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

Family Callyspongiidae de Laubenfels, 1936

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Callyspongiidae de Laubenfels (Demospongiae, Haplosclerida) contains four valid genera, four subgenera and a large number of nominal species with a worldwide distribution in tropical, temperate and cold waters. Species live principally in shallow waters. Major taxonomic characters for differentiating genera are type of ectosomal mesh, morphology of subectosomal fibres, and presence, absence and type of choanosomal fibres.

Keywords: Porifera; Haplosclerida; Callyspongiidae; *Callyspongia*; *Callyspongia (Callyspongia)*; *Callyspongia (Cladochalina)*; *Callyspongia (Euplacella)*; *Callyspongia (Toxochalina)*; *Arenosclera*; *Dactylia*; *Siphonochalina*.

DEFINITION, DIAGNOSIS, SCOPE

Synonymy

[Cavochalinidae] Carter, 1875c *(nomen nudum)*. [Tubulodigitidae] Carter, 1875c *(nomen nudum)*. Callyspongiidae de Laubenfels, 1936a: 55.

Definition

Haplosclerida with two dimensional ectosomal skeleton of primary, secondary and sometimes tertiary spongin fibres, fibres are cored by oxeas or strongyles, occasionally uncored or cored with foreign material.

Diagnosis

Encrusting, massive, vase-shaped, tubular, lamellate, fan-shaped or branching growth form. Sponge texture smooth to firm, resilient. Surface smooth or characteristically sculptured into conules, ridges or spines and fibre-reticulation tangential to the surface. Ectosomal skeleton is a two dimensional tangential reticulation of primary, secondary and sometimes tertiary spongin fibres, fibres are cored by oxeas or strongyles, occasionally uncored or cored with foreign material. Choanosomal skeleton forms a network of primary principal or longitudinal, aspicular, pauci- to multispicular spongin fibres, and secondary or connecting spongin fibres, uni-, bi- or aspicular. Choanosomal mesh typically regular or rectangular with some exceptions, e.g., subgenus *Cladochalina* with an irregular confused choanosomal mesh. Spongin is typically abundant. Megascleres: oxeas to strongyles in variable number, generally small sizes, may be vestigial, completely absent or replaced by sand grains and/or foreign material. Microscleres: if present, toxas.

Scope

Twenty-three nominal genera and many hundreds of species are included in this family worldwide, of which the following are considered valid: *Arenosclera, Callyspongia, Callyspongia (Callyspongia), Callyspongia (Cladochalina), Callyspongia (Euplacella), Callyspongia (Toxochalina), Dactylia* and *Siphonochalina*.

History and biology

A number of early names for several taxa have recently been discovered (J.N.A. Hooper & R.W.M. Van Soest, *in litteris*) which supposedly have priority. [Cavochalinidae] Carter, 1875c is a senior synonym of Callyspongiidae. However, Carter did not nominate a type species, instead it was 'named after a typical genus, but where no typical species has yet been described, was named adjectively after its most striking characters'. This name is unavailable (Article 11.7.1.1, ICZN; Anon., 1999), in lacking a valid generic name when first published. Similarly, Carter (1875c: 141) erected a suprageneric taxon [Tubulodigitata], providing a short diagnosis but again without mentioning a type genus. This suprageneric group could also be interpreted as an available family taxon, 'Tubulodigitidae', although the genus *Tubulodigitus* was erected for *T. communis* several years later by Carter (1881b: 367), and hence these taxa of the suprageneric level were both *nomina nuda* (erected without naming a type genus or species; Article 11.7.1.1, ICZN).

De Laubenfels (1936a) erected Callyspongiidae to include 'Haplosclerida possessing a characteristic surface reticulation of smaller fibres delimiting regular smaller meshes, with minute oxeas as the rule and simple microscleres toxas, present'. For de Laubenfels (1936a: 55) this family was differentiated from Haliclonidae (=Chalinidae), and closer to his concept of Poecilosclerida than to Haplosclerida. However, the absence of special spicules localised to any particular region of the sponge induced de Laubenfels to leave Callyspongiidae in the Haplosclerida. The presence of a secondary ectosomal reticulation composed of smaller fibres with smaller meshes is good reason to consider the two families to be taxonomically different. For Wiedenmayer (1977b: 78) the concept of continuous tangential reticulation or distinct ectosomal skeleton was apparently unsuitable as a diagnostic character, and having considered de Laubenfels' restriction of the family to the type species he abandoned its use. Van Soest (1980) subsequently redefined and resurrected Callyspongiidae based primarily on West Indian species. Bergquist & Warne (1980) revised the family and described New Zealand species in three genera: *Callyspongia, Chalinopsilla* and *Dactylia*. Their interpretation was based strictly on de Laubenfels' (1936a) diagnosis of the family, and they insisted on the importance of surface reticulation as a distinguishing character to discriminate between genera and species of Callyspongiidae. Desqueyroux-Faúndez (1984) described New Caledonian

Haplosclerida, including Callyspongiidae, 'introducing total content of silica in the skeleton' as a new diagnostic character, including in that study the genera *Callyspongia*, *Toxochalina* (here considered as a subgenus of *Callyspongia*) and *Arenosclera*, with silica content varying from 1–30% of dry weight. Wiedenmayer (1989) subsequently accepted Callyspongiidae, providing an expanded synonymy of *Callyspongia* to include *Spinosella* (based on features of the ectosomal and choanosomal skeleton, anatomy of fibres, spicules and morphological variations). Fromont (1993) provided a diagnosis of Callyspongiidae modified from Wiedenmayer (1989), and described several species from the Great Barrier Reef.

Distribution

Species have been collected from most tropical, temperate and cold waters. They are commonly represented along the East Pacific region from the Californian, Chile-Peru and Magellan regions; East South America, Brasilian and West Indies regions, West and South Africa and Mediterranean Atlantic region; Indo-Malaysian, Japan-China; South and North East and West Australian and New Zealand regions. No species have yet been recorded from the Boreal East and West Pacific, Atlantic regions or from Antarctica.

KEY TO GENERA AND SUBGENERA

(1) Single meshed ectosomal skeleton of foreign material, spicule tracts or single spicules, or a double meshed ectosomal reticulation of fibres or tracts 2
Three sizes of regular ectosomal mesh 7
(2) One size of confused ectosomal mesh, with abundant foreign material 3
Single or double, triangular to polygonal ectosomal mesh, without foreign material 4
(3) Tangential ectosomal mesh with no proper fibres, only fragments of foreign debris and spicules. Choanosomal irregular, fragmentary fibres with foreign material proper spicules or both .... ***Arenosclera***
Tangential ectosomal network with proper fine aspicular fibres and foreign material. Choanosomal, continuous, aspicular fibres, with only foreign material .... ***Dactylia***
(4) Ectosomal strong echinated layer with continuous, strong palisade of brushes of spicules, or free spicules,without peripheral condensation 5
Ectosomal non-echinated layer, peripheral condensation present 6
(5) Ectosomal mesh echinated by strong palisade of spicular brushes. Choanosomal multispicular primary fibres well cored, narrow spongin sheath. One single surface layer .... ***Callyspongia (Cavochalina)***
Ectosomal mesh echinated by free spicules. Choanosomal paucispicular primary fibres, with large spongin sheath. Three surface layers .... ***Callyspongia (Euplacella)***
(6) Ectosomal mesh single, small, triangular to rectangular, unispicular fibres or single spicules. Choanosomal primary longitudinal fibres paucispicular, subectosomal ends abundantly ramified, horizontally orientated and divided by connecting fibres …. ***Siphonochalina***
Ectosomal mesh double, large, rounded to polygonal, unispicular fibres. Choanosomal primary longitudinal multispicular fibres, parallel, secondary fibres subdividing subectosmal meshes parallel to the principal fibres .... ***Callyspongia (Callyspongia)***
(7) Surface strongly conulose. Choanosomal multispicular primary fibres compact, abundantly divided, non-fasciculated, abundantly ramified triangular to irregular mesh. Scarce spongin. Microscleres toxas .... ***Callyspongia (Toxochalina)***
Surface conulose to finely conulose or spiny. Choanosomal primary longitudinal fasciculated fibres, abundantly ramified, tertiary network always present. spongin variable amount, always visible. Microscleres absent .... ***Callyspongia (Cladochalina)***

CALLYSPONGIA DUCHASSAING & MICHELOTTI, 1864

Synonymy

Callyspongia Duchassaing & Michelotti, 1864: 57. [*Tuba*] Duchassaing & Michelotti, 1864: 44 (preocc. by *Tuba* Renier, 1804, Polychaeta). *Dactylochalina* Lendenfeld, 1886c: 570. *Ceraochalina* Lendenfeld, 1887c: 740, 778. *Chalinella* Lendenfeld, 1887c: 770, pl. 27, fig. 20. *Chalinopora* Lendenfeld, 1887c: 764. *Euchalina* Lendenfeld, 1887c: 742, 816. *Patuloscula* Carter, 1882a: 365. *Cavochalina* Carter, 1885c: 287; Topsent, 1932: 68. *Placochalina* Lendenfeld, 1887c: 741, 790. *Cladochalina* Schmidt, 1870: 35. *Spinosella* Vosmaer, 1887: 342. *Euplacella* Lendenfeld, 1887c: 741, 789. *Toxochalina* Ridley, 1884a: 402. *Platychalina sensu* Wiedenmayer in Hooper & Wiedenmayer, 1994: 87 (Not *Platychalina* Ehlers, 1870: 21, 30).

Type species

Callyspongia fallax Duchassaing & Michelotti, 1864 (by subsequent designation; Burton, 1934a).

Definition

Callyspongiidae with a regular ectosomal tangential reticulation of primary, secondary and sometimes tertiary spiculo-fibres, ectosomal morphology: one single size or three sizes of rounded to irregular, or triangular to rectangular ectosomal mesh. Spongin abundant. Microscleres toxas may be present (e.g., *Callyspongia (Toxochalina) multiformis* Pulitzer-Finali, 1986).

Diagnosis

Varying greatly, from massive to ramose, lamellate, foliaceous to infundibuliform, tubular or lobate, repent or erect growth forms. Ectosomal skeleton a tangential network formed by secondary and sometimes finer tertiary fibres (triple mesh ectosomal layer) or less ramified and with regular size of mesh (single mesh ectosomal layer). Choanosomal skeleton a well-developed network of primary longitudinal fibres, fasciculated or non-fasciculated, spongin sheath always present. Primary fibres ramified to form secondary and tertiary fine fibres and tertiary choanosomal network always present; or non-ramified, parallel and connected by short, parallel, non-ramified, secondary fibres, there may be peripheral condensation of the choanosomal skeleton.

Previous reviews

Burton (1934a: 539), Wiedenmayer (1977b: 90), Bergquist & Warne (1980: 24), Van Soest (1980: 46), Desqueyroux-Faúndez (1984: 785), Wiedenmayer (1989: 103), Hooper & Wiedenmayer (1994: 87).

Remarks

Wiedenmayer (1977b) considered *Callyspongia* and *Spinosella* as two distinct genera, with their principal differences being the absence of fasciculation and a much denser surface fibro-reticulation or peripheral layer, often discontinuous and not two-dimensional, but rather a condensation of the main skeleton in *Callyspongia*. In *Spinosella* (pro *Cladochalina*), Wiedenmayer (1977b) emphasized the special two-dimensional surface network, smaller angular mesh, fasciculated choanosomal fibres and the presence of conules, spines and laciniae to a variable degree. Wiedenmayer's (1977b) concept of *Callyspongia* included: [in part] *Siphonochalina*, *Sclerochalina*, [?] *Tubulodigitus*, *Patuloscula* and *Polysiphonia*. *Spinosella sensu* Wiedenmayer (1977b) included as synonyms, *Tuba*, *Cladochalina*, but also *Callyspongia* (*sensu* Burton, 1932b) and [in part] *Siphonochalina*, *Dactylochalina*, *Ceraochalina*, *Dasychalina*, *Siphonella* (*fide* Burton, 1934a) and *Euchalina* (*fide* Burton, 1934a). Bergquist & Warne's (1980) concept of *Callyspongia* included *Siphonochalina*, *Toxochalina*, *Ceraochalina*, *Dactylochalina* and *Spinosella*. Van Soest (1980) used these names as subgenera and concluded that *Callyspongia* exhibited a high proportion of spongin, variable presence of peripheral condensation (e.g., in *C. fallax* and *C. eschrichti* Duchassaing & Michelotti, 1864), presence or absence of fasciculated primary fibres (e.g., *C. vaginalis* (Lamarck) and *C. plicifera* (Lamarck)). Van Soest (1980: 55) placed emphasis on the rectangular choanosomal mesh in *Callyspongia*, as opposed to *Spinosella* (pro *Cladochalina*) which has an irregular, confused choanosomal mesh. We observed that this character is largely determined by the type of fibres present: non-fasciculated or fasciculated. The secondary, discriminatory taxonomic character in subgenera of *Callyspongia* is a special dermal skeleton with thinner secondary or even tertiary fibres, associated or not with the presence of ectosomal conules of different size. Over the years the taxon *Callyspongia* has become quite unmanageable given the high diversity of species and the subtle characters differentiating it from other allied genera (or subgenera).

