

## Family Rhabderemiidae Topsent, 1928

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Rhabderemiidae Topsent (Demospongiae, Poecilosclerida) contains four nominal genera of which only one is now valid, currently with 26 described species predominantly from shallow waters of all tropical and warm temperate seas (with one deep water species known from 1360 m depth). The family is still of uncertain relationship, having a unique apomorphy in the form of smooth or spined rhabdostyles bearing a basal spiral twist, and peculiar usually rugose microscleres resembling oxeas or toxas (thraustoxeas), sigmas (spirosigmata, thraustosigmata) and microstyles, although these are probably analogous to toxas and sigmas found in other poecilosclerids. Species are usually thinly encrusting but also include branching, club-shaped, digitate or massive forms, usually fleshy, with species differing mainly in their microsclere composition and geometry and spicule dimensions.

**Keywords:** Porifera; Demospongiae; Poecilosclerida; Microcionina; Rhabderemiidae; *Rhabderemia*.

### DEFINITION, DIAGNOSIS, SCOPE

#### Synonymy

Rhabderemiidae Topsent, 1928c: 64.

#### Definition

Microcionina of uncertain relationship, with smooth or spined rhabdostyles bearing an extra spiral twist at the rounded extremity and microscleres include peculiar toxiform (thraustoxeas), sigmoid-like (spirosigmata, thraustosigmata) and rugose microstyles.

#### Diagnosis

Thinly and thickly encrusting, massive, lobate, anastomosing, digitate, arborescent and lobate-flabellate growth forms; megascleres consist of smooth or distally spined monactinal choanosomal rhabdostyles bearing a basal spiral twist forming hymedesmioid (Fig. 1A–B), plumose, plumo-reticulate (Fig. 2B) or reticulate skeletal structures, usually with poorly developed spongin fibres, with rhabdostyles usually forming diverging plumose tracts within fibres; microscleres if present include rugose oxeote or toxa-like spicules (thraustoxeas), rugose sigma-like spicules (spirosigmata, thraustosigmata) and rugose microstyles.

#### Scope

Monogeneric, with 26 described species predominantly tropical–subtropical.

#### History and biology

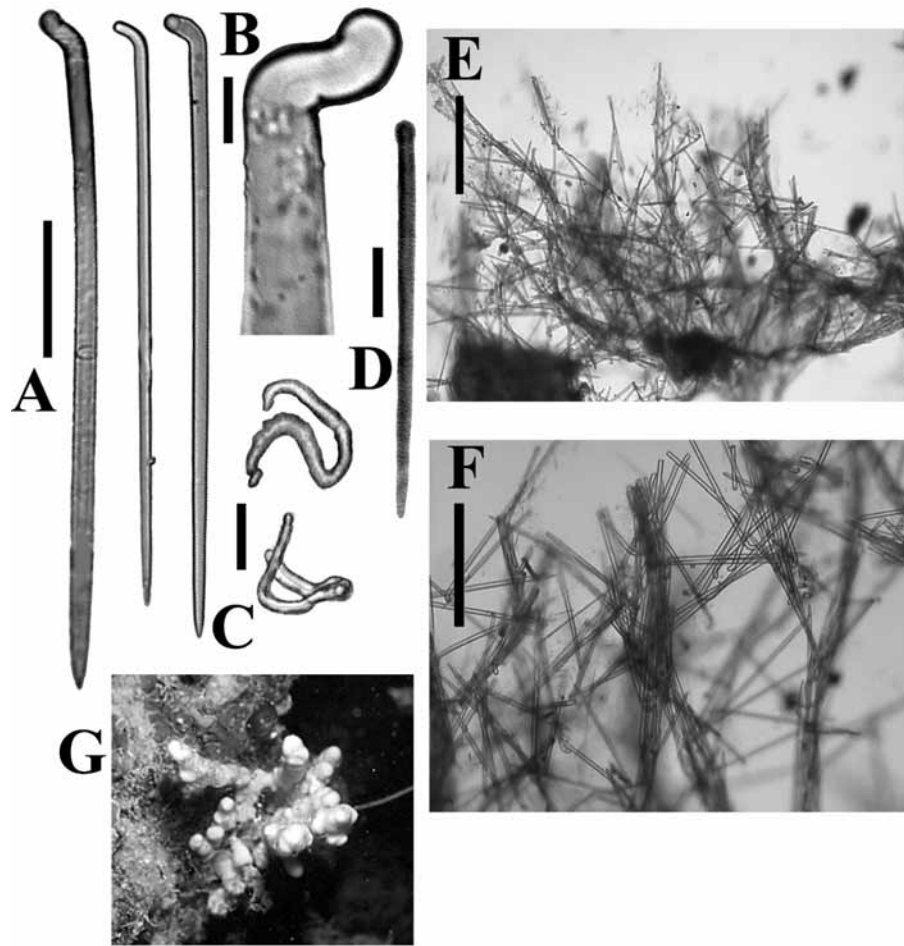
Rhabderemiidae is a monogeneric family since the included genera (*Rhabderemia*, *Rhabdosigma*, *Nisibaris* and *Stylospira*) were synonymised (Hooper, 1990a; Van Soest & Hooper, 1993). Until recently the family was included in the polyphyletic order Axinellida (Lévi, 1973; Hartman, 1982), although it has also been assigned to the Poecilosclerida (e.g., Topsent, 1928c) and Hadromerida (in the family Spirastrellidae) (de Laubenfels,

