

Pacifigorgia marviva (Anthozoa: Octocorallia) a new species from Coiba National Park, Pacific Panama

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Pacifigorgia marviva, a new shallow-water species of the family Gorgoniidae, was found in Coiba National Park, Pacific Panama at 35–40 m depth. It is characterized by having white to cream, small, erect colonies composed of 1–4 fronds, stems short or absent network irregular and open without fan midribs, and polyp mounds slightly raised and sparsely distributed. All sclerites are colourless. Coenenchymal sclerites mostly composed of long spindles reaching up to 0.25 mm in length, and long and thin anthocodial rods, up to 0.16 mm in length. Morphological characters are analysed and illustrated. Scanning electron microscopy was used for sclerite study. The new species is herein described and compared with other similar species reported from the eastern Pacific. *Pacifigorgia marviva* increases the number of *Pacifigorgia* species to 35; 20 in Panama representing 57% of the genus in the eastern Pacific, followed by Costa Rica and Ecuador with 14 and 10 species, respectively.

Keywords: Octocorallia, Gorgoniidae, *Pacifigorgia*, Coiba National Park, eastern Pacific, Panama

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INTRODUCTION

The awareness about protecting species and habitats has increased and the biodiversity crisis has prompted rapid inventories at all levels. Ideally, full species inventories based on basic taxonomy and phylogenetic research (Wheeler, 1995) including the abundance and distribution of species both at regional and global levels are the first steps for conservation planning. Certainly, protected areas provide the basis for the protection of whole ecosystems (Mora *et al.*, 2006) but in many cases, local biodiversity and levels of endemism are unknown and ignored (Brooks *et al.*, 2006). Coral reefs in western Pacific Panama (Gulf of Chiriquí) are among the most diverse in scleractinian and octocoral species in the Marine Conservation Corridor of the Eastern Tropical Pacific (Guzman *et al.*, 2004, 2008; Guzman & Breedy, 2008). This high diversity area of Panama encompasses more than 445 islands, islets, and over 2300 km of coastline creating atypical habitats suitable for several species if compared with others in the region. Seventy-five coral species are reported including 52 octocorals (Guzman & Breedy, 2008; Guzman *et al.*, 2008). Centred in the Gulf of Chiriquí is the 2025 km² Coiba National Park marine protected area, containing most of the endemic octocoral species and is presumably a regional diversity hot spot (Guzman & Breedy, 2008).

The genus *Pacifigorgia* Bayer, 1951 is one of the most diverse and abundant. *Pacifigorgia* includes reticulated fan-

shaped gorgoniids. Historically, 18 species have been recognized, all restricted to the Pacific Ocean from southern California to Chile and the Galápagos Islands, except for one western Atlantic species (Breedy & Guzman, 2002). Further taxonomic research has unveiled several new species increasing the list to a total of 34 worldwide (Breedy & Guzman, 2003a, b; Breedy & Guzman, 2004; Williams & Breedy, 2004).

Herein, we describe a new species of *Pacifigorgia* from Coiba National Park, and discuss its relationship with other members of the genus. This discovery is a contribution to the biodiversity knowledge in the area.

MATERIALS AND METHODS

Specimens were collected by SCUBA diving, down to 40 m in depth at Punta Hermosa, Coiba Island National Park, Gulf of Chiriquí, Panama, and the population was visually assessed in terms of abundance and size-structure. One colony sample was preserved in alcohol, two others were air-dried, and small fragments were preserved in 95% ethanol for further (and ongoing) molecular studies. Sclerites were prepared for light and scanning electron microscopy (SEM) following the standard techniques for structural analysis (Bayer, 1961; Breedy & Guzman, 2002). Comparative material was obtained from the Museo de Zoología, Universidad de Costa Rica (UCR) collection, and our recent collections in Costa Rica and Panama. Standard techniques for morphological studies were applied (Breedy & Guzman, 2002) giving measurements of branches, meshes, and sclerites corresponding to the maximum size found. The terminology used in the description

