

MAGNETIA QUEENSLANDICA, A NEW GENUS AND NEW SPECIES OF TYPHLOPLANID FLATWORM (PLATYHELMINTHES: RHABDOCOELA) FROM MAGNETIC ISLAND IN NORTH QUEENSLAND, AUSTRALIA

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ABSTRACT. – A new genus of rhabdocoel turbellarian from the family Typhloplanidae, *Magnetia*, is described from the marine interstitial habitat of Magnetic Island, Queensland, Australia. *Magnetia queenslandica* new species is characterized by paired eye-like rhabdite packs, an extensive rhabdite fan, and posterior pharynx rosulatus. The male reproductive system is distinguished by paired, ventral, anterior testes reaching the tip of the head, paired posterior seminal vesicles and a copulatory organ containing a boot-shaped sclerotic stylet. The female reproductive system consists of paired vitellaria, a single ovary, receptaculum seminis, and weakly muscular bursa. *Magnetia queenslandica* new genus, new species might be closely related to *Haloplanella* within the subfamily Typhloplaninae. This represents the first account of a marine typhloplanid from Australia.

KEY WORDS. – Australia, flatworm, meiofauna, Turbellaria, Typhloplanidae.

INTRODUCTION

The free-living microturbellarian fauna of the Southern Hemisphere has received scant attention relative to its northern counterpart. In particular, there are few detailed accounts of microturbellarians from Australia despite the large number of tropical and temperate aquatic habitats. To date, fifty-four species of microturbellaria have been described. Among these are seven species of Acoela (reviewed in Winsor, 1990), four species of Macrostomida (Faubel et al., 1994b), thirty six species of Proseriata (Martens & Curini-Galletti, 1989; Curini-Galletti & Martens, 1991; Curini-Galletti & Cannon, 1995, 1996, 1997; Curini-Galletti 1997, 1998; Faubel & Rohde, 1998; Curini-Galletti et al., 2002), and thirteen species of Rhabdocoela, the latter consists of five species of Dalyelliida (Schmarda, 1859; Faubel et al., 1994a; Hartenstein & Dwine, 2000; Hochberg & Cannon, 2001, 2002), one species of Kalyptorhynchia (Curini-Galletti & Puccinelli, 1998), and seven species of Typhloplanida (Schmarda, 1859; Kolasa & Schwartz, 1988; Hochberg & Cannon, 2002). Among the typhloplanids, all seven species are from freshwater. There are no published accounts of marine typhloplanids from the region, though several species are known (personal observations). In this study, we describe one new genus and species of marine Typhloplanida from a collecting expedition to Magnetic Island in tropical northern Queensland.

MATERIALS AND METHODS

Fauna was collected during a visit to Magnetic Island, northern Queensland, Australia, in November, 2001. Sediment was collected from the low intertidal region of Horseshoe Bay and Nelly Bay on Magnetic Island (Fig. 1). Sediment was kept in a bucket for 3 days prior to extraction. Meiofauna were extracted using 7.5% MgCl₂. Approximately twenty-two live typhloplanids were transferred to slides and viewed with an Olympus BH-2 compound microscope with DIC/Nomarski optics and equipped with an ocular micrometer. Digital photographs were taken with a Sanyo Hi-Res Color camera. Specimens were photographed alive under minimal coverglass compression. Some specimens were placed directly in Faure's fluid to make permanent whole-mounts of copulatory stylets.

For histological study, animals were fixed in Bouin's for 24-36 hours, dehydrated in an ethanol series, and embedded in Paraplast. Sections were cut at 6-8 µm intervals. Slides were stained using either hematoxylin and eosin or Mallory's trichrome. One Mallory's stained wholemount was also made. Type specimens are deposited at the Queensland Museum (QM). Wholemount muscle preparations were made following the protocol of Hochberg & Litvaitis (2001) using Alexa 488-phalloidin (Molecular Probes, Eugene, OR., USA). Stained specimens were viewed on an Olympus BX60 compound microscope with a FITC filter and photographed with a SPOT digital camera at the Centre for Microscopy and Microanalysis, University of Queensland.

