

SHORT COMMUNICATION

The snowflake soft coral *Carijoa riisei* (Cnidaria: Octocorallia) in Costa Rica

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ABSTRACT. Introduction: *Carijoa riisei* (Clavulariidae) is found throughout the world in tropical waters and is considered an invasive species at certain locations. A specimen was collected intertidally in the upper Gulf of Nicoya estuary, Pacific coast of Costa Rica. The collection of the Museum of Zoology of the University of Costa Rica (MZUCR) includes additional specimens identified as *C. riisei*. **Objective:** To identify the specimen and list the MZUCR records for the Pacific coast. **Methods:** The coral was kept in sea water to allow observation of open polyps. The sclerites were studied under a scanning electron microscope. A list of MZUCR records was assembled. **Results:** The morphologies of the colony and sclerites are similar to those described for *C. riisei*. The MZUCR includes 50 records of *C. riisei* along the Pacific coast and at Coco Island. **Conclusions:** Based on morphology, the specimen is identified as *Carijoa riisei*, but genetic studies are desirable. Most of the UCRMZ records are from a decade or more ago. An evaluation of the presence of this coral in both the Pacific and Caribbean coasts is needed to better establish its present ecological role in Costa Rica.

Keywords: Eastern Tropical Pacific, invasive species, biodiversity, estuary, Clavulariidae

RESUMEN. “El coral blando copo de nieve *Carijoa riisei* (Cnidaria: Octocorallia) en Costa Rica” **Introducción: *Carijoa riisei* (Clavulariidae) se encuentra alrededor del mundo en aguas tropicales. Es considerado como una especie invasora en algunas localidades. Un ejemplar fue colectado entre mareas en la región superior del estuario del Golfo de Nicoya, costa Pacífica de Costa Rica. La colección del Museo de Zoología de la Universidad de Costa Rica (MZUCR) incluye otros especímenes identificados como *C. riisei*. **Objetivo:** Identificar el ejemplar y elaborar una lista de registros del MZUCR. **Métodos:** El coral fue mantenido en agua de mar para permitir la observación de los pólipos abiertos. Las escleritas fueron estudiadas bajo el microscopio electrónico de barrido. Se preparó una lista de los registros del MZUCR. **Resultados:** Las morfologías de la colonia y de las escleritas son similares a las descritas para *C. riisei*. El MZUCR incluye 50 registros de *C. riisei* a lo largo de la costa del Pacífico y en la Isla del Coco. **Conclusiones:** Pendiente de corroboración genética, identificamos el espécimen como *Carijoa riisei* con base en su morfología. La mayoría de los registros del MZUCR son de hace una década o más. Una evaluación de la presencia de este coral en las costas del Pacífico y Caribe es necesario para establecer mejor su papel ecológico actual en Costa Rica.**

Palabras clave: Pacífico Este Tropical, especie invasora, biodiversidad, estuario, Clavulariidae

Carijoa riisei (Duchassaing & Michelotti, 1860) is an octocoral of the family Clavulariidae reported from different tropical locations worldwide, where it is considered an invasive species (Venkataraman et al., 2016). The coral was first described from the Atlantic Ocean (Virgin Islands) and was later reported from Hawaii in the Pacific Ocean in 1972 (Kahng & Grigg, 2005). Genetic evidence, however, suggests *C. riisei* is native to the Indo Pacific (Concepcion et al., 2010). In the Eastern Tropical Pacific it has been reported from Mexico (Galván-Villa & Ríos-Jara, 2018), El Salvador, Nicaragua (Cortés et al., 2017), Panamá (Gómez et al., 2014), Colombia (Sánchez & Ballesteros, 2014; Quintanilla et al., 2017) and Ecuador (Cárdenas-Calle et al., 2021). The only record for the Caribbean coast of Costa Rica was identified as *Telesto riisei* (later recognized as *C. riisei*, UCRMZ 93) collected in 1983 at the port of Limón (Guzmán & Cortés, 1985). In Culebra Bay, on the northern Pacific coast of Costa Rica, *Carijoa* sp. was found to be the most abundant (more than 40%) community member at waters deeper than 20m (Cortés & Jiménez, 2003). Museum specimens from the Gulf of Nicoya estuary identified as *C. riisei* were reported by Vargas & Breedy (2021). *Carijoa riisei* has also been reported from the oceanic (05° 32'N - 87° 03'W) Coco Island (*Isla del Coco*) by Cortés et al. (2017).