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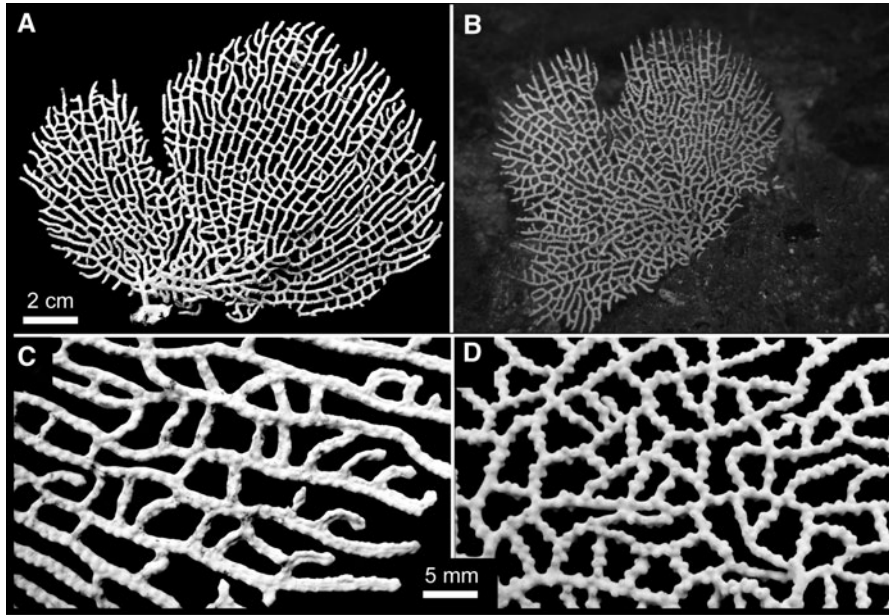


Fig. 1. *Pacifigorgia marviva* sp. nov. (A–C) Holotype STRI 1185; (A) dry preserved, whole specimen; (B) *in situ* at Punta Hermosa, 38 m in depth; (C) detail of branches; (D) paratype, STRI 1184, alcohol preserved, detail of branches.

follows Bayer *et al.* (1983) and Breedy & Guzman (2002). The holotype and paratypes are deposited in the UCR. The abbreviation STRI stands for the Smithsonian Tropical Research Institute.

SYSTEMATICS

Class ANTHOZOA Ehrenberg, 1834
 Subclass OCTOCORALLIA Haeckel, 1866
 Order ALCYONACEA Lamouroux, 1816
 Family GORGONIIDAE Lamouroux, 1812
 Genus *Pacifigorgia* Bayer, 1951
 Complete synonymy in Breedy & Guzman, 2002

Type species: *Gorgonia stenobrochis* Valenciennes, 1846, by original designation (Bayer, 1951: 94).

DESCRIPTION

Flabellate gorgoniids with reticulated colonies composed of a single or multiple fans growing in one or several planes. Fan sizes are from a few centimetres to up to 1 m in height and 1.2 m in width. They are attached to the substrate by encrusting, expanded holdfasts. Stems are absent or short. Midribs could be present or not. When present they are thick and cross the fans or thin, almost blended into the network. Networks are regular or irregular with meshes of various dimensions and shapes. Axes horny, with a cross-chambered central core that includes a network of organic filaments mineralized with microspheres of CHAp (carbonate hydroxylapatite). Calyces absent, polyps retract into dome-shaped coenenchymal mounds. Polyp-mounds are prominent or slightly raised above surface of the coenenchyme. Coenenchymal sclerites basically of two kinds, with a number of intermediate derivatives: spindles with acute, blunt, or irregular ends and several whorls of warty tubercles, can reach up to 0.2 mm in length; and capstans ornamented with different levels of complexity, can reach up to 0.09 mm in length. Anthocodial

sclerites are flattened rods with smooth, scalloped, indented or lobed margins.

