

A new species of *Coelocarteria* (Porifera: Demospongiae) from Sulawesi, Indonesia

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A new sponge species *Coelocarteria agglomerans* sp. nov. (Isodictyidae: Mycalina: Poecilosclerida) is described from the reef slopes of Bunaken National Marine Park, North Sulawesi, Indonesia. The new species can be separated from the other two congeneric species: *C. singaporensis* and *C. spatulosa* by several characters concerning sponge surface, fistule shape, form and size of the spicules and habitat. In detail it differs from *C. singaporensis* in the presence of strongyles instead of oxeads as main megascleres and of spines in the shaft of palmate isochelae. It differs from *C. spatulosa* in the absence of characteristic fistules with spatula shaped hoods and in spicule size, because both categories of strongyles and palmate isochelae are remarkably larger in the latter.

INTRODUCTION

The Marine National Park of Bunaken belongs to the province of North Sulawesi, eastern Indonesia, that is located at 0°30'–4°3' north latitude and 121°127' east longitude. The area has been repeatedly surveyed for sponges within researches related to a master's degree in tropical marine biodiversity and bioactive molecules that has been run since 2001 by the Università Politecnica delle Marche and the Sam Ratulangi University of Manado in collaboration with other Italian Institutions.

Several of the collected species from this biodiversity hotspot (Bell & Smith, 2004; de Voogd et al., 2006) appear to be new to science and we plan to describe them in a series of publications with special attention to their ecological role (Calcinai et al., 2005, 2006).

The present study deals with a new species of the genus *Coelocarteria* Burton, 1934, to which only two species *C. singaporensis* (Carter, 1883) and *C. spatulosa* Bergquist & Fromont, 1988 were till now attributed. The genus has been recently allocated within the sub-order Mycalina (Hajdu et al., 1994), family Isodictyidae Dendy, 1924 on the basis of the reticulate architecture of the choanosome and of the presence of palmate isochelae (Hajdu & Lobo Hajdu, 2002). It has a tropical, Indo-West Pacific distribution, with a single doubtful record from Tristan da Cunha (southern Atlantic Ocean) (Ridley & Dendy, 1887). It occurs both in superficial and deep waters.

In the present paper we describe the new species and compare it with the closely related species *Coelocarteria singaporensis*.

MATERIALS AND METHODS

Sponge specimens were collected by SCUBA diving from the islands of Siladen and from the coast of Sulawesi close to the town of Manado (Figure 1). Specimens were

photographed *in situ* and after collection and preserved in 70% ethanol or dried.

Spicule preparations were made by dissolving small fragments of the sponge in 65% nitric acid, both in test-tubes and directly on slides, rinsing with water, dehydrating with 90% ethanol and mounting in Eukitt resin.

Tangential and transverse sections, cut by hand with a blade, from partly dehydrated specimens were mounted in Eukitt resin to study the skeletal architecture. Dissociated spicules dried directly on stubs, and dried fragments of the skeleton were gold sputtered and examined with a Philips XL 20 scanning electron microscope (SEM).

At least 30 randomly chosen spicules per category were measured; averages are indicated in parentheses.

The holotype and two paratypes were entrusted to the sponge collection of the Museum of Natural History of Genoa (MSNG). The remaining material is deposited in the personal collections of the authors at Dip. Te. Ris.

SYSTEMATICS

Order POECILOSCLERIDA Topsent, 1928

Suborder MYCALINA Hajdu, van Soest & Hooper, 1994

Family ISODICTYIDAE Dendy, 1924

Genus *Coelocarteria* Burton, 1934

Coelocarteria agglomerans sp. nov.

(Figures 2–5)

Type material

Holotype: BU 48, dry specimen, Bunaken Island, Raymond's Point, water depth 20 m, [MSNG 52831]. Collected 23 May 2005 by C. Cerrano.

Paratype: BU 644, preserved in 70% ethanol, Siladen Island, water depth 23 m, [MSNG 52832]. Collected 25 January 2007.

