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Author's Contributors

AF and FR conceived the study. AF collected the samples during the surveys. MG and FR performed taxonomic work in the laboratory and wrote species descriptions. MG led preparation of the initial draft. All authors contributed to the discussion, interpretation of results, writing of text, and review and editing of the final version.
Two new species of *Rosalinda* (Cnidaria, Hydrozoa, Anthoathecata) from West African cold-water coral mounds

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### Abstract

In this paper, two new species of the genus *Rosalinda* found growing on bivalves from West African cold-water coral mounds are described. *Rosalinda nowaldi* sp. nov. was found on *Acesta angolensis* (Adam & Knudsen, 1955) off northern Angola, and *Rosalinda lundalvi* sp. nov. on *Acesta excavata* (Fabricius, 1779) off Mauritania. Both new species have a similar cnidome, but they can be easily differentiated by the structure of their hydrorhizae and number of tentacles of the hydranths. The differences between the new species and all other species included in the genus *Rosalinda* on the basis of their morphology, habitat, and geographical distribution were also established.

**Keywords:** *Rosalinda nowaldi* sp. nov.; *Rosalinda lundalvi* sp. nov.; Mauritania; Angola; deep-waters

### 1. Introduction

The genus *Rosalinda* was described by Totton (1949) based on material collected from a submarine cable lying at a depth of about 440 m in the Bay of Biscay. The diagnostic characteristics for this genus are a crust-like hydrorhiza with a perisarcal skeleton formed by a meshwork of chitinous trabeculae with spines and ridges covered by the coenosarc, cylindrical or club-shaped hydranths with quite numerous capitate tentacles scattered over the entire body, and a cnidome including stenoteles and macrobasic mastigophores (Vervoort 1966; Bouillon et al. 2006; Schuchert 2010). In addition, in all known described species, the colonies grow as epibionts on different invertebrates. Currently, the genus includes only four species, but it has a wide, almost
circumglobal, geographical distribution. *Rosalinda williami* Totton, 1949, the type species of the
 genotype, has been reported from the northeast Atlantic; *Rosalinda incrustans* (Kramp, 1947), from
 the northeast Atlantic, western Mediterranean, and Gulf of Mexico; *Rosalinda marlina* Watson,
 1978, from Australia; and *Rosalinda naumovi* Antsulevich and Stepanjants, 1985, from the
 northwest Pacific. Another *Rosalinda* species was described from Sagami Bay, Japan, by Hirohito
 (1988, as *Rosalinda* sp.), and Henry et al. (2008) reported an undescribed species from the
 northwest Atlantic, off the southeast coast of the United States. Of the known species, only *R.
 marlina* and *R. naumovi* have been reported from shallow-waters. Finally, *Rosalinda* sp. has been
 collected from the deep shelf at a depth of 100–125 m (Hirohito 1988).

Our study is based on the seabed surveys of cold-water coral mounds in Mauritanian and Angolan
 waters conducted onboard R/V *Maria S. Merian* and R/V *Meteor*. Among the collected samples,
 we detected a few colonies of two undescribed shell-encrusting rosalindid hydroids living on the
 bivalves *Acesta angolensis* (Adam & Knudsen, 1955) and *Acesta excavata* (Fabricius, 1779). In
 this paper, both species are herein named and described.

2. Material and Methods

2.1. Ship-based methods and sampling

Benthic observations were recorded and samples were obtained by R/V *Maria S. Merian* Cruise
 *PHAETON MSM 16/3* in October–November 2010 and R/V *Meteor* Cruise *M122 ANNA* in January
 2016; the main objective of these surveys was to investigate deep-water coral mound structures
 off Mauritania (Westphal et al. 2012) and Angola (Hebbeln et al. 2017) (Fig. 1).

On the *PHAETON MSM 16/3* cruise, a Sperre SubFighter 7500 DC from the Tjarno Centre for
 Underwater Documentation, University of Gothenburg, was used. The ROV was equipped with
 one Sperre HD video camera (1080 i and 720 p), two standard video cameras for navigation and
 umbilical surveillance, and one still camera (Canon Powershot G9, 12 mega pixel). Sampling was
 performed with a hydraulic manipulator.

