

Seagrasses from the Philippines



ERNANI G. MEÑEZ, RONALD C. PHILLIPS,
and HILCONIDA P. CALUMPONG

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ABSTRACT

Meñez, Ernani G., Ronald C. Phillips, and Hilconida P. Calumpong. Seagrasses from the Philippines. *Smithsonian Contributions to the Marine Sciences*, number 21, 40 pages, 26 figures, 1983.—Seagrasses were collected from various islands in the Philippines during 1978–1982. A total of 12 species in seven genera are recorded. Generic and specific keys, based on vegetative characters, are provided for easier differentiation of the seagrasses. General discussions of seagrass biology, ecology, collection and preservation are presented. Local and world distribution of Philippine seagrasses are also included.

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Introduction

The seagrass flora of the western tropical Pacific is unusually diverse (den Hartog, 1970). Tsuda, Fosberg, and Sachet (1977) reported ten species for Micronesia; Johnstone (1979) listed 13 taxa for Papua New Guinea; and den Hartog (1970) reported 11 species for the Philippines. Despite the interesting questions associated with this diversity and the widespread occurrence of seagrasses in the Philippines, only a few papers have been published which treat Philippine seagrasses. Earlier records include Blanco's (1837, 1845, 1879) reports of *Vallisneria sphaerocarpa* (= *Enhalus acoroides*) from Zambales. Another report of *Vallisneria sphaerocarpa* from Palawan was by Merrill (1918). Ostenfeld (1909) recorded *Halophila ovata* (= *Halophila minor*) from the Philippines, based on Loher's specimen from Luzon and later, Merrill's collection from Manila Bay. A critical morphological study of *Thalassia hemprichii* was published by Pascasio and Santos (1930). Domantay (1962) listed eight species of seagrasses in his study of the marine vegetation of the Hundred Islands in Pangasinan. Merrill (1912, 1915, 1918, 1925), Mendoza and del Rosario (1967) included seagrasses in vascular plant floras. Calumpong (1979) reported three sea-

grasses in an ecological study of the sea hare, *Dolabella auricularia* (Lightfoot), in Central Visayas region. Cordero (1981) illustrated and described the morphology and distribution of three species of seagrasses.

The Philippines is an archipelago of about 7,100 islands. It lies between latitudes 4°40'–21°50' N and longitudes 116°50'–126°35' E, surrounded by the South China Sea in the west, Sulu Sea and Celebes Sea in the south, the Philippine Sea, which opens into the Pacific Ocean, in the east, and the Luzon Strait in the north. The country is naturally divided into four geographical regions (Figure 1): the Luzon Region, including the islands of Luzon, Babuyan, Catanduanes, Mindoro, Masbate, Romblon, and Marinduque; the Mindanao region, including Mindanao, Basilan, and the Sulu Group; the Visayas region, including Samar, Leyte, Bohol, Cebu, Negros, and Panay; and the Palawan region, including Palawan, Balabac, Culion, and the Cuyo Group.

Seagrasses are important, but their role has often been overlooked due largely to their submerged state. Thayer, Wolfe, and Williams (1975) gave an overall summary of the importance of seagrasses:

1. Seagrass has a high growth rate, producing an average of about 300–600 g dry weight/m²/year, not including root production. Compared to world averages for cultivated corn (412 g C/m²) or rice (497 g C/m²), seagrass beds are more productive.

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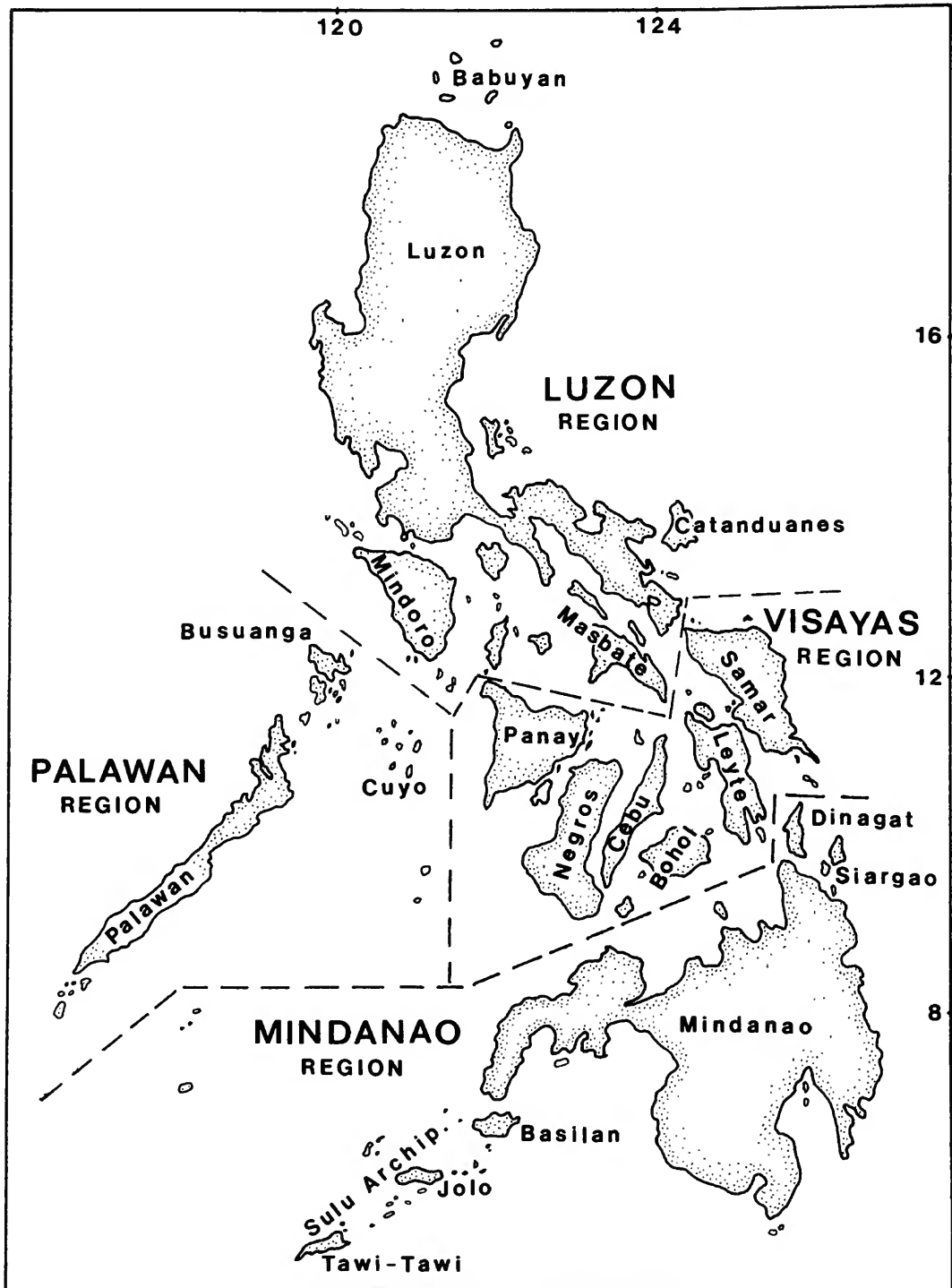


FIGURE 1.—General map of the Philippines.

2. The leaves support a large number of epiphytic organisms, with a total biomass perhaps approaching that of the seagrass itself.
3. Although a few organisms may feed directly on the seagrass and several may graze on the epiphytes, the major food chains are based on seagrass detritus and its resident microbes.
4. The organic matter in the detritus and in decaying roots initiates sulfate reduction and maintains an active sulfur cycle.
5. Seagrass roots bind the sediment together and, with the protection afforded by the leaves, surface erosion is reduced, thereby preserving the microbial flora of the sediment and the sediment-water interface.
6. Seagrass leaves retard the currents and increase sedimentation of organic and inorganic materials around the plants.
7. Seagrass absorbs phosphorus through the roots and the leaves; it may be that the phosphorus absorbed through the roots is released through the leaves, thereby returning phosphate from sediments to the water column. Nitrogen also is taken up by the roots and transferred to the leaves and into the medium.

It is now imperative that we properly recognize how they contribute to the oceanic realm of the Philippines. All over the world humans and seagrasses are coming into conflict for space along the coast in areas that are in demand for human activities, from the creation of recreational places, such as marinas, to industrial ones, such as power plants, mining sites, freighter and tanker terminals. Unfortunately, discharges of warm water from power plants and silt and nutrients from mining, sewage treatment plants, and tanker terminals directly harm seagrasses. Before we destroy or even degrade any more seagrass habitats, we must know where the seagrasses are and the true value of this coastal resource.

The resolution of this conflict need not be an inevitable loss of seagrasses. It is our hope that this study not only will alert people to the seagrasses by allowing them to identify the various species, but also by making them aware of where to find them and to appreciate some of the plant and animal associations that occur within the

seagrass ecosystems. Most importantly, seagrass communities in the Philippines serve as habitats and breeding grounds for various marine organisms that are economically important to the local populace. Appropriate planning and reasonable environmental management can ensure the perpetuation of these ecosystems.

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Hilconida Calumpong acknowledges the assistance of Mr. Willy Rasay and Ms. Janet Estacion in collecting and preparation of herbarium specimens of seagrasses. Ronald Phillips appreciates the financial aid, given by the Seattle Pacific University Institute for Research, for travel in March 1982. A portion of this research was supported by the National Science Foundation, International Decade of Ocean Exploration, Living Resources Program, Seagrass Ecosystem Study (OCE77-25559). Ernani Meñez appreciates the travel and research support in the Philippines from the Smithsonian Institution Fluid Research Fund.

For their critical review of this paper, we are indebted to Dr. Raymond Fosberg, Botanist Emeritus, Smithsonian Institution, to Dr. C. den Hartog, Catholic University, Nijmegen, The Netherlands, and to Dr. Calvin McMillan, Professor of Botany, University of Texas at Austin.

The loan of *Halophila beccarii* and *H. spinulosa* specimens from Rijksherbarium, Leiden, is gratefully acknowledged.

MATERIALS AND METHODS.—The seagrasses collected during the Smithsonian Institution Biological Expeditions of 1978 and 1979 to Central Visayas, Philippines, and the authors' personal collections during 1980–1982 from the Visayas region, Palawan, La Union, and Ilocos Norte, Philippines, were used in this study. Replicates of material are being deposited in the U.S. National Herbarium (Smithsonian Institution), the Seattle

Pacific University Herbarium, the Silliman University Herbarium, the National Herbarium of the Philippines, and the Rijksherbarium.

In the systematic section of this paper, the author, date, and page of the original publication of each taxon, plus basionyms and published records from the Philippines, are given. The characteristics, natural history, local and world distribution of each species are also given. A dichotomous key and line drawings are included in order to facilitate easier identification of the twelve species of seagrasses from the Philippines. Most of the natural history and distribution data of Philippine seagrasses in this study are from den Hartog's (1964, 1970) publications. Additional information has been taken from Isaac (1968), Kay (1971), Kirkman (1975), McMillan (1980a, b), McMillan, Bridges, Kock, and Falanruw (1982) and Johnstone (1982).

COLLECTING AND PRESERVING SEAGRASSES.—Seagrasses may be collected as drift plants cast ashore or as freshly dug specimens. The major problems in the use of drift plants is that they may be broken and their original attachment site is uncertain. It is known that seagrass plants are buoyant and can float for weeks if detached from the bottom.

The recommended procedure for collecting and preserving seagrass specimens for herbarium storage and study is as follows. A collector should get the entire plant including the root and rhizome system. One should use a shovel or dig by hand deeply enough into the substrate to get below the rhizome mat. The plant mass can then be torn loose from the bottom. All sediment and animals should be washed from the rhizome and roots. Specimens covering all development phases should be collected from the same area. It is best to include plants with flowers, fruits, and seeds, as well as vegetative plants with intact leaf tips and root systems.

The plants should be returned to the laboratory in a plastic bag, preferably in an ice chest. The plants should be kept moist and should not be exposed to direct sunlight.

The plants can be preserved by dry-mounting on herbarium paper or by soaking first in a

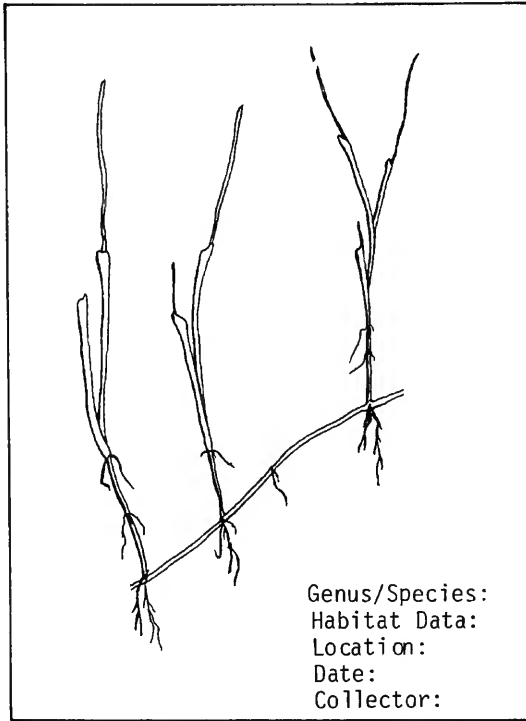
solution of seawater formalin. Soaking the plants first in formalin keeps down the growth of fungi (mildew) and destruction by insects, but renders the plants useless for chemical analysis. If one wishes to kill the plants before mounting on herbarium paper, the plants should be soaked for one hour in a 5% solution of seawater-formalin (8 parts seawater to 1 part formaldehyde). Then the plants should be drained dry and mounted on herbarium sheets or other stiff, high-quality paper.

Seagrasses, such as the small and fragile *Halophila* species, are most easily mounted on herbarium sheets if they are floated first in a tray of seawater. A sheet of herbarium paper is placed under the plant in the water, the plant arranged on the sheet, the sheet is lifted out and the excess water drained off. The sheet is then ready for the plant press (Figure 2).

The plant press can be made from two pieces of 3/8-inch plywood, each 12 × 17 inches. Inside the press there should be a complement of corrugated cardboard ventilators, heavy blotters, and waxed paper, in addition to the herbarium paper with the specimens. Each of these sheets is the same size as the plant press. Two or more straps (belts or pieces of clothesline) are needed to hold the press together.

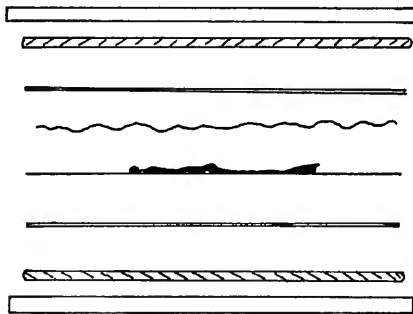
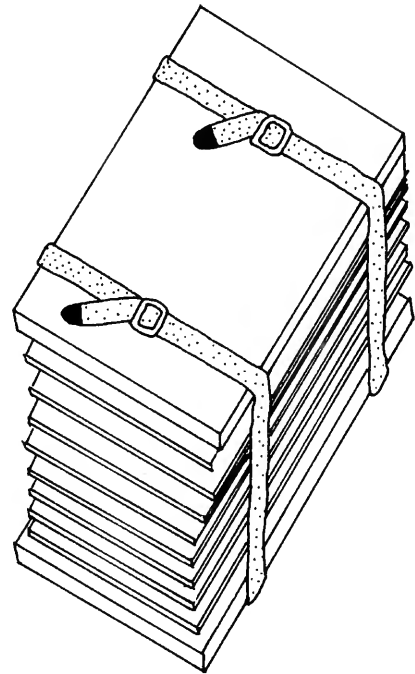
The plant press is assembled by placing a herbarium sheet with its plant specimen on a blotter. A sheet of waxed paper is placed on top of the specimen. Another blotter is placed on top of the waxed paper. Cardboard ventilators are used to separate blotters. When all of the plants have been put into the press, the straps are used to bind the press tightly together. The press may be placed over a source of mild heat to allow a current of warm dry air to rise through the corrugations of the ventilators. Until the plants are dry, the press should be opened each day and dry ventilators and blotters exchanged for the wet ones. When the sheets are dry, the dried plants should be fixed to the herbarium sheets using clear Duco cement.

The following information should be typed on a specimen-label form: scientific name (with author), habitat information (depth of water, type



Herbarium Sheet with Data

Full Plant Press



- Plywood
- Cardboard Ventilator
- Blotter
- Waxed Paper
- Herbarium Sheet with Specimen
- Blotter
- Cardboard Ventilator
- Plywood

Plant Press Arrangement

FIGURE 2.—Illustration showing proper plant press arrangement for drying seagrasses.

of substrate, etc.), location (specific but also general area), date of collection, collector's name. The label should be pasted in the lower right corner of the sheet.

General Features of Seagrass Biology and Ecology

The narrow fringe of the edge of the sea is both the most productive and the most threatened portion of the ocean. In this area of the shallow water light can penetrate to the bottom and nutrients arrive from both land and sea. It is here that marine plant ecosystems flourish. These marine systems are the foundations of inshore productivity and form the basis for animal life.

The value and significance of the shallow-water habitats have been overlooked in the past, in part because the connections from the plants to animals are complex and often indirect. Paradoxically, the most important contribution of all seagrass ecosystems to the chains of life is death. The bacteria that devour the dead leaves of the plant not only nourish and enrich the area in which the plants grow, but also affect waters for miles around. Seagrass and mangrove leaves have been found in deep-sea trenches far from shore and thousands of feet deep. Even in these most remote regions of the sea, the leaves provide food and shelter for resident animals.

Seagrasses are not true grasses, but they do resemble them and have many similarities with them in the biology of their life cycle. Seagrasses usually form dense meadows that resemble more familiar prairies or grasslands. Seagrasses are vascular plants. The vascular system in the seagrasses consists of an internal network of tubes that is continuous from the roots to the leaf tips, transporting water, nutrients, and gases for tissue growth. Because of this system, seagrass growing in sand or mud can use the highly concentrated nutrients of the bottom, nutrients that may be hundreds or thousands of times more concentrated than those in the overlying water column. This source, the bottom sediment, is unavailable to all other marine plants; these others must depend for growth only on nutrients dissolved in the water. Seagrasses can absorb nutrients from

water through their leaves like algae, but are not limited to that source. Seagrasses, then, are a mechanism for returning nutrients to other marine life that would otherwise be lost in the sediments. They are the only plants in the sea that can do this. The significance of this dual nutrient source is reflected in growth rates that are high or higher than those of any other plant community in the sea. The roots and rhizomes not only absorb nutrients from the sediment, but also prevent the movement of bottom sediments. In dense meadows of *Thalassia hemprichii* (turtle grass) and *Enhalus acoroides*, the roots and rhizomes form a dense mat that prevents erosion of the coast that would otherwise occur from strong currents and severe typhoons. Since they occur inshore of the coral fore-reef, they act in concert with the reef in coastal protection.

Part of the importance of seagrasses is their high productivity. Seagrass beds have been shown to be among the most productive areas of the earth, including those under intensive agriculture. Seagrasses have a complement of attached algae, called epiphytes, which contribute to the high productivity of the seagrass ecosystem. This primary productivity is the first link in the food chains of these ecosystems, and generally supports a high productivity in the associated animal community.

Seagrasses constitute a haven and refuge for animals in the sea. They are especially important as nurseries for fish, shrimps, lobsters, scallops, and other valuable food animals. The protection that these plant systems afford extends beyond their associated animal life to the coast itself. Although many of the animal associations with seagrasses are indirect and inconspicuous, there are notable exceptions: dugongs, sea turtles, some fish, and sea urchins and other invertebrates feed directly on these plants.

A seagrass meadow or bed may consist of a few hundred to a few thousand leafy shoots per square meter and can cover bottom areas from a few acres up to many square miles. These meadows are crucial habitats for a variety of marine life. To some animals they are a refuge; to others they are the local swim-in restaurant where a free lunch is always available. One of the reasons for

this concentration of marine life in seagrass meadows is the great habitat complexity resulting from the dense canopy of leaves; the leaves provide a surface area that can be 20 or more times greater than that of the bottom they occupy — a veritable jungle. A myriad of small animals and plants, some epiphytes and some merely clinging, can be found on seagrass leaves. These form an essential part of the complex food webs that exist in a seagrass meadow.

An essential feature of any seagrass meadow is the fate of the leaves as they age and become detached from the leaf stalk, an event similar to the autumn drop of leaves in a forest. A large proportion of these leaves sink to the bottom where they become the basis of yet another complex food web. Through wave action and browsing activities of invertebrates, the leaves break down and decompose into particulate matter that remains suspended in the water column. In so doing, they provide inorganic nutrients that are essential to the continued growth of the living seagrasses, and nourishment to a variety of bacteria. Some of the soluble plant chemicals leach out into the surrounding water and help to feed the same bacteria. These bacteria are the food of

diverse species of small animals that are themselves the food for slightly larger species of animals and so it goes. This decomposer food chain begins with bacteria in the upper levels of bottom sediments and around the surface of the particulate plant matter, an environment devoid of oxygen, but eventually it leads to the more familiar larger food animals, worms, clams, shrimps and consequently to fishes. The steps in this food chain are still more obscure than the one based on direct grazers and there is still doubt about its significance in the economy of the sea. The production of detritus from the constant sloughing of leaves in the seagrass meadow results in a relatively constant source of food for the bacteria and animals of the decomposer food chain throughout the year.

Many studies in the United States have proven that seagrass presence and growth is absolutely dependent on relatively clear water. Seagrasses stabilize bottom sediments and baffle water motion inside the meadow, but additions of dirty water from dredging, mining, sewage, and boating activities can sharply curtail or eliminate the productivity or even presence of seagrass in an area.

Key to the Philippine Seagrasses

- 1. Leaves terete ***Syringodium isoetifolium***
 Leaves flat 2
- 2. Leaves elliptic, ovate, lanceolate or linear-oblong; 4—30 mm long
 ***Halophila***
 - A. Leaves lanceolate, without cross-veins ***H. beccarii***
 Leaves otherwise, with cross-veins B
 - B. Leaves with 12–22 pairs of cross-veins ***H. ovalis***
 Leaves with 4–7 pairs of cross-veins C
 - C. Leaves up to 22 pairs, distichous on long shoot ***H. spinulosa***
 Leaves in pairs on every short shoot ***H. minor***
 Leaves linear, usually 5–100 cm long 3
- 3. Leaves ligulate 4
 Leaves not ligulate 6
- 4. Nerves no more than 3 ***Halodule***
 - A. Leaf tip with irregular serrations; tip of midrib often furcate
 ***H. pinifolia***
 Leaf tip tridentate; tip of midrib not furcate ***H. uninervis***
 - Nerves more than 3 5

5. Unbranched or once-branched shoots produced at every fourth internode on rhizome; leaf tips with bi-trifurcate teeth; roots borne on internode with numerous tough, wiry laterals; internodes 3–10 mm long
 *Thalassodendron ciliatum*
 Not as above *Cymodocea*
 A. Leaf tip smooth or slightly serrulate; leaf blades linear *C. rotundata*
 Leaf tip serrate-dentate; leaf blades linear-falcate *C. serrulata*
6. Rhizome 2–4 mm in diameter; roots densely beset with filiform laterals; leaves linear-falcate; without basal black fibers .. *Thalassia hemprichii*
 Rhizome more than 1 cm in diameter; roots naked; leaves linear; with persistent basal black fibers *Enhalus acoroides*

Division ANTHOPHYTA

Class MONOCOTYLEDONEAE

Order HELOBIAE

Family POTAMOGETONACEAE

Cymodocea rotundata Ehrenberg and Hemprich, ex Ascherson

FIGURES 3A,B, 4

Cymodocea rotundata Ehrenberg and Hemprich, ex Ascherson, 1871a:83.—Merrill, 1925:24.—Mendoza and del Rosario, 1967:12.—den Hartog, 1970:166, fig. 47.

CHARACTERISTICS.—Plants of moderate size, with moderately robust rhizomes, reaching 2 mm in diameter; internodes 0.5–3 cm long; laxly branched roots usually 1–3 per node. Erect shoots short, generally with 2–4 leaves. Persistent leaf sheaths up to 4 cm long, usually forming scarious mass at maturity; when shed, conspicuous scars are left on stem. Leaf blades linear, 2–4 mm wide and up to 10 cm long, with round apices or slightly serrulate, nerves 8–12.

NATURAL HISTORY.—*Cymodocea rotundata* occurs in shallow water, on sand-mud or sand substrates in sheltered coves or bays, lagoons, mouth of rivers and coral reefs. The plant may be found growing with *Halophila ovalis*, *Halodule uninervis*, *Enhalus acoroides*, *Thalassia hemprichii*, *Syringodium isoetifolium*, or *Cymodocea serrulata*. Epiphytic algae found on leaves of the plant include melobesioids and *Hypnea*. In New Caledonia and Thursday

Island, staminate flowers were observed during April and November, respectively. Pistillate flowers have been reported during November at Thursday Island. At Bristow Island, both staminate and pistillate flowers were found in March. Plants with fruits were recorded from Yap, Tomil-Gagil, and Map islands in Micronesia during March and June–July. In New Guinea and the island of Bali, fruits were observed in June.

