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## New Records of Marine Rhodophyta from the Pacific Coast of Mexico

Raúl Aguilar-Rosas<sup>1\*</sup>, Luis E. Aguilar-Rosas<sup>2</sup>, Luz Elena Mateo-Cid<sup>3</sup> and  
Catalina Mendoza-González<sup>3</sup>

<sup>1</sup>Facultad de Ciencias Marinas, Universidad Autónoma de Baja California, km 107 Carretera Tijuana Ensenada,  
Ensenada, Baja California. C.P. 22830, México

<sup>2</sup>Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, km 107 Carretera Tijuana Ensenada,  
Ensenada, Baja California. C.P. 22830, México

<sup>3</sup>Departamento de Botánica, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional,  
Prolongación Carpio y Plan de Ayala, D.F. 11340, México

Two species of marine red algae, *Jania unguolata* (Yendo) Yendo f. *brevior* (Yendo) Yendo and *Peyssonnelia japonica* (Segawa) Yoneshigue (Rhodophyta) were collected for the first time from Mexican Pacific coast. Their vegetative and reproductive structures are described, as well as the habitat where they were found and their geographical distribution along the Pacific coasts of Mexico. *Jania unguolata* f. *brevior* is a commonly growing epiphytic and *Peyssonnelia japonica* is epiphyte. The fact that we found this new records in Mexican coast is noteworthy, due that this species are originally described in Japanese coast. The absence of records of this species in the Mexican coast is likely related in part to the lack of specific collections and the fact that the specimens are small and delicate, and may commonly be unnoticed during samplings.

**Key Words:** *Jania unguolata* f. *brevior*, Pacific Mexico, *Peyssonnelia japonica*, Rhodophyta

### INTRODUCTION

The number of species of marine algae registered for the Mexican Pacific coast is 1108 (Pedroche and Senties 2003a). In particular the western coast of the Peninsula of Baja California, is one of the most studied and the one than it shows the greater number of species (742 taxa), in comparison with the region of the Gulf of California with 669 and the Mexican Tropical Pacific with 444 species (Pedroche and Senties 2003b). However, the knowledge of marine algae in the Mexican Pacific has been increased in recent years, with the records and descriptions of new species (Broom *et al.* 2002; Pedroche and Senties 2003; Aguilar-Rosas *et al.* 2004; Aguilar-Rosas *et al.* 2005; Mateo-Cid *et al.* 2005). The marine floral inventory is still incomplete and more complete surveys are still needed in understudies and more remote locations.

This study provides the first record of two species from the Mexican Pacific coast including the states of Baja California Sur, Sonora, Jalisco, Colima, Guerrero

and Oaxaca. The species are *Jania unguolata* (Yendo) Yendo f. *brevior* (Yendo) Yendo and *Peyssonnelia japonica* (Segawa) Yoneshigue (Rhodophyta). These records are based on collections conducted between 1970 and 1998. The vegetative and the reproductive structures of these species have been studied.

### MATERIALS AND METHODS

Thallus were collected from the intertidal zone in several locations along the Mexican Pacific coast that include the states of Baja California Sur, Sonora, Colima, Guerrero and Oaxaca, during 1970-1998 (Fig. 1). Collections were fixed with 4% formalin seawater solution in the field. Preserved specimens were sectioned and stained with blue aniline for anatomical examination using light microscopy. The specimens were decalcified with 0.6M HNO<sub>3</sub> and dehydrated with ethyl alcohol. Small segments were embedded in paraffin, cut into sections 9-10  $\mu$ m thick with a manual microtome, fixed on slides with Ruyter's adhesive (Martoja and Martoja-Pierson, 1970), and stained with blue aniline and hematoxylin-eosine. Observation and photomicrography were

\*Corresponding author (raguilar@uabc.mx)



**Fig. 1.** Map showing the study area and collections sites. 1) Punta Conejo; 2) Puerto Peñasco; 3) El Corral; 4) Playa La Audiencia; 5) Playa Las Gatas; 6) Playa Santa Elena.

