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Biodiversity assessment in the Lower Mekong basin: First record of the genus *Oncosclera* (Porifera: Spongillina: Potamolepidae) from the Oriental Region

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Abstract

Taxonomic richness of Thai Spongillina numbers so far seven species (five genera, one family). The first record of the genus *Oncosclera* Volkmer-Ribeiro, 1970 belonging to the family Potamolepidae Brien, 1967 is here reported with the description of a new species from the Pong River (NE Thailand, Oriental Region) in the framework of a biodiversity assessment in the Lower Mekong Basin. An emended diagnosis of the genus is also provided. The new species, ascribed to the genus *Oncosclera* for diagnostic traits of the skeleton and the gemmular architecture, differs from all the other known species of the genus in its unique combination of diagnostic traits. *O. asiatica* **sp. nov.** is characterised by *i)* more or less alveolate skeleton, *ii*) conulose surface with a network of branched subdermal canals, *iii*) acanthoxeas as dominant megascleres and less frequent acanthostrongyles, *iv*) gemmular theca sublaminar of compact spongin with a scantly developed pneumatic layer of fibrous spongin, and *v)* gemmuloscleres as acanthostrongyles from elongated to ovoid with tubercles/spines particularly dense towards the tips. Despite the extremely disjunct distribution *O. asiatica* is morphologically similar to *O. intermedia* and *O. jewelli* from the Neotropical Region and *O. gilsoni* from Pacific Islands, from which the former diverges for megascleres and/or gemmuloscleres traits.

Key words: Freshwater sponges, *Oncosclera asiatica* **sp. nov.**, Pong River, Thailand, Morphology, SEM, Taxonomy, Biogeography

Introduction

Some species of freshwater sponges sharing the diagnostic trait ‘gemmule armed by tangential strongyles and/or oxeas’ were firstly ascribed to the family Spongillidae Gray, 1867 and then transferred to the genus *Oncosclera* Volkmer-Ribeiro, 1970 of the family Potamolepidae Brien, 1967 (cf. Penney & Racek, 1968; Volkmer-Ribeiro, 1970; Manconi & Pronzato, 2002, 2007, 2009).

After the record of *S. navicella* by Carter (1881) from the Amazon Basin, registered also by Potts (1887), most species were ascribed firstly to the genera *Spongilla* Lamarck, 1816 or *Stratospongilla* Annandale, 1909a in the Neotropical Region (Argentina, Venezuela) from the Paraná, Uruguay, Plata and Orinoco Basins (*S. atrata*, *S. intermedia*, *S. navicella*, *S. petricola*, *S. ponsi*, *S. schubarti*, *S. spinifera*, *S. stolonifera*, *S. tonollii*) by Bonetto & Ezcurra (1962) and Bonetto & Ezcurra de Drago (1964, 1967, 1968, 1970, 1973) and from Brazil (*S. jewelli*) by Volkmer (1963) and Volkmer-Ribeiro (1970). Also the Afrotropical representatives of the genus described from the sub-Saharan Africa were firstly ascribed to the genus *Spongilla* and then to *Stratospongilla* Annandale, 1909a (*S. macrospiculata*, *S. rousseletii*, *S. schubotzi*) by Stephens (1919), Kirkpatrick (1906) and Weltner (1913), respectively, as occurred also for the Pacific Islands Region lineages as *S. diahoti* from New Caledonia and *S. gilsoni* from the Fiji Islands, by Rützler (1968) and Topsent (1912), respectively.

In their worldwide revision Penney & Racek (1968) did not mention most of the species, presently belonging to the genus *Oncosclera*, but only recorded three species, *viz*. *Stratospongilla gilsoni*, *S. rousseletii*, and *S. schubotzi*.

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Volkmer-Ribeiro (1970) supported the suggestion by Penney & Racek (1968) with the erection of the new genus *Oncosclera*, and redescription of *S. navicella* and *S. jewelli* moving both into the new genus together with *S. ponsi*, *S. rousseletii* and *S. schubotzi* from Africa, *S. gilsoni* from Fiji, and *Spongilla clementis* Annandale, 1909b from Philippines. The status of *S. clementis* is however controversial (cf. Penney & Racek, 1968; Volkmer-Ribeiro, 1970; Manconi & Pronzato, 2002) and this species characterised only in part by diagnostic traits matching those of the genus *Oncosclera* needs revision in depth. More recently *O. intermedia*, *O. navicella* and *O. spinifera* were reported from Venezuela (Volkmer-Ribeiro & Pauls, 2000), and *O. schubarti* from Brazil (Batista & Volkmer-Ribeiro, 2002).

The gemmules of the genus *Oncosclera* are characterised by a 'theca exclusively armed by tangential gemmuloscleres'. This key diagnostic trait was considered by Volkmer-Ribeiro (1970) as plesiomorphic between the genera *Oncosclera* and *Stratospongilla* with the latter genus displaying also skeletal microscleres. However, the analysis in depth of the gemmule cross sections by Scanning Electron Microscopy in the type species *Stratospongilla bombayensis* (Carter, 1882), resulted in the discovery, as previously reported in part by Carter (1882), of a double layer of gemmuloscleres belonging to different spicular types in the gemmular theca, *viz*. only strongyles tangentially arranged (as in *Oncosclera*) and strongyles tangentially arranged in the outer layer plus acanthoxeas radially arranged in the intermediate layer of the theca (cf. Manconi & Pronzato, 2002, Fig. 74, p. 963).

The geographic range of the genus *Oncosclera* is at present typically tropical with a highly disjunct Gondwanian pattern in the Neotropical (10 species) and Afrotropical (3 species) Regions, with spots in Pacific Islands (2 species) (Manconi & Pronzato, 2002, 2009).

This paper is intended to promote attention to the taxonomic richness of aquatic invertebrates within the Lower Mekong Basin (south-eastern Asia) in the framework of a biodiversity assessment international cooperation program focusing on Porifera. At present freshwater sponges of Thailand belong exclusively to the family Spongillidae with five genera and seven species, namely *Corvospongilla siamensis* Manconi & Ruengsawang, 2012, *Eunapius carteri* (Bowerbank, 1863), *E. potamolepis* (Annandale, 1918), *Spongilla alba* Carter, 1849, *S. lacustris* (Linnaeus, 1759), *Stratospongilla indica* (Annandale, 1908), and *Umborotula bogorensis* (Weber, 1890). We report here the first record of the potamolepid genus *Oncosclera* from the Oriental Region with the description of a new species in the Pong River (Thailand).

