BULLETIN DE L'INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE,
BULLETIN VAN HET KONINKLIJK BELGISCH INSTITUUT VOOR NATUURWETENSCHAPPEN,
BIOLOGIE, **66** suppl. : 123-133, 1996
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A toxic *Biemna* from Madagascar (Demospongiae : Poecilosclerida)

by John N.A. HOOPER

Abstract

A new species of toxic marine sponge, *Biemna laboutei* sp. nov., belonging to the order Poecilosclerida, family Desmacellidae, is described from the outer-reef slope of Nosy-Be, Madagascar. The species is the sixth known desmacellid to have toxic (dermatitis-producing) properties. It is compared with other desmacellids from the Indian Ocean region.
Keywords : Porifera, Demospongiae, Poecilosclerida, Desmacellidae, *Biemna*, new species, Madagascar, Indian Ocean, taxonomy, toxic sponge.

Résumé

Une nouvelle espèce d'éponge marine de la pente récifale externe de Nosy-Bé, Madagascar, *Biemna laboutei* sp. nov. appartenant au groupe des Poecilosclerida, famille Desmacellidae, est décrite. Cette espèce est la sixième desmacellide qui présente des propriétés toxiques (dermatites). La comparaison est faite avec d'autres desmacellides de l'Océan Indien.
Mots-clés : Porifera, Demospongiae, Poecilosclerida, Desmacellidae, *Biemna*, nouvelle espèce, Madagascar, Océan Indien, taxonomie, éponge toxique.

Introduction

Several marine sponges are now well known to produce a toxic dermatitis reaction (SOUTHCOTT, 1987), and most of these belong to the genera *Neofibularia* and *Biemna* (family Desmacellidae). So far most of these species with confirmed toxicity are described from the Australasian region (HARTMAN, 1967; WILKINSON, 1978; HOOPER *et al.*, 1991; HOOPER & LÉVI, 1993), with only one from the western tropical Atlantic (HARTMAN, 1967). The present paper provides a description of another toxic sponge from NW Madagascar, western Indian Ocean, and compares the species to others from this region. Until the present discovery 11 *Biemna* were known from the western Indian Ocean (Table 2), although none of these have documented instances of producing a toxic reaction in humans.
Sponges were collected by SCUBA and photographed *in situ*. Methods of spicule preparation for light and scanning electron microscopy are described elsewhere (HOOPER, 1991). Abbreviations used in the text : BMNH, Natural History Museum, London; MNHN, Muséum National d'Histoire Naturelle, Paris; QM, Queensland Museum, Brisbane; SMF, Natur-Museum und Forschungsinstitut Senckenberg, Frankfurt. Type material examined in this study is listed in Table 2.

Systematics

Family **Desmacellidae** RIDLEY & DENDY
Genus ***Biemna*** GRAY

Biemna laboutei sp. nov.
(Figs 1-3, Tables 1-2)

TYPE MATERIAL

Holotype - QMG304830 : Banc de 5 m, Nosy-Be, Madagascar, 12°40'S, 48°30'E, 20 m depth, coll. P. LABOUTE.
Paratype - QMG304831 : Grand Banc de l'Entrée, 16 km from mainland, Nosy-Be, Madagascar, 35 m depth, coll. P. LABOUTE.

OTHER MATERIAL

QMG304500 : Grand Banc de l'Entrée, 16 km from mainland, Nosy-Be, Madagascar, 40 m depth, coll. P. LABOUTE.

ECOLOGY

Relatively restricted known habitat, on the outer reef slope off Nosy-Be, 20-40 m depth, in an area of relatively strong tidal currents, mostly attached to dead corals or boulders, in association with *Dendronepthya*, *Halimeda* beds and other sponges. The species is also known to live in a sand zone, 20-30 m depth, off Ambatoloaka Beach, on sand and rubble substrata, where it is more common, grows to a larger size, and is paler in colour.

A

B

Fig. 1. - *Biemna laboutei* sp. nov. *in situ*. A, paratype QMG304831; B, holotype QMG304830 (photographs P. LABOUTE).

DISTRIBUTION

Known only from NW coast of Madagascar.

DESCRIPTION

Shape and surface features

Erect, clumped, arborescent, tubulo-digitate growth form, up to 130 mm high, 150 mm breadth, 300 mm long, growing more or less in one plane; sponge attached to substrate by expanded basal plate, up to 28 mm wide, 10 mm thick, incorporating coralline debris; with short, cylindrical basal stalk, 10-35 mm long, 8-10 mm diameter, producing dichotomously branched, cylindrical tubular digits, 55-95 mm long, 5-17 mm diameter at base, 25-30 mm diameter at apex; each tubular digit bulbous, tapering, constricted at base and swollen at apex, bifurcating at least 2 times; apex of digits flat, chiselled on top, with 1 or 2 pointed conules on apex of each digit, each with a single terminal oscule. Surface glabrous, not porous, with prominent subectosomal drainage canals running longitudinally along all sides of digits, and entire length of each digit, ascending to apex of digit and opening into terminal oscule; in life drainage canals visible through surface, covered by opaque ectosomal membrane; in preserved state subectosomal canals contracted forming deep longitudinal grooves and ridges, with transparent ectosomal membrane collapsed on surface and stretched across adjacent ridges; grooves up to 5 mm wide, ridges up to 6 mm high; surface of ridges with low, irregular conules producing a 'goose-flesh' surface.