conducted using a digital camera (Sony DSC-S85, Tokyo, Japan) connected to a Zeiss microscope (Axioscop 40, Goettingen, Germany). The figures were edited using Adobe® Photoshop® 7.0 (Adobe Systems Inc., San Jose, USA). Specimens examined were deposited in the herbarium (ENCB) of the National School of Biological Sciences of the Instituto Politécnico Nacional and the Herbarium (CMMEX) of the Faculty of Marine Sciences of the Universidad Autónoma de Baja California (Holmgren *et al.* 1990). For descriptive terminology we followed Segawa (1941), Denizot (1968), and Moura and Yamaguishi-Tomita (1998).

## RESULTS AND DISCUSSION

### *Jania ungulata* (Yendo) Yendo f. *brevior* (Yendo) Yendo 1905: 38

(Fig. 2)

Basionym: *Corallina ungulata* Yendo f. *brevior* Yendo (1902: 27)

Type locality: Boshu Province, Chiba, Japan.

Distribution: Indian Ocean (Kenya, India, Tanzania, Seychelles Archipelago and Mauricio Islands) (Silva *et al.* 1996). Atlantic Ocean (Brazil) (Moura and Yamaguishi-Tomita 1998). Pacific Ocean (Colombia and Galapagos islands). Asia (China, Japan, Korea, Philippines and Vietnam) (Silva, Basson and Moe 1996, Lee and Kang 2001, Sahoo *et al.* 2001) and Pacific coast of Mexico (present study).

Specimens examined: Baja California Sur. Punta Conejo, 5.XII.1992, L.E. Mateo-Cid and C. Mendoza-González (ENCB 14204); Jalisco. Playa El Corral,

24.V.1970, L. Huerta Múzquiz (ENCB 13064); Colima. Playa La Audiencia, Manzanillo, 27.VII.1988, L.E. Mateo-Cid and C. Mendoza-González (ENCB 14205); Guerrero. Playa Las Gatas, Bahía de Zihuatanejo, 8.XI.1996, C. Mendoza-González and L.E. Mateo-Cid (ENCB 15782). Oaxaca. Playa Santa Elena, 8.V.1998, L.E. Mateo-Cid and C. Mendoza-González (ENCB 17138).

Thallus were commonly growing epiphytes in *Padina* sp. in tidal pools on the rocky intertidal zone, having pinkish thalli, consisted of articulated erect, delicate fronds, to 1.2 cm tall (Fig. 2A), arising from diminutive, calcified semi-circular crustose bases. Fronds were dichotomously branched in a single plan, show the Y-patterns and with open branches at less than a 45° angle. Intergenica terete, with lower and middle branches and terminals bearing unguate apices, flattened. Tetrasporangial conceptacles were axial with a pore and ramulus of 2-4 terete intergenicula. Tetrasporangia are zonate, 80-110 µm long and 25-50 µm in diameter.

The genus *Jania* was established by Lamouroux (1812) and consists of about 70 species (Johansen and Womersley, 1994), characterized by an articulated thallus with dichotomous branching; filiform and slender intergenicula, cell filaments interconnected by cell fusions and the conceptacles axial and uniporate, carrying ramulus, except in the male (Johansen 1970; Johansen and Forest 1978).

There are 12 species of *Jania* reported from the Mexican Pacific coast (Dawson 1953). However, many of these have been reported in floristic lists or ecological publications and need to be analyzed in detail to distinguish different taxa. In the present study, *Jania ungulata* is registered for the first time to Mexico and recognized as a typical element of the tropical flora, as in other areas of the world (Silva *et al.* 1996; Moura and Yamaguishi-Tomita 1998; Sahoo *et al.* 2001).

The absence of records of *Jania ungulata* f. *brevior* along the Pacific coast of Mexico may be related in part to the lack of specific collections along the coast and in part to the difficulty in locating this species due to the small size of the thallus (Mendoza-González and Mateo-Cid 1992; Moura and Yamaguishi-Tomita 1998).