On the *M122 ANNA* cruise, underwater imaging and sampling were performed with the MARUM
 SQUID-ROV (SAAB Seaeye, UK). The main working camera was the Insite Pacific MiniZEUS
MKII, a full HD camera with a resolution of 2.38 megapixels. Still images were obtained with the Imenco Tigershark camera, which acquires images at a resolution of 12 mega pixels. Both cameras were mounted on the ROV’s pan and tilt unit. Shell sampling was performed with an Orion 7P manipulator. The collected specimens were placed within aquarium sample boxes at the bottom of the ROV. The ROV was equipped with a calibrated SBE 37 CTD, which recorded water mass properties such as dissolved oxygen in ml/l and temperature in °C.

After recovery of the ROV, the specimens were placed in aquaria with cooled water from previously collected deep-water Niskin bottle samples on both cruises. This procedure allowed further photographic documentation of the live specimens. The samples were then fixed in 95% ethanol for final storage.

Fig. 1. Study sites: yellow for PHAETON MSM 16/3 (*Rosalinda lundalvi* sp. nov.; Mauritania); red for M122 ANNA (*Rosalinda nowaldi* sp. nov.; Angola).
2.2. Lab-based imaging and storage

Lab-based SEM imaging of the colonies was performed with a Tescan Vega 3 XMU scanning electron microscope by using backscatter electrons in low vacuum mode at the Marine Research Department, Wilhelmshaven, Germany. Additional imaging was performed with a Nikon DS-Fi2 digital camera mounted on a motorized Nikon SMZ25 stereomicroscope, using NIS-Elements Microscope imaging software with an Extended Depth of Focus (EDF) patch at the Marine Zoology Laboratory of the University of Vigo, Spain. Nematocysts were studied with an Olympus BX50 compound microscope equipped with Nomarsky differential interference contrast and a DP73 digital camera.

The type specimens of *Rosalinda nowaldi* sp. nov. and *Rosalinda lundalvi* sp. nov. have been deposited in the collections of the Senckenberg Museum in Frankfurt (Germany).

3. Results

**Class** Hydrozoa Owen, 1843  
**Order** Anthoathecata Cornelius, 1992  
**Family** Rosalindidae Totton, 1949

*Rosalinda nowaldi* sp. nov. (Figs. 2–9)

This name is registered in ZooBank under urn:lsid:zoobank.org:act:FFE6B8F5-E7EB-463E-A238-1D3CC93D27B6

**Material examined.** Holotype: R/V *Meteor* Cruise M122 ANNA, Castle Mound, off Caboledo, Angola, ROV station GeoB 20957-1, coordinates: -9.6852, 12.7157, -415 m, leg. 25.01.2016: One fully developed colony growing on both valves of an adult *Acesta angolensis*, without gonophores, SMF 12906 (Fig. 2). Paratype: R/V *Meteor* Cruise M122 ANNA, Buffalo Mound, off Caboledo, Angola, ROV station GeoB 20927-1, coordinates: -9.7019, 12.7296, -385 m, leg. 21.01.2016: One juvenile colony with only four hydranths growing on the lunule area of a sub-adult *Acesta angolensis*, SMF 12907 (Fig. 3).
**Fig. 2.** Rosalinda nowaldi sp. nov. on Acesta angolensis (framed in red) on a lithified carbonate pinnacle at the base of Castle Mound (station GeoB 20957-1); scale bar, 10 cm. (Image copyright MARUM, Bremen, ROV Squid team).

**Fig. 3.** Adult Acesta angolensis from Castle Mound (station GeoB 20957-1), the brownish “film” shows the spread of the perisarc meshwork and the hydranths (arrow) of Rosalinda nowaldi sp. nov.; scale bar, 3 cm.

**Description.** Holotype colony growing on the valves of the file clam Acesta angolensis (Figs. 2, 3). Hydrorhiza crust-like, covering the entire surface of the valves and composed of a chitinised...
perisarcal skeleton covered by a naked hyaline layer of nematocyst-rich coenosarc. The perisarcal skeleton is composed of spines and trabeculae or ridges, thus forming a meshwork that covers the entire outer shell surfaces (Fig. 4). The spines, of varying height, have a blunt or rounded distal end that may cross through the coenosarc and protrude (Fig. 5b) or remain fully covered by it (Fig. 5c). Bases of spines star-shaped, 0.4 to 0.8 mm in diameter, and usually provided with 4 to 6 “branches” or basal ridges resembling rootlets (Fig. 5a–b). Some spines may appear isolated within the hydrorhiza, but most of them are connected by the basal ridges or perisarcal trabeculae (Fig. 5a).