Oscules

Relatively small, 1.5-4 mm diameter when preserved, terminal on apex of branches, surmounted on pointed conules and with slightly raised, membranaceous lips.

Colour

Nosy-Be specimens pale orange-brown alive (Munsell 7.5YR 8/6-7/10), pale brown in ethanol; Ambatoloaka Beach specimens paler, white to beige alive. No documentation available on colour changes in formaldehyde.

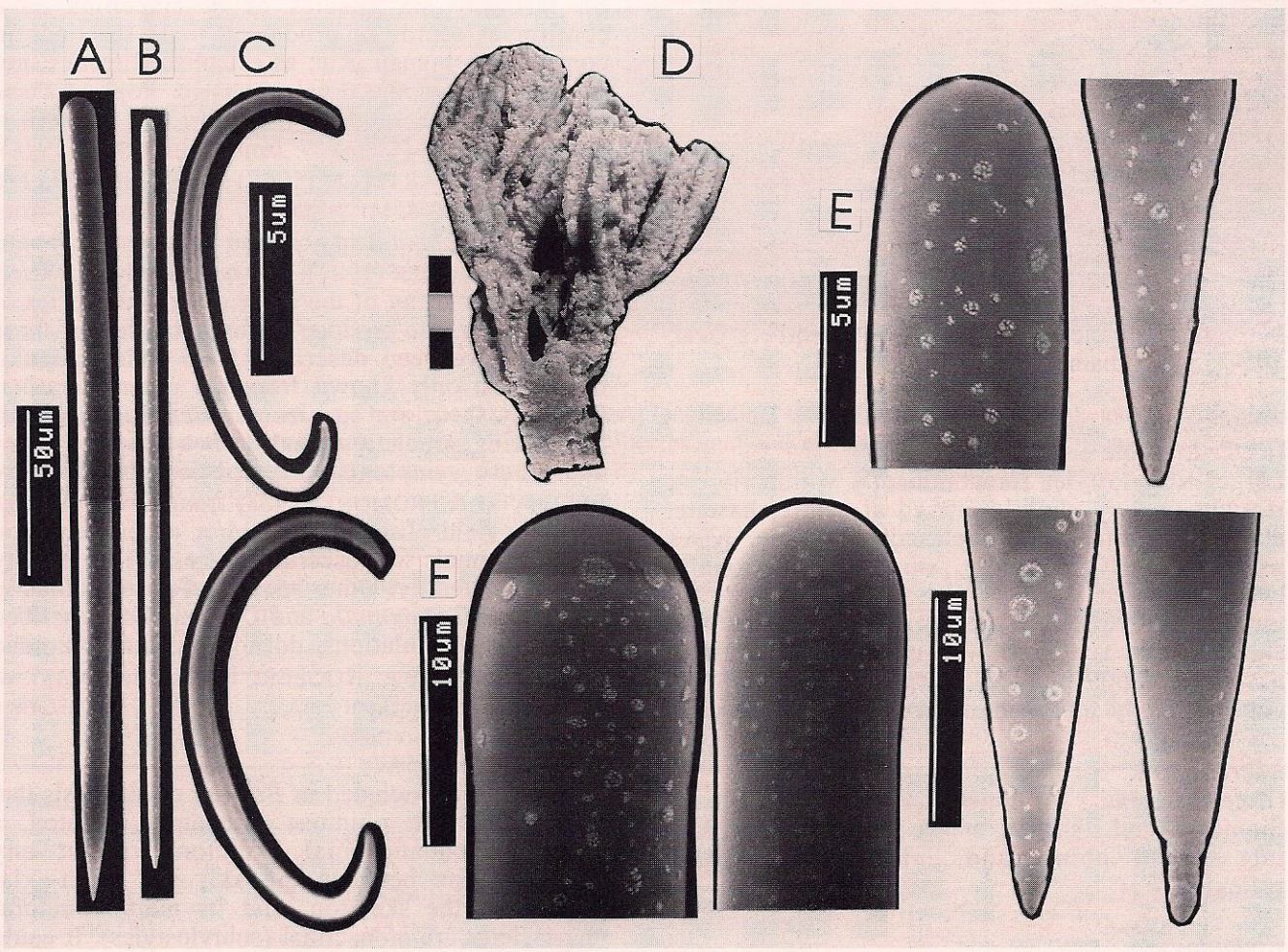

Fig. 2. - *Biemna laboutei* sp. nov. holotype QMG304830. A, larger (choanosomal) subtylostyles; B, smaller (ectosomal, interstitial) subtylostyles; C, sigmas; D, holotype preserved (bar length 30 mm); E, rounded base and faintly telescoped point of smaller subtylostyle; F, subtylote and rounded bases and telescoped points of larger subtylostyles.

