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Order Baerida Borojevic, Boury-Esnault & Vacelet, 2000

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Baerida Borojevic *et al*. (Calcarea, Calcaronea) contains three families with a leuconoid aquiferous system without radial symmetry, characterized by a skeleton either made exclusively of microdiactines or in which microdiactines constitute predominantly a specific sector of the skeleton. As in Lithonida they are represented by well characterized and very distinctive genera, suggestive of long-term evolution.
Keywords: Porifera; Calcarea; Calcaronea; Baerida; Baeriidae; Lepidoleuconidae; Trichogypsiidae; *Leuconia*; *Eilhardia*; *Kuarrhaphis*; *Lamontia*; *Lepidoleucon*; *Leucopsila*; *Leucyssa*; *Trichogypsia*.

DEFINITION, DIAGNOSIS, SCOPE

Synonymy

Baerida Borojevic, Boury-Esnault & Vacelet, 2000: 249.

Diagnosis

Leuconoid Calcaronea with the skeleton either composed exclusively of microdiactines, or in which microdiactines constitute exclusively or predominantly a specific sector of the skeleton, such as choanoskeleton or atrial skeleton. Large or giant spicules are frequently present in the cortical skeleton, from which they can partially or fully invade the choanoderm. In sponges with a reinforced cortex, the inhalant pores can be restricted to a sieve-like ostia-bearing region. Dagger-shaped small tetractines (pugioles) are frequently the sole skeleton of the exhalant aquiferous system. Although the skeleton may be highly reinforced by the presence of dense layers of microdiactines in a specific region, an aspicular calcareous skeleton is not present.

Scope

Baerida contains three families, Baeriidae Borojevic *et al*., 2000 with four genera, Trichogypsiidae Borojevic *et al*., 2000 with three genera, and Lepidoleuconidae Vacelet, 1967b which is monotypic.

History and biology

Baerida was erected by Borojevic *et al*. (2000) for a group of calcaronean sponges without any trace of radial symmetry, which apparently has not followed the sycettid pathway of evolution. Most of them were already considered as aberrant by Dendy & Row (1913) and provisionally included in their Grantiidae. The aquiferous system is always leuconoid, with choanocyte chambers distributed irregularly throughout the sponge wall. There is no true atrial or subatrial skeleton reminiscent of the central or radial tube. During reorganization after dissociation, known in one species of *Baeria*, the sponge does not pass through olynthus and sycettid stages, as in Leucosolenida, but develops a leuconoid aquiferous system by the formation of a rhagon similar to that described for Demospongiae.

Taxonomic remarks

Baerida are also characterized by having two distinct categories of spicules, which may correspond to the megascleres and microscleres in Demospongiae. Small spicules, most frequently microdiactines, are found throughout the sponge. Giant spicules are limited to the cortical region or invade the choanosome from the cortex. Harpoon-like tetractines, or pugioles, are found in the skeleton of exhalant canals. Although these pugiole tetractines appear to be characteristic of Baerida, they are also observed in some Lithonida, suggesting affinities between these two orders. As Lithonida, the Baerida are represented by well-characterized and very distinct genera, with no intermediate forms, suggestive of long-term evolution in which a small number of only the most specialized forms are conserved. This contrasts with Leucosolenida, in which continuous evolutionary lineages with all the intermediate forms are observed, suggesting a recent evolutionary radiation. A similar situation is observed in the Calcinea for Murrayonida and Clathrinida.

