ACANTHODISCUS NEW GENUS AND GENUS ANHETEROMEYENIA REDEFINED (PORIFERA, SPONGILLIDAE)

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ABSTRACT

The Neartic-Neotropical genus Anheteromeyenia Schröder, 1927 is restricted and redefined to include A. argyrosperma Potts, 1880, type species and A. ornata (Bonetto & Ezcurra de Drago, 1970) comb. n.. Acanthodiscus, new genus, with a Paleartic, Neartic-Neotropical distribution is proposed for A. ryderi (Potts, 1882) comb. n., type species, and A. sheilae (Volkmer-Ribeiro, De Rosa-Barbosa & Tavares, 1988) comb. n..

KEYWORDS. Neartic-Neotropical, freshwater sponges, Anheteromeyenia, Acanthodiscus, new genus.

INTRODUCTION

The sub-genus Anheteromeyenia Schröder (1927), elevated to generic rank by LAUBENFELS (1936), was originally defined to contain those Heteromeyenia Potts, 1881, species which missed microscleres. PENNEY & RACEK (1968) selected Spongilla argyrosperma Potts, 1880, as type species, enlarged Schröder’s original definition, recognized the exclusive characters of A. argyrosperma and grouped the few species of the genus into two morphologically distinct groups. A. argyrosperma was solely placed in a group on account of its gemmules having a distinct porus tube and two classes of gemmoscleres differing in lenght rather than in shape. The other four species, A. ryderi (Potts, 1882), A. pictouensis (Potts, 1885), A. conigera (Old, 1931) and A. biceps (Lindenschmidt, 1950), composed the second group of species having gemmules devoid of a porus tube and with two classes of gemmoscleres exhibiting sharp differences in shape as well as in size. BONETTO & EZCURRA DE DRAGO (1970) described Radiospongilla ornata from argentinian waters. The gemmules in this species, similarly to those of A. argyrosperma, have a distinct porus tube and gemmoscleres grading from longer to shorter birotulates with rotules composed of an irregular arrangement of rays or spines. VOLKMER-RIBEIRO et al., 1988 described Anheteromeyenia sheilae

from South Brazil, included in the *A. ryderi* species group. The characteristics shared by *Anheteromeyenia argyrosperma* and *A. ornata* recommend the restriction of genus *Anheteromeyenia* to the type species plus *A. ornata*. The new genus *Acanthodiscus* is proposed for *A. ryderi* and *A. sheilae*. The characteristics presented in common by the two species are not shared with species in any of the presently known genera of freshwater sponges.


**Anheteromeyenia** Schröder, 1927

*Heteromeyenia (Anheteromeyenia) SCHRÖDER, 1927: 108 (partim).*
*Anheteromeyenia* LAUBENFELS, 1936: 36 (partim); PENNEY & RACEK, 1968: 114 (partim);

Type species: *Spongilla argyrosperma* Potts, 1880, subsequent designation by PENNEY & RACEK, 1968: 114.

Diagnosis. Freshwater sponges with two series of slim, spiny, irregularly birotulated gemmoscleres which gradually proceed from long, into short ones; rotules of the longer gemmoscleres consisting of long recurved clawlike hooks, regular or irregularly placed around the shaft extremities; shorter gemmoscleres reaching about half the size of the long ones, their rotules consisting of several recurved or randomly turned small spines arranged in one or more irregular circles at the shaft extremities. Shafts of the longer gemmoscleres stout and with large spines, sometimes a ring of larger spines present at middle of the shaft; shafts of the shorter gemmoscleres slimmer with abundant small spines; spines in the middle portion of the shaft in both classes are straight whilst those placed towards the extremities are usually recurved. The shorter gemmoscleres predominate in the gemmular coat. Microscleres absent.

Redescription. Sponges forming very shallow gray or green incrustations or sponges perceived only by the conspicuous gemmular patches partially covered by a few megascleres.

Skeleton reduced and progressing from an irregular deposition of the megascleres on the gemmules to a few largely spaced horizontal fibers giving off very few lateral fibers. The very slim fibers are one or two spicules thick; ectosome thick at places. Osculæ few and inconspicuous.

Megascleres stout, sparsely spined, straight to slightly curved, abruptly pointed oxea. Spines at the extremities of the spicules turned towards the spicule ends. Gemmoscleres as in the genus diagnosis.