![Image](https://example.com/image.png)

**Fig. 4.** Details of perisarcal skeleton of hydrorhiza; scale bar, 1 mm.
Fig. 5. Rosalinda nowaldi sp. nov. a, details of the perisarcal spines with star-shaped base. 1. Isolated spines. 2. Spines conected by basal branches or ridges; scale bar, 1000 µm. b, protruding spine with “branches”; scale bar, 100 µm. c, details of hydrorhiza with spines fully covered by the coenosarc; scale bar, 500 µm.

Trabeculae measure 0.1–0.3 mm in diameter and are concentrated beneath the pathways of the endodermal canals connecting individual hydranths of the colony (Fig. 6a). The perisarcal skeleton seems slightly reinforced under the base of the polyps with radially disposed ridges, performing a lax rosette slightly depressed (Fig. 6b). Color of spines and trabeculae greenish to brownish. The hyaline ectodermal layer allows observation of the nematocysts as small spherical bodies and the structure and disposition of the spines and ridges within the hydrorhiza (Fig. 6c).

Fig. 6. Rosalinda nowaldi sp. nov. a, trabeculae; scale bar, 2000 µm. b, reinforced perisarcal skeleton (“rosette”) beneath a polyp; scale bar, 2000 µm. c, hyaline ectodermal layer of the hydrorhiza; scale bar, 100 µm.
Polyps white, 4–15 mm high, cylindrical when expanded but club-shaped when contracted, with
60–170 capitate tentacles irregularly scattered over the whole surface of the hydranths (Fig. 7f).
Hypostome rounded, bright white under living conditions, and surrounded by a whorl of six
tentacles (Fig. 7a–c); a whorl of seven tentacles was observed only once. Hydranths disposed
irregularly over the whole surface of the valves, but concentrated near the ventral (outer) margin
of the shell, where the largest polyps are also located (Fig. 8). Some juvenile hydranths, scattered
between the adult ones, carry only an oral whorl of 4–6 tentacles (Fig. 7e).
Gonophores not observed.

Fig. 7. **a**, Living colony of *Rosalinda nowaldi* sp. nov. in aquarium (holotype); scale bar, 20 mm. **b**, details
of polyps with white hypostome. **c**, hypostome surrounded by a whorl of tentacles, scale bar, 500 µm. **d**,
The cnidome includes basically three types of nematocysts: large stenoteles of 25.21–29.33 × 20.29–25.45 µm, small stenoteles of 14.87–18.28 × 12.22–14.09 µm, and very large macrobasic mastigophores of 31.45–35.94 × 28.10–30.50 µm (Fig. 9a–i). Both types of stenoteles were found in the capitate head of the tentacles and on the hydrorhiza. The macrobasic mastigophores were distributed on the hydrorhiza and body of the hydranths but not on the tentacles. A fourth type of nematocyst, a putative and very small macrobasic mastigophore of 7.89–10.05 × 6.98–8.81 µm (Fig. 9j–l), was found only once in the distal part of the hydranth, below the oral tentacles; only three undischarged capsules were observed and measured. Its morphology, broad oval with the thread inside the capsule, is similar to that of the large macrobasic mastigophore; therefore, we included it, tentatively, in this category.

The paratype is represented by a juvenile colony integrated by only four hydranths located at the lunule area of *A. angolensis* (Fig. 8). One hydranth was detached from the colony for study of the nematocysts. The colony has a crust-like hydrorhiza devoid of perisarcal skeleton, from which arises four small and club-shaped hydranths. The hypostome is dome-shaped, and capitate tentacles, up to 63 in number, are disposed only in the distal half around the column (Fig. 7d).

Cnidome similar and with the same distribution in the colony as that described for the holotype: large stenoteles (25–26 × 20–21 µm), small stenoteles (15–16 × 10–11 µm), and very large macrobasic mastigophores (32.5–37.5 × 25–30 µm). The small putative macrobasic mastigophores were not observed.
Fig. 9. *Rosalinda nowaldi* sp. nov. **a–b**, large stenoteles, undischarged. **c**, large stenotele, discharged. **d**, large and small stenoteles. **e**, small stenoteles. **f**, large macrobasic mastigophore, side view. **g**, large macrobasic mastigophore, frontal view. **h–i**, large macrobasic mastigophores, side view. **j, l**, small macrobasic mastigophores, side view. **k**, small macrobasic mastigophore, frontal view. All scale bars, 20 µm.