Materials & methods

Collection of sponges was carried out during visual census by wading, snorkelling and SCUBA diving in the Pong River (Mekong Hydrographic Basin, Khon Kaen Province, NE Thailand) (Fig. 1). The most representative specimens were photographed and registered in a voucher collection. A set of macro- and micro-morphological characters *viz*. growth form, consistency, colour, surface, architecture of ectosomal and choanosomal skeleton, topographic distribution and morphotraits of skeletal megascleres and microscleres, topographic distribution of gemmules, morphotraits of gemmular architecture (foramen, cage, theca, spatial arrangement of spicules), and gemmulosclere morphology, was considered diagnostic at the genus and species levels (Manconi & Pronzato, 2002). Representative fragments of sponges were dissected for Light Microscopy (LM) and/or Scanning Electron Microscopy (SEM). Spicules processed by dissolution of organic matter in boiling 65% nitric acid were suspended in ethanol and dropped onto slides and/or stubs (see Manconi & Pronzato, 2000). Dry body fragments, dissociated spicules, entire gemmules and their cross-sections were sputter-coated with gold and observed under SEM Leo 1450VP. Measurements were performed by LM on *ca*. 50 spicules of each diagnostic spicular type. Measurements on gemmular architecture were performed by SEM.

Acronyms: BMNH (The Natural History Museum, London, United Kingdom), DTRG (ex–IZUG, Dipartimento per lo studio del Territorio e delle sue Risorse, Dip.Te.Ris., Università di Genova, Italy), FZBRS (Fundação Zoobotânica do Rio Grande do Sul, Brazil), IRScNB (Institut Royal de Sciences Naturelles de Belgique, Bruxelles, Belgium), MCN (Museu de Ciências Naturais da Fundação Zoobotânica, Porto Alegre, RS, Brazil), MNHN (Muséum National d'Histoire Naturelle, Paris, France), MNRJ Museu Nacional, Universidade Federal do Rio de Janeiro, Brazil, MRAC (Musée Royal de l'Afrique Centrale de Tervuren KMMA, Belgium), MSNG (Museo civico di Storia Naturale 'G. Doria', Genova, Italy), ZMB (Zoologisches Museum für Naturkunde an der Universität Humboldt, Berlin, Germany).

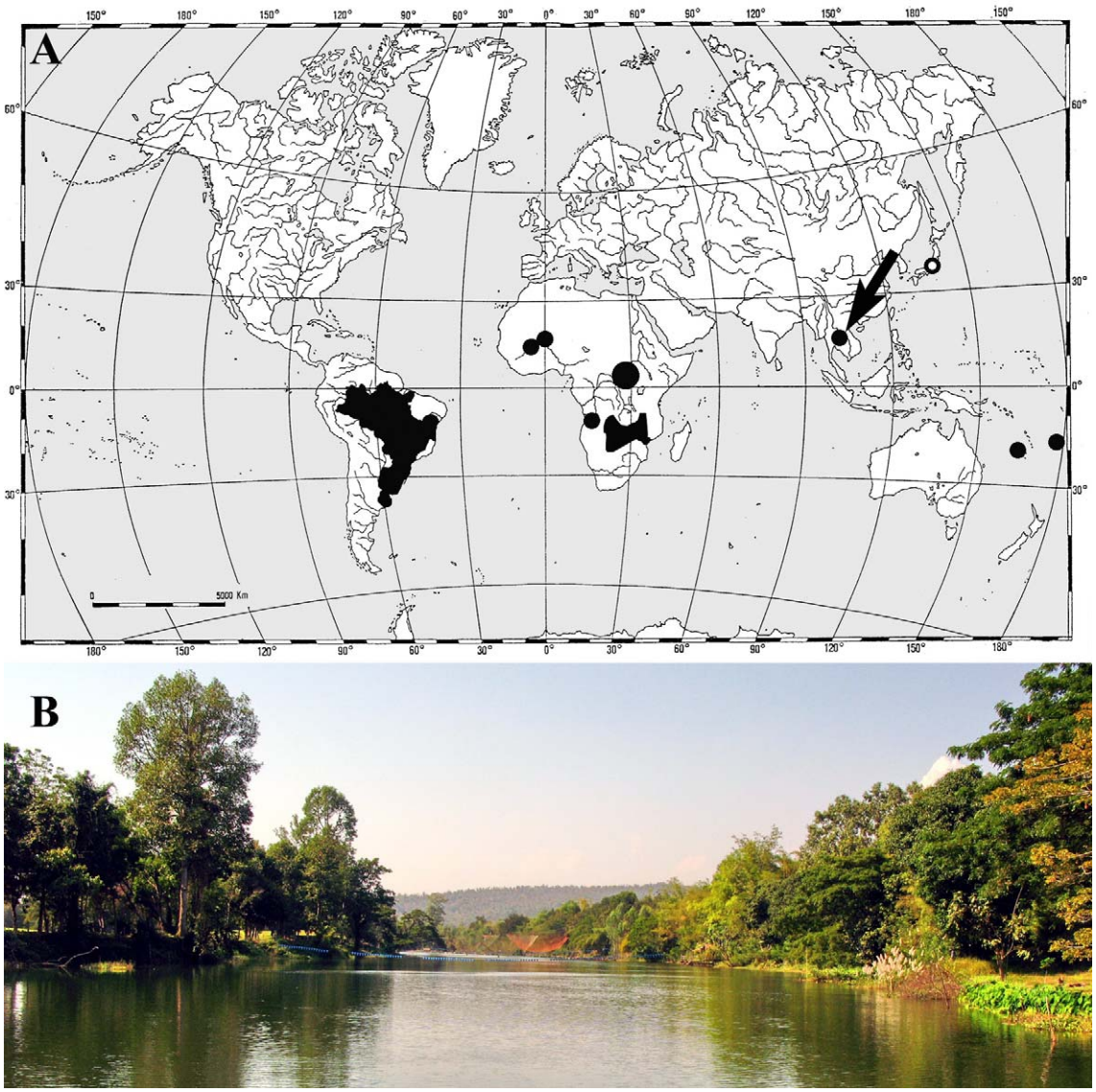

FIGURE 1. A, Biogeographic pattern of the genus *Oncosclera* (modified from Manconi & Pronzato, 2002, 2009). The type locality of *Oncosclera asiatica* at Ban Huai Sai, Thailand (16˚46´20.40˝N, 102˚42´48.22˝E) is indicated by an arrow. The black & white circle indicates the single fossil record for the genus. B, Type locality along the Pong River, Lower Mekong Basin, Thailand.

Taxonomic accounts

Class Demospongiae Sollas, 1888
Order Haplosclerida Topsent, 1928
Suborder Spongillina Manconi & Pronzato, 2002
Family Potamolepidae Brien, 1967
Genus *Oncosclera* Volkmer-Ribeiro, 1970
[Type species substitute: *Spongilla jewelli* Volkmer, 1963]

Diagnosis (emended from Manconi & Pronzato, 2002) Potamolepidae with encrusting growth form up to some metres in diameter. Stony hard, fragile consistency. Spongin scanty except for the basal spongin plate and gemmular theca. No special ectosomal skeleton except for spicular tufts supporting conules. Choanosomal skeleton irregularly alveolate with paucispicular tracts, sometimes with ascending fibres towards the surface. Megascleres abruptly pointed oxeas to strongyles from smooth to ornamented by variably dense short spines/tubercles.