Texture
Compressible, elastic, rubbery, difficult to tear.

Ectosome and subectosome
Erect, plumose brushes of smaller subtylostyles forming sparse, discontinuous palisade on surface; spicule brushes arise from terminal spongin fibres and spicule tracts, protruding slightly through surface; each ectosomal spicule brush containing 2-4 larger choanosomal subtylostyles, also protruding through surface; subectosomal skeleton irregularly reticulate, with cavernous meshes and choanosomal spicule tracts diverging and becoming more plumose near periphery.

Choanosome
Irregularly sub-renieroid reticulate skeletal structure, with heavy, widely spaced spongin fibres, producing rectangular or oval meshes; fibres differentiated into primary and secondary components; primary fibres 70-140 μm diameter, ascending, multispicular, cored by 5-12 larger subtylostyles, occupying approximately 70% of fibre diameter; secondary connecting fibres 20-60 μm diameter, transverse, uni- or paucispicular, with 1-4 spicules per tract occupying only about 50% of fibre diameter; fibres more heavily invested in collagen at core than in peripheral skeleton; fibre anastomoses vaguely sub-renieroid, relatively close meshed in central region of choanosome, meshes 90-220 μm diameter, more cavernous, plumoreticulate near periphery, meshes 180-330 μm diameter; many smaller subtylostyles (including raphidiform examples) scattered throughout mesohyl between fibres and sometimes surrounding (but external to) spongin fibres; collagen abundant but lightly pigmented; choanocyte chambers oval, 105-235 μm diameter.

Megascleres
(Refer to Table 1 for dimensions).
Larger subtylostyles (predominantly within fibres), straight or very slightly curved at centre, hastate, abruptly pointed, often telescoped points, bases usually faintly subtylote, smooth, occasionally evenly rounded.
Smaller subtylostyles (predominantly in ectosomal skeleton and scattered within mesohyl) straight, hastate, abruptly pointed, sharply pointed or telescoped, slightly subtylote or evenly rounded bases.

Microscleres
(Refer to Table 1 for dimensions).
Sigmas c- and s-shaped, small, very thin, with hastate abrupt points and only small terminal reflexion.

Etymology
Named for the collector, M. Pierre LABOUTE, eminent ORSTOM marine biologist, naturalist and photographer.

Toxicological remarks
Live specimens of this species produce a mild stinging reaction when in contact with human skin (P. LABOUTE, pers. comm.). The species also has significant pharmacological activity of commercial interest (J. VACELET, pers. comm.), although this chemical activity has not yet been published, nor is it certain nether observed toxicity is wholly related to sponge metabolites or due to some contribution from microbial symbiosis. Several toxicological studies on *Biemna* have discovered a diversity of novel compounds in species, some with substantial bio-active properties. DELSETH *et al.* (1979) and ZENG *et al.* (1993a) discovered several unconventional sterols and ZENG *et al.* (1993b) found two polycyclic aromatic alkaloids, all exhibiting cytotoxicity against human epidermoid carcinoma and murine lymphoma cells *in vitro*. ISHIBASHI *et al.* (1993) isolated a bioactive glycolipid with derivatives of keruffaride from several unrelated species of marine sponges from Okinawa, including a species of *Biemna*, suggesting the possibility of at least some toxicity due to microbial interaction, but this has yet to be empirically demonstrated.

So far only six species of desmacellids have confirmed records of producing toxic reactions in contact with human skin, as established from experimental and/or anecdotal evidence. Four of these species belong to *Neofibularia* (*N. hartmani* HOOPER & LÉVI (1993), *N. irata* WILKINSON (1978), *N. mordens* HARTMAN (1967) and *N. nolitangere* (DUCHASSAING & MICHELOTTI, 1864), and two from *Biemna* (*B. laboutei* sp.nov. and *B. saucia* HOOPER, CAPON & HODDER (1991). It is quite likely, however, that some or many of the other described species of *Biemna* may also produce erythma, but few of these species have been described from living populations, most only known from the older literature. Certainly there are species of *Biemna* described from living populations that do not apparently produce these symptoms (e.g. species described by BERGQUIST & FROMONT (1988) from New Zealand), but only field observations and/or experimentation on live animals will ascertain the extent of toxicity within this family. Other species of desmacellids in the genera *Sigmaxinella* and *Desmacella*, described from living populations, do not have any recorded toxicity so far (e.g. HOOPER, 1984; BERGQUIST & FROMONT, 1988).