The classification proposed here is largely a 'convenient one', with five of the fifteen generic names included in synonymy with *Callyspongia* by Wiedenmayer (in Hooper & Wiedenmayer, 1994) treated here as subgenera: *Euplacella*; *Toxochalina*; *Cladochalina* (including *Spinosella*); *Cavochalina* (including *Placochalina*). This present classification is based on an earlier morphological analysis of Callyspongiidae and other haplosclerids (Desqueyroux-Faúndez, 1999) using structural characters more so than previous classifications. One of the difficulties encountered in the recognition of reliable characters to separate taxa of Callyspongiidae is the irregular occurrence of microscleres in some genera, where toxas are sometimes present *(Toxochalina)*, not present *(Callyspongia s.s.)*, or only fine skeletal details appear to differentiate taxa at even the species levels.

A similar case is observed for other skeletal characters. For example, peripheral condensation of the fibres may be produced in several different ways: (a) by the presence of more than one surface layer of the ectosome (e.g., in *Euplacella* we observed three successive layers, each growing over a previous surface layer 'growth lines') (Fig. 5C); (b) by subectosomal smaller mesh obtained by vertical subdivision of primary fibres and modification of subectosomal connective fibres (e.g., *Ceraochalina*, Fig. 1A–D); or (c) simply by transversal condensation of the subectosomal secondary fibres, occurring between terminal ends of parallel primary fibres (in *Siphonochalina*, Fig. 9D). In *C. fallax* (D. & M., 1864) peripheral condensation is variably present, whereas it is always present in *C. typica* (Lendenfeld, 1887c). The latter is the type species of *Ceraochalina* (by indication; Burton's (1934a: 540) subsequent designation of *Cladochalina nuda* Ridley, 1884a as the type species is invalid), which is included in this work as synonym of *Callyspongia*. Further comment is required on the generic synonymy of *Callyspongia*. *Chalinella*, with type species *Chalinella macropora* (by subsequent designation, Burton, 1927: 296), is a subjective synonym of *Ceraochalina* (taxonomic decision this work) and a synonym of *Callyspongia* (taxonomic decision Wiedenmayer in Hooper & Wiedenmayer, 1994). *Chalinopora* is included in synonymy with *Callyspongia* following Wiedenmayer (1989: 104) (type species *Chalinopora typica* Lendenfeld, 1887c: 765, by indication; Burton's (1927: 293) subsequent designation of *Acervochalina claviformis* Carter, 1886 as the type species is invalid, and Burton's (1934a: 535) record of *Chalinopora claviformis* refers to a typical *Adocia*). *Euchalina* (with type species *Euchalina typica* Lendenfeld, 1887c, by indication), is a subjective synonym of *Chalinopora* (taxonomic decision this work), and a synonym of *Callyspongia* (taxonomic decision Wiedenmayer in Hooper & Wiedenmayer, 1994), with Burton's (1934a: 540) subsequent designation of *Euchalina rigida* as the type species being invalid (Wiedenmayer, 1989: 104).

Wiedenmayer, in Hooper & Wiedenmayer, (1994), included *Platychalina* Ehlers, 1870 (type species *Platychalina foliacea* (Esper, 1797) Ehlers, 1870, by monotypy) in synonymy with *Callyspongia*, whereas other authors have produced contradictory decisions. The first author to 'tackle this mess', Ridley (1884a), doubted the chalinid nature of the genus at all. He studied material from H.M.S. 'Alert' which, in his opinion, strongly agreed with Esper's figure and description with the exception of small morphological details described by Ehlers, 1870 (such as the single occurrence of isolated spicules, or different disposition of 'pores') Ridley identified his specimen as *Euspongia foliacea*. Conversely, several other authors treated *P. foliacea* in very different ways. None of these subsequent authors, however, have studied the type material given that it is lost (Wiedenmayer, 1989: 104): "not represented in the Australian region" (Lendenfeld, 1887c: 792); synonym of *Isodictya* Bowerbank (de Laubenfels, 1936a: 54); *Platychalina foliacea*, unnecessary designation of type species, lipochelous form of *Homeodictya elastica*, and a pre-emptive of *Homoeodictya* Ehlers, 1870 (Burton, 1936: 143); *Platychalina*, might replace *Spinosella* as subgenus of *Callyspongia* if the specific identity of *S. vaginalis* Lamarck and *S. foliacea* could be established (Van Soest, 1980: 60). But as the debate cannot be resolved without re-examination of Ehlers' missing type, if it still exists, in this work, we follow Wiedenmayer in Hooper & Wiedenmayer (1994) , and we consider here, *Platychalina* as a junior synonym of *Callyspongia*.

Another taxon that is potentially associated with *Callyspongia* is [*Cacochalina*] Schmidt, 1868, but this is a *nomen nudum*, following ICZN Article 5.1. as Schmidt (1868) did not name a type species.

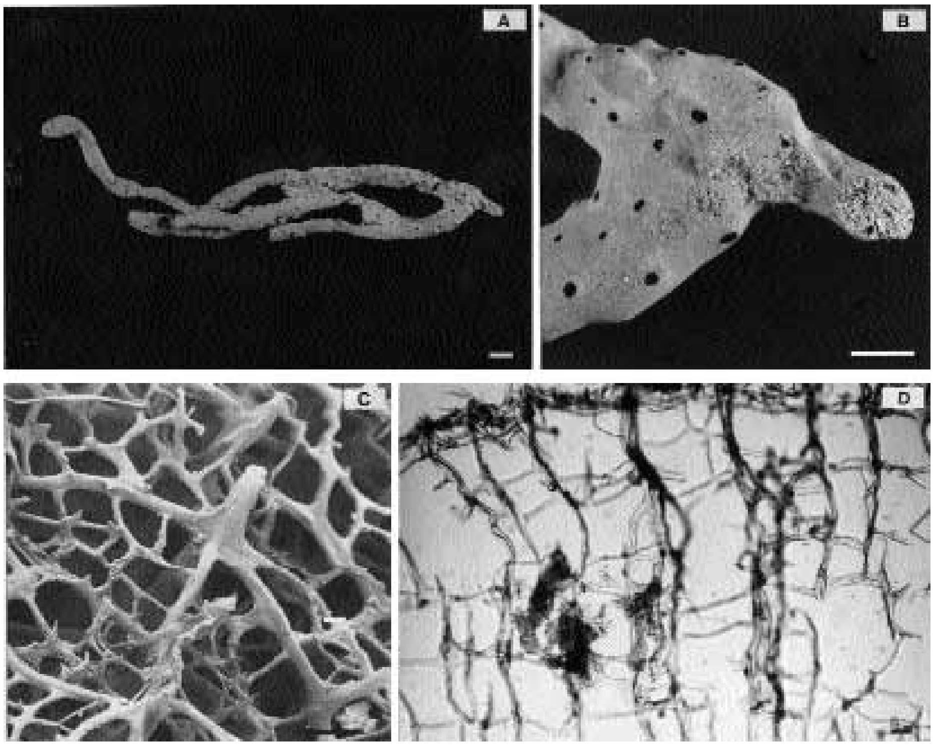

Fig. 1. *Callyspongia (Callyspongia) typica* (Lendenfeld, 1887c as *Ceraochalina*) (holotype BMNH 1886.8.27.439). A, holotype. B, enlarged view of the surface. C, ectosomal skeleton, one size of mesh, hispid surface, small conules (scale 100 μm). D, ectosomal and choanosomal skeleton, longitudinal view, subectosomal smaller mesh obtained by vertical subdivision of primary fibres and modification of subectosomal connective fibres (peripheral condensation).

However, Article 11.4.1. also specifies that a genus group name without associated nominal species could be accepted consistent with the Principle of Binomial Nomenclature in the absence of evidence to the contrary. *Cacochalina* Schmidt, 1870 was also declared unrecognisable (Burton, 1927; de Laubenfels, 1936a), because the two species assigned by Schmidt (1870) (*C. subtilis*, Florida and *C. rubiginosa*, Antilles), are unrecognizably described. Van Soest *(in litteris)* studied slides of Schmidt in London (BMNH 1870.5.3.135 Florida, 9 fathoms) and in Copenhagen (ZMUC), and in his opinion these slides were so poor that no genus characters can be extracted from them. Consequently, we propose here to declare [*Cacochalina*] Schmidt a *nomen nudum* (taxonomic decision, this work).

SUBGENUS *CALLYSPONGIA* DUCHASSAING & MICHELOTTI, 1864

Synonymy

Callyspongia Duchassaing & Michelotti, 1864: 57. *Ceraochalina* Lendenfeld, 1887c: 740, 778. *Chalinella* Lendenfeld, 1887c: 770, pl. 27, fig. 20. *Chalinopora* Lendenfeld, 1887c: 764. *Euchalina* Lendenfeld, 1887c: 742, 816. *Anatoxius* Lendenfeld, 1887c: 798. *Patuloscula* Carter, 1882a: 365.

Type species

Callyspongia fallax Duchassaing & Michelotti, 1864 (subsequent designation; Burton, 1934a: 539).

Definition

Callyspongia with one size of ectosomal mesh. Single ectosomal non-hispid, layer. Choanosomal fibres multispicular, non-fasciculated, spongin sheath present. Well defined, connecting fibres, rectangular mesh without free spicules.

Diagnosis

Lobate repent encrusting to massive or short anastomosed upright tubes with apical oscule. Surface smooth. Single ectosomal non-hispid, layer and regular size of single, rounded to polygonal mesh. Choanosomal a well-developed network with rectangular empty mesh, primary choanosomal fibres multispicular, non-fasciculated, non ramified, spongin sheath well-defined. There may be peripheral condensation of the choanosomal skeleton. Microscleres, toxas may be present.

Distribution

Cosmopolitan (Hooper & Wiedenmayer, 1994).

Previous reviews

Burton (1934a: 539), Wiedenmayer (1977b: 90), Van Soest (1980: 46).

Description of type species

Callyspongia fallax Duchassaing & Michelotti, 1864 (Fig. 2).