KEY TO GENERA

(1) Skeleton composed of only diactines (Trichogypsiidae) 2
Skeleton composed of diactines, triactines and/or tetractines 4
(2) Microdiactines 'needle-eye' type ..... ***Kuarrhaphis***
Lanceolate diactines with spines on one or both ends, or smooth diactines 3
(3) Lanceolate spiny diactines ..... ***Trichogypsia***
Smooth diactines ..... ***Leucyssa***

(4) Sponge with a specialized inhalant zone bearing pores 5
Sponge without a specialized inhalant zone (Baeriidae) 6
(5) Cortex composed of scales derived from triactines ..... ***Lepidoleucon***
Cortex composed of triactines and tetractines and sometimes diactines; pugioles are present in the atrial skeleton ..... ***Lamontia***
(6) Calyciform sponges with inhalant ostia localized on the inner surface and oscula on the outer surface ..... ***Eilhardia***
Not calyciform sponges 7
(7) Atrial skeleton with pugioles ..... ***Leuconia***
Atrial skeleton with microdiactines ..... ***Leucopsila***

FAMILY BAERIIDAE BOROJEVIC, BOURY-ESNAULT & VACELET, 2000

Synonymy

Baeriidae Borojevic *et al*., 2000: 251.

Definition

Baerida with a choanoskeleton consisting of giant triactines, and/or of tetractines in no particular order, and/or of very numerous microdiactines. No traces of radial organization can be seen in the choanoskeleton. The cortical skeleton consists of triactines, giant diactines, and/or numerous microdiactines, and occasionally the basal actines of cortical giant tetractines. The choanoskeleton consists of scattered spicules similar to those observed in the cortex, to which numerous microdiactines can be added, or which can be entirely replaced by microdiactines. The exhalant aquiferous system is formed by ramified canals that have no tangential skeleton, being loosely or densely covered by harpoon-shaped pugioles and/or microdiactines.

Scope

Baeriidae contains five nominal genera of which four are considered valid: *Leuconia* Grant, 1833 (with junior synonym *Baeria* Miklucho-Maclay, 1870); *Eilhardia* Poléjaeff, 1883; *Lamontia* Kirk, 1895; *Leucopsila* Dendy & Row, 1913.

LEUCONIA GRANT, 1833

Synonymy

Baeria Miklucho-Maclay, 1870; Borojevic *et al*., 2000: 251.

Type species

Spongia nivea Grant, 1826 (subsequent designation; Bowerbank, 1862: 1094) (Fig. 1).

Diagnosis

Baeriidae in which the choanoskeleton consists of giant triactines and/or tetractines, lying without apparent order, and of very numerous microdiactines. A cavity equivalent to the atrium, localized only under the oscula, has a skeleton supported by tangential triactines. All the other exhalant canals have a skeleton composed of harpoon-shaped pugioles.

Scope

Leuconia contains five species, two of which, *L. johnstoni* (Carter, 1871d) and *L. nivea* (Grant, 1826) have long been classified in *Leucandra*. The genus *Baeria* Miklucho-Maclay, is a junior synonym of *Leuconia*. Its type species, *Baeria ochotensis* Miklucho-Maclay, 1870 (Fig. 1) has many microdiactines with the needle-eye form, corresponding in fact to tiny triactines, needle-eye form, corresponding in fact to tiny triactines, with two reduced paired actines generally fused at the end, or when free corresponding to the diapason triactines of the Lithonida (Dendy & Row, 1913).

Distribution

Sea of Okhotsk, Arctic, NE Atlantic, E Australia. The type species is common in the NE Atlantic.