PHILIPPINE DISTRIBUTION.—Luzon (Lingayen Gulf, Catanduanes, Mindoro); Palawan (Cuyo Islands); Visayas (Samar, Negros, Siquijor); Mindanao (Pearl Bank, Tawi-Tawi Group).

RANGE.—*C. rotundata* is widely distributed in the Indian and western Pacific oceans. It occurs in Egypt, Sudan, Kenya, Tanzania, Mozambique, Madagascar, Yemen, Thailand, Andaman Islands, Ryukyu Islands, Malaysia, Indonesia, Papua New Guinea, Caroline Islands, Queensland, and New Caledonia.

Cymodocea serrulata (R. Brown) Ascherson and Magnus

FIGURES 5A–C, 6

Caulinia serrulata R. Brown, 1810:339.

Cymodocea serrulata (R. Brown) Ascherson and Magnus, in Ascherson, 1871a:84.—Merrill, 1925:24.—Mendoza and del Rosario, 1967:13.—den Hartog, 1970:171, fig. 48.

CHARACTERISTICS.—Plants of moderate size, rhizomes 2–3 mm in diameter; internodes 1–4 cm long; usually 2 to several sparsely branched roots per node. Erect shoots short, bearing up to 4

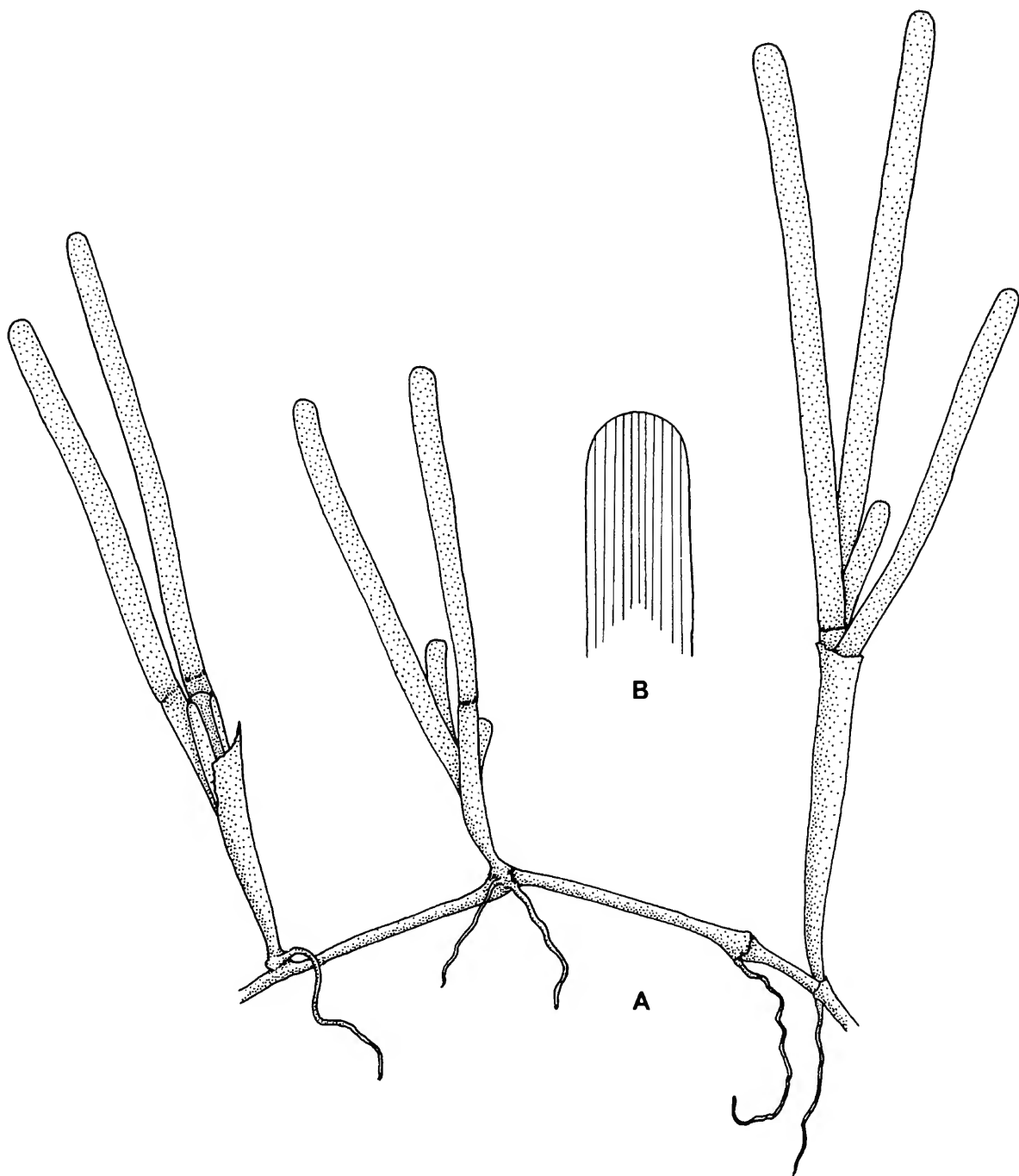


FIGURE 3.—*Cymodocea rotundata*: A, habit of plant, $\times 1.4$; B, upper portion of a leaf showing perpendicular veins, $\times 4.4$.

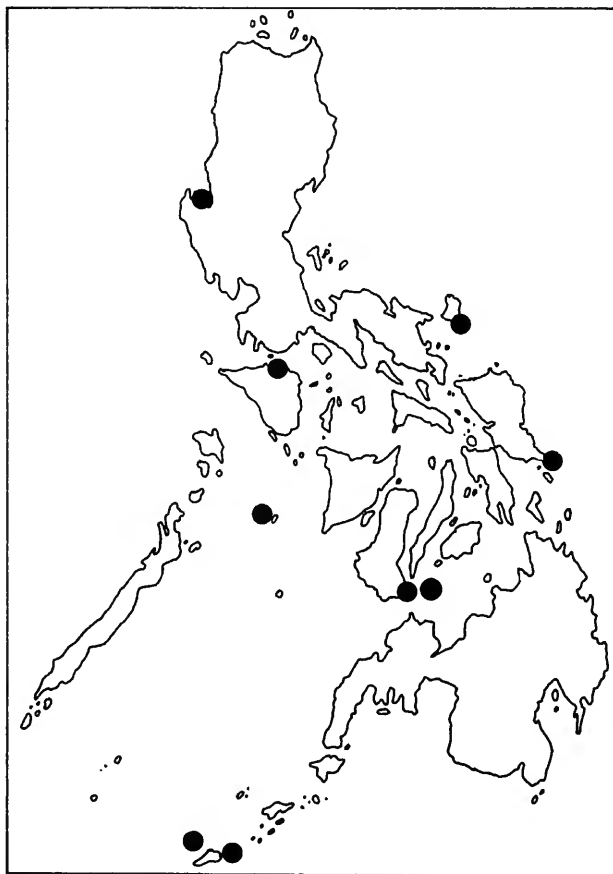
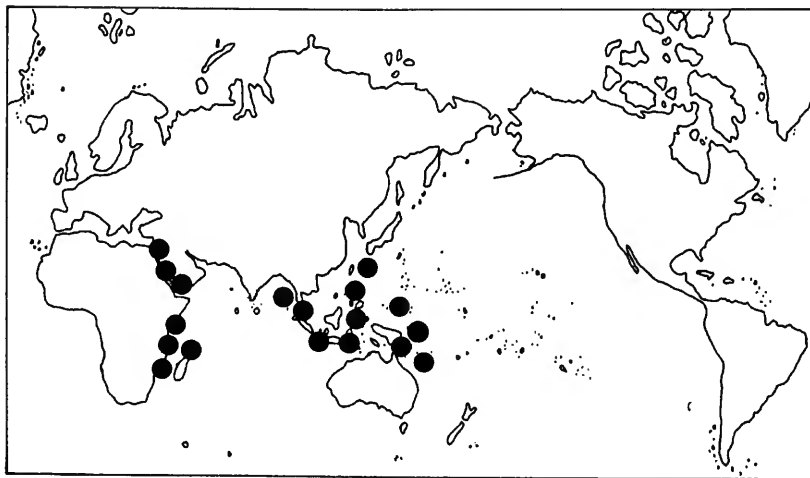


FIGURE 4.—*Cymodocea rotundata*: top, world distribution; bottom, Philippine distribution.

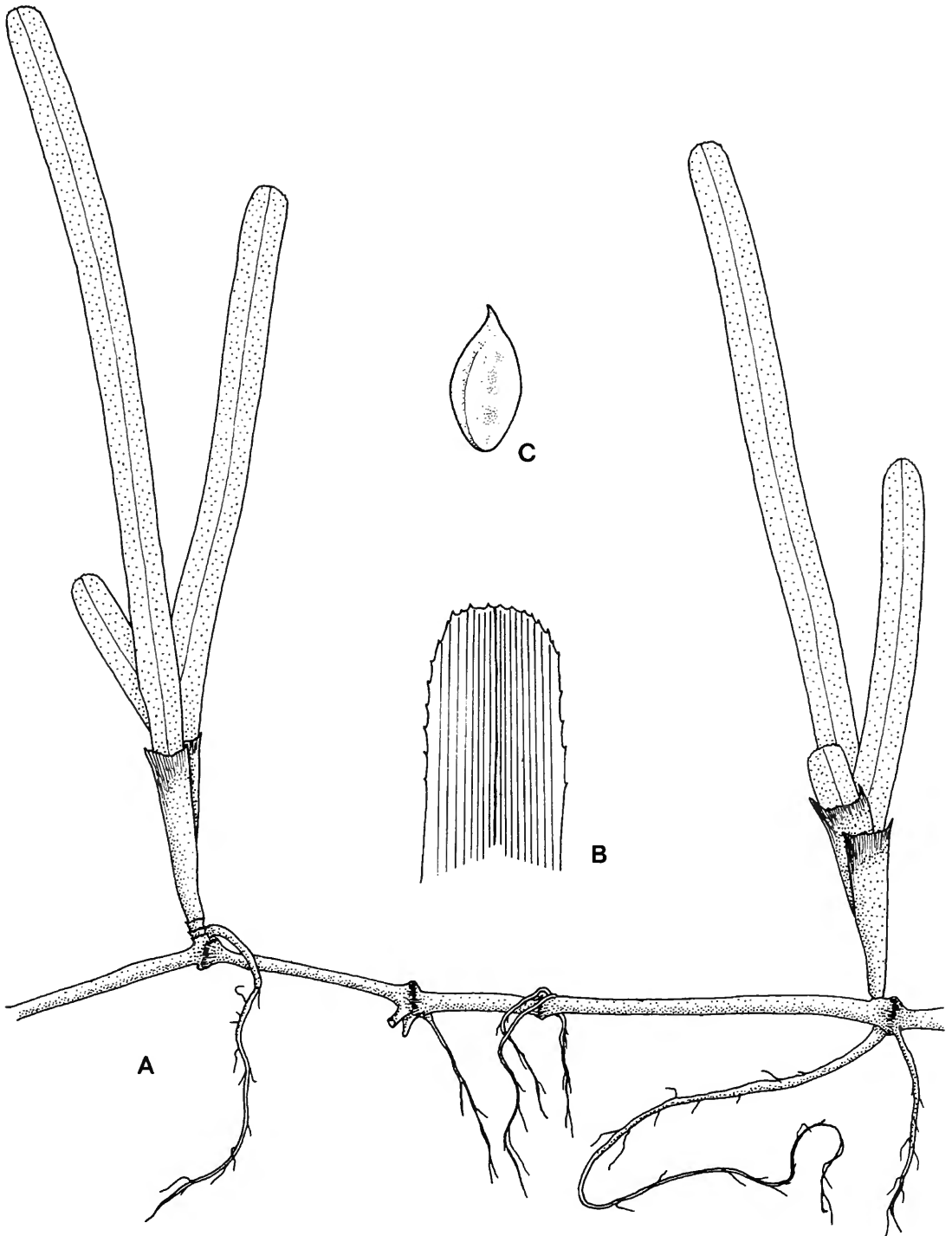


FIGURE 5.—*Cymodocea serrulata*: A, habit of plant, $\times 1.2$; B, upper portion of a leaf showing serrate tip and perpendicular veins, $\times 2.2$; C, fruit, $\times 1.8$