Microscleres typically absent. Gemmules at the sponge base strictly adhering to the basal spongin plate, sometime free in the basal portion also in layers. Gemmular theca bi- to tri-layered with apparently absent to scarcely developed pneumatic layer of fibrous, not chambered spongin. Foramen not always evident. Gemmuloscleres tangentially arranged, elongate to ovoid oxeas to strongyles, variably ornamented to entirely smooth.

Oncosclera asiatica Manconi & Ruengsawang, sp. nov.

Figures 1–4; Table 1

Materials. Holotype MSNG 56534a, Ban Huai Sai (16˚46′20.40″N, 102˚42′48.22″E) type locality, Pong River**,** Thailand, 14.vi.2008, encrusting on submerged bamboo stick in contact with the paratype, leg. Nisit Ruengsawang (schizotype DTRG FW719). Paratype MSNG 56534b**,** associated with the holotype on submerged bamboo stick (Fig. 2, arrow), Ban Huai Sai (16˚46′20.40″N, 102˚42′48.22″E), Pong River**,** Thailand, 14.vi.2008, leg. Nisit Ruengsawang. Topotype OS DP2**,** Ban Huai Sai (16˚46′20.40″N, 102˚42′48.22″E), type locality, Pong River**,** Thailand, 20.viii.2010, leg. Nisit Ruengsawang, 1 specimen on PVC net.

Comparative materials. *O. jewelli*, Rio Tainhas, São Francisco de Paula, Rio Grande do Sul, 10.ix.1960, C. Volkmer-Ribeiro det. (Holotype MNRJ 001, schizotype DTRG FW 547); *O. jewelli*, Rio Tainhas, São Francisco de Paula, Rio Grande do Sul, Brazil, C. Volkmer leg. det., 17.i.1971 (topotype BMNH 1978.12.12.12, ex-FZBRS 124, schizotype DTRG FW 410); *O. jewelli*, FZBRS MCN 1080, River Teinhesves, 11.i.1983 (fragment FW 487); *O. macrospiculata* Niger, Timbuktu, on shells of *Aetheria* sp., 1931, A. Chevalier leg., Topsent det. (MNHN DT 2846, fragment DTRG FW 508ab); *O. rousseletii*, Zambezi River above Victoria Falls (holotype BMNH 06.2.28.IC, 13.IIIC, alcohol, schizotype DTRG FW 390); *O. schubotzi*, Aruwimi River near Banalia, on *Aetheria elliptica*, v.1908, Schubotz leg., Weltner 1919 det. (holotype ZMB 3716a, schizotype DTRG FW 539); *O. schubotzi*, Aruwimi River near Banalia, v.1908, Schubotz leg., Weltner 1919 det. (paratype MRAC 205 ex-ZMB 3716, dry, schizotype DTRG FW 471); *O. gilsoni*, River Waidina, Viti Levu, Fiji Islands, E. Topsent det., 22.x.1897 (Type IRScNB POR.048, schizotype DTRG FW 361).

Description

Growth form encrusting, less than 2 mm in thickness (Fig. 2A). **Consistency** hard and fragile both *in vivo* and dry condition. **Colour** yellowish *in vivo* (Fig. 2A), light brown in ethanol. **Surfac**e (Fig. 2A, B) with a dense network of branching subdermal canals and slight hispidation of more or less erected ectosomal spicules supporting small scattered conules. **Oscules** not conspicuous *in vivo*, scattered in a network of subdermal canals. **Inhalant apertures** scattered. **Ectosomal skeleton** (Fig. 2C) without special architecture, with triangular to quadrangular meshes (80–100 µm in diameter) in an irregular network of oxeas (Fig. 3A, B) arranged in mono- to pauci-spicular tracts. **Choanosomal skeleton** irregularly alveolate network, extremely thin, with triangular to quadrangular meshes (93–108 µm in diameter) with scarcely developed ascending mono- to pauci-spicular fibres. **Spongin** notably scanty, except for the gemmular theca and the basal spongin plate. **Basal spongin plate** (Fig. 4A) well developed, covered by a dense multilayer of oxeas (megascleres). **Megascleres** (Fig. 3A, B) acanthoxeas (140–185 x 14 µm, n = 75), stout, slightly bent to rarely straight, spiny on the entire shaft with abruptly pointed tips; spines towards the tips notably curved; spines scattered on the shaft small, straight, acute, bearing microspines. Rare oxeas and strongyloxeas (133–159 x 9–12 µm, n = 5) with tips densely spiny and small, acute spines scattered on the shaft. Acanthostrongyles megascleres (195 x 14 µm, n = 2) extremely rare, bearing a few scattered spines. Slender oxeas (101–139 x 3–6 µm, n = 3) rare, smooth, bent with fusiform tips were considered to belong to larvae. **Microscleres** absent. **Gemmules** (Fig. 4A) hemispherical, single (525–882 µm in diameter) or in groups of up to 3 gemmules (1913 µm in length) partly sharing the theca at the sponge base, strictly adhering to the basal spongin plate armed by tangential megascleres (Fig. 4A, arrow). Foramen not evident. Gemmular theca trilayered (50 µm in thickness) (Fig. 4F) with outer layer of compact spongin covering tangentially embedded gemmuloscleres (Fig. 4D) more or less in a mosaic-manner (Fig. 4D). Pneumatic layer of spongin fibres forming small, more or less rounded meshes, with 1–4 layers of gemmuloscleres tangentially embedded (Fig. 4F). Inner layer of compact spongin with sublayers (Fig. 4F, arrows). **Gemmuloscleres** (Fig. 4B, E) acanthostrongyles (43–125 x 6–17 µm, n = 75) elongated, from bent to rarely straight, to ovoid, with frequently inflated shaft in the middle and large tubercles/spines particularly dense towards the tips.