RESULTS

Magnetic Island. – Magnetic Island is a continental island 8 km off the Townsville coast in northern Queensland. Horseshoe Bay is on the northeast side of the island where the beaches are subject to low wave action. The sands of Horseshoe Bay are coarse, moderately sorted and clean. The following grain size statistics are for the low tide level: median, 0.25 Phi; mean, -0.33 Phi; quartile deviation, 0.99; and skewness, 0.32. Nelly Bay is on the southeast side of the island and receives very little wave action. The sands are also coarse, moderately sorted and clean. Meiofauna of Horseshoe Bay and Nelly Bay included Gastrotricha (*Macrodasys* sp., *Xenotrichula* sp.), Harpacticoida, Nematoda, and various groups of Platyhelminthes (Acoela, Kalyptrorhynchia, Macrostomida and Tricladida).

SYSTEMATICS

FAMILY TYPHLOPLANIDAE GRAFF, 1905

SUBFAMILY TYPHLOPLANINAE LUTHER, 1963

Magnetia, new genus

Type species. – *Magnetia queenslandica*, new species, by present designation.

Diagnosis. – A marine typhloplanid worm with anatomy characteristic of the family Typhloplanidae. Body is bottle-shaped. Anterior fan of adenal rhabdites bifurcates posteriorly into two sets of finger-like processes. Vertical

pharynx rosulatus in posterior one-third of body. Male reproductive system consists of paired elongate testes at anterior tip of head and ventral to adenal rhabdites and vitellaria. Paired pea-shaped seminal vesicles in posterior third of body lead to sclerotic stylet. Female reproductive system consists of paired vitellaria with a solitary posterior ovary, seminal receptacle and copulatory bursa.

Etymology. – Generic name refers to Magnetic Island. Gender feminine.

Remarks. – *Magnetia*, new genus, bears strong resemblance in body shape and general anatomy to most members of the Typhloplanidae Graff, 1905. The body is highly deformable and the head and neck regions often cycle through numerous extensions and retractions while the animal remains stationary. The extensive array of adenal rhabdites is similar to many species of the families Trigonostomidae and Typhloplanidae, with a fan-like anterior zone, thin middle zone, and branching posterior zone (Figs. 2, 3). The presence of eye-like rhabdite patches at the anterior end is however unknown from any other species. Histologically, each patch consisted of several eosinophilic spindle-shaped rhabdites. A membrane around the rhabdite patches was not observed. The caudal haptic region in *Magnetia* appears morphologically similar to the haptic girdles of kalyptrorhynchs. However, the adhesive region of *Magnetia* is in the form of a patch rather than a belt-like girdle and the papillae are much smaller.

Concerning the reproductive system, the location of the testes and the structure of the copulatory stylet are unique. Only species of *Anthopharynx* Karling, 1940, *Tensopharynx* Ehlers, 1972, and *Trisaccopharynx* Karling, 1940 (Solenopharyngidae) possess a similar anterior placement of the testes; however, the testes in *Magnetia* are much more anteriorly directed and elongate than in any other genus (Figs. 2, 3). The unusual boot-like shape of the stylet is also unique, especially with its thickened proximal walls and the tear-drop shaped distal opening (Figs. 6, 7). The two groove-like lines present around the neck of the stylet are similar to the “knickstellen” on the stylets of species of *Haloplanella* Luther, 1946 (e.g., Ehlers & Sopott-Ehlers, 1989).

The new genus can be diagnosed by the structure of the reproductive system and the location of excretory pores. Cannon (1986) and Kolasa (1991) indicate that genera can be separated taxonomically (not necessarily with phylogenetic relevance) based on a dorsal or ventral position of the testes relative to the vitellaria. In *Magnetia*, the testes are located ventral to the adenal rhabdites and the vitellaria. The relative position of the testes is difficult to establish in wholemounts because the animals are often stretched out and the testes are anterior of the vitellaria. However, sections of contracted specimens showed a consistent overlap of the vitellaria on the distal end of the testes. In relaxed specimens, it seems likely that only the spermatic ducts will be ventral to the vitellaria. The location and branching pattern of protonephridial ducts was difficult to observe. In only a single specimen were protonephridial ducts found to open in the

