

Caribbean Journal of Science, Vol. 38, No. 3-4, 252-256  
 Copyright 2002 College of Arts and Sciences  
 University of Puerto Rico, Mayagüez

## Notes on the Marine Algae of Puerto Rico VII. Seven New Records of Benthic Rhodophyta

DAVID L. BALLANTINE<sup>1</sup>, HÉCTOR RUIZ<sup>1</sup>, AND MICHAEL J. WYNNE<sup>2</sup> <sup>1</sup>*Department of Marine Sciences, University of Puerto Rico, Mayagüez, Puerto Rico 00681, USA. D\_Ballantine@rumac.uprm.edu.*, <sup>2</sup>*Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, Michigan 48109, USA*

Although the marine algal flora of Puerto Rico is the best known of all Caribbean islands, offshore and in-shore collections continue to yield new species and new records. Recent collecting along the south and west coasts has led to the recognition of seven additional species for the flora. Collections were made with the use of SCUBA or by snorkeling. Specimens of all species have been deposited in the Herbarium of the Department of Marine Sciences, University of Puerto Rico (MSM), and duplicates are deposited in the Algal Collection of the U.S. National Herbarium, Smithsonian Institution (US). Herbarium abbreviations follow Holmgren et al. (1990) and authority abbreviations follow Brummitt and Powell (1992).

### LIST OF TAXA

#### Rhodogorgonales, Rhodogorgonaceae

*Rhodogorgon ramosissima* J.N.Norris & Bucher (Figs. 1, 2)

Specimens examined: *DLB 5570*, El Negro Reef (Joyuda, Mayagüez), 3.0 m, Coll. Héctor Ruiz, 16.vi.2001; *DLB 5573*, Punta Arenas (Joyuda, Mayagüez), 1.0 m, Coll. H.R., 29.vi.2001; *DLB 5599*, *ibid.*, 14.x.2001; *DLB 5588*, Turrumote Reef, 14 m, Coll. H.R., 28.ix.2001.

This species is never abundant and has been found sporadically at a number of Caribbean islands (Norris and Bucher, 1989; Ogden, 1992), Florida (Ballantine, 1996) and Veracruz, Mexico (Lehman and Tunnell, 1992). The species has also been reported from the western Pacific in the Philippines (Ogden, 1992) and Papua New Guinea (Coppejans and Millar, 2000). Nevertheless, the Punta Arenas collection yielded 10 specimens on a single rock. Branching of Puerto Rican plants exhibit substantial variation, ranging from opposite to secund and being tight and compact to loose and sparse. Based mainly on branching variability, Ogden (1992) treated the two species initially recognized by Norris and Bucher (1989) as a single entity, *R. ramosissima*.

#### Cryptonemiales, Halymeniaceae

*Halymenia duchassaingii* (J.Agardh) Kylin (Fig. 3)

Specimens examined: *DLB 5523*, tetrasporophytic; Crash Boat Beach, Aguadilla, 6 m; Coll. H.R., 4.ii.2001.

This species, originally described as *Meristotheca duchassaingii* J.Agardh (1872), based on specimens from Guadeloupe, French West Indies, is also known from Brazil in the western Atlantic (Joly et al., 1965). The species has been reported also from the eastern Atlantic (Gabon, western Africa- John and Lawson, 1974) and from the Indian Ocean (Islam and Aziz, 1983). *Halymenia duchassaingii* is easily recognizable by its erose dentate margin and prominent papillate surface. The Puerto Rican specimens contain colorless medullary cells that measure from 8-11  $\mu\text{m}$  diam., with local swellings to 35  $\mu\text{m}$ . Large stellate ganglia to 55  $\mu\text{m}$  are common in the medulla. Crucially divided tetrasporangia are abundantly produced in the cortex and measure to 18  $\mu\text{m}$  in width and to 28  $\mu\text{m}$  in length.

