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and
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ABSTRACT

Meñez, Ernani G., and Hilconida P. Calumpong. The Genus *Caulerpa* from Central Visayas, Philippines. *Smithsonian Contributions to the Marine Sciences,* number 17, 21 pages, 2 figures, 3 plates, 1982.—This taxonomic study of *Caulerpa* shows 20 taxa occurring in Central Visayas, Philipines, including *Caulerpa reyesii*, new species. Of these, three are newly reported from the Philippines and seven taxa are new records from Central Visayas.

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Contents

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Introduction

During the summers of 1978 and 1979, Smithsonian Institution conducted biological collecting expeditions in Central Visayas, Philippines, in order to collect marine plant and animal organisms for purposes of systematic, ecological, and distributional studies. Included in the plant collection was a large number of *Caulerpa* species, which forms the basis of the present study, taken from different parts of this region.

Fifty-three taxa of *Caulerpa* have been previously reported from the Philippines. Of these, 14 occurred in Central Visayas. These were *Caulerpa brachypus*, *C. cupressoides*, *C. fastigiata*, *C. lentillifera*, *C. peltata*, *C. racemosa*, *C. racemosa* var. *laetevirens*, *C. racemosa* var. *macrophysa*, *C. serrulata*, *C. serrulata* var. *typica* f. *lata*, *C. sertularioides*, *C. taxifolia*, *C. urvilliana*, and *C. verticillata*. A few of these taxa were not found in our collections.

The principal collecting areas are in Central Visayas, in the middle of the Philippine Archipelago (Figure 1). The area consists of the islands of Negros, Cebu, Bohol, Siquijor, and their satellite islets. Except for the southwestern portion of Negros Island, which is exposed to a major body of water, the Sulu Sea, the rest of Central Visayas is sheltered. Because it is practically closed off by other surrounding islands, the greater portion of this area is uniquely protected from intense wave actions and currents, thus, Central Visayas may represent a major local phytogeographic boundary in the Philippines. In an unpublished thesis by Calumpong (1981), she recorded 216 taxa of benthic marine algae from Central Visayas. Of these, 50 taxa are newly reported from the Philippines.

The first detailed study on Philippine *Caulerpa* was by Gilbert (1942), who reported 10 taxa but only *Caulerpa serrulata* var. *typica* f. *lata* was recorded as occurring in Mactan and Cebu Islands, Central Visayas. Later, Taylor (1966) listed two varieties of *Caulerpa racemosa* from Cebu Island. However, the bulk of the work on algae from Central Visayas was done by Reyes (1972, 1976), who collected from the islands of Negros and Siquijor and described 11 taxa of *Caulerpa* from this region.

The purpose of this study is to identify the *Caulerpa* species occurring in Central Visayas, Philippines, and to provide a sound reference and a simple, workable key for the identification of these species. Twenty taxa are described, includ-

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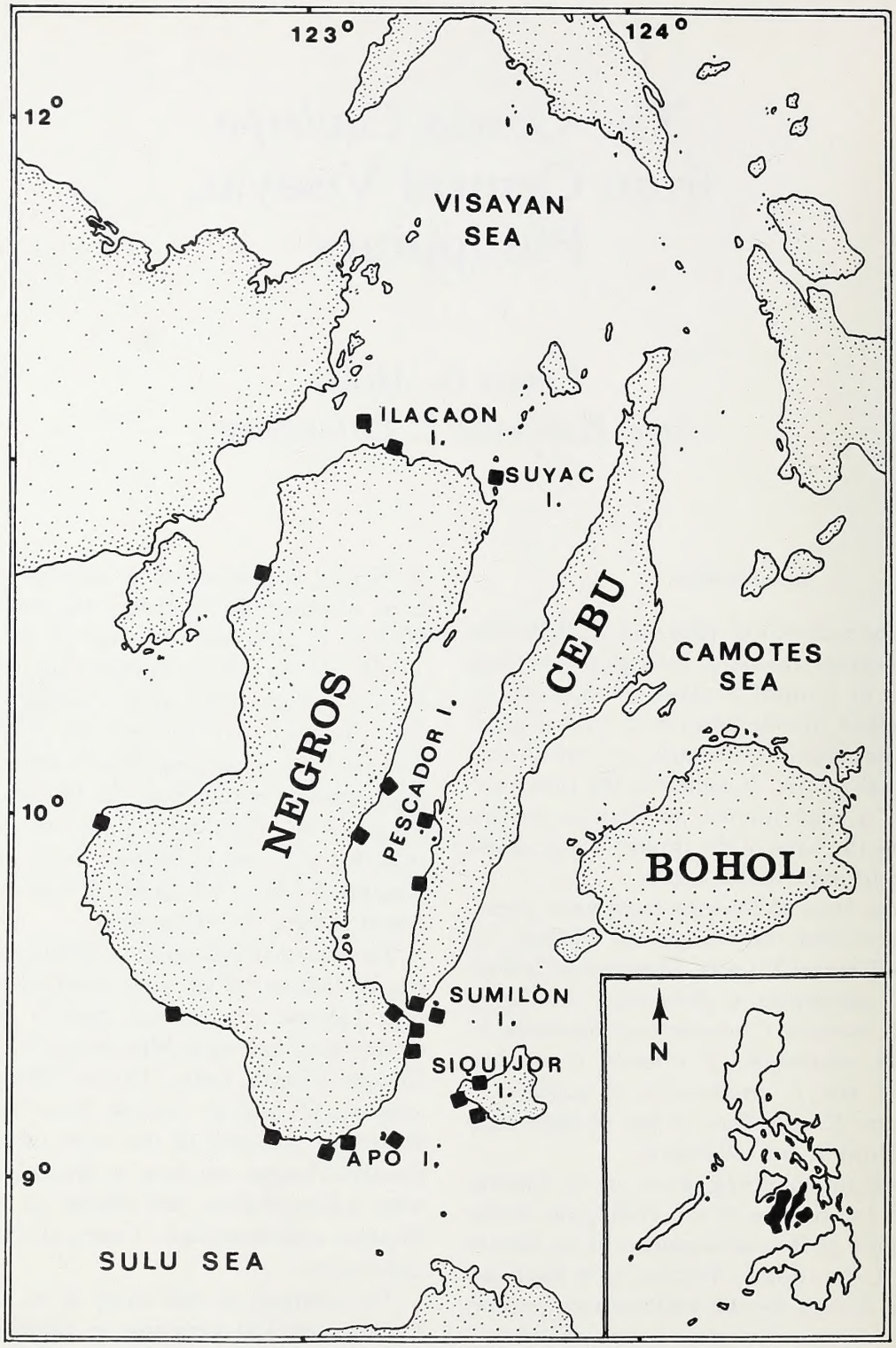