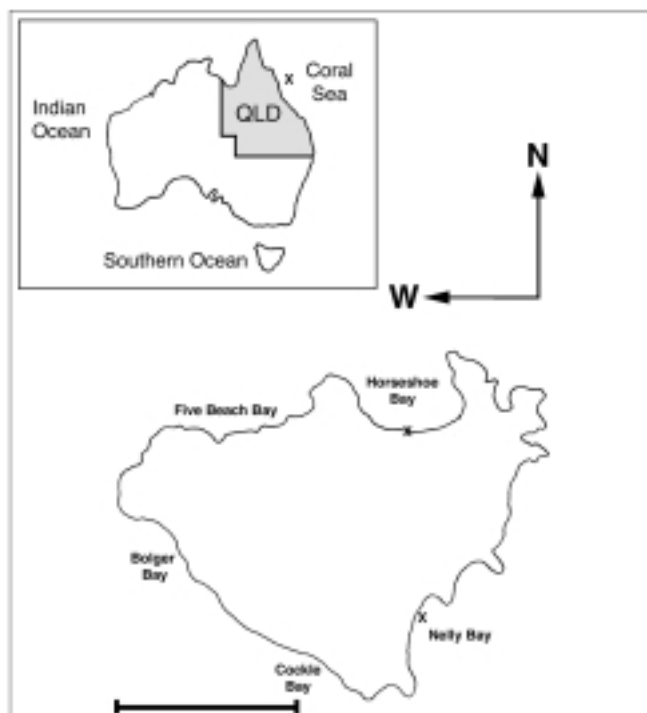


Fig. 1. Location of study area in northern Queensland. Scale bar = 4 km.

region of the mouth/pharynx. According to Cannon (1986), these characters indicate the new genus belongs to the subfamily Typhloplaninae Luther, 1963.

Relationships within the Typhloplaninae remain unknown, but in-group relations may be tentatively classified according to the topology of general anatomical and reproductive characters. Accordingly, *Magnetia* might be closely related to *Haloplanella* Luther, 1946. Shared features include prominent rhabdite tracts, pharynx in mid to posterior body region, testes anterior to pharynx, posterior pea-shaped seminal vesicles, short copulatory organ (relative to *Pratoplanea* Ax, 1960) and strongly sclerotic stylet.

***Magnetia queenslandica*, new species**
(Figs. 2-7)

Material examined. – Holotype – mature adult (QM G218757), Horseshoe Bay, Magnetic Island, Queensland, Australia, coll. R. Hochberg, Nov.2001.

Paratypes – 4 mature adults (QM G218758-61), same data as holotype, coll. R. Hochberg, Nov.2001.

Description. – Specimens often translucent except for the gut and anterior rhabdite tracts, the latter is often dark brown under transmitted light (Fig. 2). Body length 300-492 μm and body width to 89 μm at widest point in mid trunk region.

In gliding animals, the head end is often stretched anteriorly and the trunk is in the shape of a bottle. Even in slightly contracted specimens, the head end is noticeably narrower than the trunk, often with an elongate neck-like region. Eyes are absent, but two distinct patches of rhabdites are present lateral to an anterior rhabdite fan and give the appearance of eyespots (Figs. 2-4). The ciliated epidermis consists of columnar to cuboidal cells with cilia to 3-4 μm long. Dermal rhabdites are present over most of the body except for a region ventral to the testes (Fig. 2C). Anteriorly, there is a prominent adenal rhabdite fan much darker than the rest of the body (Figs. 2-4). All rhabdites are spindle-shaped and 5-6 μm long. In a specimen 343 μm long by 64 μm wide, the rhabdite fan was 25 μm wide and 40 μm long. In cross-section, the anterior fan filled up ca. fifty percent of the body, the epidermis had indistinct cell borders, and few dermal rhabdites were present. Posteriorly, the rhabdite fan narrowed to a single rhabdite tract for approximately 40-50 μm (Fig. 2C). The rhabdite tract then bifurcated and each fork expanded into several finger-shaped processes (Figs. 2C, 3). In cross-section, the adenal rhabdites filled approximately one-third of the body. Dermal rhabdites were present in greater numbers in the trunk region. A caudal adhesive region was present as minute papillae at the posterior end (Fig. 3). It is perhaps noteworthy that this region was indistinct in living specimens and only visible in a single stained wholemount (QM G218761).