DISTRIBUTION

Eastern Pacific, from southern California to Chile and the Galápagos Islands; Atlantic coast, only one species (*Pacifigorgia elegans* (Milne Edwards & Haime, 1857)) from Trinidad to Brazil (Bayer, 1951; Breedy & Guzman, 2002).

Pacifigorgia marviva sp. nov.
 (Figures 1–3)

TYPE MATERIAL

Holotype: dry specimen. (Punta Hermosa, Coiba Island, Gulf of Chiriquí, Panama; coordinates: 07°31.385'N 081°53.515'W; water depth: 37 m) [STRI 1185]. Collected by: O. Breedy and H.M. Guzman, 29 April 2010.

Paratypes: alcohol preserved specimen (same as the holotype; water depth: 35 m) [STRI 1184]. Collected by: O. Breedy and H.M. Guzman, 29 April 2010. Dry specimen (same as the holotype; water depth: 35 m) [STRI 1185]. Collected by: O. Breedy and H.M. Guzman, 29 April 2010.

DIAGNOSIS

Small, erect sea fans composed of 1–4 fronds. Stems short or absent, midribs not present, network irregular and open. Colonies white to pale pink, polyp mounds slightly raised and sparsely distributed. Coenenchymal sclerites mostly composed of long spindles reaching up to 0.25 mm in length. Anthocodial rods long and thin, up to 0.16 mm in length. All sclerites are colourless.

DESCRIPTION

The holotype consists of a fan-shaped colony, 11 cm in height, and 14.5 cm with two erect fronds that arise from a common, oval holdfast (17 mm in diameter) and extend in the same plane (Figures 1A, B). Stem is short, 3.5 mm