FIGURE 1.—Map of Central Visayas, Philippines; inset is general map of Philippines showing location of Central Visayas (black squares = collecting sites).

ing *Caulerpa reyesii*, new species. Of these, three are newly reported from the Philippines and seven taxa are new records from Central Visayas. The taxa new to the Philippines are designated with one asterisk (*) and those from Central Visayas are marked with two asterisks (**) in the systematic section. Basionyms and synonyms are included in the list. References pertinent to the study of *Caulerpa*, general collection data, and distribution records in the Philippines are included. Collector is designated as EM for E.G. Meñez. The numbers preceding the collector correspond to the year of collection. The collecting site number appears after the collector and this is followed by specimen numbers in parentheses. Specimens are being deposited in the U.S. National Herbarium, Smithsonian Institution, the Silliman University Herbarium in Dumaguete City, Philippines, and the Philippine National Herbarium in Manila, Philippines.

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We appreciate the help of Dr. Harold E. Robinson, Department of Botany, Smithsonian Institution, in the Latin description of *Caulerpa reyesii*, new species. We also wish to thank Dr. Paul C. Silva, Curator, University of California (Berkeley) Herbarium for the use of the Index Nominum Algarum card file and his assistance with problems of literature citations.

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The bulk of the material used for this study was provided by the Smithsonian Oceanographic Sorting Center. The material was collected during the 1978 and 1979 Smithsonian Institution marine biological expeditions to Central Visayas, Philippines. The expeditions were organized by the Smithsonian Oceanographic Sorting Center and supported by the Smithsonian Scholarly Studies Program and Dreyfuss Foundation.

Description of Collecting Sites

78 EM-1:Liloan Point, southern Cebu (9°25′15″N, 123°-18′10″E). Algae collected from seagrass bed and coral reef, 0.5–3.0 m, 8 May 1978.

78 EM-3: Paliton, San Juan, Siquijor Island (9°10′25″N, 123°28′15″E). Algae collected from an extensive seagrass bed and from a back reef with isolated clumps of corals, 0.2–6.5 m, 9 May 1978.

78 EM-5: Solong-on, Siquijor town, Siquijor Island (9°13′00″N, 123°27′30″E). Algae collected from seagrass bed, 0.5–3.0 m, 10 May 1978.

78 EM-7: Tambobo, Siaton, Negros Oriental (9°03′45″N, 123°07′33″E). Algae collected from isolated limestone rocks inside the bay, 1.5–3.0 m, 12 May 1978.

78 EM-9: Bantayan Beach, Dumaguete City, Negros Oriental (9°22′30″N, 123°15′45″E). Algae collected from isolated rocks and seagrasses, 1.0–2.0 m, 15 May 1978.

78 EM-10: Lag-it, Okiot, Bais, Negros Oriental (9°35′46″N, 123°09′24″E). Algae collected from seagrass beds and corals, 1.0–2.0 m, 17 May 1978.

78 EM-22: Linaon, about 8 km south of Sojoton Point, Negros Occidental (9°57′06″N, 122°26′24″E). Algae collected from seagrass bed, dead staghorn corals and isolated limestone rocks, 0.5–5.0 m, 28 May 1978.

78 EM-23: Actin, Basay, Negros Oriental (9°25′00″N, 122°36′12″E). Algae collected from *Sargassum* bed, rocks and stony corals, 0.5–5.0 m, 29 May 1978.

78 EM-24: Cabcab, Zamboanguita, Negros Oriental (9°05′30″N, 123°11′15″E). Algae collected from seagrass bed and back reef, 0.2–5.0 m, 2 June 1978.

78 EM-25: Banilad, Dumaguete City, Negros Oriental (9°16′45″N, 123°18′15″E). Algae collected from isolated rocks, seagrass bed and back reef, 0.5–5.0 m, 3 June 1978.

78 EM-26: Tapon-Norte, San Jose, Negros Oriental

(9°25′00″N, 123°14′15″E). Algae collected from rocky outcrops, seagrass bed and corals, 0.5–4.0 m, 5 June 1978.

78 EM-27: Suyac Island, off old town of Sagay, Negros Occidental (10°57′15″N, 123°27′00″E). Algae collected from coral rubbles, 0.3–6.0 m, 8 June 1978.

78 EM-28: Rocky area between Ilacaon Island and Cadiz, Negros Occidental (11°00′45″N, 123°15′52″E). Algae collected from rocks, 2.0 m, 9 June 1978.

78 EM-29: Ilacaon Island, Negros Occidental (11°02′22″N, 123°12′00″E). The substrate consists of rocks, corals and seagrass, 0.3–6.0 m, 9 June 1978.

78 EM-30: Sumilon Island (9°27′00″N, 123°23′24″E). Algae collected from limestone rocks and corals, 0.3–6.0 m, 15 June 1978.

78 EM-31: Ayungon, Negros Oriental (9°50′30″N, 123°-08′30″E). Rocky platform, seagrass and coral rubbles, 0.3–3.0 m, 17 June 1978.

78 EM-32: Apo Island (9°04′55″N, 123°16′30″E). Algae on limestone rocks and dead staghorn corals, 0.5–3.0 m, 22 June 1978.

78 EM-33: Apo Island, northern end (9°05′09″N, 123°-16′00″E). Rocks and stony corals provide excellent substrate for algae, 0.4–3.0 m, 23 June 1978.

78 EM-34: Apo Island, western end (9°04′40″N, 123°-16′00″E). Algae collected from limestone rocks and corals, 0.5–3.0 m, 23 June 1978.

78 EM-37: Bantayan Beach, Dumaguete City, Negros Oriental (9°22′30″N, 123°15′45″E). Seagrasses and corals provide good substrate for a rich algal flora, 1.0–2.0 m, 23 June 1978.