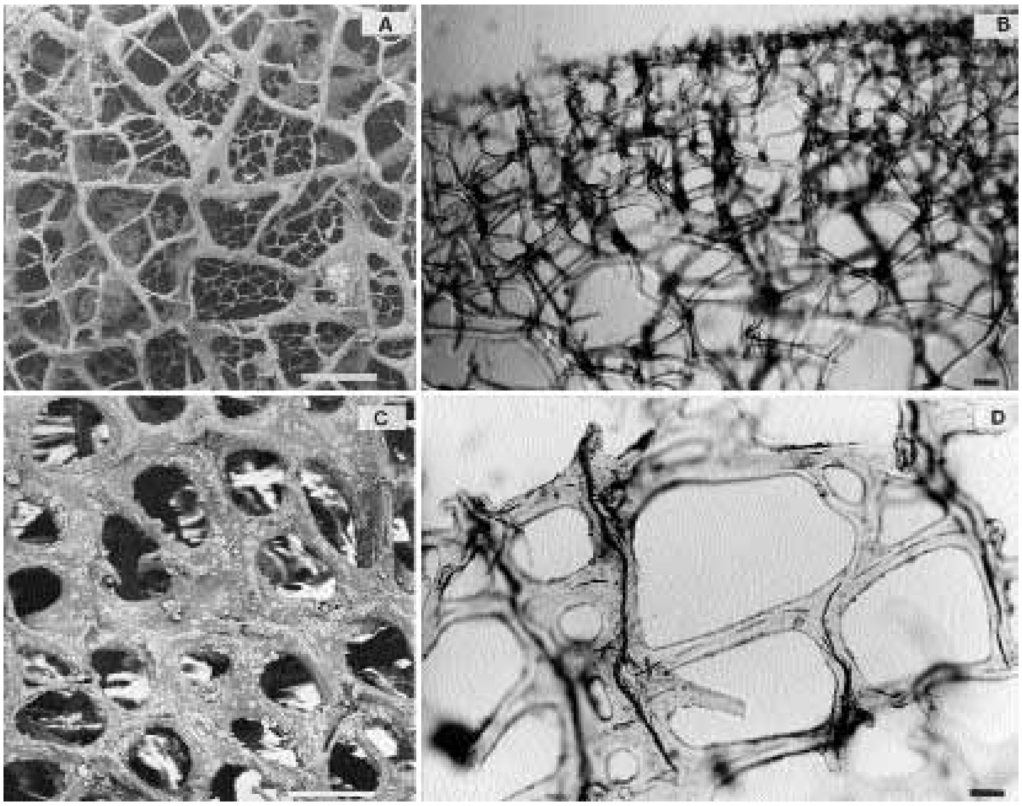

Fig. 2. *Callyspongia (Callyspongia) fallax* Duchassaing & Michelotti, 1864 (Lectotype: MT Por 84). A, lectotype. Ectosomal skeleton a typical tangential network of rectangular to polygonal mesh, formed around the apex of a primary longitudinal fibre that ramifies on surface (scale 200 μm). B, choanosomal skeleton a regular network of rectangular to roundish mesh, formed by primary, longitudinal paucispicular, connected at right angle by secondary unispicular fibres. C, *Patuloscula procumbens* Carter, 1882a, ectosome uniform, membranous layer with one size of rounded mesh, limited by one single spicule by side (scale 500 μm). D, *C. fallax*, primary paucispicular and connecting unispicular fibres, regular choanosomal skeleton.

Synonymy. *Callyspongia fallax* Duchassaing & Michelotti, 1864: 57; Wiedenmayer, 1977b: 92 (in part); Van Soest, 1980: 47.

Material examined. Lectotype (designated by Van Soest, 1980: 47): MT Por 84 (fragments BMNH 1928.11.12.5, MNHN NBE 1067, MHNG 22213) – St Thomas. Comparative material. Lectotype of *Callyspongia eschrichtii* Duchassaing & Michelotti, 1864: 56: ZMA POR 620 – St Thomas. Paralectotypes: MZUT POR 44, 45, ZMA POR 623, (fragment MHNG 14839) – St Thomas. Holotype of *Dactylochalina australis* Lendenfeld: BMNH 1886.8.27.466a (slide); BMNH 1886.8.27.469, wet subsample. *Dactylochalina reticulata* Lendenfeld, 1886c: BMNH 1886.8.27.467a – slide, W coast of Australia.

Description. Repent mass of anastomosing lobes, measuring 12–14 cm in length by 2–3 cm in diameter, with terminal oscule, 10–12 mm in diameter, and a short aquiferous canal. Surface smooth. Consistency firm, tough to barely compressible in dry state. Colour yellowish, amber-like to beige, with purple spots. In dry state, light brown. Ectosomal skeleton a typical tangential network of rectangular to polygonal mesh, formed around the apex of a primary longitudinal fibre that ramifies on the surface. Mesh delimited by primary fibres, 107–(193)–350 μm large, mesh delimited by finer fibres, 50–74 μm, in diameter. Primary fibres 30–50 μm, in diameter. Secondary and tertiary fibres, 7–26 μm and 4–6 μm in diameter respectively. Choanosomal skeleton a regular network of rectangular to roundish mesh 246–(297)–360 μm large, formed by primary, longitudinal paucispicular fibres (5–7 divergent spicules in a central row), 53–(78)–114 μm in diameter, connected at right angle by secondary unispicular fibres, 12–(23)–33 μm in diameter. Sometimes primary fibres are fused and/or subdivided, but not fasciculated. If fused, two central axes of coring spicules are visible. Van Soest (1980) described subdermal peripheral condensation of choanosomal skeleton by intercalated vertical secondary fibres, which we did not observe. Spicules: strongyloxeas, 38–(46)–80 μm length and 0.5–2 μm in diameter.

Distribution. Caribbean: St Thomas, Curaçao, Bonaire, Viecques, Florida, Grenada, Tortola, Bahamas. Occurring only on reefs. From secondary source: Van Soest (1980).

Remarks

Van Soest (1980) considered *C. eschrichti* an available species and different from *C. fallax*, contrary to Burton (1934a) and Wiedenmayer (1977b) who both considered *C. eschrichti* to be a synonym of *C. fallax* or a growth form of *Callyspongia (Spinosella pro Cladochalina) vaginalis*. We support Van Soest's contention that *C. eschrichti* is a valid species but closest to *C. fallax* because of its typical *Callyspongia (Callyspongia)* type of skeleton, but without peripheral condensation. They also have different habits and spicule micrometries.

Subgenus *Callyspongia* differs from other subgenera by the absence of choanosomal fibro-fascicles and the presence of constantly regular, rectangular mesh. Ectosomal network is formed by ramified ends of primary longitudinal fibres, spread on the surface and delimiting regular triangular to rounded or polygonal ectosomal mesh. Burton (1934a) considered *Patuloscula* Carter, 1882a as synonym of *Callyspongia*, since *P. procumbens* its type species was synonym of *C. fallax* (Fig. 2A–D). De Laubenfels (1936a) remarked that *Patuloscula* was 'very similar by its external form, with *Callyspongia*, except by the possession of toxiform spicules'.

Several syntypes of *P. procumbens* studied by Carter (1882a) and Dendy (1890a) illustrate the large morphological variability of the type species of *Patuloscula*, and consequently the difficulties of discriminating between this genus and *Callyspongia*, to the extent that Wiedenmayer (1977b) also included *P. procumbens* in synonymy with *C. fallax*. Dendy (1890a) provided details of the ectosomal skeleton of *Patuloscula* (as *Siphonochalina*) *procumbens*, describing a polygonal reticulation of mesh delimited by sparse uni-serially distributed spicules. The structure of the ectosome we observed in the type specimens of *P. procumbens*, surface membrane pierced by one size of ectosomal mesh delimited by unispicular fibres is, in our opinion, the only difference between *P. procumbens* and *C. fallax* and following Wiedenmayer (1977b) and Van Soest (*in litteris*), in this work we consider *Patuloscula* a junior subjective synonym of *Callyspongia* (*Callyspongia*).

Dactylochalina Lendenfeld, 1886c (type species *Dactylochalina australis* Lendenfeld, 1887c, by subsequent designation; Burton, 1934a), is considered here a junior synonym of *Callyspongia (Callyspongia)*. The type of skeleton in both genera is similarly formed by fibres with abundant spongin with a central row of spicules, unispicular in secondary fibres and a paucispicular in primary fibres. *Callyspongia* and *Dactylochalina* are different only by their spicule sizes, which in any case are vestigial as Lendenfeld (1886c) mentions. Skeletal meshes are empty of fibres and foreign material is absent. Spicule micrometries in *D. cylindrica* Lendenfeld, 1886c, are: oxeas 48–61 × 4.8–6.4 μm. Longitudinal primary fibres are 92 μm in diameter, connecting secondary fibres 42 μm in diameter, meshes of the surface are 60 μm diameter and choanosomal meshes are 170–176 μm diameter.

Anatoxius Lendenfeld, 1887c (type species *Phylosiphonia stalagmites* Lendenfeld, 1887c, here designated, syntype AM Z618 not seen), was erected as a subgenus of *Phylosiphonia*, which is a *Chalinula* (Chalinidae) by virtue of Burton's type species assignment, but most if not all *Phylosiphonia* (*Anatoxius*) species are *Callyspongia*, including the type species here designated.

SUBGENUS *CAVOCHALINA* CARTER, 1885

Synonymy

Cavochalina Carter, 1885d: 287; Topsent, 1932: 68. *Placochalina* Lendenfeld, 1887c: 741, 790.

Type species

Cavochalina bilamellata (Lamarck, 1814) Carter, 1885d (by subsequent designation; Topsent, 1932).

Definition

Callyspongia with two different types of surfaces. External surface very rough (Fig. 3A). Internal surface (Fig. 3C), smooth, concentrically lined, extremely porous. Ectosomal tangential network with strong fibres and rounded mesh of one size.

Diagnosis

Stalked, bilaterally compressed, bilamellate to funneliform growth form. Outer surface strongly rough, coarse, reticulate, rugous, inner surface smooth, microhispid, concentrically lined, strongly porous, with regularly distributed oscula. Consistency tough, rubbery. Skeleton: ectosomal small mesh echinated by erect spicule brushes and unispicular fibres. Choanosomal (Fig. 3B) regular network with longitudinal parallel paucispicular fibres and strong central core and spongin sheath. Connective secondary fibres, short, non-ramified, paucispicular. Spicules: small oxeas.

Previous reviews

Topsent (1932: 68; in part, as *Cribrochalina bilamellata*), Wiedenmayer (1989: 106).

Description of type species

Callyspongia (Cavochalina) bilamellata (Carter, 1885d) (Fig. 3).

Synonymy. *Spongia bilamellata* Lamarck, 1813–14: 484; *Cribrochalina bilamellata* Topsent, 1932: 68; *Callyspongia bilamellata* Wiedenmayer, 1977b: 118; 1989: 106; *Placochalina pedunculata* var. *dura* Lendenfeld, 1887c: 791.

Material examined. Holotype: MNHN LBIM DT 602 – King I., Bass Strait. Holotype of *Cavochalina bilamellata* Carter, 1885d (Fig. 3D): BMNH 1886.12.15.182 – S coast Australia. Comparative material. Holotype of *Placochalina*: BMNH 1886.12.15.182 – Port Phillip Heads, S coast Australia. Syntype of *Cavochalina bilamellata* (Carter's specimen): BMNH 1886.8.27.561 – Port Jackson. Syntypes of *Placochalina peduncula* var. *dura* Lendenfeld, 1887c: BMNH 1886.8.27.563, 564, 565 – Torres Straits, Port Jackson and Illawarra. Holotype of *Placochalina peduncula* var. *poculum* Lendenfeld, 1887c: BMNH 1886.8.27.562 – South coast of Gulf St Vincent. Holotype of *Placochalina peduncula* var. *mollis* Lendenfeld, 1887c: BMNH 1886.8.27.562 – South coast of Gulf St Vincent.

Description. Pedicellate sponge, 28 cm high, bilamellate, 15–16 cm in length, doubled up like a bivalve shell with a long, hard stem, ending in a root-like expansion, vasiform, compressed, infundibular toward terminal part. Consistency leathery. Colour pale pinkish brown. Outer surface irregular, corrugated and wrinkled, reticulated with numerous microconules. Internal surface even, smooth, microhispid, concentrically lined, small oscula regularly scattered over internal surface. Skeleton: Ectosome with numerous erect spicule brushes from terminal part of strongly ramified primary fibres, one size of rounded mesh. Choanosome with regularly parallel-branched primary longitudinal fibres, 35–140 μm in diameter. Secondary fibres, short connected, some of them slightly branched, similar in diameter to primary fibres. Rounded mesh. Spongin abundant, except on surface where spicules are more important, ends of fibres ramified to form bundles with spicule brushes, resembling ectosomal skeleton of *Cribrochalina*. Spicules: fusiform oxea, slightly bent, 37–43–51 × 2–3 μm, small free vestigial oxeas and strongyles.