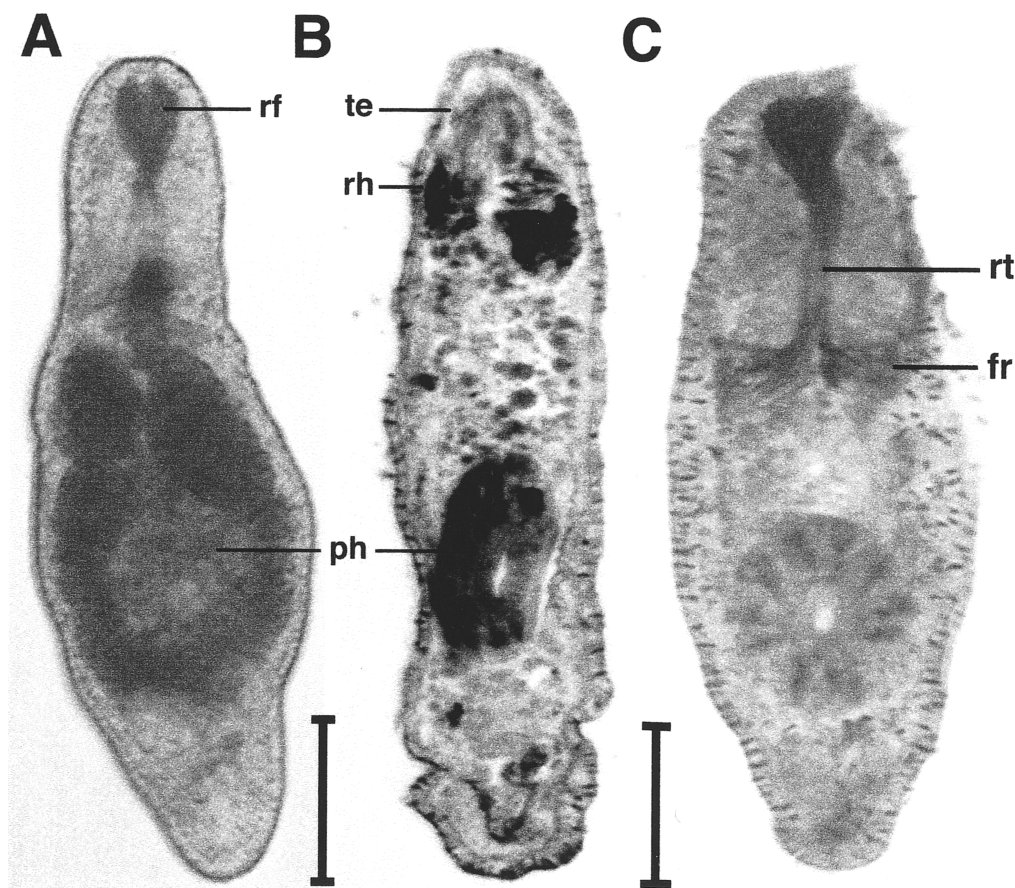


Fig. 2. *Magnetia queenslandica*, new genus, new species. A, light micrograph. B, frontal section. C, stained wholemount. fr, finger-like rhabdite branches; ph, pharynx; rh, rhabdites; rf, rhabdite fan; rt, rhabdite tract; te, testis. Scale bar = 125 μm .

The muscular system consisted of an outer layer of circular muscles and inner layers of longitudinal bands and several diagonal muscles (Fig. 5). Other muscles were present around some of the reproductive organs described below.

The digestive tract consists of a saccate gut and pharynx rosulatus. The gut often contained diatoms. A vertically-oriented pharynx rosulatus is present in the posterior body region and up to 72 μm diameter (Figs. 2, 3, 5). Approximately ten to eleven eosinophilic glandular zones were symmetrically disposed around the perimeter (Fig. 2C; Paratype QM G218761).