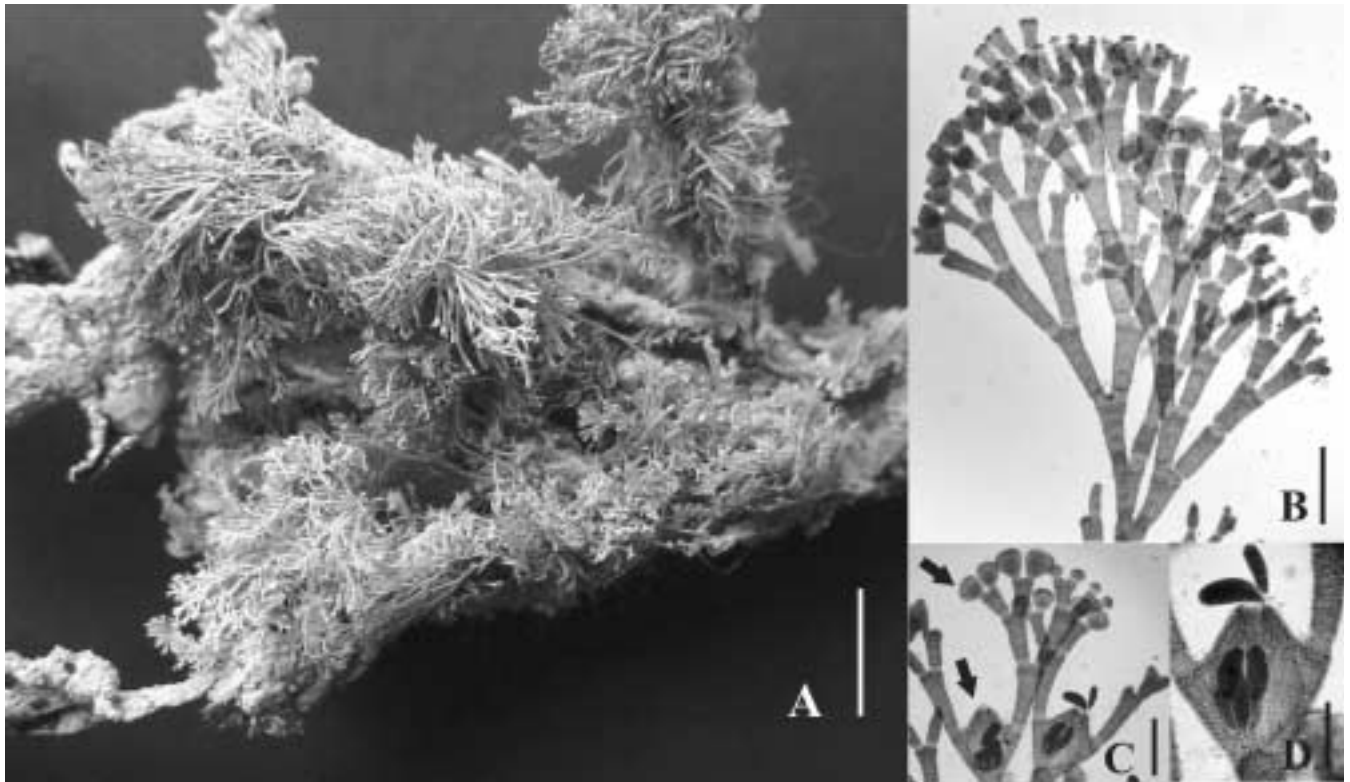
### *Peyssonnelia japonica* (Segawa) Yoneshigue 1984: 134

(Fig. 3)