Remarks. Topsent (1932) affirmed that *C. bilamellata* is a Haplosclerida but close to *Cribrochalina* given the possession of an ectosomal layer in both. Wiedenmayer (1977b) remarked that this species was much like *Cribrochalina vasculum* from the West Indies, a species he also associated with Lendenfeld's varieties of *Placochalina*, with spicule-dimensions being the only significant difference between them. We have also remarked on similar characters between *Cribrochalina infundibulum* (type species of *Cribrochalina*) and *C. bilamellata*, but in addition to differences in spicule micrometries they have a different type of fibres and a different type of ectosomal layer. *Cribrochalina infundibulum* has larger

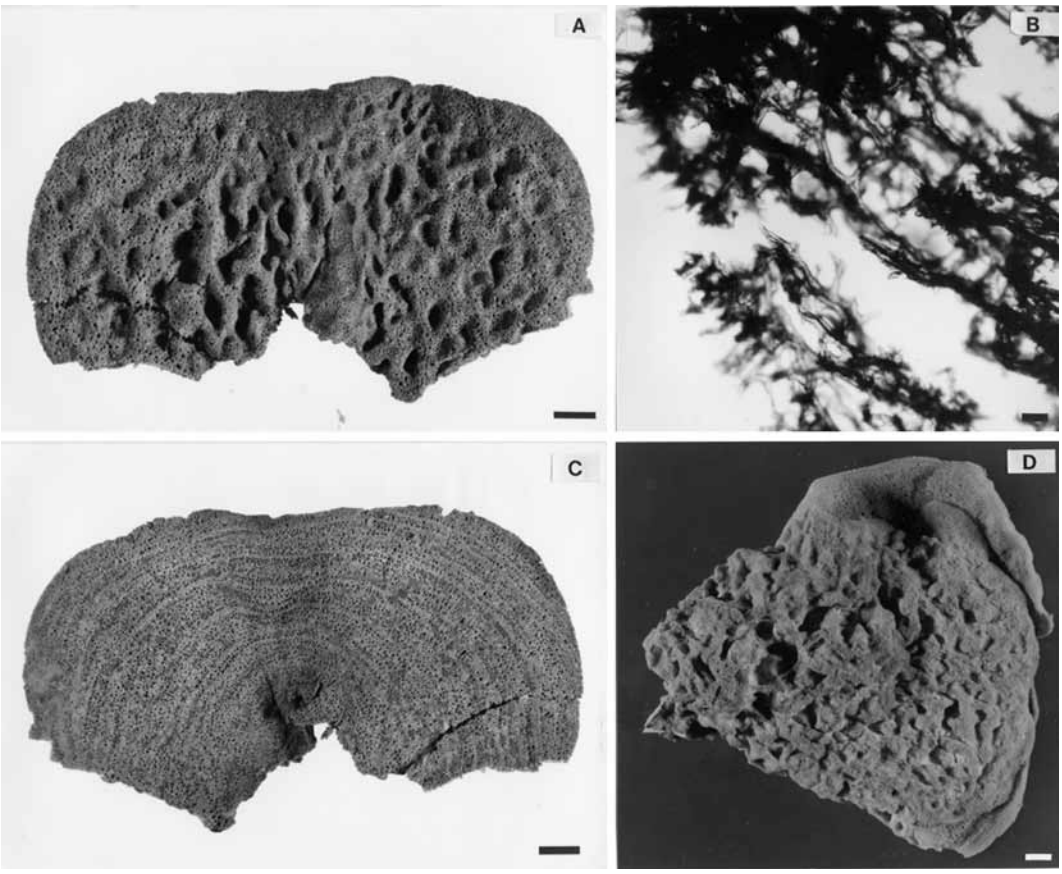

Fig. 3. *Callyspongia (Cavochalina) bilamellata* Carter, 1885 (holotype MNHN LBIM DT602). A, holotype, external surface view. B, choanosomal skeleton, regular network with longitudinal parallel paucispicular fibres and strong central core, large spongin sheath. C, internal surface of the holotype. D, *Cavochalina bilamellata*, Carter's specimen BMNH 1886.12.15.182.

spicules (strongylote oxeas: 108–(134)–164 × 3–4 μm) and stronger, compact multispicular primary fibres (160–180 μm in diameter), arising to the surface to form strong brushes of spicules in a palisade or crust.

Cavochalina was introduced by Carter (1882a: 277) for *S. bilamellata* (Lamarck) but without nominating it as the type species. We consider *Cavochalina* to be an available genus, based on Article 11.5 of the ICZN 'by bibliographic reference' through Topsent's (1932) revision of Lamarck's collection in the MNHN Paris. Topsent (1932) confirmed *Spongia bilamellata* Lamarck, 1814 typical form, as the species described by Carter as *Cavochalina bilamellata* 'a typical chalinine' that he named *Cribrochalina bilamellata*. Topsent (1932) therefore considered *Cavochalina* and *Placochalina* to be objective synonyms (both genera share the same type species), and closer to *Cribrochalina* (Niphatidae) (both sharing a similar type of ectosomal layer). Only two species of *Cavochalina* have been described, both by Carter (1882a; 1885d), and both from the S coast of Australia.

Placochalina, a genus of doubtful status, with the type species *Cavochalina bilamellata* (Lamarck) Carter, 1885d (by subsequent designation de Laubenfels, 1936a) was mixed up in *Cavochalina bilamellata* and *Cribrochalina* Schmidt, 1870 by Lendenfeld (1887c). Lendenfeld (1887c: 790) included several species of Carter, Schmidt, Vosmaer and Bowerbank in his new genus *Placochalina* (viz., *Cavochalina bilamellata* Carter, as *Placochalina pedunculata* var. *dura*; *Cavochalina digitata* var. *arenosa* Carter, 1882a, as *P. arenosa*; *Cribrochalina cretacea* Schmidt as *P. cretacea* Lendenfeld; *Cribrochalina infundibulum* Schmidt as *P. pedunculata poculum*; *Cribrochalina variabilis* vars. *crassa* Vosmaer and *salpingoides* Vosmaer as *P. variabilis* vars. *variabilis* and *salpingoides*; *Isodictya infundibuliformis* Bowerbank as *P. infundibuliformis*). We confirm here, from re-examination of type material, that *Placochalina* is a junior objective synonym of *Cavochalina*.

SUBGENUS *CLADOCHALINA* SCHMIDT, 1870

Synonymy

Cladochalina Schmidt, 1870: 35. *Spinosella* Vosmaer, 1887: 342.

Type species

Tuba armigera Duchassaing & Michelotti, 1864 (by subsequent designation; Burton, 1927).

Definition

Callyspongia with ectosomal network with three sizes of mesh around terminal ends of primary fibres largely spread on the surface. Multispicular primary fibres well defined, always fasciculated, and ramified to form a choanosomal tertiary network of fine fibres always present. Spongin sheath clearly visible. Conulose surface.

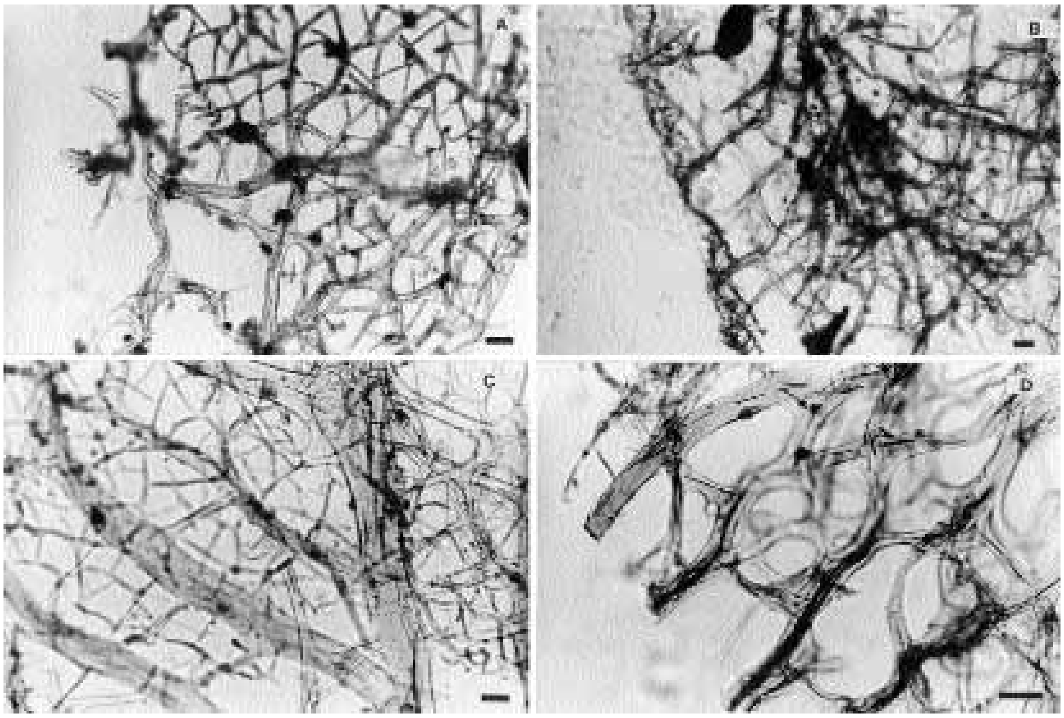

Fig. 4. A–B, *Callyspongia (Cladochalina) armigera* (Duchassaing & Michelotti, 1864) (lectotype MUS. TURIN POR 75). A, lectotype, ectosomal skeleton network, strictly tangential, primary-secondary and tertiary fibres in one plan, determining three sizes of irregular mesh. B, longitudinal view of conule, fasciculated primary fibre, apex at bottom of the figure. C–D, *Spinosella sororia* (Duchassaing & Michelotti, 1864) (lecto- and paralectotypes MT Por 126, 118). C, paralectotype, choanosomal skeleton strong, irregular, with primary longitudinal fasciculated fibres, abundantly ramified to form free secondary and tertiary fibres with rounded to elongate always subdivided mesh. D, lectotype, longitudinal view of choanosomal skeleton, Spongin always present. Spicules: oxeas to strongyloxeas well developed or vestigial.

Diagnosis

Branched, tubuliform or vase-like growth form, with tendency to form coalescent tubes or masses of branches, with a common base, with large apical vents, or irregularly distributed oscula. Surface strongly to finely conulose or spiny. Texture elastic, strong or fragile and breakable, in dry state. Ectosomal skeleton network, strictly tangential, primary secondary and tertiary fibres in one plane, determining three sizes of irregular mesh (Fig. 4A). Several end branches of one primary longitudinal fibre form the skeletal axis of each surface conule or spine (Fig. 4B). Choanosomal skeleton strong, irregular, with primary longitudinal fasciculated fibres, abundantly ramified to form free secondary and tertiary fibres with rounded to elongate, always subdivided mesh (Fig. 4C, D). Spongin always visible present in variable amounts. Spicules: oxeas to strongyloxeas well developed or vestigial.

Previous reviews

Burton (1934a: 540), Wiedenmayer (1977b: 100; 1989: 104, 105), Van Soest (1980: 110).

Description of type species

Callyspongia (Cladochalina) armigera (Duchassaing & Michelotti, 1864) (Fig. 4).

Synonymy. *Tuba armigera* Duchassaing & Michelotti, 1864: 48, pl. 8, fig. 3; *Callyspongia armigera*; Burton, 1934a: 540; *Spinosella vaginalis* forma *armigera*; Wiedenmayer, 1977b: 104; *Callyspongia (Spinosella) vaginalis* forma *armigera*; Van Soest, 1980: 60.

Material examined. Lectotype (designated by Van Soest, 1980: 60): BMNH 1870.5.3.136, MT Por 75 (Schmidt's original slides) – St Thomas (Fig. 6A, B). Paralectotype: ZMA POR 2407 (fragments. BMNH 1928.11.12.93, 94, MHNG INVE POR 980.176) – Florida, Antilles.

Description (emended from Van Soest, 1980: 60). Ramose, branches 12 cm long by 1.5 cm in diameter, somewhat compressed. Oscula scattered over branches, 3–6 mm in diameter. Surface conulose, smooth in between. Ectosomal skeleton, large mesh 250 µm in diameter, small mesh 60–100 µm in diameter, secondary fibres 8–12 µm in diameter. Choanosomal skeleton: fibrofascicles 200 µm in diameter, primary, paucispicular fibres (1–4 spicules), 40–70 µm in diameter; secondary paucispicular fibres (1–3 spicules), 25–35 µm in diameter, tertiary, aspicular to unispicular, fibres, 6–15 µm in diameter (Fig. 4D). Spicules: oxeas, 48–(88)–99 × 1.5–(3)–4.5 µm in diameter.

Remarks. Further comment is required on the synonymy outlined above. [*Tuba*] Duchassaing & Michelotti, 1864 (type species *T. sororia* D. & M., by subsequent designation) (Burton, 1934a: 540), Topsent (1932: 75), is junior homonym of *Tuba* Renier, 1864 (Polychaeta), [*Tuba*] Oken, 1815 (Nemertina), [*Tuba*] Fabricius, 1823 (Mollusca), [*Tuba*] Lea, 1833 (Mollusca) and [*Tuba*] Barrande, 1848 (Mollusca). Vosmaer (1887) proposed *Spinosella* as a replacement name (with type species *Tuba sororia* D. & M., 1864, by original designation). Burton (1934a: 540) and

Bergquist & Warne (1980: 24) considered it to be a synonym of *Callyspongia*; Dendy (1890a: 357) suggested it was close to *Siphonochalina*; and Van Soest (1980: 56, 64) used *Spinosella* as a subgenus, including redescription of the lectotypes of *T. megastoma*, *T. irregularis* and *T. sororia*, synonymising them in *Callyspongia (Spinosella) vaginalis*, therefore making it a subjective synonym of *Callyspongia*.