1936a; Bergquist, 1968). Hooper (1990a) returned the family to Poecilosclerida on the basis that its monactinal choanosomal megascleres, the diversity and geometry of microscleres are homologous to those of poecilosclerids. However, Van Soest & Hooper (1993) suggest that there is doubt over the homology of the sigmoid toxiform microscleres between *Rhabderemia* and other poecilosclerids (hence the use of the terminology of ‘spirosigmata’ and ‘thraustosigmata’ as opposed to ‘normal sigmata’ and ‘thraustoxea’ as opposed to ‘normal oxeas’), given their persistently spined condition, but they retained the family taxon for ‘practical purposes’.

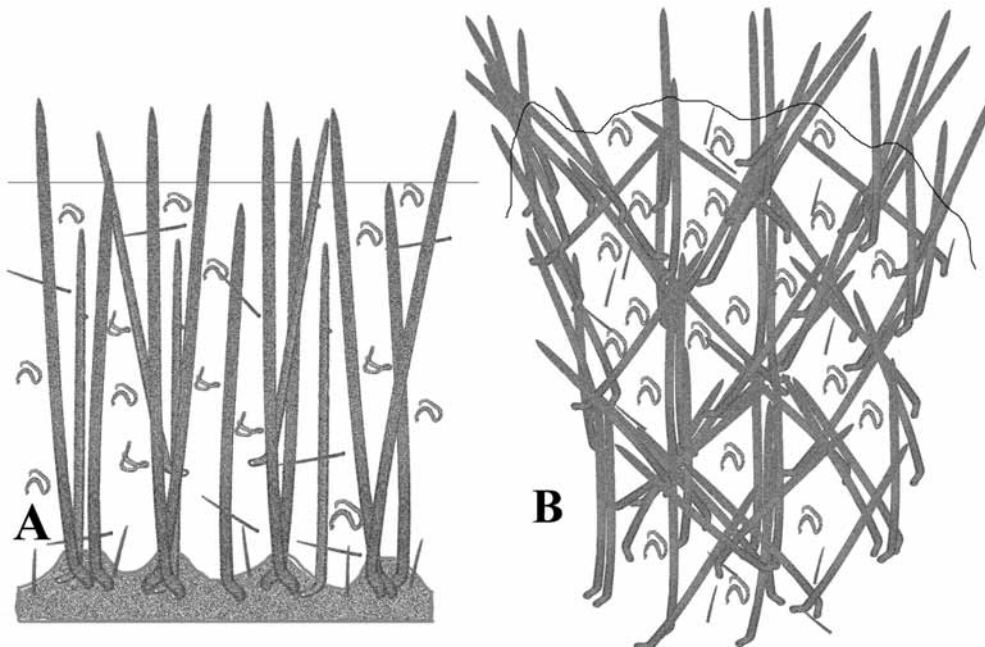
This definition of Rhabderemiidae in the Poecilosclerida was developed from those of contemporary authors (Lévi, 1973; Bergquist, 1978; Hartman, 1982; Hooper, 1990a; Van Soest & Hooper, 1993), whereas earlier definitions (Topsent, 1928c; de Laubenfels, 1936a) were non-committal in the higher taxonomic placement of the family. The 26 described species in this monogeneric family are nearly cosmopolitan (excluding arctic and antarctic seas), and confined largely to cryptic habitats (particularly in coral reefs). Some morphological trends are apparent amongst species: rhabdostyles (an autapomorphy for the family) may lose their spiral twist in the rhabdose end and lose spination on their distal ends; and microstyles, thraustoxeas, contorted sigmata and thraustosigmata may be lost in some species (Van Soest & Hooper, 1993).