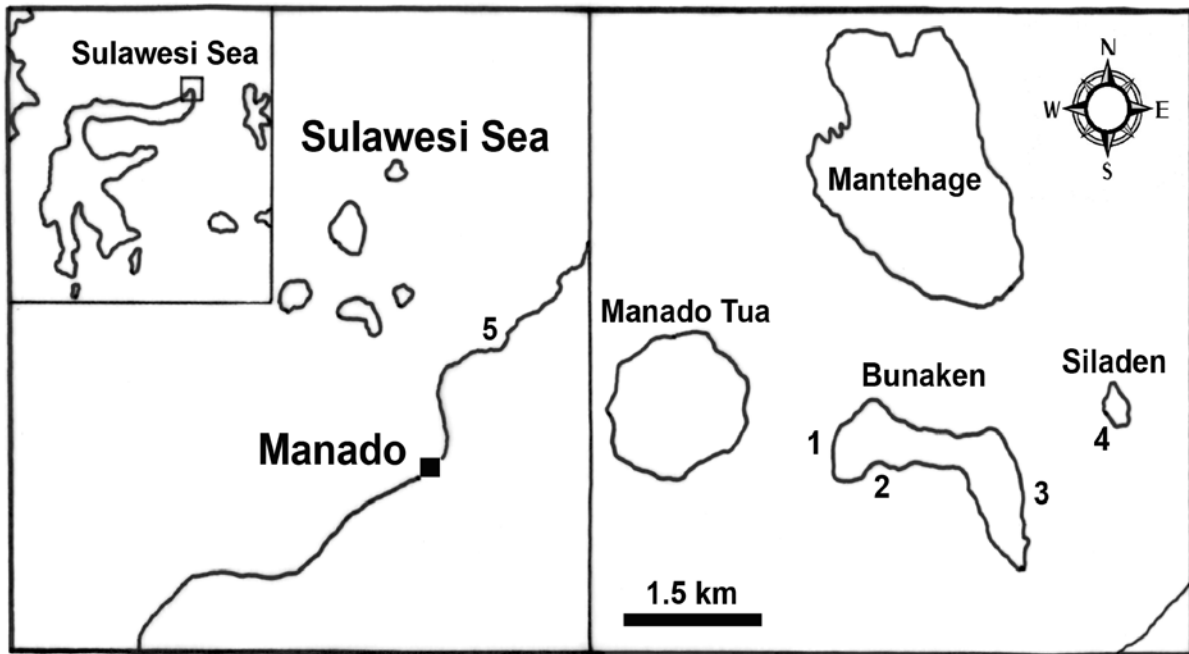


Figure 1. Map of the studied area with the location of the sampling sites: (1) Raymond's Point; (2) Alung Banua; (3) Panggalisang; (4) Siladen; (5) Tiwoho.

