

Gelidiaceae (Rhodophyta) in Bahía de Banderas, Western Pacific, México

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Abstract

We present the results of a floristic study of intertidal species of Gelidiaceae collected in ten localities in the Bahía de Banderas region. The study area is within an extensive overlapping transitional zone between the tropical and subtropical regions of the Mexican Pacific coast. Species of the genera *Gelidium* and *Pterocladia* were found, *G. microdentatum* and *G. pusillum* being the most abundant and widely distributed in the Bay. The local and Mexican Pacific distribution for each species is given. The number of species found in this study is compared with the numbers reported in the literature for the Mexican Pacific.

Introduction

The Pacific coast of México, approximately 7475 km long, is divided into three areas: the Mexican Tropical Pacific (MTP), both coasts of the Gulf of California (GC) and the Pacific side of Baja California (PBC) areas which present distinctive physiographic, geological and climatic conditions which make possible the presence of a very diverse algal flora.

A total of 19 species is currently recognized in the genera *Gelidium* Lamouroux and *Pterocladia* J. Agardh (Gelidiaceae), for México, of which 14 are treated as species of *Gelidium* and 6 of *Pterocladia*. Ten species of *Gelidium* are found in the PBC and 5 and 4 species in the GC and MTP, respectively. The number of species of *Pterocladia* in each of the three areas is 2–4 species (González *et al.*, *in prep.*).

Four of the species of *Gelidium*, *G. coronadense*, *G. deciduum*, *G. johnstonii* and *G. microdentatum*, are known only from the Mexican coasts, and two, *G. nudifrons* and *G. robustum* were described

originally from Mexican localities. Both of the latter also occur on the Pacific coast of California, USA. In the present paper a floristic analysis is made of the family Gelidiaceae in Bahía de Banderas region, on the coast of the Mexican states of Jalisco-Nayarit. This area is within an extensive overlapping transitional zone, located between Manzanillo-Colima, Mazatlán-Sinaloa and Cabo San Lucas Baja California Sur (Hubbs & Roden, 1964). We compare the number and distribution of species reported for the entire Mexican Pacific coast with those found in this study.

Study area

Bahía de Banderas, also called Valle de Banderas, is a wide bay situated on the west coast of México on the Pacific Ocean between Punta Mita, Nayarit (20° 46' N and 105° 33' O) on the North and Cabo Corrientes, Jalisco (20° 24' N and 105° 43' O) on the South. It is 48 km across from east to west, and 30 km long from north to south

