

Occurrence and Distribution of the Genus *Jania* J. V. Lamouroux (Corallinales, Rhodophyta) in the Pacific Coast of Baja California and Gulf of California, Mexico

Luz Elena Mateo-Cid¹, A. Catalina Mendoza-González¹, Luis E. Aguilar-Rosas², Raúl Aguilar-Rosas³

¹Instituto Politécnico Nacional, Escuela Nacional de Ciencias Biológicas, Departamento de Botánica, Ciudad de México, México;

²Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Ensenada, Baja California, México;

³Facultad de Ciencias Marinas, Universidad Autónoma de Baja California, Ensenada, Baja California, México.

Email: lmateoc@ipn.mx

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ABSTRACT

This paper provides a description of the articulated species of the Tribe Janieae (Corallinales, Rhodophyta) in the Pacific coast of Baja California and Gulf of California, Mexico. This taxonomic report is based on newly collected data in the study area and material currently housed at several herbaria. As a result of the present study, the record of the tribe Janieae is represented at the Pacific coast of Mexico for one genus: *Jania* J. V. Lamouroux with nine species. Morphological, reproductive and anatomical descriptions are provided in detail. In addition, keys for determination are included, as well as habitat, nomenclature, comparisons with other species and information on distribution. Instead of eleven species of *Jania* currently recorded for the study area, we recognize only nine. *Jania verrucosa* is restricted to the occidental coast from the Peninsula of Baja California. The remainder of the species commonly occurs in the Gulf of California and the Pacific coast of Baja California's Peninsula. On the other hand, the gametangial thalli of *J. adhaerens* and tetrasporangial conceptacle in *J. longiarthra* are reported for the first time in Mexico.

Keywords: Janieae; Morphology; Distribution; Pacific; Mexico

1. Introduction

All members of the subfamily Corallinoideae (J. E. Areschoug) Foslie are constructed of uncalcified genicula and calcified intergenicula and form branched fronds. The Tribe Corallineae J. E. Areschoug is characterized by genicula consisting of a single uncorticated and uncalcified tier of medullar cells and lateral cellular fusion. The genera of the Corallinoideae are referred to two tribes: the Corallineae and the Janieae, which are delimited on the basis of morphological and reproductive features [1,2]. The Janieae is distinguished from the Corallineae by reproductive characteristics, such as thick, compact carposporophytic fusion cells bearing marginal carposporangial filaments, male conceptacles with narrow chambers and short canals, and a comparatively small number of sporangia in each tetrasporangial conceptacle [3]. The tribe Janieae includes one genus: *Jania* J. V. Lamouroux. The genus *Jania* is an important component of the marine benthic flora in the Gulf of California. How-

ever, in spite of their abundance, representatives of this genus have received little attention. The aim of this paper is to provide morphological, anatomical and reproductive accounts of this genus. Distinctive field characters as well as pertinent photographs are provided for each species.

2. Materials and Methods

Specimens of *Jania* were borrowed from ENCB (National School of Biological Sciences) of the Department of Botany, National School at Biological Sciences, Mexico, D. F.); CMMEX (School of Marine Sciences) of the Faculty of Marine Sciences, University of Baja California, Ensenada, Baja California); UC (University of California) University and Jepson Herbaria of the University of California at Berkeley and LAM (Natural History Museum of Los Angeles, California), transferred recently to UC [4], these samples were collected for different people from 1940 to 2001. Also, specimens of *Jania* was found in

samples of general collections collected by reef-walking or snorkeling at Loreto, Bahia Agua Verde and La Paz. Samples were preserved in 5% formalin/seawater. Preserved specimens were decalcified with 0.6 M HNO₃. Small segments were stained with aniline blue and hematoxylin-eosine for anatomical observations and measurements.

The classification system of Abbott and Hollenberg [5] and Guiry and Guiry [6], are used throughout this paper. In cell measurements length denotes the distance between primary pit connections whereas diameter denotes the maximum width of the cell lumen at right angles to this. Conceptacle measurements follow the system of Johansen [7], Adey and Adey [8]. Descriptive terminology follows Johansen and Silva [1] and Abbott and Hollenberg [5]. Pertinent remarks about the morphology, detailed descriptive accounts, and specimens examined are provided for each species. In this study we made observations on a total of 80 specimens are housed at herbaria ENCB and CMMEX. Description of the vegetative, reproductive characters and information related to the habitat, the geographic distribution and examined specimens are included for each species.

3. Results

Nine species representing genus *Jania* were found during the present study.

1) *Jania* J. V. Lamouroux 1812 [9]

Calcified articulated algae of erect fronds that are primarily dichotomously branched, attached by minute to small crustose holdfast and stolon-like holdfasts. Intergenicula are cylindrical, subcylindrical or compressed, and smooth, winged or lobed. The intergenicula is usually considerably longer than broad, and composed of arching tiers of medullary cell, an outer cortex of pigmented cells, and external single-layer of epithallial cells. Medullary cells in tiers that are all the same height. Cells are with pit-connections. Trichocytes present, but not always evident. Genicula (joints) uncalcified, and consist of a single tier of long, straight cells (sometimes partially covered by overlapping calcification of intergenicula). Sporangial conceptacles contain up to 12 (-15) tetrasporangia or bisporangia. Conceptacles are solitary and terminals with an apical pore, sometimes the conceptacles give rise to new branches, so they are called antenniferous. Carposporangial conceptacles with narrow (to 35 µm), wide (to 130 µm) fusion cells. Spermatangial conceptacles long and narrow, lanceolate; spermatangia along inner walls of chamber.

Key to the species:

1a) Thalli epiphytic, segments markedly compressed throughout *J. tenellavar. zaca*

1b) Thalli saxicolous or epiphytic, segments normally

all cylindrical, rarely compressed below

2a) Thallus with common alternate or opposite pinnate branches, in addition to the major branching dichotomous *J. subpinnata*

2b) Thallus strictly dichotomously branched

3a) Thalli decussate-dichotomously branched; branch wide angles wide, mostly greater than 45°, branch intergenicula 50 - 100 µm in diameter and 400 - 800 µm in length *J. capillacea*

3b) Thalli dichotomously branched though branch angles narrow, usually less than, but up to 45°, branch intergenicula, mostly 100 - 400 µm in diameter

4a) Segments mostly 300 - 500 µm in diameter *J. verrucosa*

4b) Segments mostly 100 - 200 µm in diameter

5a) Segments 120 - 150 (-210) µm in diameter; very long, 6 - 11 times longer than wide, 700 - 1200 µm in length *J. longiarthra*

5b) Segments 120 - 200 µm in diameter; mostly 2.0 - 5.0 times longer than wide

6a) Segments 120 - 200 µm in diameter; tetrasporangial conceptacles seriate *J. pacifica*

6b) Segments 120 - 200 µm in diameter; tetrasporangial conceptacles all terminal

7a) Branch angles mostly about 30°; branch intergenicula 120 - 150 µm in diameter; 2 - 5 times longer than wide, (240-) 300 - 750 µm in length *J. adhaerens*

7b) Branch angles rather narrow, mostly 45° or less; segments 120 - 120 µm in diameter; mostly 2.0 - 5.0 times longer than wide

8a) Segments 120 - 200 µm in diameter; and 150 - 600 µm in length; tetrasporangial conceptacles terminal *J. tenella*

8b) Segments (110) 120 - 160 (170) µm in diameter and 400 - 580 (640) µm in length; with terminals bearing unguulate apices, flattened, tetrasporangial conceptacles axial *J. unguolata* f. *brevior*

2) *Jania adhaerens* J. V. Lamouroux, 1816:270 [10]

Type locality: "Méditerranée?" (Lamouroux 1816:270 [10]).