On December 7, 2021, at the Punta Morales Peninsula in the mid upper region (10° 04'N - 84° 58'W) of the Gulf of Nicoya, Pacific coast, during a very low tide (- 0,21m to + 2,93m), a solitary colony of soft coral was found growing on a rock exposed to sediment-loaded waters (Fig. 1 A, B). The objectives of this note are to identify the species, provide a description of the specimen, and list previous records from the Pacific coast of Costa Rica. A fragment of the colony was collected (Fig. 1 C) and kept in sea water where it was observed with the characteristic white polyps extended (Fig. 1 D, E). The fragment was later preserved in alcohol and a small section cut off to study the sclerites under a scanning electron microscope. A list of specimens of *C. riisei* deposited in the Museum of Zoology of the University of Costa Rica (UCRMZ) was assembled

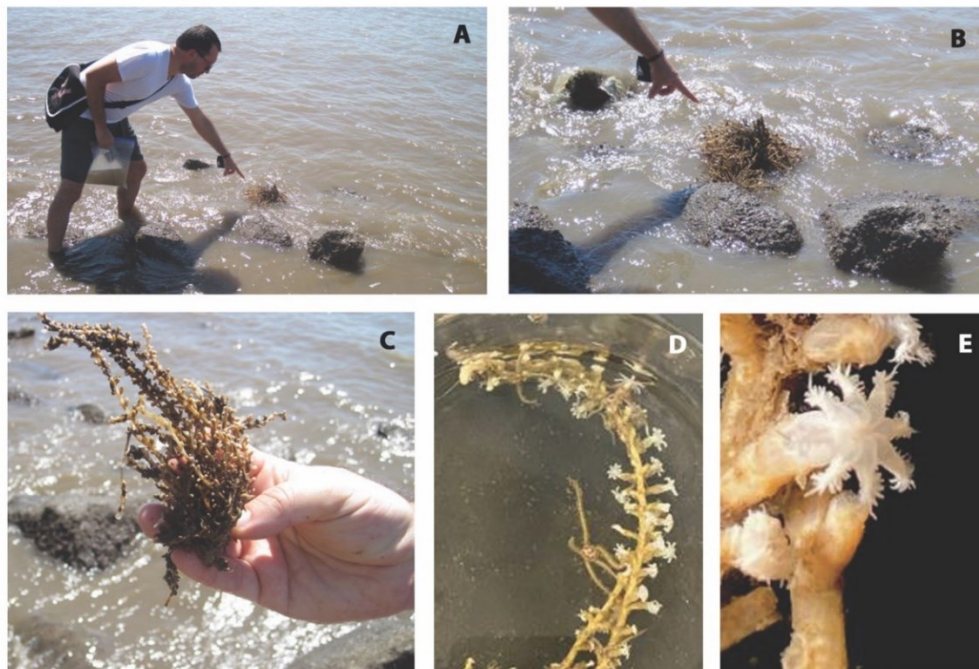


Fig. 1. A. B. Solitary colony of *Carijoa riisei* (MZUCR 3317) on a rock at the low intertidal water edge, Punta Morales, mid upper Gulf of Nicoya estuary. C. Live fragment of the colony with retracted polyps and natural colour. D. Distribution of open polyps along the axis. E. Close view of open polyp.

The colony found at Punta Morales consists of cylindrical conical polyps budding mostly laterally at opposite sides, at distances of 1-3mm apart distally and more widely dispersed basally, about 4mm apart. Branching is monopodial, with several single erect branches up to 13cm long. Polyps are joined at their bases by thin ribbon-like stolons. Apical polyps form clusters of 3 or 4 buds surrounding each axial polyp. The colour of the colony is light brown when alive (Fig. 1) and lighter when preserved in alcohol. An epizoic assemblage is present which includes hydroids, polychaete worms and micro-crustaceans.

Polyp sclerites are elongated rods, 0,27 – 0,46mm long, and around 0,017 – 0,047mm wide, with sparse, thorny tubercles; some with forked ends (Fig. 2A). Sclerites in stolons are tuberculate rods, with simple and sparse tubercles, some bifurcated or thorn-like, 0,11 – 0,32mm long, and 0,028 – 0,084mm wide (Fig. 2B), often fused into characteristic tangled clumps (Fig. 2C). Tentacles with flat, unornamented rods, 0,13 – 0,22mm long and around 0,012mm wide (Fig. 2D). All sclerites are colourless.