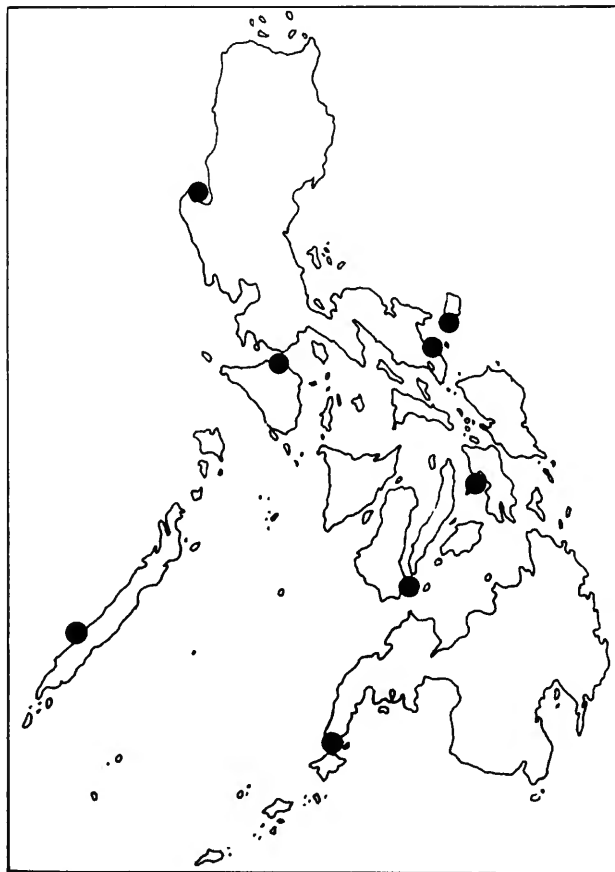
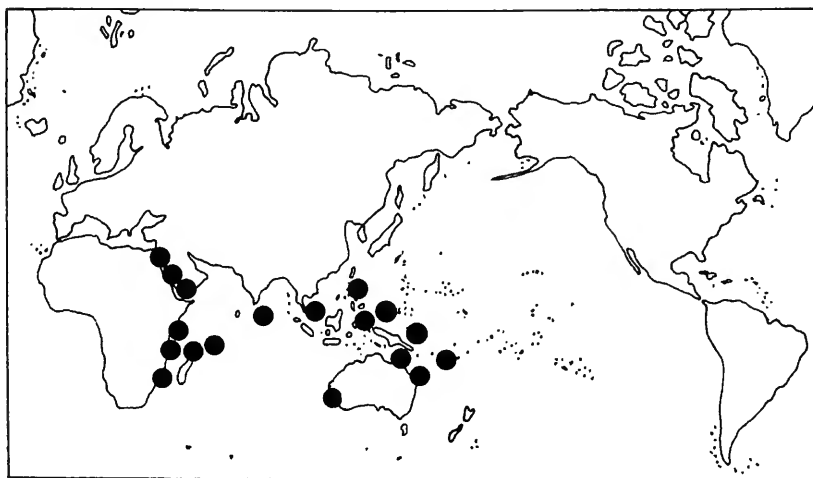


FIGURE 6.—*Cymodocea serrulata*: top, world distribution; bottom, Philippine distribution.

leaves. Leaf sheaths 1–3 cm long, tapered towards the base; when shed, leaving conspicuous scars around the stem. Leaf blades linear-falcate, 3–7 mm wide, up to 9 cm long, narrowed at the base; with round to obtuse, serrate leaf tips; margins mostly entire, spinulose only near the tip; having 8–16 nerves connected by cross-veins. Fruits nearly elliptic, compressed, sessile and with dorsal ridges.

NATURAL HISTORY.—*Cymodocea serrulata* occurs in the lower intertidal zone, in sheltered localities, on coarse coral-sand, sand-mud, or mud with coral rubble substrates. The plant is reported growing together with *Thalassia hemprichii*, *Enhalus acoroides*, *Halophila ovalis*, *Halodule uninervis*, and *Syringodium isoetifolium*. Pistillate flowers have been reported during April in New Caledonia; in Kenya, they have been observed in January and August. Plants with staminate flowers have been recorded during February and March from Mor-ton Bay, Queensland. In Kenya, they occurred in September. Contrary to den Hartog's (1970) comment that *Cymodocea serrulata* is absent in places where there is freshwater influence, in Albay Gulf, southeastern Luzon, Philippines, the plant was collected from boulders near the mouth of a stream, growing together with *Halodule uninervis*. Epiphytic algae found on the leaves of *Cymodocea serrulata* were melobesioids, *Ceramium* and *Acrochaetium*. In Negros, Philippines, fruits were found on *Cymodocea serrulata* in August.

PHILIPPINE DISTRIBUTION.—Luzon (Pangasi-nan, Albay, Catanduanes, Mindoro); Palawan (Bajallanura Island, Double Island); Visayas (Negros, Leyte); Mindanao (Zamboanga).

RANGE.—*C. serrulata* is common in tropical and subtropical regions. It occurs in Egypt, Sudan, Kenya, Tanzania, Mozambique, Madagascar, Comoro Islands, Seychelles, Yemen, Sri Lanka, Malaysia, Indonesia, Western Australia, Queensland, Papua New Guinea, Caroline Islands, and New Caledonia.

Halodule pinifolia (Miki) den Hartog

FIGURES 7A,B, 8

Diplanthera pinifolia Miki, 1932:787.

Halodule pinifolia (Miki) den Hartog, 1964:309; 1970:158.

CHARACTERISTICS.—Plants small, with slender rhizomes, up to 1.5 mm in diameter; internodes usually 0.5–2.0 cm long; simple or laxly branched roots, 2 to several per node. Short, erect shoots consisting of 2–4 leaves borne at each node. Leaf blades linear, 4–15 cm long, not more than 1.5 mm wide. Leaf tips obtuse with few irregular serrations. Leaf margins entire; conspicuous mid-rib furcate at the tip. Basal portion of leaves enclosed by sheaths, 3 cm long. Ovate scales on each node not persistent at maturity.

NATURAL HISTORY.—*Halodule pinifolia* occurs in sheltered and semi-exposed bays, coral reef plat-forms, in pools, also in wave-beaten sites. The plant has only been collected from two sites along the coast of Negros and Samar islands of the Visayas region of the Philippines. Those collected from Negros were from the upper sublittoral zone and were sterile. The rarity of this species in our collections suggests that it is less tolerant of pre-ailing hydrographic parameters compared to other seagrasses. In the literature (den Hartog, 1970), its companion species on compact mud is *Cymodocea rotundata* and on soft mud, *Halophila ovalis*. At Cairns, Queensland, flowering and fruiting plants of *Halodule pinifolia* were found during November. Species of crustose melobesioids *Acrochaetium*, *Ceramium*, *Hypnea*, and *Polysiphonia*, were found growing on leaves of *Halodule pinifolia*.

PHILIPPINE DISTRIBUTION.—Luzon (Mindoro); Visayas (Negros, Samar, Bohol); Mindano (Cav-illi Island, Pearl Bank).

RANGE.—*H. pinifolia* is most commonly distrib-uted in tropical and subtropical localities. It oc-curs in Ryukyu Islands, Vietnam, Indonesia, Tonga Islands, Papua New Guinea, Fiji Islands, Queensland and New Caledonia.

Halodule uninervis (Forskål) Ascherson

FIGURES 9A,B, 10

Zostera uninervis Forskål, 1775:157.

Halodule uninervis (Forskål) Ascherson, in Boissier, 1882:24.—den Hartog, 1970:147.

Diplanthera uninervis Ascherson, in Engler and Prantl, 1897:37.—Domantay, 1962:275.—Mendoza and del Ro-sario, 1967:13.

CHARACTERISTICS.—Plants of moderate size,

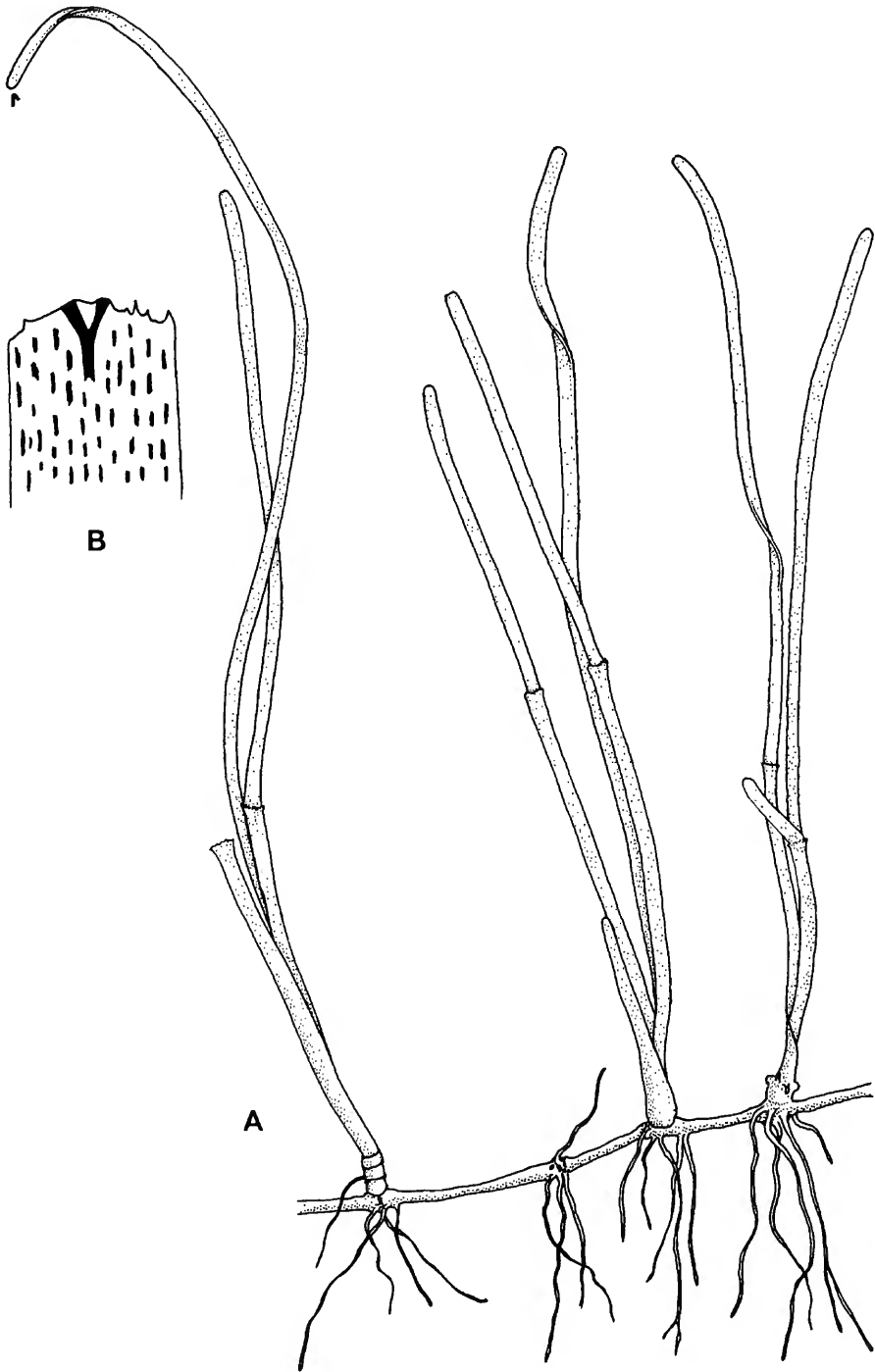


FIGURE 7.—*Halodule pinifolia*: A, habit of plant, $\times 2.1$; B, upper portion of leaf showing furcate midrib and irregular teeth at tip, $\times 28$.