Burton (1927) designated *T. armigera* (Fig. 4A, B) the type species of *Cladochalina*, differing from *C. fallax* in having three sizes of mesh in the ectosomal skeleton, but he also concluded that this difference was not significant at the generic level, and included *Cladochalina* in synonymy with *Callyspongia*. Burton (1934a) considered that *T. sororia*, the type species of *Spinosella* (Fig. 4C, D), was a synonym of *C. fallax*. Consequently, both *Cladochalina* and *Spinosella* became synonyms of *Callyspongia*. The present study confirms their synonymy from re-examination of their respective type species, *T. armigera* and *T. sororia*. Wiedenmayer (1989: 103, 105) proposed the use of the name *Cladochalina* to replace *Spinosella* as a subgenus of *Callyspongia* based on seniority of the two taxa.

Cladochalina presents a skeleton similar to *Toxochalina* Ridley, these genera are included here as subgenus of *Callyspongia*. Both exhibit three sizes of ectosomal mesh, irregular choanosomal mesh and abundantly ramified, confuse principal fibres. Their principal difference being the presence of toxa in *Toxochalina*. This has been considered in contradictory ways: Burton (1934a) considered *Desmacidon folioides* had a skeleton like that of *Cladochalina armigera* with toxas for microscleres, but toxas, could be also present in *Callyspongia* (e.g., *C. fallax*), therefore, *Toxochalina* was synonym of *Callyspongia*.

Distribution

West Indies: St Thomas, Viecques (Duchassaing & Michelotti, 1864), Florida, Antilles, Jamaica (Lehnert & Van Soest, 1999a).

SUBGENUS *EUPLACELLA* LENDENFELD, 1887

Synonymy

Euplacella Lendenfeld, 1887c: 741, 789.

Type species

Euplacella australis Lendenfeld, 1887c: 782 (by subsequent designation; Burton, 1934a: 597).

Definition

Callyspongia with three distinct surface layers and one size of close polygonal-triangular mesh delimited by echinated secondary fibres. Choanosomal parallel, strong longitudinal paucispicular fibres.

Diagnosis

Thin lamellae or thin plates, foliate, with two different surface layers: upper surface smooth, regular, with numerous, evenly distributed oscules (Fig. 5A). Ectosomal skeleton a tangential layer of upper surface with one size regular small mesh ends of primary fibres echinated by free spicules (Fig. 5B, D). Inner surface irregularly undulated, ectosomal layer with small rounded mesh, without hispidation. Subectosomal region of upper surface exhibits three (in type specimen) (Fig. 5C)) successive ectosomal layers or 'growth lines or lamellae', Inner surface with single ectosomal layer. Choanosomal skeleton (Fig. 5D) of parallel paucispicular primary longitudinal fibres, non-ramified, strongly cored with large spongin sheath, rounded to rectangular large empty choanosomal mesh, and short, non-ramified connecting unispicular fibres. Spicules, small, slightly bent oxeas.

Previous reviews

Van Soest (1980: 110), Wiedenmayer (1989: 104, 105), Wiedenmayer in Hooper & Wiedenmayer (1994: 87).

Description of type species

Callyspongia (Euplacella) australis (Lendenfeld, 1887c) (Fig. 5).

Synonymy. *Euplacella australis* Lendenfeld, 1887c: 741, 789; Burton, 1934a: 597; Wiedenmyaer, 189: 106.

Material examined. Holotype (fragment): BMNH 1886.8.27.591 (dry) – Torres Straits. Comparative material. Slide of Lendenfeld as *Euplacella bilamellata* (Carter): BMNH 1887.8.27.591a. Syntype of *Euplacella frondosa* (Lendenfeld, 1887c): BMNH 1886.8.27.424 – Port Jackson. Syntypes of *Euplacella frondosa* (Lendenfeld, 1887c): BMNH 1886.8.27.453, 453a – Port Jackson. Syntype slide of *Euplacella frondosa* (Lendenfeld, 1887c): BMNH 1954.2.12.88 – Port Jackson. Holotype of *Euplacella mollissima* (Lendenfeld, 1887c): BMNH 1886.8.27.423 (dry) – Westernport Bay, Victoria.

Description. Holotype of *Euplacella australis* (Fig. 5A–D) is represented by a small flattened rectangular fragment of frond, lamella or thin plate, with two different surfaces. The original description stated: 'A pedunculated plate, undulated and curved, diameter 150 mm, thickness 3 mm, margin continuous. Consistency strong and hard' (Lendenfeld, 1887c). Outer surface finely hispid, with numerous, irregularly distributed oscules. Inner surface with one single surface layer. Consistency tough, hard, in dry state. Ectosomal skeleton with one size of small rounded mesh, with erect brushes of spicules, present in the outer surface. Choanosomal skeleton, with primary longitudinal parallel paucispicular fibres, 33–(55)–66 μm in diameter with central core of spicules and large spongin sheath, connected by uni- to trispicular, short, non-ramified fibres, 25–(33)–41 μm in diameter. Large rounded to rectangular regular mesh 82–(120)–148 μm in diameter, without or with a few free spicules. Mesh near the surface, 5–(6)–7 μm in diameter. Longitudinal fibres of triple layers, 16–(22)–25 μm in diameter, ending at the surface by perpendicular palisade of spicules delimiting ectosomal mesh Spicules: small oxeas, 48–(56)–65 × 3–4 μm, or even smaller (Lendenfeld, 1887c cites oxeas as 67 × 3.3 μm).

Remarks. Burton (1934a) designated *E. australis* the type species of *Euplacella* (making de Laubenfels' (1936a: 59) subsequent designation of *E. mollisima* Lendenfeld, 1887c, invalid), and gave a diagnosis that emphasised the typical ectosomal network characteristic of this genus, which he considered important enough to warrant its recognition as a valid genus of Callyspongiidae. Burton (1934a) also included *Placochalina* in synonomy with *Euplacella*, and Van Soest (1980: 110) redefined the genus based on *Pachychalina elongata* Ridley & Dendy, 1886, including *Placochalina* as a junior synonym of *Euplacella*, whereas we have demonstrated here that it is a synonym of *Cavochalina* Carter.

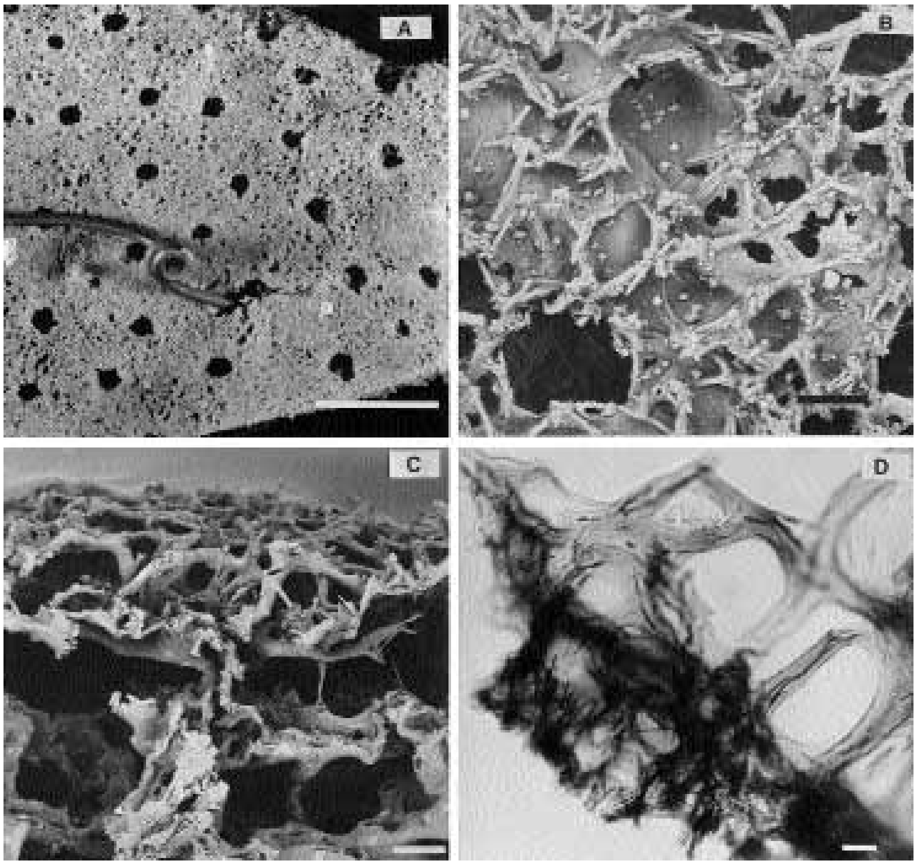

Fig. 5. *Callyspongia (Euplacella) australis* (Lendenfeld, 1887c) (holotype bmnh 1886.8.27.591). A, holotype, small flattened rectangular fragment of lamella, with numerous small oscula irregularly distributed on the outer, finely hispid surface. B, ectosomal skeleton with one size of small rounded mesh, underlined by abundant free spicules. Unispicular fibres, tangential view (scale 50 μm). C, subectosomal region as triple surface layer or 'growth lines or lamellae'. D, echinated ends of primary fibres.

Wiedenmayer (1989: 104–5) incorrectly proposed that *Ceraochalina* Lendenfeld (type species *C. typica*) was a senior synonym of *Euplacella*. Both are lamellate with a smooth, regular porous surface, and numerous small oscula, but their external morphology appears to be the only common character whereas there are many skeletal differences between the two. These differences are clear at the level of subectosomal and ectosomal regions. *Ceraochalina* exhibits subectosomal peripheral condensation. The hispid surface of *Ceraochalina* (Fig. 1B), results from isolated spicules echinating connecting fibres around mesh. The ends of primary fibres form small hispid conules around which ectosomal small one size mesh are distributed. In contrast, in *Euplacella* longitudinal fibres of subectosomal region form three succesive surface layers (Fig. 5C). The ends of primary fibres form three dense ectosomal layers with small mesh of a single size without conules (a hispid surface is produced by echinated ends of primary and connecting fibres, appearing as palisade of isolated brushes of spicules (Fig. 5D). The small size of conules in *Ceraochalina* and the regular size of the ectosomal mesh in both genera make their surfaces appear the same type. Therefore, we consider here that *Ceraochalina* is a synonym of *Callyspongia (Callyspongia)*.

Surface hispidation is an important character of *Euplacella*, *Cribrochalina* and *Cavochalina bilamellata* (see Wiedenmayer, 1989: 107). In *Euplacella* surface hispidation is visible as palisade of spicule brushes especially on the secondary fibres of surface mesh. In *Cavochalina bilamellata* surface hispidation is also made of isolated spicule brushes, but they are more evident at the ends of the primary fibres, of the choanosomal skeleton. Primary fibres in *Cavochalina* are abundantly cored, while secondary fibres are sparsely cored by small oxeas, representing a *Callyspongia* type of skeleton. In *Cribrochalina* (Niphatidae) surface hispidation is apparently similar, consisting of a strong continuous palisade of single oxeas, issuing from the surface ends of primary fibres, like a crust. In addition, the compact multispicular longitudinal fibres cored by sinuous, larger spicules produce more obvious differences between these callyspongiids and *Cribrochalina*. *Euplacella* Lendenfeld is also close, by its morphology and skeleton, to *Cavochalina*. But the three surface layers in *Euplacella* is significantly different between both genera.

Distribution

North coast of Australia, Torres Strait.

SUBGENUS *TOXOCHALINA* RIDLEY, 1884

Synonymy

Toxochalina Ridley, 1884a: 402.