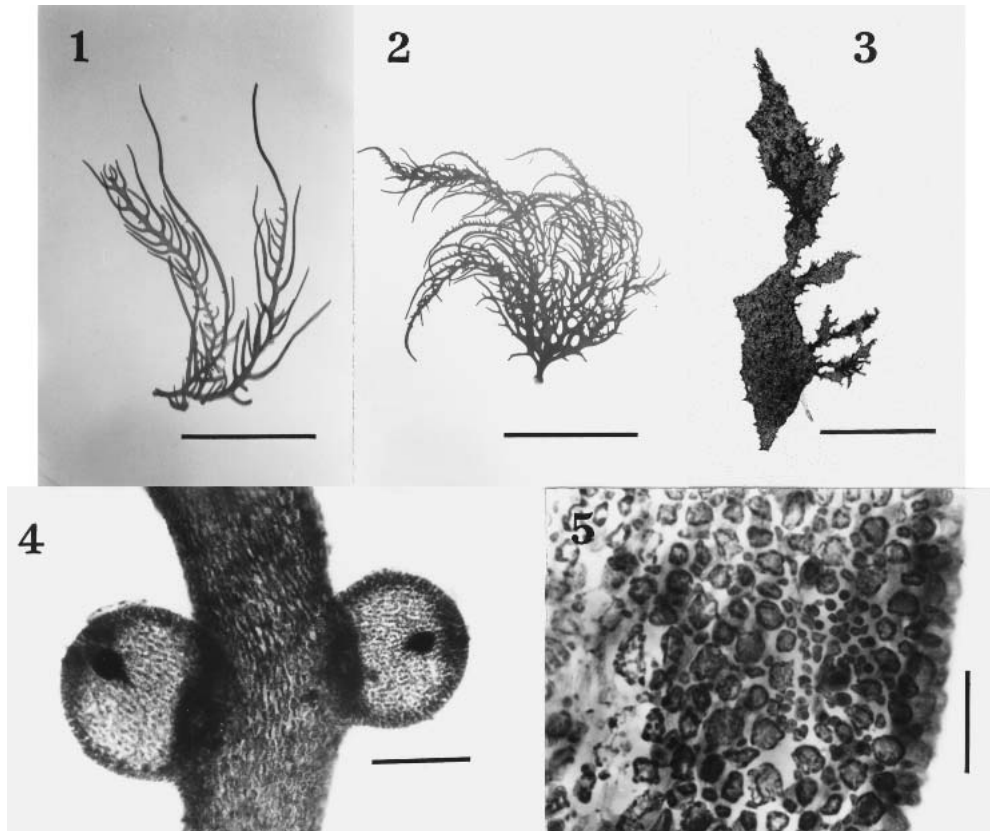
#### Rhodymeniales, Lomentariaceae

*Lomentaria rawitscheri* A.B.Joly (Figs. 4, 5)

Specimens examined: *DLB 1659*, tetrasporophytic, Caracoles Reef, La Parguera (fore reef), epiphytic on *Amphiroa*, 1.5 m, Coll. David L. Ballantine, 21.xi.1984; *DLB 5253*, gametophytic, Mario Reef, La Parguera (fore reef), epiphytic on *Amphiroa*, 1.5 m, Coll. Iván López and Deborah Parrilla, 9.xii.1997; *DLB 5362*, tetrasporophytic, Enrique Reef, Reef, La Parguera (reef flat), epiphytic on *Amphiroa*, 1.0 m, Coll. DLB, 29.ix.1999.

