Erylus aleuticus sp. nov. (Porifera: Demospongiae: Astrophorida: Geodiidae) from the Aleutian Islands, Alaska, USA

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A new species of *Erylus* from the Aleutian Islands is described. This is the first record of the genus from the Aleutian Islands. The new species differs from all other known species of *Erylus* in the presence of different types of monaxonic megascleres, ranging from oxeas, strongyles, styles, tylostyles to tylotes, often with unequal ends and irregular modifications of these types. The lack of a secondary category of asters is also unusual for the genus.

INTRODUCTION

The genus *Erylus*, Gray, 1867 was erected for *Erylus mammilaris* (Schmidt, 1862) from the Adriatic Sea. The genus is known from the Mediterranean Sea, Atlantic and Pacific Oceans and contains 57 nominal species, but the taxonomic validity of all species has been questioned (Adams & Hooper, 2001). Some species reportedly contain bioactive compounds with antitumour, antifungal and antiviral properties, especially against retroviruses such as the human immunodeficiency virus (HIV) (Adams & Hooper, 2001). The genus *Erylus* and five other genera constitute the family Geodiidae Gray, 1867 which is characterized by the presence of sterrasters as the main cortical microscleres and various forms of triaenes among the megascleres. Additional microscleres are euasters and microrhabds. Growth forms are massive or thickly encrusting. There is still some debate whether the family should be divided into two families, Erylidae and Geodiidae, or whether all genera belong to a single family with the latter view currently favoured (Uriz, 2002). The genus *Erylus* is characterized by short-shafted triaenes, usually flattened aspidasters and by centrotylote microrhabds. In addition to the triaenes, most species have oxeas as megascleres but, as will be shown below, other spicule types occur as well.

For a recent review of worldwide species we refer to Adams & Hooper (2001). It is the purpose of the present publication to describe a new species of *Erylus* and compare it with other congeners.

MATERIALS AND METHODS

The holotype was collected during a cruise of the RV 'Velero IV' along the Aleutian Islands in June and July 2004. Samples were collected with the submersible 'Delta' and stored in 95% ethanol after collection. Identification followed the usual procedures of obtaining sections and spicule preparations for investigation by light microscopy

and scanning electron microscopy (SEM), described earlier (e.g. Lehnert & van Soest, 1996). The SEM studies were carried out at the Institute for Zoology I in Erlangen, Germany.

SYSTEMATICS

Order: ASTROPHORIDA

Family: GEODIIDAE Gray, 1867

Genus: *Erylus* Gray, 1867

Erylus aleuticus sp. nov.

Material

Holotype: 6230-20-4, collected 34.8 km north of Amlia Island (52°28'8.5"N 173°35'52.9"W) at 190 m depth. Deposited at the Senckenberg Museum, Frankfurt am Main, Germany, under the registration no. SMF 10330.

Description

The holotype (Figure 1A) consists of three attached flattened lobes with oval to circular outlines; the largest lobe is 17×12×3.5 cm, all three lobes are part of the same individual. The surface is creamy white and hard, due to an ectosomal crust of aspidasters about 0.5 mm in thickness. Numerous uniporal orifices are scattered over the surface at intervals of 0.5–2.0 mm. They are round, 0.5–1.0 mm in diameter and slightly (<0.5 mm) raised above the surface. The choanosome is softer and choanosomal megascleres are extremely variable with many malformed and distorted spicules, irregularly bent or straight. Spicule shapes (Figure 1C,D) range from oxeas, styles, tylostyles, strongyles to tylotes, some with irregular diameters; some bat-shaped, size-range, 520–1728×18–42 µm; orthotriaenes (Figure 1B), also with variable rays, blunt or pointed, rays of cladome often bent in one direction, rhabds, 615–790×23–42 µm, clad, 270–380×24–35 µm; aspidasters (Figure 2A,B), measuring 200–225×160–175×28–62 µm; dermal centrotylote microstrongyles

Figure 1. (A–D) *Erylus aleuticus* sp. nov. (A) Holotype, *in situ* at 190 m depth near Amlia Island; (B) cladome of triaene with bent rays; (C) strongylote megasclere among other spicules; and (D) tylote.

(Figure 2C), $30\text{--}47 \times 4\text{--}6\text{ }\mu\text{m}$; oxyasters (Figure 2D), $9\text{--}12\text{ }\mu\text{m}$ in diameter.

Distribution

Known only from the type-locality.

DISCUSSION

Erylus aleuticus sp. nov. is unique with its many types of monaxonic megascleres and the lack of a large category of asters. As will be shown in more detail below, most other known species of *Erylus* have oxeas as choanosomal megascleres; occasionally strongyles are reported or, for some species (described by Lendenfeld, 1910, see below), a mixture of oxeas, styles and strongyles are present. For *E. rotundus* Lendenfeld, 1910 (briefly described below)

‘aster like rhabd clusters’ are reported, so several types of choanosomal megascleres and spicule ‘anomalities’ are not unusual in the genus. However, the high variety of monaxonic megascleres present in *E. aleuticus* sp. nov. has not been demonstrated for congeners. We are aware that malformed spicules occur in many species but in *Erylus aleuticus* they occur in unusually high quantities so that they cannot be regarded as rare exceptions only. Growth forms, spicule categories and their measurements as well as the distribution of North- and central Pacific species of *Erylus* are shown in Table 1.