78 EM-39: Calindagan Reef, off Dumaguete City, Negros Oriental (9°21′00″N, 123°16′00″E). Algae collected by local diver using SCUBA, 26 m, 6 June 1978.

78 EM-40: Bacolod City, Negros Occidental (10°41′15″N, 122°56′45″E). Algae collected nearshore from sand substrate, 8 June 1978.

79 EM-8: Pescador Island, Moalboal, Cebu (9°55′30″N, 123°20′36″E). Few algae collected from crevices on rocks and corals, 0.3–4.5 m, 7 May 1979.

79 EM-9: Pinagsamahan Beach, Moalboal, Cebu (9°-56′12″N, 123°23′25″E). Algae abundant in seagrass bed and corals, 1.0–4.5 m, 8 May 1979.

79 EM-11: Northern end of Apo Island, Dauin, Negros Oriental (9°05′20″N, 123°16′10″E). Fore-reef slope with few algae, 12.0–36.5 m, 10 May 1979.

79 EM-12: Northwestern portion of Apo Island, Dauin, Negros Oriental (9°04′45″N, 123°16′00″E). Algae sparse on rocks and rubbles, 0.5–1.5 m, 10 May 1979.

79 EM-13: Southern end of Apo Island, Dauin, Negros Oriental (9°04′10″N, 123°16′00″E). Algae collected from rocks exposed to heavy surf, 0.3–3.5 m, 11 May 1979.

79 EM-14: Southeastern portion of Apo Island, Dauin, Negros Oriental (9°04′30″N, 123°16′15″E). Algae collected from staghorn corals, 0.6–4.5 m, 11 May 1979.

79 EM-15: Malo, Siaton, Negros Oriental (9°03′00″N, 122°59′00″E). Algae attached to rocks at 3.0 m, 14 May 1979.

79 EM-16: Polopantao, Jimalalud, Negros Oriental (9°-59′00″N, 123°12′06″E). Algae attached to rocks and corals near river mouth, 1.0–3.0 m, 15 May 1979.

79 EM-18: Barrio Dumanhog, northwestern side of Siquijor Island (9°12′57″N, 123°30′14″E). Algae depauperate in seagrass bed and rubbles, 4.5 m, 14 May 1979.

79 EM-21: Barrio Dapdap, northwestern side of Siquijor Island (9°13′21″N, 123°29′05″E). Few algae collected from rocks, 4.5 m, 15 May 1979.

79 EM-22: Barrio Cang-aluang, northwestern side of Siquijor Island (9°13′24″N, 123°28′48″E). Algae collected from coral reef, 4.5 m, 15 May 1979.

79 EM-23: Barrio Sabang, Larena, northwestern side of Siquijor Island (9°14′27″N, 123°34′00″E). Algae collected from coral reef, 4.5 m, 16 May 1979.

Class CHLOROPHYCEAE

Family CAULERPACEAE

Genus *Caulerpa*

Caulerpa Lamouroux, 1809a:136

Thallus a branched coenocyte, differentiated into a cylindrical, prostrate, creeping stolon and erect assimilative branches; attached by branched rhizoids; erect branches simple or branched, usually bearing terete, flat or compressed branchlets. Thallus internally traversed by extensions (trabeculae) of the cell wall. Reproduction sexual or asexual (anisogamous), when sexual, biflagellated gametes are liberated through branch papillae. Plants are widely distributed in tropical and subtropical seas.

Key to Species of *Caulerpa* from Central Visayas

1. Erect branches angular, with thorn-like or dentate projections, stolons naked ..... ***C. urvilliana***
   Erect branches not angular, stolons naked or tomentose 2

2. Stolons and branches similar in form 3
   Stolons and branches dissimilar in form 4
3. Erect branches bearing verticillate branchlets ..... ***C. verticillata***
   Erect branches without verticillate branchlets ..... ***C. fastigiata***
4. Erect branches flat or compressed 5
   Erect branches not flat or compressed 10
5. Ramelli present 6
   Ramelli absent 9
6. Ramelli cylindrical 7
   Ramelli flat or compressed 8
7. Plants small, to 15 mm tall, branches substipitate, bearing pinnules to 1.5 mm long ..... ***C. arenicola***
   Plants moderately large, to 60 mm tall, branches long-stalked, bearing pinnules to 8 mm long ..... ***C. sertularioides***
8. Branchlets oppositely-pinnate; stolons 200 μm in diameter ..... ***C. crassifolia***
   Branchlets tetrastichous, distichous; stolons 1–2 mm in diameter ..... ***C. reyesii***, new species
9. Branches dichotomous, margins regularly serrate ..... ***C. serrulata***
   Branches proliferous, margins irregularly serrate ..... ***C. brachypus***
10. Stolon tomentose ..... ***C. webbiana***
    Stolon naked 11
11. Ramelli seminaviculate, in several ranks ..... ***C. cupressoides***
    Ramelli clavate or abruptly ending in swollen tips 12
12. Ramelli thick-walled, not translucent ..... ***C. racemosa***
    Ramelli thin-walled, translucent 13
13. Ramelli many, imbricate or in 4-rows; branches long and near each other ..... ***C. lentillifera***
    Ramelli few; branches short, distantly spaced ..... ***C. microphysa***

* *Caulerpa arenicola* Taylor

Plate 1h

Caulerpa arenicola Taylor, 1950:55, 204, pl. 28: fig. 2.

Description.—Plants small, forming loose mats on sand, to 15 mm tall; the creeping stolon branched, terete, to 0.5 mm in diameter, bearing very short, slender, few descending branches with filiform rhizoids at the ends; the substipitate, erect foliar branches simple or forked once or twice, with terete rachis, to 300 μm in diameter, bearing oppositely-pinnate, cylindrical, filiform pinnules, 250–300 μm in diameter, to 1.5 mm long, slightly upcurved to straight, distal end conical, apiculate with basal end somewhat narrower; the foliar branches of even margin, or interrupted occasionally by shorter pinnules.

Specimens Studied.—78 EM-9(126–130, 178); 78 EM-25(7); 79 EM-16(50).

Philippine Distribution.—Visayas (Siquijor, Negros Oriental).