Taxonomic remarks
This species is included in *Biemna* on the basis that it has an erect, plumose ectosomal skeleton, a reticulate choanosomal skeleton without any differentiation between the axis and extra-axial regions of the skeleton, and its main structural megascleres are monactinal (subtylostyles). It could be argued for its inclusion in *Neofibularia* due to the presence of heavy spongin fibres and a choanosomal skeleton verging on isodictyal - reti

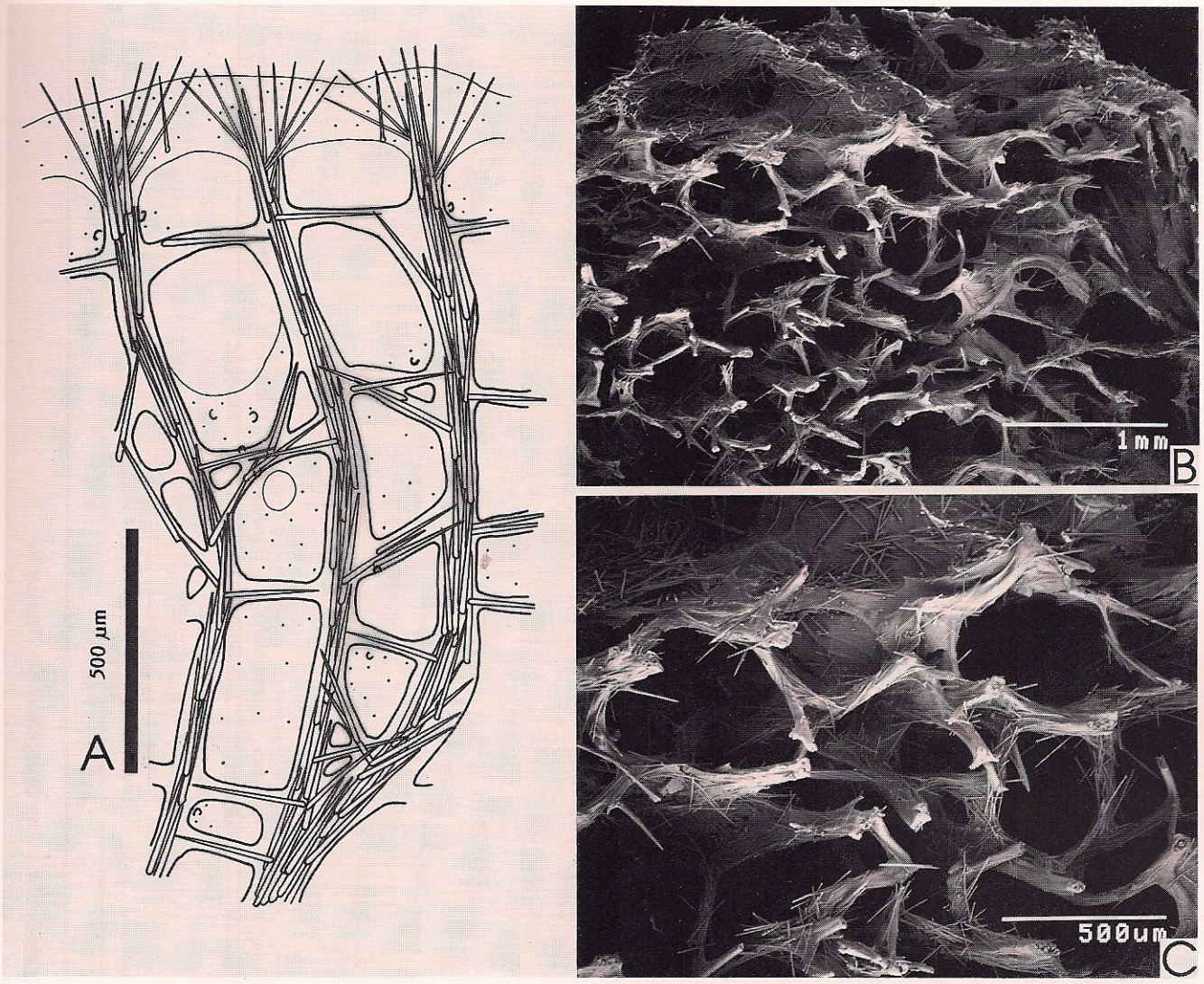

Fig. 3. - *Biemna laboutei* sp. nov. holotype QMG304830. A, longitudinal section through peripheral skeleton; B, transverse section through branch showing cavernous subectosomal and choanosomal meshes; C, fibre characteristics, showing longitudinal, ascending fibres cored by larger subtylostyles, surrounded on their exterior by smaller subtylostyles.

Table 1 :
Comparative spicule dimensions for specimens of *Biemna laboutei* sp. nov. All measurements are given in micrometres, based on 25 examples of each spicule type, and denoted as range (and mean) of lengths (L) and widths (W).

SPICULE		Holotype QMG304830	Paratype QMG304831	Specimen QMG304500
Styles I :	(L)	142-(224.2)-281	172-(234.7)-284	249-(268.3)-285
	(W)	6-(8.9)-13	7-(8.6)-11	6-(9.6)-13
Styles II :	(L)	137-(204.1)-242	171-(226.4)-273	213-(254.8)-316
	(W)	2.5-(4.1)-7	1.5-(3.6)-6	3-(4.4)-7
Sigmas :	(L)	10-(12.6)-15	11-(12.8)-15	12-(13.9)-16
	(W)	0.8-(0.9)-1.5	0.8-(1.0)-1.5	0.5-(0.8)-1.5

Table 2 :
Comparison in spiculation between new and known species of *Biemna* found in the Indian Ocean and Indo-Malay regions. All measurements are given in micrometres, and denoted as range of length x width. Species are cited from material indicated or otherwise taken from the literature where not.