Gemmules abundant, close to the substrate, large; foraminal tube short, delicate, straight, set in a conical depression in the fully developed gemmules. Gemmoscleres rather radially embedded in one single layer in the pneumatic coat, the larger gemmoscleres projecting half of their shafts beyond the level of the outer coat or supporting its
proeminentes. Inner gemmular coat thick, pneumatic coat also thick with small polyedrical air spaces, outer gemmular coat thin and smooth.

Distribution. Nearctic and Neotropical.

Key to the *Anheteromeyenia* species

1. Gemmoscleres of the long class with rotules consisting of a circle of regular or irregular large, sometimes bifid, recurved clawlike hooks; shaft spines large, few

   .................................................................................................................. *A. argyrospersma*

   Gemmoscleres of the long class with rotules consisting of a circle of regular or, more frequently, an irregular grouping of recurved spines; shaft spines small, numerous

   .................................................................................................................. *A. ornata*

*Anheteromeyenia argyrospersma* (Potts, 1880)

(Figs. 1,2,6,10)

*Spongilla argyrospersma* Potts, 1880: 357; 1887: 239, pl. VI, fig. i; pl. XI, figs. I, II, type locality Lehigh River at Lehigh Gap, Pennsylvania, USA.

*Anheteromeyenia argyrospersma*; Penney & Racek, 1968: 116, pl. 10, figs. 8, 9, 10 (and synonymy); Harrison, 1974: 37; Volkmer-Ribeiro & TraveSet, 1987: 233, fig. 6 (only topotypes found, ANSP); Frost, 1991: 115, fig. 4.9; Ricciardi & Reiswig, 1993: 666, fig. 1.

Redescription. Sponge forming delicate incrustations consisting of patchy groups of large, whitish gemmules which may be covered by an irregular deposition of megascleres. Living sponge gray or green (when associated to symbiotic algae).

Megascleres small, thin, slightly curved to sigmoid, sparsely spined, abruptly pointed anfioxea, spines at the extremities of the sclere turned towards the sclere ends.

Gemmules forming a grading series of slim, spiny, domeshaped biorotules with small rotules. The series runs from long, stout, biorotules with rotules consisting of a circle of usually irregular, rarely regular, large, sometimes bifid, recurved hooks to short, slim biorotules with rotules consisting of a circle or of a terminal grouping of irregular, small spines. Shafts of the longer birotulates with a few large spines, shafts of the short birotulates with abundant small spines; spines at the middle part of the shaft in both long and short birotulates are straight whilst those placed towards the extremities are recurved (figs. 1, 2, 6, 10).

Gemmules abundant, large, silvery, provided with a thick pneumatic coat and a broad, short, foraminial tubule set in a conical depression of this coat. Pneumatic coat consisting of regular, polyedrical alveoli. Gemmoscleres radially embedded in this coat in one single layer, the longer gemmoscleres projecting their distal ends far beyond the pneumatic coat or supporting its conical proeminentes. Some megascleres are usually found tangentially embedded in the pneumatic coat. Outer coat thin (fig. 6). Gemmules loosely to strongly solded to the basal plate and forming irregular groups of two to several ones gapped together by a number of megascleres singly stuck against the walls of any two closely set gemmules.

Skeleton drastically reduced to a disorderly deposition of megascleres around
and on top of the gemmular groups, such a deposition may progress as to partially conceal the gemmules; in such cases a granular ectosome may form but no oscules can be perceived in it.

Dimensions. Megascleres length 133 - 329, width 7 - 15; longer gemmoscleres length 114 - 179, width 5.9 - 10.2; shorter gemmoscleres length 57 - 89, width 3.9 - 6.7; diameter of gemmules 494 - 686.

Distribution. Eastern half of the Neartic Region, from Quebec and New Brunswick (Canada) to Florida (USA)(FROST, 1991; RICCIARDI & REISWIG, 1993).

Habitat. The species is found in running waters but also occurs in lakes, ponds and even small standing roadside waters. It seems to prefer submerged stems and timber as support and has been found in pH and conductivity ranging respectively from 4.2 to 7.5 and 80 - 750 micromhos / cm (HARRISON, 1974).