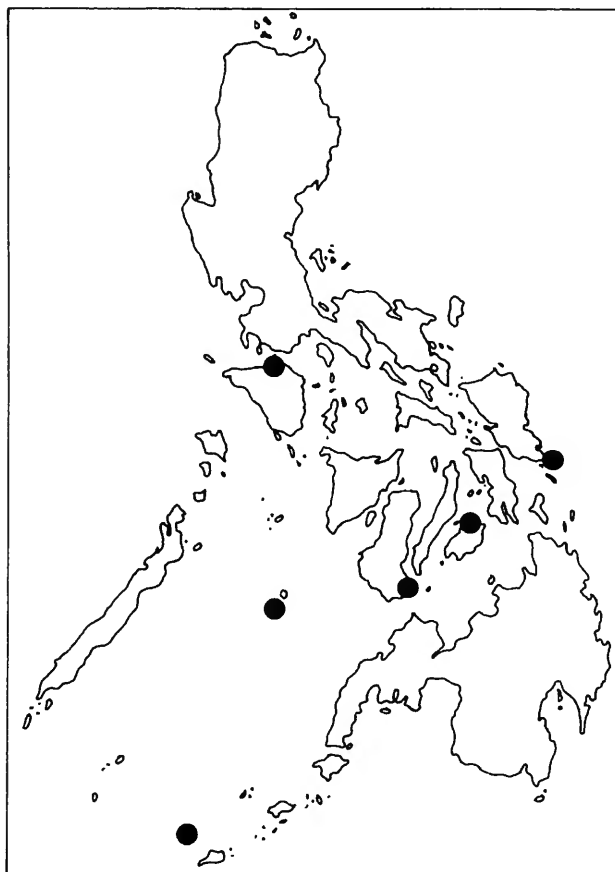
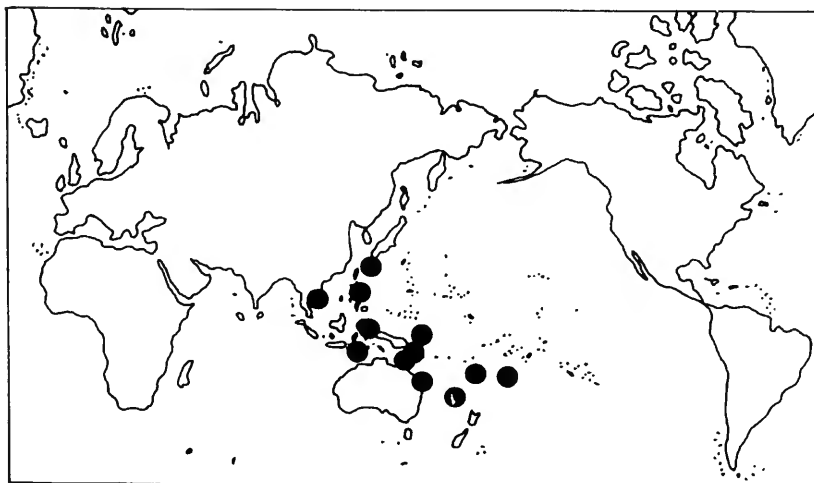


FIGURE 8.—*Halodule pinifolia*: top, world distribution; bottom, Philippine distribution.

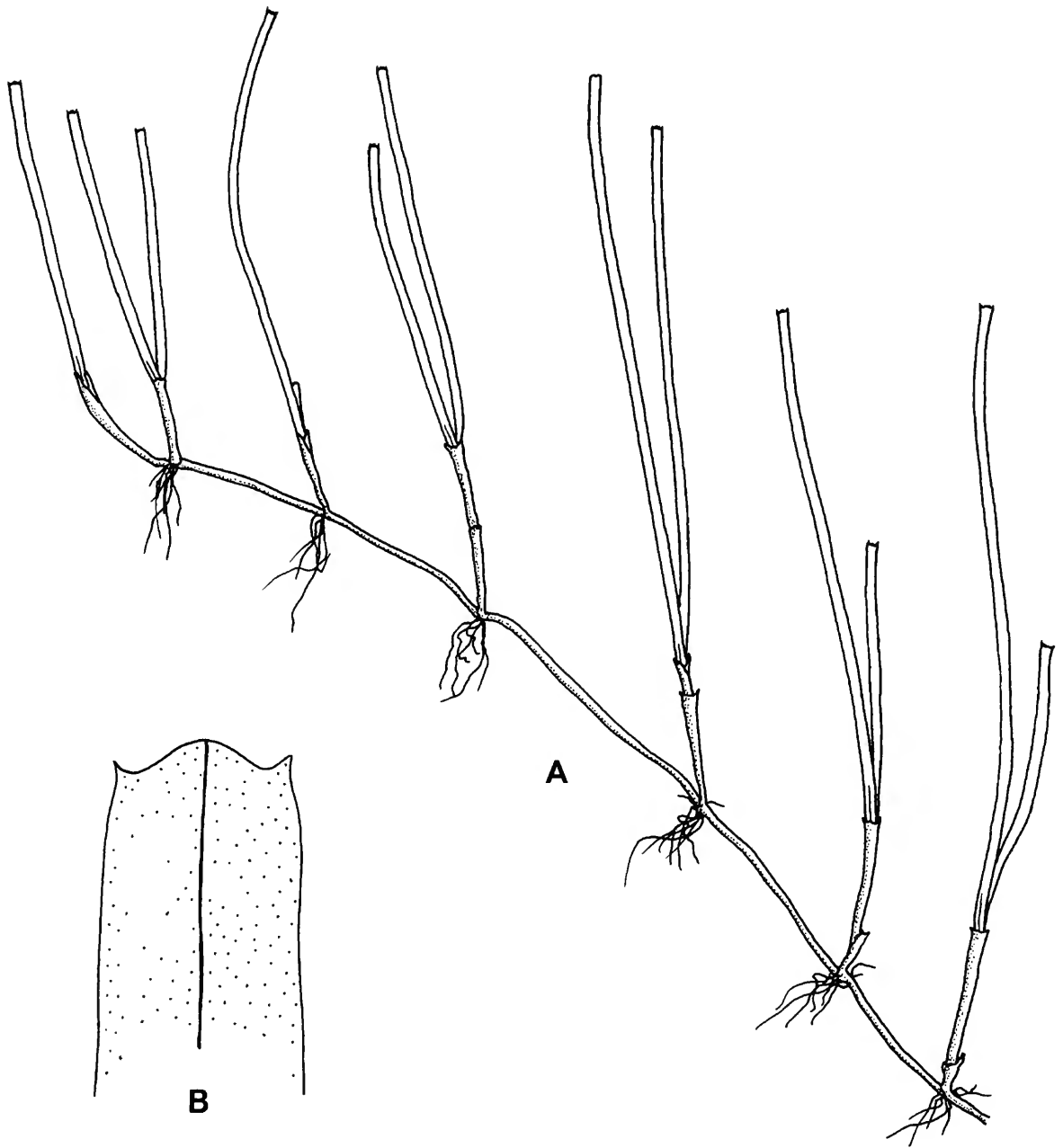


FIGURE 9.—*Halodule uninervis*: A, habit of plant, $\times 0.95$; B, leaf tip showing two acuminate teeth and median nerve, $\times 10.4$.

with slender rhizomes barely reaching 2 mm in diameter; internodes 2–3 cm long; unbranched to sparsely branched roots not more than 5 per node. Erect shoots short, with 2–4 leaves enveloped

below by a 1–2 cm long leaf sheath; when shed, leaf sheaths leave conspicuous annular scars on stem. Leaf blades linear and narrow at the base, 2–5 mm wide, reaching 15 cm in length. Blades

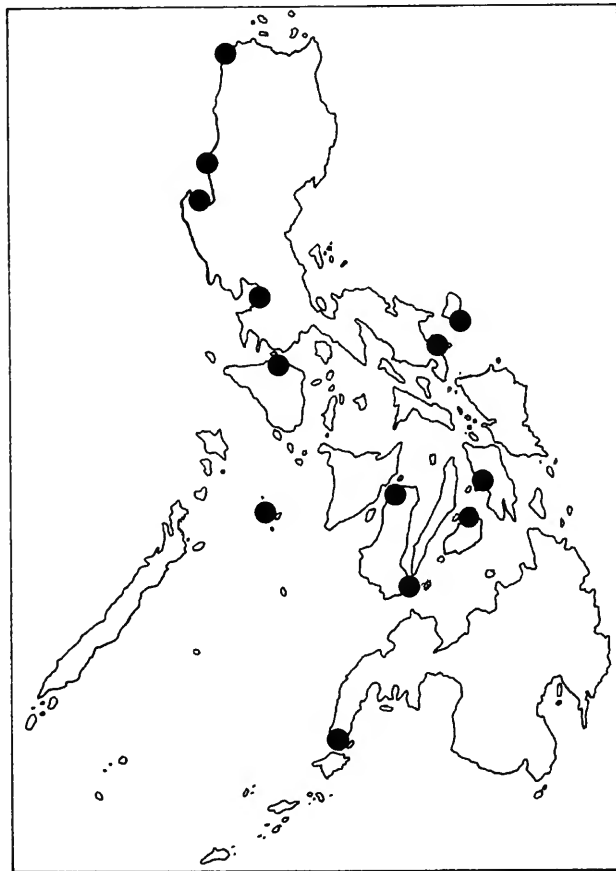
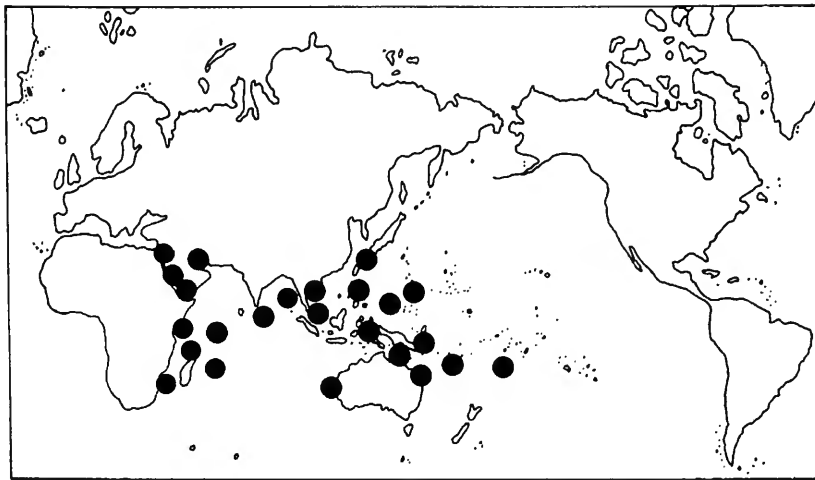


FIGURE 10.—*Halodule uninervis*: top, world distribution; bottom, Philippine distribution.

with 3 nerves; the middle one very distinct and ending in the median apical obtuse tooth, while the lateral nerves ending in 2 abruptly acuminate teeth. Leaf tip tridentate; leaf margin entire.

NATURAL HISTORY.—*Halodule uninervis* occurs in sheltered or exposed localities in the shallow intertidal to the upper subtidal zone, on sand-mud, coarse coral-sand, or sand substrates. In the Philippines, occasional patches of the plant may be mixed with *Thalassia hemprichii*, *Halophila ovalis*, *Syringodium isoetifolium*, *Enhalus acoroides*, and *Cymodocea serrulata*. On the leaves and particularly the basal parts of *Halodule uninervis*, epiphytic algae, such as *Colpomenia sinuosa*, *Dictyopteris delicatula*, *Jania adherens*, *Mastophora rosea*, and species of *Ceramium*, were found. Flowering and fruiting plants of *Halodule uninervis* have not been observed to date in the Philippines. At Queensland, flowering plants were found during October and November.

PHILIPPINE DISTRIBUTION.—Luzon (Manila Bay, Pangasinan, Albay, Catanduanes, Mindoro, La Union, Ilocos Norte); Palawan (Cuyo Islands); Visayas (Negros, Bohol, Leyte, Cebu); Mindano (Zamboanga).

RANGE.—*Halodule uninervis* is widely distributed along the tropical coast of the Indian and western Pacific oceans. It occurs in Egypt, Eritrea, Somalia, Tanzania, Madagascar, Mozambique, Mauritius, Seychelles, Saudi Arabia, Kuwait, Bahrain Islands, Yemen, Sri Lanka, Andaman Islands, Thailand, Vietnam, Malaysia, Indonesia, Papua New Guinea, Western Australia, Queensland, New Caledonia, Tonga Islands, Caroline Islands, Mariana Islands, and Japan.

Syringodium isoetifolium (Ascherson) Dandy

FIGURES 11A–D, 12

Cymodocea isoetifolia Ascherson, 1868:163.

Syringodium isoetifolium (Ascherson) Dandy, in Dandy and Tandy, 1939:116.—den Hartog, 1970:177, figs. 50, 51a–d.

CHARACTERISTICS.—Plants of moderate size, with slender rhizomes not more than 1.5 mm in diameter; internodes 3–15 mm long; one to several laxly branched roots below the erect shoots.