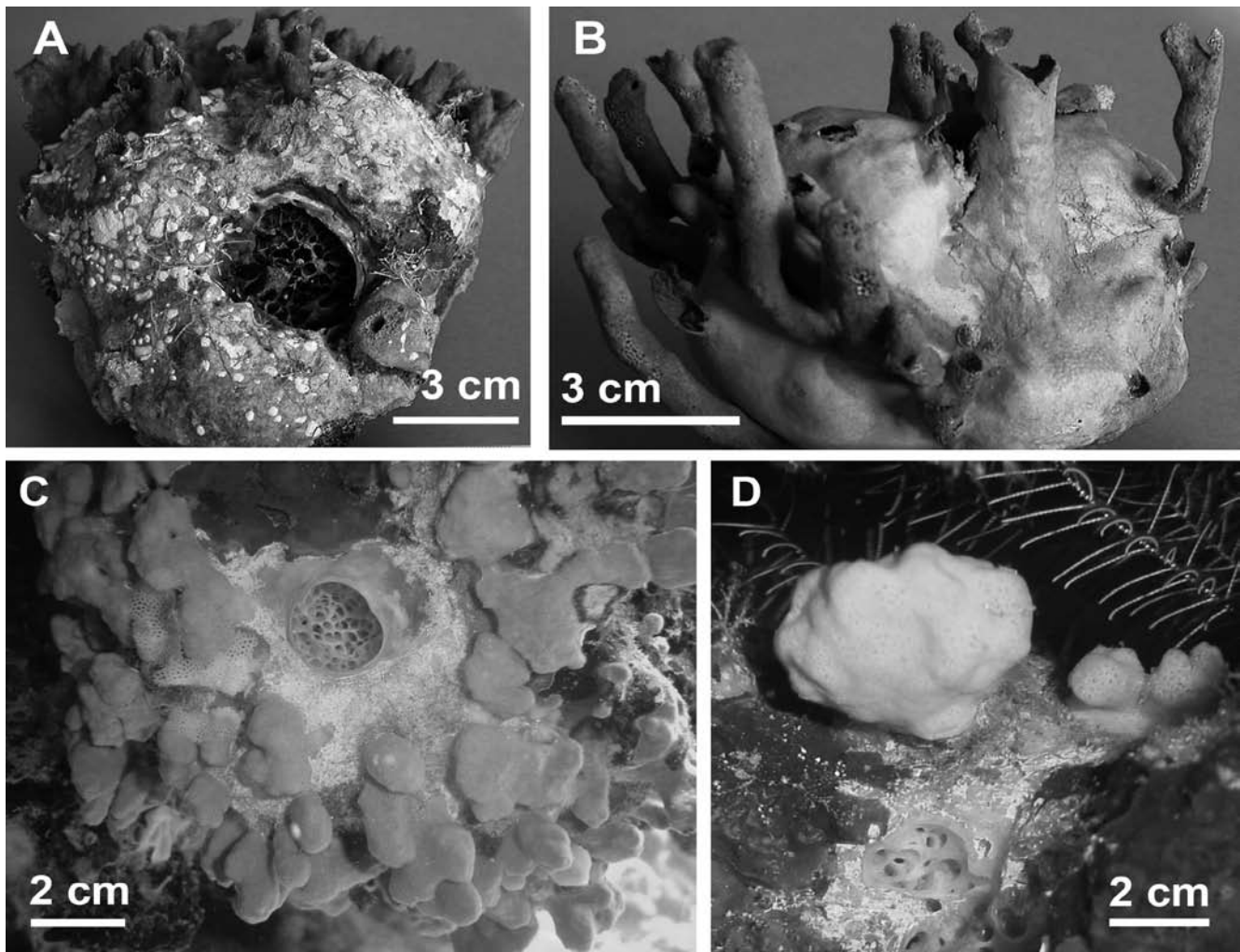


Figure 2. *Coelocarteria agglomerans* sp. nov.: (A) BU 48 (holotype); (B) *Coelocarteria singaporensis* (Carter, 1883); specimen ZMAPOR15154 on loan from the Zoological Museum of Amsterdam; *Coelocarteria agglomerans* sp. nov.: (C) specimen BU 616 (paratype) *in situ*; (D) a club shaped fistule.