This species was originally described from Brazil (Joly, 1957) and had previously been collected only from the Netherlands Antilles in the Caribbean (Vroman, 1968). It has been characterized as growing in tufts from creeping thalli that produce whorled branchlets which commonly anastomose. The original description was based on tetrasporophytic material and plants were epiphytic on articulated coralline algae. All Puerto Rican plants were growing epiphytically over *Amphiroa rigida* J.V.Lamour. var. *antillana* Borgesen. Prostrate axes, measure to 400  $\mu\text{m}$  diam., are attached to the substratum by adventitious holdfasts which give rise to short simple branchlets. Branch tips occasionally produce rhizoids. Branchlets containing tetrasporangia are inflated to 700  $\mu\text{m}$  and tetrasporangia measure 45-56  $\mu\text{m}$  diam. Algae are monoecious, with male sori occurring in irregular patches (Fig. 4). Pericarps are almost spherical, not ostiolate (Fig. 5), and measure to 600  $\mu\text{m}$  diam. Sazima (1979) reported in detail on female gametophyte reproductive structures in this species and indicated that mature pericarps are nearly spherical; the pericarps measured by Sazima were slightly larger than the ones reported here.

Puerto Rican specimens compare well with Joly's original description. The morphologically similar *Lomentaria corallicola* Borgesen (1939) has been reported from Brazil (Yoneshigue, 1985) and Colombia (Bula-Meyer and Norris, 2001) in the western Atlantic. *Lomentaria rawitscheri* does not reach the 7 mm height or the 750  $\mu\text{m}$  diam. reported for *L. corallicola* by Norris (1987), who further illustrated an elongate cystocarp with a defined carpostome. Although Yoneshigue (1985) also indicated differences between the two species, Bula-Meyer and Norris considered them conspecific (although they did not discuss cystocarpic speci-



FIGS. 1-2. *Rhodogorgon ramosissima*. Scale bar = 5.0 cm. 1. Habit of DLB 5570]. 2. Habit of DLB 5599.  
 FIG. 3. *Halymenia duchassaingii*, habit [DLB 5523], scale bar = 5.0 cm.  
 FIGS. 4-5. *Lomentaria rawitscheri* [DLB 5253]. 4. Portion of axis bearing two nearly spherical cystocarps, scale bar = 250  $\mu\text{m}$ . 5. Surface of branch bearing spermatangia, scale bar = 50  $\mu\text{m}$ .

mens of *L. rawitscheri*). Our observations on cystocarp differences (in agreement with Sazima) argue for maintaining the two species as separate. The inconspicuous nature of *L. rawitscheri* in forereef habitats suggests that the species is more common than records indicate.

#### Ceramiales, Ceramiaceae

*Crouanophycus latiaxis* (I.A.Abbott) Athanas. (Figs. 6, 7)

Specimens examined: DLB 1401, Desecheo Island, on sponge *Verongia*, 18 m, 18.x.1980; DLB 5306, 1.5 km seaward Media Luna Reef, La Parguera, epiphytic, 17 m, 15.xii.1998.

Puerto Rican plants agree fully with the features of the genus *Crouaniella*, as described by Athanasiadis (1996). Recognizing that this generic name had been used, Athanasiadis (1998) proposed the new name *Crouanophycus*. Features of the genus include 3 whorl branchlets per axial cell which overtop the apices of indeterminate branches, secondary indeterminate branches formed as fourth whorl branches, rhizoids

cut off from axial cells and periaxial cells, and lack of gland cells. In the Puerto Rican specimens, the determinate laterals reach only the level of apices (as also figured in Athanasiadis [1996, Fig. 106 A]). The Puerto Rican specimen possesses axes to 22.5  $\mu\text{m}$  diam. and to 140  $\mu\text{m}$  long. Prostrate basal axes measure to 75  $\mu\text{m}$  diam. and to 325  $\mu\text{m}$  long. Puerto Rican plants examined were not reproductive.

