Systema Porifera: A Guide to the Classification of Sponges, Edited by John N.A. Hooper and Rob W.M. Van Soest

Suborder Mycalina Hajdu, Van Soest & Hooper, 1994

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Suborder Mycalina Hajdu *et al*. (Demospongiae, Poecilosclerida) contains sponges characterized by possession of palmate chelae or derivates thereof and a single megasclere type, usually smooth styles with a slight constriction subapically (dubbed 'mycalostyles'). Several families possess diancistras or derivates thereof and along with the mycalostyles these are interpreted as synapomorphies of the suborder. In some families chelae are absent, presumed lost, and in rare cases megascleres are strongyles or oxeas. Chelae may be modified to become anisochelate (families Mycalidae and Cladorhizidae), anchorate (genus *Chondrocladia*), polydentate (subgenus *Mycale* (*Grapelia*)), or strongly modified (family Guitarridae). These chela types are presumed to be derived from ordinary palmate isochelae. Microscleres that may be present in addition to chelae and diancistras are normal sigmas, toxas (which are occasionally spined), microxeas (which may be rugose, spined or amphiaster-like), trichodragmas and commata. Skeletal structure is mostly plumose or plumoreticulate, occasionally isodictyal-anisotropic, with tangential ectosomal skeleton frequently developed, but occasionally absent. One family contains coralline sponges with a limestone basal skeleton. Nine families are distinguished based on the presence of microscleres, morphology and skeletal architecture, distributed worldwide and in all marine habitats.
Keywords: Porifera; Demospongiae; Poecilosclerida; Mycalina; Cladorhizidae; Desmacellidae; Esperiopsidae; Guitarridae; Hamacanthidae; Isodictyidae; Merliidae; Mycalidae; Podospongiidae.

DEFINITION, DIAGNOSIS, SCOPE

Synonymy

Mycalina Hajdu, Van Soest & Hooper, 1994a.

Definition

Poecilosclerida possessing palmate chelae or derivates thereof (occasionally absent) and smooth megascleres of a single type; tridentate chelae and toxas absent; sigmas or derivates thereof usually present. Skeleton plumose or plumoreticulate.

Diagnosis

Sponges with encrusting, massive, lobate, repent, branching, tubular, stipitate or flabellate shape. Consistency usually soft and compressible, but may be firm to hard exceptionally. One family has a coralline basal skeleton. Spicule skeleton structure is basically plumose, with bundles of spicules fanning out towards the surface; in various Mycalina, these bundles may be consolidated by spongin and interconnected by secondary bundles. At the surface, crusts of tangential spicules or a reticulated skeleton may be present. Within Poecilosclerida, the Mycalina are unique in lacking a differentiation of megasclere types, all megascleres being of a single smooth type, usually characteristic styles with a slight subapical constriction, dubbed mycalostyles, but occasionally megascleres are strongyles, oxeas or tylostyles (derived from styles as indicated by the existence of intermediate forms in some taxa). However, some differentiation in size between ectosome and choanosome may exist and occasionally this is also expressed in modification of the megasclere morphology, but no division into main and auxiliary megascleres is found, unlike suborders Microcionina and Myxillina. Mycalina are also unique in the possession of diancistras, knife-edged sigma derivates occurring in several families across the suborder. With suborder Microcionina they share the possession of palmate chelae and toxas (sometimes lost); with suborder Myxillina they share the possession of sigmas (also sometimes lost). Microscleres are diverse: palmate isochelae, palmate anisochelae, palmate unguiferate anisochelae, anomochelae, naviculichelae, anchorate unguiferate isochelae, spined isochelae, placochelae, biplacochelae, tetropocilli, smooth sigmas, spined sigmas, sigmancistras, diancistras, clavidiscs, commata, toxas, spined toxas, microxeas, rugose microxeas, spined microxeas, spinorhabds, raphides, trichodragmas, and rarely, forceps.

Scope

In the extended concept of Mycalina presented here, nine families are included: Cladorhizidae, Desmacellidae, Esperiopsidae, Guitarridae, Hamacanthidae, Isodictyidae, Merliidae, Mycalidae, and Podospongiidae. Together these comprise a complement of sponges occurring all over the world in all marine habitats. Apart from family Mycalidae, the individual families have a modest species diversity not exceeding a few dozen species.

Compared to Hajdu *et al.*'s (1994a) original content of Mycalina, the family Isodictyidae (previously assigned to haplosclerids, see Hajdu *et al*., 1994b) is added based on the study of Samaai *et al*. (1999). Podospongiidae is also included in Mycalina – previously considered part of Latrunculiidae and generally assigned to Hadromerida (see e.g., Bergquist, 1978), based on studies of Kelly & Vacelet (1995) and Kelly & Samaai (this volume). Nevertheless, the family is not 'typical' of other mycalinids and is therefore included as *incertae sedis* (see below). The families Esperiopsidae (previously assigned to family Mycalidae) and Merliidae (previously assigned to Demacellidae or Hamacanthidae) are revived for reasons explained elsewhere in this volume (see chapters by Van Soest & Hajdu).