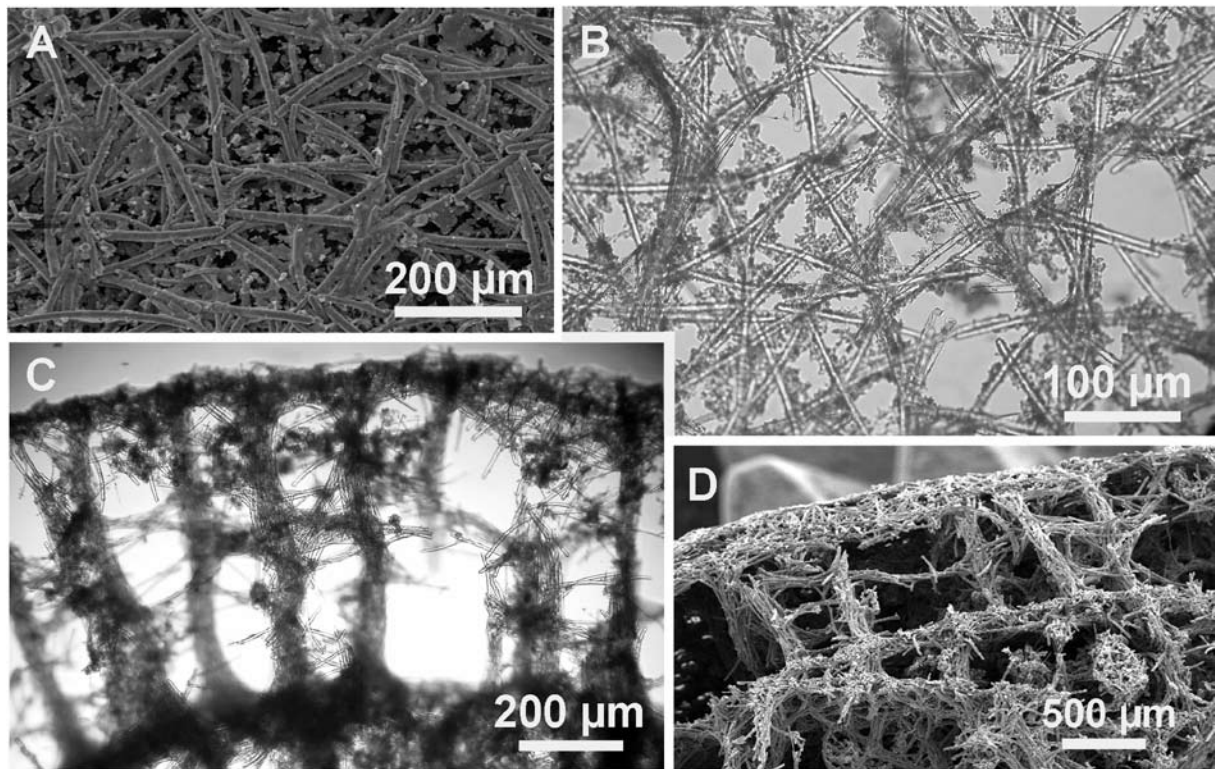


Figure 3. *Coelocartheria agglomerans* sp. nov.: (A) ectosomal skeleton of the body; (B) ectosomal skeleton of a fistule; (C, D) choanosomal skeleton.

Paratype: BU 616, preserved in 70% ethanol, Bunaken Island, Alung Banua, water depth 28 m. [MSNG 52833]. Collected 14 January 2005.

The additional specimens from the Bunaken Marine Park listed below are deposited in the personal collection of the authors at Dip.Te.Ris.

BU 15, preserved in 70% ethanol, Bunaken Island, Alung Banua, water depth 23 m. Collected 17 March 2000.

BU 37, preserved in 70% ethanol, Siladen Island, water depth 38 m. Collected 18 March 2000.

BU 132, preserved in 70% ethanol, Bunaken Island, Raymond's Point, water depth 20 m. Collected 25 March 2000.

BU 329, preserved in 70% ethanol, Bunaken Island, Raymond's Point, water depth 26 m. Collected 24 May 2005.

PH 39, PH 46, preserved in 70% ethanol, Bunaken Island, Panggalisang, water depth 24 m. Collected 13 May 2005.

PH 51, preserved in 70% ethanol, Bunaken Island, Tiwoho, water depth 26 m. Collected 17 January 2005.

Comparative material examined

Coelocartheria singaporensis (Carter, 1883) Zoological Museum of Amsterdam, specimen ZMAPOR15154, Sulawesi, Kudingareng Keke. Collected 16 April 1997 (det.: N.J. de Voogd).

Diagnosis

(Emended from Hajdu & Lobo Hajdu, 2002). Isodictyidae with closed fistules of variable shape (cylindrical, club shaped, lobated, hooded), a phloeodictyid like architecture with a dense but neat reticulation of plurispicular tracts of

strongyles and/or oxeas. Microscleres: palmate isochelae and in some cases toxas.

Description of the holotype

The holotype (Figure 2A) is massive globose with a major diameter of 12 cm. It has a single, oval osculum (3.5×3 cm across), where many excurrent canals converge. The osculum occupies a slight depression of the sponge body and it is bordered by a solid rim (less than 1 mm thick). A wide area free of fistules surrounds the osculum. The body surface is almost entirely covered by epibiotic organisms, mainly coralline algae, bryozoans and other sponges. Coral debris are overgrown by the sponge and embedded into its body. Fistules are concentrated in the upper part of the specimen and represent the incurrent part of the sponge. They may be cylindrical, branching lobate or club shaped (Figure 2A,C&D). Their maximum height in the holotype is 3 cm, but in other specimens they can be as high as 6 cm. In the latter case they are always cylindrical. All fistules are closed at their top and hollow inside, with a wall thickness of 0.5–0.8 mm. Their surface is smooth or slightly irregular, but completely devoid of epibioses. The consistency of the sponge body is stony hard, whereas fistules are solid but fragile. The colour of the body is golden yellow *in situ*, as those of the fistules that may show a lighter shade (Figure 2C,D). It becomes brown after preservation and does not show much variation among the studied specimens.