The study of young hydranths of the holotype and paratype showed that, in the early stages of growth, the hydranths have only 4–6 tentacles disposed in a whorl around the hypostome. During further development, the number of tentacles increases gradually by successive addition of new tentacles below the oral whorl. However, in the juvenile stages, the tentacles do not reach the base of the hydranths (Fig. 7d). The tentacles seem to be distributed throughout the column in only fully developed hydranths.

**Etymology.** The specific name honors Nicolas Nowald, leader of the MARUM Squid ROV team during the maiden ROV operation on the R/V *Meteor* Cruise *M122 ANNA*.

**Distribution.** *Rosalinda nowaldi* sp. nov. is known only from two sites located off Caboledo, Angola, between 385 and 415 m depth.
**Rosalinda lundalvi** sp. nov.  
(Figs. 10–17)  
The name is registered in ZooBank under urn:lsid:zoobank.org:act:6992ADE9-C562-474B-8396-7BBE904E2198

**Material examined.** Holotype: R/V *Maria S. Merian* Cruise MSM 16/3 PHAETON, Mauritania, ROV station GeoB 14908-1, coordinates: 17.66949, -16.67887, -522 m, leg. 16.11.2010: One colony growing on both valves of an adult *Acesta excavata*, without gonophores, SMF 12908 (Fig. 10).

**Description.** Holotype colony growing on the valves of the file clam *Acesta excavata* (Fig. 10). Hydrorhiza crust-like, composed of a chitinised perisarcal skeleton covered by a hyaline layer of naked coenosarc filled with nematocysts. The perisarcal skeleton is composed of a meshwork of spines and trabeculae or ridges growing on the entire outer shell surfaces (Fig. 11a). Spines of different sizes are rounded distally and protrude through the coenosarc (Fig. 11b); their base is wide, without the basal ridges observed in *Rosalinda nowaldi* sp. nov. (Fig. 11c), and, on occasion, some of them appear fused (Fig. 11b). In some cases, the spines are connected by trabeculae, forming straight ridges on the shell surface (Fig. 11a–b). Trabeculae measuring 28–67 µm in diameter and concentrated beneath the pathways of the endodermal canals connecting the hydranths of the colony (Fig. 12a–b). Color of spines and trabeculae greenish to brownish. Spines and trabeculae covered by a continuous layer of the coenosarc that, in certain parts, is thickened, forming strands, conferring a reticulated aspect to the hydrorhiza (Fig. 12a, 13), but in some parts, forms a continuous layer of coenosarc; between the coenosarcal strands, protruding spines can appear (Figs. 12, 13). The coenosarc is also reinforced with a thicker layer under the base of the polyps (Fig. 14a).
Fig. 10. *Rosalinda lundalvi* sp. nov. growing on *Acesta excavata* from a Mauritanian cold-water coral habitat, holotype; prior to sampling with ROV; Bunda Mounds, 522 m, scale bar, 1 cm. Note, *A. excavata* is attached to a *Lophelia pertusa* colony.

Fig. 11. *Rosalinda lundalvi* sp. nov. a, details of perisarcal spines and trabeculae or ridges; scale bar, 1000 μm. b, details of fused spines; scale bar, 500 μm. c, details of a perisarcal spine without star-shaped base; scale bar, 20 μm.
Fig. 12. *Rosalinda lundalvi* sp. nov. **a**, details of trabeculae and endodermal canals on hydrorhiza; scale bar, 1000 µm. **b**, details of ridges; scale bar, 1000 µm. **c**, spines between the coenosarcal strands; scale bar, 100 µm.

Fig. 13. *Rosalinda lundalvi* sp. nov., details of coenosarcal strands and perisarcal spines; scale bar, 1000 µm.