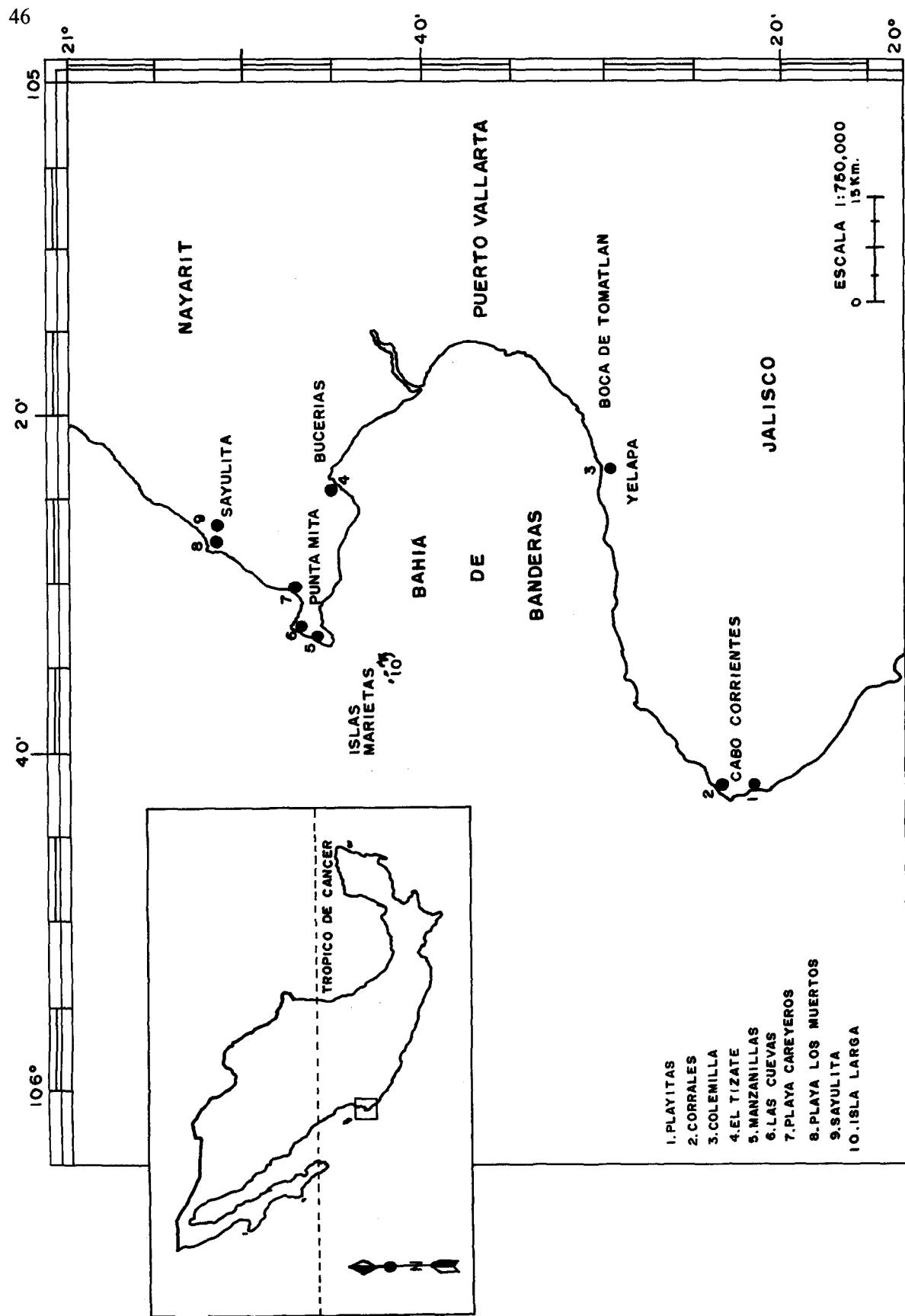


Fig. 1. Localities in Bahía de Banderas region.

(Fig. 1). The spurs of the Sierra del Cuale (a mountain range) constitute its southern limit which is high and abrupt interrupted in part by some valleys and flat sandy beaches into which several freshwater streams flow. The NE portion is low, flat and sandy; the mouth of the Ameca river is located here. The Northern portion is rocky because the spurs of the Sierra de Vallejo approach the coast. Since it opens to the W it is exposed to the winds that blow from the open ocean. It reaches a depth of up to 80 m. In its E most sheltered part is Puerto Vallarta. In front of the bay there is a group of islands, the Tres Marietas, aligned in a NE-SW direction as a submarine prolongation of Punta Mita. (Diccionario Porrúa, 1964; Secretaría de Marina, 1979 and Secretaría de Gobernación, 1988).

This region is influenced by the confluence of two important systems of currents, the California Current and the North Equatorial Current (Hubbs & Roden, 1964) which causes steep salinity and temperature gradients and a local seasonal pattern of circulation.

Ten collecting sites (Fig. 1) were selected along the intertidal rocky of the Bay, 1. Playitas, 2. Corrales, 3. Colemilla in Jalisco and 4. El Tizate, 5. Manzanillas, 6. Las Cuevas, 7. Playa Careyerros, 8. Playa Los Muertos, 9. Sayulita, 10. Isla Larga in Nayarit.

Sites 1, 2, 3, 5, 8, 9 consist of steep rugged rocks, mounds, or steep cliffs separated from the coast, more or less isolated from each other with portions that remain above water even at high tide.

Sites 6 and 10 are characterized by cliffs or continuous collision barriers, directly exposed to strong shock by the waves.