CHARACTER	*B. aruensis* HENTSCHEL (1912 : 352)	*B. anisotoxa* LÉVI (1963 : 18)	*B. bihamigera* (DENDY) (1922 : 112)	*B. ciocalyptoides* (1) sensu BURTON (1959 : 227)	*B. democratica* SOLLAS (1902 : 213)	*B. fistulosa* (TOPSENT) (1897 : 462)	*B. fortis* TOPSENT (1897 : 463)	*B. fragilis* KIESCHNICK (1898 : 53)	*B. humilis* THIELE (1903 : 944)	*B. laboutei* sp. nov.	*B. liposphaera* HENTSCHEL (1912 : 352)
Styles I :	365-688x10-16	300-350x6-10	640-1400x15-50	900x32	180-260x2-6	270-330x8-12	939-1416x20-47	400-500x29-40	220-250x5-8	142-285x6-13	410-625x8-18
II :	58-240x2-4.5	-	-	-	-	-	200-27x1-5	-	-	137-316x1.5-7	-
Sigmas I :	-	35-40	50-52x3	52-75	80x3	58-60x2	90-112x4-6	90	-	-	70-240x2-4
II :	-	18-22	-	-	-	-	20-40	-	20-26x1	-	40-65x1-3
III :	-	10	15-18	12-20	10x1	15-25x1	10-12	-	-	10-16	10-27x1-1.5
Raphides	95-190	115-130x1	-	160	-	110-120	140-160	200-300	36-45	-	168-219
Microxeas I :	-	55-68x2	-	160x4	-	105-165x2-3	30-40x1-2	-	-	-	52-158x1-1.5
II :	-	-	-	-	-	30-33x1.5	-	-	-	-	-
Toxas	-	35-60x1	-	-	-	-	-	90-100	-	-	-
Spheres	-	-	-	-	-	-	-	-	-		-
Commas	-	-	-	-	-	30	-	-	-	-	-
Micro-strongyles	-	-	-	-	-	-	-	-	-	-	-
Locality	E Indonesia	South Africa	Providence, Aldabra, Madagascar	Red Sea	Malay Peninsula	E Indonesia Mombasa, Zanzibar, Shimoni	Indo-Malay Archipelago, NW India, Red Sea, Mombasa	E Indonesia	E Indonesia, Zanzibar, Shimoni	Madagascar	E Indonesia
Material	holotype SMF958	holotype MNHNDCL578	-	-	-	-	holotype SMF1054	-	-	holotype QMG304830	holotype SMF960T

(1) A junior homonym of *Biemna ciocalyptoides* (DENDY, 1897), possibly conspecific with *B. seychellensis* THOMAS.

Table 2 : continued

CHARACTER	*B. megalosigma* HENTSCHEL (1912 : 351)	*B. microstrongyla* (HENTSCHEL) (1912 : 354)	*B. microxa* (2) HENTSCHEL (1911 : 316)	*B. pedonculata* LÉVI (1963 : 18)	*B. polyphylla* LÉVI (1963 : 18)	*B. saucia* HOOPER *et al.* (1991 : 28)	*B. seychellensis* THOMAS (1973 : 39)	*B. sigmodragma* LÉVI (1963 : 18)	*B. trirhaphis* (TOPSENT) (1897 : 461)	*B. truncata* HENTSCHEL (1912 : 353)	*B. tubulata* (DENDY) (1905 : 155)	*Biemna sp.* HENTSCHEL (1912 : 352)
Styles I :	555-719x12-25	336-496x7-22	216-288x4-6	350-550x30-50	450-550x35-45	522-764x15-29	452-849x8-21	650-800x15-30	280-500x9-18	272-304x4-6	280-302x5-6	528-632x8-10
II :	-	-	-	-	-	326-684x3-12	-	-	-	-	-	-
Sigmas I :	75-222x2-5	-	-	80-95x8-9	130-160x6-9	53-208x2.5-8	50-63x4	200-210x8	60-100x3	-	-	-
II :	30-52x1-3	-	-	18-20	18-20	22-45x1.5-4	21-29	30-85x2-5	35-45x2	50-60	16-32	35
III :	19-25x0.5-1	9-10	-	9-10	9-10	8-25x0.5-1.5	-	10-11	18-21x1	-	-	-
Raphides	156-211	160-240	25	100-130	100-110x1	140-244x0.2-1	28-48	110-120	80	-	20-109	80-32
Microxeas I :	49-122x1-2	40-60	65-77x1	50-65	35-55	62-125x1.5-4	40-48x1	30x1	75-170	-	50-71x2-4	-
II :	-	-	-	-	-	25-58x1.5-3	-	-	25-35	-	-	-
Toxas	-	-	-	-	-	-	-	-	-	-	29-32	-
Spheres	9	-	-	-	-	-	-	-	-	-	-	-
Commas	-	-	-	-	-	-	14	-	12	-	-	-
Microstrongyles	-	12.5-14x4-6	-	-	-	-	-	-	-	-	-	-
Locality	E Indonesia	E Indonesia, Mombasa	W Australia	South Africa	South Africa	NW Indian Ocean	Seychelles	South Africa	E Indonesia, Red Sea, Mombasa, Zanzibar	E Indonesia, Sri Lanka, Seychelles	Sri Lanka, Andaman Sea, NW India, Providence, Seychelles	E Indonesia
Material	holotype SMF1056	holotype SMF988	-	holotype MNHNDCL577	holotype MNHNDCL580	holotype NTMZ2644	-	holotype MNHNDCL579	-	Syntype SMF1540	holotype BMNH1907. 2.153	-