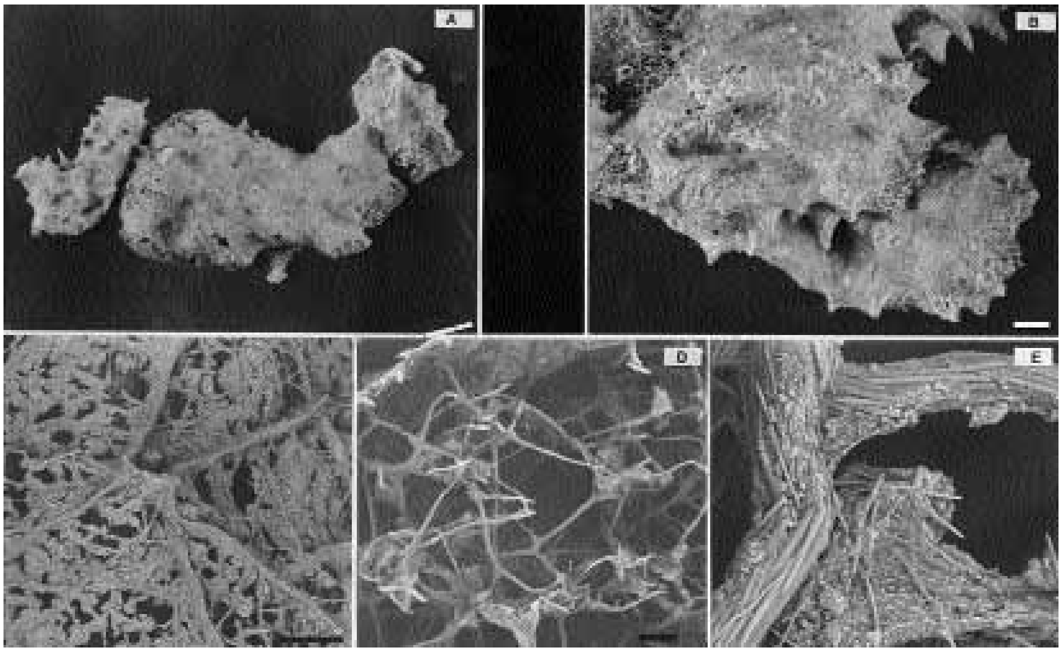

Fig. 6. *Callyspongia (Toxochalina) folioides* (Bowerbank, 1875) (Holotype and and Ridley, 1884a specimen, BMNH 1877.5.21.2034, 1882.2.23.311). A, holotype. B, Ridley, 1884a specimen, enlarged view of the surface. C, ectosomal layer, central conule, three sizes of mesh (scale 100 μm). D, choanosomal strong network of primary irregularly distributed multispicular fibres, abundantly ramified to form connective, ramified smaller network; ectosomal network on top (scale 500 μm). E, choanosomal fibres, abundantly cored, multispicular without spongin sheath (scale 20 μm).

Type species

Desmacidon folioides Bowerbank, 1875 (by subsequent designation; Burton, 1934a: 597).

Definition

Callyspongia with three sizes of ectosomal mesh and conspicuous surface conules. Choanosomal strong, irregular network with compact multispicular fibres abundantly divided to form tangled, irregular connective fibres and large triangular to irregular choanosomal mesh. Scarce spongin.

Diagnosis

Compact ramified subcylindrical branched growth form (Fig. 6 A, B), issuing from an enlarged basal portion. Surface conulose with a strong ectosomal network and strong fibres, numerous small conules. Oscula irregularly distributed. Consistency hard, strong. Ectosomal irregular network, three sizes of mesh around compact small conules, strong multispicular primary fibres, abundantly ramified (Fig. 6C). Mesh with abundant free oxeas and toxas. Choanosomal (Fig. 6D) strong network of compact multispicular primary fibres, irregularly distributed (Fig. 6E), abundantly ramified to form connective paucispicular fibres, as smaller network of tertiary uni to aspicular small fibres, similar to the surface network. Spongin scarce, present only to bind spicules. Spicules: straight oxeas, microscleres toxas.

Previous reviews

Ridley & Dendy (1887: 49), Dendy (1905: 139), Topsent (1928: 66), de Laubenfels (1936a: 59), Bergquist & Warne (1980: 24), Van Soest (1980: 110), Desqueyroux-Faúndez (1984: 811).

Description of type species

Callyspongia (Toxochalina) folioides (Bowerbank, 1875) (Fig. 6).

Synonymy. *Desmacidon folioides* Bowerbank, 1875: 295; Ridley, 1884a: 402.

Material examined. Holotype: BMNH 1877.5.21.2034 – Straits of Malacca (Bowerbank collection). Specimens of *Toxochalina folioides* Ridley, 1884a: BMNH 1882.2.23.311, 550 – Prince of Wales Channel, Torres Strait. H.M.S. 'Alert'.

Description. Ramose, sponge issued from a basal, enlarged portion. Surface conulose but smooth in between, with small ostia and oscula, irregularly distributed, covered by a conspicuous membrane minutely reticulated with abundant toxa and oxeas. Ectosomal fibres strong and ramified to form irregular large mesh. Choanosomal strong network of multispicular primary fibres abundantly divided to form secondary and tertiary fibres of a tangled network. Spicules: oxeas (1) 70–(78)–88 × 4 μm in diameter; oxeas (2) 62–(69)–67 × 2 μm in diameter. Microscleres, if present, toxas, 64–(81)–115 × 2 μm in diameter.

Remarks. The most distinctive character of *Toxochalina folioides* is its surface. It has a strong surface membrane with strongly ramified fibres, clearly visible under the surface membrane. The ectosomal network with large mesh is subdivided by fine fibres with small spicules. *Toxochalina* exhibits a compact and ramified ectosomal skeleton, close to that seen in *Callyspongia*, and these two genera are considered by most authors to be synonyms. We use *Toxochalina* as a subgenus of *Callyspongia*, because in addition to possessing toxa microscleres its skeletal structure is much more compact and irregular, with tangled tertiary fibres, than *Callyspongia sensu stricto*, whereas additional taxonomic characters are required to accurately establish its exact taxonomic status. De Laubenfels (1936a) suggested that it was a synonym of *Patuloscula*, a review rejected here, whereas Van Soest

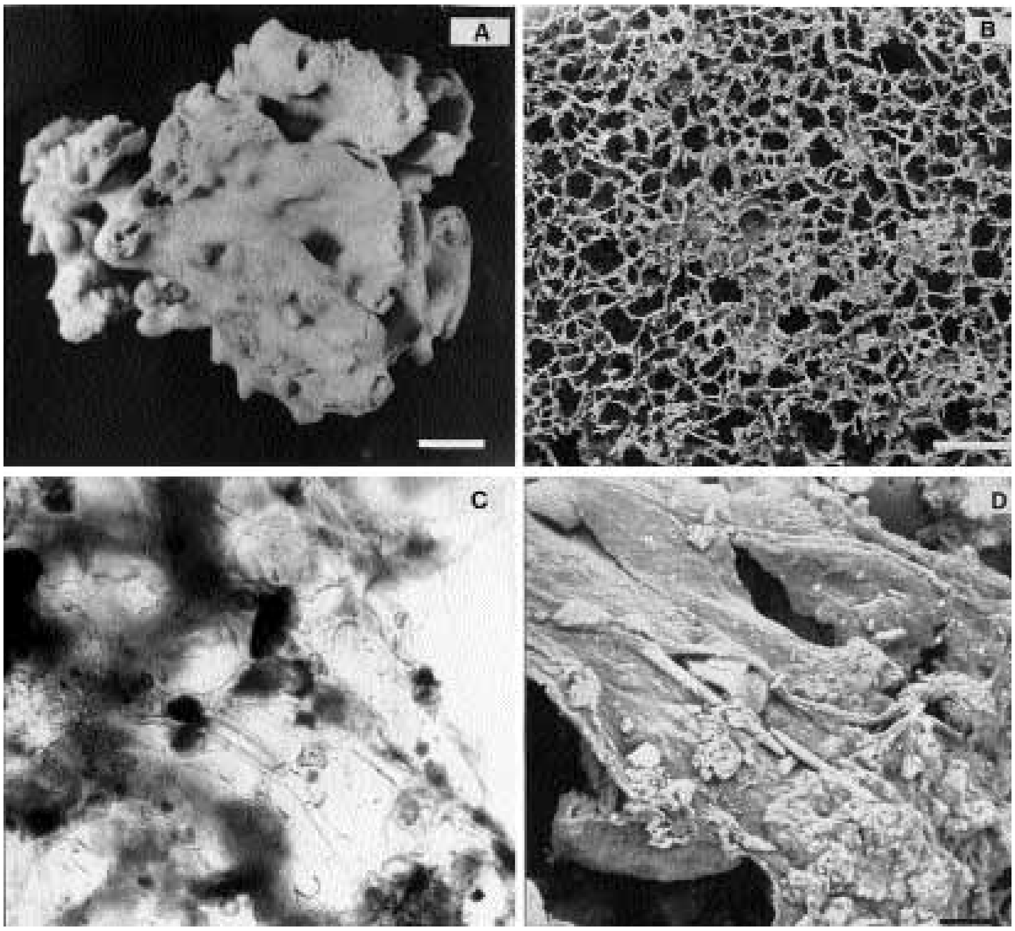

Fig. 7. *Arenosclera heroni* Pulitzer-Finali, 1981 (holotype MSNG 46949 her 32, specimen MHNG 22920). A, New Caledonian specimen. B, Great Barrier Reef holotype, ectosomal tangential network, no proper fibres, roundish to irregular mesh, foreign debris and spicules, slightly amount of spongin (scale 200 μm). C, choanosomal skeleton, irregular, primary and secondary fibres not clearly distinguishable. D, thicker tracts cored by foreign debris, proper spicules or both (scale 20 μm).

(1980) and Bergquist & Warne (1980) both suggested it was a synonym of *Callyspongia*.

Distribution. N coast of Australia, Great Barrier Reef, Torres Strait, Prince of Wales Channel, Thursday Island, Indo-Malayan region, New Zealand (Bergquist & Warne, 1980); Auckland islands (Brøndsted, 1923), New Caledonia, Ambon, Indo-Pacific region (Desqueyroux-Faúndez, 1984).

ARENOSCLERA PULITZER-FINALI, 1981

Synonymy

Arenosclera Pulitzer-Finali, 1981: 123.

Type species

Arenosclera heroni Pulitzer-Finali, 1981, by original designation.

Definition

Callyspongiidae with ectosomal skeleton of sand and foreign debris cemented by scarce spongin, rounded mesh. Choanosomal fibres irregular, discontinuous, with foreign debris, proper spicules or both.

Diagnosis

Massive, irregularly lobate and repent growth form. Oscula unique at end of lobes, or numerous and scattered, volcano-shaped (Fig. 7A). Surface uneven, smooth, fine reticulate sandy membrane, aquiferous system clearly visible. Consistency hard, firm, resilient. Ectosomal tangential network, no proper fibres, roundish to irregular mesh, foreign debris and spicules, with a small amount of spongin. Choanosomal skeleton intricate, irregular, primary and secondary fibres not clearly distinguishable, thicker tracts cored by foreign debris, proper spicules or both. Thinner tracts irregularly distributed, sparse spicules or uncored. Spongin scarce. Microscleres absent.

Previous reviews

Pulitzer-Finali (1981: 123), Desqueyroux-Faúndez (1984: 817).

Description of type species

Arenosclera heroni Pulitzer-Finali, 1981 (Fig. 7).

Synonymy. *Arenosclera heroni* Pulitzer-Finali, 1981: 123, figs 33–35; Desqueyroux-Faúndez, 1984: 817, figs 27, 201–206.

Material examined. Holotype: MSNG 46949 HER 32 – Heron Island, S Great Barrier Reef, Australia. Other material.

Arenosclera heroni. MHNG 22920 – Ile Daougae, New Caledonia. Holotype of *A. rosacea* Desqueyroux-Faúndez, 1984: MHNG 978.437 – Ile Ndu, New Caledonia.

Description. Massive, irregularly lobate, repent, issued from a basal encrusting plate (Fig. 7A). Each lobe 5–25 mm high, and 5–15 mm in diameter. Apical oscules, 3–12 mm in diameter, at each lobe, deep aquiferous cavity pierced by numerous pores. Surface smooth, uneven, with low conules, 1–2 mm length, covered by the sandy reticulate membrane, under which the aquiferous system is clearly visible. Colour: grey to violet. Consistency hard, firm, resilient. Ectosomal, a tangential irregular network, formed by foreign debris and spicules agglutinated by scarce spongin, 60–70 μm in diameter with rectangular to polygonal mesh 80–250 μm wide (Fig. 7B). Very rare, unispiculate, fragmentary, fine fibres, 10–15 μm in diameter, irregularly present. The choanosomal skeleton (Fig. 7C, D) is an irregular, confused network of undifferentiated fibres. Thicker irregular tracts, 50–100 μm in diameter, alternatively cored by foreign debris and by spicules; rounded irregular mesh, 90–164–295 μm large, subdivided by uni- or bispicular fine fragmentary, secondary fibres, 10–30 μm in diameter, free of debris, that form a fine isodictyal network of one spicule size. Spicules: fine oxeas, slightly bent, 51–(63)–90 × 1–2 μm.