Erylus aleuticus sp. nov. shares strongylote megascleres and aspidasters of similar size with *E. cornutus* Wilson, 1925: 306, but *E. cornutus* is lacking all other types of monaxonic megascleres and has strongylasters only, which are considerably larger. Furthermore *E. cornutus* is

Figure 2 (A–D) *Erylus aleuticus* sp. nov. (A) Juvenile aspidaster; (B) aspidasters; (C) centrotylote microstrongyle on the surface of an aspidaster; and (D) oxyaster.

described from the Phillipines which makes conspecificity quite unlikely. *Erylus placenta* Thiele, 1898 from Japan is geographically the closest record of another congeneric species. It is described as thinly encrusting (2–3 mm in thickness) and reddish-grey coloured in ethanol and so it differs in both growth form and colour. The presence of oxeas as the only megascleres and smaller aspidasters further differentiate *E. aleuticus* sp. nov. from *E. placenta*. *Erylus placenta* has a category of similar sized asters but they are sphaerasters and, in contrast to *E. aleuticus*, a large category of oxyasters is present.

Erylus schmiederi Austin, 1996: 248 was recorded from the Pacific coast of Mexico at 37 m depth. In addition to short-shafted orthotriaenes it also has dichotriaenes, oxeas (740–1340×19–25 μm), and rare styles and strongyles (900–1550×14 μm) as monaxonic megascleres. The

aspidasters (65–125×53–73×10–15 μm) are considerably smaller than in *E. aleuticus*. Centrotylote microstrongyles (30–50×1–4 μm) are about the same size as in many *Erylus* species. Oxyasters occur in two size-categories: small (8–13 μm), multiple rayed with roughened apices and, larger, typically six-rayed oxyasters, typically also with roughened apices (20–25 μm). *Erylus aleuticus* is lacking the dichotriaenes and the second category of asters of *E. schmiederi* while *E. schmiederi* is lacking the high variety of megascleres. *Erylus discastera* Dickinson, 1945 is known from the Gulf of California at 140 m depth. Dickinson (1945) described plagiotriaenes ‘about 40 μ by 2000 μ’ which is, we assume, the dimension of the rhabd. He also mentions occasional triaenes which are almost calthrops but does not provide their sizes. Megascleres are oxeas (20×600 μm). Aspidasters are

Table 1. North- and central Pacific species of *Erylus*: growth forms, spicule categories, dimensions and distribution.

	Growth form	Monaxonic megascleres	Orthotriaenes	Other triaenes	Aspidasters Centrotyle Microhabds	Large oxyasters	Small oxyasters	Other asters distribution
<i>Erylus placenta</i> Thiele, 1898	Encrusting	Oxeas, 700–800 × 15 µm	Rhabd, 500 µm, clad, 270 µm	None	170–200 × 80–90 × 18 µm centrotyle microxeas, 25–50 µm 220 × 175 × 112 µm microstrongyles, 25–50 × 6 µm	40–60 µm, 3–6 rays	None	Sphaerasters, 10 µm Kagoshima, Japan
<i>Erylus cornutus</i> Wilson, 1925	Cup-like	Strongyles, 700–1750 × 30–40 µm, oxeas, 500–1200 × 12–25 µm	Rhabd, 500 × 50 µm, clad, 500 × 50/ray, occasionally one dichotomous ray	None		None	None	Stronglyasters, 20–28 µm, 5–7 rays Philippines
<i>Erylus schmiederi</i> Austin, 1996	Encrusting to subglobose	Oxeas, 740–1340 × 19–25 µm, rare strongyles and styles, 900–1550 × 14 µm	Rhabd, 130–400 × 10–15 µm, clad, 200–660 µm	Dichotriaenes, rhabd, 580–880 × 22–30 µm, clad, 130–180 µm and apical rays 65–140 × 22–30 µm	65–125 × 53–73 × 10–15 µm microstrongyles, 30–50 × 1–4 µm	Mostly six rayed, 20–25 µm	Many rayed, 8–13 µm	None Mexico Pacific
<i>Erylus discastera</i> Dickinson, 1945	Massive	Oxeas, 600 × 20 µm	Present, size not given	Plagiotriaenes and diaenes, rhabd (?), 2000 × 20 µm	Large, 240 µm, additionally small sterraster (?), 9 µm in diameter mentioned microstrongyles, 60 × 3 µm	None	None	Sphaerasters, 15 µm Gulf of California
<i>Erylus aleuticus</i> sp. nov.	Massive encrusting, 3.5 × 1.8 cm	Oxeas, strongyles, tylotes, tylostyles, 520–1728 × 18–42 µm	Rhabd, 615–790 × 23–42 µm, clad, 270–380 × 24–35 µm	None	200–225 × 160– 175 × 28–62 µm microstrongyles, 30–47 × 4–6 µm	None	Many rayed, 9–12 µm	None Aleutian Islands, Alaska