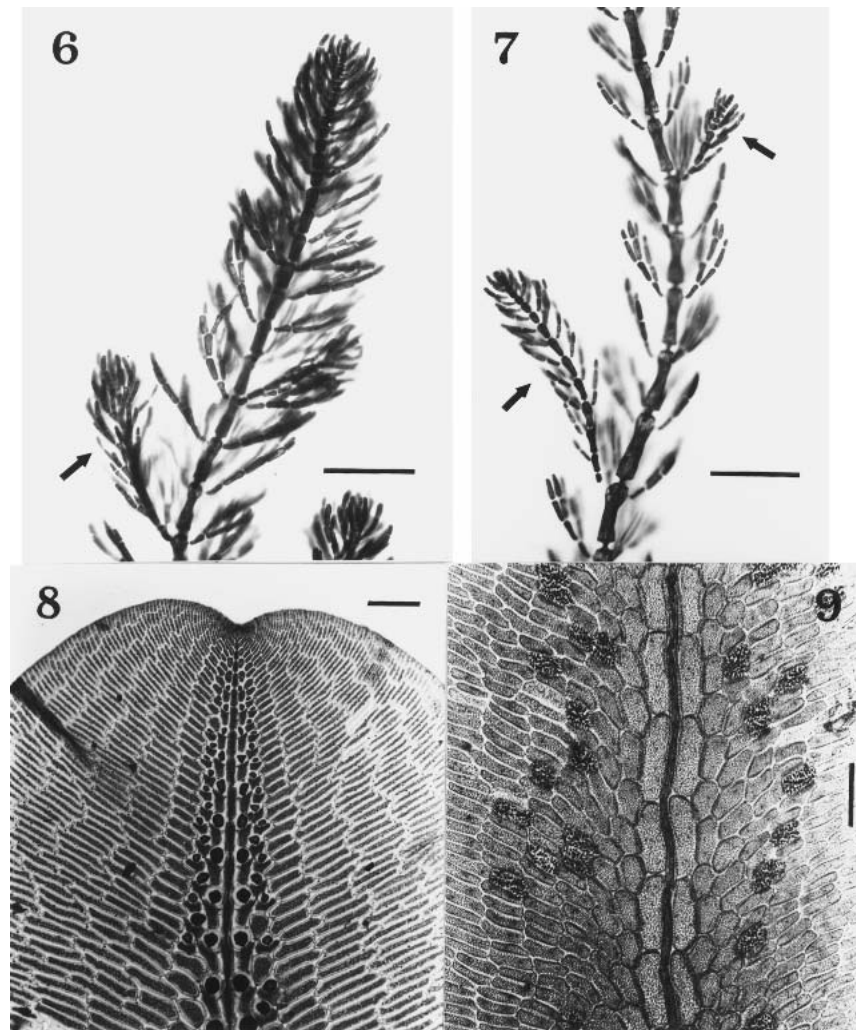
The species is also known from St. Croix, U.S. Virgin Islands (Abbott, 1979), from Martinique and Nevis in the Lesser Antilles (Bucher and Norris, 1995), and from Belize, western Caribbean (specimen in MSM, [DLB 495, Southwest Cay, Glovers Reef, on sponge *Verongia*, 18 m, 30.vi.1979]).

#### Delesseriaceae

*Hypoglossum subsimplex* M.J.Wynne (Figs. 8, 9)

Specimens examined: DLB 5255, Leeward of Guayacán Island, La Parguera, epiphytic on *Halimeda incrasata* (J.Ellis) J.V.Lamour., 1.0 m, 16.xii.1997

Puerto Rican plants possess numerous blades devel-



FIGS. 6-7. *Crouanophycus latiaxis* [DLB 5306]. Scale bar = 100  $\mu\text{m}$ . 6. Branch apex showing whorled determinate branchlets and indeterminate branches (arrow). 7. Portion of indeterminate axis showing whorled determinate branchlets and indeterminate branches (arrows).

FIGS. 8-9. *Hypoglossum subsimplex* [DLB 5255]. Scale bar = 100  $\mu\text{m}$ . 8. Apex of tetrasporangial blade. 9. Blade of male plant showing scattered spermatangial sori on both sides of the midline.

opening from a single enlarged holdfast. Blades measure to 9.5 mm long and to 1.3 mm wide. The limited branching occurs from the midrib. Tetrasporangial sori are elongate (Fig. 8) and narrow, with tetrasporangia cut off from pericentral cells and blade cells adjacent to the pericentral cells. The tetrahedrally divided tetrasporangia reach 65  $\mu\text{m}$  diam. Spermatangia are produced in discrete sori scattered on the blade (Fig. 9).