Sites 4 and 7 are in areas where rocky-sandy, submerged, shallow platforms are more or less exposed to the breaking waves.

Materials and methods

A total of 200 samples were collected from the rocky intertidal zone of Bahía de Banderas region during April 1986 and 1988 (dry season) and in October 1987 (rainy season) in all sites.

Plant were collected by hand, using scraping tools, hammer and chisel and preserved in a solution of 4% formaldehyde and sea-water.

Of the total of 200 samples, specimens of one or more species of Gelidiaceae were found in only 47; these were separated for systematic analysis. Whole mounts of specimens of each sample were made using 45% corn syrup (Karo Syrup, Corn Products, Inc.) solution in distilled water and containing a trace of phenol. Cross sections with a freezing microtome were also prepared from apical, basal and medium levels of the remaining specimens, stained with 1% aniline blue and mounted in 25% Karo syrup. These were analyzed under an optical microscope (Reichert Zepton 1).

Dawson (1953) and Taylor (1945) were used for taxonomic determinations, supplemented by Santelices & Stewart (1985), Stewart (1968, 1974, 1976, 1984) and Stewart & Norris (1981).

Table 1. Distribution of species of *Gelidium* and *Pterocladia* in the Bahía de Banderas region. 1 = Playitas, 2 = Corrales and 3 = Colemilla in Jalisco; 4 = El Tizate, 5 = Manzanillas, 6 = Las Cuevas, 7 = Playa Careyerros, 8 = Playa Los Muertos, 9 = Sayulita y 10 = Isla Larga in Nayarit. * = Presence, - Absence.

Species	Localities									
	1	2	3	4	5	6	7	8	9	10
<i>G. microdentatum</i> Dawson	*	*	*	-	*	*	-	*	*	*
<i>G. pusillum</i> (Stackhouse) Le Jollis	*	-	*	-	*	*	-	*	*	*
<i>G. sclerophyllum</i> Taylor	*	-	-	-	-	*	*	-	*	-
<i>P. caloglossoides</i> (Howe) Dawson	-	-	-	*	*	-	-	-	*	-
<i>P. capillacea</i> (Gmelin) Bornet & Thuret	-	-	*	-	-	*	-	*	*	-

Voucher material is deposited in the Science Faculty Herbarium (FCME), Universidad Nacional Autónoma de México, in the marine algae collection.

Results

Three species of *Gelidium* and two of *Pterocladia* were identified from the Bay (Table 1).

In Table 2 we present the distribution of species of *Gelidium* and *Pterocladia* that have previously been reported from the Mexican Pacific coasts for the MTP, GC, PBC and transition zone. In the later zone we also include the species reported in this paper.

Of the 20 species reported for the genera *Gelidium* and *Pterocladia* in the Mexican Pacific, Bahía de Banderas includes 5 species (25%). Analysis of separate genera, reveals that 21% of

the total (14) of species of *Gelidium* are found in the study area, and, in the case of *Pterocladia*, the percentage is 33%.

Discussion

The specimens of *Gelidium microdentatum*, *G. sclerophyllum*, *G. pusillum* and *Pterocladia caloglossoides* found in Bahía de Banderas closely resemble descriptions found in the literature (Dawson 1953, 1960; Taylor, 1945; Santelices & Stewart, 1985). *G. microdentatum* was first reported by Dawson (1960) who pointed out that the presence of small teeth at the border of the axes and branches is the distinctive feature of the species. This was verified in the specimens examined, particularly in the upper portions of the plants, producing a characteristic apex type 'J' (Rodríguez & Santelices, 1987).

Certain specimens similar to descriptions of

Table 2. Distribution and synonyms of the species of *Gelidium* and *Pterocladia* in the Mexican Pacific areas.