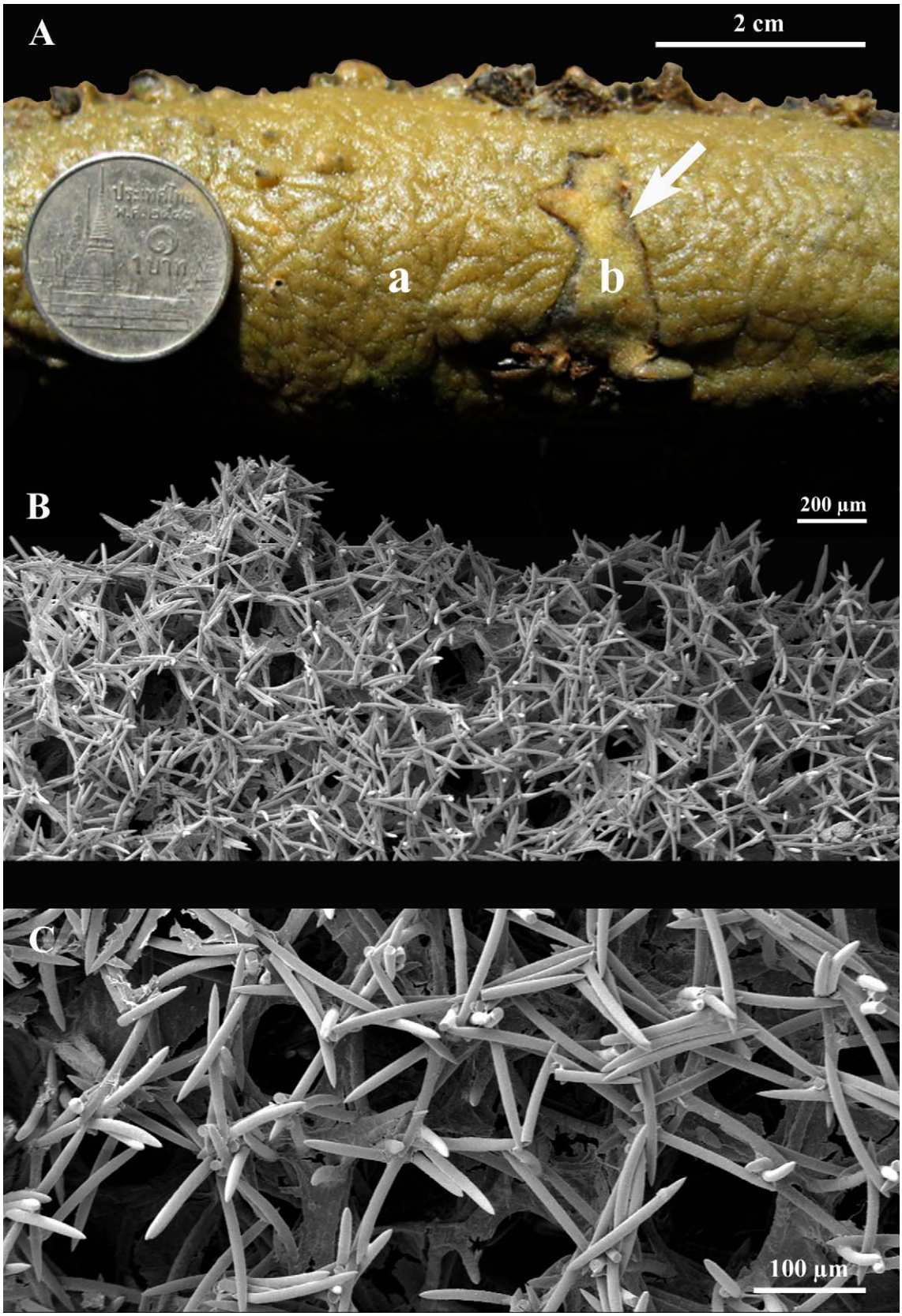

FIGURE 2. *Oncosclera asiatica*, type materials. Aa, Holotype MSNG56534a on a submerged bamboo stick from the Pong River (Lower Mekong), encrusting, yellowish *in vivo*, with a network of branching subdermal canals. Ab, Paratype MSNG56534b associated with the holotype. Aa and Ab sharing the same substrate are separated by an evident border in between (arrow). B, Ectosomal surface with small conules and scattered oscules. C, Ectosomal and choanosomal skeleton of stout oxeas in an irregular network of mono- to pauci-spicular tracts.

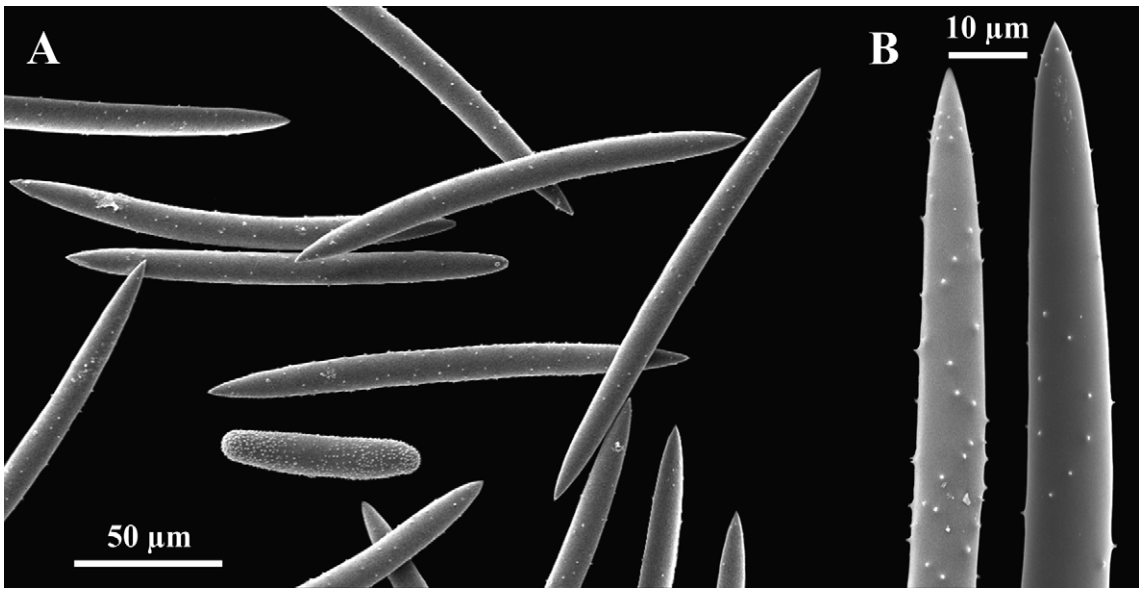

FIGURE 3. *Oncosclera asiatica*, Holotype MSNG56534a from the Pong River (Lower Mekong). A, Spicular complement of acanthoxeas (megascleres) entirely ornamented by scattered spines and acanthostrongyle (gemmulosclere) entirely and densely spiny except in the middle portion. B, Detail of acanthoxeas.

Habitat. Lotic, on submerged bamboo sticks or artificial substrata (fishing nets) along riverbanks. Associated with *Limnoperna* sp. (Bivalvia), Bryozoa, and other species of Porifera belonging to the family Spongillidae, namely *Corvospongilla siamensis* and *Eunapius* sp.