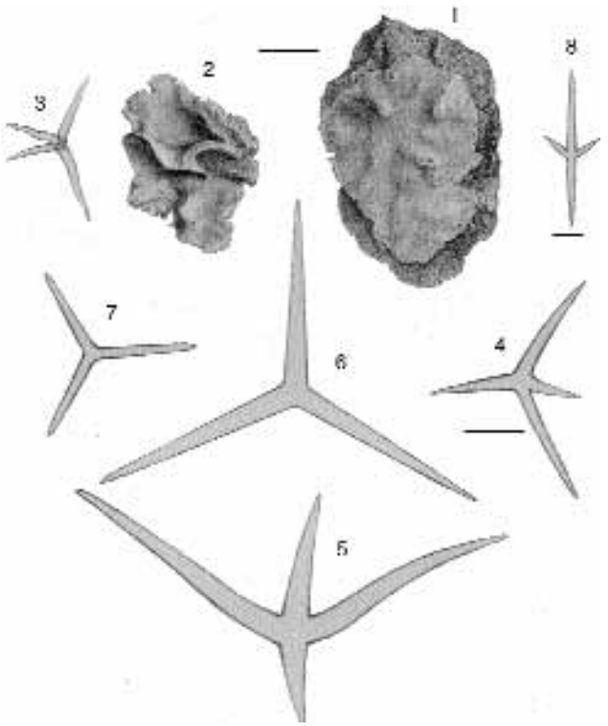

Fig. 1. *Leuconia nivea* (Grant, 1826). 1–2, specimens from sheltered (1) and exposed (2) habitat (scale 10 mm). 3–7, triactines and tetractines (scale 125 μm). 8, harpoon-like tetractine (pugiole) (scale 38.5 μm). From Bowerbank, 1874.

EILHARDIA POLÉJAEFF, 1883

Synonymy

Eilhardia Poléjaeff, 1883: 70; Burton, 1963: 316; Borojevic *et al*., 2000: 253.

Type species

Eilhardia schulzei Poléjaeff, 1883 (by monotypy) (Fig. 2).

Diagnosis

Calyciform Baeriidae with inhalant ostia on the inner surfaces, and oscula on the outer surfaces. The ostia-bearing surface is supported by a thin layer of tangential triactines and scattered microdiactines. The skeleton of the exhalant system and of the choanoskeleton is composed of large triactines and microdiactines. The cortical skeleton consists of giant longitudinal diactines and small diactines as well as tangential triactines.

Scope

The genus is monotypic and has been well described by Poléjaeff (1883).

Distribution

E Australia.

LAMONTIA KIRK, 1895

Synonymy

Lamontia Kirk, 1895; 0Burton, 1963: 557; Borojevic *et al*., 2000: 253.