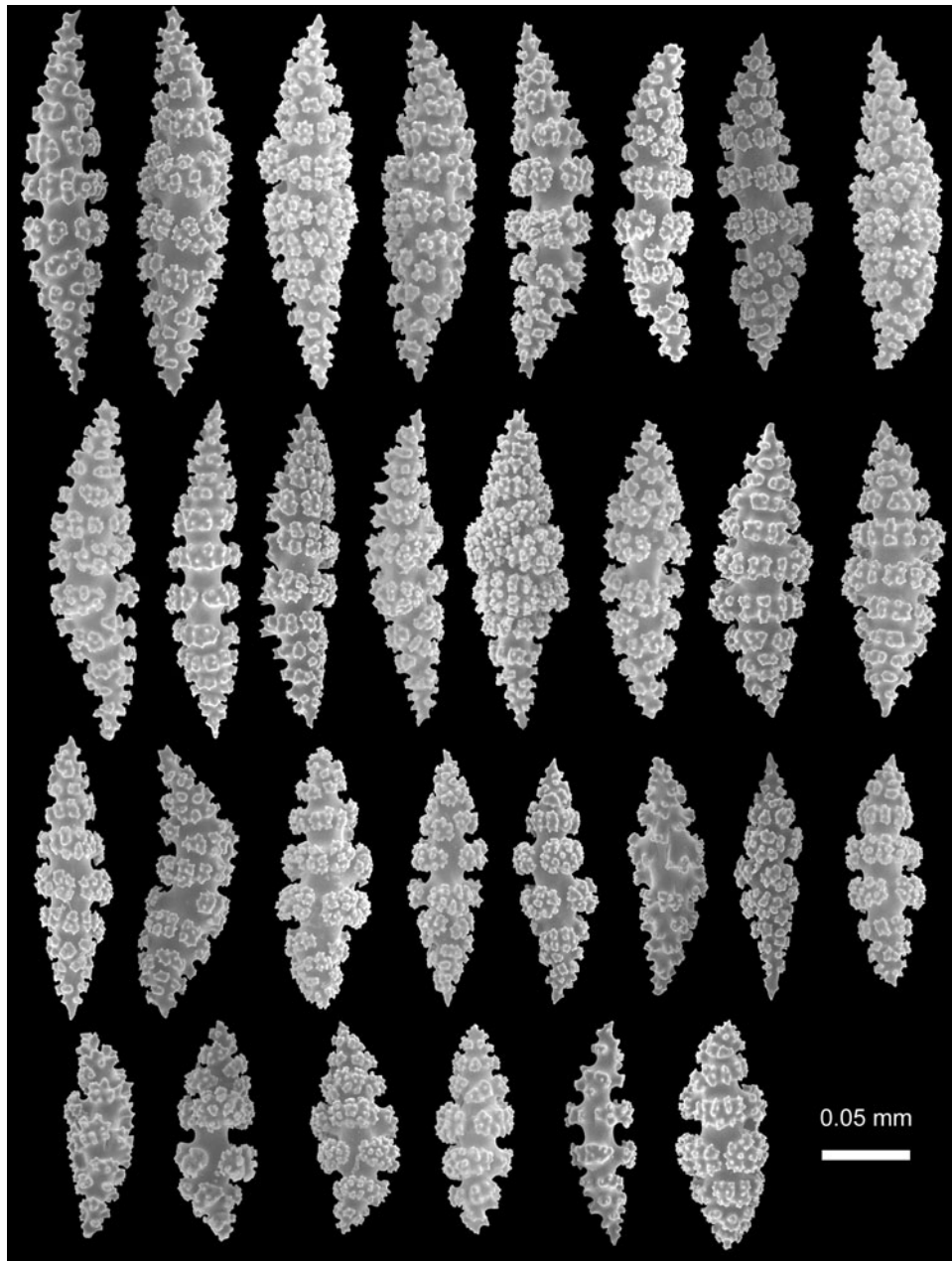


Fig. 2. *Pacifigorgia marviva* sp. nov. Holotype, spindles from the coenenchyme.

in height, and slightly flattened, 2 mm in diameter. No midribs cross the fan. Network is irregular. Meshes are open (4–6 meshes/cm²), and mostly angular 2–13 mm long (Figure 1C). Mesh branches are squarish in cross-section, mostly 1–1.5 mm in diameter, but up to 2 mm in diameter at the base of the colony. End branchlets are 1–1.5 mm in diameter: they reach up to 19 mm long, and have blunt tips. Free twigs are scarce and reach up to 4 mm in length (Figure 1C). Colour of colony was white when alive and immediately after collection, but cream or pale pink when dry. Polyps are white and fully retractile into dome-shaped coenenchymal mounds which are slightly raised with slit-like apertures, up to 0.5 mm long (Figure 1C). Polyp-mounds are sparsely arranged, about 0.5–1.5 mm apart. Polyps are distributed mostly in two rows on each side of branches, or in a single row on

thinner branches (Figure 1C). There are 22–28 per cm around a branch. Longitudinal grooves are slightly marked between the polyp rows along the branches. All sclerites are colourless. Anthocodiae are weakly armed with rods in untidy points-like arrangements. Anthocodial rods measure up to 0.14 mm in length and 0.02 mm in width and have margins that are scalloped or just have a few, short tubercles (Figure 3D). Coenenchymal sclerites are strongly tuberculated and are mostly long spindles with acute ends. They reach up to 0.23–0.25 mm in length, and 0.06 mm in width, with up to 12 complete whorls of warty tubercles, and constitute the longest spindles reported for the genus so far (Figure 2). A number of intermediate forms also occur in the coenenchyme: smaller irregular spindles with blunt warty ends, up to 0.10 mm in length and 0.05 mm in width (Figure 3A); small capstans and radiates, up to