(2) HOOPER *et al.* (1991) suggested that this species might be a synonym of *Biemna tubulata* (DENDY) from Sri Lanka, but this has not yet been substantiated.

culate (whereas most *Biemna* have relatively poorly developed spongin fibres and a predominantly plumoreticulate skeletal structure; BERGQUIST & FROMONT, 1988; HOOPER & LÉVI, 1993). However, all four species of *Neofibularia* have heavy, membranaceous collagenous ectosomes, tangential ectosomal skeletons, characteristically smooth, slimy surfaces (producing varying amounts of mucus), and predominantly diactinal megascleres (strongyles, oxeas) (HOOPER *et al.*, 1991). In megasclere geometry *Neofibularia* and *Biemna* are easily differentiated, and in skeletal structure *Neofibularia* is relatively consistent, but species of *Biemna* show a much greater range of skeletal patterns spanning the continuum from halichondroid-reticulate (e.g. *B. fortis* (TOPSENT), sub-renieroid reticulate (e.g. *B. laboutei*), plumose (e.g. *B. 'ciocalyptoides'* BURTON), to hymedesmoid (e.g. *B. democratica* (SOLLAS). HOOPER *et al.* (1991) noted that several desmacellid genera are currently differentiated predominantly by their skeletal architecture (e.g. *Sigmaxinella* with a compressed reticulate axis and plumose extra-axial skeleton, *Desmacella* with vaguely halichondroid arrangement). But this differentiation is probably not straightforward, based as it is on this single, probably unreliable feature.

There are only three other species of *Biemna* in the Indo-Pacific system that have a relatively depauperate spiculation, in comparison to other desmacellids, consisting of only one category of microscleres (viz. sigmas) : *B. truncata* HENTSCHEL, *Biemna bihamigera* (DENDY) and *B. democratica* SOLLAS.

Biemna truncata (recorded from Aru I., Indonesia (HENTSCHEL, 1912), Sri Lanka (BURTON, 1930) and the Seychelles (THOMAS, 1973), is a massive (non-tubular) species, with irregularly lobate surface projections, particularly at the base of the sponge into which are embedded numerous foreign particles. Oscules are small and not confined to any particular area of the surface. It is fragile, porous, has a prominently conulose, shaggy surface. The ectosomal skeleton is plumose (at the ends of surface conules), or tangential or absent between conules, and there are no differences between ectosomal and choanosomal megascleres. Choanosomal skeletal structure is plumoreticulate, where spongin fibres are well developed and form a more-or-less even reticulation whereas coring megascleres form plumose, multispicular, ascending tracts and paucispicular, transverse, interconnecting tracts. Megascleres are distinctive tylostrongyles of a single homogeneous size class, with prominent subtylote bases and evenly rounded points. Microscleres are c- and s-shaped sigmas (Table 2).

Biemna bihamigera (from Providence Reef (DENDY, 1922), Aldabra (LÉVI, 1961) and Shimoni, East Africa (PULITZER-FINALI, 1993), is an amorphous, massive or encrusting sponge with an irregular, hispid surface, oscules grouped near the apex of the sponge, and compressible, friable texture. Ectosome is detachable with a paratangential layer of choanosomal spicules, and the choanosomal skeleton is vaguely plumoreticulate with columns of very long styles radiating towards the surface, protruding through the surface for a long distance. Styles are extremely long (comparable to those of *B. fortis*), of a single size class, curved and tapering towards the basal end, with evenly rounded (non-tylote) bases and hastate (abruptly) pointed ends. Sigmas are c- and s-shaped, extremely abundant, and divided into two size classes (Table 2).

Biemna democratica (from the Straits of Malacca; SOLLAS, 1902), is a thinly encrusting, lamellate species with shaggy surface. Megascleres are rhabdose tylostyles, often polytylote. These are approximately the same size range as found in *B. laboutei* (both of which are substantially shorter than those of *B. bihamigera*; Table 2), but their geometry is quite different. Skeletal structure was not described by SOLLAS (1902), but is probably typical for thinly encrusting sponges (i.e. hymedesmoid). Microscleres are sigmas of two sizes.