Caulerpa brachypus Harvey

Plate 1i

Caulerpa brachypus Harvey, 1860:333.—Gilbert, 1961:435.—Domantay, 1962:279.—Taylor, 1966:350; 1977:4.—Trono, 1972:95; 1973:217.—Cordero, 1974:6; 1977:25, figs. 2, 3.—Reyes, 1976:153, pl. 7: fig. 4.

Description.—Plants of moderate size, form-

ing dense, long and spreading mats on sand-mud substrate among seagrasses, to 50 mm tall; the prostrate, sparingly branched, terete stolon to 1 mm in diameter, with few descending branches bearing filiform rhizoids at the ends; the substipitate, erect foliar branches proliferous occasionally, ligulate, 5–40 mm long, 2–4 mm wide, with serrate margins or almost entire in a few specimens, irregularly disposed, 2–15 mm distance apart on upper side of stolon.

Specimens Studied.—78 EM-5(29–33, 298–316); 79 EM-22(1, 2).

Philippine Distribution.—Luzon (Pangasinan); Visayas (Siquijor, Negros Oriental, Negros Occidental); Mindanao (Zamboanga, Basilan, Sulu).

** *Caulerpa crassifolia* (C. Agardh) J. Agardh

Plate 1D,E

Caulerpa taxifolia var. *crassifolia* C. Agardh, 1823:436.
Caulerpa crassifolia (C. Agardh) J. Agardh, 1873:13.—Gilbert, 1942:12; 1946:78; 1961:436.—Meñez, 1961:53.

Description.—Plants forming loose clusters on sand, at 10 m, to 43 mm tall; the creeping stolon terete, slender, no more than 200 μm in diameter, bearing descending branches with filiform, laxly branched rhizoids at the ends; the stipitate, erect foliar branches simple, with compressed rachis, 1–1.5 mm wide, bearing oppositely-pinnate, flat to compressed ramelli, 0.5–1 mm wide, 1.5–3.5 mm long, almost with an even width, except for slight attenuation near the rounded tip, longer ramelli slightly curved; ramelli at mid-portion of foliar branch longer than basal and distal portions; foliar branches very few, distantly spaced on upper side of prostrate stolon, with stipes rarely exceeding 5 mm in length.

Specimens Studied.—HPC-6 (material collected by H.P. Calumpong).

Philippine Distribution.—Luzon (Pangasinan); Visayas (Negros Oriental).

Remarks.—Specimens were collected from sandy bottom, 10 m deep, from Ajong, Sibulan, Negros Oriental on 12 November 1979. Plants examined are smaller compared to those described by Gilbert (1942:12) from West Java.

Caulerpa cupressoides (West in Vahl) C. Agardh

Plate 1B,C

Fucus cupressoides West in Vahl, 1802:38.
Caulerpa cupressoides (West in Vahl) C. Agardh, 1823:441.—Reyes, 1972:142; 1976:155, pl. 8: fig. 7.

Description.—Plants of moderate size, forming loose mats on rocks and seagrasses, to 60 mm tall; the creeping, terete, naked, sparingly branched stolon to 2 mm in diameter, bearing descending branches with thick, branched, filiform rhizoids at the ends; the stipitate, erect, foliar branches simple or branched, with terete or slightly compressed rachis, to 1.5 mm in diameter in larger plants, bearing multiseriate or occasionally pinnate, upcurved, compressed, seminaviculate, ovoid, conical, sometines linear branchlets, to 2 mm long, not exceeding 0.5 mm at the widest portion, with cuspidate or mucronate tips.

Specimens Studied.—78 EM-3(62–65); 78 EM-5(243–245); 78 EM-9(131, 179, 243); 78 EM-18(75–79);78 EM-25(8–11).

Philippine Distribution.—Visayas (Negros Oriental, Siquijor).

Caulerpa fastigiata Montagne

Plate 1A

Caulerpa fastigiata Montagne, 1837:353.—Gilbert, 1942:9; 1961:436.—Reyes, 1976:154, pl. 8: figs. 1, 2.

Description.—Plants filiform, forming thick mats on rocks and sand, to 30 mm tall; the terete, creeping stolon to 300 μm in diameter, with laxly branched, filiform rhizoids borne at the ends of descending filaments; the ascending filaments morphologically similar to stolons, with subopposite, alternate, dichotomous or occasionally subverticillate branches, to 1 mm long, 150–225 μm in diameter, with obtuse or rounded apices.

Specimens Studied.—78 EM-5(215–225); 78

EM-27(29A); 78 EM-31(25); 78 EM-34(643); 78 EM-37(16).

PHILIPPINE DISTRIBUTION.—Luzon (Oriental Mindoro); Visayas (Negros Oriental, Siquijor, Suyac, Apo); Mindanao (Zamboanga, Basilan).

Caulerpa lentillifera J. Agardh

PLATE 1F,G

Caulerpa lentillifera J. Agardh, 1837:173.—Gilbert, 1942:23, 1961:436.—Domantay, 1962:277.—Trono, 1972:96; 1973: 217; 1975:33; 1978:4.—Reyes, 1976:155, 162, pl. 8: fig. 6.—Trono and Tuazon, 1978:3.

DESCRIPTION.—Plants small, in loose mats on coral rubbles and rocks, to 30 mm tall; the terete stolon widespread, to 2 mm in diameter, bearing long, descending branches, to 20 mm long, with laxly branched, filiform rhizoids at the ends; the few, shortly stipitate, erect branches simple or subsimple, with terete rachis, 1–1.5 mm in diameter, bearing spherical translucent ramelli, to 1.5 mm in diameter, supported by stalks, 0.5–1.0 mm long; ramelli conspicuously constricted at the base, imbricately arranged or in rows of four.

SPECIMENS STUDIED.—78 EM-5(34, 227, 228); 79 EM-18(62, 63); 79 EM-23(12).

PHILIPPINE DISTRIBUTION.—Luzon (Oriental Mindoro, Pangasinan, Sorsogon, Catanduanes, Marinduque); Visayas (Negros Oriental, Siquijor); Mindanao (Zamboanga, Basilan, Sulu).

** *Caulerpa microphysa* (Weber-van Bosse) Feldmann

PLATE 2L

Caulerpa racemosa var. *clavifera* f. *microphysa* Weber-van Bosse, 1898:361, pl. 33: fig. 5.