Examined material. USA. Pennsylvania: Lehigh River at Lehigh Gap, topotypes, XI. 14. 1881, E. Potts leg. (ANSP 4538, 4587, 4588, 4589); New Jersey: River Styx, Lake Hopatcong, fragment of timber with several gemmular groups, 1882, E. Potts leg. (ANSP).

Remarks. The species was briefly introduced by POTTS (1880). A detailed redescription was presented by POTTS (1887). PENNEY & RACEK (1968: 666) synonymized H. argyrosperma var. tenuis in the nominal species. RICCIARDI & REISWIG (1993) studied a large number of A. argyrosperma specimens from Canada and reported the gemmoscleres to be so intergrading in many specimens as to make it impossible to distinguish two size classes. That in fact holds true for gemmoscleres taken out of several gemmules from a single specimen (fig. 10) as well as for those from one single gemmule. However, some entire gemmules taken out of a same specimen exhibit two very conspicuous size classes of gemmoscleres, the largest ones projecting their remarkable rotulot hooks far beyond the level of the small ones (fig. 6).

Anheteromeyenia ornata (Bonetto & Ezcurra de Drago, 1970) comb. n. (Figs. 3 - 5, 11)


Redescription. Sponge forming inconspicuous, fragile crusts consisting of a very thin skeleton barely covering the abundant gemmules. Living sponges with gray and green portions.

Megascleres thin to thicker, slightly curved, sometimes sigmoid, sparsely spined, abruptly pointed anfioxea; spines small, acute, the ones at the extremities of the scleres turned towards the sclere ends.

Gemmoscleres consisting of two not sharply defined size classes of stout, strongly spined dome to pointed shaped birotulates. Birotulates of the longer class fewer in number, their rotules consisting of an irregular arrangement of long recurved spines around the shaft ends, shafts in this class with several large spines, some of them usually grouped at the middle of the shaft; birotulates of the short class predominate in the gemmular coat, rotules with a very irregular arrangement of also irregular, short, recurved spines; shafts

of the short class with abundant, regularly spaced small spines; spines in the middle portion of long and short birotulates are straight whilst those placed towards the extremities are incurved inwards. Both long and short class gemmoscleres may exhibit second and third rows of rotular spines or conspicuous swallowings of the middle shaft. Also some small, spiny, spherical to irregularly shaped spicules, which seem to be abnormal gemmoscleres may be found in the gemmules (figs. 3 - 5, 11).

Gemmules abundant, quite large, brown to redish brown, singly solded to the substrate or forming groups of many gemmules, one gemmule thick, solded to each other and to the substrate. Gemmules provided with a single cylindrical foraminal tubule set in a conical depression of the gemmular surface. Pneumatic coat thick with polyedrical alveoli, gemmoscleres rather radially embedded in this coat in one single layer, the longer gemmoscleres projecting beyond the level of the short ones. Several megascleres are also seen tangentially embedded in the pneumatic coat.

Dimensions. Megascleres length 150 - 370, width 5 - 16; long class gemmoscleres length 103 - 170, widht 4 - 9.5; short class gemmoscleres length 61 - 126, widht 5.5 - 9.6; diameter of gemmules 500 - 650.

Distribution. Brazil, from the Amazon Basin (Amazonas State) and several rivers in Rio Grande do Sul State to Parana River (Misiones Province, Argentina).

Habitat. The species seems to prefer rocky substrates in fast running waters.


**Acanthodiscus** new genus


*Anheteromeyenia* LAUBENFELS, 1936: 36 (partim); PENNEY & RACEK, 1968: 114 (partim).

Etymology. The name refers to the spiny character of the outer and inner faces of the disk-like rotules in the short class gemmoscleres. Gender masculine.

Type species: *Heteromeyenia ryderi* Potts, 1882.

Diagnosis. Freshwater sponges with two classes of birotulate gemmoscleres, distinct in shape and size, the shorter class about two thirds the length of the long one. Short class, spool- shaped, with spiny or smooth shafts and expanded, flat, microspined or microgranulated rotules with borders serrated or cut in several straight rays, the outer rotule sometimes smaller than the inner one. Long class gemmoscleres with cylindrical, stout, spiny shafts and small, smooth, umbonate rotules composed of an irregular number of short and curved hooks or rays. Shaft spines in the short class straight and grouped in the middle of the shaft, with usually one or two larger spines; shaft spines in the long class usually conspicuously curved, grouped in the middle of the shaft or irregularly distributed along it.

