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## Reef sponges of the genus *Agelas* (Porifera: Demospongiae) from the Greater Caribbean

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### Table of contents

Abstract	301
Introduction	302
The genus <i>Agelas</i> in the Greater Caribbean	302
Material and methods	303
Classification	304
Phylum Porifera Grant, 1835	304
Class Demospongiae Sollas, 1875	304
Order Agelasida Hartman, 1980	304
Family Agelasidae Verrill, 1907	304
Genus <i>Agelas</i> Duchassaing & Michelotti, 1864	304
<i>Agelas dispar</i> Duchassaing & Michelotti, 1864	306
<i>Agelas cervicornis</i> (Schmidt, 1870)	311
<i>Agelas wiedenmayeri</i> Alcolado, 1984	313
<i>Agelas sceptrum</i> (Lamarck, 1815)	315
<i>Agelas dilatata</i> Duchassaing & Michelotti, 1864	316
<i>Agelas conifera</i> (Schmidt, 1870)	318
<i>Agelas tubulata</i> Lehnert & van Soest, 1996	321
<i>Agelas repens</i> Lehnert & van Soest, 1998	324
<i>Agelas cerebrum</i> Assmann, van Soest & Köck, 2001	325
<i>Agelas schmidti</i> Wilson, 1902	329
<i>Agelas citrina</i> Gotera & Alcolado, 1987	331
<i>Agelas sventres</i> Lehnert & van Soest, 1996	334
Discussion	337
Acknowledgements	339
References	340

### Abstract

The genus *Agelas* comprises a group of tropical and subtropical reef sponges that contains large, long-lived, often brightly colored and conspicuous species, distributed throughout the tropical western Atlantic, temperate northern Atlantic (Mediterranean Sea), and western and central Indo-Pacific Realms. Among tropical sponge genera, *Agelas* is one with similar species richness in the Greater Caribbean in comparison to the Indo Pacific. The presence of verticillated acanthostyle spicules and a fibroreticulate skeleton of spongin fibres cored and/or echinated by spicules characterize this group. Taxonomic identification relies on a combination of characters, where external morphology and color play a key role, owing to the paucity of microscopical characters. Thus, there is still a great deal of taxonomic confusion, even for the more common species. We carried out a detailed revision of *Agelas* species throughout the Greater Caribbean area using classic tax-

onomic tools. Samples and observations covered Colombia, Belize, Jamaica, the Bahamas, Barbados, Curaçao and Venezuela, and included type material from major museum collections. According to our results, the genus *Agelas* in the Caribbean has at least thirteen valid species, viz. *Agelas sceptrum* (Lamarck, 1815); *A. dispar* Duchassaing & Michelotti, 1864; *A. dilatata* Duchassaing & Michelotti, 1864; *A. clathrodes* (Schmidt, 1870); *A. cervicornis* (Schmidt, 1870); *A. conifera* (Schmidt, 1870); *A. schmidtii* Wilson, 1902; *A. tubulata* Lehnert & van Soest, 1996; *A. wiedenmayeri* Alcolado, 1984; *A. citrina* Gotera & Alcolado, 1987; *A. sventres* Lehnert & van Soest, 1996; *A. repens* Lehnert & van Soest, 1998; and *A. cerebrum* Assmann *et al.*, 2001. We found that variation of microscopic characteristics like skeleton arrangement, number of verticills and their spines, and spicule length and width, can be used as taxonomic tools, but only in a thorough comparison with other species in the same sub-regional context. Thus, a certain degree of familiarity with the genus' regional variation is often required. The richness and distribution of these species in the Caribbean area show north/south differences and other ecological patterns are evident.

**Key words:** Agelasida, taxonomy, fibroreticulate, verticillated acanthostyle

## Introduction

The genus *Agelas* Duchassaing & Michelotti (1864) comprises a group of tropical and subtropical reef demosponges that contains long-lived species distributed throughout the Mediterranean Sea, the Indo-Pacific Ocean, the Greater Caribbean Sea and Brazil. This group is defined by the presence of an almost unique type of regularly verticillated acanthose style-like megasclere (acanthostyle; see Fig. 1A, 1B). In addition, verticillated acanthoxeas are present, but they are not abundant. Other features include having a fibroreticulate spongin skeleton of primary ascending fibres invariably cored and echinated by spicules, and interconnecting secondary fibres profusely echinated by spicules and rarely cored (see Figs. 1C, 1D, 1E, 1F and 1G). These sponges typically have a thin organic pinacoderm, supported by tracts of spicules protruding from the perpendicular ends of ascending main fibres. Excepting their particular spicule architecture and characteristic spongin-fibre structure, transversely arranged collagen bundles (van Soest 2002), several morphological features of this genus resemble other Poriferan groups which include sponges of diverse growth forms, *e.g.*, thickly encrusting, massive, globular, branching, fan shaped and tubular. From the information stored in the Zoological Museum of Amsterdam (ZMA) Database (Data downloaded on January-2005) recent species of *Agelas* are found at depths from 2 m to deeper than 400 m, being common between 20–125 m (more than 60 % of the specimens are in that range).

Species belonging to *Agelas* were formerly classified under *Ectyon* Gray, 1867; *Chalinopsis* Schmidt, 1870; *Siphonochalinopsis* Schmidt, 1880 and *Pachychalinopsis* Schmidt, 1880, all of which have been synonymized with *Agelas* (see Wiedenmayer 1977; van Soest 2002). The oldest references to *Agelas* species are from Lamarck (1813, 1815) who used the generic denominations *Spongia* and *Alcyonium*.

*Agelas* species are distributed mainly in tropical reef localities, with some subtropical incursions. Highest species richnesses are found in the Indo-Pacific area with 15 species (de Voogd *et al.*, 2008), and the Greater Caribbean with 13 species (this work); the Mediterranean Sea has only 1 species. The tropical Brazilian coast has populations of at least eight Caribbean species (Mothes *et al.* 2007); however their status as species or populations needs to be established, as it is likely that they underwent a recent isolation.

## The genus *Agelas* in the Greater Caribbean

Given its conspicuousness in the Greater Caribbean reefs, almost all major taxonomic works for this area include the common species of *Agelas* (Wiedenmayer 1977; Pulitzer-Finali 1986; Zea 1987; Lehnert & van Soest 1996; 1998; 1999). In addition, some recent detailed works have added new species (Alcolado 1984; Gotera & Alcolado 1987; van Soest & Stentoft 1988; Lehnert & van Soest 1996; Assmann *et al.* 2001). However, there is still a great deal of taxonomic confusion, even for the more common species, owing to: a) reliance on live external features and on too few internal characters, b) existence of geographically distinct morphotypes within some species, and c) difficulty in defining species from old, fixed, sometimes unaccounted for, type specimens.

Previous works focused in the Greater Caribbean, have included between 16 and 21 species in *Agelas* (respectively, van Soest *et al.* 2008; Assmann *et al.* 2001), many of which are important components of the reef biota (Zea 1994). In this paper, we present a taxonomic revision of the genus for the Greater Caribbean area, using morphological characters, ascribing its richness to 13 species.

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