This species was described from collections made in the Florida Keys, where it was also an epiphyte of *Halimeda* (Wynne, 1994). The species has also been reported from the Colombian Caribbean (Bula-Meyer and Díaz-Pulido, 1995), Bermuda (Schneider, 2000),

and in the Pacific from Papua New Guinea (Millar et al., 1999). The Puerto Rican plants are slightly larger than those from Florida (9.5 mm in height vs. 6.0 mm and 1.3 mm in width vs. 1.0 mm) but otherwise agree with Wynne's description.

#### Rhodomelaceae

*Herposiphonia pecten-veneris* (Harv.) Falkenb.

Specimens examined: *D.L.B.* 5305, Leeward Media Luna Reef, La Parguera, 1.0 m, Coll. *D.L.B.*, 8.xii.1998; *D.L.B.* 5308, *ibid.*, 15.xii.1998; *D.L.B.* 5403, *ibid.*, 13.iv.1999.

This species was listed by Taylor (1960) as being known from Florida, the Bahamas, Caicos Islands, and Jamaica. Bula-Meyer and Schnetter (1988) subsequently reported it from Colombia. The Puerto Rican plants have prostrate axes with 8-9 pericentral cells and measure to 180  $\mu\text{m}$  diam. Erect branches possess 7 to 8 pericentral cells and measure to 56  $\mu\text{m}$  diam. The erect determinate branches are 11-13 segments in length. The Puerto Rican plant has characters shared by Taylor's characterizations of the species and of var. *laxa* W.R.Taylor (1960), thus questioning the taxonomic merit of the variety.

*Wrightiella blodgettii* (Harv.) F.Schmitz

Specimens examined: D.L.B. 5384, 1.5 km seaward Media Luna Reef, 1.0 m. Coll. D.L.B. 15.xii.1998.; D.L.B. 5384, *ibid.*, 5.ii.2000.

*Wrightiella tumanowiczi* (Gatty ex Harv.) F.Schmitz was reported from Puerto Rico by Almodóvar and Blomquist (1965) and this species name has since been applied uncritically to all Puerto Rican specimens of the genus (Almodóvar and Ballantine, 1983; Ballantine and Aponte, 1997). Examination of recent collections of *W. tumanowiczi* and *W. blodgettii* growing sympatrically in an offshore algal plain indicate that some plants previously assigned to the former species belonged to the latter; hence, both *Wrightiella tumanowiczi* and *W. blodgettii* occur in Puerto Rico.

Several authors have suggested that *Wrightiella tumanowiczi* and *W. blodgettii* are not distinct taxa (Schmitz, 1893; Børgesen, 1919; Schneider, 1975). Taylor (1960) indicated that *W. tumanowiczi* could be distinguished from *W. blodgettii* by having 4 rows of simple spur branchlets while *W. tumanowiczi* has few spur branchlets. Littler and Littler (2000: 234) also treated the two species separately, characterizing *W. blodgettii* as having a "stiff" thallus and *W. tumanowiczi* as being "generally lax." The Puerto Rican specimens are clearly separable on the basis of their spur branchlet arrangement and degree of thallus rigidity. Since both species occur in the same habitat, we conclude that the differences are genetically based and not due to environmental influence. The species is also known from the U.S. Virgin Islands (Børgesen, 1919), Bermuda, Florida, the Bahamas, Guadeloupe (Taylor, 1960), and Mexico (Pedrini (1984).