Description. Sponges forming light green, white, yellow or brown, thin crusts or sponges forming small hemispherical growths or yet lobose or ramose, larger massive

Figs. 1-5. Anheteromeyenia argyrosperma (Potts): 1, 2, longer and shorter gemmoscleres; Anheteromeyenia ornata (Bonetto & Ezcurra de Drago): 3, longer gemmoscleres; 4, one long and one short gemmoscleres; 5, shorter gemmoscleres with middle inflation of the shaft and double or triple rotules.

specimens, which may be 5 - 7 cm in diameter. Main skeleton an irregular network of short and thin spicule fibers, spongin rather abundant, ectosome thick, irregularly incrusted with megascleres and hispid from the piercing of the upper spicule fibers. Oscula small, conspicuous.

Megascleres slender to stout, sparsely to strongly spined, straight to slightly curved abruptly pointed anfioxea, spines straight or turned to the sclere extremities, sometimes one or a few large spines turned to different angles are present.

Microscleres absent. Gemmoscleres as in the genus diagnosis.

Gemmulae abundant, white, from small to large, distributed from the base to the top of the sponge, gemmoscleres radially embedded in the thick pneumatic coat. Foraminal tube cylindrical, short, straight. Inner gemmular coat three-foliated, pneumatic coat with large polyedrical air spaces, outer gemmular coat thick and granular. The short spool-shaped anfiodiscs contained in the pneumatic coat, the long class umbonate anfiodiscs projecting beyond the level of the pneumatic coat.

Distribution. Paleartic, Neartic and Neotropical.

Habitat. Seasonal ponds behind the dune belt along the northwestern border of the Paleartic Region and the eastern border of the Neartic and the Neotropical regions.

Key to the species of Acanthodiscus

1. Rotules of the short class gemmoscleres serrated and bearing a conical shaft projection or shaft projection missing; rotules of the long class gemmoscleres composed of long recurved hooks, with bifid or lanceolated extremities, shaft spines in this class curved .......................................................... A. ryderi

Rotules of the short class gemmoscleres deeply incised, daisy-shaped and bearing a rounded shaft projection; rotules of the long class gemmoscleres composed of thick, short recurved rays ending in small, curved spines, shaft spines in this class straight .......................................................... A. sheilae

Acanthodiscus ryderi (Potts, 1882) comb. n.
(Figs. 7, 8)

Heteromeyenia ryderi Potts, 1882: 13; 1887: 242, pl. XI, figs. IV, V, VI, type locality Cobbs Creek, Delaware River, Philadelphia, Pennsylvania, USA, E. Potts leg., 1881.

Anheteromeyenia ryderi; PENNEY & RACEK, 1968: 117, pl. 10, fig. 1 (and synonym); POIRRIER, 1977: 62, figs. 1-4; VOLKMER - RIBEIRO & TRAVESET, 1987: 233, fig. 7 (lectotype ANSP - PO 4536); VOLKMER - RIBEIRO et al., 1988: 86; figs. 13 - 17; OKLAND & OKLAND, 1989:179, figs. 3-6; FROST, 1991: 116, fig. 4.10; RICCIARDI & REISWIG, 1993: 667, fig. 2 (and synonym).

Redescription. Sponge light green when exposed to light, otherwise white or brown. Sponge forming from small, compact, hemispherical crusts to large, thick irregular crusts 5 cm high and 5 to 7.5 cm long growing into lobose, palmate or branching terminations on or around submerged vegetation, timber or, more rarely, on stones. Surface smooth, oscules conspicuous. Skeleton non fasciculated or irregularly fasciculated or skeleton forming at the branches and lobes; “many slender, nearly parallel lines of slightly fasciculated spicules, the network being completed by crossing lines of single or nearly solitary spicules” (Potts, 1887: 246).

Megascleres from stout and short to longer and slender, from straight to slightly curved, from heavily to sparsely spined, from abruptly to gradually pointed anfoxiaea, the spines at the middle part of the spicules straight, from there on the spines are turned towards each extremity.