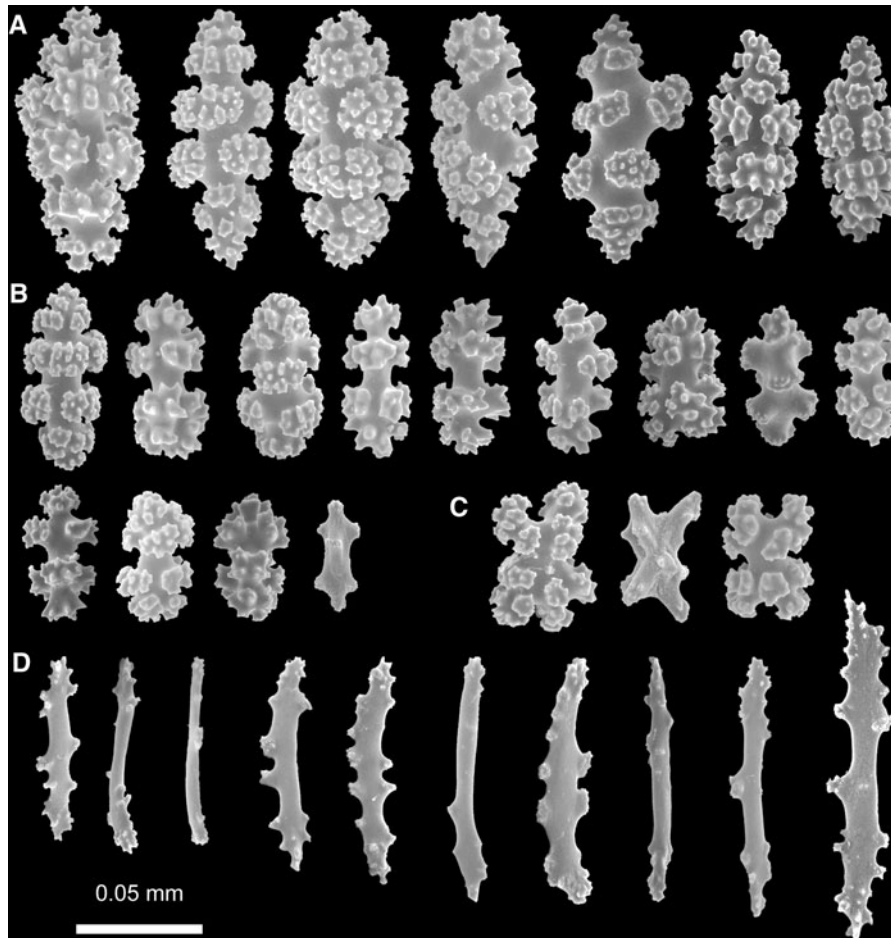


Fig. 3. *Pacifigorgia marviva* sp. nov. (A–C) Holotype, sclerites from the coenenchyme; (A) irregular spindles; (B) capstans, radiates; (C) crosses; (D) anthocodial rods.

0.065 mm by 0.035 mm (Figure 3B); and crosses that reach up to 0.065 mm by 0.06 mm (Figure 3C).

DESCRIPTION OF PARATYPES

Wider than high, STRI 1186 is 12.8 cm in height, and 13.1 cm in width, and STRI 1184 is 6.8 cm in height, and 7.7 cm in width. They agree in all essential aspects with holotype (Figure 1D). Anthocodials of the smallest colony reach up to 0.16 mm in length. Colonies white when alive or alcohol preserved and cream to pale pink when dry.

ETYMOLOGY

The species is named in honour of Erica Knie, founder and President of Fundación MarViva. Her love and passion for the oceans, unique philanthropic vision, and continuous support for law enforcement to protect marine resources in Latin America, particularly in Coiba National Park have inspired a regional change toward conservation.

HABITAT

This uncommon species was found at the base of a rocky pinnacle that breaks the surface from about 50 m deep. It was living together with other octocoral species, e.g. *Pacifigorgia sculpta* Breedy & Guzman, 2004 and *Eugorgia daniana* Verrill, 1868 (typical form and an orange variety). *Pacifigorgia marviva* sp. nov. was the most abundant species

(~12 individuals) at the collection site below 35 m and growing on flat rocky patch of approximately 250 m² along a gentle slope to 50 m.