Etymology. The specific epithet is derived from the name of the Asiatic continent.

Geographic distribution. Known until now exclusively from the type locality Pong River in NE Thailand (Lower Mekong Hydrographic Basin, Fig. 1).

Remarks

The new species, ascribed to the genus *Oncosclera* for diagnostic traits of the skeleton and the gemmular architecture, differs from all the other known species of the genus in its unique combination of diagnostic traits. *Oncosclera asiatica* is characterised by a more or less alveolate skeleton, conulose surface with a network of branched subdermal canals, acanthoxeas as dominant megascleres and less frequent acanthostrongyles/strongyloxeas, sessile gemmules bearing a gemmular theca with sublaminar compact spongin and a scantly developed pneumatic layer of fibrous spongin, gemmuloscleres from elongated to ovoid strongyles with spines/tubercles particularly dense towards the tips.

Oncosclera asiatica is morphologically similar to oncoscleras from the Neotropical and Pacific insular regions (Table 1). *Oncosclera jewelli* and *O. gilsoni* share, in part, the microtraits of megascleres and gemmuloscleres, but differs for the gemmular morph, free in the skeleton vs. sessile strictly adhering to the basal spongin plate in the new species. *O. asiatica* is distinct from *O. gilsoni* also for the extremely small size of gemmuloscleres and the evident foramina in the latter.

Oncosclera asiatica shares with *O. intermedia* the spicular complement of acanthoxeas and acanthostrongyles (megascleres) and elongated acanthostrongyles (gemmuloscleres), but diverges from the latter for the presence of ovoid gemmuloscleres and for the topographic distribution of tubercles/spines of gemmuloscleres, *viz*. towards the tips in the new species vs. scattered along the entire spicular surface in the latter.

Data scattered in morphological descriptions of all other species indicates, however, that the presence/absence of an evident foramen is related to the physiological status of active vs. dormant gemmules, i.e. foramen is evident when the gemmule is ready to hatch. As for the presence/absence of the pneuma in the gemmular theca it seems that it depends by the higher magnification power of SEM vs. LM (see Manconi & Pronzato, 2002, Fig. 160, p. 1010 for *O. jewelli*; Manconi & Pronzato, 2009, Fig. 60, p. 61 for *O. rousseletii*).

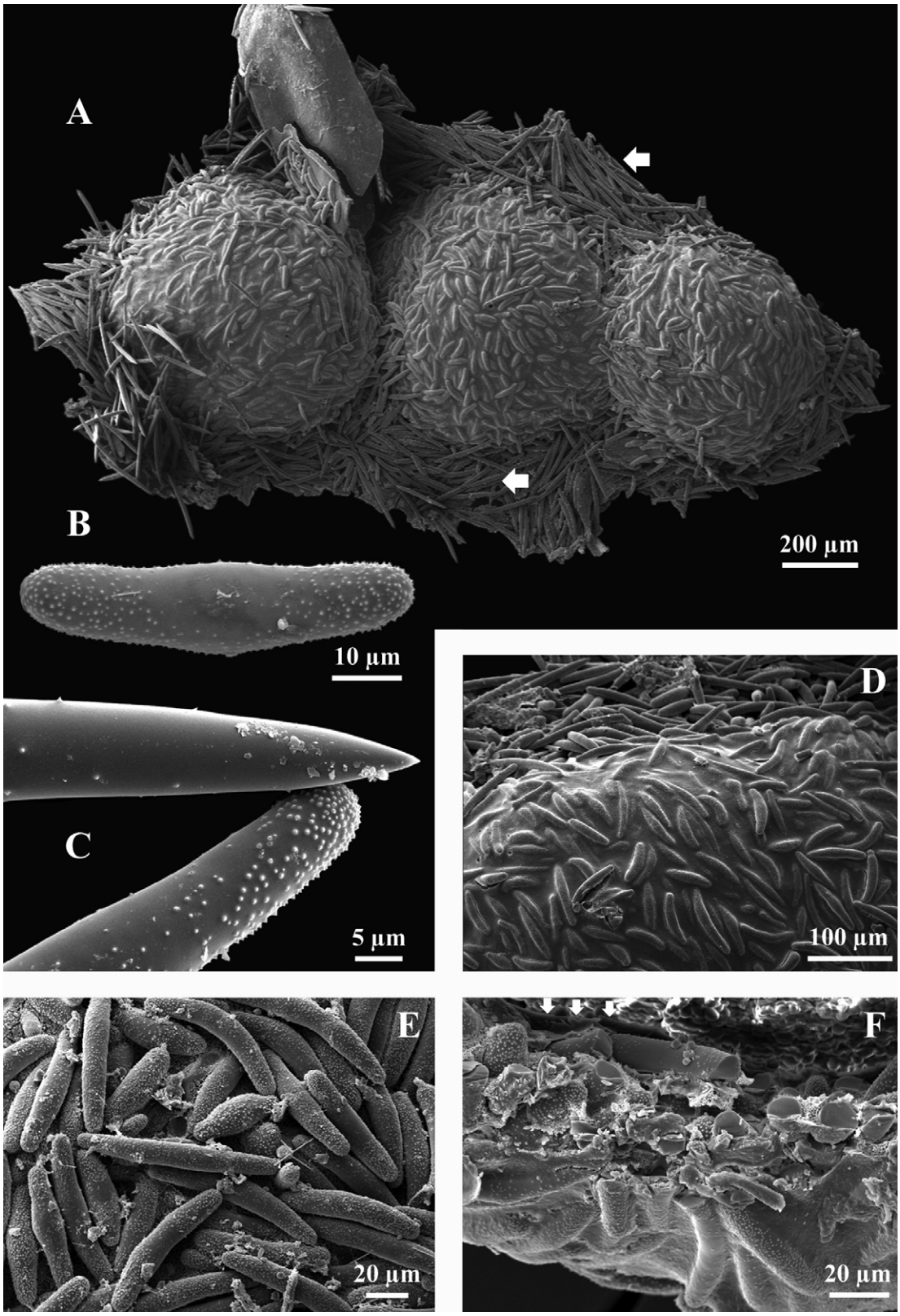

FIGURE 4. *Oncosclera asiatica*, Holotype MSNG56534a from the Pong River (Lower Mekong). A, Gemmules in cluster strictly adhering to the basal spongin plate armed by tangential oxeas (megascleres; arrows). B, Acanthostrongyle (gemmulosclere). C, Tips of acanthoxea (megasclere, top) and acanthostrongyle (gemmulosclere, bottom). D, Gemmular surface with tangential gemmuloscleres (acanthostrongyles) covered by the outer layer of spongin. E, Gemmular surface without outer spongin layer and tangential acanthostrongyles (gemmuloscleres) notably variable in shape from elongated to ovular. F, Gemmular theca (cross section) armed by layers of tangentially arranged to embedded acanthostrongyles (gemmuloscleres) within a scarcely developed pneumatic layer. Inner layer of compact sublayered spongin is indicated by arrows.