large with a maximum diameter of 240 μm ('disc shaped terrasters') and he also mentions very abundant terrasters (9 μm), spherasters (15 μm) and microstrongyles (60 $\times$ 3 μm). *Erylus discastera* is somewhat unusual for the genus given the presence of short-shafted triaenes in addition to a second category of long triaenes and diaenes. The aspidasters are very large and one cannot be sure what is meant by the small category of terrasters. However, the species differs from *E. aleuticus* by having oxeas only as monaxonic megascleres, by the possession of long-shafted triaenes, larger aspidasters, and small terrasters (whatever they might be), and the lack of oxyasters.

There are seven additional species of *Erylus* known from the Pacific Ocean. All of them occur in geographically distant areas, which make conspecificity somewhat unlikely; however, we briefly discuss these here. *Erylus monticularis* Kirkpatrick, 1900 from Funafuti in the central Pacific is thinly encrusting, has oxeas (210 $\times$ 10 μm), small orthotriaenes, microxeas (40–80 μm), oxyasters (18–30 μm), tylasters (10 μm) and aspidasters (150 $\times$ 114 μm). *Erylus decumbens* Lindgren, 1897 from Java is again an encrusting species with only oxeas (800 $\times$ 24 μm) as monaxonic megascleres. Orthoplasiotriaenes (rhabd 420 $\times$ 28 μm , clad 280 μm), microstrongyles (60 $\times$ 6 μm), oxyasters (24 μm), spherasters (10 μm), aspidasters (182 $\times$ 120 $\times$ 28 μm) are all present. *Erylus oxyaster* Lendenfeld, 1910 from the Galapagos Islands has digitate processes, oxeas (1800–2900 $\times$ 60–85 μm) and rare styles (1900–2300 $\times$ 60–105 μm). Lendenfeld (1910) mentions additional rare 'angularly bent and branched rhabd derivatives' of the same dimensions as the oxeas. Based on the figures provided in the description they are actually fused oxeate spicules which are remarkable because of the irregular rhabd derivatives of *E. aleuticus*. *Erylus oxyaster* possesses rare plasiotriaenes (rhabd 900 $\times$ 75–90 μm), dichotriaenes (rhabd, 600–1600 $\times$ 70–105 μm), microstrongyles (31–93 $\times$ 3.5–4.5 μm), oxyasters (10–90 μm) and aspidasters (208–243 $\times$ 125–150 $\times$ 30–40 μm). *Erylus nobilis* Thiele, 1900 from Ternate in western Indonesia is cylindrical, with only oxeas (1000 $\times$ 30 μm) as monaxonic megascleres, orthotriaenes (rhabd 600 $\times$ 40 μm , clad 250 μm), centrotylote microstrongyles (48 $\times$ 6 μm), 'acanthtylasters' (20 μm /ray), and aspidasters (190 $\times$ 90–100 $\times$ 40 μm). *Erylus sollasi* Lendenfeld, 1910 from the Hawaiian Islands is an irregularly-shaped massive species with blunt oxeas (425–980 $\times$ 8–24 μm) and rare pointed oxeas, strongyles and styles of similar dimensions, plasiotriaenes (rhabd 140–520 $\times$ 8–22 μm) and simple or bifurcate clads (70–300 μm), centrotylote microxeas (30–78 $\times$ 2.5–5 μm) and rare anisoactine, branched microxea derivatives, 'acanthtylasters' (10–38 μm), and aspidasters (95–156 $\times$ 55–82 $\times$ 7.4–14 μm). *Erylus rotundus* Lendenfeld, 1910 also from Hawaii is an irregular-shaped massive species with oxeas and strongyles (310–650 $\times$ 6–15 μm) and rare styles, angularly bent and rarely branch bearing rhabd derivatives of similar dimensions. Lendenfeld (1910) also describes 'aster-like rhabd-clusters' (125–180 μm in diameter), orthoplasiotriaenes (rhabd 170–370 $\times$ 6–12 μm , clad, 80–270 μm), microxeas (30–98 $\times$ 1.5–7.5 μm), acanthtylasters (12–31 μm), oxyasters

(7–17 μm), and aspidasters (50–77 $\times$ 46–70 $\times$ 4.4–8.8 μm). *Erylus caliculatus* Lendenfeld, 1910 from Hawaii is inverted, conical, and dirty white in spirit. It has blunt oxeas and strongyles (410–850 $\times$ 10–19 μm), orthotriaenes (rhabd 200–300 $\times$ 13–20 μm , clads 125–220 μm), centrotylote microstrongyles (39–52 $\times$ 3–5 μm), acanthtylasters (17–50 μm), oxyospherasters (9–18 μm) and aspidasters (72–88 $\times$ 67–77 $\times$ 10.6–12.8 μm).

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