Caulerpa microphysa (Weber-van Bosse) Feldmann, 1955: 430.—Taylor, 1966: 350.

DESCRIPTION.—Plants small, forming dense clusters on corals and rocks, to 15 mm tall; the prostrate, terete, naked stolon less than 1 mm in diameter, bearing descending branches with branched, filiform rhizoids at the ends; the ascending branches on the upper side of the stolon shortly stipitate, simple or occasionally branched, with terete rachis bearing crowded, spherical ramelli, 1–1.5 mm in diameter, supported by stalks, 0.5 mm long, constricted at the apical end.

SPECIMENS STUDIED.—78 EM-5(34A); 78 EM-33(545–547); 78 EM-30(10–12); 78 EM-34(137–139); 79 EM-8(10–15); 79 EM-11(11); 79 EM-12(7–9, 105–107); 79 EM-18(63–67); 79 EM-21(16,17); 79 EM-22(15–17).

PHILIPPINE DISTRIBUTION.—Visayas (Negros Oriental, Sumilon, Apo, Pescador, Siquijor); Mindanao (Zamboanga).

Caulerpa racemosa (Forsskål) J. Agardh

Fucus racemosus Forsskål, 1775:191.

Caulerpa racemosa (Forsskål) J. Agardh, 1873:35.—Gilbert, 1946:78.—Velasquez, 1953:100.—Meñez, 1961:51.—Taylor, 1966:350.—Reyes, 1972:142.—Trono, 1972:96; 1973: 218.—Velasquez, Cornejo, Santiago, and Baens-Arcega, 1973:14, pl. 4: fig. 20.—Trono, 1975:33; 1978:5.—Velasquez, Trono, and Doty, 1975:131.—Trono and Tuazon, 1978:3.—Cordero, 1978:280.

DESCRIPTION.—Plants highly variable, forming loose to dense, sometimes entangled colonies, consisting of few to many erect branches, simple or branched, bearing clavate, turbinate, spherical, hemispherical or discoid ramelli, which are stipitate or substipitate, having obtuse or flattened tips; ramelli distichously, multiseriately or imbricately arranged on terete rachis; creeping stolon terete, with short or long descending branches, giving off branched rhizoids at the ends.

** *Caulerpa racemosa* var. *clavifera* (Turner) Weber-van Bosse

PLATE 2A

Fucus clavifer Turner, 1808:126.

Caulerpa clavifera (Turner) C. Agardh, 1817:xxiii.—Dickie, 1877:244.—Howe, 1932:169.

Caulerpa racemosa var. *clavifera* (Turner) Weber-van Bosse, 1898:361.—Gilbert, 1946:78; 1961:437.—Galutira and Velasquez, 1964:496.

DESCRIPTION.—Plants up to 50 mm tall, with irregularly spaced erect branches, simple or oc-

casionally branched, bearing ramelli that are gradually expanded into a round end, to 2 mm in diameter; ramelli distichously or irregularly arranged on terete rachis.

Specimens Studied.—78 EM-32(53); 78 EM-33(548–552); 79 EM-12(13–18); 79 EM-23(11, 12).

Philippine Distribution.—Luzon (Batanes, Babuyan Island, La Union, Ilocos Norte, Pangasinan, Bataan, Batangas, Quezon, Oriental Mindoro); Visayas (Panay, Negros Oriental, Apo); Mindanao (Zamboanga, Misamis Oriental, Basilan, Sulu).

Caulerpa racemosa var. *macrophysa* (Kützing) Taylor

Plate 2c

Chauvinia macrophysa Kützing, 1857:6.
Caulerpa racemosa var. *macrophysa* (Kützing) Taylor, 1928: 101.—Gilbert, 1942:19; 1961:439.—Domantay, 1962: 277.—Taylor, 1966:351.

Description.—Plants large, to 100 mm tall; erect branches simple or occasionally branched, few and distantly spaced on stout, creeping stolon; branches bearing ramelli expanded into a hemispherical end and arranged irregularly on terete rachis.

Specimens Studied.—78 EM-5(1–23, 260–263, 270–297); 79 EM-18(68–71, 80, 81); 79 EM-21(6–11); 79 EM-22(64).

Philippine Distribution.—Luzon (Pangasinan, Oriental Mindoro); Visayas (Cebu, Negros Oriental, Siquijor); Mindanao (Basilan, Sulu).

** *Caulerpa racemosa* var. *occidentalis* (J. Agardh) Børgesen

Plate 2b

Caulerpa chemnitzia var. *occidentalis* J. Agardh, 1873:37.
Caulerpa racemosa var. *occidentalis* (J. Agardh) Børgesen, 1907:379.—Domantay, 1962:278.—Taylor, 1966:351.

Description.—Plants up to 50 mm tall; creeping, terete stolon giving off erect branches, simple or rarely branched, bearing ramelli abruptly expanded into subspherical ends, reaching 4 mm in diameter, distichously or radially arranged on terete rachis.

Specimens Studied.—78 EM-1(13, 14, 50, 51, 77, 78); 78 EM-9(132); 78 EM-10(80, 81); 78 EM-23(183); 78 EM-24(2–5); 78 EM-26(1, 2); 78 EM-28(53); 78 EM-29(24–29); 78 EM-30(1–5); 78 EM-31(1, 2); 78 EM-34(131); 78 EM-37 (1–5);78 EM-38(383, 390, 392, 394); 79 EM-8(17); 79 EM-12(13–18, 108–117); 79 EM-14(6–12); 79 EM-21(5).

Philippine Distribution.—Luzon (Oriental Mindoro, Pangasinan, Sorsogon, Catanduanes, Marinduque); Visayas (Negros Oriental, Siquijor); Mindanao (Zamboanga, Basilan, Sulu).

** *Caulerpa racemosa* var. *peltata* (Lamouroux) Eubank

Plate 2k

Caulerpa peltata Lamouroux, 1809b:332.—Gilbert, 1942:22.
Caulerpa racemosa var. *peltata* (Lamouroux) Eubank, 1946: 421.—Gilbert, 1961:439.