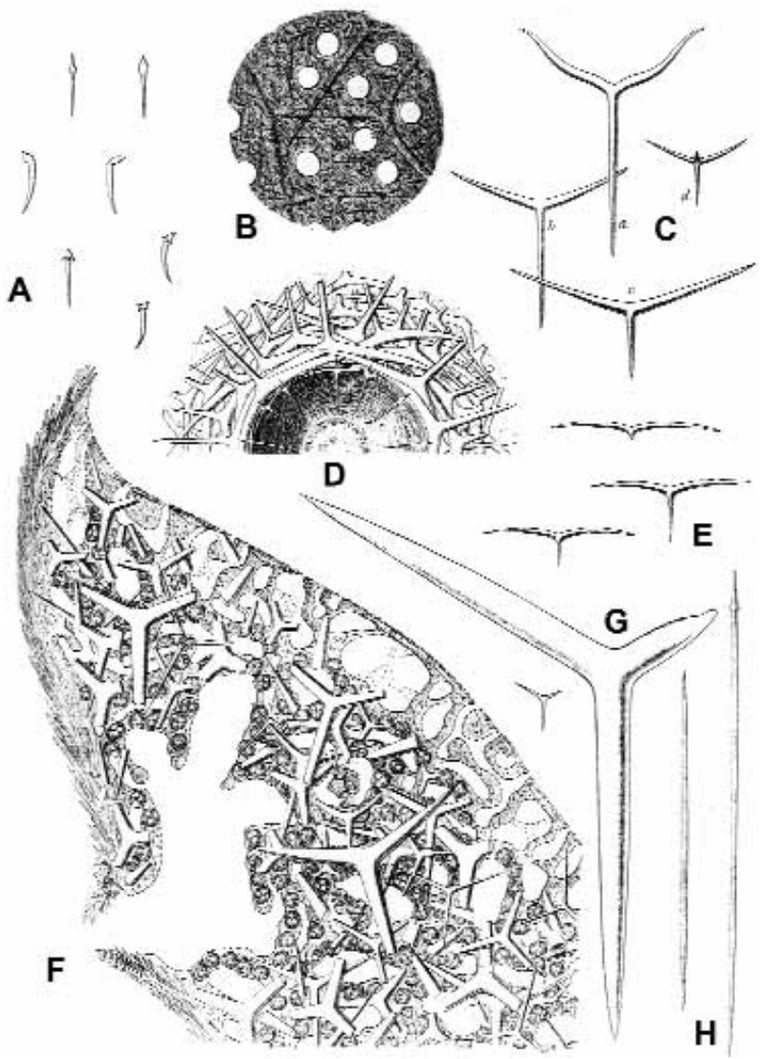

Fig. 2. *Eilhardia schulzei* Poléjaeff, 1883. A, microdiactines from the inhalant surface. B, part of the inhalant surface. C, a–d: a, triactine from the inhalant surface; b–c, triactines from the convex surface; d, perioscular tetractine. D, one half of an osculum (from within). E, perioscular triactines. F, portion of a vertical section. G, triactines from the choanoskeleton. H, diactines from the convex surface. From Poléjaeff (1883).

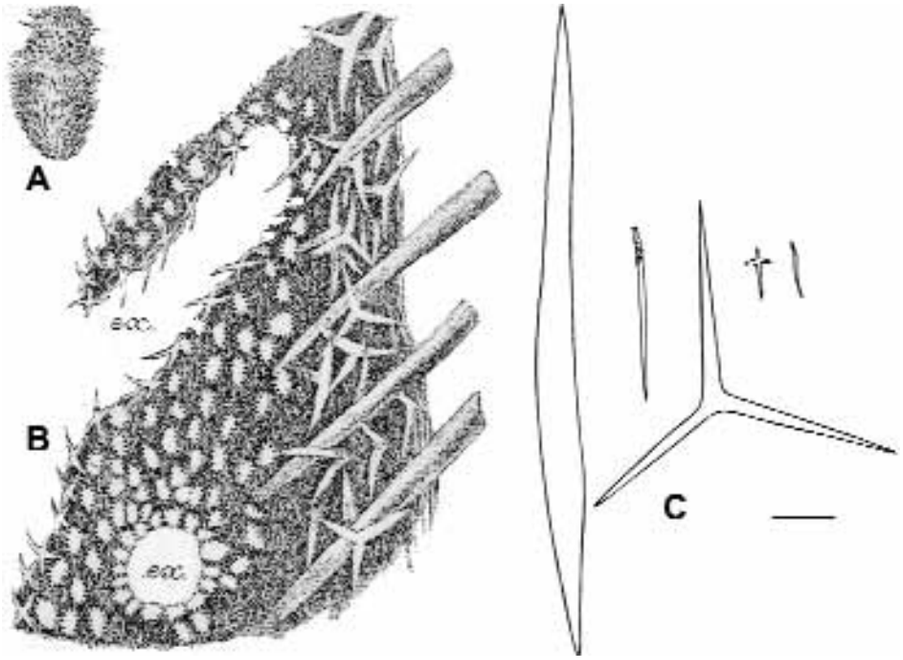

Fig. 3. *Lamontia zona* Kirk, 1895. A, type specimen. B, longitudinal section (ex, exhalant canals). C, spicules (scale 100 μm). From Kirk (1895).

Type species

Lamontia zona Kirk, 1895 (by monotypy) (Fig. 3).

Diagnosis

Baeriidae in which the choanoskeleton consists of microdiactines. Cortical and atrial skeletons is made of triactines and tetractines, and the cortex is pierced by large diactines. A specialized ostia-bearing zone, located below the osculum, leads the incurrent water flow to inhalant cavities.

Scope

Monotypic.

Distribution

New Zealand.

LEUCOPSILA DENDY & ROW, 1913

Synonymy

Leucopsila Dendy & Row, 1913: 776; Burton, 1963: 314; Borojevic *et al*., 2000: 253.