The other known toxic *Biemna, B. saucia* from the NE Indian Ocean (HOOPER *et al.*, 1991), also has a predominantly reticulate skeleton, atypical of most species, and HOOPER & LÉVI (1993) suggest that this feature may be ancestral for the genus and shared with *Neofibularia* (i.e. both these toxic *Biemna* are more primitive than other species). *Biemna laboutei* differs substantially from *B. saucia* in growth form, spicule geometry and spicule sizes (Table 2). The present species also differs from most other described *Biemna* in having two categories of subtylostyles, the thinner ones located at the surface and the thicker ones forming the main skeletal tracts. Two size classes of styles are also recorded for *B. saucia* and *B. aruensis* but these are not localised to any particular region of the skeleton as in *B. laboutei*.

There are several other species of *Biemna* also known to live in the western and central Indian Ocean regions. These are compared with *B. laboutei* as follows. Comparative spicule sizes are given in Table 2. Further comparisons with other Indo-west Pacific and southwest Pacific desmacellids are given in HOOPER (1984), BERGQUIST & FROMONT (1988), HOOPER *et al.* (1991) and HOOPER & LÉVI (1993).

Biemna anisotoxa LÉVI, from South Africa (LÉVI, 1963) is massive, yellowish, with an even surface, firm but friable texture. Ectosome with styles barely protruding, and choanosomal skeleton is cavernous, plumoreticulate, with ascending bundles of styles. Megascleres are styles slightly curved at their midsection, lacking subtylote bases, fusiform, sharply pointed. Microscleres are diverse consisting of three size classes of sigmas, raphides, microxeas, and sinuous toxas (described as 'microstyles').

Biemna ciocalyptoides sensu BURTON, from the Red Sea (BURTON, 1959) and Seychelles (VAN SOEST, 1994) [which is a junior homonym of *B. ciocalyptoides* (DENDY, 1897) from southern Australia, and either requires a new name or is possibly an aberrant specimen of *B. seychellensis* THOMAS (see below)], is massive with prominent surface conules each of which is distinctly shaggy (reminiscent of *B. saucia*), and a fragile, compressible texture. Ectosome with choanosomal styles protruding, and choanosomal skeleton with irregular, plumose to plumoreticulate tracts of styles. Megascleres are styles slightly curved near the basal end, sharply pointed, fusiform, with rounded or faintly subtylote bases. Microscleres are sigmas of two size classes, microxeas and raphides, the latter forming long plumose dragmata.

Biemna seychellensis THOMAS, from the Seychelles Is (THOMAS, 1973), originally described as a variety of the N Atlantic *B. variantia* (BOWERBANK), is spherical, massive, with a tangential ectosomal skeleton, and irregularly plumoreticulate choanosomal skeleton with ascending spicule tracts dominating transverse ones. Megascleres are curved, sharply pointed, fusiform styles with evenly rounded bases. Microscleres are diverse, consisting of c- and s-sigmas of two sizes, raphides in trichodragmata, microxeas and commas.

Biemna fortis (TOPSENT), from Ambon, Indonesia (TOPSENT, 1897; DESQUEYROUX-FAUNDEZ, 1981), Arafura Sea (HENTSCHEL, 1912), Straits of Malacca (SOLLAS, 1902), Bay of Bengal (BURTON, 1930; BURTON & RAO, 1932), Red Sea (TOPSENT, 1897; BURTON, 1959), Mombasa (PULITZER-FINALI, 1993) and Sulawesi, Indonesia, Gulf of Thailand, and Truk Atoll, Micronesia (HOOPER, unpublished data), is a massive, erect, often compressed sponge with large fistulose surface processes and terminal oscules. Surface is rough and consistency is firm, fibrous, compressible, harsh to touch. Ectosomal skeleton with protruding choanosomal megascleres but without any special spicules or structures. Choanosomal skeleton is cavernous, disorganised halichondroid reticulate. Megascleres are exceptionally long and thickest in the basal third of the spicule. Microscleres include sigmas of two sizes, raphides and microxeas.

Biemna humilis THIELE from Indonesia (THIELE, 1903), Zanzibar and Shimoni (PULITZER-FINALI, 1993) is thinly encrusting, usually on coralline algae. Skeleton is disorganised, slightly halichondroid, with choanosomal megascleres protruding through the surface. Megascleres are subtylostyles, slightly curved, evenly rounded bases, fusiform points. Microscleres are small sigmas and raphides in trichodragmata.

Biemna microstrongyla (HENTSCHEL) from Indonesia (HENTSCHEL, 1912) and Mombasa (PULITZER-FINALI, 1993) is a massive amorphous species with irregular surface and scattered small oscules. Ectosomal skeleton is irregular, paratangential peel of thinner styles. Choanosomal skeleton is halichondroid with multispicular bundles of thicker styles vaguely ascending. Megascleres are thin and thick styles, slightly curved at their centre, fusiform pointed, with evenly rounded bases. Microscleres are raphides, usually in trichodragmata, small microxeas and microstrongyles. PULITZER-FINALI (1993) suggested that the microstrongyles recorded from the Indonesian population by HENTSCHEL (1912) may be contaminants because they were not seen in his material from Mombasa, but re-examination of type material confirms their presence in this species.