Description.—Specimens belonging to this species exhibit several different forms, but consistently show the characteristic of having peltate disks at the distal ends of short stalks. The same plant may bear peltate and spherical to turbinate ramelli. The discoid ramelli may be borne on ascending branches, arranged alternately in several ranks or produced directly from the dorsal side of the creeping stolon and supported by terete stipes. Plants found in sheltered areas seem to be the largest, having terete stolons, to 1 mm in diameter, bearing single, stipitate, peltate disks, 1–5 mm in diameter. The depauperate forms were mostly found in rocky, exposed areas and these showed a high degree of polymorphism. They were smaller; slender stolon to 300 μm in diameter, bearing single, stipitate, peltate disks, which are less than 2 mm in diameter; disks sometimes several on erect branches; from margins of disks, occasionally other branches are produced. The stolon bears short, descending branches, with branched filiform rhizoids at the ends.

Specimens Studied.—78 EM-25(1–6); 78 EM-33(384, 386–389, 397–399, 401, 402, 542–544); 78 EM-34(124–130, 132, 140–145); 78 EM-30(6); 78 EM-32(24); 79 EM-8(16); 79 EM-11(16, 17); 79 EM-12(10–12, 118–120); 79 EM-15(311); 79 EM-18(59–61); 79 EM-21(9–12); 79 EM-22(11–14).

Philippine Distribution.—Luzon (Oriental Mindoro); Visayas (Negros Oriental, Siquijor, Apo, Sumilon, Pescador); Mindanao (Zamboanga).

** *Caulerpa racemosa* var. *uvifera* (Turner) J. Agardh

Plate 2d

Fucus uvifer Turner, 1819:81, pl. 230.
Caulerpa racemosa var. *uvifera* (Turner) J. Agardh, 1873:35.—Gilbert, 1961:440.

Description.—Plants simple, erect branches to 30 mm tall, bearing stalked ramelli, imbricately disposed, closely crowded, gradually expanded to swollen tips; length of stalk supporting ramelli about the same as diameter of swollen ends.

Specimens Studied.—79 EM-22(60–63).

Philippine Distribution.—Visayas (Siquijor); Mindanao (Zamboanga).

Caulerpa serrulata (Forsskål) J. Agardh

Plate 2e

Fucus serrulatus Forsskål, 1775:189.
Caulerpa serrulata (Forsskål) J. Agardh, 1837:174.—Gilbert, 1942:14; 1946:78; 1961:440.—Domantay, 1962:278.—Meñez, 1961:53.—Taylor, 1966:351.—Reyes, 1972:142.—Trono, 1972:96; 1973:218; 1975:33.—Cordero, 1973:19.—Velasquez, Cornejo, Santiago, and Baens-Arcega, 1973:15, pl. 5: fig. 21.—Trono and Tuazon, 1978:3.

Description.—Plants moderately large, widespread, in dense colonies on rocks and coral rubbles, to 50 mm tall; the creeping, terete stolon with few, short, descending branches having branched rhizoids at the ends; ascending branches many, flat or compressed, twisted, once to several times dichotomously or irregularly branched; branches regularly with serrate margins, to 30 mm long, 3 mm broad, supported by terete stalks, 3–7 mm long.

Specimens Studied.—78 EM-7(1); 78 EM-9(114–120); 78 EM-25(21); 78 EM-29(6–10); 78 EM-30(11); 78 EM-31(4–9); 79 EM-8(6–9); 79 EM-9(18); 79 EM-15(197–200); 79 EM-16(48, 49).

Philippine Distribution.—Luzon (Ilocos Sur, Pangasinan, Bataan, Batangas, Catanduanes, Sorsogon, Marinduque, Oriental Mindoro); Visayas (Leyte, Siquijor, Sumilon, Apo, Negros Oriental); Mindanao (Zamboanga, Basilan).

** *Caulerpa serrulata* var. *boryana* f. *occidentalis* (Weber-van Bosse) Yamada and Tanaka

Plate 2f

Caulerpa freycinetii var. *boryana* f. *occidentalis* Weber-van Bosse, 1898:315, pl. 25: fig. 11.
Caulerpa serrulata var. *boryana* f. *occidentalis* (Weber-van Bosse) Yamada and Tanaka, 1938:62.—Gilbert, 1942:15; 1961:441.

Description.—Erect branches to 30 mm tall, 1–3 times dichotomously branched, flat or compressed, supported by a long, terete stalk, to 7 mm long; branches not twisted.

Specimen Studied.—78 EM-24(1).

Philippine Distribution.—Palawan (Culion); Visayas (Negros Oriental); Mindanao (Sulu).

Caulerpa sertularioides (Gmelin) Howe

Plate 3f

Fucus sertularioides Gmelin, 1768:151.
Caulerpa sertularioides (Gmelin) Howe, 1905:576.—Blanco, 1938:512.—Gilbert, 1946:78; 1961:441.—Domantay, 1962:278.—Meñez, 1961:52.—Taylor, 1966:351.—Reyes, 1972:143.—Velasquez, Cornejo, Santiago, and Baens-Arcega, 1973:14, pl. 4: fig. 19.—Trono, 1972:96.—Cordero, 1978:280.

Description.—Plants moderately large, widespread, forming loose colonies on rocks and corals, to 60 mm (rarely 100 mm) tall; stolon terete, to 1 mm in diameter, bearing few, short, descending branches with branched rhizoids at the ends; the

erect, simple or occasionally branched, feather-like branches with long stalks extending into a terete rachis, to 1 mm in diameter, bearing cylindrical, pinnately arranged pinnules, commonly 8 mm long, 200 μm in diameter, upcurved with mucronate tips.

Specimens Studied.—78 EM-5(35–38, 317–323); 78 EM-22(2, 3, 14); 78 EM-40(1); 79 EM-18(72–74); 79 EM-23(9, 10).

Philippine Distribution.—Luzon (Babuyan Island, Pangasinan, Bataan, Batangas, Manila Bay, Oriental Mindoro, Sorsogon); Visayas (Siquijor, Aklan, Negros Oriental, Negros Occidental); Mindanao (Sulu).

Caulerpa urvilliana Montagne

Plate 3d,e

Caulerpa urvilliana Montagne, 1845:21.—Taylor, 1966:352.—Trono, 1972:97; 1973:219.—Reyes, 1976:154, pl. 7: fig. 5.