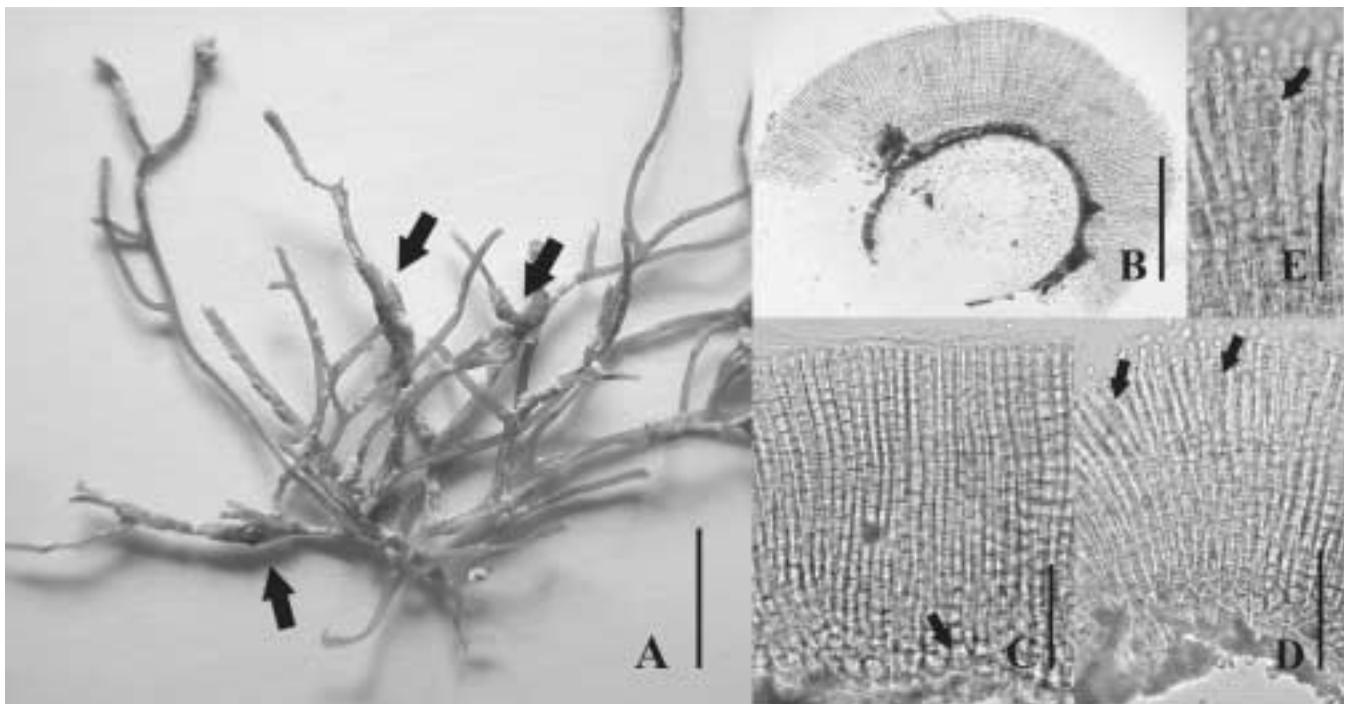
Basionym: *Cruoriopsis japonica* Segawa (1941: 259-260)

Synonym: *Cruoriella japonica* (Segawa) Denizot (1968: 147)

Type locality: Miyake-zima, Japan



**Fig. 2.** *Jania unguolata* (Yendo) Yendo f. *brevior* (Yendo) Yendo. A. Specimen collected on *Padina* sp. from Playa Santa Elena, Oaxaca (ENCB 17138). B. Detail of dichotomously branched. C. Detail of apical intergenicula and conceptacle (arrowheads). D. Detail of tetrasporangial conceptacle. (Scale: A, 1.0 cm; B, 450  $\mu$ m; C, 350  $\mu$ m; D, 150  $\mu$ m).



**Fig. 3.** *Peyssonnelia japonica* (Segawa) Yoneshigue. A. Specimen (arrowheads) growing on *Gelidiopsis variabilis* collected in Puerto Peñasco, Sonora (ENCB 17137). B. Vegetative crust in vertical section. C. Vertical section showing the basal layer (arrowheads). D. Cross-section of the frond showing ripe sporangia (arrowheads). E. Detail of tetrasporangial nemathecium. (Scale: A, 1.5 cm; B, 300  $\mu$ m; C, 70  $\mu$ m; D, 70  $\mu$ m; E, 40  $\mu$ m).