Remarks. *Arenosclera* is atypical of Callyspongiidae in having an irregular and disorganised fibre skeleton, and by its surface reticulate skeleton which is only partially visible in the type species, and is formed by very rare, fragmentary, fine fibres and abundant foreign material. We do not follow Wiedenmayer (1989: 105) who included *Arenosclera* as a synonym of *Callyspongia*, considering that presence or absence of spicules and of foreign material correspond to poorly correlated traits and represent only variations of degree within the Callyspongiidae. *Arenosclera* has some resemblance to *Dactylia*, both genera exhibiting an arenaceous ectosomal skeleton and abundant foreign debris. But the skeletal network of each is different. In *Arenosclera* the ectosomal spongin is present between foreign debris but it is only fragmentary, which is different from the well developed aspicular ectosomal fibres of *Dactylia*. The choanosomal skeleton of *Arenosclera* is irregular and confused. Proper fibres are not clearly distinguishable, and it is irregularly cored by foreign debris and spicules, with scarce spongin. In contrast, *Dactylia* has well differentiated choanosomal primary and connecting fibres cored only by foreign debris, without spicules. Growth forms of both genera are also different, with *Arenosclera* containing encrusting, repent and shortly lobate growth forms, whereas *Dactylia chaliniformis*, the type species of *Dactylia*, was described by Carter (1885d) to be a distinctly 'digito-chalina-sponge'.

Distribution

There are only two species of *Arenosclera* described so far, apparently endemic to the southwest Pacific (Australia (Pulitzer-Finali, 1981) and New Caledonia (Desqueyroux-Faúndez, 1984)).

DACTYLIA CARTER 1885

Synonymy

Dactylia Carter, 1885c: 309. [*Chalinopsis*] Lendenfeld, 1886c: 569. *Chalinopsilla* Lendenfeld, 1888: 104; 1889a: 133.

Type species

Dactylia chaliniformis Carter, 1885c: 309 (by subsequent designation; de Laubenfels, 1936a).

Definition

Callyspongiidae without spicules, ectosomal skeleton of fine network with rounded mesh, well differentiated aspicular fibres cored by abundant foreign material. Choanosomal principal fibres sand cored.

Diagnosis

Arborescent growth forms with solid digitate branches of irregular diameter, dichotomously divided and swollen terminal parts (Fig. 8A). Surface even, smooth and pierced by numerous ostia. Oscula numerous, irregularly scattered, or linearly distributed, tubuliform. Surface minutely reticulated. Texture elastic. Ectosomal skeleton (Fig. 8B) irregular, fine network with rounded mesh, formed by fine aspicular fibres, cored by abundant foreign material. Choanosomal skeleton a network of principal longitudinal divergent aspicular fibres, abundantly cored by sand and foreign spicules. Connecting fine secondary fibres, free of inclusions. Foreign inclusions present in and/or outside the fibres make it difficult to observe the skeletal framework. No proper spicules. Spongin present.

Previous reviews

De Laubenfels (1936a: 59), Bergquist & Warne (1980: 34), Wiedenmayer (1989: 105).

Description of type species

Dactylia chaliniformis Carter, 1885c (Fig. 8A–D).

Synonymy. *Dactylia chaliniformis* Carter, 1885c: 309; Lendenfeld, 1888: 110 (as *Chalinopsilla arborea* var. *macropora*); Lendenfeld, 1888: 111 (as *Chalinopsilla arborea* var. *micropora*).

Material examined. Lectotype: BMNH 1912.15.196 – S coast of Australia, Port Phillip Heads (JB Wilson collection; labelled '? *Phoriospongia chaliniformis* (Carter, 1885c) (Lendenfeld, 1889a: 200) as *Dactylia chaliniformis* = *Spongelia varia* (Gray). Det. Burton'). Slide. BMNH 12.15.196a – slide of Carter. Comparative material. Holotype (fragment) of *Chalinopsis dichotoma* Lendenfeld, 1886c: AM G8960 (MNHN LBIM DCL2061). Holotype (fragment) of *Chalinopsilla elegans* Lendenfeld, 1886c: BMNH 1886.8.27.62 (MNHN LBIM DCL2116).

Description. Arborescent, caulescent, with solid, digitiform branches of irregular diameter, enlarged at their terminal parts, "fig-like" (Carter, 1885c). Surface even, smooth, covered by a fine ectosomal network minutely reticulated, with small rounded mesh, 90–(137)–213 μm diameter, and abundant tubuliform ostia (Fig. 8C), masked by foreign material. Fine ectosomal aspicular fibres irregularly distributed, 12–(19)–33 μm in diameter. Choanosomal skeleton (Fig. 8D) an irregular network of primary ascending fibres, 41–(60)–80 μm in diameter. These are radiating to irregularly divergent, not ramified, aspicular but abundantly cored by foreign material. Short connecting secondary aspicular fibres, 12–16 μm in diameter. Foreign inclusions, present inside and/or outside the fibres, make it difficult to observe the skeleton or skeletal framework.

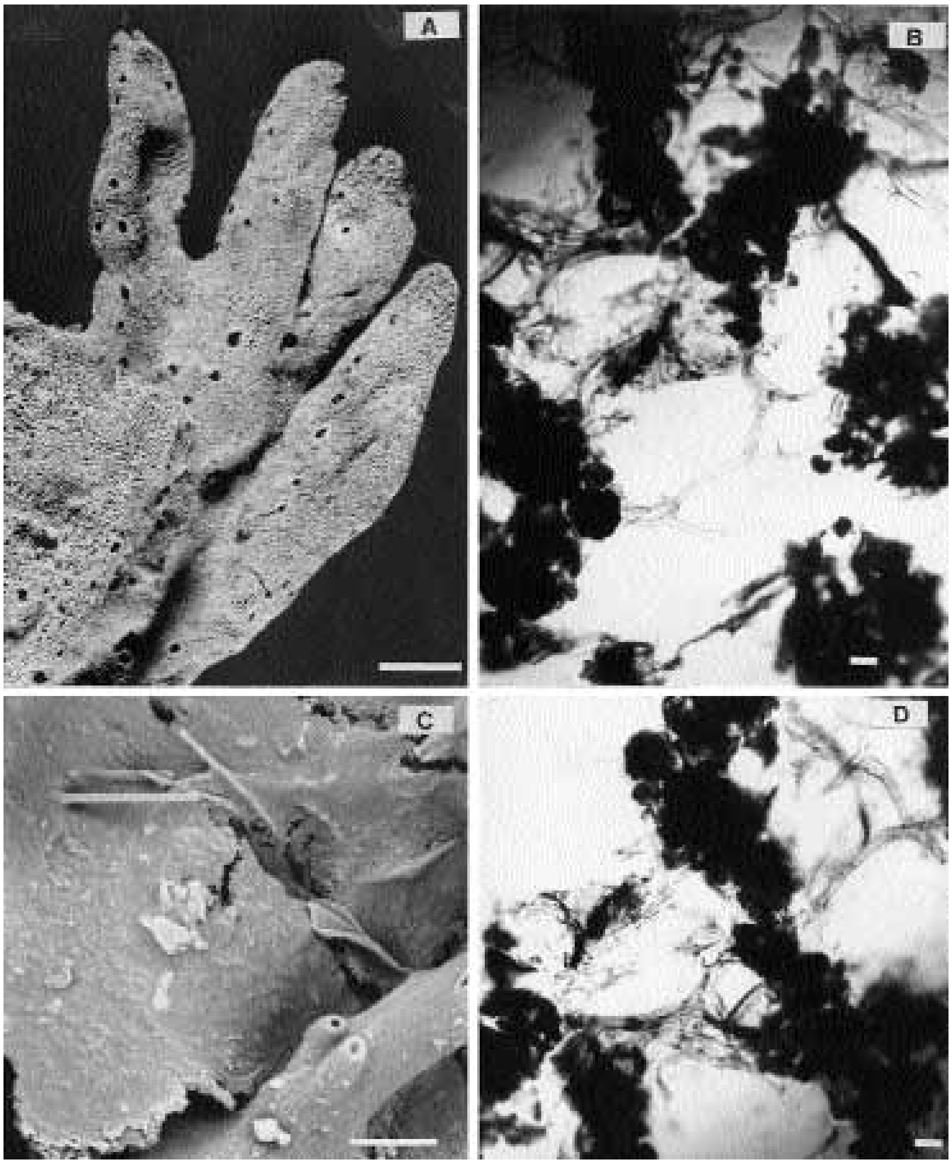

Fig. 8. *Dactylia chaliniformis* Carter, 1885. (lectotype BMNH 1886.12.15.196). A, lectotype. B, ectosomal irregular, fine network with rounded meshes, abundantly cored by foreign material. C, surface tangential view, even, minutely reticulated, tubuliform pores (scale 20 μm). D, choanosomal network with primary aspicular fibres, abundantly cored by sand and foreign spicules.

Remarks. De Laubenfels (1936a: 59) included *Dactylia* in Callyspongiidae based on the characters of its principal skeleton, despite the absence of spicules, and that it had a typical structure as 'belonging to one of the orders properly having spicules'. In addition, de Laubenfels synonyomised several genera ([*Chalinopsis*] Lendenfeld, 1886c (preocc. by *Chalinopsis* Schmidt, 1870), *Chalinopsilla* Lendenfeld, 1888, a replacement name for the preoccupied *Chalinopsis* Lendenfeld, *Paraspongia* Carter and *Psammoclema* Marshall) with *Dactylia*, of which only *Chalinopsilla* is now accepted in synonymy.

The genus has a tortuous taxonomic history. Lendenfeld (1888) described *Dactylia chaliniformis* as *Chalinopsilla arborea* var. *macropora* Duchassaing & Michelotti (sic), and var. *micropora* Carter (sic). To justify his changes he inferred the 'imitating power' of some of his new species. He considered *Chalinopsilla arborea* was able to include spicules taken from decayed specimens of the imitated species. Lendenfeld (1889a) also considered species of *Paraspongia* and *Psammoclema* as species of *Chalinopsilla*. Lendenfeld (1888, 1889a) assigned most of Carter's new species to his new form, to give new concepts to Carter's genera. Wiedenmayer (1989: 105) provided and extensive discussion of the taxonomic problems between these genera. Pulitzer-Finali (1981) transferred *Chalinopsilla arborea* Lendenfeld, 1888 to his recently described genus *Arenosclera*.

How then to correlate the presence of sand and foreign material with the absence of spicules? The absence of a strict definition of Callyspongiidae based on types of skeletons makes these characters very subjective. Bergquist & Warne (1980) considered *Dactylia* and *Chalinopsilla* as valid genera, based on the presence or absence of foreign material, respectively, however this discrimination is incorrect. *Chalinopsilla sensu* Bergquist & Warne, 1980, lacks foreign material, whereas Wiedenmayer (1989) showed that its type species, *Chalinopsilla dichotoma*, contains abundant foreign material, which we also confirm from re-examination of type material, especially in the primary fibres. Wiedenmayer (1989: 105) considered the presence or absence of spicules versus foreign material to be poorly correlated traits, with differences often only in abundance of foreign material coring the Callyspongiidae skeleton between taxa. Consequently, we consider that the absence of spicules and the presence of foreign material could be two independent characters to differentiate *Dactylia* from *Callyspongia* as there are different genera of *Callyspongia*-like sponges with spicules replaced by sand. We have conserved *Dactylia* Carter, 1885c (which has priority over *Chalinopsilla* Lendenfeld, 1886c), for these sponges which have lost spicules and replaced them, at least in the ascending primary fibres, by sand and other foreign material.

Distribution

Species of *Dactylia* are known from Australia (Carter, 1885c; Lendenfeld, 1886c, 1889a; Hooper & Wiedenmayer, 1994); West Indies (Van Soest, 1980); New Zealand (Lendenfeld, 1888; Bergquist & Warne, 1980).

SIPHONOCHALINA SCHMIDT, 1868

Synonymy

Siphonochalina Schmidt, 1868: 7. *Sclerochalina* Schmidt, 1868: 8. [*Siphonella*] Lendenfeld, 1887c: 808 (preoccupied). *Tubulodigitus* Carter, 1881b: 367.