Description.—Plants large, commonly forming loose colonies on sand, to 150 mm tall; the terete stolon to 3.5 mm in diameter, bearing few to many cylindrical, descending branches with long, branched rhizoids; the terete, erect branches several times dichotomously or alternately branched, with mamillate, multiseriately disposed protuberances and mucronate tips; these erect branches, 20–140 mm tall, supported by terete stalk, 10–60 mm long.

Specimens Studied.—78 EM-5(39–46, 246–259); 79 EM-21(13–15); 79 EM-22(56–59, 95).

Philippine Distribution.—Luzon (Sorsogon); Palawan; Visayas (Siquijor, Negros Oriental, Negros Occidental); Mindanao.

* *Caulerpa webbiana* Montagne

Plate 2g–j

Caulerpa webbiana Montagne, 1838:129.

Description.—Plants small, in thick cushions on exposed rocks, to 15 mm tall; the terete, creeping stolon beset with few, short, determinate branchlets, divided once to few times; the terete, descending branches on the ventral side of the stolon, naked or with few determinate branchlets, bearing laxly branched rhizoids at the ends; ascending branches from stolon many, simple or branched, 10–15 mm tall, having many whorls, sometimes distichous determinate branchlets 1–5 times divided, with mucronate tips. Plants in sheltered habitat have fewer, but longer branches, occasionally with distichous determinate branchlets.

Specimens Studied.—78 EM-32(54); 78 EM-33(132–144, 541).

Philippine Distribution.—Visayas (Apo).

Caulerpa verticillata J. Agardh

Plate 3a–c

Caulerpa verticillata J. Agardh, 1847:6.—Gilbert, 1961:442.—Trono, 1973:219.—Reyes, 1976:154, pl. 8: fig. 3.

Description.—Plants filiform, attached to rocks and corals, to 50 mm tall; the creeping, naked terete stolon with numerous short, descending branches, terminated by laxly branched, filiform rhizoids; the terete, erect branches, simple or irregularly branched, bearing abundant tufts of whorled, determinate branchlets, to 180 μm in diameter, to 8 times dichotomously branched; the filiform branchlets constricted at the base, with 2–3 teeth at the apices.

Specimens Studied.—79 EM-12(3–6).

Philippine Distribution.—Palawan; Visayas (Siquijor, Apo); Mindanao (Sulu, Basilan).

* *Caulerpa reyesii*, new species

Figure 2; Plate 3g–i

Description.—Plantae mediocriter robustae in coloniis laxis late effusae. Stolones repentes teretes ramosi ad 2.5 mm in diametro; rami descendentes ad 60 mm longi in apicem rhizoideis filiformis ferentes; rami ascendentes 10–70 mm alti simplices vel interdum frondiformes; frondes basi vel ad medio ramosae basi breviter terete stipitatae, stipitis in rachidis compressis 1 mm latis continuis, ramulis subsessilibus complanatis obovatis

FIGURE 2.—Habit of *Caulerpa reyesii*, new species. Holotype: 78 EM-5(330), Solong-on, Siquijor Island, 10 May 1978.

clavatis adaxialiter incurvalis ad 7 mm longis et in partibus latissimus 2 mm latis plerumque as apicem mucronatis vel cuspidatis distichis vel variabiliter tetrastichis et subimbricatis.

Plants moderately robust, widespread, forming loose colonies. The creeping stolon terete, branched, to 2.5 mm in diameter, bearing long, terete, descending branches, to 60 mm long, with filiform rhizoids at the ends. The ascending branches from stolon, 10–70 mm tall, simple or if branched, secondary branching produced from the mid-portion or the lower margin of the compressed rachis; erect branches supported by short, cylindrical stalks that extend into a compressed rachis, 1 mm broad, bearing subsessile, flat, overlapping, obovate, clavate ramelli, which are adaxially incurved, tetrastichous, distichous, to 7 mm long and 2 mm at the widest portion, mostly mucronate or cuspidate at the tips.

Holotype.—78 EM-5(330), on coral rubbles and sand in seagrass bed, at Solong-on, Siquijor Island, Philippines, 10 May 1978; deposited in the U.S. National Herbarium, Smithsonian Institution, Washington, D.C., U.S.A. Isotypes deposited in the Philippine National Herbarium, Manila, Philippines and Silliman University Herbarium, Dumaguete City, Philippines.

Paratypes Studied.—78 EM-5(24–28).

Remarks.—It is with great pleasure to name this species of *Caulerpa* after our colleague and friend, Professor Alfredo Reyes, Department of Biology, Silliman University, Dumaguete City, Philippines, for his unselfish efforts to advance phycological studies in Central Visayas. Professor Reyes (1976:157, pl. 9: figs. 6, 7) previously recorded and described this species as *Caulerpa* species. His specimens were collected from "dead coral-sandy bottom at the lower intertidal zone" at Siquijor Island, Philippines.

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PLATES

PLATE 1

(illustrations reduced to 53%)

FIGURE A.—*Caulerpa fastigiata*, habit, × 2.
FIGURE B.—*Caulerpa cupressoides*, habit, × 2.
FIGURE C.—Same, pinnules, showing 3-ranked branching, × 4.
FIGURES D., E.—*Caulerpa crassifolia*, habit, × 1.
FIGURE F.—*Caulerpa lentillifera*, ramelli, showing imbricate branching and constricted bases, × 13.
FIGURE G.—Same, habit, × 2.6.
FIGURE H.—*Caulerpa arenicola*, habit, × 3.
FIGURE I.—*Caulerpa brachypus*, habit × 1.3.