#### Differences with similar families

Rhabderemiidae shows some similarities in skeletal structure and spiculation to the Raspailiidae, particularly *Hemectyonilla* Burton and *Aulospongia* Norman (Hooper, 1991; Hooper *et al.*, 1999), but was excluded from it in having unique rugose sigmoid, toxiform and microstylote microscleres (whereas most raspailiids lack microscleres, or when present they consist only of smooth raphides). Rhabderemiids also lack any evidence of an extra-axial skeleton, but this feature is not always obvious in many raspailiids either (Hooper, 1991). Although typical raspailiids such as *Raspailia* Nardo have well differentiated axial and extra-axial skeletons, others such as *Echinodictyum* Ridley have simply reticulate skeletons, but generally in the Raspailiidae there is always at least some remnants of an extra-axial skeleton. Although some



**Fig. 1.** A–F, *Rhabderemia minutula* (Carter) (holotype). A, rhabdostyles (scale 50  $\mu\text{m}$ ). B, base of rhabdostyle (scale 10  $\mu\text{m}$ ). C, spirosgmata (scale 10  $\mu\text{m}$ ). D, microstyles (scale 10  $\mu\text{m}$ ). E, ectosomal skeleton (scale 250  $\mu\text{m}$ ). F, choanosomal skeleton (scale 100  $\mu\text{m}$ ). G, *Rhabderemia sorokinae* Hooper, *in situ*, Papua New Guinea (photo author).



**Fig. 2.** Idealised rhabderemiid skeletal structures. A, hymedesmioid species. B, plumo-reticulate species.

degree of relationship is inferred between these two families, with vague similarities appearing in skeletal architecture and the presence of rhabdostyles in genera of both (e.g., *Rhabderemia* and *Aulospongia*, respectively), this relationship is still not completely clear. Although the possession of rhabdostyles partially defines Rhabderemiidae these also occur in other demosponges: the Poecilosclerida families Raspailiidae (*Aulospongia* Norman, *Raspaxilla* Topsent, *Echinaxia* Hallmann, *Axinectya* Hallmann, *Hemectyon* Topsent) and Desmacellidae (*Biemna* Gray); and the Halichondrida families Desmoxyidae (*Halicnemia* Bowerbank, *Higginsia* Higgin), and Bubaridae (*Rhabdoploca* Topsent, *Hymerhabdia* Topsent, *Monocrepidium* Topsent). These spicules are likely homoplastic developments, derived independently within each group, and there are some significant but subtle differences in rhabdostyle morphology between these groups to support this contention (Hooper *et al.*, 1999). For example, rhabdostyles of *Rhabderemia* usually have an extra spiral twist at the rounded extremity (i.e., in a third plane), whereas amongst the rhabdosome raspailiids there is either only a slight basal rhabd, represented by a small curvature at the base of the spicule, or in species with a well developed basal rhabd this occurs in only two planes. Nevertheless, the status of this monogeneric family is still uncertain, with the suggestion that the family taxon may be superfluous (Van Soest & Hooper, 1993).

#### Previous reviews

Hooper (1990a), Van Soest & Hooper (1993).