Distribution: Asia: Korea and Japan (Yoshida 1998, Lee and Kang 2001, Kato *et al.* 2006) and Pacific coast of Mexico (present study).

Specimens examined: Sonora. Puerto Peñasco, 10.III.1997, C. Mendoza-González, L.E. Mateo-Cid, L.E. Aguilar-Rosas and R. Aguilar-Rosas, tetrasporangia (ENCB 17137).

Thallus grew epiphytically on *Gelidiopsis variabilis* (J. Agardh) Schmitz in tidepools. Were pinkish, crustose, 180-220  $\mu\text{m}$  thick, attached completely to the lower surface, and sometimes developed small rhizoids. The basal layer was 2 cells of thick, with the lower cells 10-16  $\mu\text{m}$  wide and 16-20  $\mu\text{m}$  high and the upper cells smaller than the lower, with trapezoidal in longitudinal sections. Erect filaments arose from the upper cells of the basal layer, divided into a large number near the base that were rarely dichotomous above, and consisted of 10-16 cells. Cells in the filament were cubic or little elongated 6-8  $\mu\text{m}$  wide and 8-12  $\mu\text{m}$  high in the middle portion of the filaments. Tetrasporangia were cruciately divided, stalked, and oblong and 25-50  $\mu\text{m}$  long and 16-25  $\mu\text{m}$  in diameter. The stalk of the tetrasporangia was lateral on the erect filament, consisting of 1-5 cells.

The genus *Peyssonnelia* M.J. Decaisne (1841) consists of about 71 species (Guiry and Guiry 2007), and is characterized by thalli that are prostrate, crustose, and tightly adherent to loosely attached. A single basal layer of branched filaments (hypothallus) is composed of parallel or flabellate rows, and produces unicellular or multicellular rhizoids below. The hypothallus cuts off single cells that form erect filaments (perithallus). Tetrasporangia are cruciately divided and form in nemathecium with numerous paraphyses. Denizot (1968) considered the genera *Peyssonnelia* and *Cruoriella* to be distinct, with *Cruoriella* having easily separable erect filaments in a gelatinous matrix and *Peyssonnelia* having closely adjacent erect filaments in a firm matrix. However, in accordance with Yoneshigue (1984), Maggs (1990), and Womersley (1994), *Cruoriella* is considered not generically distinct from *Peyssonnelia*. The new combination of *Cruoriella japonica* to the genus *Peyssonnelia* (*P. japonica*) was proposal by Yoneshigue (1984).

*Peyssonnelia japonica* is known only from Japan (Segawa 1941) and Korea (Lee and Kang 2001). In the Mexico Pacific coast, 14 species of *Peyssonnelia*, were reported (Dawson 1953). In the present paper, *P. japonica* is registered for the first time for Mexico extending the geographical distribution of this species to the western coast of North America (Segawa 1941; Denizot 1968;

Yoneshigue 1984).

The vegetative and reproductive structures of our specimens, agree with the descriptions and illustrations of *P. japonica* by Segawa (1941) as *Cruoriopsis japonica* and by Denizot (1968) as *Cruoriella japonica*. This species differs from the other described species by the presence of rhizoids, by the basal layer composed of trapezoidal cells, by the erect filaments divided near the base consisting of many cells which are comparatively narrow, cubic or slightly extended, and the comparatively large tetrasporangia, located sideways on the erect filaments.

We looked other specimens of *Gelidiopsis* sp. deposited in the herbarium ENCB and CMMEX, unfortunately *Peyssonnelia japonica* was not present. The absence of records of *Peyssonnelia japonica* in the Mexican Pacific coast is likely related to the fact that these have been few studies in the region and the fact that the specimens are small and delicate, and may commonly be unnoticed during samplings (Aguilar-Rosas *et al.* 2000).

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