#### LITERATURE CITED

- Abbott, I. A. 1979. Some tropical species related to *Antithamnion* (Rhodophyta), Ceramiaceae. *Phycologia* 18: 213-149.
- Agardh, J. G. 1872. Bidrag till Florideernes Systematik. *Lunds Univ. Årsskr.* 8(6): 1-60.
- Almodóvar, L. R. and D. L. Ballantine. 1983. Checklist of benthic marine algae plus additional species records from Puerto Rico. *Carib. J. Sci.* 19: 7-20.
- Almodóvar, L. R. and H. L. Blomquist. 1965. Some marine algae new to Puerto Rico. *Nova Hedwigia* 9: 65-69.
- Athanasiadis, A. 1996. Morphology and classification of the Ceramioideae (Rhodophyta) based on phylogenetic principles. *Opera Botanica* 128: 5-216.
- Athanasiadis, A. 1998. *Crouanophycus* Athanasiadis, nom. nov. [= *Crouaniella* Athanasiadis 1996, nom illeg.] a new genus of the Crouanieae (Ceramiaceae, Rhodophyta). *Nova Hedwigia* 67: 517-518.
- Ballantine, D. L. 1996. New benthic marine algal species records from Florida. *Gulf of Mexico Sci.* 1: 11-15.
- Ballantine, D. L. and N. E. Aponte. 1997. A revised checklist of the benthic marine algae known to Puerto Rico. *Carib. J. Sci.*, 33: 150-179.
- Børgesen, F. 1919. The marine algae of the Danish West Indies. Part III. Rhodophyceae (5). *Dansk Botanisk Arkiv* 3: 305-368.
- Børgesen, F. 1939. Marine algae from the Iranian Gulf especially from the innermost part near Bushire and the Island Kharg. *Danish Scient. Invest. Iran, Part 1*, pp. 47-141, Copenhagen.
- Brummitt, R. K. and C. E. Powell (eds.). 1992. *Authors of Plant Names*. Royal Botanic Gardens, Kew. 732 pp.
- Bucher, K. E. and J. N. Norris. 1995. Marine algae new to the Lesser Antilles, including *Mazoyerella kraftii* sp. nov. (Ceramiaceae, Rhodophyta). *Carib. J. Sci.* 31: 1-24.
- Bula-Meyer, G. and G. Diaz-Pulido. 1995. Macroalgas del banco de las Ainmas y nuevos registros del Caribe Colombiano. *Anales Inst. Invest. Mar. Punta de Betín* 22: 21-29.
- Bula-Meyer, G. and J. N. Norris. 2001. Notes on new records of red algae from the Colombian Caribbean. *Bot. Mar.* 44: 351-360.
- Bula-Meyer, G. and R. Schnetter. 1988. Las macroalgas recolectadas durante la Expedición Uraba II, costa Caribe del noroeste Chocoano, Colombia. *Bol. Ecotrop.* 18: 19-32.
- Coppejans, E. and A. J. K. Millar. 2000. Marine red algae from the north coast of Papua New Guinea. *Bot. Mar.* 43: 315-346.
- Holmgren, P. K., N. H. Holmgren and L.C. Barnett. 1990. *Index Herbariorum*. Part I: The Herbaria of the World. 8th edn. New York Botanical Garden, Bronx, New York. x + 693 pp. [*Regnum Vegetabile* vol. 120].
- Islam, A. K. M. N. and A. Aziz. 1983. Addition to the list of marine algae of S. Martin's Island, Bangladesh. II. Brown, red and blue-green algae. *Nova Hedwigia* 356: 643-657.
- John, D. M. and G. W. Lawson. 1974. Observations on the marine algal ecology of Gabon. *Bot. Mar.* 17: 249-254.
- Joly, A. B. 1957. Contribuição ao conhecimento da flora ficológica marinha de Baía de Santos e arredores. *Bolm. Fac. Fil. Ciênc. Letras, Univ. São Paulo, Brasil* 217, *Botanica* 14: 1-196.
- Joly, A. B. et al. 1965. Additions to the marine flora of Brazil V. *Arq. Est. Biol. Mar. Univ. Ceará* 5: 65-78.
- Lehman, R. L. and J. W. Tunnell, Jr. 1992. Species composition and ecology of the macroalgae off Enmedio Reef, Veracruz, Mexico. *Texas J. Sci.* 44: 445-457.