Pacific of Baja Calif.	Gulf of Calif.	Mexican Tropical Pacific
<i>G. californicum</i> J. Agardh	<i>G. coronadense</i> Dawson	<i>G. crinale</i> (Turner) Lamouroux
<i>G. cartilagineum</i> J. Agardh	<i>G. crinale</i> (Turner) Lamouroux	<i>G. galapagense</i> Taylor
<i>G. coronadense</i> Dawson	<i>G. deciduum</i> Dawson	<i>G. pusillum</i> (Stackhouse) Le Jollis
<i>G. coulteri</i> Harvey	<i>G. johnstonii</i> Setchell & Gardner	<i>G. sclerophyllum</i> Taylor
<i>G. crinale</i> (Turner) Lamouroux	<i>G. pusillum</i> (Stackhouse) Le Jolis	<i>P. bulbosa</i> Loomis
<i>G. deciduum</i> Dawson	<i>P. caloglossoides</i> (Howe) Dawson	<i>P. musciformis</i> Taylor
<i>G. johnstonii</i> Setchell & Gardner	<i>P. capillacea</i> (Gmelin) Bornet & Thuret	
<i>G. nudifrons</i> Gardner	<i>P. mcabbiana</i> Dawson	
<i>G. purpuracens</i> Gardner	<i>P. media</i> Dawson	
<i>G. pusillum</i> (Stackhouse) Le Jolis		Transitional Zone
<i>G. robustum</i> (Gardner) Hollenberg & Abbott		<i>G. microdentatum</i> Dawson
<i>P. caloglossoides</i> (Howe) Dawson		<i>G. pusillum</i> (Stackhouse) Le Jolis
<i>P. capillacea</i> (Gmelin) Bornet & Thuret		<i>G. sclerophyllum</i> Taylor
<i>P. media</i> Dawson		<i>P. caloglossoides</i> (Howe) Dawson
		<i>P. capillacea</i> (Gmelin) Bornet & Thuret

Synonyms:

G. purpurascens as *G. densum* Gardner, *G. papenfussii* Loomis, *G. polystichum* Gardner, *G. pulchrum* Gardner.

G. pusillum as *G. microphysa* Setchell & Gardner.

G. robustum as *G. cartilagineum* J. Agardh, *G. cartilagineum* J. Agardh var. *robustum* Gardner.

P. caloglossoides as *P. parva* Dawson.

P. capillacea as *P. complanata* Loomis, *P. mexicana* Taylor, *P. okamurai* (Setchell & Gardner) Taylor, *P. pyramidale* (Gardner) Dawson, *G. decompositum* Setchell & Gardner, *G. okamurai* Setchell & Gardner, *G. sonorensis* Dawson.

P. media as *G. crinale* (Turner) Lamouroux var. *luxurians* Collins, *G. sinicola* Gardner.

Note: One of the species for the PBC has been reported by only one author: *Gelidium californicum* by Huerta (1978).

Gelidium decompositum and *G. sonorensis* in Dawson (1953), were treated as *Pterocladia capillacea* following the suggestion of Stewart & Norris (1981).

The specimens assigned to *Gelidium microdentatum* and to *Pterocladia capillacea* presented a wide range of variation in their external morphology, with overlapping of morphs between the two species. *Gelidium microdentatum* was distinguished only by teeth being restricted to the margins of the axes near apices.

The number of species found per site is related to environmental heterogeneity. For example, Sayulita (Site 9), where the 5 species were found, is a site with a great diversity of environments provided by cliffs, channeled currents and tidal pools. At Tizate (Site 4), where there was only *Pterocladia caloglossoides*, there is a homogeneous rocky platform, with conditions similar to a large tidal pool.