Gemmoscleres birotulates of two classes distinct in shape and size. Long birotulates with domeshaped small rotules composed of an irregular number of dissimilar, recurved hooks with bifid or lanceolated ends, shafts cylindrical, stout, spined, their spines equal in length and curvature with the hooks of the rotules, singly or irregularly grouped along the shaft, rarely only at the middle of shaft. Short birotulates spool shaped, with slender usually smooth shafts abruptly enlarging towards the rotules, sometimes with a few, dissimilar, conical microspined spines at middle shaft; rotules large, flat, thick, microgranulated, with crenulated or serrated borders and containing the conical projection of the shaft, outer rotule sometimes smaller than the inner one (fig. 8).

Gemmoscleres radially embedded in the pneumatic coat the shorter class completely concealed in the pneumatic coat, the longer class with the outer rotules projecting free beyond the level of the outer coat. The number of the longer gemmoscleres varies from gemmule to gemmule (fig. 7).

Dimensions. Megascleres length 296 - 431, width 12 - 26; long class gemmoscleres length 47 - 92, width 5 - 10; short class gemmoscleres length 33 - 49, width 5 - 8, diameter of rotules 25 - 29; diameter of gemmules 300 - 800.

Distribution. An amphiatlantic distribution in the northern hemisphere with its main range along the eastern coast of North America and Canada, one record from Central America and records from the western coast of the British Islands, the Faroes and southwestern Norway (OKLAND & OKLAND, 1989).

Habitat. Small lakes and ponds with fresh, brown waters, not far from the sea border.

Examined material. USA. Philadelphia: Coobs Creek, Delaware River, 1881, E. Potts, leg., fragment with gemmules from the lectotype (ANSP-PO 4536).

Remarks. Several authors presented arguments in favor of the idea that not four species of the A. ryderi group instead four ecomorphs of A. ryderi were involved. POTTs (1887) himself relegated A. pictouensis to the subspecific rank. STEPHENS (1920) and OKLAND & OKLAND (1989) extensively studied the many specimens of A. ryderi registered from western Europe and found all variants between A. ryderi and A. pictouensis thus considering the second species an ecomorph and synonym of the first one. POIRRIER (1977) synonymized A. conigera (Old, 1931) with A. ryderi on grounds of his observation of the A. conigera gemmoscleres in gemmules produced in the laboratory from A. ryderi specimens which lacked gemmules and were provenient from waters with presumably low dissolved silica. HARRISON (1977) synonymized A. biceps with Ephydatia mülleri (Lieberkhün, 1855).
Acanthodiscus new genus ...

Figs. 6-9. Gemmular coat with “in situ” longer and shorter gemmoscleres: 6, Anheteromeyenia argyosperma (Potts); 7, Acanthodiscus ryderi (Potts); 8, short gemmosclere and part of megasclere in A. ryderi (Potts); 9, short gemmosclere in A. sheilae (Volkmer-Ribeiro et al.).

Acanthodiscus sheilae (Volkmer-Ribeiro, De Rosa-Barbosa & Tavares, 1988) comb. n. (Fig. 9)

Anheteromeyenia sheilae VOLKMER-RIBEIRO et al., 1988: 85, figs. 3-12, 18, holotype, seasonal pond behind the dunes, not far from Parque Nacional da Lagoa do Peixe, Tavares, Rio Grande do Sul, Brazil, 12.XI.1984, Sheila M. Pauis leg. (MNRJ, examined).

Redescription. Sponge forming small, irregular crusts on hardened nodules of clay on the bottom of shallow seasonal ponds. Living sponge whitish. Skeleton devoid of spicule fibers and consisting of an irregular tangential deposition of the megascleres around and on top of the abundant gemmules. Spongin abundant gluing together megascleres, gemmules and sand grains. Ectosome conspicuous at places with small oscular orifices. Surface irregular and hispid from the projection of single spicules. Dry sponge fragile and brittle.
Megascleres straight to slightly curved, sparsely spined oxea with smooth, gradually pointed extremities, spines small (VOLKMER-RIBEIRO et al., 1988, fig. 5). Young spicules grading from thin, curved or sinuous oxeas to the large adult ones.