TABLE 1. Global checklist, morphotraits and biogeographic pattern of the genus *Oncosclera* (16 recent species, one fossil).

Species	Megascleres µm	Gemmuloscleres µm	Gemmular traits Ø µm	Biogeographic Region Hydrographic basin	References
O. diahoti **(Rützler, 1968)**	oxeas 210-280 x 9-14	oxeas 100-250 x 2-8	sessile, subspherical 300-500, 520-600	Pacific Islands New Caledonia	Rützler, 1968 Volkmer-Ribeiro & Rützler, 1997
O. navicella **(Carter, 1881)**	oxeas 130-170 x 6.5	oxeas	essile, single/grouped, hemispherical free, spherical, basal portion no foramen, no pneuma	Neotropical Amazon, Plata, Cuieiras, Orinoco Manso, Paranà, Uruguay	Carter, 1881 Volkmer-Ribeiro, 1970 Volkmer-Ribeiro & Pauls, 2000 Batista & Volkmer-Ribeiro, 2002
O. schubotzi **(Weltner, 1913)**	oxeas 120-170 x 11-14 strongyles 110-120 x 12-13	oxeas 66-88 x 10-12 strongyles/styles 64 x 10	sessile/free? subspherical, 500-800	Afrotropical Aruwimi	Weltner, 1913 Penney & Racek, 1968 Manconi & Pronzato, 2009
O. petricola **(Bonetto & Ezcurra de Drago, 1967)**	oxeas 100-225 x 5-20	acanthoxeas/ acanthostrongyles 40-112 x 11-14	sessile, single hemispherical?	Neotropical Uruguay, Manso	Bonetto & Ezcurra de Drago, 1967 Volkmer-Ribeiro, 1970 Batista & Volkmer-Ribeiro, 2002
O. rousseletii **(Kirkpatrick, 1906)**	oxeas 210-260 x 12-19	acanthostrongyles 63-71 x 12-16	free, single subspherical, 380-425 foramen, pneuma	Afrotropical Zambezi	Kirkpatrick, 1906 Penney & Racek, 1968 Manconi & Pronzato, 2009
O. jewelli **(Volkmer, 1963)**	oxeas, acanthoxeas 180-235 x 24	acanthostrongyles 30-106 x 15-30	free, basal, group subspherical, 500-700 foramina, pneuma	Neotropical Amazon, Rio Grande do Sul	Volkmer, 1963 Volkmer-Ribeiro, 1970 Manconi & Pronzato, 2002
O. schubarti **(Bonetto & Ezcurra de Drago, 1967)**	oxeas/acanthoxeas 111-421 x 7-20	acanthostrongyles/strongyles 36-125 x 8-25	sessile, group hemispherical, 400-514 foramen, no pneuma	Neotropical Paranà, Uruguay, Manso	Bonetto & Ezcurra de Drago, 1967 Batista & Volkmer-Ribeiro, 2002
O. asiatica **Manconi & Ruengsawang**	acanthoxeas 140-185 x 14 acanthostrongyles 195 x 14	acanthostrongyles 43- 125 x 6-17	sessile, single/group hemispherical, 525-882 no foramen, pneuma	Oriental Mekong	This study
O. gilsoni **(Topsent, 1912)**	acanthoxeas 135-230 x 11-15	acanthostrongyles 8-21 x 8-11	free, single subspherical, 480-700 pneuma, foramen	Pacific Islands Fiji Islands Waidina	Topsent, 1912 Penney & Racek, 1968 Manconi & Pronzato, unpubl.
O. intermedia **(Bonetto & Ezcurra de Drago, 1973)**	acanthoxeas, acanthostrongyles 150-180 x 12-15	acanthostrongyles 75-140 x 12-15	sessile, single/group hemispherical, 600-800 no foramen	Neotropical Orinoco, Negro	Bonetto & Ezcurra de Drago, 1973 Volkmer-Ribeiro & Pauls, 2000
O. stolonifera **(Bonetto & Ezcurra de Drago, 1967)**	acanthoxeas 200-275 x 8-14	acanthoxeas 80-115 x 8-12	sessile hemispherical, no foramen	Neotropical Paranà	Bonetto & Ezcurra de Drago, 1967 Volkmer-Ribeiro, 1970
O. macrospiculata **(Stephens, 1919)**	strongyles 275-335 x 20-27 250-375 x 30-40	acanthostrongyles 35-100 x 12-21 45-100 x 10-13	free/sessile? subspherical, 500-550 foramen	Afrotropical Bani, Niger	Stephens, 1919 Topsent, 1932 Manconi & Pronzato, 2009
O. atrata **(Bonetto & Ezcurra de Drago, 1970)**	acanthostrongyles 190-250 x 20-28	strongyles 40-115 x 7-15	sessile, single/group hemispherical, 700-1000	Neotropical Paranà	Bonetto & Ezcurra de Drago, 1970
O. spinifera **(Bonetto & Ezcurra de Drago, 1973)**	acanthoxeas, acanthostrongyles 115-120 x 7-12	strongyles acanthostrongyles 55-100 x 8-10	sessile, single/group hemispherical, 500-700 no foramen	Neotropical Orinoco, Amazon	Bonetto & Ezcurra de Drago, 1973 Volkmer-Ribeiro & Pauls, 2000
O. kaniensis † **Matsuoka & Masuda, 2000**	acanthostrongyles/acanthoxeas 100-179 x 7-15	acanthostrongyles 23-100 x 4-7	sessile, hemispherical 500	Palaearctic Japan, Fossil-Miocene	Matsuoka & Masuda, 2000
O. ponsi **(Bonetto & Ezcurra de Drago, 1968)**	acanthostrongyles 150-235 x 17-20 acanthoxeas 160-185 x 6-15	acanthostrongyles 50-95 x 8-12 35-50 x 10-15	sessile, single/group hemispherical, 500 no pneuma	Neotropical Uruguay	Bonetto & Ezcurra de Drago, 1968
O. tonollii **(Bonetto & Ezcurra de Drago, 1968)**	acanthostrongyles/strongyles 100-250 x 15-40 acanthoxeas 95-200 x 12-17	acanthostrongyles 55-150 x 12-16 50-60 x 20-25	sessile, single/group hemispherical, 500-700 no pneuma, no foramen	Neotropical Uruguay	Bonetto & Ezcurra de Drago, 1968

A notably conservative morphological trend characterizes the genus *Oncosclera* at the level of skeletal architecture, spicules and gemmular architecture as proved also by the comparative analysis of diagnostic traits of the new species vs. the Miocene fossil remains of *O. kaniensis* Matsuoka & Masuda, 2000 and in spite of the highly disjunct pattern of the genus (Table 1, Fig. 1).