Polyps white, 3–5 mm high, cylindrical, with 45–54 capitate tentacles (Fig. 14b–c) irregularly scattered over the whole surface of the hydranths, although in some cases the tentacles are quite damaged (Fig. 14d). Hypostome rounded and bright white under living conditions and provided
with a whorl of capitate tentacles. Hydranths concentrated near the ventral margin of the shell, but several polyps were also observed on the whole surface of the valves (Fig. 15).

Gonophores not observed.

**Fig. 14.** *Rosalinda lundalvi* sp. nov. **a**, details of the coenosarc at the base of the polyps; scale bar, 1000 µm. **b–c**, details of capitate tentacles; scale bar, 500 µm. **d**, polyps with damaged tentacles; scale bar, 1000 µm.

**Fig. 15.** *Rosalinda lundalvi* sp. nov., hydranths aligned on the ventral margin of the shell and another one on the surface of the valve; scale bar, 1 mm.
Cnidome similar to that of *Rosalinda nowaldi* sp. nov. and including basically three types of nematocysts: large stenoteles of 23.24–30.52 × 19.42–23.58 µm, small stenoteles of 14.86–18.02 × 11.43–14.26 µm, and very large macrobasic mastigophores of 31.45–33.45 × 28.09–31.98 µm (Fig. 16a–e). Both types of stenoteles were found in the capitate head of the tentacles and in the hydrorhiza. The macrobasic mastigophores were distributed in the hydrorhiza and body of the hydroids but not on the tentacles. Moreover, in some cases, we observed the presence of spirocysts at the base of some polyps (Fig. 16f), but their presence in *Rosalinda lundalvi* sp. nov. must have been of exogenous origin and due to contact with a hexacoral. The presence of spirocysts was also reported in *R. naumovi* by Antsulevich and Stepanjants (1985), but the authors assumed that the spirocysts were obtained from actinians found growing close to the hydroid colony.

**Fig. 16.** *Rosalinda lundalvi* sp. nov. **a–b,** small stenoteles, undischarged. **c–d,** large stenoteles, undischarged. **e,** large macrobasic mastigophores, undischarged. **f,** spirocyst. All scale bars, 20 µm.

**Etymology.** The specific name honors Tomas Lundälv, the ROV pilot during the R/V *Maria S. Merian* Cruise MSM 16/3 PHAETON, in recognition of his skills.

**Distribution.** *Rosalinda lundalvi* sp. nov. is known only from the coast of Mauritania. The holotype was collected from the Banda Mounds, at a depth of 522 m. A review of the photographs obtained
during the German R/V *Maria S. Merian* Cruise MSM16/3 also yielded several colonies of living *Rosalinda cf. lundalvi* on *A. excavata* along the Mauritanian margin (20°–17° N), but this material was not collected during the survey (Fig. 17). These locations (total, 32; see Table 1) range from a depth of 427 to 613 m.

**Fig. 17.** *Rosalinda lundalvi* sp. nov. on *Acesta excavata* (arrows) from a Mauritanian cold-water coral habitat; scale bars, 1 cm (Image copyright T. Lundälv, Sven Lovén Centre). **a,** Inchiri Canyon, 481 m depth. **b,** Tamxat Mound Complex, 501 m depth.
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**Table 1.** List of stations where colonies of *R. cf. lundalvi*, on *A. excavata*, were observed during R/V *Maria S. Merian* Cruise MSM 16/3. Material photographed but not collected.
4. Discussion
Currently, the genus *Rosalinda* includes only four species: *Rosalinda incrustans* (Kramp, 1947), *Rosalinda williami* Totton, 1949, *Rosalinda marlina* Watson, 1978, and *Rosalinda naumovi* Antsulevich and Stepanjants, 1985. In addition, a fifth species, reported as *Rosalinda sp.*, was described by Hirohito (1988). The main characters of each species are summarized in Table 2, and their records, including geographical and bathymetric distributions, are listed in Table 3.