Ectosomal skeleton

Body: a dense, tangential layer, two to three spicules thick, of parallel or rather disorderly arranged strongyles (Figure 3A). Fistules: a (sub)isotropic paucispicular (1–2) irregular

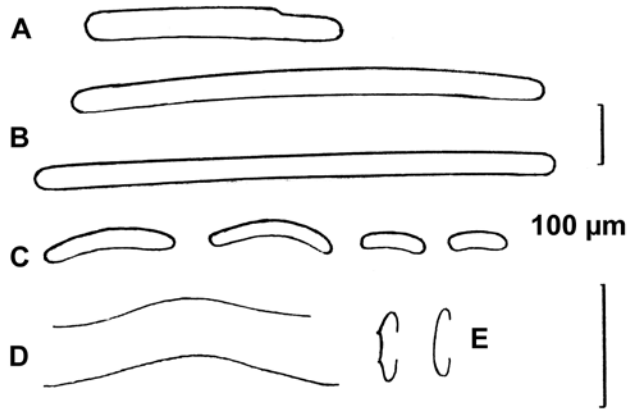


Figure 4. *Coelocarteria agglomerans* sp. nov.: spicules as seen at light microscopy: (A) merged, intermediate strongyles; (B) large strongyles; (C) small strongyles; (D) toxas; (E) palmate isochelae.

network of strongyles, supported by a reticulation of stouter (3–5) spicule tracts forming triangular or roundish meshes (Figure 3B). The spicule density is much lower in the fistule than in the body ectosomal skeleton.

Choanosomal skeleton

A rather regular reticulation of vertical multispicular tracts connected by thinner transverse tracts forming rectangular meshes. The average spicule tract thickness is around 300 µm, but 500 µm tracts are common. Abundant spicules are dispersed among spicule tracts and form an ill-defined isotropic reticulation. The overall aspect of the choanosomal skeleton is tabular (Figure 3C,D).

Spicules

Strongyles in two size-ranges: (I) large strongyles: straight, gently curved or slightly flexuous, measuring 163–337 (279.9) by 12–20 (16.4) µm (Figures 4B & 5A); and (II) small strongyles: straight, curved or sausage shaped, measuring 15–38 (27) by 6–11 (9.5) µm (Figures 4C & 5E). Intermediate forms seldom occur, but they seem to be due to the merging of two spicules (Figure 4A). The spicule thickness is not always proportional to the length, therefore small stout strongyles and slender forms do occur.

Palmate isochelae with a gently curved shaft bearing spines on the inner side. They measure 15.6–20.8 (18.4) in length (Figures 4E & 5B–D). Always present, they are more abundant in the fistules than in the sponge body.

Toxas very thin, smooth, with an ample curvature, measuring 70–107 (87.8) µm in length (Figures 4D & 5F). Never abundant, they may be completely absent in some specimens.

Ecology and distribution

The preferred habitat of this species seems to be the reef slope, where it occupies relatively sheltered and shadowed positions. Its habit is generally massive with a rather large size. The sponge sticks to dead corals and other debris that then become embedded in its body during growth. The body is almost completely overgrown by other organisms as described for the holotype. The species is common in the

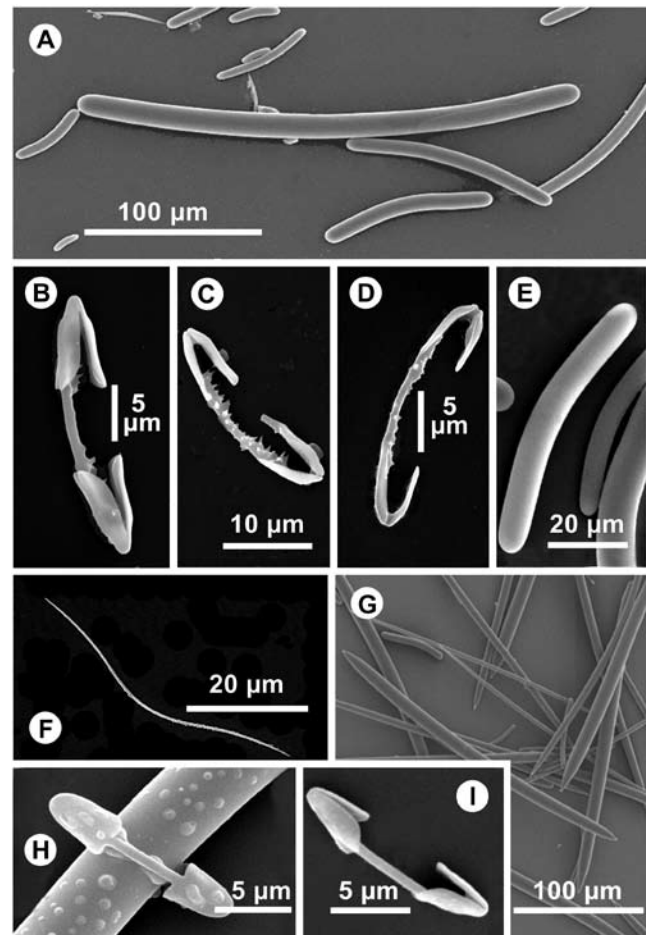


Figure 5. *Coelocarteria agglomerans* sp. nov.: spicules at SEM: (A) large and small strongyles; (B, C, D) palmate isochelae with spines on the inner part of the shaft; (E) small strongyles; (F) toxa. *Coelocarteria singaporensis* (Carter, 1883): spicules of specimen ZMAPOR15154; (G) oxeas; (H, I) palmate isochelae with smooth shaft.