DISTRIBUTION

A survey of the entire west coast of Coiba and nearby high diversity rocky areas revealed that the species is presently recorded only from the type locality, Punta Hermosa, Coiba National Park, Pacific Panama.

DISCUSSION

The new species differs from other *Pacifigorgia* species especially in having the following combination of characters. First, the colonies are white or pale pink and the sclerites are all colourless, whereas *Pacifigorgia* is generally characterized by having bright coloured colonies—dull and whitish colours not being common. Second, long spindles with more than eight whorls of tubercles are the main component of the coenenchymal sclerites in this species, and they reach up to 0.25 mm in length, and third, colonies are composed of a few fans growing in the same plane, with open meshworks, and lacking distinct midribs crossing the fans. This new species has some similarity with *Pacifigorgia senta* Breedy & Guzman, 2003a and *P. sculpta*. These two species also have

Table 1. Comparative features of *Pacifigorgia marviva* sp. nov. and other related species.

	<i>Pacifigorgia marviva</i>	<i>Pacifigorgia sculpta</i>	<i>Pacifigorgia senta</i>
Characteristics			
Colour of the colony	White/pale pink	Reddish-brown	Pink/white
Number of meshes/cm ²	4–6	2–3	3–4
Mesh shape and maximum mesh size (mm)	Angular/irregular 13 length 2 width	Oblong/irregular 45 length 25 width	Polygonal/irregular 22 length 7 width
Midribs/maximum diameter	Absent	Absent, thicker basal branch, 6 mm	Present, 8 mm
End-branchlets maximum length (mm)	20	25	16
Branch-network maximum thickness (mm)	2	2	1.5
Polyp mounds	Slightly raised	Prominent	Prominent
Colour of sclerites	Colourless	Red-orange/pale-yellow	Pink/colourless
Spindle maximum size (mm)	0.25 length 0.06 width	0.22 length 0.06 width	0.22 length 0.06 width
Capstan maximum size (mm)	0.065 length 0.035 width	0.08 length 0.04 width	0.09 length 0.02 width
Anthocodial rods maximum size (mm)	0.16 length 0.02 width	0.18 length 0.02 width	0.14 length 0.02 width

large spindles in the coenenchyme and they can reach up to 0.22 mm, but these large sizes are not as abundant as they are in the coenenchyme of *P. marviva* sp. nov. (Table 1). *Pacifigorgia senta* has white colonies; however, the colonies have thinner branches, midribs, prominent polyp mounds and more open meshes than those of *P. marviva* (Table 1). *Pacifigorgia sculpta* also differs from the new species in the colour of the colonies (reddish brown) and sclerites (red-orange/pale-yellow), the meshes are larger, the polyp mounds are prominent, and the branches are thicker (Table 1).

Pacifigorgia sculpta is endemic, with a wide distribution in the Gulf of Chiriquí; *P. senta* has a wider geographical range of distribution, having been reported from Costa Rica and Baja California South (Mexico) (Breedy & Guzman, 2003a). *Pacifigorgia sculpta* occurs together with *P. marviva* in the type locality, retaining their respective morphologies, also no intermediate forms were found in the collection site. *Pacifigorgia senta* has a deeper distribution range, down to 45 m. Its coexistence in the type locality has not been researched.

The genus *Pacifigorgia* has increased to 35 species along the eastern tropical Pacific region with this new addition (Breedy & Guzman, 2002, 2003a, 2004; Williams & Breedy, 2004). Panama continues to have the most diversity of *Pacifigorgia* spp. in the region (*sensu* Guzman & Breedy, 2008) with 20 species, representing 57% of the genus, followed by Costa Rica and Ecuador with 14 and 10 species, respectively. However, a preliminary similar high degree of endemism is observed in Panama, Costa Rica and Galápagos Islands (Ecuador) with five–six likely endemic species.

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