The diagnostic characteristics for this genus are a crust-like hydorhiza with a perisarcal skeleton formed by a meshwork of chitinous trabeculae with spines and ridges covered by the coenosarc, cylindrical or club-shaped hydranths with quite numerous capitate tentacles scattered over the entire body, and a cnidome including stenoteles and macrobasic mastigophores (Vervoort 1966; Bouillon et al. 2006; Schuchert 2010). Other features shared by some, but not all, *Rosalinda* species are a reinforcement of the trabecular meshwork below the hydranths allied with shallow depressions of the meshwork for hydranth attachment (*R. williami* and *R. naumovi* (Totton 1949; Vervoort 1966; Antsulevich and Stepanjants 1985)) and the concentration of hydranths in the most current-exposed surfaces of the host: *R. incrustans*, at end of the spines of *Anamathia rissoana* (Roux, 1828) (Vervoort 1966); *R. naumovi*, on the shell edge of the bivalve *Pododesmus macrochisma* (Deshayes, 1839) (Antsulevich and Stepanjants 1985); *R. nowaldi* sp. nov. and *R. lundalvi* sp. nov., on the ventral margin of the shell of *A. angolensis* and *A. excavata*, respectively.

The other species, *R. williami* and *R. marlina*, have been reported on non-mobile substrata (*R. williami*, on a worm tube and on *Desmophyllum dianthus* (Esper, 1794) (Totton 1949; Vervoort 1966; Schuchert 2010); *R. marlina*, on ascidians and on *Balanus trigonus* Darwin, 1854 (Watson 1978)), but information on the spatial distribution of the hydranths within the respective colonies was not included.

*Rosalinda nowaldi* sp. nov. and *R. lundalvi* sp. nov. show affinities related to their habitats because both were collected from cold-water coral mounds and found growing on the shells of two living *Acesta* species. They also have very similar cnidomes because both types and measurements of their nematocysts are similar. Nevertheless, both species can be easily distinguished by the number of tentacles, 60–70 in *R. nowaldi* sp. nov. versus 45–54 in *R. lundalvi* sp. nov., and the hydorhizal structure, with star-shaped spines forming an irregular meshwork covered by a continuous layer of coenosarc in *R. nowaldi* sp. nov. and non-star-shaped spines disposed in straight ridges and covered by a reticulate coenosarc in *R. lundalvi* sp. nov.
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrorhiza</strong></td>
<td>Continuous and crust-like, with a meshwork of chitinous trabeculae forming spines and ridges; meshes angular or polygonal, usually with a central spine</td>
<td>Continuous or reticulating crust with hollow chitinous spines solitary, connected in groups of 2-4 or arising from an incipient chitinous trabeculate meshwork</td>
<td>Crust like, with a spongy meshwork of convoluted chitinous ridges and walls sometimes produced into spines and connected by trabeculae</td>
<td>Continuous layer of coenosarc over the entire shell, with perisarcal spines randomly arranged and interconnected by a trabecular meshwork; rows of spines disposed in rosette around polyp’s base</td>
<td>Incrusting, very thin and without a distinct skeleton</td>
<td>Continuous and crust-like, with perisarcal spines usually connected by chitinous trabeculae forming a reticulate meshwork all over shells of bivalves</td>