Finally, the distribution of the species found in the study area (Fig. 2), with the exception of *Ge-*

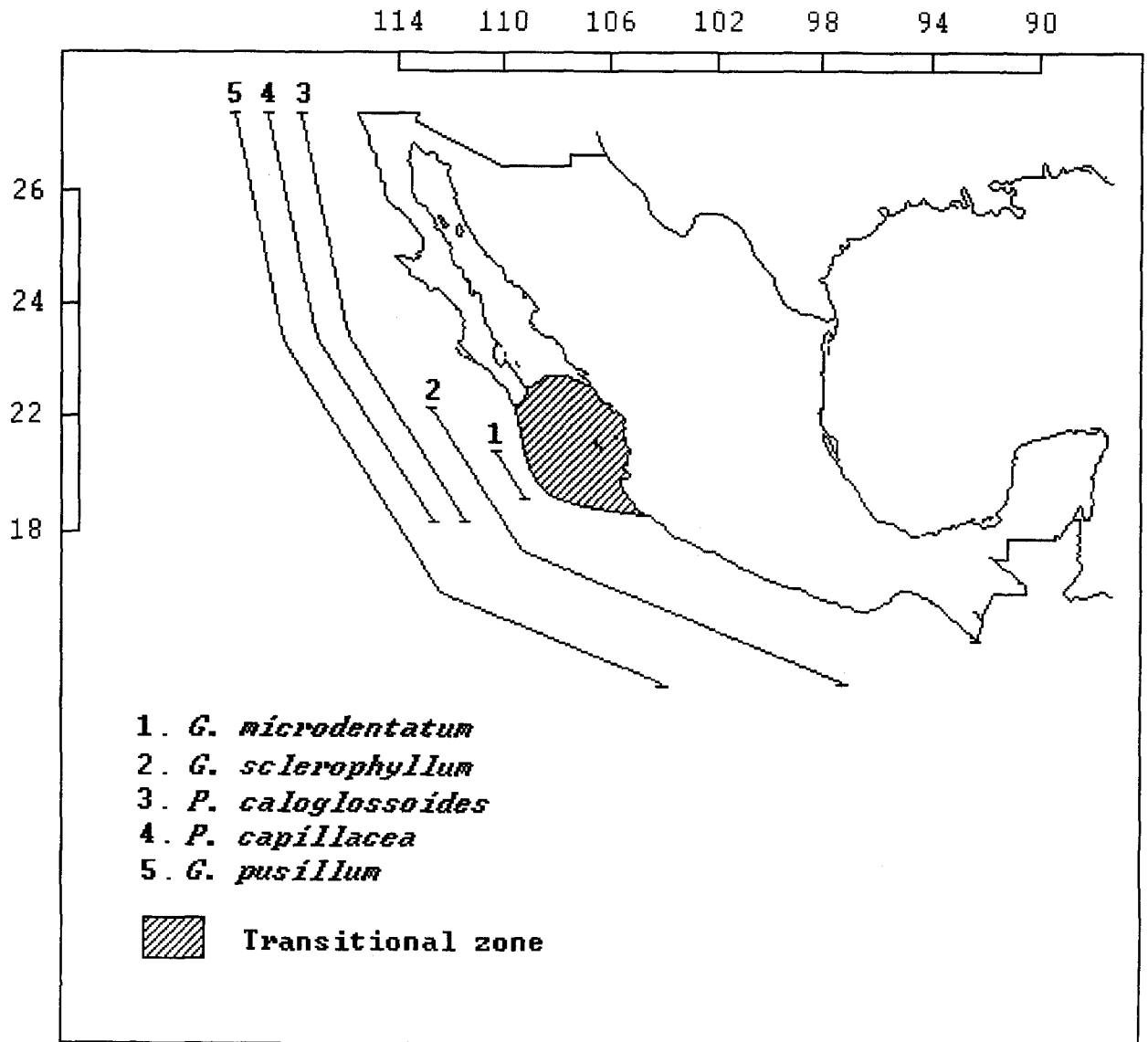


Fig. 2. Distribution of species of *Gelidium* and *Pterocladia* found in Bahía de Banderas region.

lidium pusillum which is widely distributed, supports the statement by Hubbs & Roden (1964) that this is a zone of transition and mixture of biotas given the coexistence of tropical elements such as *G. sclerophyllum* and subtropical ones such as *Pterocladia capillacea* and *P. caloglossoides*. The presence of an endemic species *G. microdentatum* which is found in a variety of ecological conditions in the Bahía de Banderas region, but has only been reported for this zone of transition, points in the same direction.

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