TAXONOMIC HISTORY

The suborder Mycalina Hajdu *et al*. (1994a: 126) was only recently erected from a re-evaluation of all poecilosclerid characters from the type species of most nominal genera. SEM examination of microsclere microstructure, especially the structure of chelae and spination on megascleres, was instrumental in revising the systematics of this group (and other poecilosclerids), and not reliant solely on light microscopy as many earlier studies. Previously employed poecilosclerid taxa, especially the families Desmacidonidae (or Desmacididae) and Coelosphaeridae *s.s.*, were based on muddled combinations of megasclere shape and features of the habit, and ignored conflicting distributions of microscleres. Until Hajdu *et al*.'s (1994a) study, no authoritative unified classification of Poecilosclerida existed, with each major author employing his or her own insights, and with their analyses sometimes biased by examination of limited comparative material or based only on restricted regional faunas. Useful reviews of these schemes are found in Bergquist & Fromont (1988) and Hajdu (1995), and are summarized in the various family chapters contained within this volume. The SEM studies referred to above revealed that fine structures of chelae coincide with broad distributions of other microsclere types such as toxas and sigmas, which led to the recognition of three suborders (a fourth suborder *incertae sedis* has now been added in this volume, see chapter on Order Poecilosclerida). The suborder Mycalina differs from other Poecilosclerida by (1) the lack of differentiated main and auxiliary acanthostyles, (2) combined possession of palmate chelae, sigmas and toxas, and (3) lack of spined megascleres.

REMARKS

Synapomorphies

In the original definition emphasis was placed on: (1) styles with subapical constriction, and (2) the occurrence of sigmancistras and derivates over the families originally united in this suborder: Mycalidae, Hamacanthidae, Desmacellidae, Cladorhizidae and Guitarridae. However, sigmancistras are absent from Desmacellidae, Isodictyidae and Podospongiidae, and only dubiously present in a single Mycalidae species (*Mycale simonis*) and a single Guitarridae species (*Eucheliplumа pristina*). Thus, its status as synapomorphy for the entire suborder Mycalina is not entirely convincing, although holding true for this central group of Mycalina. The mycalostyles are more widespread, but appear to be absent or rare in families Desmacellidae, Isodictyidae and Podospongiidae. It may be significant that two of the families lacking these synapomorphies also lack palmate chelae. In the past these groups were indeed assigned to other orders, e.g., Desmacellidae (also Biemnidae) were allocated to Axinellida; Podospongiidae to Hadromerida. In the case of Desmacellidae, the possession of sigmas is considered compelling evidence for Mycaline membership. Affinities of family Podospongiidae are more obscure, with spinose microrhabd (spinorhabd) microscleres, having suggested affinities with the Mycalidae based on possession of a sigmoid protorhabd with presumed homology to diancistra derivatives (Kelly & Samaai, this volume). For a discussion of membership of Podospongiidae, see below.

A minority of individual species of the other families have oxeas or strongyles. These are considered derived from styles, which is occasionally made clear from a series of intermediate spicule modifications found in the same individual.

The lack of differentiated ectosomal and choanosomal megascleres is also not shared by all species; notable exceptions are *Coelodischela* (two species), which has strongyles and tylotes which appear distinct. In Podospongiidae, megasclere diversity is also notable. What remains as a universal feature is the fact that all megascleres are smooth, but many individual myxilline and microcionine species and genera also have smooth megascleres.

Inclusion of Podospongiidae

This family is revived and included in Mycalina for two compelling reasons: (1) spinorhabd microscleres derived from sigmas or sigmoid microscleres, traceable ontogenetically, and (2) shared chemistry (norsesterterpene peroxides) of several podospongiid genera and several *Mycale* species. More subtle similarities are the plumoreticulate skeleton. The spinorhabd microscleres are similar to those of *Phlyctaenopora* (*Barbozia*), which is assigned to the family Mycalidae on account of the possession of palmate anisochelae. Nevertheless, the position of Podospongiidae in Mycalina is not completely clear and presently considered *incertae sedis*. The affinities of Podospongiidae with Mycalidae and the discrepancies with Latrunculiidae are discussed elsewhere in this volume (see chapters by Kelly & Samaai and Samaai & Kelly).

KEY TO FAMILIES

(1) Microscleres entirely lacking ..... **Esperiopsidae *(Ulosa, Semisuberites)***
Some form of microscleres present 2
(2) Microscleres include chelae or derivates (placochelae, tetrapocilli, etc.) 5
No chelae or derivates 3
(3) Microscleres exclusively spinorhabds ..... **Podospongiidae**
No spinorhabds 4
(4) Microscleres include clavidiscs ..... **Merliidae**
Microscleres diancistras or sigmancistras ..... **Hamacanthidae**
Microscleres sigmas, and/or trichodragmas, no clavidiscs or sigmancistras ..... **Desmacellidae**
(5) Placochelae or derivates (tetrapocilli, coelodiscs) present (these are strongly modified chelae in which the frontal ala forms a flat plate attached to the rhabd by a large number of fimbriae) ..... **Guitarridae**
No placochelae or derivatives 6
(6) Deep-sea sponges with root system, stalk and feather-like or thinly ramose shape ..... **Cladorhizidae**
Shape may be ramose, but not featherlike 7

(7) Anisochelae 8
Exclusively isochelae 9
(8) Skeleton an isodictyal-anistropic reticulation of paucispicular bundles of styles; no other microscleres ..... **Esperiopsidae** ***(Amphilectus lobata)***
Skeleton plumose or plumoreticulate; usually sigmas and/or other microscleres present ..... **Mycalidae**
(9) Megascleres diactinal (oxeas and/or strongyles) ..... **Isodictyidae**
Megascleres (mycalo-)styles ..... **Esperiopsidae** ***(Amphilectus, Esperiopsis)***