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The opisthobranch gastropods (Mollusca: Heterobranchia) from Venezuela: an annotated and illustrated inventory of species

MANUEL CABALLER GUTIÉRREZ^{1,2}, JESÚS ORTEA³, NELSY RIVERO⁴, GABRIELA CARIAS TUCKER⁵,
MANUEL ANTÓNIO E. MALAQUIAS⁶ & SAMUEL NARCISO⁷

¹Muséum national d'Histoire naturelle, 55 rue Buffon, 75005 Paris. E-mail: mcaballergutierrez@mnhn.fr

²Department of Oceanology and Coastal Sciences, Venezuelan Institute for Scientific Research, Carretera Panamericana km 11, Miranda, Venezuela. E-mail: manuelcaballergutierrez@hotmail.com

³Department BOS, Faculty of Biology, University of Oviedo, Asturias, Spain. E-mail: jorte@uniovi.es

⁴Environmental Sciences Headship, Academic Vice-Chancellorship, Caribbean Maritime Experimental National University, Ave. El Ejercito, Catia La Mar, Vargas, Venezuela. E-mail: nelsyrivero@gmail.com

⁵Clinical laboratory, Policlínica Metropolitana Urbanización Caurimare, Calle A-1, Caracas, Venezuela. E-mail: gabycariast@gmail.com

⁶Phylogenetics Systematics and Evolution Research Group, Section of Taxonomy and Evolution, Department of Natural History, University Museum Bergen, University of Bergen, PB 7800, 5020-Bergen, Norway. E-mail: Manuel.Malaquias@uib.no

⁷Centro de Investigación y Atención Comunitaria (CIAC) de la Fundación para la Defensa de la Naturaleza (FUDENA), Calle Carabobo s/n, Chichiriviche, Falcon, Venezuela. E-mail: samuelnarciso@gmail.com

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Abstract

The Caribbean waters of Venezuela are composed by a large variety of habitats, with over 2800 km of coastline, islands, and islets. This area is a transitional zone between two main biogeographic provinces, the Caribbean and the Brazilian, separated by the fresh water outflows of the Orinoco and Amazon rivers, and is therefore expected to be an area of high species diversity. However, concerning the study of molluscs, Venezuela is probably the poorest known region in the Caribbean. The best compilation of opisthobranch species known in Venezuela was produced almost a decade ago, mentioning the occurrence of 57 species, plus seven determined only to genus level. In this work, 134 species are reported for Venezuela (71 are illustrated), representing about 40 % of the entire diversity of opisthobranchs known in the Caribbean. Among the species occurring in Venezuela, 49 have here the southern limit of their distribution range and only one the northern limit. Forty-six species are recorded for the first time to the country and one is a new record for the Caribbean

Sea, namely *Placida cremoniana*. In addition, the distribution and ecology of the species are given based in literature and new data.

Key words: taxonomy, new records, southern Caribbean, benthic fauna, marine biodiversity

Introduction

Opisthobranch sea slugs and snails (*sensu* Rudman & Willan 1998) have been found to be non-monophyletic and novel classifications have been established (e.g., Schrödl *et al.* 2011; Zapata *et al.* 2014), but the descriptive term “opisthobranch” is still widely used for some “clades with similar traits” (e.g., Galvão Filho *et al.* 2015). Opisthobranchs can be found in most coastal areas of the world, from the poles to the tropics on a broad range of habitats, from supratidal pools to the deep-sea, inhabiting coral reefs, rocky shelves, seagrass beds, coral rubble, sandy bottoms and algae. They are regarded as being most diverse in shallow areas between 0–30 m deep, particularly in tropical regions (Valdés *et al.* 2006; Gosliner *et al.* 2008), but deep-sea research is unravelling high levels of previously unknown diversity of these molluscs at high depths too (Valdés 2008; Oskars *et al.* 2015). Highest species richness is found in the Indo-Pacific biogeographic region, which harbors approximately 1400 species (Gosliner *et al.* 2008). In the Atlantic, the Caribbean Sea is the biogeographic province with highest number of valid species of opisthobranchs. Presently, about 329 species are known in the area (Valdés *et al.* 2006; García & Bertsch 2009).