Gemmascles birotulates of two very distinct classes. (VOLKMER-RIBEIRO et al., 1988, figs. 4, 6-11); long class birotulates fewer in number and with stout, cylindrical shafts, bearing at middle part a group of irregular, large, straight spines and terminally with small, thick, unbonate rotules composed of an irregular number of stout, short, recurved rays abruptly slendering into small recurved spines; the short class gemmoscleres predominate in the gemmular coat, they are spool-shaped birotulates about three fourths the length of the long ones, shafts thinner at the middle part and there provided with a group of large, irregular, straight spines or shafts smooth, terminally with large, flat, granulated daisy-shaped rotules bearing a central unbonate projection of the shaft, borders deeply, irregularly cut into straight rays, rotules equal or outer rotule smaller than the inner one (fig. 9).

Gemmules abundant, whitish, spherical or hemispherical, foraminal tube conspicuous straight with outcurved bord, contained into the thick pneumatic coat, outer coat thick, granular, pneumatic coat alveolar, the outer alveoli larger than the inner ones, inner gemmular coat thick, three-foliated, gemmoscleres radially embedded in the pneumatic coat, the longer gemmoscleres projecting their outer rotules beyond the outer coat in those gemmules where the pneumatic coat has not attained its full thickness.

Dimensions. Megascleres length 259 - 462, width 4 - 17; long class gemmoscleres 41 - 70, width 2 - 10; short class gemmoscleres length 35 - 54, width 4 - 8, diameter of rotules 26 - 33; diameter of gemmules 370 - 543.

Distribution. Eastern part of Rio Grande do Sul State, Brazil.

Habitat. Seasonal, shallow ponds behind the settled, shrubby dunes along the coast-line or seasonal ponds farther inland.


DISCUSSION

Genus Anheteromeyenia, redefined shares with genus Radiospongilla Penney & Racek, 1968, the common possession of quite similar short gemmoscleres with abundantly spined shafts and small rotules, each composed of an irregular arrangement of incurred spines. Other characteristics shared by the two genera are the slim, spined, abruptly pointed oxea megascles with spines turned to the sclere ends, the absence of microscleres, the rather radial setting of the gemmoscleres in the pneumatic coat, the presence of a foraminal tubule and the abundance of gemmules. The two genera show however clear cut definitions since in genus Radiospongilla the longer gemmosclere is missing, the gemmules have a long foraminal tubule (MASUDA et al., 1981: figs. 2, 3) and a pneumatic coat with reticulate fibers (MASUDA & SATOH, 1984: figs. 12a, b, c) instead of the polyedrical alveoli of the pneumatic coat and the short foraminal tubule in Anheteromeyenia gemmules. In genus Radiospongilla there is also an abundant production.
Fig. 10: Anheteromeyenia argyrosperma (Potts), gradual size variation of the gemmoscleres.

of skeletal fibers and spongin. The author foresees as necessary a revision of genus *Radiospongilla* Penney & Racek, 1968 in the search of other species which may exhibit *Anheteromeyenia* characteristics as seems, for instance, to be the case with *Radiospongilla sendai* (Sasaki) (SASAKI, 1936). That would eventually extend the distribution of genus *Anheteromeyenia* to other geographical regions.

No evidences could be perceived supporting the hypothesis of the transformation of the gemmoscleres in *Anheteromeyenia argyrosperma* and *A. ornata* into the regular dome-shaped longer birotulate gemmosclere of *Acanthodiscus* new genus end less yet into its also regular spool-shaped shorter gemmosclere. The proposition of the new genus *Acanthodiscus* comes to shed light on a group of species with characteristics of its own. No other genus of birotulate freshwater sponges missing microscleres has two so sharply different class of gemmoscleres.

*Fig. 11: Anheteromeyenia ornata* (Bonetto & Ezcurra de Drago), gradual size variation of the gemmoscleres.
Acknowledgments. To Dr. Ines Ezcurre de Drago, Instituto Nacional de Limnologia, Santa Fé, Argentina, for the donation of a fragment of the holotype of Radiospinilla ornata; to Dr. George P. Davis (ANSP) for loan of material of Spongilla argyrosperma and of Heteromeyenia ryderi; to Mr. Cleodir J. Mansan (MCN) with the operation of the Museum JEOL-5200 SEM equipment.

REFERENCES


Received in 13.03.1995; aceito in 10.10.1995.