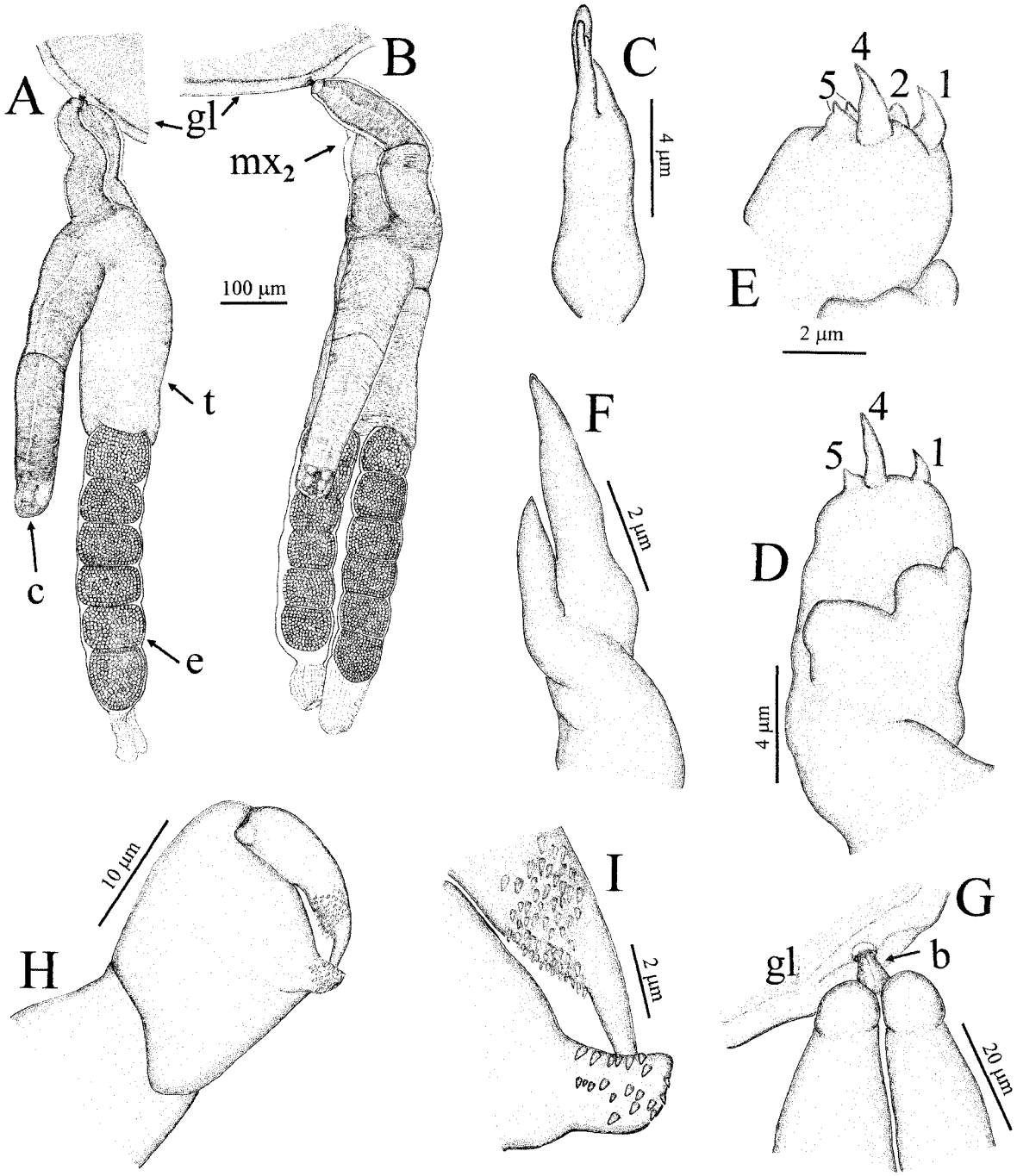

FIGURE 1. *Margolisius abditus* n. sp., adult female. **A.** General habitus, lateral. **B.** General habitus, trunk dorsal, cephalothorax ventral. **C.** First antenna, lateral. **D.** Second antenna, lateral. Elements 1, 4, and 5 according to the convention of Kabata (1979). **E.** Second antenna, tip of endopod, anterolateral. Elements 1, 2, 4, and 5 according to the convention of Kabata (1979). **F.** First maxilla, ventrolateral. **G.** Second maxillae, tips. **H.** Maxilliped, entire, ventral. **I.** Maxilliped, myxal area, and tip of claw, ventral. b = exposed portion of bulla, c = cephalothorax, e = egg sac, gl = host gill lamella, mx_2 = second maxilla, t = trunk.