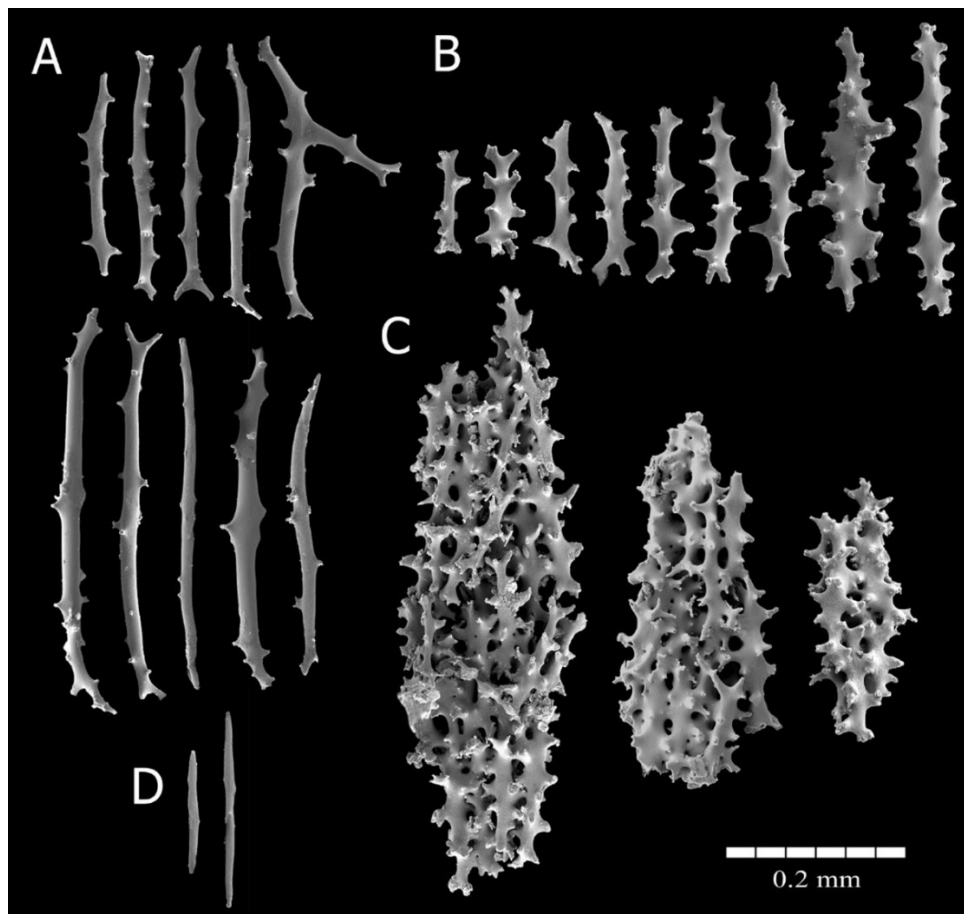


Fig.2. *Carijoa riisei*, MZUCR 3317: Scanning Electron Microscope views of sclerites from: **A.** Polyps. **B.** Stolons. **C.** Fused clumps of stolon sclerites. **D.** Tentacles.

External morphology of the colony, polyps (Fig. 1) and sclerites (Fig. 2) are similar to descriptions of *C. riisei* provided by Bayer (1961, 1981), Devictor and Morton (2010), Laackmann (1909) and Sánchez (1994). Of particular relevance are the sclerites ornamented with prickles and thorns and sometimes fusing into clumps as described by Bayer (1981). However, a clear taxonomic status has not yet been defined for the species. Thus, the specimen collected in Punta Morales is

provisionally identified as *Carijoa riisei* until integrative taxonomic studies including morphological and molecular analyses may contribute to clarify this issue in the future.

The collection of the Museum of Zoology of the University of Costa Rica has 50 records of specimens labelled as *C. riisei* for the Pacific coast of Costa Rica. The earlier records are from 1991 (Table 1). The coral was collected along the coast, from Salinas Bay on the North to the Golfo Dulce embayment on the South and at Coco Island (Table 1). Several collections come from the Gulf of Nicoya where 29 other octocoral species are reported by Vargas and Breedy (2021). The record 3323 (Table 1) is interesting as *C. riisei* was found at Culebra Bay on top of a black coral. A recent survey (Matamoros-Calderón et al., 2021) of black coral forests (*Myriopathes panamensis* and *Antipathes galapaguensis*) in an area North of Culebra Bay reported no specimens of *C. riisei* on black coral branches.

