



<http://dx.doi.org/10.11646/zootaxa.3750.4.6>

<http://zoobank.org/urn:lsid:zoobank.org:pub:C93C5FA2-3315-45C6-BE73-9AC6C648E57A>

## ***Cliona tumula* sp. nov., a conspicuous, massive *Symbiodinium*-bearing clionaid from the lower Florida Keys (USA) (Demospongiae: Hadromerida: Clionaidae)**

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### **Abstract**

*Cliona tumula* sp. nov. is described from the Florida Keys, Florida, USA. The new species is compared to representative *Cliona* spp. from the Caribbean and Indo-Pacific. *Cliona tumula* sp. nov. is a massive, mound-shaped zooxanthellate clionaid with a central, apical cluster of numerous oscula, slender tylostyles with variable heads and abundant, delicate spirasters with compound spines that can be concentrated at the ends, which in this species can appear as mushroom-like caps, with a skeleton in typical clionaid arrangement. It is distinguished from congeners by its epibenthic growth form that extends for 20–40 cm above the substratum, centrally located concentration of oscula, and calcareous fragments obtained from surrounding sediment that *C. tumula* sp. nov. incorporates in tracts that run through the choanosome perpendicular to the ectosome. This species can be locally abundant in the Florida Keys in patch reefs near sand flats, but may be restricted to the lower keys as it has not been observed on reefs to the east.

**Key words:** Porifera, Caribbean, bioerosion, new species, coral reefs

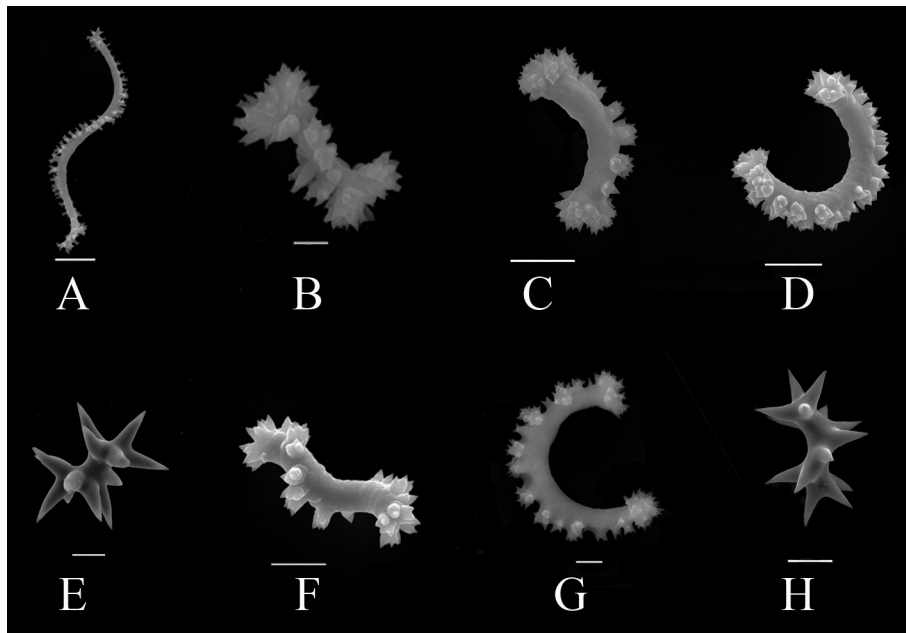
### **Introduction**

*Cliona* was erected by Grant (1826) to describe an endolithic sponge (*C. celata*) growing in oyster shells from a Scottish estuary. He was intrigued by *C. celata*'s “most obvious and remarkable property of retracting and shutting papillae when irritated” (p. 81), and chose the genus name to emphasize this aspect of the species' phenotype. Grant briefly hypothesized about the trait clionoids are probably best known for today, namely bioerosion of calcareous structures.

The clionoids represent a well-known family with a rich history in sponge literature (Schönberg 2000a, 2008; van Soest 2012). They play vital ecological roles on coral reefs as major bioeroders (e.g. Holmes 2000) and by forming symbioses with zooxanthellae (e.g. Hill *et al.* 2011). Clionoids have always presented taxonomic challenges at higher and lower levels of classification (Schönberg 2000a). The taxonomic assignment of species in either the Spirastrellidae or Clionaidae has been debated (e.g., *Anthosigmella varians* (Rützler 2002, Hajdu *et al.* 2011) and *Cervicornia cuspidifera* (Rützler & Hooper 2000)). Several examples of taxonomic challenges at the species level include the *C. caribbaea* (Carter, 1882), *C. aprica* Pang, 1973, and *C. tenuis* Zea & Weil, 2003 complex in the Caribbean (Zea and Weil 2003); *C. parenzani* Corriero & Scalera-Liaci, 1997 in the Mediterranean (Vacelet *et al.* 2008); as well as the ‘*Cliona viridis* (Schmidt 1862) complex’ on the Great Barrier Reef (Schönberg 2000a,b; Escobar *et al.* 2012).

The Gulf of Mexico and western Atlantic have experienced extensive taxonomic attention from sponge biologists, including surveys for clionaid sponges (e.g. Atlantic and Gulf Rapid Reef Assessment, Benthic Ecological Assessment for Marginal Reefs, and Southeast Florida Coral Reef Evaluation and Monitoring Project; de Laubenfels 1936, 1950, 1953; Rützler 2002; Gilliam 2007; Gilliam *et al.* 2007; Lang *et al.* 2010;). During recent work in the Florida Keys, we encountered a large bodied sponge that was conspicuous on shallow reefs near Looe Key, FL, USA. This sponge is unlike any described in the literature, and we present a formal description of this new species here.

*Cliona tumula* **sp. nov.** may have a very restricted geographic distribution. We have not observed this sponge in surveys of patch reefs in similar habitats in the upper and middle Florida Keys. Despite his thorough inventory of sponges in the Dry Tortugas, which lie to the west of Looe Key, de Laubenfels (1936) did not document this species. Additional effort is required to rule out the possibility that *C. tumula* **sp. nov.** does not occur elsewhere in the Florida Keys or Caribbean.



**FIGURE 5.** Microscleres from *Cliona orientalis*, *Cervicornia cuspidifera*, and *C. varians*. A. *C. orientalis* spiraster; B. *Cervicornia cuspidifera* spiraster; C. *Cliona varians* (encrusting) spiraster; D. *Cliona varians* (encrusting) anthosigma; E. *Cliona varians* (encrusting) diplaster; F. *Cliona varians* (massive) spiraster; G. *Cliona varians* (massive) anthosigma; H. *Cliona varians* (massive) diplaster. Scales: A, C–D, F, 5  $\mu$ m; B, G, 2  $\mu$ m; E, H, 10  $\mu$ m.

### Acknowledgements

Brittany West and Blake Ramsby helped with the first sampling of *Cliona tumula* **sp. nov.** Mote's Tropical Research Laboratory in Summerland Key, FL provided excellent logistical support, and we especially thank Erich Bartels for suggesting sites for our work. This work was funded by grants from the National Science Foundation (OCE-0647119 & DEB-0829763 to MSH). The University of Richmond also provided financial support to SF. All collections in the Florida Keys were performed in accordance with policies established by the Florida Keys National Marine Sanctuary (permit FKNMS-20070094-A1). Two anonymous reviewers provided helpful comments. Special thanks to Eduardo Hajdu for constructive recommendations on the manuscript.

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