Despite the milestone book by Valdés *et al.* (2006) on the opisthobranchs of the Caribbean Sea, several areas remain poorly studied, including the waters of Venezuela. These are composed by a large variety of habitats (e.g. coral reefs, mangroves, seagrass meadows, rocky shores, cays, sandy beaches, and coastal lagoons), stretching over 2800 km of coastline, islands, and islets (Petuch 1987). Venezuela is a transitional zone (see discussion) between two main biogeographic provinces, the Caribbean and the Brazilian (Spalding *et al.* 2007; Briggs & Bowen 2012), separated by the fresh water outflows of the Orinoco and Amazon rivers, and is therefore expected to be an area of high species diversity (Petuch 2013). However, concerning the study of molluscs Venezuela is probably the poorest known region in the Caribbean, as highlighted by Petuch (1987; 2013) more than 20 years ago.

A few opisthobranch species have been cited in regional faunal catalogs, catalogs of other regions or on ecological studies (Marcus 1957; Rodríguez 1959; Marcus & Marcus 1960; 1962; 1963; 1964; 1967a; 1970; Work 1969; Marcus 1972; 1977; Abbot 1974; Marcus & Hughes 1974; Thompson 1977; González & Princz 1979; Rios 1985; Mollo *et al.* 1994; Gavagnin *et al.* 1996; 1997; 2000; Macsotay & Campos 2001; Diaz & Liñero-Arana 2004; Fernandez & Jimenez 2007; Bitter *et al.* 2009; Massemin *et al.* 2009; Ortea *et al.* 2009; Rios 2009). The opisthobranchs are an important source of bioactive chemicals with potential medical applications, and some species inhabiting Venezuela have been cited in chemical studies: Gavagnin *et al.* (1996; 1997; 2000) found four different secondary metabolites in specimens of *Lobiger souverbii* Fischer, 1857 from Los Roques and *Elysia crispata* Mörch, 1863 from Mochima, three of them are polypropionates used as defence to high exposure to sunlight. Miloslavich *et al.* (2010), on a bibliographic compilation of the invertebrate species living in the Caribbean, reported 30 species of opisthobranchs for Venezuela. In fact, very few studies with focus on the opisthobranchs of Venezuela have ever been published: Marcus & Marcus (1967a) described *Hypselodoris acriba* Ev. Marcus & Er. Marcus, 1967a, and Marcus (1971c) described *Hypselodoris marci* Ev. Marcus, 1971c, both from Los Roques archipelago; Rivero *et al.* (1998) recorded *Aplysia parvula* Guilding in Mörch, 1863 from Venezuela; Mollo *et al.* (1994) recorded *Stiliger cricetus* Er. Marcus & Ev. Marcus, 1970 from the National Park Mochima; Ortea & Valdés (1996 in Ortea *et al.* 1996) described *Mexichromis molloi* Ortea & Valdés, 1996 from Picuda Island, Mochima; Mariño *et al.* (2011) recorded *Dondice parguerensis* Brandon & Cutress, 1985 from Buche; Caballer & Ortea (2012) described *Hypselodoris samueli* Caballer & Ortea, 2012 from Morrocoy; Crescini *et al.* (2013a) described *Learchis ignis* Crescini, De Sisto & Villalba, 2013a, from Margarita Island, where Crescini *et al.* (2013b) recorded *Doto chica* Ev. Marcus & Er. Marcus, 1960 and Villaba & Crescini (2013) cited *Favorinus auritulus* Er. Marcus, 1955. Lately, Caballer & Ortea (2015) described *Philine buchensis* Caballer & Ortea, 2015 from Buche and Grune *et al.* (2015) made an inventory of the opisthobranchs from La Restinga, Margarita.

Overall, Valdés *et al.* (2006) performed the best synthesis of opisthobranch species known to date in Venezuela. The authors mentioned the occurrence of 64 species (seven of them determined only to genus level), but most of the records have unspecified localities.