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Suborder Microcionina Hajdu, Van Soest & Hooper, 1994

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Microcionina Hajdu *et al*. (Demospongiae, Poecilosclerida) contains 42 valid genera, 19 subgenera and over 1,000 described species of sponges worldwide, with many more species awaiting description. The suborder is characterised in having terminally microspined ectosomal megascleres and up to five categories of structural megascleres, most frequently monactinal or derivatives from these, and microscleres that include palmate chelae and diverse toxas, but never sigmas. Four families are included: (1) Microcionidae (viviparous) with principal (subtylo)styles coring spongin fibres, echinating (acantho)styles perpendicular to fibres, and one or more category of accessory (subtylo)styles forming a peripheral or extra-fibre skeleton, with microscleres palmate isochelae and diverse forms of toxas. (2) Acarnidae (viviparous) with an ectosomal skeleton of basally spined tylotes arranged tangentially, with monactinal choanosomal megascleres (styles) coring fibres, with or without echinating spicules, and microscleres palmate isochelae and toxas sometimes with others such as bipocillae, modified anisochelae, microrhabds and raphides. (3) Raspailiidae (oviparous) often with some degree of axial compression of the skeleton, typically with a hispid surface produced by brushes of small ectosomal megascleres surrounding protruding choanosomal megascleres, diverse geometric modifications to echinating megascleres, and lacking microscleres other than raphides (trichodragmata) in a few genera. (4) Rhabderemiidae (presumed oviparous) with rhabdostyles bearing a basal spiral twist, and peculiar microscleres (perhaps superficially) resembling toxas (thraustoxeas), sigmas (spirosigmata, thraustosigmata) and rugose microstylote spicules, and lacking chelae.
Keywords: Porifera; Demospongiae; Poecilosclerida; Microcionina; Microcionidae; Acarnidae; Rhabdermiidae; Raspailiidae.

DEFINITION, DIAGNOSIS, SCOPE

Synonymy

Microcionina Hajdu, Van Soest & Hooper, 1994a.

Definition

Poecilosclerida with terminally spined ectosomal monactinal megascleres (occasionally modified to quasidiactinal forms); choanosomal megascleres diverse, consisting of at least two categories localized to distinct regions within the skeleton, or sometimes up to five categories including spicules echinating fibres in many taxa; isochelae of palmate origin, with diverse forms of toxas but lacking sigmas.

Diagnosis

Sponges with diverse growth forms ranging from encrusting to massive, arborescent to whip-like species, with ectosomal megascleres usually terminally microspined and up to five categories of structural choanosomal megascleres, most frequently monactinal or derivatives, and microscleres that include palmate chelae and diverse toxas, never sigmas. Ectosomal spicules range from apically spined tylotes (or anisostyles) forming a tangential ectosomal skeleton (Acarnidae), to terminally spined styles, rarely modified to quasidiactinal or diactinal forms, forming a tangential or paratangential skeleton (Microcionidae), to an erect skeleton consisting of bouquets of smaller ectosomal styles, oxeas or anisoxeas surrounding protruding larger styles or oxeas (Raspailiidae), or absent altogether (Rhabderemiidae). Choanosomal skeletal structures range from hymedesmioid, microcionid, plumo-reticulate, regularly reticulate, occasionally isodictyal or renieroid reticulate, axially compressed, to nearly halichondroid architectures, and predominantly with three skeletal regions defined by the presence of different forms of structural styles: (1) an axial (or choanosomal) skeleton with spongin fibres enveloping principal styles echinated by acanthose or smooth styles; (2) an extra-axial (or subectosomal) skeleton with tracts of auxiliary styles ascending to the surface; (3) and an ectosomal skeleton with smaller auxiliary styles forming a surface crust tangential, paratangential or perpendicular to the surface. One or more skeletal regions may be lost or modified (Rhabderemiidae lacks any differentiation between choanosomal and ectosomal regions based on megasclere distribution, but has an ectosomal layer of microscleres, although not forming a distinct crust). Megascleres are predominantly smooth (subtylo-)styles but may be replaced by and/or supplemented with quasidiactinal or true diactinal forms, lost partially or completely and replaced with detritus, or consisting only of a single category of rhabdostyles bearing an extra spiral twist at the rounded extremity (Rhabderemiidae). Microscleres include: palmate isochelae and diverse forms of toxas (Microcionidae); supplemented with bipocillae, modified anisochelae, microrhabds and raphides (Acarnidae); absent completely except for raphides (in trichodragmata) (Raspailiidae); or consist of peculiar toxiform (thraustoxeas), sigmoid-like (spirosigmata, thraustosigmata) and rugose microstyles (Rhabderemiidae).

Scope

Four families are included: Acarnidae, Microcionidae, Raspailiidae and Rhabderemiidae (the latter enigmatic and still *incertae sedis*). Together these families contain some of the most diverse shallow-water faunas, and a few deeper-water representatives, with 42 genera and 19 subgenera recognised as valid, and over 1,000 described species worldwide and many more waiting to be described.