Type species

Siphonochalina coriacea Schmidt, 1868 (by monotypy).

Definition

Callyspongiidae with an ectosomal network with one size of clearly defined mesh, unispicular fibres. Choanosomal, isolated, scarcely cored primary longitudinal fibres. Peripheral subectosomal condensation present.

Diagnosis

Tubular (Fig. 9A, B), solid, branching, creeping or erect growth form. Surface even, smooth, minutely reticulated and pierced by numerous ostia. Oscula unique, at the end of tubes and of the same diameter. Texture elastic, resistant. Ectosomal skeleton a fine irregular tangential network, triangular mesh, formed by unispicular fibres or single spicules. Subectosomal skeleton with ends of longitudinal fibres profusely divided and connected by short, secondary unispicular fibres, peripheral condensation. Choanosomal skeleton with isolated, parallel, strong longitudinal primary fibres with large spongin sheath. Connecting secondary fibres, parallel, regularly distributed. Spongin and spicules abundant.

Previous reviews

Schmidt (1868: 7), Ridley (1884a: 401), Topsent (1892a: 66; 1925a: 236; 1938b: 4) (as *Sclerochalina*), Van Soest (1980: 113), Wiedenmayer (1989: 104).

Description of type species

Siphonochalina coriacea Schmidt, 1868 (Fig. 9).

Synonymy. Schmidt 1868: 7; Topsent, 1927a [file card], figs 1–4.

Material examined. Holotype: MNHN LBIM DCL (Schmidt spec. 77) (fragment BMNH 1868.3.2.13) – La Calle, Algeria. Other material. Holotype (fragment) of *Siphonochalina typica* var. *levis* Lendenfeld, 1887c: AM G8976 (MNHN LBIM DCL2077) – Port Jackson, NSW, Australia. Holotype (fragment) of *Siphonochalina osculata* var. *macropora* Lendenfeld, 1887c: AM G8993 (MNHN LBIM DCL2082) – Western Australia. Holotype of *Siphonochalina axialis* Lendenfeld, 1887c: AM G unreg. (fragment MNHN LBIM DCL1956) – Port Jackson, NSW, Australia. Holotype of *Sclerochalina asterigena* Schmidt, 1868: MNHN LBIM DCL89/11 – Algeria. Neotype of *Tubulodigitus* (=*Siphonochalina*) *communis* Dendy, 1889: BMNH 1889.1.21.1. Specimen (Fig. 9B) and slide of *Siphonochalina (Tubulodigitus) communis* Cater, 1881b: BMNH 1881.10.21.338, 339a – H.M.S. 'Alert', Port Jackson. BMNH 1882.1.5.2 – Kurrachee.

Description. Tubular sponge (Fig. 9A), divided into several tubes from the basal part, with a large, interiorly smooth aquiferous cavity of uniform diameter, ending in a central oscule of the same diameter. Surface, smooth covered by a fine ectosomal network with numerous ostia. Texture fragile, resilient. Ectosomal skeleton (Fig. 9C) formed by fine, irregular network of unispicular fibres or single spicules. Longitudinal view of the surface (Fig. 9D) exhibits small peripheral condensed mesh of the subectosomal region, produced by terminal part of choanosomal fibres, abundantly ramified and by connecting fibres (Fig. 9D). Principal fibres paucispicular, 2–3 spicules, longitudinally divergent, with a large spongin sheath, 26–40 μm in diameter, connecting or secondary fibres, unispicular parallel, 12–20 μm or more in diameter, often of the same diameter as primary fibres. Spicules: slightly bent oxeas, 96–(111)–128× 3.5–(4)–4.5 μm in diameter.

Remarks. Topsent (1925a, 1927a, 1938b) redescribed, defined and erected new species of this genus originally created for a single briefly (but exactly) described species by Schmidt (1870). It has been included as a synonym of *Callyspongia* for a long time by authors (e.g., Burton, 1932b, 1934a; de Laubenfels, 1936a) who were not familiar with the type species. Based on Topsent's (1938b) descriptions of *Sclerochalina asterigena* Wiedenmayer (1977b: 91) considered 'peripheral condensation' of the main skeleton to be the main diagnostic criterion differentiating *Siphonochalina* from other callyspongiids. Dendy (1890a) described several West Indian species recognising the peripheral condensation of the ectosomal skeleton as a 'proliferation of new fibres between the old ones'. In spite of this statement he subsequently confused the genera *Siphonochalina*, *Callyspongia* and *Patuloscula* when placing some of the West Indian species (Dendy 1890a). At the same time he considered *Siphonochalina*, *Callyspongia* and *Spinosella* (pro *Cladochalina*) as genera exhibiting very similar morphologies that could result in a wrong identification and that peripheral condensation of the ectosomal skeleton is an important character to differentiate them.

Our study of type specimens showed clearly the different types of ectosomal skeletons in *Siphonochalina*, *Callyspongia (Callyspongia)* and *Callyspongia (Cladochalina)*. *Siphonochalina* (including the junior subjective synonyms *Sclerochalina*, *Siphonella* and *Tubulodigitus*) presents a dense ectosomal tangential network with small mesh, varying from triangular–rectangular to polygonal, which is in no way divisible into primary or secondary

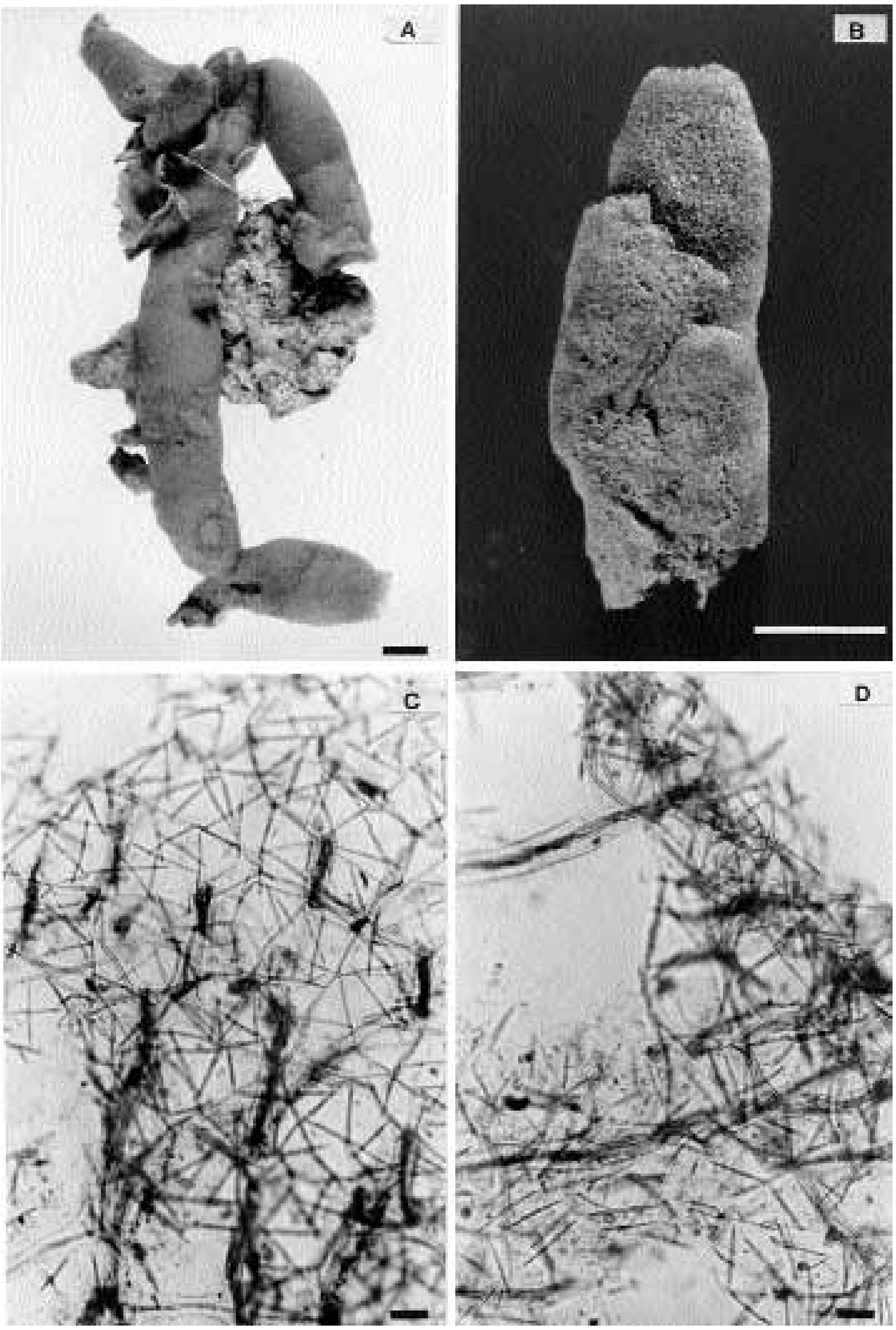

Fig. 9. *Siphonochalina coriacea* Schmidt, 1868 (holotype MNHN DT77). A, holotype. B, neotype of *Siphonochalina communis* Dendy, 1889. C, ectosomal skeleton formed by fine, irregular network of unispicular fibres or single spicules over choanosomal isolated, parallel, strong longitudinal primary fibres with large spongin sheath, longitudinal view. Connecting secondary fibres, parallel, regularly distributed. Spongin and spicules abundant. D, peripheral condensation occurring by proliferation of the subectosomal ends of parallel primary fibres, connected by fine unispicular fibres, smaller mesh.

mesh. Longitudinal section through the subectosomal region (Fig. 9D) shows a condensed region of rectangular small mesh and abundant, parallel secondary fibres, produced by ramification of subectosomal ends of primary longitudinal fibres, in contrast to the larger ectosomal polygonal meshes of *Callyspongia (Cladochalina)*. Primary longitudinal and connecting fibres of both genera are also different. In *Siphonochalina* primary fibres are parallel-radiating, non-fasciculated, abundantly ramified near the surface to form connecting fibres parallel to the surface, or badly differentiated fibres, replaced by single spicules. In *Callyspongia (Callyspongia)* and *Callyspongia (Cladochalina)* primary longitudinal and connecting fibres are well differentiated, fasciculated or non-fasciculated, forming regular, short connecting fibres and rectangular scalariform in *Callyspongia (Callyspongia)* or tangled, irregular meshes in *Callyspongia (Cladochalina)*. In addition, terminal ends of primary fibres in *Callyspongia (Cladochalina)* form conspicuous or inconspicuous conules. *Siphonochalina* exhibits a smooth, non-conulous surface.

Several nominal genera are included here in synonymy with *Siphonochalina* and require further comment. The inclusion of *Sclerochalina* Schmidt (type species *Sclerochalina asterigena* Schmidt, 1868, by monotypy) follows Topsent (1938b). [*Siphonella*] Lendenfeld (type species *Siphonochalina fortis* Ridley, 1881, by subsequent designation; Burton, 1934a: 540) is a junior homonym of *Siphonella* Macquart, 1835 (Diptera), [*Siphonella*] Issel, 1869 (Mollusca) and [*Siphonella*] Hagenow, 1850 (Polyzoa). The subsequent designation of *Siphonella communis* Lendenfeld, 1887c as the type species by Van Soest (1980: 118) is therefore invalid, who in any case included it in his monograph in a section of 'generic names of uncertain identity'. Wiedenmayer in Hooper & Wiedenmayer (1994: 88) synonymised it, without justification, with *Callyspongia* (following Wiedenmayer, 1989: 104). *Tubulodigitus* (type species *Tubulodigitus communis* Carter, 1881b, by monotypy) was referred to *Adocia* by Burton (1934a: 536), with the type specimen lost and Dendy's (1889: 81) specimen of *Siphonochalina communis* nominated as neotype. De Laubenfels (1936a: 59) considered that in this genus '*Callyspongia* and callyspongid tendencies are so pronounced that it would seem to be decidedly worthy of separate generic rank'. This opinion is not adopted here and *Tubulodigitus* is retained in synonymy with *Siphonochalina*.

Distribution. Coast of Algeria, East coast of Australia, Western Australia, New Zealand (Wiedenmayer in Hooper & Wiedenmayer, 1994), Gulf of Manaar, Kurrakhee (Carter, 1881b).