Type species

Leuconia stilifera Schmidt, 1870 (by monotypy).

Diagnosis

Baeriidae in which the cortex is formed by tangential triactines and microdiactines. The choanoskeleton is composed almost exclusively of irregularly scattered giant tetractines, and numerous microdiactines. Both the cortical and atrial surfaces are covered by a dense layer of microdiactines. While in the cortex microdiactines overlay the continuous layer of tangential triactines, they are the sole skeleton of the exhalant aquiferous system.

Scope

The monotypic genus *Leucopsila* differs from *Leuconia* mainly by the replacement of pugioles of the exhalant system by microdiactines.

Distribution

Arctic and subarctic waters of the Atlantic and Pacific regions.

FAMILY TRICHOGYPSIIDAE BOROJEVIC, BOURY-ESNAULT & VACELET, 2000

Synonymy

Trichogypsiidae Borojevic *et al*., 2000: 254.

Definition

Baerida with a skeleton entirely formed by diactine spicules.

Scope

Trichogypsiidae contains three genera, *Kuarrhaphis* Dendy & Row, 1913 and *Leucyssa* Haeckel, 1872, which are monotypic, and *Trichogypsia* Carter, 1871d, with two species.

History and biology

Trichogypsiidae has been erected for poorly known sponges that have affinities with the Baeriidae, but that have only diactine spicules. They have been only described from boreal or arctic regions.

KUARRHAPHIS DENDY & ROW, 1913

Synonymy

Kuarrhaphis Dendy & Row, 1913: 780; Burton, 1963: 245; Borojevic *et al*., 2000: 254.

Type species

Leucyssa cretacea Haeckel, 1872 (by monotypy) (Fig. 4).

Diagnosis

Trichogypsiidae with a skeleton composed exclusively of small perforated needle-eye diactines.

Scope

The genus is monotypic. *Kuarrhaphis cretacea* is an encrusting sponge with a leuconoid organization. The needle-eye spicules are similar to diapason triactines.

Distribution

North Pacific (Kamtshatka).

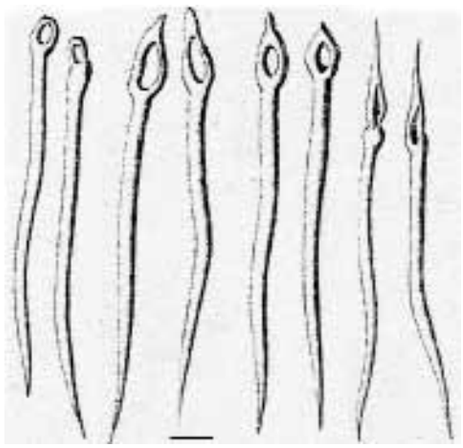

Fig. 4. *Kuarrhaphis cretacea* (Haeckel, 1872). Needle-eye diactines (scale 10 μm). From Haeckel (1872).

LEUCYSSA HAECKEL, 1872

Synonymy

Leucyssa Haeckel, 1872: 137; Dendy & Row, 1913: 779; Burton, 1963: 575; Borojevic *et al*., 2000: 255.

Type species

Leucyssa spongilla Haeckel, 1872 (by monotypy) (Fig. 5).

Diagnosis

Trichogypsiidae with a skeleton composed only of smooth diactines.

Scope

The genus is monotypic. *Leucyssa spongilla* is a pedunculate growth form with a clathrate body of anastomosed tubes, as found in some Clathrinida, but rather unusual in both Baerida and Leucosolenida. The canal system is described as leuconoid.

Distribution

Japan.

TRICHOGYPSIA CARTER, 1871

Synonymy

Trichogypsia Carter, 1871d: 1; Dendy & Row, 1913: 779; Borojevic *et al*., 2000: 254.