The male reproductive system consists of paired testes, vasa deferentia, paired seminal vesicles, and a copulatory bulb

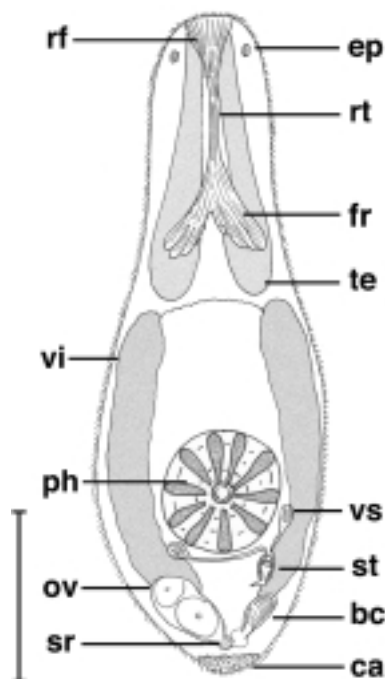


Fig. 3. *Magnetia queenslandica*, new genus, new species. Schematic illustration of general anatomy. ca, caudal adhesive region; bc, bursa copulatrix; ep, eye-like rhabdite patch; fr, finger-like rhabdite branches; ov, ovary; ph, pharynx; rf, rhabdite fan; rt, rhabdite tract; sr, seminal receptacle; st, stylet; te, testis; vi, vitellaria; vs, vesicula seminalis. Scale bar = 125 μm .

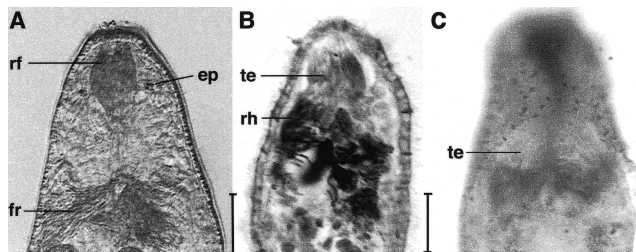


Fig. 4. *Magnetia queenslandica*, new genus, new species. Structure of anterior end. A, light micrograph. B, frontal section. C, Stained wholemount. ep, eye-like rhabdite patch; fr, finger-like rhabdite branches; rf, rhabdite fan; rh, rhabdites; te, testis. Scale bar = 40 μm .

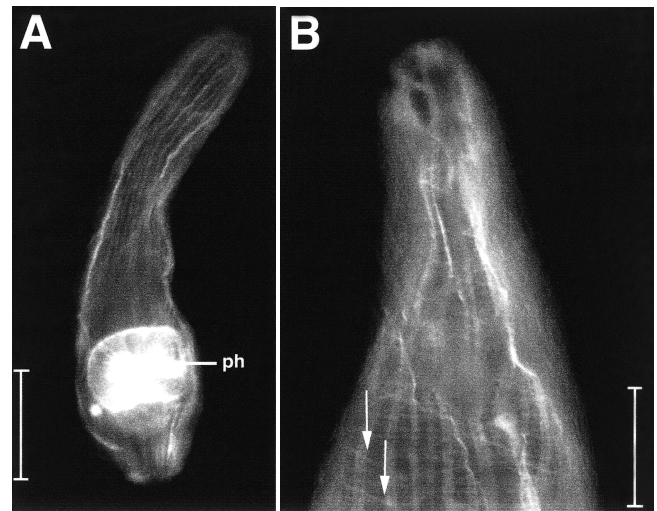


Fig. 5. *Magnetia queenslandica*, new genus, new species. Phalloidin-stained specimens. A, ventral view of wholemount. Scale bar = 100 μm . B, ventral view of anterior end. Arrows point to diagonal muscles. p, pharynx. Scale bar = 40 μm .