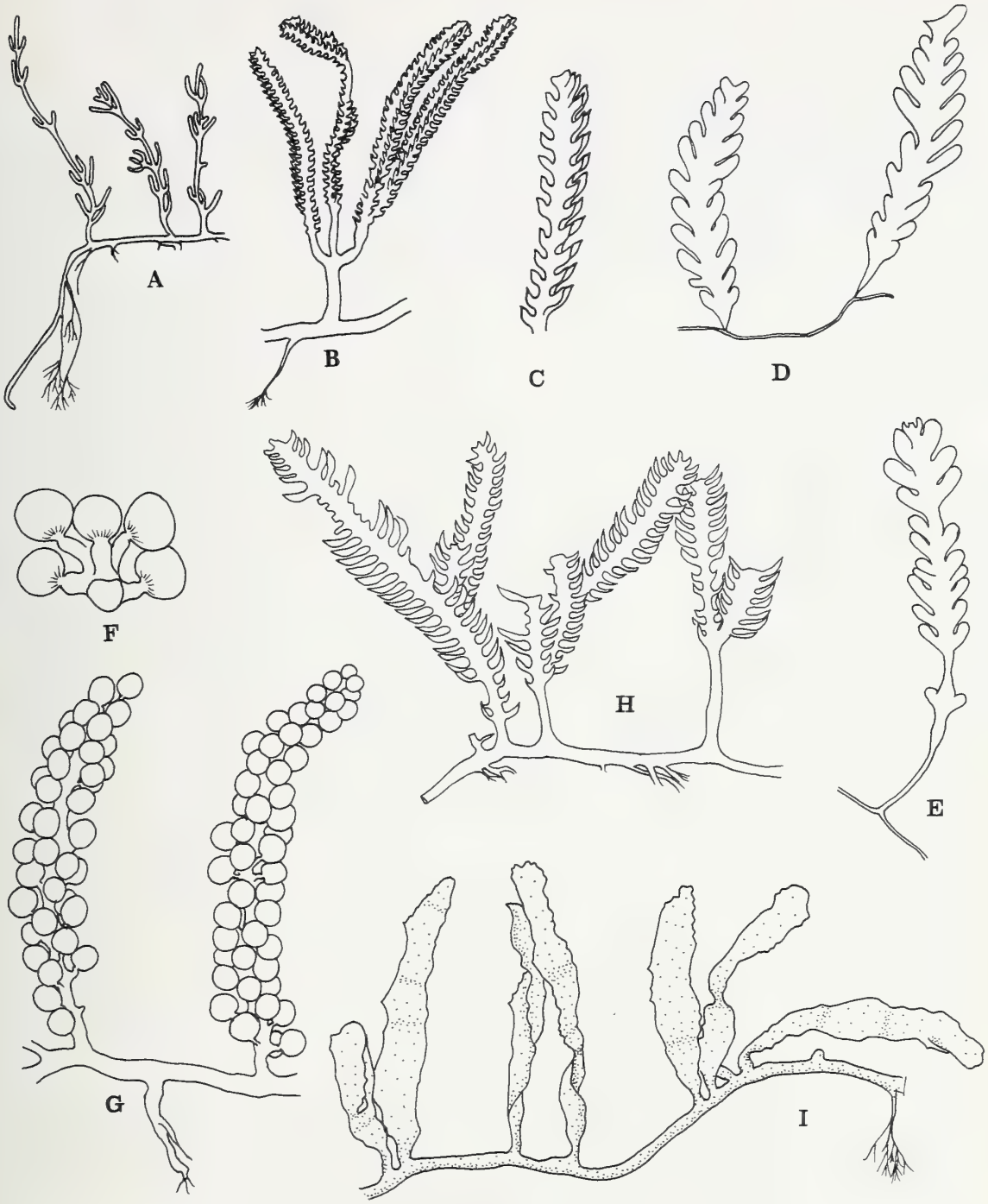
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PLATE 2

(illustrations reduced to 53%)

FIGURE A.—*Caulerpa racemosa* var. *clavifera*, habit, × 2.5.
FIGURE B.—*Caulerpa racemosa* var. *occidentalis*, habit, × 1.
FIGURE C.—*Caulerpa racemosa* var. *macrophysa*, habit, × 1.
FIGURE D.—*Caulerpa racemosa* var. *uvifera*, habit, × 1.
FIGURE E.—*Caulerpa serrulata*, typical, habit, × 1.
FIGURE F.—*Caulerpa serrulata* var. *boryana* f. *occidentalis*, habit, × 1.
FIGURE G.—*Caulerpa webbiana*, habit × 2.
FIGURE H.—Same, erect branch with whorled branchlets, × 12.
FIGURE I.—Same, erect branch with distichous branchlets, × 16.
FIGURE J.—Same, stolon beset with determinate branchlets, × 16.
FIGURE K.—*Caulerpa racemosa* var. *peltata*, habit, × 2.
FIGURE L.—*Caulerpa microphysa*, habit, × 2.


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PLATE 3

(illustrations reduced to 55%)

FIGURE A.—*Caulerpa verticillata*, habit, × 3.3.
FIGURE B.—Same branchlets with toothed apices, × 31.
FIGURE C.—Same, portion of erect branching showing whorled branchlets, × 7.
FIGURE D.—*Caulerpa urvilliana*, habit, × 1.
FIGURE E.—Same, erect branch with mamillate protuberances, × 6.
FIGURE F.—*Caulerpa sertularioides*, habit, × 2.
FIGURE G.—*Caulerpa reyesii*, new species, habit, × 1.
FIGURE H.—Same, erect branch with multi-ranked branchlets, × 3.5.
FIGURE I.—Same, erect branch with distichous branchlets, × 3.


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Bibliography, depending upon use, is termed "References," "Selected References," or "Literature Cited." Spell out book, journal, and article titles, using initial caps in all major words. For capitalization of titles in foreign languages, follow the national practice of each language. Underline (for italics) book and journal titles. Use the colon-parentheses system for volume/number/page citations: "10(2):5–9." For alinement and arrangement of elements, follow the format of the series for which the manuscript is intended.

Legends for illustrations must not be attached to the art nor included within the text but must be submitted at the end of the manuscript—with as many legends typed, double-spaced, to a page as convenient.

Illustrations must not be included within the manuscript but must be submitted separately as original art (not copies). All illustrations (photographs, line drawings, maps, etc.) can be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively. If several "figures" are treated as components of a single larger figure, they should be designated by lowercase italic letters (underlined in copy) on the illustration, in the legend, and in text references: "Figure 9b." If illustrations are intended to be printed separately on coated stock following the text, they should be termed **Plates** and any components should be lettered as in figures: "Plate 9b." Keys to any symbols within an illustration should appear on the art and not in the legend.

A few points of style: (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled-out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

Arrange and paginate sequentially EVERY sheet of manuscript—including ALL front matter and ALL legends, etc., at the back of the text—in the following order: (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.