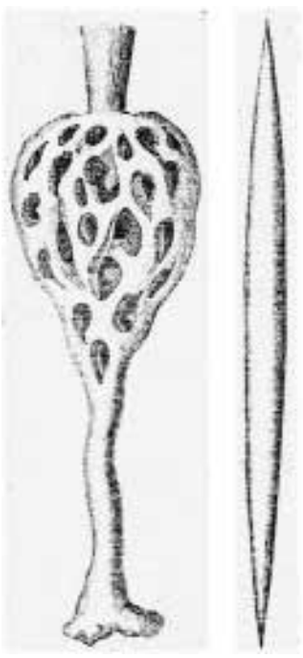

Fig. 5. *Leucyssa spongilla* Haeckel, 1872. External form and spicule. From Haeckel (1872).

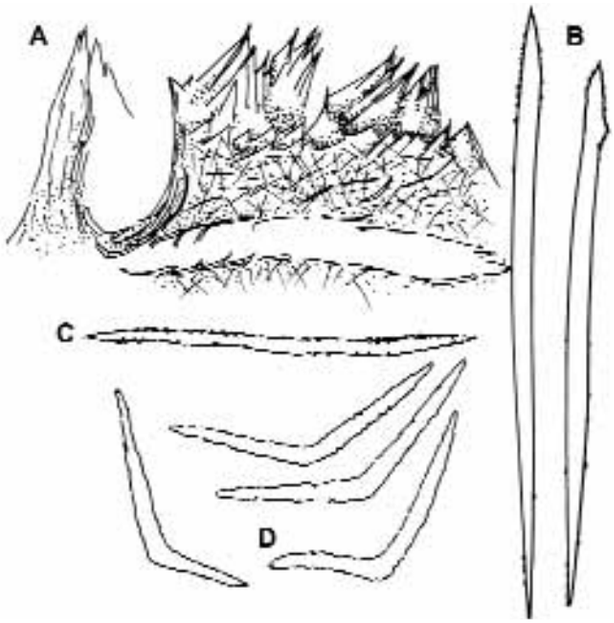

Fig. 6. *Trichogypsia villosa* Carter, 1871d. A, transverse section of the body wall, showing a pit-like cavity and a canal parallel to the external surface that bears conules containing very densely arranged parallel diactines. B, diactines of the cortical conules. C, diactine of the internal reticular skeleton. D, diactines lining the pit-like cavity. From Borojevic *et al.* (2000).

Type species

Trichogypsia villosa Carter, 1871d (by subsequent designation; Dendy & Row, 1913).

Diagnosis

Trichogypsiidae with a skeleton composed of spined diactines.

Description of type species

Trichogypsia villosa Carter, 1871d (Fig. 6).

Synonymy. *Trichogypsia villosa* Carter, 1871d: 1; Burton, 1963: 357; Borojevic *et al*., 2000: 254.

Material examined. Holotype: BMNH 1870.10.1.9 (Carter's slide).

Description. Encrusting growth form, with a thick cortex elevated in conules. Cortex supported by very densely packed parallel diactines, arranged in bunches in the conules. A large, deep cavity present at the surface, surrounded by a particular skeleton composed of bent diactines and connected to a canal parallel to the surface. Both the canal surface and the internal skeleton consisting of straight or slightly curved spiny diactines forming a rather loose network.

Scope

Two species, *T. villosa* and *T. incrustans* Haeckel, 1872.