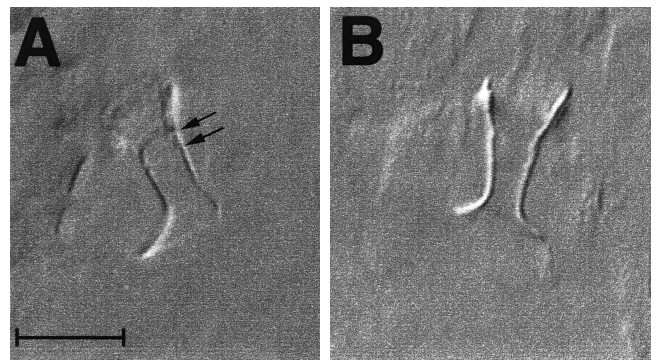


Fig. 6. *Magnetia queenslandica*, new genus, new species. Sclerotic stylet. A, lateral view. Arrows point to paired grooves on neck. B, ventral view. Scale bar = 20 μm .

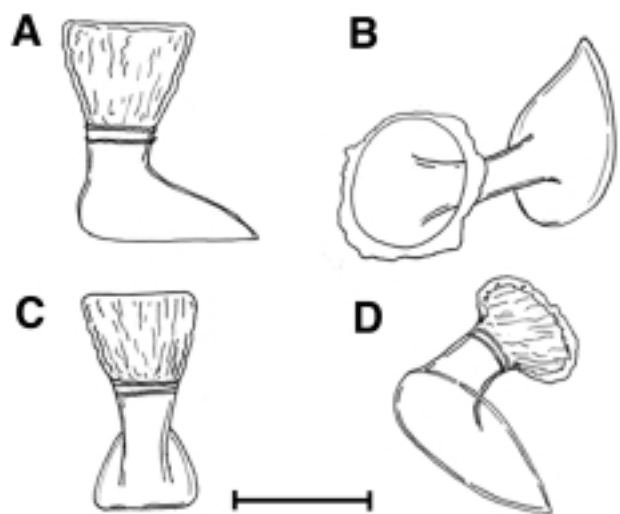


Fig. 7. *Magnetia queenslandica*, new genus, new species. Camera lucida drawings of sclerotic stylet. A, Holotype: QM G218757, dorsal view of stylet. B, Paratype: QMG218758, proximal end view of stylet. C, Paratype: QMG218759 "back" view of stylet. D, Paratype: QMG218760, distal end view of stylet. Scale bar = 20 μm .

containing a sclerotic stylet (Figs. 2-7). The paired testes are located at the anterior tip of the head and ventral to the adenal rhabdite fan (Fig. 4C). The testes extend posteriorly as tear-drop shaped sacs and are often longer than the rhabdite tracts in living animals. Vasa deferentia arise posteriorly from the testes and extend around the pharynx where they enlarge as pea-shaped seminal vesicles. A sperm duct arises medially from each seminal vesicle and opens into the proximal part of the male copulatory bulb located on the right side of the body. A weak supply of prostatic tissue is located within the anterior portion of the copulatory bulb. The copulatory bulb is oblong, to 38 μm long, and covered in a delicate sheath of circular muscles. The copulatory stylet lies at the distal end of the copulatory bulb. The stylet is in the shape of a 'boot' and up to 19 μm long with the distal tip pointing toward the body midline (Figs. 6,7). The proximal opening is up to 12 μm in diameter that narrows to 5 μm in the neck region before expanding to 12 μm at the distal opening. The upper 8 μm of the proximal region has irregularly thickened walls with transverse striations. Immediately below this are two thickened grooves, separated by 2-3 μm , around the circumference of the neck (Fig. 6). The distal opening is tear drop shaped. The stylet leads directly into the genital atrium by way of a short genital canal.

The female reproductive system consists of paired vitellaria, a single ovary, bursa copulatrix and receptaculum seminis (Fig. 3). The paired vitellaria begin at approximately one-third body length. The vitellaria come in close contact with the solitary ovary but vitelline ducts were not observed. The ovary is located posterior and opposite the male copulatory stylet at the caudal end. The distal end of the ovary narrows before the oviduct expands into a seminal receptacle. The seminal receptacle connects to the lateral wall of the genital atrium. A weakly muscular bursa copulatrix communicated with the opposite wall of the genital atrium. A gonopore was not observed.

Etymology. – The species is named after the state of collection, Queensland. Gender feminine.

Locations. – Type locality - Horseshoe Bay (19° 07' S, 146° 51' E), Magnetic Island, Queensland, Australia. Second locality - Nelly Bay (19° 09' S, 146° 51' E), Magnetic Island.

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