Morphology: Small calcified articulated algae; epiphytic, or on hard surfaces, forming dichotomously branched brittle turfs, usually less than 2 cm tall (**Figure 1(a)**); attached by a crustose base, and secondarily by creeping, rhizomatous basal segments with lateral discoid holdfasts. Branch apices generally finely modified angles, more often than not less than 30°. Axes are dichotomously branched, mostly in one plane, intergenicula (segments) heavily calcified, cylindrical, and sometimes slightly flattened at branch dichotomies; mostly 120 - 200 µm in diameter and 300 - 900 in length (**Figure 1(b)**).

Anatomy: In longitudinal section cells of the medulla 7 - 11 µm breadth and 50 - 90 µm length, cortical region

composed by 2 - 3 layers of cells, these of 6 - 8 μm breadth and 9 - 10 μm length. Genicula (85) 105 - 125 (140) μm breadth by (220) 240 - 312 (330) μm length.

Reproductive structures: Tetrasporangial conceptacles vase-shaped, surmounted with swollen branches (**Figure 1(c)**), within chambers that are 150 - 200 μm in diameter and 250 - 300 μm high (**Figure 1(d)**). Tetrasporangia are zonately divided, 120 - 130 μm length and 40 - 45 μm breadth. Male chambers 120 - 140 μm in diameter (**Figure 1(e)**).

Habitat: Epilithic and in tide pools; intertidal to shallow subtidal.

Distribution: Eastern Pacific: Southern California to Todos Santos, Baja California Sur; Isla Guadalupe; Sinaloa to Colima; Hawaiian Islands; Ecuador. Western Pacific: China; Japan; Korea.

Specimens examined: Baja California (Gulf): Playa Santa Teresa, 21.X.1995, A. C. Mendoza-González and

L. E. Mateo-Cid (ENCB 12052) (Aguilar-Rosas *et al.* 2000:131 [11]); Puertecitos, 4.II.1996, A. C. Mendoza González and L. E. Mateo Cid (ENCB 12054) (Aguilar-Rosas *et al.* 2000:131 [11]); Isla Ángel de la Guarda, E. Y. Dawson, 4.II.1940 (UC 940249). Baja California Sur (Gulf): Bahía Concepción (Las Palmas and Punta Guadalupe), 17.I.1990, L. E. Mateo-Cid and M. Aguirre (ENCB 12062); (El Coyote), 27.III.1949, E. Y. Dawson (LAM 54845 and US 0000456) (Huerta-Múzquiz and Mendoza-González 1985: 49 [12] Mateo-Cid *et al.* 1993: 46 [13]); Punta Arena (Mateo-Cid *et al.* 2000:64 [14]); Arrecife de Cabo Pulmo (Anaya-Reyna and Riosmena-Rodríguez, 1996:863 [15]; Mateo-Cid *et al.* 2000:64 [14]). Sonora: Mazatlán (Mendoza-González *et al.* 1994:106 [16]).

Remarks. *Jania adhaerens* is widely distributed in the Gulf of California, and has the widest distribution of the species of *Jania* located in this study. Yendo (1902) [17] noted that the original description of *Jania adhaerens* J. V.

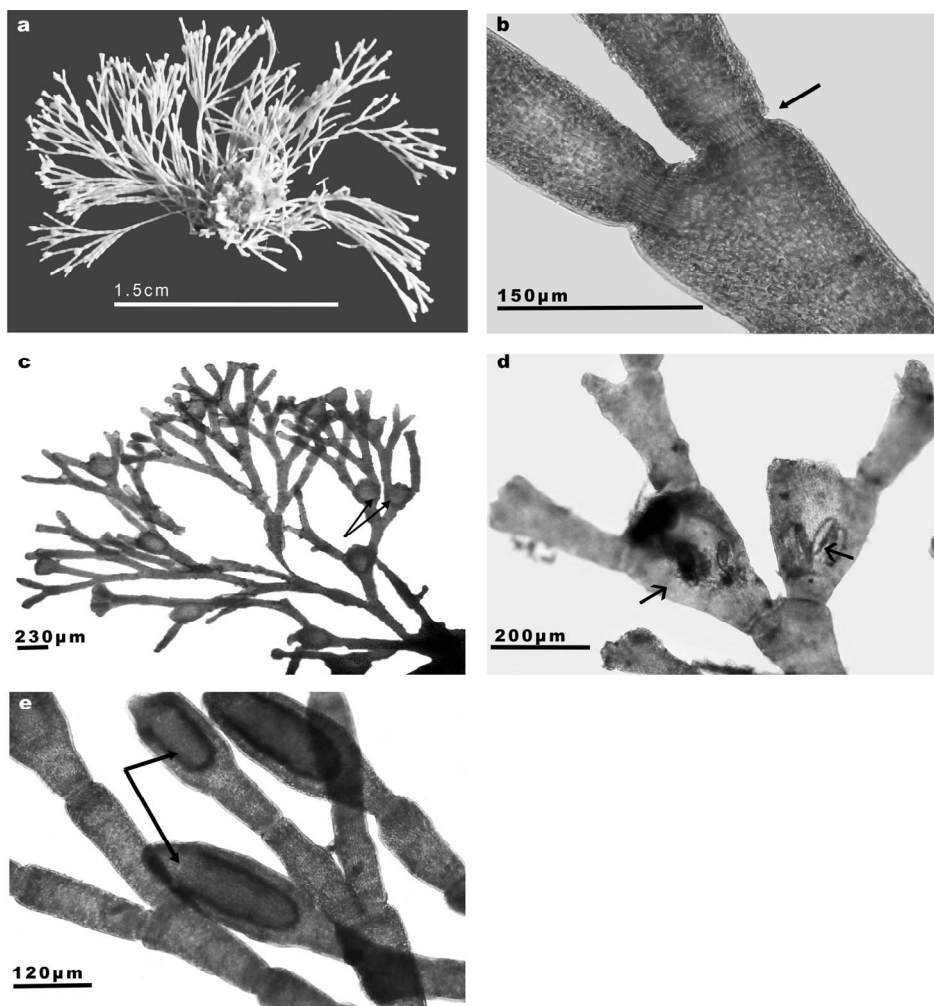


Figure 1. *Jania adhaerens*, (a) Habit for specimen of Puerto Penasco, Sonora. ENCB 3002; (b) Superficial view of intergeniculum and geniculum; Arrow point to geniculum; (c) Plant bearing tetrasporangial conceptacles (arrow); (d) A conceptacle filled with tetrasporangia; (e) A spermatangial conceptacle, arrow points the chamber.

Lamouroux (1816) [10] could also apply to his *J. decussato-dichotoma* Yendo (1905) [18] as well.

3) *Jania capillacea* Harvey 1853:84 [19]

Type locality: Bahia Honda Key (Bahia Honda State Park), Florida Keys, Florida.

Morphology: Thalli minute tufts, 1.0 - 1.3 cm tall (**Figure 2(a)**); branching dichotomously or sometimes more or less decussate (**Figure 2(b)**); branch angles very wide, 60° - 90°; attached by a disc. Intergenicula (segments) cylindrical, 80 - 90 µm in diameter, ultimate branches usually 50 - 60 µm in diameter and 400 - 800 µm in length (**Figure 2(c)**).

Anatomy: In longitudinal section cells of the medulla 7 - 9 µm breadth and 25 - 50 µm length, cortical region composed by 1 - 2 layers of cells, these of 6 - 9 µm breadth and 7 - 9 µm length. Genicula 50 - 70 µm breadth and 50 - 85 µm length.

Reproductive structures: Tetrasporangial conceptacles,

ovoid-shaped, on swollen tips of branches and occur terminally between 2 long antenna-like branches (**Figure 2(d)**), about 300 µm wide, chambers measure 200 - 250 µm in diameter by 350 - 380 µm length. Tetrasporangia are zonately divided, 140 - 150 µm length and 40 - 45 µm breadth (**Figure 2(e)**). Gametangial thallus not found.

Habitat: usually growing among other turf-algae, sometimes on rocks or epizoid on sponges; intertidal.

Distribution: Gulf of California: Puerto Peñasco; Isla Ángel de la Guarda to Cabo San Lucas. Eastern Pacific: Isla Guadalupe; Isla Cedros; Isla Socorro (Islas Revillagigedo); Isla Clipperton; Baja California to Guerrero; Ecuador; Galápagos Islands.

Specimens examined: Baja California (Gulf): Punta Bufo (Littler and Littler, 1981:151 [20]). Baja California Sur (Pacific): Laguna de San Ignacio, 09.XI.1992, R-Núñez López (ENCB 12086); Baja California Sur (Gulf): Bahía Concepción (Punta Arenas), 6.XII.1992, L. E.

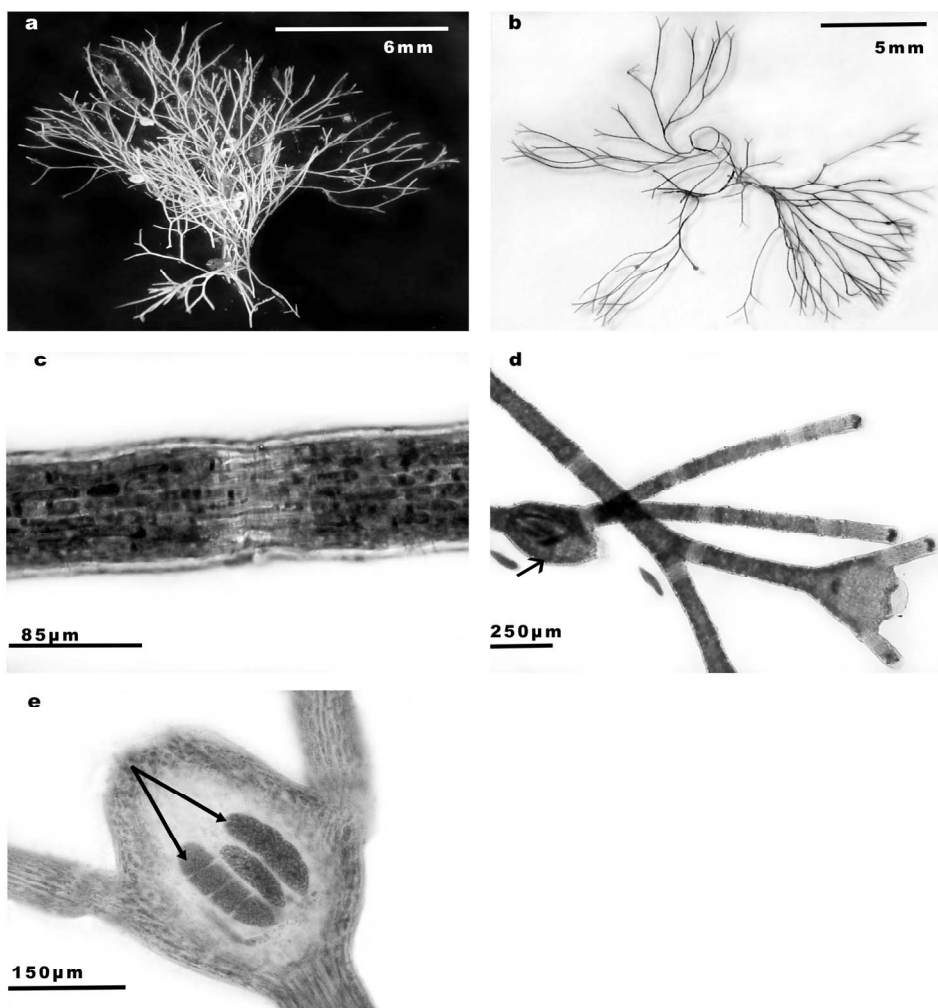


Figure 2. *Jania capillacea*. (a) Habit for specimen of Bahia de la Paz, BCS. ENCB SN; (b) Habit of a decalcified thallus; (c) Superficial view of intergeniculum and geniculum; (d) Plant bearing tetrasporangial conceptacles, arrow points the conceptacles; (e) A conceptacle filled with tetrasporangia, arrow point the tetrasporangia, noted the conceptacle' shaped.

Mateo-Cid (ENCB 12087); Puerto Escondido, 11.IV.1958, E. Y. Dawson (LAM 52689) (Dawson, 1959:7, 20, 22 [21]); Isla Partida (Dawson, 1959:4, 20, 22 [21]). Sonora: Isla Turner, 18.VII.1940, E. Y. Dawson (LAM 2693 and US 00072783). Sinaloa: Bahía Topolobampo, 15.II.1965, E. Y. Dawson (US 00004544).

Remarks. While *Jania capillacea* is generally recognized as a distinct species (for example, Wynne 2005 [22]), Cribb (1983) [23] and later Price and Scott (1992) [24] have considered it to be conspecific with *J. adhaerens*.

4) *Jania longiarthra* E. Y. Dawson, 1953:119 [25]

Type Locality: Bahía San Gabriel, Isla Espíritu Santo, Baja California Sur, Gulf of California.

Morphology: Algae erect, up to 2.5 cm tall, forming coarse tufts; densely dichotomously branched (**Figure 3(a)**), sometimes rather prominently but irregularly decussate; branching at very narrow angles. Intergenicula cylindrical uncontracted (**Figure 3(b)**), with smooth surfaces; 200 - 220 μm in diameter, and 720 - 1000 μm in length, about 6 - 8 times longer than wide.

Anatomy: In longitudinal section cells of the medulla 7 - 9 μm breadth and 35 - 55 μm length, cortical region composed by 1 - 2 layers of cells, these of 8 - 9 μm breadth and 7 - 12 μm length. Genicula 150 - 185 μm

breadth and 150 - 160 μm length.

Reproductive structures: Tetrasporangial conceptacles, pyriform-shaped, terminal or subterminal, about 300 μm wide, upper end with 2 - 3 long antenna-like branches, chambers 250 - 260 μm in diameter and 390 - 400 μm in length. Tetrasporangia are zonately divided, 160 - 190 μm length and 50 - 55 μm breadth (**Figure 3(c)**). Gametangial thallus not found.

Habitat: Growing among other turf algae; mid to low intertidal.

Distribution. Gulf of California: Puerto Peñasco to Guaymas; Isla Carmen to Isla Espíritu Santo. Eastern Pacific: Clipperton Island (île de la Passion); Costa Rica.

Specimens examined: Baja California (Gulf): Playa Santa Teresa Aguilar-Rosas *et al.* 2000: [26], 21.X.1996, A. C. Mendoza-González, L. E. Mateo-Cid, L. E. Aguilar-Rosas and R. Aguilar-Rosas (ENCB 12052); Puertecitos, 3.VI.1996, A. C. Mendoza, L. E. Mateo-Cid, L. E. Aguilar-Rosas and R. Aguilar-Rosas (ENCB 12053).

Baja California Sur (Gulf): Isla Monserrat (Dawson, 1959:22 [21]); Bahía Agua Verde (Dawson, 1959:22 [21]); Isla San Diego (Dawson, 1959:22 [21]); Isla San Francisco (Dawson, 1959:8, 22 [21]); Bahía San Gabriel (Dawson, 1953:119 [21]); Puerto Balandra (Dawson, 1959:8, 22 [21]); Calerita (Bahía de La Paz, 24.IV.1994,

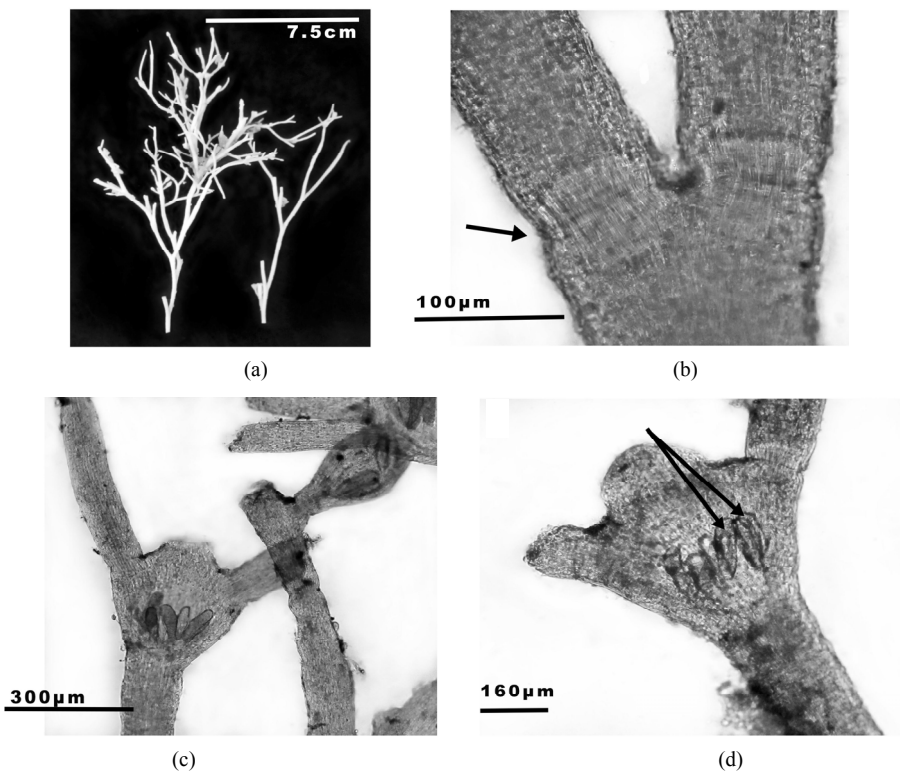


Figure 3. *Jania longiarthra*. (a) Habit for specimen of El Sargento, Baja California Sur ENCB 19033; (b) Superficial view of intergeniculum and geniculum, arrow point to geniculum; (c) Plant bearing tetrasporangial conceptacles; (d) Arrow point the tetrasporangia, noted the conceptacle' shaped, arrow point the tetrasporangia.

A. C. Mendoza-González, L. E. Mateo-Cid, L. E. Aguilar-Rosas and R. Aguilar-Rosas (ENCB 19031); El Sargento, 23.IV.1994, A. C. Mendoza, L. E. Mateo, L. E. Aguilar and R. Aguilar (ENCB 19033). Sonora: Puerto Peñasco (Punta Pelicanos), 9.III.1997, A. C. Mendoza-González, L. E. Mateo-Cid, R. Aguilar-Rosas and L. E. Aguilar-Rosas (ENCB 15758).

Remarks. *Jania longiarthra* has been recorded in the southern Gulf (Dawson, 1953 [25]) and upper Gulf (Mateo-Cid *et al.* 2006 [26]). It differs from other species of *Jania* reported in the Gulf, by its very long intergenicula and narrow angles of branching (Dawson 1953 [25]).

4) *Jania pacifica* J. E. Areschoug, 1852:556 [27]

Type Locality: Huatulco, Oaxaca, México.

Heterotypic Synonyms

Jania mexicana W. R. Taylor 1945 [28]

Morphology: Thalli attached to barnacles or saxicolous, densely tufted, (1.5) 1.8 - 3.5 (4.0) cm high (**Figure 4(a)**), branching dense subcorymbose, intergeniculas cylindrical throughout (**Figure 4(b)**); segments (150) 170 - 220 (240) μm in diameter and (340) 360 - 600 (660) μm long, (170) 180 - 190 (200) μm in diameter and (200) 220 - 400 (420) μm long in ultimate segments above; apices obtuse-conical.

Anatomy: In longitudinal section cells of the medulla 9 - 12 μm breadth and 49 - 110 μm length, cortical region composed by 2 - 3 layers of cells, these of (4.5) 7 -

9 (10) μm breadth and 12 - 18 μm length. Genucula 130 - 140 μm breadth and 80 - 90 μm length.

Reproductive structures: Tetrasporangial conceptacles antenniferous, terminal or subterminal (**Figure 4(c)**), chambers (240) 260 - 380 (420) μm in diameter and (400) 440 - 560 (580) μm in length. Tetrasporangia are zonately divided, 140 - 180 μm length and 50 - 65 μm breadth. Gametangial thallus not found.

Habitat: Epilithic, occurring in shallow eulittoral pools or on rocks near low tide level and 1 - 3 m deep.

Distribution. Madagascar, Taiwan, Philippines

Specimens examined: Baja California: Desembarcadero de Miller (Dawson, 1944:228 [29], as *Jania mexicana*). Baja California Sur: Los Cerritos (Todos Santos), 12.XI.1988, A. C. Mendoza González and L. E. Mateo Cid (ENCB 12119). Baja California (Gulf): Isla Estanque (Dawson, 1944:277 [29], as *Jania rubens*). Baja California Sur (Gulf): Punta Gallito (Bahía Concepción), 18.I.1990, E. Rodríguez (ENCB 12116). Sonora: Bahía Kino, 17.II.1983, L. E. Mateo-Cid and C. Flores (ENCB 12124) (Mendoza-González and Mateo-Cid, 1986:423 [30]). Sinaloa: Mazatlán (El Camarón), 8.XII.1946, E. Y. Dawson, (LAM 49519) (De Lara-Issasi, 1991:27 [31]).