Collections of *C. riisei* on the Pacific coast of Costa Rica have been occasional and most have occurred more than a decade ago (Table 1). A comprehensive evaluation of its presence in intertidal and subtidal sites in both the Pacific and Caribbean coasts is needed to better assess its actual ecological role in coastal waters of Costa Rica.

TABLE 1

Specimens identified as *Carijoa riisei* from the Pacific coast of Costa Rica in the collection of the Museum of Zoology, University of Costa Rica

MZUCR Catalog	Year collected	Locality and water depth (n.d. = no data)
572	1991	Nicoya Peninsula, Punta Pitahaya, 10m
573, 584	1991	Nicoya Peninsula, Playa Pitahaya, 9m
605	1991	Upper Gulf of Nicoya, Cortezas islets, intertidal
679	1992	Guanacaste, Culebra Bay, Pelonas islets, 20m
754	1994	Golfo Dulce, Salsipuedes Islet, 3m
778	1994	Guanacaste, Murciélago islands, 24m
1712	2007	Caño Island, 30m
1723	2004	Golfo Dulce, Punta Banco, 10m
1728	2002	Mid Gulf of Nicoya, inner Negritos Island, 10m
1729	2002	Mid Gulf of Nicoya, Cedros Island, 6m
2616	2014	Tip of Nicoya Peninsula, Cabo Blanco, n.d.
2618	2013	Coco Island, shark fin
2663	2015	Golfo Dulce, La Viuda, 14m
2664	2002	Guanacaste, Salinas Bay, Bajo Rojo, 15m
2669	2011	Coco Island, Punta María, 26m
2703	2004	Golfo Dulce, Puerto Jiménez, Matapalito, 18m
2754	2005	Nicoya Peninsula, near Playa Bejuco, 26-73m trawl
2755	2005	Nicoya Peninsula, near Playa Carrillo, 40-96m trawl
2892	1995	Manuel Antonio National Park, Olocuita Island, n.d.
3050, 3058	2018	Coco Island, Manuelita channel, 25m
3163, 3164	1999	Gulf of Nicoya, islets South of San Lucas Island
3301	2002	Golfo Dulce, Punta Aguja, n.d.
3302	1997	Golfo Dulce, Punta Gallardo, n.d.
3303	2007	Caño Island, Bajo Diablillo
3304	2012	Gulf of Nicoya, n.d.
3305	2013	Golfo Dulce, Puerto Jiménez, n.d.
3306	2016	Guanacaste, Santa Elena Peninsula, Cuajiniquil, n.d.
3307	1998	Guanacaste, Culebra Bay, 8m
3308	2010	Coco Island, 30m
3309, 3324	2021	Coco Island, 25m
3310	1997	Guanacaste, Culebra Bay, n.d.
3311	1996	Caño Island, Cambutal, 18m
3312	1997	Guanacaste, Sámara, n.d.
3313	2006	Guanacaste, Santa Elena Bay, n.d.

3314, 3319	2002	Gulf of Nicoya, n.d.
3315	2021	Coco Island, Arco dos Amigos, n.d.
3316	2021	Coco Island, Manuelita Islet
3317	2021	Gulf of Nicoya, Punta Morales, Playa Blanca, intertidal
3318	2007	Gulf of Nicoya, n.d.
3320, 3322	2007	Caño Island, n.d.
3321	2005	Guanacaste, Santa Elena Bay, n.d.
3323	1998	Guanacaste, Culebra Bay, 18m, on top of black coral
3325	2016	Guanacaste, Santa Elena Peninsula, Punta Blanca, 7m
3326	1998	Guanacaste, Sámara, n.d.

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ETHICAL, CONFLICT OF INTEREST AND FINANCIAL STATEMENTS

The authors declare that they have complied with all pertinent ethical and legal requirements, both during the study and in the production of the manuscript; that there are no conflicts of interest of any kind, and agree with the final edited version. A signed document has been filed in the journal archives. The contribution of each author was: J.V. Original idea, writing, editing. O. B. Taxonomic review, writing, scanning electron microscope work.

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