

Protosuberites denhartogi spec. nov., a new name for European '*Prosuberites epiphytum*' (Demospongiae, Hadromerida)

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The common NE Atlantic sponge species hitherto known under the name *Prosuberites epiphytum* (Lamarck, 1814), is differentiated from the South Australian type and other regional specimens. Spicule size and form, although generally similar, are subtly different. Australian *P. epiphytum* apparently persistently overgrow the thallus of algae, possibly as part of a symbiotic association, and this is not known for European specimens. In view of these facts and taking into account the disjunct distribution, it is proposed to assign the NE Atlantic populations to a new species. The genus *Prosuberites* has been restricted recently to species with single long tylostyles with heads embedded in a basal spongin plate, and both *P. epiphytum* and the new species do not conform to this definition. They are here assigned to *Protosuberites* Schwartzschewsky, 1905. The new species is named *Protosuberites denhartogi* spec. nov. in honour of J.C. den Hartog.

Introduction

The sponge species hitherto known under the name of *Prosuberites epiphytum* (Lamarck, 1814) is a common inhabitant of shallow-water hard substratum along the coasts of the North East Atlantic, including the Netherlands (Topsent, 1900, Arndt, 1935, Van Soest, 1977, Van Soest et al., 2000). It is a yellow, yellow-orange or pale brownish, persistently thin encrustation on the undersides of boulders, on barnacles and mussels, or on stipes of brown weeds in the lower intertidal and the shallow subtidal. Its consistency is compact and not easily damaged, which may distinguish it from other yellowish usually soft encrustations.

Similar sponges are reported from wide-ranging parts of the world oceans, e.g. Tasmania (Lamarck, 1814; Topsent, 1933), E Australia (Ridley, 1884), SW Africa (Uriz, 1988), Azores (Topsent, 1904), Mediterranean (Pulitzer-Finali, 1983), NW Atlantic (Hartman, 1964). Unambiguous tropical records appear to be lacking. Conveniently all these sponges were assigned the same name based on Ridley's (1884) and Topsent's (1933) opinions. A recent revision of the family Suberitidae in the framework of the 'Systema Porifera' project (Van Soest, 2002), emphasized that according to Topsent (1933) the original material of Lamarck's *Alcyonium epiphytum* originated from South Australia (Péron collection), and moreover it has a peculiar possibly obligatory relationship with a furoid? brown alga, overgrowing the thallus

to cover most or all its surface. There were also zooanthids and alcyonaceans epizoic on the sponge. Topsent's (l.c.) redescription of Lamarck's type material demonstrated that Lamarck's species is a probable senior synonym of *Ophlitaspongia fucoides* Bowerbank, 1876, described from Shark Bay, Western Australia, likewise overgrowing the thallus of furoid algae.

Although the NE Atlantic specimens may grow occasionally on the stipes of brown algae, they are not known to overgrow the algal thallus. There are no records from Europe of epizoic zoanthids or alcyonaceans. Tylostyles in European specimens, although possessing peculiar semiglobular tyles, appear to be shaped subtly dissimilar to those of *Alcyonium epiphytum*, and on the average are longer and thicker (see below). Combined with the apparent largely anti-tropical distribution and the considerable geographic gap between Australian and NE Atlantic waters, these facts make it very likely that there are more than one species involved in the alleged records of *Prosuberites epiphytum*. It is the purpose of this paper to provide a formal description of the NE Atlantic representatives as a species new to science, subtly different from Australian specimens.

The revision of Suberitidae (Van Soest, 2002), also demonstrated unambiguously that the genus *Prosuberites* cannot receive either the species *epiphytum* nor the new species described here, due to the characters of its type species *P. longispina*. These are Suberitidae with a basal plate of spongin from which rise single long (>2000 µm) tylostyles. *Alcyonium epiphytum* and our material described below differ substantially from this in lacking a clear spongin plate and possessing ectosomal brushes of tylostyles in addition to single or bundles of choanosomal tylostyles. They conform to *Protosuberites* Schwartzschewsky, 1905, as revived and newly defined by Van Soest (2002).

Materials and methods

Specimens studied for this study included one of the syntypes of *Alcyonium epiphytum* (MNHN DT3421), a slide of *Suberites epiphytum* sensu Ridley, 1884 (BMNH 1881.10.21.301), specimens from SW Netherlands incorporated in the ZMA collections labelled *Prosuberites epiphytum* (ZMA 03566, 04110, 04198, 04403, 04645, and 15009), two specimens from Roscoff, France (ZMA 04870, 04871), one specimen from Ireland (ZMA 04408), one specimen from Portugal (ZMA 05229, Molido, coll. R. Ates), and one from Cape Cod, U.S.A. likewise incorporated in the ZMA collection (ZMA 6189, coll. S. Zea) and similarly labelled. All specimens were studied from thick sections mounted in Canada balsam. Fragments of the types of *Alcyonium epiphytum* and the new species were boiled in concentrated nitric acid, the spicule residue was washed several times, and subsequently mounted on stubs for SEM observations.