Remarks: *Jania pacifica* is widely distributed in the tropical Pacific coast of Mexico, is infrequent on the northwest coast of Baja California and in the Gulf of California. It could be distinguished from other species of *Jania* present in the Pacific coast by the width-length

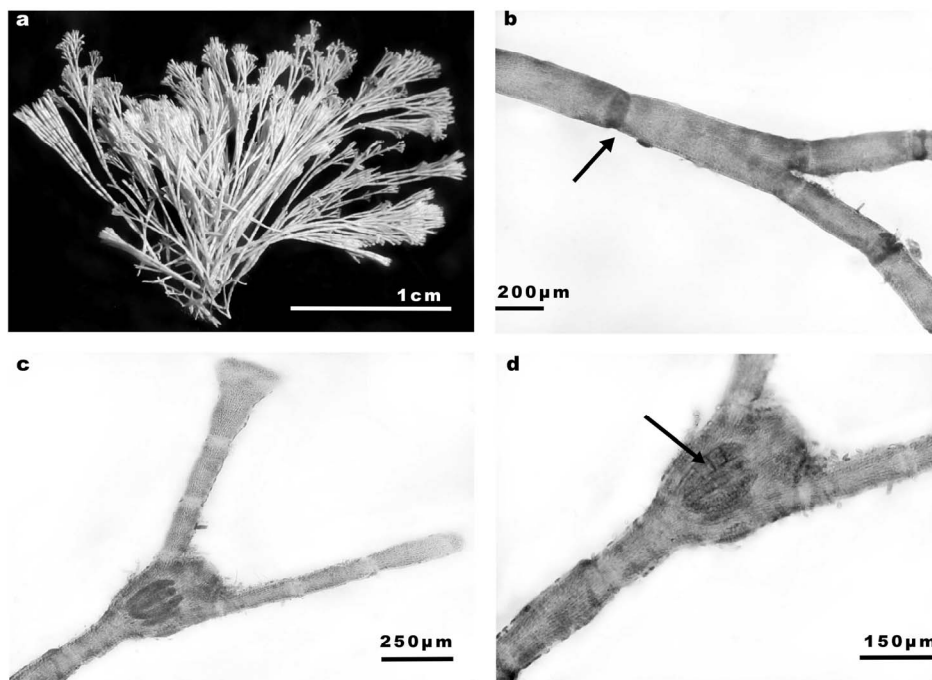


Figure 4. *Jania pacifica*. (a) Habit for specimen of Todos Santos, Baja California Sur ENCB 12119; (b) Superficial view of intergeniculum and genuculum, arrow points to genuculum; (c) Plant bearing tetrasporangial conceptacles; (d) A conceptacle filled with tetrasporangia, arrow point the tetrasporangia, noted the conceptacle' shaped.

of the intergeniculas and its robust and branching habit that is denser in apical portions.

5) *Jania subpinnata* E. Y. Dawson 1953:115 [25]

Type locality: Bay of La Paz, Baja California Sur.

Morphology: Thalli always epiphytic, 4 - 6 mm high (**Figure 5(a)**), forming a densely branched, confused, matted, primary branching dichotomous, but subopposite or pinnate branching frequent and often prominent; pinnate branches arising secondarily from near the distal end of mature intergenicula, segments terete 150 - 170 μm in diameter and 600 - 700 μm long (**Figure 5(b)**), mostly 3 - 4 diameters long, smaller above (90) 96 - 120 (130) μm wide.

Anatomy: In longitudinal section cells of the medulla 10 - 12 μm breadth and 18 - 30 μm length, cortical region composed by 1 - 2 layers of cells, these of 5 - 6 μm breadth.

Reproductive structures: Tetrasporangial conceptacles urn-shaped, rostrate with antenna-like branch (**Figure 5(c)**), about 350 μm in diameter, chambers 250 - 300 μm in diameter and 290 - 300 μm long, tetrasporangia are zonately divided, 110 - 120 μm length and 55 - 60 μm breadth (**Figure 5(d)**).

Habitat: Epiphytic on *Dictyopteris* ssp, intertidal level.

Specimens examined: Baja California Sur (Pacific): Bahía de la Paz (Dawson 1953:115 [25]). E. Y. Dawson; 10.XI.1946; Epiphytic on *Digenia simplex*. (HAHF 3459), Baja California (Pacific): El Sauzal, Ensenada, 12.XI.1986, Ma. E Sánchez Rodríguez (ENCB 1130A).

Remarks. As primordial characteristic for the determination of this species is the peculiar secondarily pin-

nate branching distinguishes this plant readily from other species of *Jania* along the study area. This is the second record of *J. subpinnata* since it was described from Bay of La Paz.

6) *Jania tenella*(Kützing) Grunow, 1874:42 [32]

Type locality. Syntype localities: "in sinu neapolitano et ad oras mexicanas" (Kützing 1858:41 [33]); Gulf di Napoli, Italy (Dawson 1953 [25]) Silva *et al.* 1996 [34], and Mexico (South and Skelton 2003 [35]).

Morphology: Algae forming dense tufts of congested branches, (1.0) 1.2 - 2.0 (2.2) cm tall, branching dichotomous (**Figure 6(a)**), at narrow angles; attached by a usually inconspicuous disc. Intergenicula cylindrical (or sometimes with lower intergenicula slightly compressed), 100 - 120 μm in diameter (**Figure 6(b)**), mostly 2.5 - 5.0 times longer than wide, 150 - 600 μm in length.

Anatomy: In longitudinal section cells of the medulla 7 - 8 μm breadth and 40 - 60 μm length, cortical region composed by 1 - 2 layers of cells, these of 4 - 6 μm breadth and 9 - 12 μm length (**Figure 6(c)**). Gencula 50 - 60 μm breadth and 70 - 90 μm length.

Reproductive structures: Tetrasporangial conceptacles, urn-shaped, up to 250 μm in diameter, with long extensions from prominent shoulders. Chambers measure 150 - 175 μm in diameter and 300 - 350 μm in length, tetrasporangia are zonately divided, 150 - 170 μm length and 35 - 50 μm breadth (**Figure 6(d)**). Carposporangial conceptacle, urn shaped 200 - 250 μm Indiameter (**Figure 6(e)**), chambers 160 - 170 μm in diameter and 210 - 230 μm in length. Spermatangial conceptacles elongate ellipsoidal (**Figure 6(f)**), chamber about 110 - 130 μm in

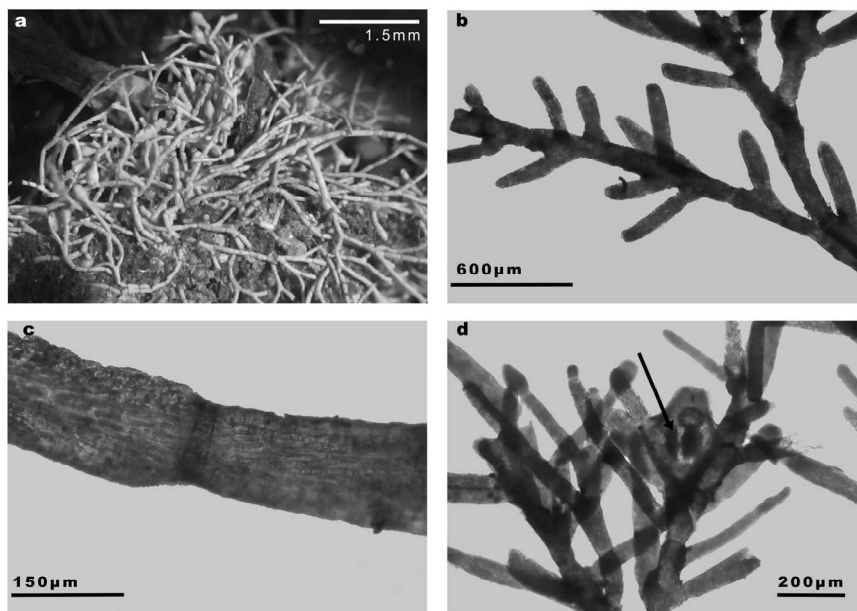


Figure 5. *Jania subpinnata*. (a) Habit for specimen of El Sauzal, Baja California ENCB 1130A; (b) Terminal branch with subopposite braching; (c) Superficial view of intergeniculum and geniculum; (d) Plant bearing tetrasporangial conceptacles.