#### RHABDEREMIA TOPSENT, 1890

##### Synonymy

*Rhabderemia* Topsent, 1890b: 28; Topsent, 1892a: 115; Dendy, 1905: 180; Topsent, 1928c: 309; de Laubenfels, 1936a: 144; Lévi, 1973: 606; Hooper, 1990a: 66; Van Soest & Hooper, 1993: 323. *Rhabdosigma* Hallmann, 1916b: 520; Hallmann, 1917b: 398; Topsent, 1928c: 312; de Laubenfels, 1936a: 144; Hooper, 1990a: 66; Van Soest & Hooper, 1993: 323. *Stylospira* de Laubenfels, 1934: 10. *Nisibaris* de Laubenfels, 1936a: 144; Hooper, 1990a: 66; Van Soest & Hooper, 1993: 323. [*Hallmannia*] Burton, 1931a: 352 (preocc.); Hooper, 1990a: 66 (not *Hallmannia* Burton, 1930c: 519). Taxonomic decision for synonymy: Van Soest & Hooper (1993).

##### Type species

*Microcionia pusilla* Carter, 1876 (by subsequent designation; Dendy, 1905: 180) (junior synonym of *Microcionia minutula* Carter, 1880b; Van Soest & Hooper, 1993: 323).

##### Definition

As for family.

##### Diagnosis

As for family.

#### Description of type species

*Rhabderemia minutula* (Carter, 1876) (Figs 1A–F).

**Synonymy.** *Microcionia minutula* Carter, 1876: 479; *Rhabderemia minutula*; Van Soest & Hooper, 1993: 323 (Not *Rhabderemia minutula*; Topsent, 1904b: 152; Topsent, 1918: 541; Lévi, 1956b: 393; Boury-Esnault, 1971b: 306; Biblioni & Gili, 1982: 231; Biblioni *et al.*, 1990: 327; Pulitzer-Finali, 1983: 533; Hooper, 1990a: 77). *Microcionia pusilla* Carter, 1876: 239 (*lapsus*); *Microcionia pusilla* Carter, 1880a: 437; *Rhabderemia pusilla*; Topsent, 1892a: 116 (Not *Rhabderemia pusilla*; Dendy, 1922b: 85).

**Material examined.** Holotype: BMNH 1902.11.16.32 – uncertain locality, possibly Caribbean. Other material. See below (also refer to Van Soest & Hooper, 1993: 324).

**Description.** Encrusting and partially insinuating (excavating) growth form; choanosomal skeleton hymedesmioid with basal layer of spongin charged with microstyles and rhabdostyles erect on basal spongin, singly or in sparse plumose bundles; ectosomal skeleton charged with microscleres predominantly microstyles and sigmoid spicules; megascleres rhabdostyles bearing spirally twisted base and slightly rugose or more prominently spined distal end, possibly 2 size categories (81–352×4–9 μm); microscleres rugose microstyles with subtylote subterminal swellings (90–135×1 μm), and rugose sigmata-like spicules either irregular or contort spirosigmata (9–18 μm long).

**Remarks.** Carter's (1876) taxon *M. pusilla* is invalid because he emended the name himself to '*minutula*' in a subsequent publication (Carter, 1880a), and therefore the earliest available name for the type species is *M. minutula*. Van Soest & Hooper (1993) redescribed the type species based on recent material from the Caribbean, restricting the species to shallow-water West Indies populations, hence the number of invalid published records of the species from other localities (many of which represented new sibling species).

The synonymy of *Rhabderemia* proposed by Hooper (1990a) and Van Soest & Hooper (1993) is confirmed through examination of relevant type material: *Rhabdosigma* Hallmann (type species *Sigmaxinella mammillata* Whitelegge, 1907 (by original designation) holotype AMG4356); *Stylospira* de Laubenfels (type species *Stylospira mona* de Laubenfels, 1934 (by original designation) holotype USNM22324); and *Nisibaris* de Laubenfels (type species *Hallmannia spirophora* Burton, 1931a: 352 (by original designation) holotype NM1254). *Hallmannia sensu* Burton (1931a: 352) is not conspecific with *Hallmannia* Burton (1930c: 519), with the former referred to *R. spirophora* (Burton) by Van Soest & Hooper (1993), and the latter (having seniority) a junior synonym of *Biemna* (with *B. aruensis* Hentschel as its type species).

##### Distribution

Found predominantly in shallow waters of all tropical and warm temperate seas, although one species has been recorded from 1360 m (Boury-Esnault *et al.*, 1995), none from colder waters (Van Soest & Hooper, 1993).