Biemna pedonculata LÉVI, from South Africa (LÉVI, 1963), is massive, clavulate, pedunculate sponge with short basal stalk and expanded basal attachment, hispid and membraneous, porous surface. Ectosome with choanosomal styles protruding a short distance from surface, in bundles or singly. Choanosomal skeleton plumoreticulate, slightly condensed in the axis, with radial fibres cored by multispicular, ascending tracts of styles diverging towards the surface, interconnected by pauci- or unispicular transverse tracts. Megascleres are long, robust styles with fusiform, sharp points and evenly rounded bases. Microscleres are sigmas of three sizes, raphides and microxeas.

Biemna polyphylla LÉVI, from South Africa (LÉVI, 1963), is erect, digitate-foliose, with central stem and thinly lobate, flattened branches, with a corrugated, porous surface. Ectosomal skeleton plumoreticulate with plumose bundles of styles protruding through the surface and abundant microscleres. Choanosomal skeleton is plumoreticulate with multispicular bundles of styles and heavy spongin fibres. Megascleres are short, very thick styles, hastate pointed, and slightly tapering evenly rounded bases. Microscleres are sigmas of three sizes, raphides and microxeas.

Biemna sigmodragma LÉVI, from South Africa (LÉVI, 1963) (originally described as a subspecies of *B. megalosigma* HENTSCHEL from SE Indonesia), is massive, cushion-shaped, solid, with an irregular shaggy and hispid surface. Ectosome is a detachable layer of microscleres, with choanosomal styles barely protruding. Choanosomal skeleton is plumoreticulate with multispicular, ascending bundles of styles and abundant microscleres. Megascleres are long, robust styles, straight or slightly curved centrally, sharply pointed but slightly hastate, with evenly rounded bases. Microscleres include three categories of sigmas, raphides and microxeas.

Biemna trirhaphis (TOPSENT), from Ambon, Indonesia (TOPSENT, 1897; DESQUEYROUX-FAUNDEZ, 1981), Red Sea (BURTON, 1959; LÉVI, 1961), and Mombasa and Zanzibar (PULITZER-FINALI, 1993) is

massive, semi-digitate, with a shaggy surface and elastic consistency. Ectosomal skeleton is a confused paratangential layer of megascleres; choanosomal structure is also vaguely confused, reticulate, halichondroid. Megascleres are styles curved towards the basal end, sharply pointed fusiform, evenly rounded bases. Microscleres are diverse consisting of sigmas of three sizes, microxeas of two sizes, and raphides in trichodragmata.

Biemna tubulata (DENDY) from Sri Lanka (DENDY, 1905), NW India (DENDY, 1916), the Mergui Archipelago and Andaman Sea region (BURTON & RAO, 1932), Providence Reef (DENDY, 1922), and Seychelles Is (THOMAS, 1973), has a growth form slightly reminiscent of *B. laboutei*, being basically cylindrical and tubular in construction, but its tubes are very thin-walled, fragile, easily torn, soft, with several large oscules on the apex of each tube, and the surface is prominently shaggy. There is no ectosomal skeleton although the terminal choanosomal fibres protrude from the peripheral skeleton forming the shaggy surface conules. Choanosomal skeletal architecture is irregularly reticulate, close-meshed, with light fibres cored by multi- or paucispicular tracts of megascleres more-or-less in confusion. Megascleres are curved, fusiform, sharply pointed styles with evenly rounded bases. Microscleres are much more diverse than either *B. laboutei* or *B. truncata* consisting of c- and s-shaped sigmas, large microxeas, toxas (occasionally in dragmata), and raphides usually in trichodragmata.

Another species from the Red Sea, *Sigmaxinella megastyla* DENDY (1959) should also be compared to *B. laboutei* in having a massive digitate morphology. The surface of *S. megastyla* is prominently hispid from protruding choanosomal spicules, and the skeleton contains loose plumose columns of styles running transversely through branches, acending and piercing the ectosomal skeleton. Megascleres are styles with a small basal rhabd and fusiform points. Microscleres are large sigmas, raphides in trichodragmata and long microxeas. This species is included in *Sigmaxinella* in having a well organised plumose extra-axial skeleton, despite lacking the compressed axial skeleton typical of the genus (see HOOPER *et al.*, 1991), but nevertheless is a borderline case between *Biemna* and *Sigmaxinella*.

Acknowledgements

I thank M. Pierre LABOUTE for providing specimens, photographs and data on this species, and Dr. Jean VACELET for his assistance in bringing this species to my attention and for providing further information on its biology and ecology. I am also grateful to Ms Shirley STONE (BMNH London), Prof. Claude LÉVI (MNHN Paris) and Dr. Manfred GRASSHOFF (SMF Frankfurt) for access to the sponge type material under their care. I also thank Mr John KENNEDY and Ms Leonie HOOPER for preparation of electron micrographs and line drawings, respectively.

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