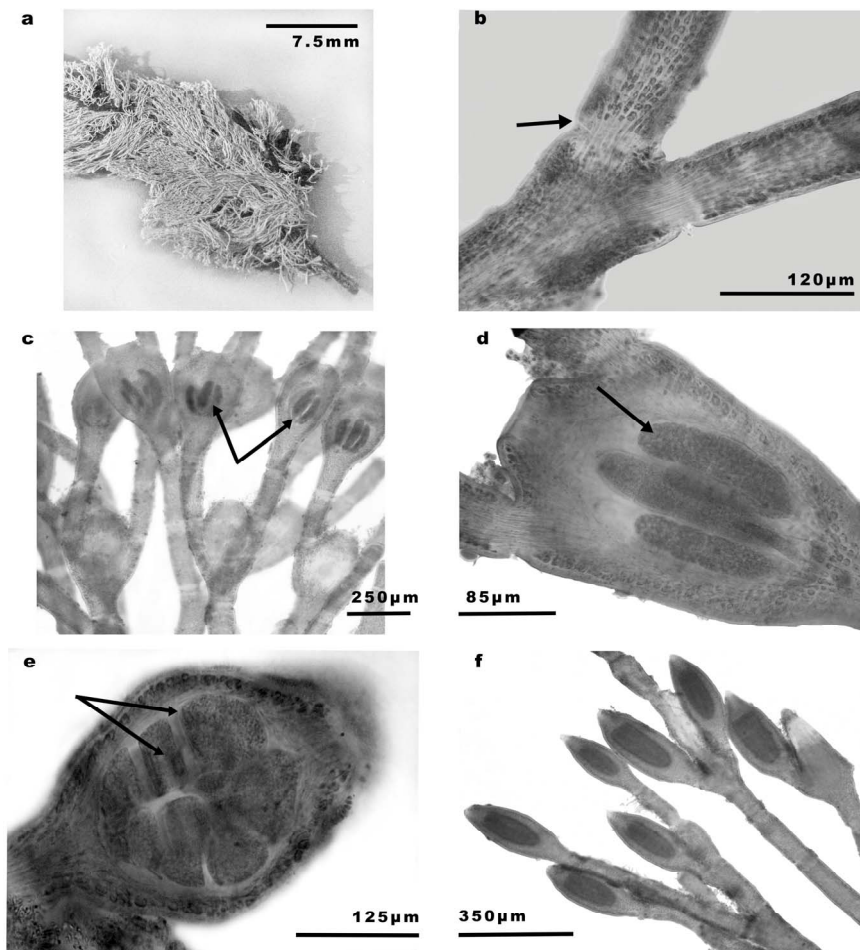


Figure 6. *Jania tenella*. (a) Habit for specimen of Bahia Agua Verde, BCS. ENCB 18715; (b) Superficial view of intergeniculum and geniculum. Arrow point to geniculum; (c) Plant bearing tetrasporangial conceptacles, arrow points the conceptacles; (d) A conceptacle filled with tetrasporangia, arrow point the tetrasporangia, noted the conceptacle' shaped; (e) A cystocarpic mature conceptacle, arrow points to carposporangia; (f) A spermatangial conceptacle, arrow points the chamber.

diameter and 300 - 350 µm in length.

Habitat: Epiphytic on various algae, occasionally on rocks; mid to low intertidal.

Distribution. Gulf of California: Puerto Peñasco Punta Palmilla to Cabo Pulmo; Mazatlan. Eastern Pacific: Santa Catalina Island (California Channel Islands); southern California to Bahía Magdalena, Baja California Sur; Rocas Alijos; Sinaloa to Michoacán; Costa Rica; Chile; Rapa Nui (= Easter Island). Western Pacific: Japan.

Specimens examined: Baja California (Gulf): Playa Santa Teresa, 30.VIII.1996, A. C. Mendoza-González and L. E. Mateo-Cid (ENCB 12329); (Aguilar-Rosas *et al.* 2000:131 [11]); Isla Rasa, 21.XI.1964, E. Y. Dawson (US 00037336). Baja California Sur (Gulf): Isla San Ildefonso, 24.IV.1958, E. Y. Dawson, (LAM 52704); Bahía de La Paz (Calerita), 15.X.1979, G. Hernández and M. L. Chávez B. (ENCB 5273) (Huerta-Múzquiz and Mendoza-González, 1985:50 [12]); Arrecife Cabo Pulmo (Anaya-Reyna and Riosmena-Rodríguez, 1996:863 [15]); San

José del Cabo, 7.XI.1946, E. Y. Dawson (US 00004567). Sonora: Puerto Peñasco, 20.XI.1971, R. Setzer (LAM 85803).

Remarks. *Jania tenella* is apparently restricted to the warmer subtropical waters. We described for the first time the male and female thalli in the Gulf of California.

7) *Jania tenella* (Kützinger) Grunow var. *zaca* E. Y. Dawson, 1953:121-122 [25]

Type locality. Bahía Piedra Blanca, Costa Rica.

Morphology: Thalli always epiphytic, 4 - 6 mm high (**Figures 7(a)**, and **(b)**), forming separate and widely spaced tufts on the host, consisting of several erect, branched parts from a small disc, branching dichotomous throughout (**Figure 7(c)**) intergenicula compressed (60) 65 - 70 (84) µm wide and (170) 180 - 210 (220) µm long below, mostly 2 - 2.5 diameters long, smaller above (90) 96 - 120 (130) µm wide (**Figure 7(d)**).

Anatomy: In longitudinal section cells of the medulla 5 - 7 µm breadth and 25 - 35 µm length, cortical region