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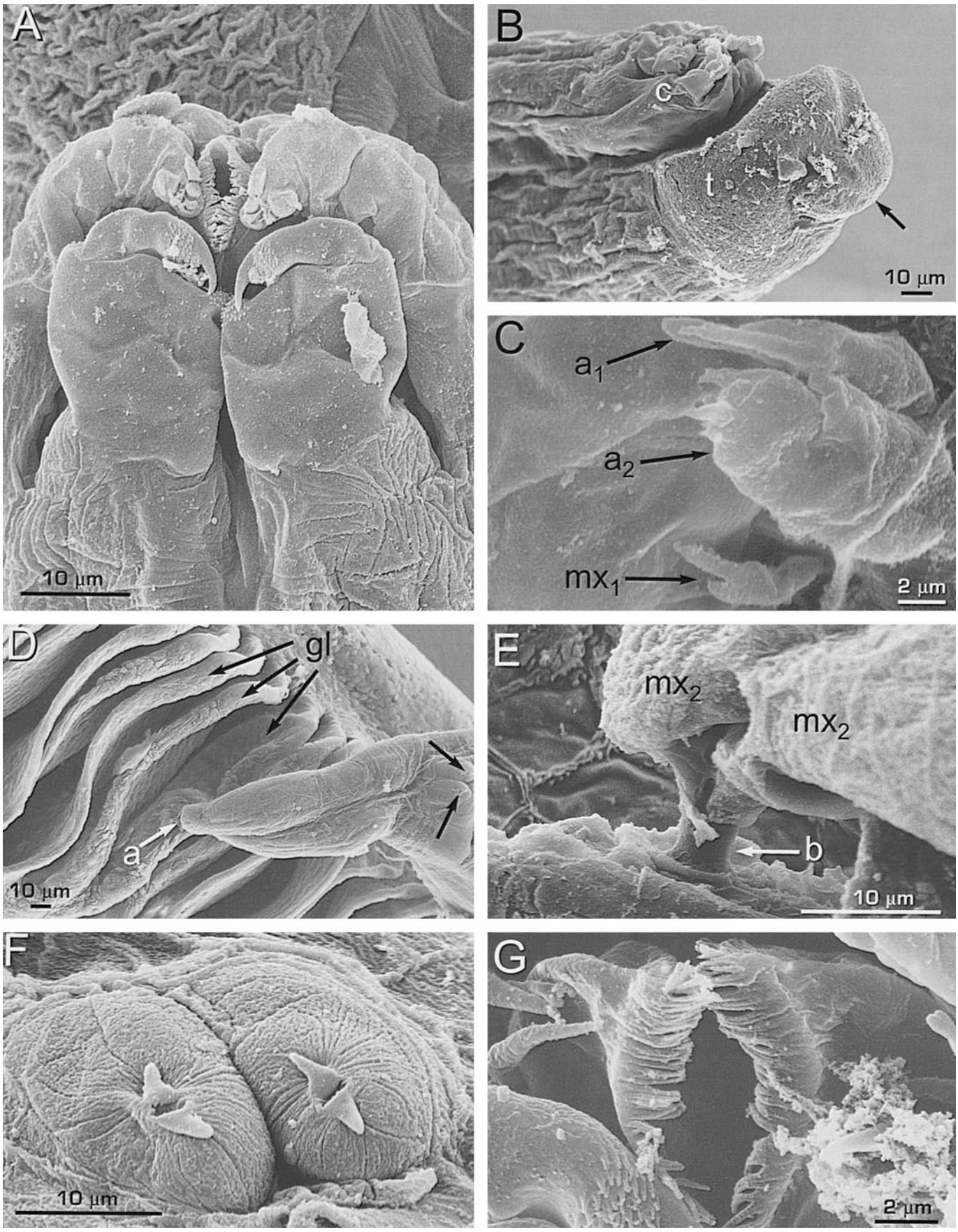
FIGURE 2. Scanning electron photomicrographs of adult female *Margolisius abditus* n. sp. **A.** Cephalothorax tip, ventral. **B.** Tips of trunk and cephalothorax, lateral. Arrow points to blunt ventral swelling. **C.** First antenna, second antenna, and first maxilla, lateral. **D.** Second maxillae attached to host gill lamella. Note the orifices of the maxillary glands (arrows) at base of the second maxillae. **E.** Tips of second maxillae near point of attachment. **F.** Second maxillae, orifices of maxillary glands, ventral. **G.** Opening of mouth. a = point of attachment, a_1 = first antenna, a_2 = second antenna, b = exposed portion of bulla, c = tip of cephalothorax, gl = host gill lamella, mx_1 = first maxilla, mx_2 = second maxilla, t = tip of trunk.


