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Leptohelia flexibilis gen. nov. *et* sp. nov., a remarkable deep-sea stylasterid (Cnidaria: Hydrozoa: Stylasteridae) from the southwest Pacific

ALBERTO LINDNER[1], STEPHEN D. CAIRNS[2] & HELMUT ZIBROWIUS[3]

[1]*Departamento de Ecologia e Zoologia, Centro de Ciências Biológicas, Universidade Federal de Santa Catarina, Edifício Fritz Müller, Florianópolis, SC, 88040-970, Brazil. E-mail: alberto.lindner@ufsc.br*

[2]*Department of Invertebrate Zoology, NMNH, Smithsonian Institution, P. O. Box 37012, W-205, MRC-0163, Washington, D. C., 20013-7012, U.S.A. E-mail: cairnss@si.edu*

[3]*Le Corbusier 644, 280 Boulevard Michelet, 13008 Marseille, France. E-mail: helmut.zibrowius@orange.fr*

Abstract

Leptohelia flexibilis gen. nov. *et* sp. nov., the first stylasterid with a combined calcified and non-calcified skeleton, is described from seamounts and the slope off the islands of New Caledonia, in the southwestern Pacific. The new species is distinguished from all other species of the family Stylasteridae by having a non-calcified organic axis, internal to the basal portion of the calcified corallum. The internal axis is flexible and enclosed by a series of up to 10 calcified annuli, allowing passive lateral bending of the colony. Molecular phylogenetic analyses confirm that *Leptohelia flexibilis* is a stylasterid coral and reveal that the species is closely related to *Leptohelia microstylus* comb. nov., a southwestern Pacific stylasterid that lacks an internal axis.

Key words: evolution, systematics, New Caledonia, Norfolk Ridge, coral

Introduction

Corals are "animals in the cnidarian classes Anthozoa and Hydrozoa that produce either calcium carbonate (aragonitic or calcitic) secretions resulting in a continuous skeleton or as numerous, usually microscopic, individual sclerites, or that have a black, horn-like, proteinaceous axis" (Cairns 2007:312). Whereas the black, horn-like proteinaceous axis of black corals (Anthozoa: Hexacorallia: Antipatharia) and the microscopic calcified sclerites of octocorals (Anthozoa: Octocorallia) are important skeletal elements, it is the continuous calcified skeletons of the so-called 'hard' or 'stony' corals that provide the major building blocks of reef and non-reefal environments worldwide. This polyphyletic assemblage embraces a number of hydrozoans and anthozoans, most notably the families Stylasteridae and Milleporidae (Class Hydrozoa) and the order Scleractinia (Class Anthozoa), the most speciose group of stony corals, with about 1500 species (Cairns *et al*. 1999; Cairns 2007).

Yet, in contrast to the non-calcified or partially calcified colonies of black corals and octocorals that bend with currents, the sturdiness of the continuous calcified colonies of scleractinian and stylasterid corals prevents mobility of colony parts. In this study, we describe the first stylasterid coral with an internal, non-calcified axis. The axis is flexible and enclosed by a series of up to 10 calcified annuli that allow lateral bending of the colony without breakage of the corallum. Molecular phylogenetics and the presence of gastropores, dactylopores and gastrostyles in the calcified portion of the colony confirm that the species is a stylasterid coral (Cnidaria: Hydrozoa: Stylasteridae), the second most diverse group of stony corals with 290 extant species (Cairns *et al*. 1999, Lindner *et al*. 2008).

Material and methods

Colonies of *Leptohelia flexibilis* sp. nov. were collected at depths of 265 to 720 meters off the islands of New Caledonia: off the south and north sides of Grande Terre, off Island of Pines, the Loyalty Islands, and on northern seamounts and banks of the Norfolk Ridge (Table 1). The material has been collected during various cruises,

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colony (Figure 2B). This strongly indicates that the non-calcified axis is not a foreign structure, but part of the species. The largest colony (USNM1078266) is a broken corallum 8.7cm long with 10 basal annuli and with a maximum diameter of 2.4mm, i.e., the colony is 36 times taller than wide. Both the tip of the corallum and its basal encrusting portion are broken, and the colony was thus certainly taller, possibly up to 10 cm (>40 times taller than wide).

Although not closely related, the hydroid *Hydractinia antonii* Miglietta, 2006 is another hydrozoan species with both flexible and calcified parts, as in *L. flexibilis*. The flexible axis of *Leptohelia flexibilis* is also similar to the chitinous internal skeleton of the capitate hydrozoan *Solanderia* Duchassaing & Michelin, 1846 (Capitata: Solanderiidae) in being smooth surfaced and in having anastomosing threads (Figure 3; Bouillon & Cornelius 1988, Bouillon *et al*. 1992). The axis of *L. flexibilis* is even more similar to the skeleton of *Pseudosolanderia picardi* Bouillon & Gravier-Bonnet, 1987, which is also smooth surfaced and mostly solid, but differs by having ridges and spines on its surface (whereas axes of *L. flexibilis* are only slightly undulated and with short projections; Figure 3C, H). Although further analyses remain to be performed, these morphological similarities indicate that the axis of *L. flexibilis* may be of chitin, the polysaccharide inferred to be synthesized by species of *Solanderia, Pseudosolanderia*, and numerous hydrozoans. *Leptohelia flexibilis* is one more remarkable species discovered in deep-water seamounts and slopes off the islands of New Caledonia (Richer de Forges *et al*. 2000) and the flexible axis is another example of a morphological novelty originating in the deep sea (Lindner *et al*. 2008).

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