The comparative analysis of spicular complement suggests the existence of some species groups (Table 1) that however reflect only in part the geographic distribution. Megascleres range in the genus from oxeas to strongyles, however oxeas, as occur in *O. asiatica*, are dominant in 10 species (*O. diahoti*, *O. gilsoni*, *O. intermedia*, *O. jewelli*, *O. navicella*, *O. petricola*, *O. rousseletii*, *O. schubarti*, *O. schubotzi*, and *O. stolonifera*) vs. six species (*O. atrata*, *O. kaniensis*, *O. macrospiculata*, *O. ponsi*, *O. spinifera*, and *O. tonollii*).

Spiny ornamentation of megascleres, as occur in *O. asiatica*, is dominant in eight (*O. atrata*, *O. gilsoni*, *O. intermedia*, *O. kaniensis*, *O. ponsi*, *O. spinifera*, *O. stolonifera*, and *O. tonollii*) vs. eight species bearing smooth skeletal spicules (*O. diahoti*, *O. jewelli*, *O. macrospiculata*, *O. navicella*, *O. petricola*, *O. rousseletii*, *O. schubarti*, and *O. schubotzi*) although the association dominant oxeas/presence of spines occurs only in four species (*O. asiatica*, *O. gilsoni*, *O. intermedia*, and *O. stolonifera*).

The species sharing the trait 'hemispherical gemmules fixed to a stout basal spongin plate' are the majority (Table 1) whereas only a few share the morph 'gemmules free in the skeletal network towards the basal portion' (Table 1).

As reported in the last global assessment, the worldwide checklist of freshwater sponges, and the World Porifera Database, no record of the genus *Oncosclera* is known until now from the Oriental Region (Manconi & Pronzato, 2007, 2008; Manconi & Van Soest, 2012; Ruengsawang *et al*., 2012). The discovery from the Indochinese area (NE Thailand) increases to 16 recent species and one fossil so far (Table 1) and enlarges the geographic range of the genus *Oncosclera* to the Oriental Region representing the single record from the entire continental Asia.

The highest value of species richness of the genus is recorded in the Neotropical Region. Spot-like enclaves are in the Afrotropical and Pacific Islands Regions, and the Indochinese area. Although all species belonging to the genus *Oncosclera* seems to be strictly endemic, only the conservation status of *O. jewelli* is focused by the red list of endangered fauna of Brazil (Volkmer-Ribeiro, 2007).

Although the disjunct geographic range of the genus *Oncosclera* appears to be the result of the Gondwana splitting as firstly focused by Bonetto & Ezcurra de Drago (1967), this contrasts with the single fossil record from the eastern Palaearctic region (*O. kaniensis*, Miocene of Japan). Among freshwater sponges only the genus *Metania* Gray, 1867 (Metaniidae) from the circum-tropical biome of rain forests of the Neotropical, Afrotropical, Oriental and Australasian Regions displays a Gondwanian pattern (Stanisic, 1979; Volkmer-Ribeiro, 1979, 1986; Volkmer-Ribeiro & Costa, 1993; Manconi & Pronzato, 2009). Until further palaeontological data or new findings of recent species will clarify better the historical biogeographic pattern of *Oncosclera*, we consider it as Gondwanian-like.

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References

Annandale, N. (1908) Notes on freshwater sponges. VIII. Preliminary notice of a collection from western India with description of two new species. *Records of the Indian Museum*, 2, 25–28.

Annandale, N. (1909a) Beiträge zur Kenntnis der Fauna von Süd-Afrika. Ergebnisse einer Reise von Prof. Max Weber im Jahre 1894. IX. Freshwater sponges. *Zoologische Jahrbücher. Abteilung für Systematik, Geographie und Biologie der Tiere*, 27(6), 559–568.

Annandale, N. (1909b) Freshwater Sponges in the collection of the United States National Museum. Part I. Specimens from the