Systematic description

Class Demospongiae

Order Hadromerida

Family Suberitidae

Genus *Protosuberites* Schwartzchewsky, 1905

Protosuberites denhartogi spec. nov.

Protosuberites epiphytum; Topsent, 1900: 178, pl. VI fig. 15; Arndt, 1935: 43, fig. 71; Borojevic et al., 1968: 9; Könnecker, 1973: 455; Van Soest, 1977: 266, fig. 2; Van Soest et al., 1981: 39; Durán & Solórzano, 1982: 52; Van Soest, 1983: 29; Huysman, 1983: 74, figs. 1-2; Ackers et al., 1992: 71, fig. 134; Breton et al., 1995: 13, fig. 3; Van Soest et al., 1999/2000 (CD-ROM).

Suberites epiphytum; Burton, 1957: 29.

(not: *Alcyonium epiphytum* Lamarck, 1814: 163; Topsent, 1933: 34, pl. III figs 2-3; *Suberites epiphytum* sensu Ridley, 1884: 465)

Material examined.— Holotype ZMA POR. 04403, Netherlands, Zierikzee, outside lock, 51.64°N 3.91°E, coll. R.W.M. van Soest & J.J. Vermeulen, 14.ix.1976, overgrowing barnacles and mussels, water temp. 16°C.

Paratypes: ZMA POR 03566, Netherlands, Wemeldinge, seawall, 51.52°N 4.02°E, coll. J.H. Stock, 30.viii.1971; 04110, Netherlands, Kanaal door Walcheren bij Vlissingen, 51.45°N 3.60°E, coll. S. Weinberg & J.J. Vermeulen, 19.viii.1976; 04198, Netherlands, Gat van Ouwerkerk, 51.66°N 3.89°E, 1 m depth, coll. R.W.M. van Soest & J. Vermeulen, 04.viii.1976; 04645, Netherlands, Den Osse, Grevelingen, 51.75°N 3.90°E, 6-10 m depth, coll. R.W.M. van Soest, 15.vii.1980; 15009, Netherlands, Wemeldinge, lock wall and harbour piles, 51.52°N 4.02°E, coll. R.W.M. van Soest, J. Vermeulen, & S. Weinberg, 18.viii.1976.

Additional material: ZMA POR. 04408, Ireland, Lough Hyne, 51.70°N 4.84°W, under stones, coll. R.W.M. van Soest, 04.x.1978; 04870, France, Bretagne, Roscoff, Ile Callot, 48.74°N 4.01°W, yellow, LLWS, coll. R.W.M. van Soest, 06.vi.1982.

Comparative material: *Protosuberites* aff. *epiphytum*, ZMA POR. 06189, U.S.A., Massachusetts, Cape Cod, Crab Ledge, approx. 41.72°N 70.03°W, orange yellow, on rocks, 31 m, coll. S. Zea, 19.vi.1985.

Description.— Colour: Pale brown or yellow, occasionally orangish.

Shape, size, surface and consistency: Very thin sheets, usually less than 2 mm. Surface even, smooth, slightly hispid. Subsurface canal patterns visible in some specimens. Apertures not apparent if canal patterns are absent. Contraction slight, accompanied by closure of canals. Consistency compact.

Skeleton: In very thin specimens, the skeleton consists of tylostyles arranged perpendicularly to the substrate, with the heads directed to the substrate and sometimes touching it. In thicker specimens the basal spicules are overlain by spicule bundles that anastomose and may run either perpendicular or parallel to the substrate. Individual bundles are closely adjacent and may be not easily differentiated. Overall spicule density high (causing the sponge to be compact). At the surface the spicule bundles usually support projecting tufts of spicules (causing the hispid appearance).

Spicules: The megascleres are tylostyles, considerably variable but overlapping in size, without distinct size categories, 110-258.7-456 × 4-6.3-11 µm in the holotype, but occasionally spicules may be up to 600 × 12 µm (Ackers et al., 1992). There is no consistent relation between length and width (width is measured just beneath the head). The shafts are usually curved. The curvature occurs about one quarter to one third the

length of the shaft from the head and is sometimes pronounced. The shaft tapers gradually to a sharp point in the distal half to one third of its length. The tyle is characteristically squat, i.e. wider than high, and then is terminal; however, more commonplace tylostyles with more elongate tyles, also occur frequently. Thinner spicules often exhibit a smaller additional swelling immediately adjacent to the head, but this is not characteristic as it occurs frequently in other suberitids. Microscleres are absent.