Bunaken Marine National Park at depths from 5 to 10 m to the limit of our observations (around 40 m). According to good photographs on the internet (www.poppe-images.com) it could be present also in Cabilao Island (Philippines).

Comparison

The specimen of *Coelocarteria singaporensis* (Carter, 1883) (ZMAPOR15154) on loan from the Zoological Museum of Amsterdam (Figure 2D) is light brown on the surface and darker inside. The sponge surface is smooth and completely devoid of epibiotic organisms. Fistules are hollow, more or less cylindrical, up to 7 cm long and 1 cm in diameter. Fistule wall is less than 1 mm thick. The skeleton fits with the genus diagnosis. Spicules are oxeas: 260–310 (289.6) × 5–13 (9.3) µm (Figure 5G); strongyles 50–122 (73.4) × 5.5–11.5 (7.1) µm (Figure 5G); palmate isochelae with smooth shaft: 13–16 (14.3) µm long (Figure 5H,I); rare toxas, about 70 µm long. No remarkable differences in the spicule size occur between fistules and sponge body, both in the ectosome and choanosome. However, slender (2–5 µm thick) juvenile forms, of both oxeas and strongyles with the usual length, are present in the choanosome.

Etymology

The species is named after its capacity for agglomerating exogenous material.

DISCUSSION

Coelocarteria agglomerans sp. nov. has as unique characters the presence of only strongyles as megascleres, the constant presence of spines on the shaft of palmate isochelae, the golden yellow colour, the short and often branched fistules, the surface covered by epibiotic organisms and the habit of overgrowing exogenous material.

It differs from *Coelocarteria spatulosa* Bergquist & Fromont, 1988 in shape: the latter has characteristic fistules with spatula shaped hoods; spicules: both categories of strongyles are longer (>500 µm and >100 µm) than those of *C. agglomerans* and palmate isochelae are about 40 µm long; habitat: since the only specimen known was collected at a depth of 205 m.

Closest to the new species is *C. singaporensis* (Carter, 1883) that is common in Indonesia and in the western Pacific (van Soest, 1989) but whose records in the sponge literature are relatively few (Bergquist, 1965).

Coelocarteria singaporensis has a size-range of megascleres similar to that of *C. agglomerans* but it has oxeads together with small strongyles. On the contrary, in none of the specimens of *C. agglomerans* sp. nov. collected in the Bunaken Marine National Park have oxeads been observed. The main difference in the microscleres is the presence of spines on the shaft of palmate isochelae of *C. agglomerans* sp. nov. which are lacking in the comparative material of *C. singaporensis*. However, two small spines are detectable on the inner side of the shaft of a palmate isochela reported by Hajdu & Lobo Hajdu (2002, p. 704), even if they were disregarded in the description. Toxas may be longer in *C. agglomerans* sp. nov. than in *C. singaporensis*, but since they may be absent in both species they are less useful for comparison.

The fistules of the new species tend to be shorter and larger than in *C. singaporensis*, but even the long finger-like forms do occur. The colour of *C. agglomerans* is a steady golden yellow, whereas *C. singaporensis* was reported in life as vivid yellow, yellowish green, dark olive, brown (Bergquist, 1965). Both species become brown when preserved.

The depth-range of *C. singaporensis* extends from the intertidal (Bergquist, 1965; Hajdu et al., 1994) to the undetermined deep water of Dendy (1905), whereas for the new species the ecological requirements seem to be the rather low light conditions that are to be found at various depths depending on the bottom profile.

Two diterpenes able to inhibit the growth of human gastric adenocarcinoma cells have been recently isolated from specimens of the new species (reported as *Coelocarteria* cfr. *singaporensis*) collected from the Bunaken park (Fattorusso et al., 2006). No other bioactive products from *C. singaporensis* were found in the literature, but molecular data are reported by Erpenbeck et al. (2005).

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