A
10 µm
B
c
t
10 µm
C
a1
a2
mx1
2 µm
D
gl
a
10 µm
E
mx2
mx2
b
10 µm
F
10 µm
G
2 µm

Mexico on 25 June 1996. The holotype and 1 paratype (both females) have been deposited in the Colección Nacional de Crustáceos at the Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Mexico City (CNCR 17996 and 17997); 8 paratypes (all females) have been deposited in the U.S. National Museum (USNM 288054); remaining paratypes (all females) have been retained in the personal collection of the senior author.

Host: A remora, *R. remora* (L.) (Perciformes: Echeneidae).

Habitat: Bulla attached to the free lateral edge of gill lamella (Fig. 2D), with copepod lying between 2 adjacent gill filaments.

Etymology: Generic name honors the late Dr. Leo Margolis (of the Pacific Biological Station, Nanaimo, British Columbia) for his many contributions to parasitology and society. Specific name *abditus* (Latin for hidden, secret) refers to the fact that this species is difficult to see in situ due to its small size and transparent body.

DISCUSSION

To establish the generic distinctness of *M. abditus* n. gen., n. sp., one must compare it with the 13 lernaeopodid genera known to contain species sharing the following characteristics: (a) absence of posterior trunk processes; (b) presence of a relatively long cylindrical cephalothorax, usually reflected along the dorsal surface of the trunk; and (c) a marine habitat. These genera are: *Alella* Leigh-Sharpe, 1925; *Anaclavella* Heegaard, 1940; *Clavella* Oken, 1815; *Clavellisa* Wilson, 1915; *Clavellistes* Shiino, 1963; *Clavellodes* Wilson, 1915; *Clavellomimus* Kabata, 1969; *Clavellotis* Castro and Baeza, 1984; *Euclavellisa* Heegaard, 1940; *Mixtio* Kabata, 1986; *Nudiclavella* Ho, 1975; *Proclavellodes* Kabata, 1967; and *Pseudomixtio* Kabata, 1990. The most obvious difference between *Margolisius* n. gen. and these 13 genera is the former's diminutive size. With *M. abditus* adult females being significantly less than 1 mm long, this species defies comparison in this respect with any hitherto known lernaeopodid. However, the distinctness of *M. abditus* is not limited to its dimensions. Its first antenna is unsegmented and has apical armature reduced to 3 setiform processes. Its second antennae are even more distinct. In all genera compared here with *Margolisius*, the longitudinal axis of this appendage runs through the sympod and exopod, leaving the endopod displaced to one side and usually smaller than the exopod (see Heegaard, 1940; Kabata, 1967, 1969a, 1979, 1986, 1990; Ho, 1975; Castro and Baeza, 1984). In contrast, the second antenna in *Margolisius* has its longitudinal axis along the sympod–endopod line, and the exopod is greatly reduced. This design of the second antenna is reminiscent of those found in *Vanbenedenia* Malm, 1860 and *Tracheliastes* von Nordmann, 1832 (see Kabata, 1979), but in *Margolisius* the reduction of the exopod has progressed much farther. The armature of the endopod shows clear homology with that of the endopods of other lerneaopodids (e.g., see Kabata, 1979) all of which are outside the group compared here. There is, however, 1 exception. The site usually occupied by the slender seta (2) is in *M. abditus* occupied by a tubercle, reminiscent of tubercle (3) that is usually located on the lateral side of the hook (1) (see Kabata, 1979). In *M. abditus*, tubercle (3) appears to be missing. In addition, the structure of the first maxilla of *M. abditus* is simplified. The 2 terminal processes of its endopod are not surmounted by clearly delimited setae and the exopod is missing. In Figure 1F this appendage is slightly twisted, but the absence of the exopod is quite clear. Among the 13 lernaeopodid genera of the group compared here, this condition has only been recorded in *Euclavellisa* (see Heegaard, 1940), which, however, differs from *Margolisius* in other features.

In view of the aforementioned differences between the species described here and the group with which it was compared, we are compelled to assign it to a new genus, *Margolisius.*

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