Remarks

Microcionina are not homogeneous in terms of all taxa having the primary apomorphies (terminally spined ectosomal megascleres, multiple categories of structural megascleres, only palmate chelae, not arcuate or anchorate chelae or sigmas), and in this regard the suborder may be artificial. Microcionidae and Acarnidae are the most closely related families in sharing these characters, and are both viviparous (where known). This close relationship has some empirical support from biochemical analyses (e.g., carotenoid proteins, C28 fatty acids; Lee & Gilchrist, 1985; Lawson *et al*., 1984). On the one hand Raspailiidae appears to be very different. It is oviparous (where known), lacks the poecilosclerid chelae apomorphy (with only a few taxa having raphides), and has a unique ectosomal apomorphy consisting of bouquets of oxeas or styles surrounding longer choanosomal oxeas or styles at the surface. On the other hand it shares some strong skeletal features and megasclere geometries with Microcionidae (reticulate or plumo-reticulate skeletons; both families having representatives with axial compression of the skeleton; acanthostyles echinating fibres; large numbers of megasclere categories (up to 4–5) mostly localised to particular regions within the skeleton), resembling the Microcionidae more than any other poecilosclerid family, and certainly more than any other demosponge family. There is also some early biochemical support for this relationship (e.g., carotenoid proteins, general protein electrophoresis, free amino acid patterns; Lee & Gilchrist, 1985; Hooper, 1990b; Hooper *et al*., 1992), but this evidence is equivocal because it is now outdated and has not yet been corroborated by more substantive genetic data. Rhabderemiidae has even less support for its inclusion in Microcionina (or indeed within Poecilosclerida). Its reproductive strategy is unknown, presumed by some authors (e.g., Lévi, 1973) to be oviparous on the basis that incubated larvae have never been recorded, and both its megascleres and microscleres are highly unusual for poecilosclerids. Its inclusion in both the order and suborder is based on some similarities in skeletal structure and spiculation to the Raspailiidae, particularly *Hemectyonilla* Burton and *Aulospongus* Norman (Hooper, 1991; Van Soest & Hooper, 1993; Hooper *et al*., 1999), but this is a working hypothesis and requires corroboration from other data sets.

Recent revision

Hajdu *et al*., 1994a.

KEY TO FAMILIES

(1) Ectosomal skeleton present 3
Ectosomal skeleton absent 2

(2) No special ectosomal megascleres although choanosomal rhabdostyles may protrude through the surface singly or in sparse bundles; microscleres include peculiar thraustoxea, spirosigmata, thraustosigmata and rugose microstylotes ..... **Rhaderemiidae**
Ectosomal spicules lost, with only choanosomal spicules (oxeas and/or styles) protruding through surface; microscleres absent apart from occasional raphides ..... **Raspailiidae** (all of *Cyamon*, *Amphinomia*, most of *Echinodictyum*, some of *Aulospongus*, *Raspailia (Clathriodendron)*, *Eurypon*, *Ceratopsion*)

(3) Ectosomal skeleton formed by tangentially arranged tylotes with spined bases; microscleres may include palmate isochelae and toxas, sometimes with others (bipocillae, modified anisochelae, microrhabds and raphides) ..... **Acarnidae**
Ectosomal skeleton composed of accessory (subtylo)styles, often with microspined bases, forming a paratangential skeleton on or just below the surface; microscleres include only palmate isochelae and toxas ..... **Microcionidae**
Ectosomal skeleton with brushes of small completely smooth ectosomal styles or oxeas (or modified forms of these) surrounding long protruding single choanosomal styles or oxeas; microscleres absent except for raphides in some taxa ..... **Raspailiidae** (typical genera)

FAMILIES OF MICROCIONINA

Microcionidae Carter, 1875c

Microcionidae (including Clathriidae Lendenfeld, 1884, Ophlitaspongiidae de Laubenfels, 1936a), contains nine genera, twelve subgenera and approximately 460 described species worldwide (with many more species awaiting description), predominantly in shallow waters with a few recorded from deeper seas. Species have monactinal principal structural (subtylo)styles coring spongin fibres, echinating (auxiliary) (acantho)styles perpendicular to fibres, and one or more categories of accessory (subtylo) styles forming a peripheral or extra-fibre skeleton. Only palmate isochelae microscleres are present and these are only exceptionally modified to arcuate-like or anchorate-like forms as a result of torsion of the shaft and detachment of alae. Toxa morphologies are diverse, including microxea-like toxas in a few species. Skeletal structure ranges from hymedesmioid and microcionid in encrusting taxa, to plumo-reticulate and occasionally axially compressed in some species, but typically reticulate in most taxa, occasionally replaced completely by detritus.

Acarnidae Dendy, 1922b

Acarnidae (including Iophonidae Burton, 1929a and Cornulidae Lévi & Lévi, 1983b), contains thirteen valid genera and probably several hundreds of species worldwide, although several genera are restricted to colder temperate waters or to very narrow geographic distributions (regional endemics). Ectosomal skeleton typically with tangentially arranged tylotes with spined bases, and choanosomal skeleton is reticulate in massive growth forms or plumose in encrusting growth forms, with or without echinating spicules. Megascleres are styles and microscleres are palmate isochelae and toxas, sometimes lost or sometimes with other microscleres such as bipocillae, modified anisochelae, microrhabds and raphides.

Raspailiidae Hentschel, 1923

Raspailiidae (including Euryponidae Topsent, 1928c) contains nineteen valid genera (one *incertae sedis*), seven subgenera, and approximately 250 named species worldwide, mainly from shallow waters and a few from abyssal depths. Species have a

typically hispid surface, with genera differentiated mainly on the basis of three morphological characters: (a) skeletal architecture ranging from axial compression to reticulate, plumo-reticulate or plumose skeletons; (b) the presence or absence of a specialized ectosomal skeleton (apomorphic for the family, whereby brushes of small ectosomal megascleres surround long protruding single choanosomal megascleres); and (c) geometric modifications to echinating megascleres, with about 15 distinct morphologies recognised.

Rhabderemiidae Topsent, 1928c

Monogeneric, with 26 described species found predominantly in shallow waters of all tropical and warm temperate seas, and one abyssal species. The family has unique apomorphies consisting of rhabdostyles bearing a basal spiral twist, and peculiar microscleres resembling toxas (thraustoxeas), sigmas (spirosigmata, thraustosigmata) and rugose microstylote spicules.