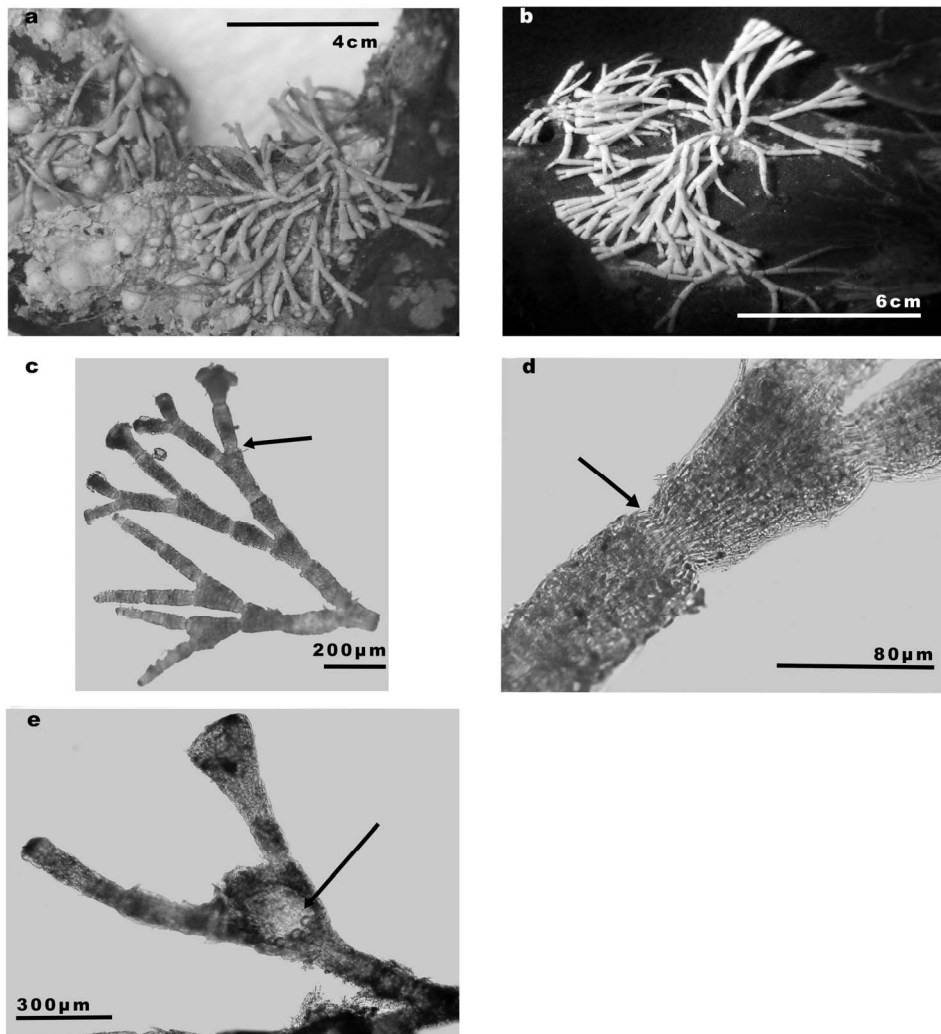


Figure 7. *Jania tenella* var. *zacaе*. (a) and (b) Habit for specimen of Punta Cabeza Mechudo, Bahía de la Paz, Baja California Sur. ENCB 19343; (c) Terminal branch with subopposite bracing; (d) Superficial view of intergeniculum and geniculum, arrow point to geniculum; (e) Plant bearing tetrasporangial conceptacles, noted the conceptacle' shaped.

composed by one layer of cells, these of 5 - 6 μm breadth. Genticula (65) 70 - 80 μm breadth (**Figure 7(d)**).

Reproductive structures: Tetrasporangial conceptacles urn-shaped, slightly compressed, about 325 μm in diameter, rostrate with antenna-like branch, chambers (200) 220 - 230 (245) μm in diameter and (250) 266 - 290 (300) μm long, tetrasporangia are zonately divided, (90) 96 - 100 (110) μm length and (60) 62 - 65 (68) μm breadth.

Habitat: Epiphytic on *Sargassum* ssp, intertidal.

Distribution. Costa Rica, Philippines

Specimens examined: Baja California Sur (Pacific): Punta Malarrimo (Bahía de Sebastián Vizcaíno), (Dawson, 1953:121-122 [21]). Baja California Sur (Gulf): Isla San Ildefonso (Dawson, 1959:9, 22 [21]). (Punta Cabeza de Mechudo, Bahía de La Paz), 11.I.1988, I. Sánchez Rodríguez and Ma. C. Fajardo (ENCB 19343).

Remarks. *Jania tenella* var. *zacaе*, is a rare species,

perhaps due to its epiphytic habit and size go undetected or be confused with other species of *Jania*. This taxa could be distinguished from other species of *Jania* by its size and the shape of the intergeniculas.

8) *Jania ungulata* (Yendo) Yendo f. *brevior* (Yendo) Yendo: 1905:38 [18]

Corallina ungulata Yendo f. *brevior* Yendo 1902:27. [17]

Type locality. Province of Boshu, Chiba, Japan.

Morphology: Thalli consisted of articulate erects delicate fronds to 1.0 cm height (**Figure 8(a)**), arising from diminutive, calcified, semi-circular crustose base, branching dichotomously in a single plan. Intergenicula terete, segments (110) 120 - 160 (170) μm in diameter and 400 - 580 (640) μm long below, (100) 105 - 180 μm in diameter and 450 - 730 (800) μm long in middle portions; terminal branches bearing unguulate apices (**Figure 8(b)**)

180 - 260 (280) μm wide.

Anatomy: In longitudinal section cells of the medulla 7 - 12 μm breadth and 60 - 85 μm length, cortical region composed by 1 - 2 layers of cells, these of 7 - 10 μm breadth and 14 - 20 μm length. Genicula (60) 70 - 100 (110) μm breadth by (80) 90 - 130 μm length.

Reproductive structures: Tetrasporangial conceptacles were terminals, antenniferous (**Figure 8(c)**) oval-shaped, slightly compressed, about 250 μm in diameter, chambers 165 - 200 (220) μm in diameter and (220) 240 - 280 (300) μm long, tetrasporangia are zonately divided (**Figure 8(d)**), 90 - 120 (130) μm length and (35) 40 - 60 μm breadth.

Habitat: Growing on rocks, intertidal. Distribution. Kenya, India, Philippines, Australia and New Zealand. Specimens examined: Baja California Sur (Pacific): Punta Conejo, 5.XII.1992, L. E. Mateo Cid and A. C. Mendoza González (ENCB 14204).

Remarks. As primordial characteristic for the determination of this species is the form of the apical intergeniculas unguulate, this feature appears to be unique to this taxon. Taylor (1945) [28] reported, as uncertain, the presence of *Jania unguolata* f. *brevior* to Ecuador. On the other hand, Moura and Yamaguishi-Tomita (1998) [36] mentioned that *J. unguolata* f. *brevior* is a typical representative of the tropical flora.

9) *Jania verrucosa* Lamouroux, 1816:270 [10]

Type locality. "Amérique Méridionale".

Sinónimos taxonómicos:

Jania crassa Lamouroux, 1821:23. [37]

Jania natalensis Harvey, 1849 (1847-1849):107. [38]

Morphology: Thallus saxicolous, forming clumps (4) 5.0 - 7.5 (9.0) cm high, usually of a pink color, consisting of erect cylindrical, richly branched parts from a crustose basal stratum (**Figure 9(a)**), branching dichotomous throughout (**Figure 9(b)**), basal intergeniculas terete (**Figure 9(c)**), (400) 420 - 500 (520) μm in diameter and (0.4) 0.5 - 1.5 (1.7) mm long; the middle portion of (180) 190 - 200 (220) μm in diameter and (450) 460 - 530 (700) μm length; apices obtuse-conical (170) 180 - 190 (210) μm in diameter.

Anatomy: In longitudinal section cells of the medulla (8) 9 - 12 (14) μm breadth and 91 - 105 μm length, cortical region composed by 2 - 3 layers of cells, these of (11) 12 - 14 (15) μm breadth and (15) 16 - 18 (20) μm length. Genicula 50 - 120 μm breadth and (120) 130 - 160 (180) μm length.

Reproductive structures: Tetrasporangial conceptacles not abundant, forming the terminal bulge or short-clavate terminal segments, bi or tri-antenniferous (**Figure 9(d)**), within chambers that are (360) 370 - 420 (440) μm in diameter and μm (360) 380 - 450 (480) μm high. Tetrasporangia are zonately divided, (105) 110 - 124 (130) μm length and (30) 35 - 40 (46) μm breadth (**Figure 9(e)**). Gametangial thallus not found.

Habitat: Epilithic, occurring in shallow eulittoral pools or on rocks near low tide level.

Distribution. Cape Verde Islands, California, Angola, Kenia, South Africa, China, Singapur, Hawaiian Islands, Azores, Indonesia, Brazil.

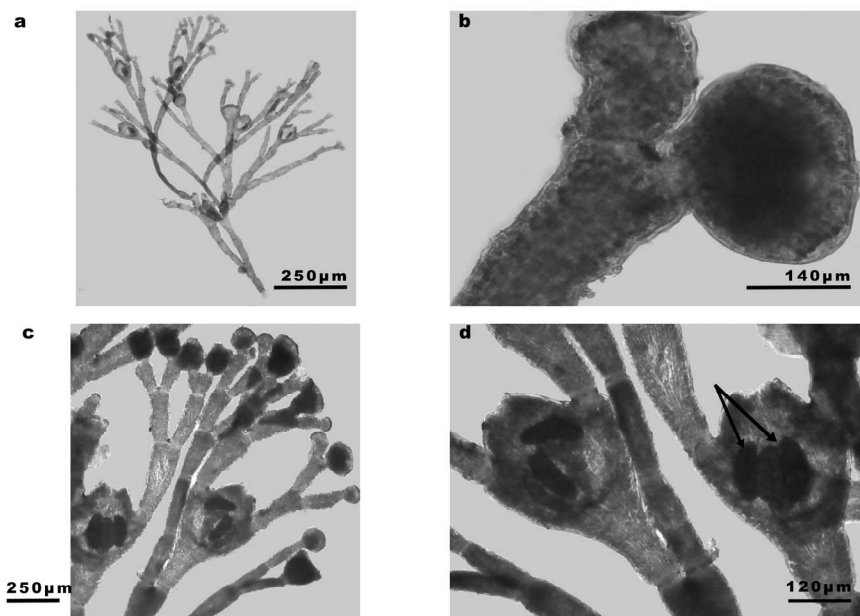


Figure 8. *Jania unguolata*. f. *brevior*. (a) Habit for specimen of Punta Conejo, Baja California Sur. ENCB 14204; (b) Superficial view of terminal unguulate apices; (c) Plant bearing tetrasporangial conceptacles, noted the conceptacle' shaped; (d) A conceptacle filled with tetrasporangia, arrow point the tetrasporangia, noted the conceptacle' shaped.

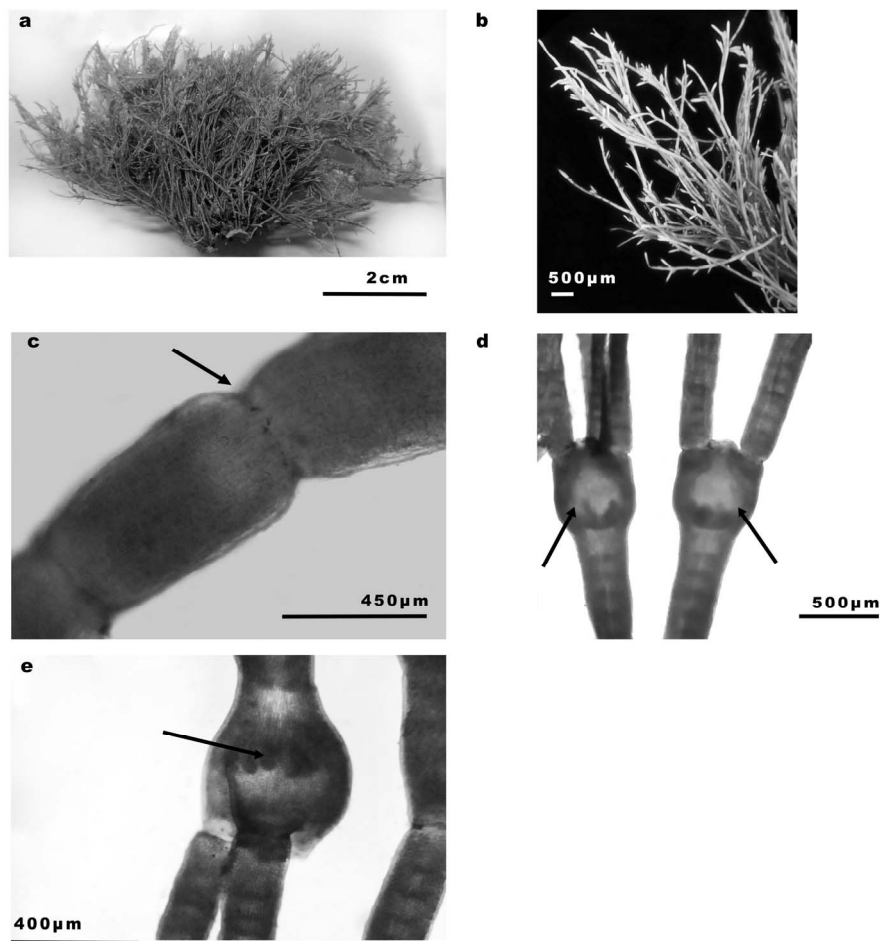


Figure 9. *Jania verrucosa*. (a) Habit for specimen of Rancho Packard, Ensenada, Baja California ENCB 12331; (b) Terminal branch with lateral branching; (c) Superficial view of tergeniculum and geniculum, arrow point to geniculum; (d) and (e) Plant bearing long antenniferous tetrasporangial conceptacles, arrow point the conceptacles, noted the conceptacle shaped.

Specimens examined: Baja California (Pacific): Ensenada, 2.XI.1982, A. C. Mendoza-González and C. Flores (ENCB 12127); Punta Descanso (Dawson 1949: 218 [39] as *Jania mexicana*; Dawson, 1953:118 [25], as *Jania natalensis*); Raúl's, (Pacheco-Ruíz and Aguilar-Rosas, L. 1984:72 [40], as *J. crassa*); Bahía de Todos Santos (Aguilar-Rosas, L., 1981:93 [41]; Aguilar-Rosas, L. *et al.* 1985 [42]:125, Aguilar-Rosas, L. and Pacheco-Ruíz, 1989:81-82 [43], as *J. crassa*). Baja California Sur (Pacific): Laguna Ojo de Liebre (Dawson, 1952:429, as *J. natalensis*); Punta Márquez (Littler and Arnold, 1982:309 [44], as *J. crassa*). Baja California Sur (Pacific). Bahía Tortugas, 18.XI.1986, A. C. Mendoza González and C. Flores (ENCB 12117).

Remarks. *Jania verrucosa* occurs only on the Pacific coast of the Baja California Peninsula and is easily distinguished by its size and robust habit as well as the relation width-length of the intergeniculas. In this study we recorded for first time the distribution of this species towards the south of the Peninsula of Baja California.

4. Discussion

The genus *Jania* is widely distributed in tropical and subtropical waters of the planet [45]. The total number of described species of this genus is controversial, are considered from 20 - 70 [46,47]. According to Johansen and Womersley (1994) [48], many species need to be reexamined due to inappropriate diagnosis or nomenclatural problems. During the analysis of articulate coralline *Jania* from the shores of the Gulf of California was verified the presence of four taxa. It was established that several species have problems for correct recognition. There are also other species have been recorded for the Gulf of California, but could not confirm its presence, as in the case of *Jania decussata-dichotoma* Yendo, two samples were reviewed, but these are very close to *Jania adhaerens*. In fact, Johansen (1970) [7], Yoshida (1998) [49], and Price and Scott (1992) [24] have considered *J. decussato-dichotoma* conspecific with *J. adhaerens*.

Jania huertae, was described from the northern Gulf, and is only known from the type specimen. (Chávez-

Barrera 1972) [50]. Unfortunately, the type is lost and during this study we did not find specimens that confirm the presence of this taxon in the study area. In addition to reviewing the original description of *J. huertae*, it seems to be closely related to *J. longiarthra*, mainly in the morphology of both species. Furthermore, *J. huertae* was described based only on morphological characteristics and reproductive structures were not reported, by this reasons in this study we considerer *J. huertae* as a doubtful record, until locate the type specimen or find samples that are consistent with the characteristics of *J. huertae*.

5. Conclusion

Relationships among the species of *Jania* are very complex, and our morphological data indicate that the species of *Jania* could be delineated by the branching pattern of the main axes, intergenicular shape, and conceptacle position. However, the information provided by the analysis of vegetative and reproductive characteristics is not enough, so it requires molecular studies to achieve a more consistent classification of this genus.

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