Myzostomida from Madagascar, with the description of two new species

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Abstract
Four myzostomidan species were collected during a survey of echinoderms made on the Great Reef of Toliara, southwest Madagascar. The four species were associated with comatulid crinoids. *Notopharyngoides aruensis* infested the anterior part of the digestive lumen of *Stephanometra indica*. *Comanthus* sp. aff. *wahlbergii* were infested by three myzostomidan species, two of them are new to science. *Myzostoma polycyclus* and *Myzostoma pseudocuniculus* n. sp. lived at the surface of crinoids. *Myzostoma toliarense* n. sp. live in soft cysts induced on crinoid arms. Cysts are always located close to the ambulacral grooves. They are each infested by one myzostomid.

Introduction

The Myzostomida are obligate commensals or parasites of echinoderms, particularly crinoids. Their usual textbook status as a class of the Annelida (Brusca & Brusca, 1990) or as an aberrant family of the Polychaeta (Ruppert & Barnes, 1994) is generally accepted, though recent phylogenetic analyses based on DNA sequences suggest that myzostomids are not annelids, but rather form a group close to Platyhelminthes (Eeckhaut et al., 2000; Zrzavý et al., 2001). In the most recent taxonomic review of the group (Grygier, 2000), the Myzostomida form a class of Annelida divided in two orders and eight families. Myzostomids account for more than 150 described species and occur almost worldwide, from the intertidal zone to over 3000 m depth. Most are known from the Pacific Ocean and, according to Grygier (1990), seven species are Indian Ocean endemics and 12 others occur in both oceans. In the Indian Ocean, myzostomids have been recorded in India (e.g., Subramaniam, 1938; George, 1950; Rao & Sowbhagavathi, 1972), Singapore (Eeckhaut et al., 1994; Eeckhaut & Jangoux, 1995), Thailand (Grygier, 1989), west Australia (Grygier, 2000), the Maldives (Atkins, 1927; Chesunov et al., 1989), Mauritius (Clark, 1921), and Zanzibar (Grygier, 1989). Myzostomids also occur on crinoids from the Red Sea (e.g., Boulenger, 1913; Fishelson, 1974; Grygier, 1992). No species has yet been recorded from Madagascar. Here, we report on the myzostomids infesting comatulid crinoids on the Great Reef of Toliara (southwest Madagascar); two of the four species found are new to science.

Materials and methods

Crinoids with their associated myzostomids were collected by hand during dives in September 1998, September 1999, February 2000 and November 2000 at various sites on the Great Reef of Toliara (23° 21′ 14″ S, 43° 40′ 57″ E). Each crinoid was placed in a solution of 20% ethanol in seawater and shaken vigorously. Ectocommensal myzostomids fell from their hosts and were counted under a binocular microscope, then photographed and put into fixatives for morphological studies. Intradigestive myzostomids were removed from the host digestive system after partial dissection of crinoids.

To state the male, female or hermaphroditic condition of the new species, individuals were fixed in a solution of 3% glutaraldehyde in cacodylate buffer (0.1 M, pH 7.3) for 3 h at 4°C, then washed in cacodylate buffer, postfixed for 1 h with 1% osmium tetroxide in 0.1 M of the same buffer, and washed again in buffer. After dehydration, specimens were embedded in Spurr resin and cut into 1 µm sections, which were stained in a 1:1 solution of Methylene
Blue/Azur II according to the procedure of Bozzola & Russel (1992).

For SEM observations, myzostomids were fixed in Bouin’s fluid for 24 h, then dehydrated in graded concentrations of ethanol and critical point dried using CO₂ as the transition fluid. Specimens were then mounted on aluminium stubs, coated with gold in a sputter coater, and observed with a JEOL JSM 6100 scanning electron microscope.

Descriptions of the parapodial hook apparatus were made following digestion of the soft tissues in weak bleach. Once most of the tissue was dissolved, the hooks and support rods were dried and mounted on slides. Microscopical observations were made with an Olympus IMT-2 phase contrast microscope.

Drawings of the new species were made from fixed specimens with a Leica MZ8 zoom microscope equipped with a drawing tube or were based on photographs of living individuals. The type lots of the new species have been deposited in the Institut Royal des Sciences Naturelles de Belgique, Brussels and recorded under the IG number 29360.

**Taxonomy**

Four species of comatulid crinoids were collected on the Great Reef of Toliara: *Capillaster multiradiatus* (Linne, 1758), *Tropiometra carinata* (A.H. Clark, 1921), *Stephanometra indica* (Smith, 1816) and *Comanthus* sp. aff. *wahlbergii* (J. Muller, 1843). The two first species (two and 10 specimens, respectively) were not infested by myzostomids although both are known for being infested by various myzostomids in other Indo-Pacific regions (Fishelson, 1974; Chesunov et al., 1989; Eeckhaut et al., 1998). Four myzostomidian species were found on the two last crinoids: *Notopharyngoides aruensis* (Remscheid, 1918), *Myzostoma polycyclus* (Atkins, 1927), *M. pseudocuniculus* n. sp. and *M. toliarense* n. sp. *Notopharyngoides aruensis* (Remscheid, 1918)


*Myzostomum ijimae* – Iwase et al., 1990: 91.


*Material examined:* Toliara, Madagascar: 2 specimens (IG29360.201-202) from 1 *Stephanometra indica*.

*Remarks:* Both specimens infested the anterior part of the digestive lumen of the only individual of *S. indica* collected. One myzostomid was located above the other, the ventral side of the upper individual contacting the dorsal side of the lower one. Their external anatomy was similar to that of Papuan specimens described in detail by Eeckhaut et al. (1998). Each was very stout, 4 mm long, and lacked cirri; colour (in life) uniformly red.

*Hosts:* *N. aruensis* is an opportunistic endocommensal, infesting nine species of comatulid crinoids from five different genera: *Comanthus, Oxycomanthus, Oxymetra, Stephanometra* and *Tropiometra*.

*Distribution:* This species has a very broad Indo-West Pacific distribution, having been recorded from southwest Madagascar (present paper) and in Indonesia, Enewetak and Kwajalein, Papua New Guinea, north and northwest Australia, Japan, and New Caledonia (Eeckhaut et al., 1998).

*Myzostoma polycyclus* Atkins, 1927


*Myzostomum elegans* – Jägersten, 1940: 104–107, Fig. 1; Iwase et al., 1990: 91.

*Myzostomum irregularare* – Chesunov et al., 1989: 172–3, Fig. 1.

*Material examined:* Toliara, Madagascar: 6 specimens (IG29360.301-306) from 4 *Comanthus* sp. aff. *wahlbergii*.

*Remarks:* All six specimens were observed on the surface of four out of the ten *Comanthus* sp. aff. *wahlbergii* collected. Prevalence of infestation was 40%. One or two myzostomids per crinoid, each 1–2 mm in diameter. The external anatomy of the specimens was very similar to that of Papuan specimens described in detail by Eeckhaut et al. (1998). They had 49–68 marginal cirri and the color in life was uniform beige, with a characteristic dorsal pattern of a central yellow, discoid patch surrounded by four alternating black and white rings.

*Hosts:* This species has been observed on nine species from six genera of Comasteridae: *Comanthus, Clarkcomanthus, Oxycomanthus, Comatula, Comatella,* and *Capillaster*. The most common host is *Comanthus parvicirrus* (J. Muller, 1841), which is widespread in...