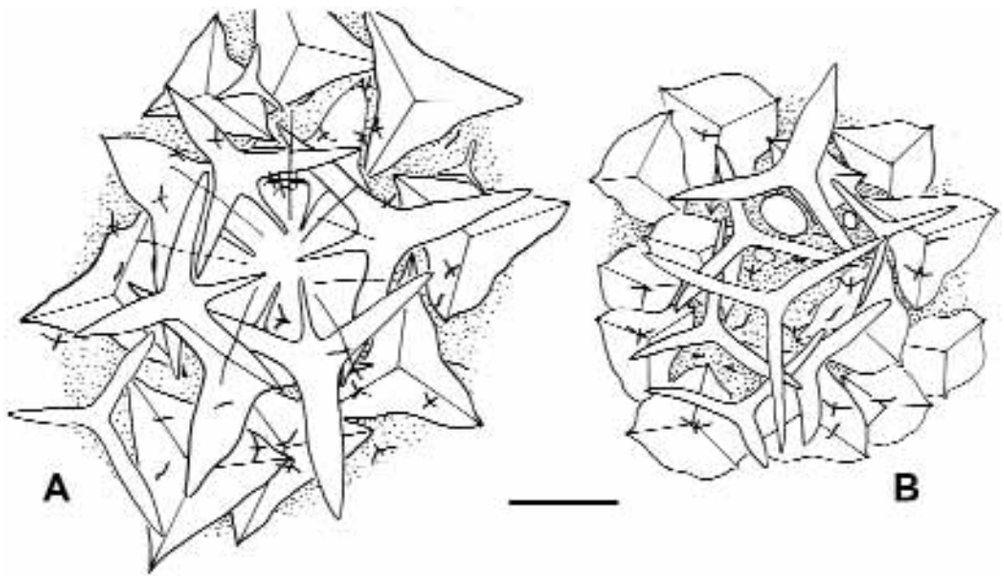

Fig. 7. *Lepidoleucon inflatum* Vacelet, 1967b. A, surface view of the osculum. B, surface view of the inhalant area (scale 150 μm).

Distribution

Norway, British Isles, probably from the Laminaria zone.

FAMILY LEPIDOLEUCONIDAE VACELET, 1967

Synonymy

Lepidoleuconidae Vacelet, 1967b.

Definition

Baerida with a leuconoid organization and with an irregular outer layer of scales derived from triactines. Choanoskeleton exclusively composed of scattered micro-diactines. Ostia localized in a special area where the triactines are not transformed into scales. Osculum with a circlet of modified tetractines.

Scope

Monotypic, with a single species.

History and biology

The family has been described as an uncertain 'pharetronid', and then transferred to Baerida by Borojevic *et al*., 2000. The calcareous superficial scales derived from triactines are reminiscent of the scales of Murrayonidae and Paramurrayonidae in subclass Calcinea. The organization of the skeleton, however, is similar to that of other Baerida.

Remarks

Scales derived from triactines have been described in the poorly known *Leucetta trigona* Haeckel, 1872, which may belong to family Lepidoleuconidae.

LEPIDOLEUCON VACELET, 1967

Synonymy

Lepidoleucon Vacelet, 1967b.

Type species

Lepidoleucon inflatum Vacelet, 1967b (by monotypy).

Diagnosis

As for family.

Description of type species

Lepidoleucon inflatum Vacelet, 1967b (Fig. 7).

Synonymy. *Lepidoleucon inflatum* Vacelet, 1967b: 54; Vacelet, 1977a: 352; Vacelet, 1981: 349.

Material examined. Holotype: MNHN 28/9/1964. Paratypes: BMNH 06014. Other material. Several specimens from Madagascar, New Caledonia and French Polynesia.

Description. Tiny hemispherical growth form, 0.4–1 mm in diameter, covered by several superficial layers of triangular or rounded scales, 160 μm in maximum diameter, deriving from triactines. Osculum single, central, with a circlet made by the inflated lateral actines of special tetractines whose apical actine is directed towards the centre of the aperture. Ostia localized in a lateral area devoid of scales and bearing large triactines. Colour yellowish or brownish. Choanoskeleton exclusively composed of microdiactines. Aquiferous system leuconoid, with apinucleated choanocytes. Amphiblastula larvae.

Distribution and ecology. Indian Ocean (Madagascar), Western and Central Pacific (New Caledonia, Tuamotu Islands), in underwater caves and tunnels of the fore-reef zone, 3–30 m depth.

Distribution

As for type species. The genus is monotypic.