<td>Usually reticulated, with perisarcal spines fused or connected by chitinous trabeculae forming a reticulate meshwork all over shells of bivalves</td>
</tr>
<tr>
<td><strong>Polyp, length (mm)</strong></td>
<td>1.5–3 white</td>
<td>1.25–2 rose-red</td>
<td>Up to 2.65 rose-red</td>
<td>3–4</td>
<td>Up to 2 white</td>
<td>4–15 white</td>
<td>3–5</td>
</tr>
<tr>
<td><strong>Colour (when living)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nº tentacles</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nematocysts:</strong></td>
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<td></td>
</tr>
<tr>
<td>Small stenoteles (µm)</td>
<td>9–10.5 x 7–8</td>
<td>10–11.3 x 8–8.8</td>
<td>9 x 13</td>
<td>11–13 x 8–10</td>
<td>13–10</td>
<td>14.87–18.28 x 12.22–14.09</td>
<td>14.86–18.02 x 11.43–14.26</td>
</tr>
<tr>
<td>Small ?macrobasic mastigophores</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Isorhizas (µm)</td>
<td>8 x 18</td>
<td>5 x 3.8</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>7.89–10.05 x 6.98–8.81</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Overview of main morphological characteristics of *Rosalinda* species.
<table>
<thead>
<tr>
<th>Species</th>
<th>Basibiont</th>
<th>Taxon</th>
<th>Location</th>
<th>Depth [m]</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>R. incrustans</em></td>
<td><em>Anamathia rissoana</em></td>
<td>Crustacea</td>
<td>Josephine Seamount, NE Atlantic</td>
<td>225</td>
<td>Kramp (1947)</td>
</tr>
<tr>
<td><em>R. incrustans</em></td>
<td><em>Anamathia rissoana</em></td>
<td>Crustacea</td>
<td>Western Mediterranean Sea</td>
<td>200–800</td>
<td>Several locations compiled in Mastrototaro <em>et al.</em> (2016)</td>
</tr>
<tr>
<td><em>R. incrustans</em></td>
<td><em>Isididae indet.</em></td>
<td>Octocorallia</td>
<td>Viosca Knoll, Gulf of Mexico</td>
<td>310</td>
<td>Calder &amp; Cairns (2009)</td>
</tr>
<tr>
<td><em>R. williami</em></td>
<td><em>Desmophyllum dianthus, worm tubes</em></td>
<td>Scleractinia, Polychaeta</td>
<td>Chapelle Bank, NE Atlantic</td>
<td>440</td>
<td>Totton (1949)</td>
</tr>
<tr>
<td><em>R. williami</em></td>
<td><em>Spongosorites coralliophaga</em></td>
<td>Porifera</td>
<td>Mingulay Reef, NE Atlantic</td>
<td>122–131</td>
<td>Kazanidis <em>et al.</em> (2016)</td>
</tr>
<tr>
<td><em>R. marlina</em></td>
<td><em>Balanus trigonus, ascidians</em></td>
<td>Crustacea, Tunicata</td>
<td>Bass Strait, Australia</td>
<td>10–36</td>
<td>Watson (1978)</td>
</tr>
<tr>
<td><em>R. naumovi</em></td>
<td><em>Pododesmus macrochisma</em></td>
<td>Bivalvia</td>
<td>Iturup Island, NW Pacific</td>
<td>5–15</td>
<td>Antsulevich &amp; Stepanjants (1985)</td>
</tr>
<tr>
<td>Rosalinda sp.</td>
<td><em>brachiopod</em></td>
<td>Brachiopoda</td>
<td>Sagami Bay, NW Pacific</td>
<td>100–125</td>
<td>Hirohito (1988)</td>
</tr>
<tr>
<td>Rosalinda n.sp.?</td>
<td><em>Cladocarpus paradiseus</em></td>
<td>Hydrozoa</td>
<td>Jacksonville Mounds, NW Atlantic</td>
<td>595</td>
<td>Henry <em>et al.</em> (2008)</td>
</tr>
<tr>
<td><em>R. nowaldi</em> sp. nov.</td>
<td><em>Acesta angolensis</em></td>
<td>Bivalvia</td>
<td>Angola, Central E Atlantic</td>
<td>385–470</td>
<td>This study</td>
</tr>
<tr>
<td><em>R. lundalvi</em> sp. nov.</td>
<td><em>Acesta excavata</em></td>
<td>Bivalvia</td>
<td>Mauritania, Central E Atlantic</td>
<td>400–600</td>
<td>This study</td>
</tr>
</tbody>
</table>