Philippines and Australia. *Proceedings of the United States National Museum*, 36, 627–632.
Annandale, N. (1918) Zoological results of a tour in the Far East. II. Freshwater sponges from Japan, China, and the Malay Peninsula. *Memoirs of the Asiatic Society of Bengal*, 6, 199–216.
Batista, T.C.A. & Volkmer-Ribeiro, C. (2002) Comunidades de esponjas do curso superior dos rios Paraná (Goiás) e Paraguai (MatoGrosso), Brasil, com redescrição de *Oncosclera schubarti* (Bonetto & Ezcurra de Drago). *Revista Brasileira de Zoologia*, 19(1), 123–136.
Bonetto, A.A. & Ezcurra, I.D. (1962) Dos nuevas esponjas para el Paraná medio. *Physis*, 23(65), 209–214.
Bonetto, A.A. & Ezcurra de Drago, I.D. (1964) Esponjas del Paraná medio e inferior. *Anales del II Congreso Latinoamericano de Zoología*, 1, 245–260.
Bonetto, A.A. & Ezcurra de Drago, I.D. (1967) Esponjas del noreste argentino. *Acta Zoologica Lilloana*, 23, 331–347.
Bonetto, A.A. & Ezcurra de Drago, I.D. (1968) El género *Spongilla* Lamarck en el río Uruguay (Porifera, Spongillidae). *Physis*, 27(75), 429–436.
Bonetto & Ezcurra de Drago, I.D. (1970) Esponjas de los afluentes del Alto Paraná en la provincia de Misiones. *Acta Zoologica Lilloana*, 27, 37–61.
Bonetto, A.A. & Ezcurra de Drago, I.D. (1973) Aportes al conocimiento de las esponjas del Orinoco. *Physis*, 32(84), 19–27.
Bowerbank, J.S. 1863. A monograph of the Spongillidae. *Proceedings of the Zoological Society London*, 1863, 440–473.
Carter, H.J. (1849) A descriptive account of the freshwater sponges (genus *Spongilla*) in the Island of Bombay, with observations on their structure and development. *The Annals and Magazine of Natural History*, 4(2), 81–100.
Carter, H. J. (1881) History and classification of the known species of *Spongilla*. *The Annals and Magazine of Natural History*, 5(7), 77–107.
Carter, H.J. (1882) Spermatozoa, Polygonal Cell-structure, and the Green Colour in *Spongilla*, together with a new species. *The Annals and Magazine of Natural History*, 5(10), 362–372.
Kirkpatrick, R. (1906) Report on the Porifera with notes on species from Nile and Zambesi. Zoological results of the third Tanganyika expedition by W.A. Cunnington, 1904–1905. *Proceedings of the Zoological Society of London*, 1, 218–227.
Linnaeus, C. (1759) *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Tomus II. Editio decima, reformata. Laurentii Salvii, Holmiae, 561 pp.
Lamarck, J.P.B. (1816) *Histoire naturelle des Animaux sans vertèbres*, Verdier, Paris, 568 pp.
Manconi, R. & Pronzato, R. (2000) Rediscovery of the type material of *Spongilla lacustris* (L., 1759) from the Linnean Herbarium. *Italian Journal of Zoology*, 67(1), 89–92.
Manconi, R. & Pronzato, R. (2002) Spongillina n. subord. Lubomirskiidae, Malawispongiidae n. fam., Metaniidae, Metschnikowiidae, Palaeospongillidae, Potamolepidae, Spongillidae. *In*: Hooper, J.N.A. & R.W.M. van Soest, (Eds.), *Systema Porifera. A guide to the classification of sponges*. Kluwer Academic/Plenum Publ., New York, pp. 921–1019.
Manconi, R. & Pronzato, R. (2007) Gemmules as a key structure for the adaptive radiation of freshwater sponges: a morphofunctional and biogeographical study. *In*: Custódio, M.R., Lôbo-Hajdu, G., Hajdu, E. & Muricy, G. (Eds.), *Porifera research: biodiversity, innovation and sustainability. Série Livros 28*, Museu Nacional, Rio de Janeiro, pp. 61–77.
Manconi, R. & Pronzato, R. (2008) Global diversity of sponges (Porifera: Spongillina) in freshwater. *Hydrobiologia*, 595, 27–33.
Manconi, R. & Pronzato, R. (2009) *Atlas of African freshwater sponges*. Studies in Afrotropical Zoology, Vol. 295. Royal Museum for Central Africa, Tervuren, 214 pp.
Matsuoka, T. & Masuda, Y. (2000) A new potamolepid freshwater sponge (Demospongiae) from the Miocene Nakamura Formation, central Japan. *Paleontological Research*, 4(2), 131–137.
Penney, J.T. & Racek, A.A. (1968) Comprehensive revision of a worldwide collection of freshwater sponges (Porifera: Spongillidae). *Bulletin of the United States National Museum*, 272, 1–184.
Potts, E. (1887) Contributions towards a synopsis of the American forms of fresh water sponges with descriptions of those named by other authors and from all parts of the world. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 39(2), 158–279.
Ruengsawang, N., Sangpradub, N., Hanjavanit, C. & R. Manconi (2012) Biodiversity assessment of the Lower Mekong Basin: A new species of *Corvospongilla* (Porifera: Spongillina: Spongillidae) from Thailand. *Zootaxa* 3320: 47–55.
Rützler, K. (1968) Fresh-water sponges from New Caledonia. *Cahiers de l'Office de la Recherche Scientifique et Technique d'Outre-Mer (Hydrobiologie)*, 2(1), 57–66.
Stanisic, J. (1979) Freshwater sponges from the Northern Territory (Porifera: Spongillidae). *Proceedings of the Linnean Society of New South Wales*, 103(2), 124–130.
Stephens, J. (1919) Two new African freshwater sponges. *Annals and Magazine of Natural History*, 9(3), 94–100.
Manconi, R. & R. Van Soest (2012) *Oncosclera* Volkmer-Ribeiro, 1970. In: Van Soest, R.W.M, Boury-Esnault, N., Hooper, J.N.A., Rützler, K, de Voogd, N.J., Alvarez de Glasby, B., Hajdu, E., Pisera, A.B., Manconi, R., Schoenberg, C., Janussen, D., Tabachnick, K.R., Klautau, M., Picton, B., Kelly, M., Vacelet, J., Dohrmann, M. (2012) World Porifera database. Accessed through: Van Soest, R.W.M, Boury-Esnault, N., Hooper, J.N.A., Rützler, K, de Voogd, N.J., Alvarez de Glasby, B., Hajdu, E., Pisera, A.B., Manconi, R., Schoenberg, C., Janussen, D., Tabachnick, K.R., Klautau, M., Picton, B., Kelly, M., Vacelet, J., Dohrmann, M. (2012) World Porifera database at http://www.marinespecies.org/porifera on 2012-09-28
Topsent, E. (1912) Description de *Spongilla (Stratospongilla) gilsoni* n. sp., Éponge d'eau douce des Iles Fidji. *Annales de Biologie lacustre. Bruxelles*, 5, 1–5.

Volkmer, C. (1963) *Spongilla jewelli* n. sp. from fresh-water sponge at Brazil. *Anais da Academia Brasileira de Ciências*, 35(2), 271–273.

Volkmer-Ribeiro, C. (1970) *Oncosclera* - a new genus of freshwater sponges (Porifera-Spongillidae) with redescription of two species. *Amazoniana*, 2(4), 435–442.

Volkmer-Ribeiro, C. (1979) Evolutionary study of genus *Metania* Gray, 1867 (Porifera-Spongillidae): I. The new species. *Amazoniana*, 6(4), 639–649.

Volkmer-Ribeiro, C. (1986) Evolutionary study of genus *Metania* Gray, 1867: III. Metaniidae, new family. *Amazoniana*, 9(4), 493–509.

Volkmer-Ribeiro, C. (2007) South American continental sponges: state of the art of the research. *In*: Custódio, M.R., Lôbo-Hajdu, G., Hajdu, E. & Muricy, G. (Eds.), *Porifera research: biodiversity, innovation and sustainability. Série Livros 28*, Museu Nacional, Rio de Janeiro, pp. 117–121.

Volkmer-Ribeiro, C. & Costa, P.R.C. (1993) Redescription of the Oriental and Australian species of the genus *Metania* Gray, 1867 (Porifera: Metaniidae). *Iheringia* Ser. Zool., Porto Alegre, 74, 81–101.

Volkmer-Ribeiro, C. & Pauls, S.M. (2000) Esponjas de agua dulce (Porifera, Demospongiae) de Venezuela. *Acta Biologica Venezuelica*, 20(1), 1–28.

Volkmer-Ribeiro, C. & Rützler, K. (1997) *Pachyrotula*, a new genus of freshwater sponges from New Caledonia (Porifera: Spongillidae). *Proceedings of the Biological Society of Washington*, 110(4), 489–501.

Weber, M. (1890) Spongillidae des Indischen Archipels. *Zoologische Ergebnisse einer Reise nach Niederlandisch Ost-Indien*, 1, 30–47.

Weltner, W. (1913) Süßwasserschwämme (Spongillide) der Deutschen Zentralafrika expedition 1907–1908. *In*: Schubotz (Ed.). *Wissenschaftliche Ergebnisse der Deutschen Zentral-Afrika-Expedition 1907–1908*, Klinkhardt & Biermann, Leipzig, 4, *Zoologie*, 475–485.