Ecology.— On mussels, barnacles, occasionally on hydroids, on undersides of boulders, and holdfasts of algae. Specimens tend to be small and cryptic. Depth from LLWS to ca. 12 m, possibly occurring also in deeper water.

Distribution.— Common in the Netherlands, especially in the Oosterschelde area



Fig. 1. *Protosuberites denhartogi* spec. nov., left: two representative spicules (scale bar 100 μm) and a detail of the head (scale bar 10 μm), right: in situ photo from Grevelingen estuary, SW Netherlands.

(Huysman, 1983). North Sea coast, south and west coasts of British Isles, west coasts of France. Solórzano (1991) summarizes records of the species from Galicia without descriptive information; however, the ZMA collection holds a specimen from Portugal (Molido), which appears to conform to *S. denhartogi* spec. nov., thus confirming the occurrence on the Atlantic coasts of the Iberian Peninsula.

Etymology.— We dedicate this species to our much valued friend and colleague Koos den Hartog, who died much too soon, in recognition of his great contributions to Dutch marine (in)vertebrate zoology, and in fond remembrance of the wonderful field trips we shared.

Remarks

The species is re-assigned to *Protosuberites* on the basis of the presence of peripheral tufts of spicules, which are absent in *Prosuberites*. The present material represents a new species, because *P. epiphytum*, as it was previously known, is restricted to Australian waters (as *Alcyonium epiphytum* Lamarck, 1814, and *Ophlitaspongia fucoides* Bowerbank, 1876). The tylostyles in the type specimen (MNHN DT3421) measure 90-179.7-270 × 2.5-4.1-6 µm, are similar in shape and curvature, but do not reach the upper length range of *P. denhartogi* spec. nov. (456-600 µm). The tyles in *P. epiphytum* are subtly more flattened and more distinctly set-off from the shaft than those of our new species. Nevertheless, it is obvious that the two are closely related morphologically.

Hymedesmia simplicima Bowerbank (1874: 253, pl. LXXX fig.1) from Shetland has been suggested as a synonym of *Prosuberites epiphytum*, and if so then would be the senior name of the present species. However, Bowerbank's description of the structure of the skeleton and his drawing of the arrangement of the spicules is very different from the above redescription of the type and paratypes of *Protosuberites denhartogi* spec. nov., and, importantly, the spicules as measured from the drawing are 600-650 µm, considerably longer than the longest spicules in our material of *P. denhartogi* spec. nov. Burton (1930) and Arndt (1935) assigned *simplicima* to *Pseudosuberites*, and their decision is followed here.

Ridley's (1884) specimen, described as *Suberites epiphytum* from Port Curtis (now Gladstone), Queensland, overgrew a *Tubularia* which in turn grew on a crab. Ridley (l.c.) described (but did not figure) the shape of the tylostyle heads as 'transversely elongated', meaning to indicate the relatively flattened tyles. We re-examined Ridley's material (BMNH 1881.10.21.301) and discovered that most tylostyles have quadrilobate flattened tyles, characteristic for the genus *Terpios*. The arrangement of the spicules into loose plumose bundles also concurs with the definition of that genus. It is quite possibly a specimen belonging to the species *Terpios cruciatus* (Dendy, 1905, as *Suberites*) reported from Indo-West Pacific tropical localities.

Topsent (1888: 150; 1889: 113) mistook this species for *Hymeniacion sulphurea* Bowerbank, 1866 (now *Pseudosuberites sulphurea*), but later assigned it to *Prosuberites epiphytum* claiming a worldwide distribution for this species. Topsent's (1889, as *Suberites sulphurea*) Mexican Caribbean record of the species may belong to either *Terpios* - species of which may possess tylostyles with flattened tyles (cf. Rützler & Smith, 1993) - or possibly to *Protosuberites*. The Mexican (Banc de Campêche) specimen was mentioned several times (Topsent, 1889, 1894, 1896, 1900) but he never properly described it. Topsent (1900: 182)

gives the size of the tylostyles as 100-270 x 4-8 μm . We examined a spicule slide which possibly belongs to this specimen (MNHN DT 1847, labeled as *Suberites suberea*, possibly a misprint for *Suberites sulphurea*) and can confirm the spicules sizes as well as the relatively thick shafts. The spicules are similar to *P. epiphytum*, but appear thinner. They do not reach the upper size of *P. denhartogi* spec. nov. (380-600 μm).

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