**Table 3.** Overview of *Rosalinda*-basibiont relationships
These two new species are clearly distinguishable from all other species of the genus by the size of the large and small stenoteles, which are clearly bigger than those reported for all other rosalindids (see Table 2). The higher number of tentacles also distinguishes *R. nowaldi* sp. nov. from all other rosalindids, including *R. lundalvi* sp. nov. Other differences have been discussed below.

*Rosalinda marlina* differs most notably from *R. nowaldi* sp. nov. and *R. lundalvi* sp. nov. in lacking large stenoteles in the cnidome, while possessing smooth, hollow spines on the hydrorhiza, a merely incipient perisarcal meshwork, and a perisarcal hydrophore at the base of some hydranths. Moreover, *R. marlina* is a shallow-water species (depth, 10-36 m) reported thus far only from Australia (Watson 1978).

*Rosalinda naumovi* differs both in the size of its stenoteles and in its geographic distribution and habitat. It is a shallow-water species, reported only from Iturup Island, South Kuril Islands, Russia, at a depth of 5-15 m on the bivalve *P. macrochisma*.

*Rosalinda williami*, the type species of this genus, is only known with certainty from the type locality in the Bay of Biscay at 440 m depth, growing on tube worms and on a solitary scleractinian. Additional differences with our new species are convoluted chitinous ridges in the hydrorhizal skeleton, red-rose color of living hydranths, and the substrate (Totton 1949). Here, the records of *R. williami* from the Mingulay reef complex, Outer Hebrides Sea (Kazanidis et al. 2016), and Goban Spur, Celtic Sea (Tyler and Zibrowius 1992), are considered as doubtful. The reference of these authors to the presence of stems or axes occasionally branched in the colonies raises some doubts about its identification, taking into account that *R. williami* develops as a stolonial colony devoid of stems or axes.

*Rosalinda incrustans* is also a deep-water species, and its geographical distribution is restricted to the Josephine Bank (type locality) and the Mediterranean (Kramp 1947; Schuchert 2010), with an isolated record in the Gulf of Mexico (Calder and Cairns 2009). In the northeast Atlantic, *R. incrustans* has always been found growing on the decapod *A. rissoana*, but the colony from the Gulf of Mexico was found on a dead bamboo coral (Collins, pers. comm. in February 2017). The structure of the perisarcal skeleton, at least in the colonies of *R. incrustans* growing on *A. rissoana*, is very different to that described here for *R. nowaldi* sp. nov. and *R. lundalvi* sp. nov. (see Table 2). Nevertheless, the particular morphology of the skeletal meshwork seems to be largely determined by the surface structure of the crab integument (Schuchert 2010), and the central spine
derives from the setae of the carapace, thickened by perisarcal overgrowth, resulting in a very regular pattern of polygonal meshes with raised and chitinised spines (Vervoort 1966). In Schuchert’s opinion, the hydrorhizal skeleton may be quite different if the species colonizes other substrates, and, therefore, it would not be a reliable diagnostic character for *R. incrustans*. Calder and Cairns (2009) included only the nominal record for *R. incrustans* in the Gulf of Mexico, without any description; however, this finding on a bamboo coral leaves open the question raised by Schuchert (2010). Furthermore, we want to highlight that *R. nowaldi* sp. nov. and *R. lundalvi* sp. nov. colonize very similar substrates—the valves of *A. angolensis* and *A. excavata*, respectively—and the hydrorhizal skeletons are quite different, which suggests that, at least in these two species, the morphology of the hydrorhiza is a reliable diagnostic character at the species level. Recently, Mastrototaro *et al.* (2016) reported living colonies of *R. incrustans* photographed on the carapace of *A. rissoana* in the West Mediterranean Sea. The habitus of the colony, with very elongate hydranths, capitate tentacles scattered throughout the polyp, and the hypostome distinctively white and provided with a whorl of 4–5 oral tentacles (Mastrototaro *et al.* 2016), is very similar to that reported for living specimens of *R. nowaldi* sp. nov. and *R. lundalvi* sp. nov. However, these species can be distinguished by differences in the size of their stenoteles, in hydrorhizal morphology, and, for *R. nowaldi* sp. nov., in the number of tentacles.

Finally, *Rosalinda* sp. as described by Hirohito (1988) differs from the two new species in having a hydrorhiza devoid of a perisarcal skeleton. It also differs in both habitat and geographic distribution, being a deep-shelf species collected at 100–150 m depth on a brachiopod shell in Sagami Bay, Japan.

The occurrence of two different *Rosalinda* species in Angolan and Mauritanian cold-water coral mounds and attached to two *Acesta* species is striking. Both West African *Rosalinda coral/Acesta* sites are located within the same biogeographical province—the Tropical Eastern Atlantic Province, which extends from southern Morocco to Moçâmedes in Angola (Briggs and Bowen 2012). However, the existence of these two *Rosalinda* species in West Africa is in accordance with the observations of Gil (2017) and Gil and Ramil (2017), who found that strictly tropical hydroid species do not reach the Mauritanian coast. This suggests that, at least for hydroids, the boundary between the Tropical Eastern Atlantic and Lusitanian provinces is located in Senegal (see also Briggs 1995).
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R/V Maria S. Merian Berichte.


HIGHLIGHTS

- Two new species of Rosalinda (Hydrozoa: Antothecata) are described from West Africa
- The differences between new species and all other Rosalinda species are discussed
- World-wide distribution and habitat of Rosalinda species are reviewed
- New contribution to the knowledge of cold water corals associated fauna
Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: