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New Records of Marine Algae from the 1974 R/V *Dolphin* Cruise to the Gulf of California

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ABSTRACT

Norris, J. N., and K. E. Bucher. New Records of Marine Algae from the 1974 R/V *Dolphin* Cruise to the Gulf of California. *Smithsonian Contributions to Botany,* number 34, 22 pages, 13 figures, 1976.—Six species of benthic marine algae (one Chlorophyta, two Phaeophyta, and three Rhodophyta) are newly reported from the Gulf of California, Mexico. Species of *Halicystis, Sporochnus, Bonnemaisonia, Dudresnaya,* and *Sebdenia* represent genera new to the Gulf, with the last being new to North America. The distribution of twelve other species is extended. Two new nomenclatural combinations, *Dasya baillouviana* var. *nudicaulus* and *Dasya baillouviana* var. *stanfordiana,* are proposed. The morphological variation of some species is discussed. Spermatangia of *Dudresnaya colombiana,* and tetrasporangia and spermatangia of *Kallymenia pertusa* are reported and described for the first time.

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Contents

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Introduction

The marine flora of the Gulf of California is particularly interesting because it contains elements that are associated with tropical regions (species of *Caulerpa* and *Padina,* for example), as well as genera more commonly associated with temperate waters (*Gigartina* and *Desmarestia*). An opportunity to join a cruise of the R/V *Dolphin* from Scripps Institution of Oceanography to the northern Gulf in 1974 was therefore welcomed by the authors. The expedition enabled us to collect benthic marine algae of Las Islas de la Cintura (Midriff Islands) and from the Gulf coast of Baja California del Norte. This paper provides new distributional records and new nomenclatural combinations in the marine algae resulting from these collections.

The chief scientist of the cruise, Dr. William Fenical of Scripps Institution of Oceanography, and his students were investigating the algae for unique natural products. In addition to our own studies, we identified and prepared herbarium vouchers of the algae used in their chemical studies. Their research was directed toward the halogen containing compounds synthesized by some marine algae (Fenical, 1975). Plants recognized by thin layer chromatography as containing these compounds were collected, and dried for later extraction and structural elucidation (Fenical, 1974; Fenical and J. Norris, 1975; and Howard and Fenical, 1975).

Oceanographic expeditions have contributed greatly to the knowledge of the Gulf of California's marine flora (e.g., Setchell and Gardner, 1924a; Dawson, 1944, 1959, 1966b; J. Norris, 1972). An historical review of marine botanical exploration has been provided by J. Norris (1976). From 1941 to 1966, Dr. E. Yale Dawson contributed the majority of information concerning the taxonomy and distribution of the Gulf's marine algae. Currently a marine algal flora is being assembled by J. Norris for the northern Gulf as a result of studies conducted over several years.

The 11-day cruise (19–30 April 1974) visited seven localities in Las Islas de la Cintura and vicinity. Cruise stations ranged from San Felipe (lat. 31°02′30″; long. 144°48′50″) south to Isla San Esteban (lat. 28°40′15″, long. 112°30′30″) (Figure 1). Most specimens were obtained subtidally by scuba diving and some by free diving. Others were collected intertidally during low tides. Where pertinent, specimens obtained by us and others during

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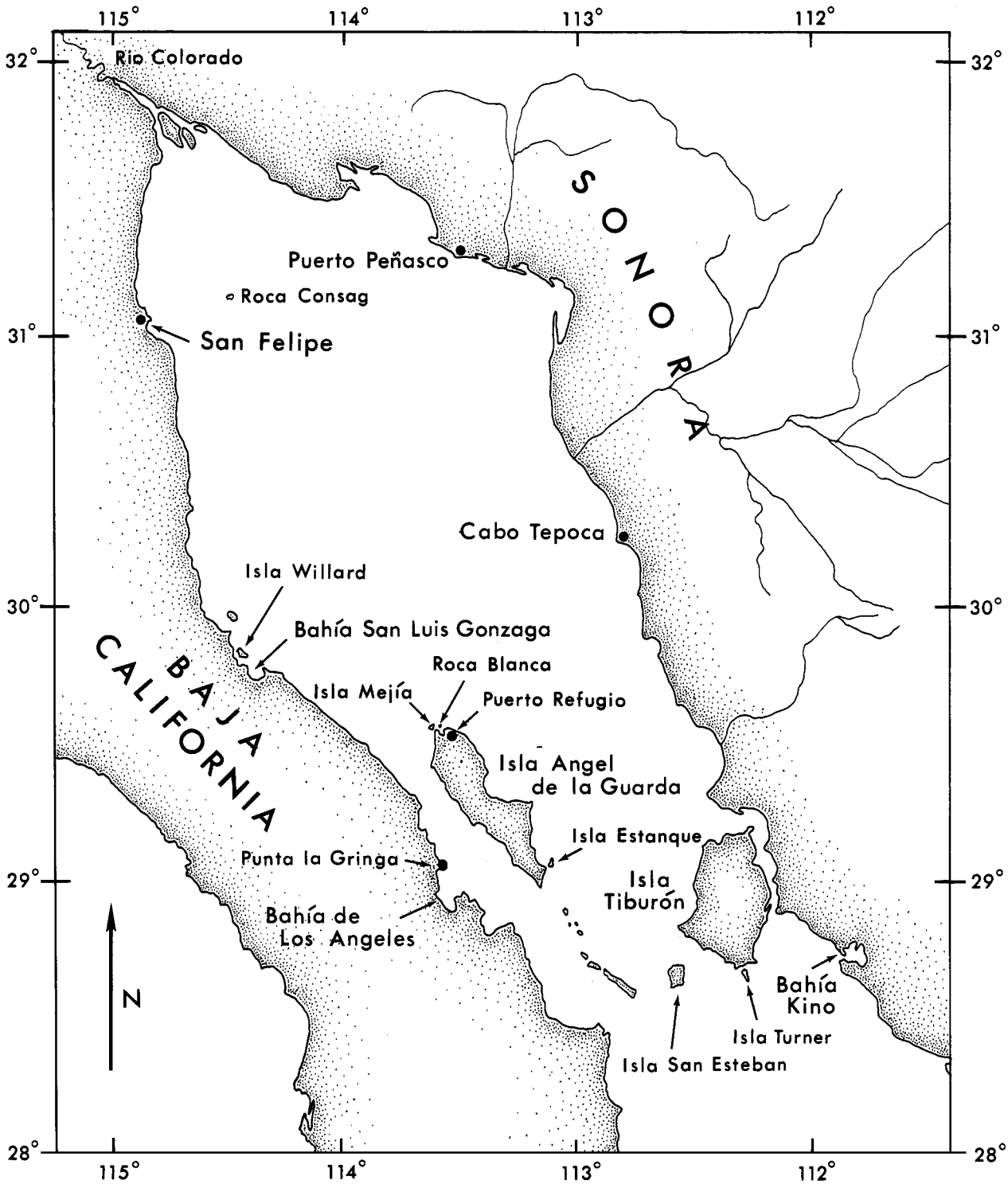

FIGURE 1.—Northern Gulf of California, Mexico: Cruise stations of the R/V *Dolphin*.

field work in Baja California and Sonora, from 1972 to 1974, are also included in this study.

Specimens studied are being deposited in the following herbaria: United States National Herbarium, Smithsonian Institution (US); Universidad Nacional Autónoma de Mexico (MEXU); Gilbert M. Smith Herbarium, Hopkins Marine Station, Stanford University (GMS); University of Washington, Seattle (WTU); University of California, Berkeley (UC); University of Arizona, Tucson (ARIZ); University of Michigan (MICH); and Allan Hancock Foundation Herbarium, University of Southern California (AHFH). Abbreviations for J. N. Norris and Katina E. Bucher are given as JN and KB respectively. The collection numbers refer to the field notebooks of JN. Latitude and longitude of collecting localities are taken from U. S. Naval Oceanographic Office charts NO 21008, NO 21181, and NO 21017. Gulf distribution data within the text is listed from north to south.

ACKNOWLEDGMENTS.—We are grateful to Dr. William Fenical (Chief Scientist) for the opportunity to participate in the cruise of R/V *Dolphin*. Thanks are also due the National Science Foundation for field travel expenses provided by Grant No. BMS 73-07000 A01 and No. BMS 75-13960 (formerly NSF GB-38623), awarded to M. Neushul and J. Norris. Special appreciation is extended to Dr. Isabella A. Abbott, who has kindly examined most of the specimens studied and critically read the manuscript. Dr. Michael Neushul also read the manuscript, and his comments and continuing encouragement are gratefully acknowledged. Our colleague, Dr. Harold Robinson, too, offered a critical reading of the paper providing us with thought-provoking discussions. Dr. George J. Hollenberg and Dr. William Randolph Taylor have examined the *Sporochnus* material and offered valuable comments. Our thanks to Dr. Richard E. Norris for studying the *Pugetia* and *Kallymenia* material. Dr. John Paul, Dr. William Fenical, Dr. Howard Sleeper, Dr. David Lindquist, George Boehlert, David Moore, Bruce Howard, Mark Helvey, and Ken Robertson assisted as diving partners and have shared their collections. Sr. Raphael Guerrero also provided material. Alice Tangerini has skillfully drawn the map. Finally we wish to thank Arhelia Gonzales, of the Shrimp Culture Facilities, Environmental Research Laboratory, Puerto Peñasco, Sonora, for help in processing some of the algae, and Carl N. Hodges, director, for use of Laboratorio de Biología Marina, University of Arizona and Universidad de Sonora, Puerto Peñasco.

CHLOROPHYTA

CAULERPALES

DERBESIACEAE

Halicystis ovalis (Lyngbye) Areschoug

FIGURE 2

Halicystis ovalis (Lyngbye) Areschoug, 1850:447.

This distinctive genus is new to the Gulf of California flora. The nearest previous collections of *H. ovalis* are from the Northern Pacific (Smith, 1969). Gulf specimens were found growing epi-

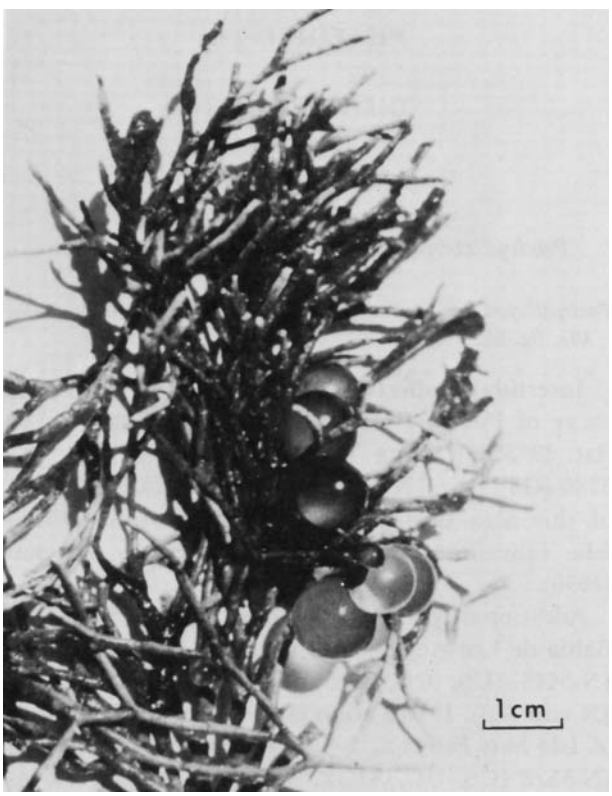

FIGURE 2.—*Halicystis ovalis*, epiphytic on *Amphiroa subcylindrica* from Isla Willard (JN-5732).

phytic on *Amphiroa subcylindrica* Dawson, intertidal to 4.6 m depth, at the northeast end of Isla Willard, Bahía San Luis Gonzaga (lat. 29°49′30″, long. 114°23′24″) 20 Apr 1974, JN–5732 (US, UC, MEXU, ARIZ, AHFH), (leg. JN, KB, J. Paul, and K. Robertson). While our specimens agree well with *H. ovalis* from the Pacific coast of California (Hollenberg, 1935; Smith, 1944), they differ in habitat. In the Gulf of California they were discovered on an articulated coralline, while in California waters they have been reported only on crustose corallines.

Kormann (1938) found *Derbesia marina* to be an alternate in the life history of *H. ovalis,* and Scagel (1961) grew a "Derbesia-stage" from *H. ovalis.* Although *Derbesia* spp. (Dawson, 1966a) and *Derbesia turbinata* Howe et Hoyt (Dawson, 1966b) have been reported in the Gulf, it remains for future culture studies to establish whether either of these species are involved in the life history of the Gulf *Halicystis.*

PHAEOPHYTA

DICTYOTALES

DICTYOTACEAE

Pachydictyon coriaceum (Holmes) Okamura

Pachydictyon coriaceum (Holmes) Okamura, 1899:39; 1936: 165, fig. 84.

Intertidal collections off the rocky northeast shore of Puerto Refugio, Isla Angel de la Guarda (lat. 29°32′30″, long. 113°32′23″) 23 Apr 1974, JN-5780 (US), (leg. JN), extend the known distribution of this alga northward from Bahía Agua Dulce, Isla Tiburón where it was collected by Dawson (1950).

Additional specimens are from Punta La Gringa, Bahía de Los Angeles, 1–7.6 m depth, 28 Apr 1974, JN-5445 (US, UC, GMS, AHFH, MEXU), (leg. JN and KB). It was abundant off the southeast end of Isla San Esteban, 1–4.6 m depth, 26 Apr 1974, JN-5522 (US, UC, ARIZ, MEXU, GMS); 3–7.6 m depth, 25 Apr 1974, JN-5544 (US, UC, ARIZ) and JN-5719 (US), (all three collections leg. JN and KB).

SPOROCHNALES

SPOROCHNACEAE

Sporochnus bolleanus Montagne

FIGURES 3, 4*a,b*

Sporochnus bolleanus Montagne, 1856:393.

A subtidal collection from 23 m depth, off Roca Blanca, in Puerto Refugio, Isla Angel de la Guarda (lat. 29°33′04″, long. 113°33′51″) 21 Apr 1974, JN-5264a & b (US), (leg. JN), is the first record of the occurrence of this genus in the Gulf of California. Previously *S. bolleanus* has been known in the Pacific from the west coast of Baja California (Dawson, Neushul, and Wildman, 1960), the Galapagos Islands (Taylor, 1945), and in the Atlantic from the Gulf of Mexico (Earle, 1969), Bermuda, Puerto Rico, and Brazil (Taylor, 1960).

Sporochnus bolleanus is somewhat similar to *S. pedunculatus* but whereas the latter is delicate, slender, and smaller in size, *S. bolleanus* is a coarser plant, larger in dimensions throughout. Our specimens have intermediate vegetative measurements between *S. bolleanus* Montagne and *S. pedunculatus* (Hudson) C. Agardh (1820) as they were reported from the Gulf of Mexico (Taylor, 1960; Earle, 1969). Earle (1969) has noted difficulty in separating *S. pedunculatus* and *S. bolleanus* in some material from the northeastern Gulf of Mexico. There some plants may have young branches resembling *S. pedunculatus* and mature branches with the characteristics of *S. bolleanus.*

In specimens where the length of the determinate branchlets (pedicel, swollen fertile portion and tuft of hairs) are intermediate between these two species, the shape of the fertile part may be important in determining the species (Taylor, 1960). The fertile part of the Gulf of California material is cylindrical and elongate (Figure 4*a,b*), conforming to the description of *S. bolleanus,* while the fertile parts of *S. pedunculatus* are shorter and rounded, tending toward spindle-shape (Taylor, 1960:253, pl. 35: figs. 2–5; cf. Earle, 1969:190, figs. 89–92).

On the Pacific Coast of North America *Sporochnus pedunculatus* is recorded from Santa Catalina Island, off southern California, to Laguna Ojo

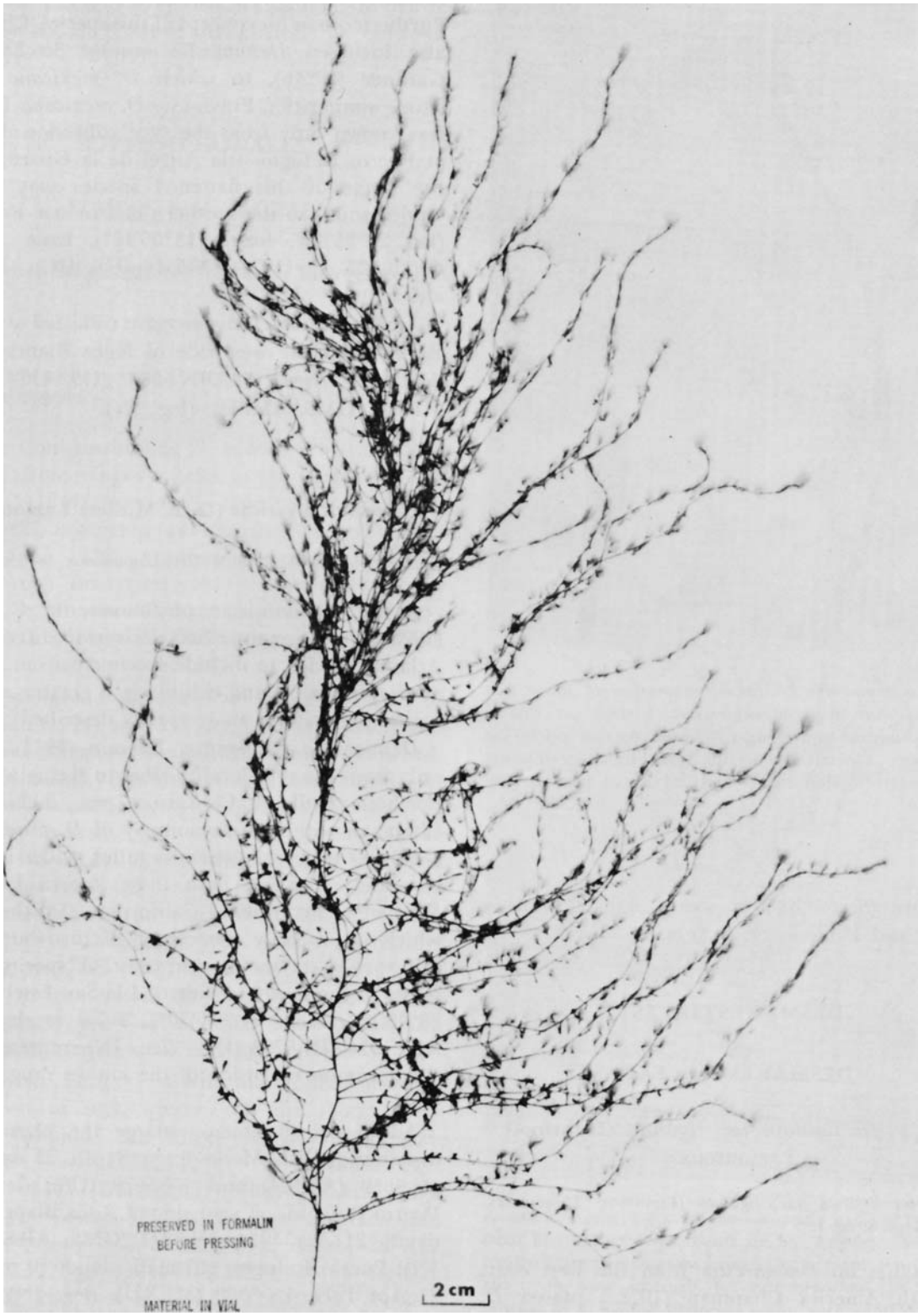

FIGURE 3.—Habit of *Sporochnus bolleanus* from Roca Blanca, Puerto Refugio (JN-5264a).

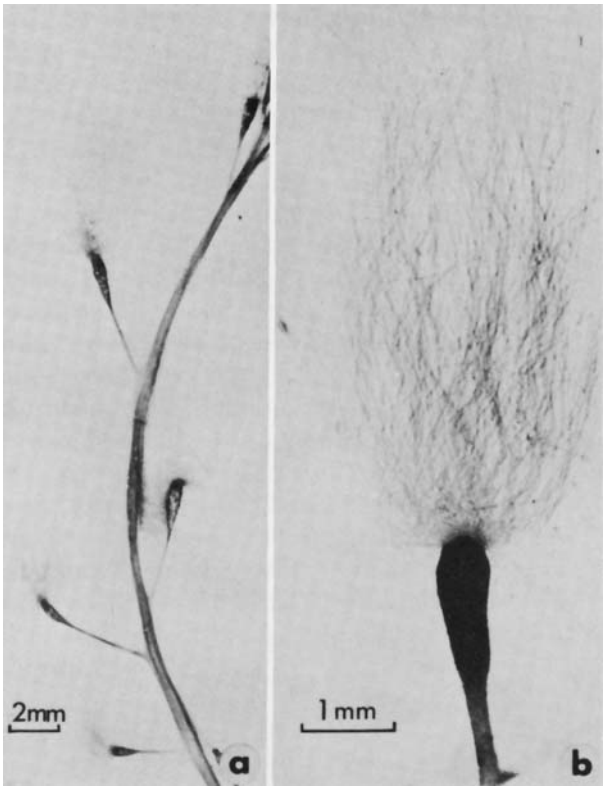

FIGURE 4.—*Sporochnus bolleanus*: *a*, portion of lower axis (JN-5264b) with larger branchlets which show the characteristic cylindrical and elongated fertile portion below the tuft of hairs; *b*, detail of a smaller branchlet also exhibiting the characteristic elongated cylindrical fertile portion (JN-5264a).

de Liebre (Scammon's Lagoon), Baja California (Abbott and Hollenberg, in press).

DESMARESTIALES

DESMARESTIACEAE

Desmarestia ligulata var. *ligulata* (Lightfoot) Lamouroux

Desmarestia ligulata var. *ligulata* (Lightfoot) Lamouroux, 1813:45, pl. 8: fig. 1.

In studies on *Desmarestia* from the west coast of North America Chapman (1972a) placed *D. mexicana* Dawson (1944) from the Gulf of California in synonymy with *D. ligulata* var. *ligulata*. Furthermore in his concept of this species, Chapman also included *Desmarestia munda* Setchell and Gardner (1924b), to which *D. mexicana* shows strong similarities. Previously *D. mexicana* Dawson was known only from the type collection dredged at Puerto Refugio, Isla Angel de la Guarda. Now the range of this flattened species may be extended south to the southern end of Isla Estanque (lat. 29°03′36″, long. 113°06′48″), from 10.7 m depth, 27 Apr 1974, JN-5514 (US, UC), (leg. JN and KB).

Additional material was again collected at Puerto Refugio, off the west side of Roca Blanca, 23 m depth, 21 Apr 1974, JN-5283 (US, UC, ARIZ, MEXU, GMS, AHFH), (leg. JN).

Desmarestia viridis (O. F. Muller) Lamouroux

Desmarestia viridis (O. F. Muller) Lamouroux, 1813:45.

As with other species of *Desmarestia*, Chapman (1972b) has circumscribed *D. viridis*, a common Atlantic species, to include specimens from a wider geographic range and exhibiting a greater morphological variation than is usually described.

Desmarestia filamentosa Dawson (1944), known only from the type-locality (Puerto Refugio) in the northern Gulf of California, was included by Chapman within the synonymy of *D. viridis*. The Gulf specimens are generally taller, wider in diameter and more lax than those known from the Monterey Peninsula, California (Smith, 1969) which is probably the center of distribution for this species on the Pacific coast. A specimen collected at the southeast side of Isla San Esteban (lat. 28°40′15″, long. 112°30′30″), 3–7.6 m depth, 25 Apr 1974, JN-5708 (UC), (leg. JN), represents the southernmost extension of the known range in the Gulf.

Additional specimens enlarge the plant's Gulf distribution: Isla Mejía, 6.1 m depth, 23 Apr 1974, JN-5839 (AHFH) and JN-5679 (US), (leg. JN); Puerto Refugio, off west side of Roca Blanca, 20 m depth, 21 Apr 1974, JN-5271 (GMS, ARIZ), (leg. JN); Puerto Refugio, off small island, 10 m depth, 21 Apr 1974, JN-5360 (MEXU), (leg. JN); Punta la Gringa, Bahía de Los Angeles, 7.6 m depth, 28

Apr 1974, JN-5448 (US), (leg. JN) and 6.5 m depth, 22 May 1972, JN-3042 (US), (leg. JN and G. Boehlert).

SCYTOSIPHONALES

SCYTOSIPHONACEAE

Rosenvingea aff. *sanctae-crucis* Boergesen

FIGURE 5*a,b*

Rosenvingea sanctae-crucis Boergesen, 1914:22, figs. 14–17.—Taylor 1960:263.

Collections resembling *R. sanctae-crucis* establish another *Rosenvingea* species in the northern Gulf. Dawson (1944) previously reported *R. intricata* (J. Agardh) Boergesen (1914) in the Gulf (cf. Wynne and Norris, 1976). Another species, *R. orientalis* (J. Agardh) Boergesen (1914), apparently closely related to *R. sanctae-crucis* (Earle, 1969:210–213), was noted by Dawson (1960) from the Pacific coast of Costa Rica.

Rosenvingea sanctae-crucis as described by Boergesen (1914) and Taylor (1960) is sparsely and irregularly alternate or subdichotomously branched. Our specimens, however, are trichotomously or oppositely branched (Figure 5*a,b*). Gulf material is thicker in transection (cavity to cortex), 90–120 μm and 4–5(–6) cell layers, while those of Boergesen and Taylor are 3–4 cell layers (thickness not given). A specimen, *R. sanctae-crucis* of Taylor and Rhyne (1970:8) from Dominica, West Indies (Stern and Wasshausen-27825 (US)) is similarly branched, but thinner in transection, 60 μm and 3–4 cell layers. Unfortunately the Gulf material is not fertile, and we are unable to make further comparisons.

Northern Gulf of California collections are: Northwest of rock window on the shoreline of Puerto Refugio, Isla Angel de la Guarda (lat. 29°32′15″, long. 113°34′12″), 9 m depth, 21 Apr 1974, JN-5343 (US, MICH), (leg. JN and KB); Punta La Gringa, Bahía de Los Angeles (lat. 29°01′54″, long. 113°32′00″), 9 m depth, 28 Apr 1974, JN-5471 (US, MICH, AHFH, GMS), (leg. JN and KB), and 7 m depth, 22 May 1972, JN-3042 (US, GMS, MICH), (leg. JN and G. Boehlert).

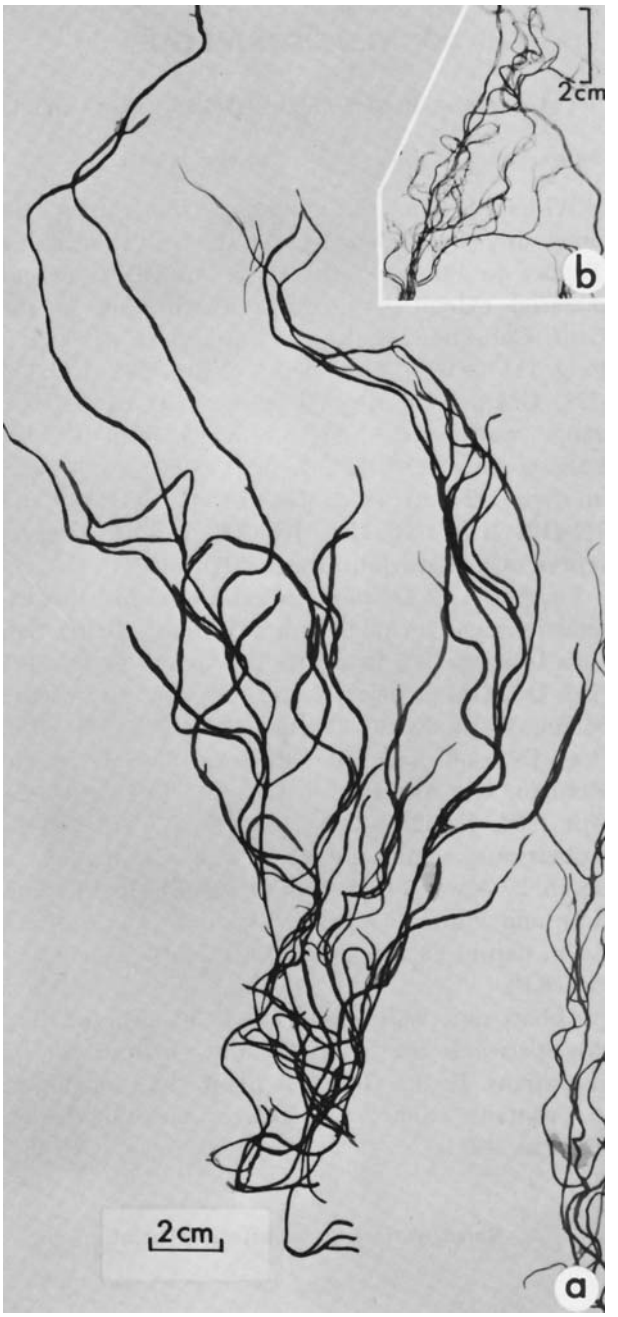

FIGURE 5.—*Rosenvingea* aff. *sanctae-crucis*, habit of two plants from Punta La Gringa, Bahía de Los Angeles, showing the predominate trichotomous branching: *a*, plant of wide diameter with long intervals between branches (JN-5471); *b*, portion of a smaller diameter plant, with shorter intervals and congested branches (JN-3042).

RHODOPHYTA

NEMALIALES

BONNEMAISONIACEAE

Asparagopsis taxiformis (Delile) Trevisan

Asparagopsis taxiformis (Delile) Trevisan, 1845:45.

Widespread in tropical waters, this species had previously been encountered in the Gulf from Bahía Tepoca to Punta Frailes (Dawson, 1953). Recent material extends the known distribution in the Gulf. Collections at Rocas Consag (lat. 31°06′54″, long. 114°29′00″), 7.6 m depth, 2 Jun 1972, JN-3113 (US, GMS, UC), (leg. D. Lindquist) extend the range northward, and specimens from Cabeza Ballena (lat. 22°53′12″, long. 109°50′30″), 3.3–4.5 m depth, 2 Jan 1973, JN-4090 (US, GMS) and JN-4121 (US, UC), (leg. JN, KB, and H. Sleeper) represent a slight southward extension.

Further R/V *Dolphin* collections within this extended range include: Punta Willard, Bahía San Luis Gonzaga, 3.3 m depth, 20 Apr 1974, JN-5401 (US, UC, GMS), (leg. JN and KB); east end of Isla Mejía, 15 m depth, 23 Apr 1974, JN-5675 (US), (leg. JN); off west side of Roca Blanca, Puerto Refugio, Isla Angel de la Guarda, 9 m depth, 21 Apr 1974, JN-5296 (US), (leg. JN, J. Paul and K. Robertson); south end of Isla Estanque, 6.1 m depth, 27 Apr 1974, JN-5485 (US, UC), (leg. JN and KB); and Punta La Gringa, Bahía de Los Angeles, 7.6 m depth, 28 Apr 1974, JN-5474 (US), (leg. JN and KB).

Abbott and Williamson (1974) have noted that this species is the favorite edible seaweed of the Hawaiians. In the Gulf this plant has been found to contain some interesting polyhaloketones (Fenical, 1974).

Bonnemaisonia hamifera Hariot

FIGURE 6*a*

Bonnemaisonia hamifera Hariot, 1891:223.

New to the Gulf of California, this species was often found entangled on *Sargassum* by means of its distinctive hooklike tendrils, though also occurring on other substrates. We found material from the west side of Roca Blanca, Puerto Refugio, (lat. 29°33′04″, long. 113°33′51″) 22 Apr 1974, JN-5802 (GMS) and JN-5284 (US, MEXU), (leg. JN) south to Isla Estanque, (lat. 29°03′36″, long. 113°06′48″) 27 Apr 1974, JN-5579 (ARIZ), (leg. JN and KB).

Numerous additional collections were made at the following localities: off small island, Puerto Refugio, 4.5–9 m depth, 21 Apr 1974, JN-5361 ♀ (US, GMS, UC, ARIZ), (leg. JN and KB); northeast shore of Puerto Refugio, intertidal, 23 Apr 1974, JN-5740 (GMS, AHFH) and JN-5773 (UC), (leg. JN and KB); northwest of rock window on shore, Puerto Refugio, 21 Apr 1974, JN-5315 (US), (leg. JN and KB); Punta la Gringa, Bahía de Los Angeles, 28 Apr 1974, JN-5438 (US, UC), (leg. JN and KB); Isla La Ventana, Bahía de Los Angeles, 15.3–24.6 m depth, May 1972, JN-2989 ♀ (US), (leg. JN and G. Boehlert).

Fertile plants, originally described from Japan (Hariot, 1891), were previously unknown in Mexican collections (Dawson, 1953). Cystocarps observed on JN-5361 and JN-2989 were ellipsoid, surrounded by an ostiolate pericarp, and borne on a short pedicel. The mature cystocarps were 400 μm wide, and 520 μm in height, agreeing with those described by Chihara (1961) for Japanese plants. In the Gulf this species appears to be found only during spring months. Dawson (1961b) recorded this alga from Santa Rosa Island, off southern California, to Punta San Quintín, Baja California del Norte. A single earlier collection from Puerto Refugio, identified as *Acrosymphyton caribaeum* (Norris, 1972:10, pl. 2), is now recognized to be *Bonnemaisonia hamifera*. The alternate phase in the life history of this species, *Trailliella intricata*, has not been found in the Gulf.

CRYPTONEMIALES

DUMONTIACEAE

Dudresnaya colombiana Taylor

FIGURES 7*a–c*,8*a,b*

Dudresnaya colombiana Taylor, 1945:162.

This soft, gelatinous species was encountered subtidally at two cruise localities, adding another genus to the Gulf of California flora.

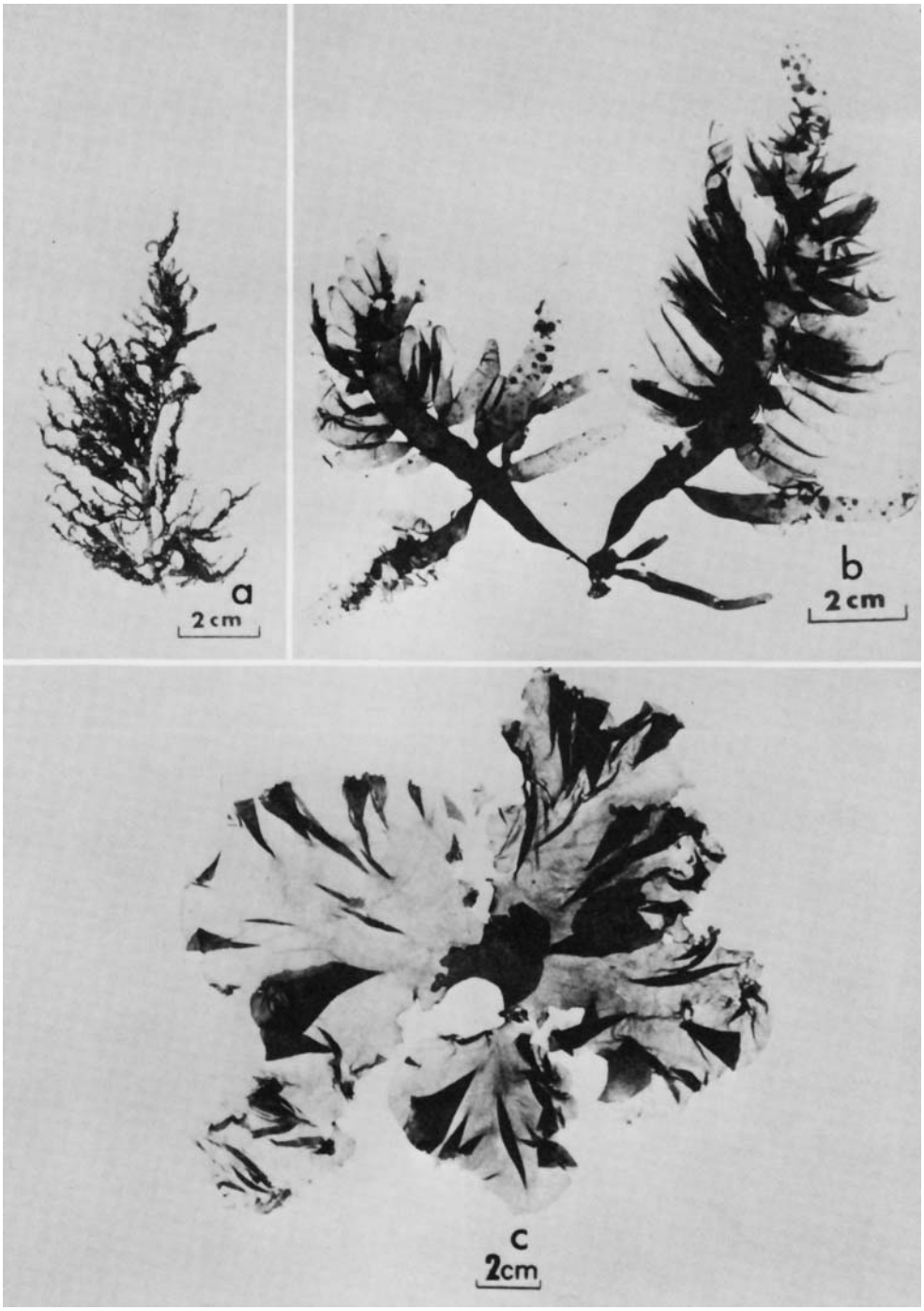

FIGURE 6.—Habits: *a, Bonnemaisonia hamifera* from Roca Blanca, Puerto Refugio (JN-5802); *b, Botryocladia hancockii* collected off Isla Mejía, Puerto Refugio (JN-5685); *c, Predaea masonii* from Roca Blanca, Puerto Refugio (JN-5295), showing the deeply divided blade.

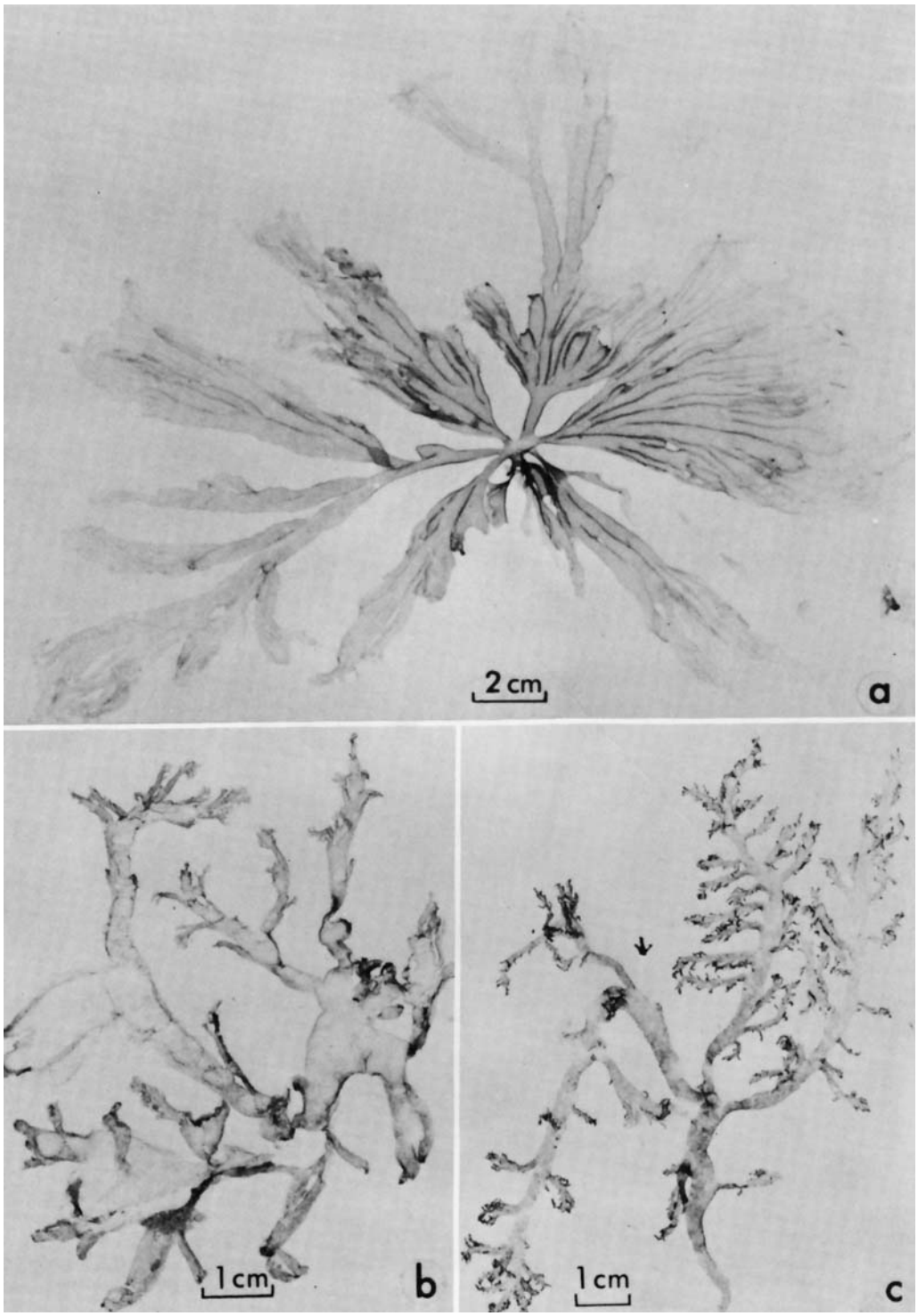

FIGURE 7.—*Dudresnaya colombiana* showing variation in branching: *a*, large specimen from Isla Mejía (JN-5680) branching of 1–2 orders and mostly from the lower portion of the thallus; *b, c*, smaller plants collected off Isla Estanque (JN-5480) with more numerous branches.

The Gulf plants are translucent pink to rose in color, with fronds variously branched above a single, short stipe. Branching in the largest specimens (Figure 7*a*) is mostly from the lower portion of the thallus and of 1–2 orders. Other, shorter thalli (Figure 7*b,c*) are branched 2–4 times from the main axis, with the branches becoming progressively smaller in diameter upward, and the ultimate branchlets shorter with acute apices. Internally the axial filaments range from (5–)7 to 12(–21) μm diameter, and to 45–70 μm diameter in broader older portions. Slender (to 2 μm diameter) rhizoidal filaments from basal cells of laterals, are loosely woven throughout. The filaments of the laterals branch dichotomously and taper slightly toward the outer surface. Cells of these branches are more or less cylindrical, becoming shorter and oval at the apices, with the ultimate cells 5–8 μm long and up to 4 μm in diameter.

The material studied is dioecious. The auxiliary cell branch is a single series of 8–17 rounded cells. Cystocarps are subspherical, 120–180 μm diameter, and borne on the auxiliary cell, usually the third cell from the proximal end (Figure 8*a*). Spermatangial plants, previously unknown, were also collected. Spermatia are clustered terminally on the lateral filaments of these plants (Figure 8*b*).

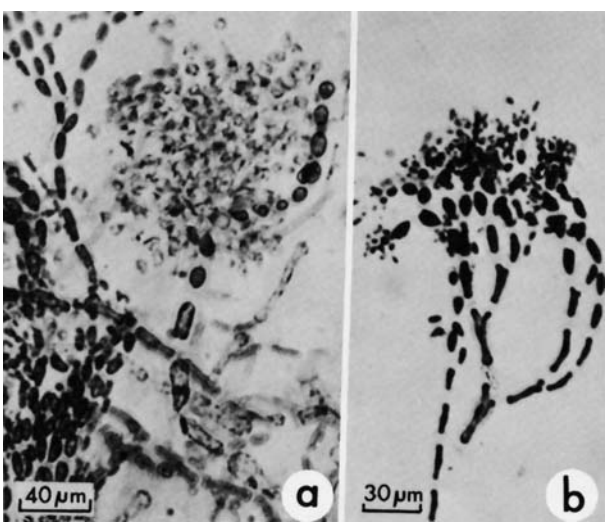

FIGURE 8.—*Dudresnaya colombiana* from Isla Estanque (JN-5480 ♀ ; ♂): *a*, intercalary position of cystocarp borne on the auxiliary cell; *b*, spermatia clustered terminally on the end of the lateral filament.

Our plants generally agree with Taylor's description of *D. colombiana* but with some differences in size and branching. The original description was based on fragments, up to 5 cm tall, with fronds to 6 mm wide (Taylor, 1945). The Gulf specimens are entire, from 7 cm (JN-5480) to 14 cm (JN-5680) tall with fronds 3–5(–10) mm in diameter. The axial filaments of the type specimen were 12–16(–20) μm agreeing with most Gulf material. Gulf thalli of wide diameter had larger axial filaments measuring 45–70 μm diameter. The Colombian specimens branch to three orders, while a few of the Gulf specimens branch to four orders.

The plants were found growing subtidally at the east end of Isla Mejía (lat. 29°33′35″, long. 113°34′52″), 15.1–22.7 m depth, 23 Apr 1974, JN-5680 (US, UC), (leg. JN) and at the south end of Isla Estanque (lat. 29°03′36″, long. 113°06′48″), 9–10.6 m depth, 27 Apr 1974, JN-5480 (US, MEXU, ARIZ, UC, GMS, AHFH), (leg. JN and KB). The type-locality of *D. colombiana* is Isla Gorgona, Colombia (Taylor, 1945:162), where it was collected intertidally (Taylor, 1945:18). An additional record of this species has been reported by Mower and Widdowson (1969) from 6 m depth off Santa Catalina Island, southern California.

KALLYMENIACEAE

Kallymenia pertusa Setchell and Gardner

FIGURE 9

Kallymenia pertusa Setchell and Gardner, 1924a:746.

Subtidal collections from 18.4–23 m depths, off the east end of Isla Mejía (lat. 29°33′35″, long. 113°34′52″) 23 Apr 1974, JN-5667 (US, WTU, UC, MEXU, AHFH, GMS, ARIZ), (leg. JN, J. Paul, and K. Robertson), now extend the range of this perforated foliose alga northward from Punta La Gringa, Bahía de Los Angeles (R. Norris and J. Norris, 1973). The R/V *Dolphin* material reveals this endemic alga to be more common than previously believed. Numerous and luxuriant specimens were found growing on rocks at Isla Mejía. Fertile cystocarpic plants were uncommon among these collections.

The generic position of this taxon was uncertain (Setchell and Gardner, 1924a) until it was clarified

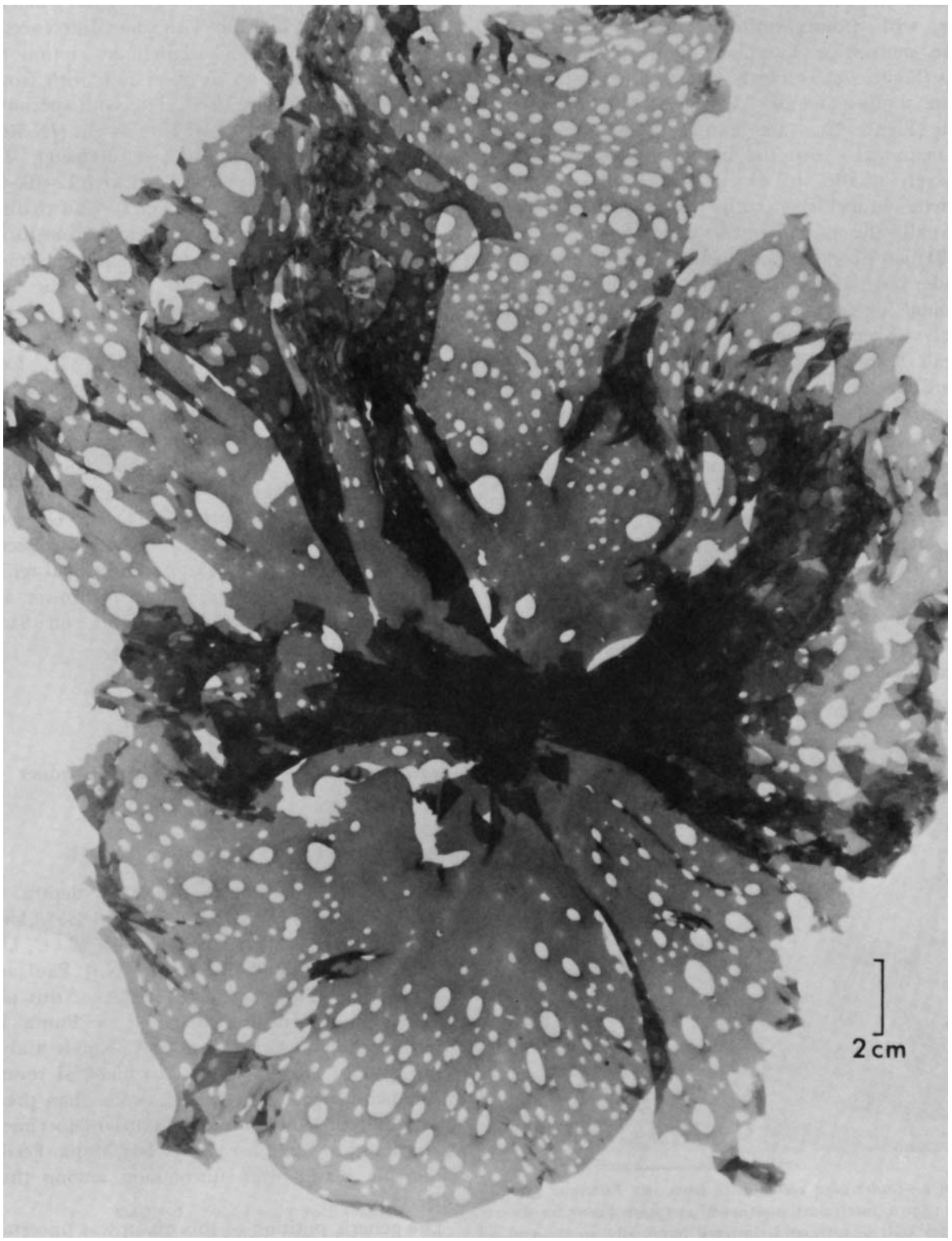

FIGURE 9.—Tetrasporangial plant of *Kallymenia pertusa* from Isla Mejía (JN-5667).

by R. E. Norris and J. N. Norris (1973) on the basis of cystocarpic material. Tetrasporic plants were found among the recent collections (JN-5667⊕). The tetrasporangia are cruciately divided, 24–30 μm long and 16–22 μm wide, embedded within the cortex and scattered over the thallus surface. Spermatangial plants were also found. One or two spermatangia, 2.5–5.0 μm diameter, are developed from each small outer cortical cell (JN-5667♂) (R. E. Norris, pers. comm.).

Though sporadic in distribution, the species can be abundant where found. It was particularly common at 20–23 m depths off Isla Mejía and Roca Blanca, Puerto Refugio, Isla Angel de la Guarda. Field observations suggest that the plant develops subtidally, attached to rocks and large pieces of shell. Large plants can become abraded and detached, possibly due to grazing or prevailing currents. The drifting plants and fragments become entangled with other algae, often at shallower levels (5–15m), and appear to continue to grow there. Such entangled specimens were found at 6.1–9 m depth, off Punta La Gringa, Bahía de Los Angeles, 28 Apr 1974, JN-5449 (US), (leg. JN and KB) and off the southeast end of Isla San Esteban, 6.1–9 m depths, 25 Apr 1974, JN-5727 (US) and JN-5538 (WTU, ARIZ, UC, US), (both leg. JN).

Pugetia mexicana Dawson

FIGURE 10

Pugetia mexicana Dawson, 1966b:62.

This species was previously known only from a few collections (Dawson, 1966b; J. Norris, 1972). Numerous richly developed specimens, however, were collected during the cruise. Whereas Dawson's material was 4–6 cm in height, our specimens measured as much as 20 cm tall and 35 cm wide. The branching pattern of both is similar. The blades are deeply divided and subdichotomous to irregularly lobed in the upper portions; the apices are round. R. E. Norris (pers. comm.) has found the

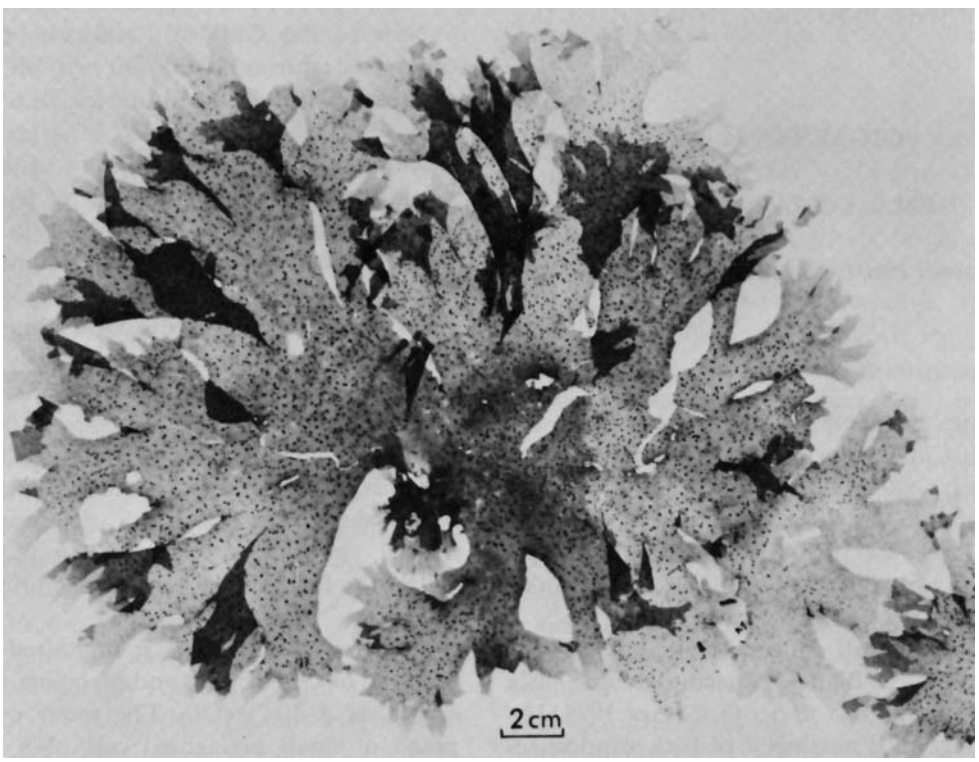

FIGURE 10.—An exceptionally large cystocarpic specimen of *Pugetia mexicana* from Isla Mejía (JN-5672).

female reproductive systems of both sized plants to be the same. Until more studies can be made on fresh material, it seems best to regard large and small specimens as conspecific.

The collections at Isla Mejía (lat. 29°33′35″, long. 113°34′52″), 15.1–22.7 m depth, 23 Apr 1974, JN-5668 (MEXU, ARIZ, WTU, US, UC) and JN-5672 (WTU, US, MEXU, ARIZ, GMS, AHFH), (leg. JN) extend the known distribution northward from Isla San Lorenzo del Sur (Dawson, 1966b).

This species was also collected from the following cruise localities: off the west side of Roca Blanca, Puerto Refugio, 9–22 m depth, 21 Apr 1974, JN-5281 (US) and JN-5303 (AHFH), (leg. JN, J. Paul, and K. Robertson); off small islet, Puerto Refugio, 21 Apr 1974, JN-5362 (US, UC), (leg. JN); northwest of rock window on shore, Puerto Refugio, 22 Apr 1974, JN-5816 (US, UC), (leg. JN and KB); south end of Isla Estanque, 1–10.6 m depth, 27 Apr 1974, JN-5500 (US), (leg. JN and KB); Punta La Gringa, Bahía de Los Angeles, 1–7.6 m depth, 28 Apr 1974, JN-5427 (US, UC, AHFH), (leg. JN and KB); southeast end of Isla San Esteban, 4.5 m depth, 26 Apr 1974, JN-5516 (US) and JN-5517 (UC), (leg. KB).

GIGARTINALES

NEMASTOMATACEAE

Predaea masonii (Setchell and Gardner) De Toni f.

FIGURE 6*c*

Predaea masonii (Setchell and Gardner) De Toni f., 1936:[5].

The species was previously known from the southern Gulf of California (Dawson, 1961a). Material recently collected from the north side of Puerto Calamajue (lat. 29°42′12″, long. 114°10′00″), 10 m depth, 28 Mar 1973, JN-4699 (US), (leg. JN and KB) now adds this alga to the northern Gulf's flora.

Other northern Gulf collections include: off the west side of Roca Blanca, Puerto Refugio, Isla Angel de la Guarda, 22.7 m depth, 21 Apr 1974, JN-5295 (US), (leg. JN); northwest of rock window on shore, Puerto Refugio, 9 m depth, 21 Apr 1974, JN-5300 (US), JN-5335 (UC), JN-5347 (GMS), (leg. JN) and epiphytic on worm tube, JN-5308 (US), (leg. JN and KB); south end of Isla Estanque, 10.6 m depth, 27 Apr 1974, JN-5607 (US), JN-5509 (US), JN-5510 (US) and JN-5511 (US), (leg. JN and KB); Islas de los Gemelos, Bahía de Los Angeles, 21 May 1972, JN-3006a (US, NCU), (leg. JN and G. Boehlert).

Though we have not seen the type specimen (from Isla Clarión, Revilla Gigedo Archipiélago), Setchell and Gardner described *Clarionea masonii* as a "single rather shapeless mass of jelly" (1930: 175). A few of our specimens resemble this form, however, the majority are lobed, similar to those of Dawson (1961a). Most of the present material differs from those previously described by Dawson (1961a) in being deeply divided (Figure 6*c*).

SEBDENIACEAE

Sebdenia polydactyla (Boergesen) Balakrishnan

FIGURES 11*a–c*, 12*a–c*

Sebdenia polydactyla (Boergesen) Balakrishnan, 1960:89.

New to the Gulf of California, this alga was discovered during scuba surveys off Islas de los Gemelos, Bahía de Los Angeles, 24.6 m depth, 21 May 1972, JN-3007 (US, NCU), (leg. JN and G. Boehlert). This is the first record of the occurrence of this genus on the west coast of North America.

Plants from the Gulf of California are subcylindrical, dichotomously branched fronds, to 21 cm tall. They are rose-red to dark purple-red in color, elastic and tough in texture. Branching is repeatedly dichotomous (or sometimes irregularly dichotomous in older, grazed or damaged fronds); small marginal proliferations are rarely present. The first frond division is 2.5–4.0 cm above a 2–4 mm broad discoid holdfast. Branch intervals between successive dichotomies vary from 1.3 to 3.5 cm; branch width is 0.5–1.1 cm, but occasionally 1.6 (2.3) cm broad below the forks. Branch apices are blunt or broadly rounded.

Internally the thallus is organized into a wide medulla of stellate cells and filaments, and a narrow cortex of 4–5(–7) cells. The outer cortex is composed of small pigmented cells, 3–6 μm diameter and 3.0–12.5 μm long. These grade into the larger and more loosely arranged subcortical cells, 20–30 μm diameter. In the outer medulla the stellate cells

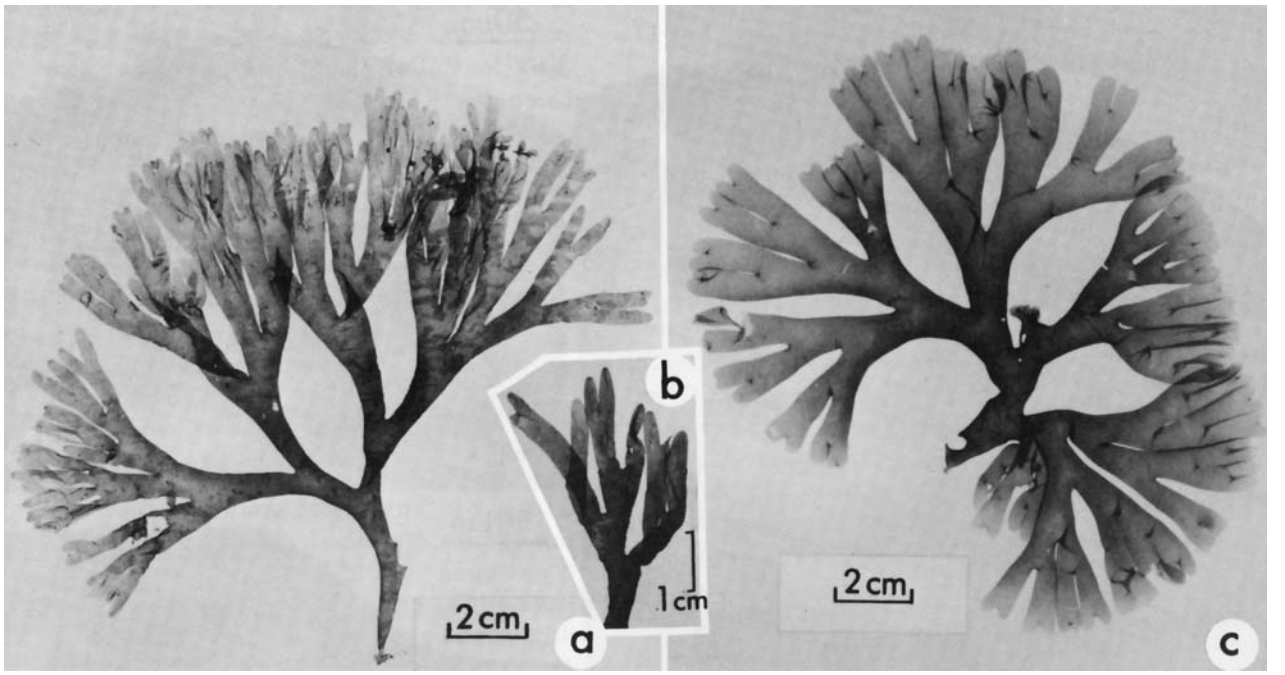

FIGURE 11.—*Sebdenia polydactyla* showing different growth forms: *a*, from Isla la Ventana, Bahía de Los Angeles (JN-4430⊕) rose-red in color with blunt apices; *b*, portion of a cystocarpic plant (JN-4430♀); *c*, collected at Isla Mejía (JN-5671) dark purple-red in color with broadly rounded apices.

are closely placed and markedly ganglioid. The center of these cells is 12–23 μm diameter, with short rays to 30 μm long. Toward the inner medulla the stellate cells are more loosely arranged, the center 18–40 μm diameter, and the rays becoming progressively longer, 130–180(–300) μm in length and 5–20 μm diameter. Filaments, 3–10 μm diameter, are irregularly placed throughout the medulla. Densely staining "gland cells", 5–12.5 μm diameter, 7.5–20 μm long, are occasionally present on the center and rays of the stellate cells, as well as the filaments.

Tetrasporangia are cruciately divided, spherical to vertically elongated, (13–)18 μm wide, 20(–31) μm long, and borne in the cortex.

Dioecious in the Gulf of California, cystocarpic plants were collected at 7.6–18 m depth, Isla la Ventana, Bahía de Los Angeles, 27 Jul 1973, JN-4430♀ (GMS, US, UC), (leg. JN, M. Helvey and H. Sleeper). Cystocarps are scattered over the middle portions of the thallus. They are 180–310 μm in diameter and immersed within the cortex. The ostiole is slightly projecting beyond the thallus surface, but is not always readily visible in dried material. In transection, cystocarps (Figure 12*b*,*c*) are enclosed by vertical rows of from 5 to 7 cortical cells; the basal portion shows large, dense, irregularly shaped cells, staining deeply with aniline blue. These appear to be fusion cells.

Sebdenia polydactyla is known from widespread geographical areas. Described originally as *Halymenia polydactyla* (Boergesen, 1932) from India, it is also reported under this name in Japan (Yamada, 1938; Segawa, 1968) and more recently from North Carolina, (Schneider and Searles, 1975). In his studies of monoecious material from the type-locality Balakrishnan (1960, 1961) concluded that *H. polydactyla* should be placed in *Sebdenia*. The major difference between *Sebdenia* (Gigartinales) and *Halymenia* (Cryptonemiales) is found in the female reproductive system. Ampullae present in *Halymenia* are lacking in *Sebdenia*. Other important differences in *Sebdenia* include the development of the outer cortical cells into an arched wall above the cystocarp, and the presence below of nutritive tissue (dense fusion cells) (Balakrishnan,

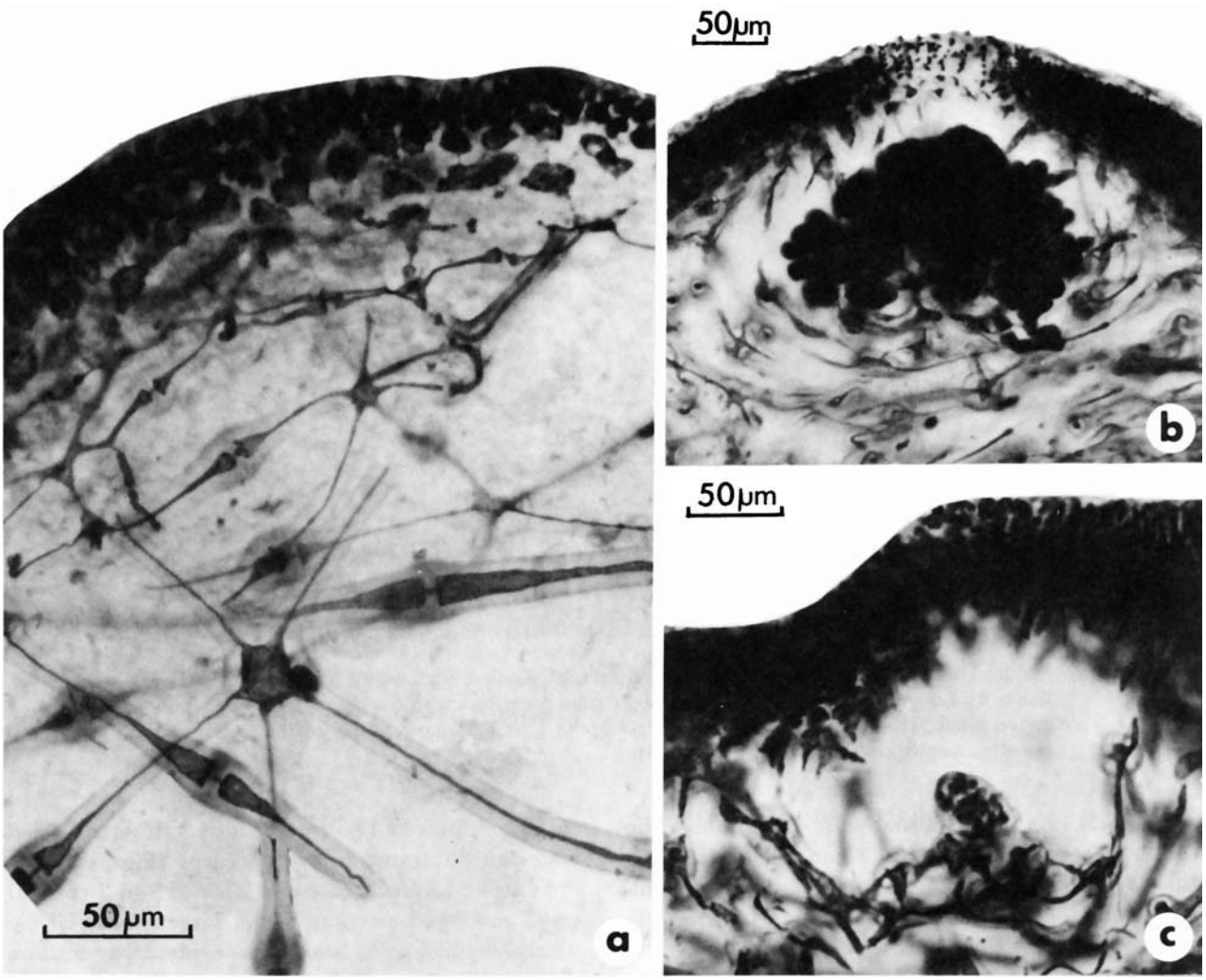

FIGURE 12.—Transections of *Sebdenia polydactyla: a,* through the cortical and medullary layers, showing the deeply stained "gland cell" on the large stellate cell of the inner medulla (JN-3398⊕); *b,* through a mature cystocarp with ostiole, showing the arched wall composed of anticlinal rows of cortical cells (JN-4430♀); *c,* through a developing cystocarp, showing the densely stained basal fusion (nutritive) cells (JN-4430♀).

1961). These features are found in *H. polydactyla* and on this basis Balakrishnan (1960) transferred it to the genus *Sebdenia* in the Sebdeniaceae Kylin (1932; 1956).

Sebdenia polydactyla is externally similar to *Halymenia agardhii* De Toni (1905). It differs vegetatively by the presence of "gland cells" and by its more rigid texture (Boergesen, 1932:123; Balakrishnan, 1961). Balakrishnan (1961:205) has suggested that the dense "gland cells" of Boergesen are rhizoid initials. The stellate cells (Figure 12*a*) of *S. polydactyla* are larger, more numerous, and coarser, creating a denser medulla than those of *H. agardhii.*

In other geographic areas color differences have been considered useful in distinguishing the vegetatively similar *H. agardhii,* rose in color, from *S. polydactyla* (=*H. polydactyla*), a darker purple-red (Boergesen, 1932; Segawa, 1968; Srinivasan, 1969; Schneider and Searles, 1975). However, our

specimens of *S. polydactyla* varied from a light rose-red to a deep purple-red; hence, color differences seem of little value in the Gulf of California. Schneider and Searles (1975) have noted what may be another useful characteristic for distinguishing between these two. In their North Carolina collections the manner of branching was effective in separating these species. *Halymenia agardhii* branched in more than one plane while they did not observe this in *S. polydactyla* (as *H. polydactyla*).

Since these two species, *S. polydactyla* and *H. agardhii,* are close in appearance, re-examination of the latter record from the Pacific coast seemed in order. *Halymenia agardhii* (Taylor, 1945; Dawson, 1954) from Isla María Magdalena, of Las Islas Tres Marias, off Nayarit, Mexico (W. R. Taylor 39–646a, (US)), dredged from 21.5 m depth on 9 May 1939, was found to be the same as the Gulf material and on the basis of its dense medulla with large stellate cells and "gland cells" we referred it to *Sebdenia polydactyla.* Material from Isla Asunción, Pacific Baja California, 8–12 m depth, Dawson 20389 (US), (leg. M. Neushul), 25 Aug 1957, having similar anatomy, is also now referred to *S. polydactyla.*

This species has been collected throughout the Gulf of California, from Punta Pinto, vicinity of Puerto Peñasco (lat. 31°20′00″, long. 113°40′04″), 9 m depth, 17 Mar 1974, JN-5032 (US), (leg. JN, KB and D. Moore) to Caleta Santa María, northeast of Cabo San Lucas (lat. 23°04′36″, long. 109°36′40″), 9 m depth, 11 Aug 1972, JN-3398 (US, UC), (leg. D. Lindquist).

Additional collections include: Las Islas de la Cintura: 15.3–23.0 m depth, off east end of Isla Mejía, 23 Apr 1974, JN-5671 (US, UC, ARIZ), (leg. JN); 10.7 m depth, off south end of Isla Estanque, 27 Apr 1974, JN-5490 (US), (leg. JN and KB); 3–7.6 m depth, off southeast end of Isla San Esteban, 25 Apr 1974, JN-5550 (US, AHFH), (leg. JN).

Presently the known range of *S. polydactyla* on the West coast of North America is from central Pacific Baja California to Nayarit, Pacific Mexico, and throughout the Gulf of California. *Halymenia agardhii* is, for now, excluded from the flora of this area.

GRACILARIACEAE

Gracilaria tepocensis (Dawson) Dawson

Gracilaria tepocensis (Dawson) Dawson, 1961a:211.

Gulf collections of this species have been known only from dredged material (Dawson, 1944; 1961a), from Bahía Tepoca and Isla Estanque. A third collection has been reported from Agiabampo, Sonora (Dawson, 1966b). Total distribution includes Costa Rica (Dawson, 1961a) and Peru (Acleto, 1973). The species is now recorded for the first time from Las Islas de la Cintura.

Our diving surveys have revealed additional specimens and habitat information: Puerto Refugio, Isla Angel de la Guarda off small islet 4.5–10.7 m depth, JN-5356 (US), and NW of the rock window on shore, 6–9 m depth, JN–5336a (US, UC, ARIZ, AHFH), both 21 Apr 1974 (leg. JN and KB); and from the south end of Isla Estanque, shallow subtidal to 9 m depth, 27 Apr 1974, JN-5605 (US, UC), (leg. JN and KB). Our field observations make Dawson's (1961a) dredged depth of 372 ft (114 m) a dubious habitat for attached intact plants.

The recent specimens agree with Dawson's description (1961a), but they are larger in size. His plants were 5–13 cm tall, mostly 2–3 mm wide, and branched at remote intervals of up to 4.5 cm apart. Present collections (JN-5336a) are up to 25.5 cm tall, mostly 2–3 mm wide, but up to 5.5 mm wide, and branched at intervals of up to 6 cm.

GIGARTINACEAE

Rhodoglossum hancockii Dawson

FIGURE 13

Rhodoglossum hancockii Dawson, 1944:304.

The second known collection from the type-locality, Isla San Esteban, was made at a 3–7.6 m depth, 25 Apr 1974, JN-5563 ♀ (US), (leg. JN). This material closely resembles the type collection of Dawson (1944, pl. 71: fig. 1; 1961a). *Rhodoglossum* is a genus more commonly associated with temperate seas, and, in the Gulf, *R. hancockii* is apparently restricted to the cooler waters of Las Islas de la Cintura.

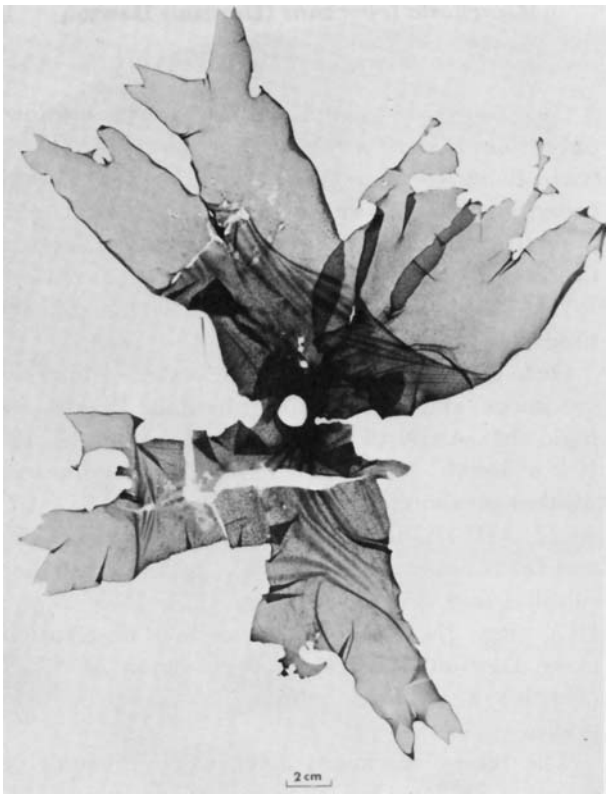

FIGURE 13.—*Rhodoglossum hancockii*: Cystocarpic thallus from the type-locality, Isla San Esteban (JN-5563).

Another specimen from Isla San Pedro Nolasco was referred to this species by Dawson (1959). Our examination of this plant (Dawson 18553 (US), 25 Apr 1958) has led us to conclude it is not *R. hancockii*. It appears to be closely related to the *R. affine* (Harvey) Kylin (1928) complex of the Pacific coast (see Dawson, 1961a; Smith, 1969). The San Pedro Nolasco specimen differs from *R. hancockii* by its small size, 4–5 cm tall, and narrow straplike fronds, (1–)2–3(–5) mm wide, which have subacute to blunt tips. New Gulf material is in close agreement with *R. hancockii*, a species with broadly expanded blades arising from a very short stipe, to 20 cm tall and 5–8(12) cm wide, having dichotomous divisions that narrow in the uppermost portions to acute tips. An additional collection is recorded from the south side of Isla Patos (Dawson, 1949).

RHODYMENIALES

RHODYMENIACEAE

Botryocladia hancockii Dawson

FIGURE 6*b*

Botryocladia hancockii Dawson, 1944:305.

Originally described from Bahía Agua Verde, in the southern Gulf of California (Dawson, 1944), two additional collections from Bahía Salinas, Isla Carmen and Punta Frailes, both in the southern Gulf, were later reported by Dawson (1963a). The known distribution may now be extended northward to Isla Mejía, Puerto Refugio, Isla Angel de la Guarda (lat. 29°33′35″, long. 113°34′52″), 18.4 m depth, 23 Apr 1974, JN-5685 ♀ (US, AHFH, ARIZ), (leg. JN). Other specimens were found at the south end of Isla Estanque, 10.7 m depth, 27 Apr 1974, JN-5600 (US, UC), (leg. JN), and Isla Espíritu Santo, 8 Mar 1974, (♀; GMS), (leg. Rafael Guerrero, I. A. Abbott, pers. comm.).

First described as up to 3.4 cm high (Dawson, 1944), the size of this species was enlarged to 5 cm or more on additional specimens (Dawson, 1963a). Both plants, JN-5685 and JN-5600, are larger than earlier collections, 15 cm (profusely speckled with cystocarps) and 12 cm, respectively. This is an extraordinary species of *Botryocladia*, bearing the largest recorded vesicles in the genus (Figure 6*b*).

CERAMIALES

CERAMIACEAE

Platythamnion pectinatum Kylin

Platythamnion pectinatum Kylin, 1925:53.

Several collections of this alga represent a northward extension of the known range from Isla San Lorenzo del Norte (Dawson, 1966b). Specimens were collected from the following cruise localities: off the east end of Isla Mejía, Puerto Refugio, Isla Angel de la Guarda (lat. 29°33′35″, long. 113°34′52″), 15.3–23 m depth, 23 Apr 1974, JN-5697 (US) and JN-5698 (US), (leg. JN); off the west side of Roca Blanca, Puerto Refugio, Isla Angel de la Guarda, 23 m depth entangled with *Sporochnus*,

21 Apr 1974, JN-5263 (US), (leg. JN), and JN-5289 (US), epiphytic on *Dasya* (leg. JN); and off the south end of Isla Estanque, 10.7 m depth, 27 Apr 1974, JN-5522 (US), epiphytic on *Sebdenia polydactyla* (leg. JN and KB). One additional Gulf collection has been reported from Cabo San Lucas, Baja California del Sur (Dawson, 1962; Wollaston, 1972).

DASYACEAE

Dasya baillouviana var. *nudicaulis* (Dawson), new combination

Dasya pedicellata var. *nudicaulis* Dawson, 1963b:406, pl. 128: fig. 1; pl. 131: fig. 6.

Dixon and Irvine (1970) have shown that an earlier name for *Dasya pedicellata* (C. Agardh) C. Agardh (1824) is *D. baillouviana* (Gmelin) Montagne (1841). Accordingly new combinations are proposed for the two varieties of this species which occur in the Gulf of California.

This variety was originally recognized by Dawson (1963b) as differing from var. *stanfordiana* by its nearly barren axis and sparse determinate lateral branches (filaments). He suggested this might be a deep water modification. Dixon and Irvine (1970) noted *D. baillouviana,* known from the Mediterranean and Atlantic Coast of North America, varys markedly in appearance seasonally. In spring and early summer the axes are densely covered with determinate lateral filaments, and in the autumn these filaments drop leaving the axes naked. During our April diving we found the two Gulf varieties growing sympatrically, however, the Gulf plants could have similar seasonal variation of habit. It seems best to continue to recognize the two varieties within the Gulf until their seasonal variation has been studied.

R/V *Dolphin* specimens of this species generally agree with Dawson's description (1963b) differing only in a few dimensions. The determinate laterals are much longer, up to 960 μm (previously noted to 500 μm), and our plants can be taller, to 38 cm long, as compared to the 20 cm plants described by Dawson.

The material studied, representing a northern extension of known range, was collected at 15.3–21.5 m depths, off the west side of Roca Blanca, Puerto Refugio, Isla Angel de la Guarda (lat. 29°33′04″, long. 113°33′51″) 27 Apr 1974, JN-5800 (US), (leg. JN). Previously this alga was known from Bahía de Los Angeles and from Puerto Escondido in the southern Gulf (Dawson, 1963b).

Dasya baillouviana var. *stanfordiana* (Farlow), new combination

Dasya stanfordiana Farlow, 1902:94.
Dasya pedicellata var. *stanfordiana* (Farlow) Dawson, 1963b: 407, pl. 128: fig. 3; pl. 130 [including cited synonymy].

This alga has been known from numerous localities in the Gulf of California (Dawson, 1963b). Its known range is now expanded northward by a collection at Playa Hermosa, Puerto Peñasco (lat. 31°17′42″, long. 113°34′48″), epiphytic on *Galaxaura,* intertidal, 7 Sep 1972, JN-3492 (US), (leg. JN and KB) and southward by the collection at Caleta Santa María, NE. of Cabo San Lucas, Baja California del Sur (lat. 23°04′36″, long. 109°36′40″), epiphytic on *Digenia simplex,* 4.5–9 m depth, 11 Aug 1972, JN-3409b (US), (leg. D. Lindquist).

The R/V *Dolphin* specimens add these additional new localities: Punta La Gringa, Bahía de Los Angeles, 7.6 m depth, 28 Apr 1974, JN-5441 (US, UC), JN-5432 (UC, AHFH), and JN-5475 (US), (leg. JN, KB, J. Paul, and K. Robertson); east end of Isla Mejía, 15.3–21.5 m depth, 23 Apr 1974, JN-5673 (ARIZ, US), (leg. JN); and the south end of Isla Estanque, 10.7 m depth, 27 Apr 1974, JN-5503 (MEXU), and JN-5603 (US), (leg. JN and KB). (Dawson 1963 lists other localities.)

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