Erect shoot consisting of 2–3 terete leaf blades per node. Leaf blades reaching 25 cm long, 1.0–2.5 mm in diameter, narrow towards the base; central vascular bundle encircled by 6–11 air channels; pericentral vascular bundles 7–9. Leaf sheaths up to 5 cm long. Inflorescence cymose; sheaths of reduced leaves in the inflorescence mostly 4–7 mm long. Staminate flowers with 2 ovate anthers, 4 mm long and connected by the middle to the apex of a 2 mm, terete stalk.

NATURAL HISTORY.—*Syringodium isoetifolium* occurs in sheltered and semi-exposed habitats, on coarse coral-sand substrate. The plants are found in the upper subtidal zone, forming thick carpets with *Thalassia hemprichii*, *Cymodocea rotundata*, *C. serrulata*, and *Halodule uninervis*. In the Philippines, pistillate and staminate flowers were found during May. Crustose melobesioids sometimes heavy on leaf blades; *Chaetomorpha crassa*, *Tolyptocladia glomerulata*, *Hypnea valentiae*, *Dictyota* species, and *Gracilaria blodgettii* attached at the base of leaves and on leaf sheaths of *S. isoetifolium*.

PHILIPPINE DISTRIBUTION.—Luzon (Pangasinan, Albay, Catanduanes, Mindoro, La Union); Visayas (Negros, Siquijor, Bohol); Mindanao (Zamboanga).

RANGE.—*Syringodium isoetifolium* is widely distributed in the tropics. It occurs in Egypt, Kenya, Tanzania, Mozambique, Madagascar, Seychelles, Mauritius, Yemen, Bahrain Islands, Sri Lanka, Nicobar Islands, Vietnam, Malaysia, Papua New Guinea, Tonga Islands, Caroline Islands, Ryukyu Islands, Western Australia, Queensland, and New Caledonia.

Thalassodendron ciliatum (Forskål) den Hartog

FIGURES 13A–C, 14

Zostera ciliata Forskål, 1775:157.

Thalassodendron ciliatum (Forskål) den Hartog, 1970:186, figs. 52a–j.—Meñez and Calumpong, 1983:103–111.

CHARACTERISTICS.—Plants moderately large, occasionally branched once, reaching a height of 45 cm. Rhizome thick, up to 5 mm in diameter; internodes 3–10 mm long; roots 1–6 borne on

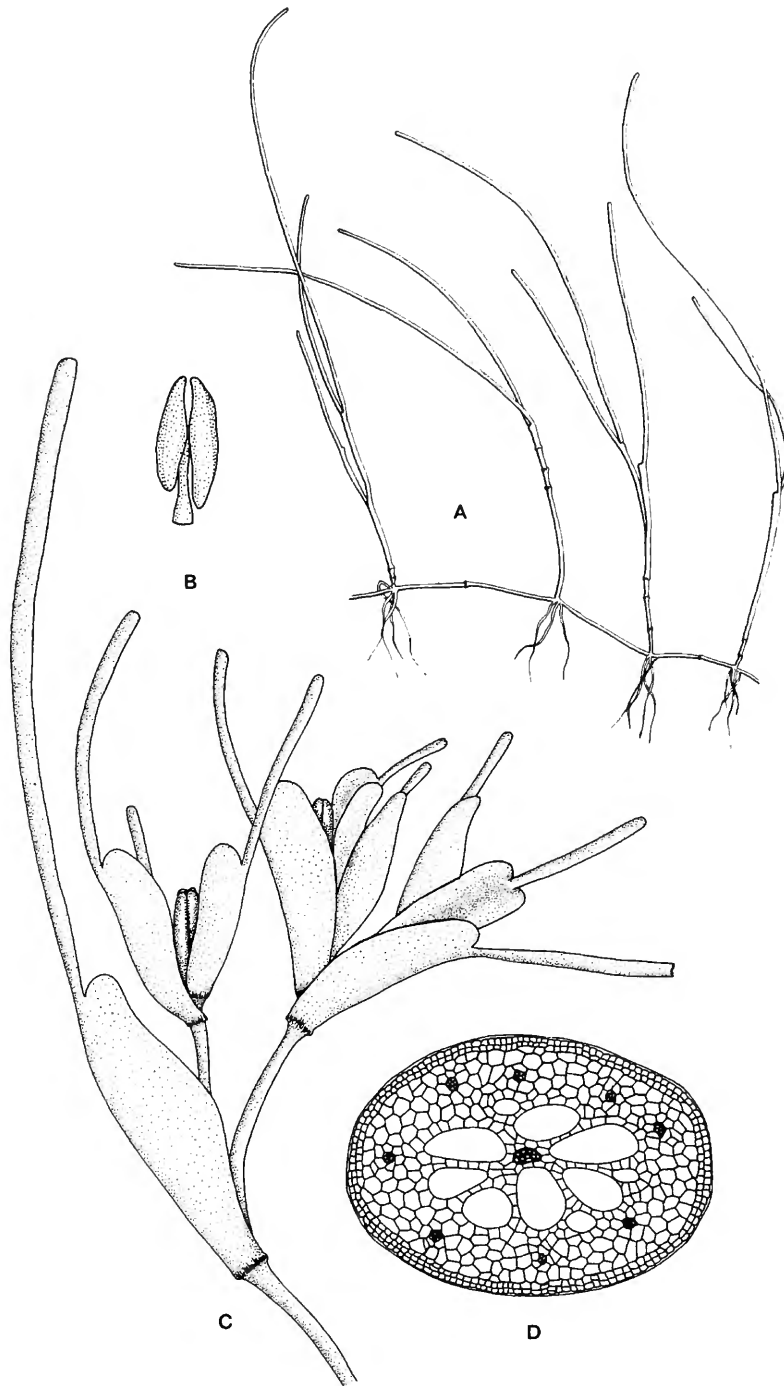


FIGURE 11.—*Syringodium isoetifolium*: A, habit of plant, $\times 0.3$; B, staminate flower with 2 anthers, $\times 4.1$; C, portion of male plant, $\times 3.1$; D, section of leaf-blade showing central vascular bundle and air channels, $\times 21.8$.

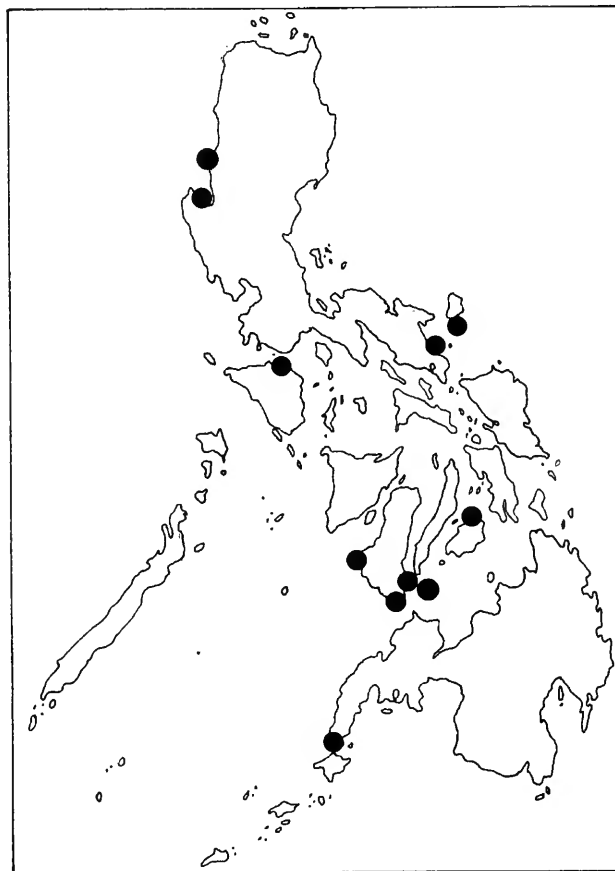
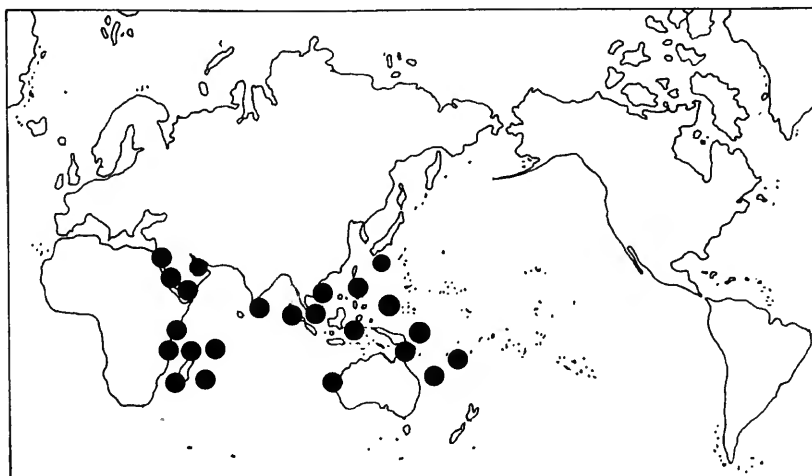


FIGURE 12.—*Syringodium isoetifolium*: top, world distribution; bottom, Philippine distribution.

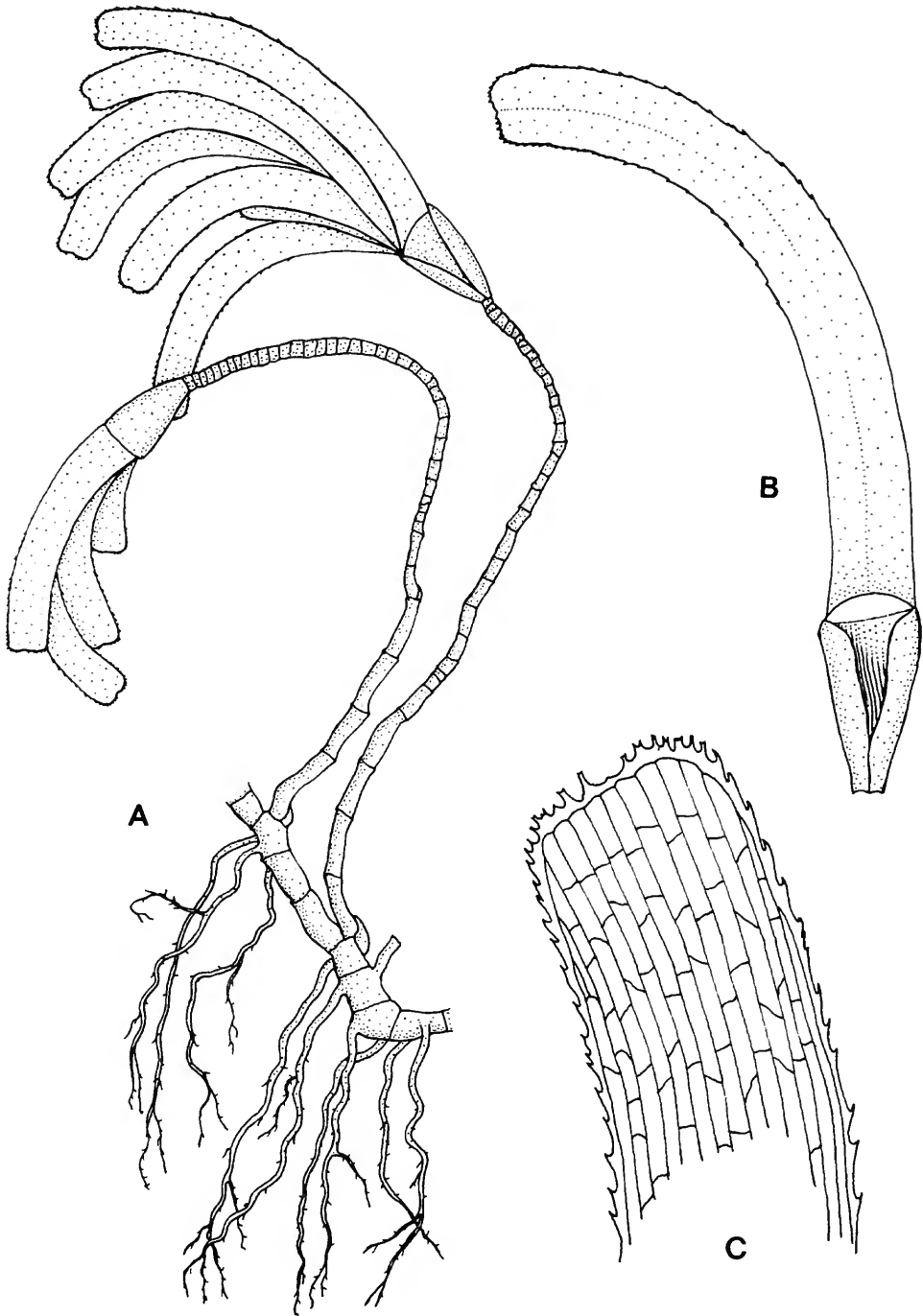


FIGURE 13.—*Thalassodendron ciliatum*: A, habit of plant, $\times 0.8$; B, leaf with ligules and sheath, $\times 1.9$; C, details of apical portion of leaf showing denticulate tip, irregularly serrate margin and nerves connected by cross veins, $\times 6.3$.

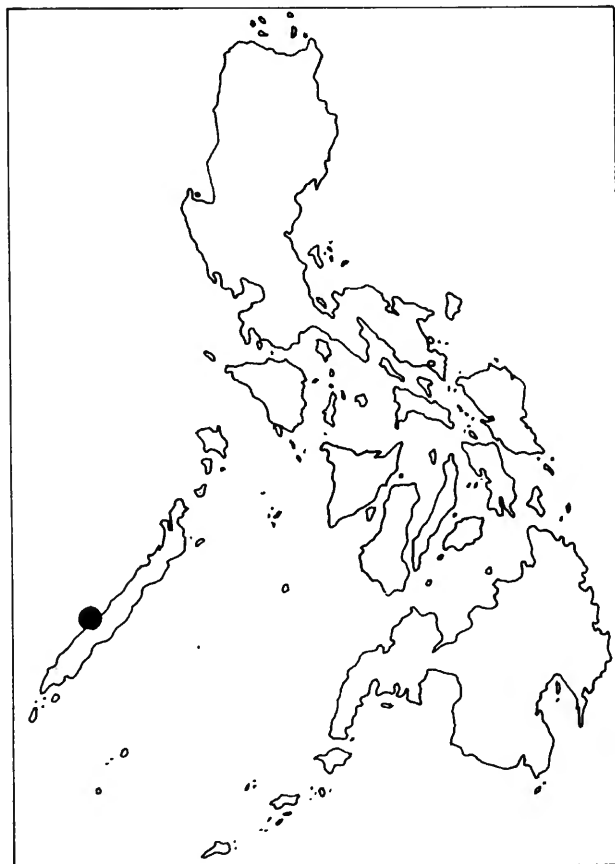
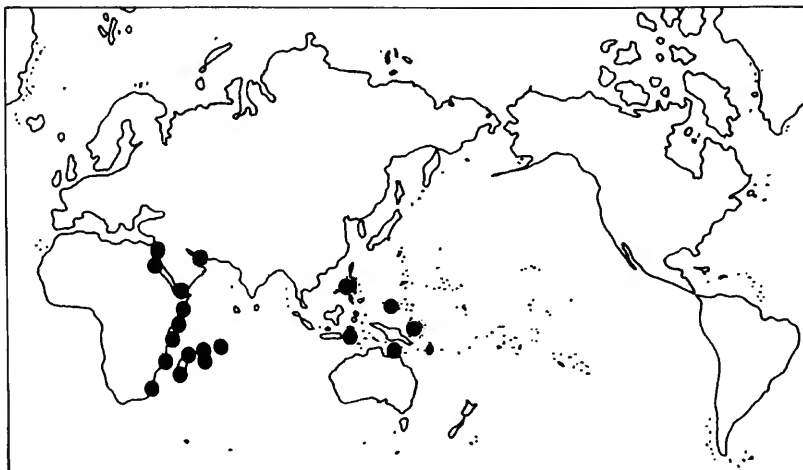


FIGURE 14.—*Thalassodendron ciliatum*: top, world distribution; bottom, Philippine distribution.

internode, with tough, wiry laterals, no more than 1.5 mm in diameter. Two stems produced at every fourth internode on rhizome; one fully developed, long and erect with numerous leaf scars and another, usually an undeveloped stem-bud. Upper part of erect stem compressed, but the basal portion terete. Leaf blades usually 6, linear-falcate, narrowed towards the base, up to 10 mm wide and 13 cm long; leaf tips rounded, denticulate; apical teeth bi-trifurcate; upper half of leaf margin with irregular serrations, becoming distant and few towards the base; lower half of leaf margin almost entire. Leaf nerves 12–18, connected by a few oblique cross-veins. Leaf sheaths obtuse, up to 12 mm wide and 20 mm long, with obtuse auriculae and ligules.

NATURAL HISTORY.—*Thalassodendron ciliatum* occurs in sheltered and semi-exposed localities, in the upper sublittoral zone. The plants from the Philippines were sterile and found in small patches among dead and living corals in clear water. In Kenya and Mozambique, staminate and pistillate flowers were observed during August and January, respectively. In Tanzania, staminate flowers have been recorded during August. Algal epiphytes found growing on Philippine specimens of *T. ciliatum* include *Hypnea valentiae*, *Jania adherens*, *Amphiroa rigida*, *Codium arabicum*, *Giffordia rallsiae*, *Sphaecularia furcigera*, *Polysiphonia mollis*, species of *Padina* and *Dictyota*, *Ceramium mazatlanense*, and *Champia parvula*. The latter two algal taxa were present on both leaves and stems, while the rest were only on the stem.

The authors wish to point out that *Thalassodendron ciliatum* may often be confused with the “long-stemmed” *Cymodocea serrulata*. Johnstone (1982) has found two growth forms of *Cymodocea serrulata* in New Guinea and reported that the “normal” form to be the most common. McMillan (1983) has found evidence that the “long-stemmed” plants are controlled by light intensity. *T. ciliatum* and *C. serrulata* are easily distinguished by a careful morphological examination.

PHILIPPINE DISTRIBUTION.—Palawan (Bajallan-ura Island, Tidepole Island, Double Island, western side of Tapon Cave at Quezon).

RANGE.—*T. ciliatum* occurs in Egypt, Sudan,

Somalia, Kenya, Tanzania, Mozambique, South Africa, Madagascar, Chagos Archipelago, Seychelles, Amirante Islands, Aldabra Islands, Comoro Island, Mauritius, Saudi Arabia, Iran, Indonesia, Papua New Guinea, Solomon Islands, Caroline Islands, and Queensland.

Family HYDROCHARITACEAE

Enhalus acoroides (L. f.) Royle

FIGURE 15, 16

Stratiotes acoroides L. f., 1781:268.

Vallisneria sphaerocarpa Blanco, 1837:780; 1845:538; 1879:186.—Merrill, 1918:59.

Enhalus acoroides (L. f.) Royle, 1840:453.—Merrill, 1925:27.—Domantay, 1962:275.—den Hartog, 1970:215, fig. 60.—Cordero, 1981:321, fig. 1.

CHARACTERISTICS.—This is the largest of the seagrass species from the Philippines, reaching a height of more than a meter. Rhizome thick, up to 1.5 cm in diameter, deeply embedded in substrate, bearing many roots, 2–5 mm in diameter and up to 15 cm long. Persistent leaf fibers very dense and masking rhizome. Leaves 3 or 4, produced directly from rhizome; leaf blades linear, to 1.5 cm wide and reaching 1 m in length; leaf tips rounded, beset occasionally with minute serrate projections when young; leaf margins entire, slightly rolled. Characteristic tough, black vascular bundles persistent after death and decay of other leaf tissues. Nerves 10–40, parallel to about as many air-channels. Fruits ovoid, 4–7 cm long, with acuminate tips and densely covered with bifid projections. Fruit stalk long and coiled.

NATURAL HISTORY.—*Enhalus acoroides* occurs in sheltered localities in the lower intertidal and upper subtidal zones, on sand-mud, coarse coral-sand or mud substrates. In the Philippines, the plant was observed in pure stands next to a mangrove where silt was thick and water was murky, or in occasional patches in coarse coral-sand growing together with *Thalassia hemprichii*, or mixed with *Halodule uninervis*, *Cymodocea serrulata*, *Syringodium isoetifolium*, and *Halophila ovalis*. Fruiting plants of *Enhalus acoroides* were found in May–October in Central Visayas and during



FIGURE 15.—*Enhalus acoroides*: habit of plant, $\times 0.4$.

April staminate flowers were collected from southern Luzon in the Philippines. According to den Hartog (1970), this plant probably flowers and fruits the whole year round. Crustose melobesioids are sometimes very thick on leaves and on black "hairs." *Hypnea* and *Cladophora* were found attached to the melobesioids. Few thalli of *Ceramium* were epiphytic on *Enhalus acoroides* leaves.

PHILIPPINE DISTRIBUTION.—Luzon (Zambales, Catanduanes, Mindoro); Palawan (Tay-tay Bay, Quezon, Cuyo Islands); Visayas (Cebu, Samar, Leyte, Negros, Bohol); Mindanao (Surigao, Zamboanga, Basilan).

RANGE.—*E. acoroides* is widely distributed in the tropics. It occurs in Kenya, Seychelles, Madagascar, Saudi Arabia, Yemen, India, Sri Lanka, Andaman Islands, Malaysia, Kampuchea, Vietnam, Ryukyu Islands, Indonesia, Papua New Guinea, Mariana Islands, Caroline Islands, Queensland, and New Caledonia.

Halophila beccarii Ascherson

FIGURES 17A,B, 18

Halophila beccarii Ascherson, 1871b:302.—Merrill, 1912:70; 1925:25.—Mendoza and del Rosario, 1967:21.—den Hartog, 1970:261.

CHARACTERISTICS.—Plants small, with slender rhizomes not more than 1 mm in diameter; internodes 1–3 cm long; with one root at each node. Uneven pair of scales enveloping the erect shoot that consists of up to 10 closely set, petiolated leaves. Leaf blades lanceolate, with acute apices and cuneate or attenuate bases, 8–15 mm long and 1–2 mm wide; margins entire, rarely minutely spinulose. Conspicuous midrib extending to leaf apex, with one intramarginal vein on each side that is connected only at the base of the midrib and joining it again just below the tip. Cross-veins absent.

NATURAL HISTORY.—*Halophila beccarii* occurs in the shallow, intertidal zone in sheltered localities, such as mangroves, mouths of rivers, and brackish ponds. The plant seems to favor sand-mud, particularly muddy substrates. In Singapore, samples of the species were found abundant on mud and

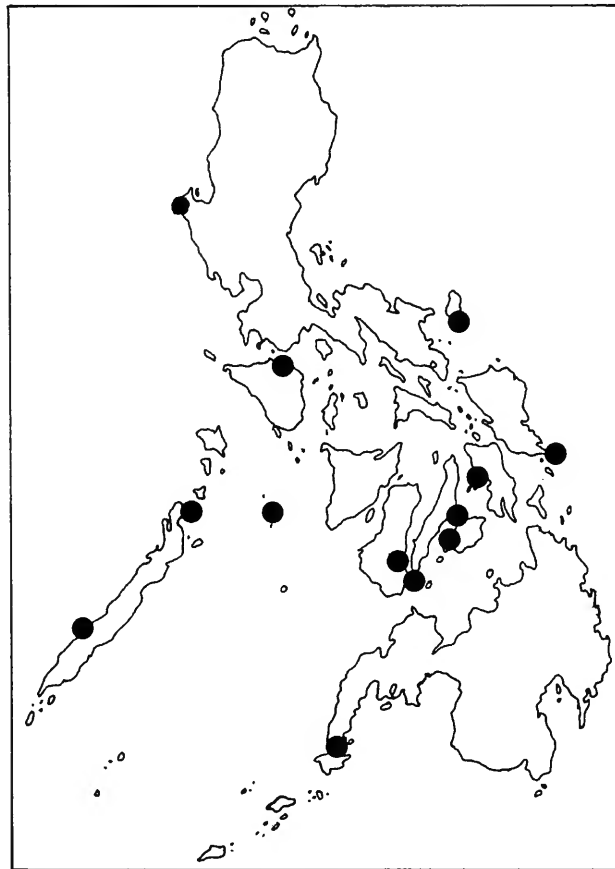
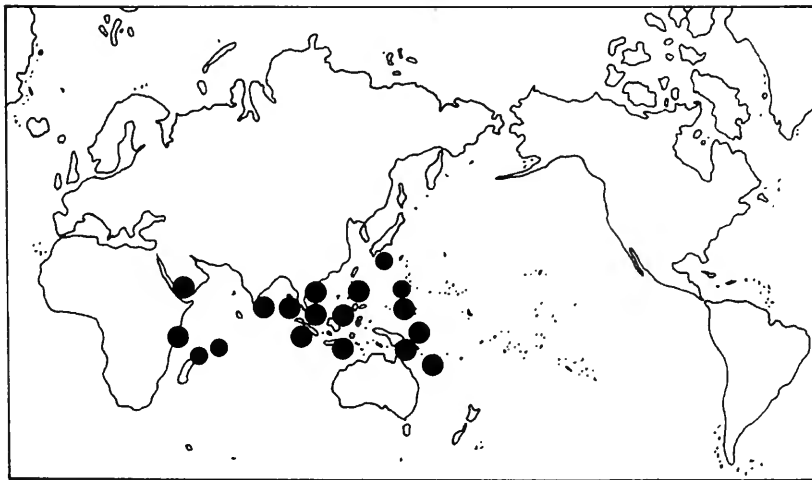


FIGURE 16.—*Enhalus acoroides*: top, world distribution; bottom, Philippine distribution.

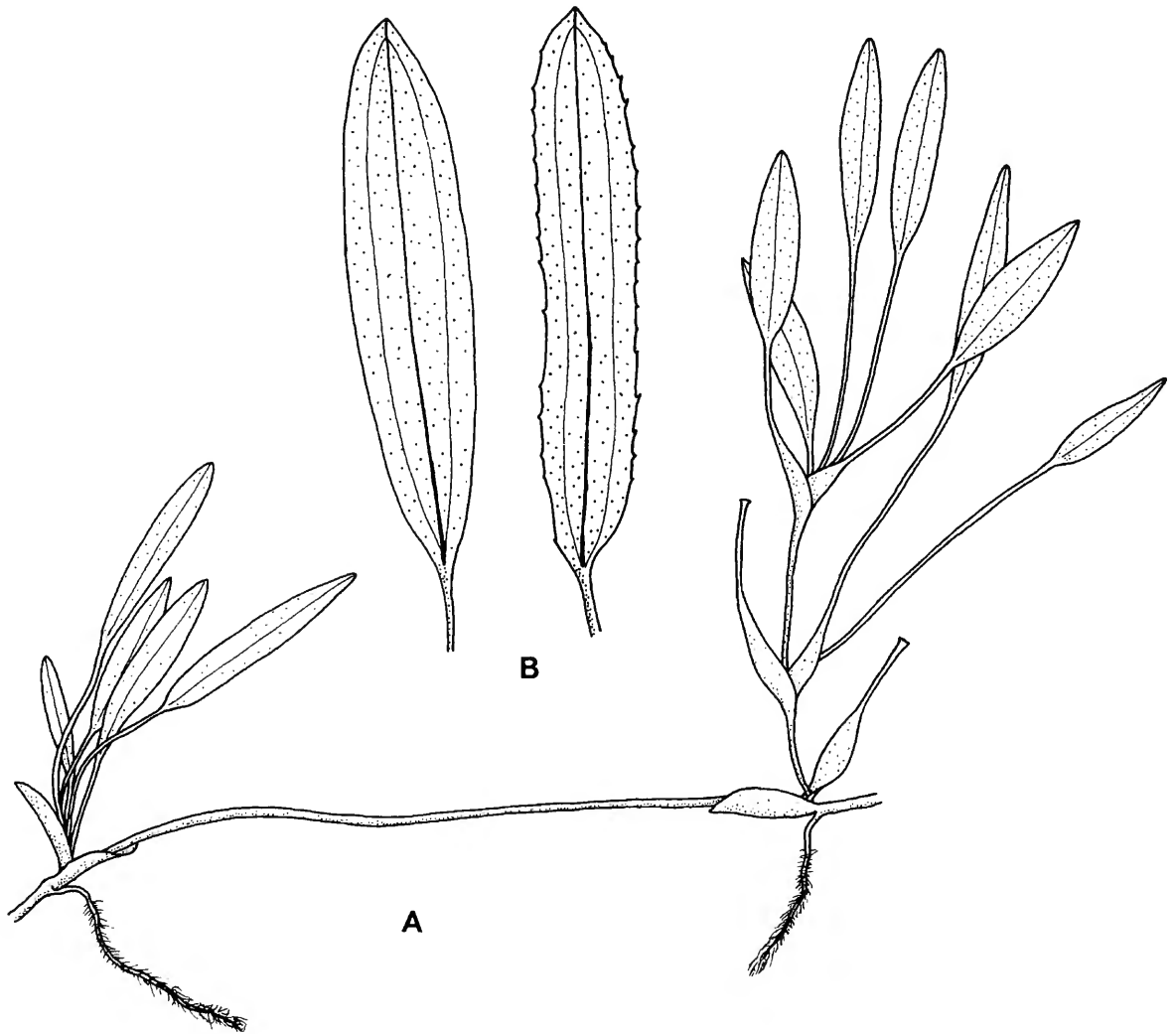


FIGURE 17.—*Halophila beccarii*: A, habit of plant, $\times 2.9$; B, leaves showing entire and spinulose margins, including conspicuous midrib and intramarginal veins, $\times 7.3$.

on sand in shaded stream beds, and in brackish water in mangroves. Flowering of *Halophila beccarii* have been observed during February, June, and August. The plant may be found growing in pure stand or together with *Halophila ovalis*, *H. minor*, or *Halodule uninervis*. A few patches of crustose melobesioids were observed growing on leaves of *Halophila beccarii* collected from the Philippines.

PHILIPPINE DISTRIBUTION.—Luzon (Manila Bay, Parañaque).

RANGE.—*H. beccarii* occurs in Chilka Lake, a salt-water lake along the eastern coast of India. It has also been recorded in Sri Lanka, Burma, Vietnam, and Malaysia:

***Halophila minor* (Zollinger) den Hartog**

FIGURES 19A-C, 20

Lenmopsis minor Zollinger, 1854:75.

Halophila minor (Zollinger) den Hartog, 1957:410.—Mendoza and del Rosario, 1967:21.

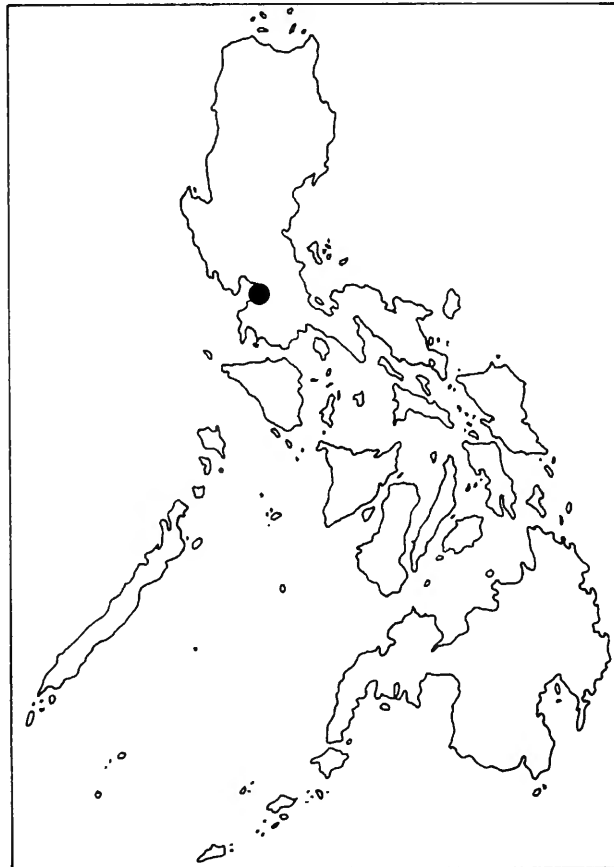
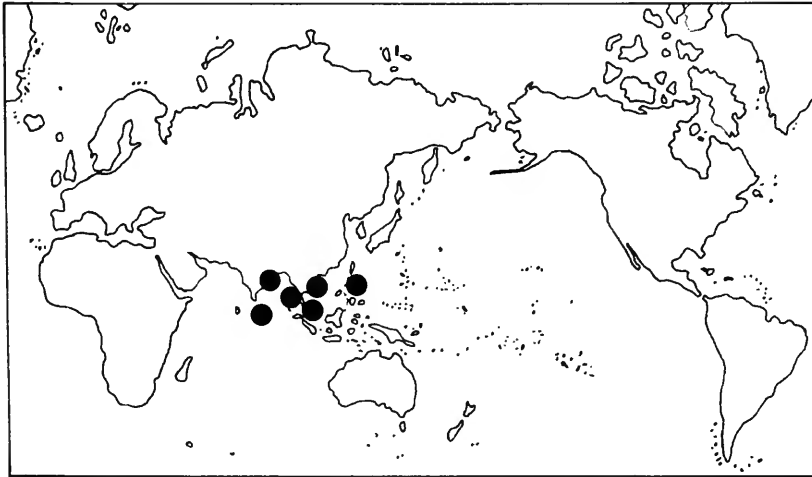


FIGURE 18.—*Halophila beccarii*: top, world distribution; bottom, Philippine distribution.

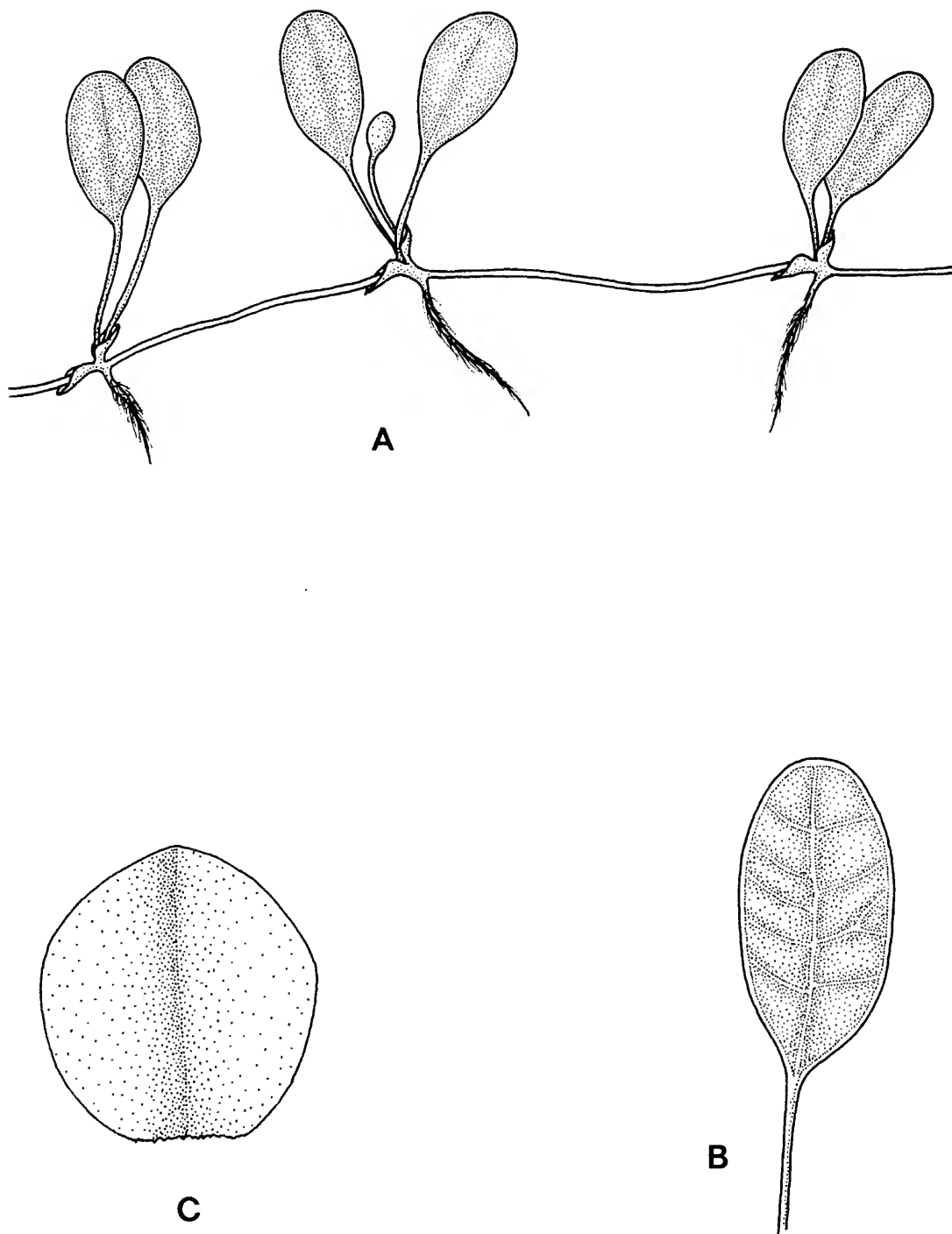


FIGURE 19.—*Halophila minor*: A, habit of plant, $\times 4.9$; B, leaf showing cross veins, $\times 9.7$; C, scale, $\times 29.1$.

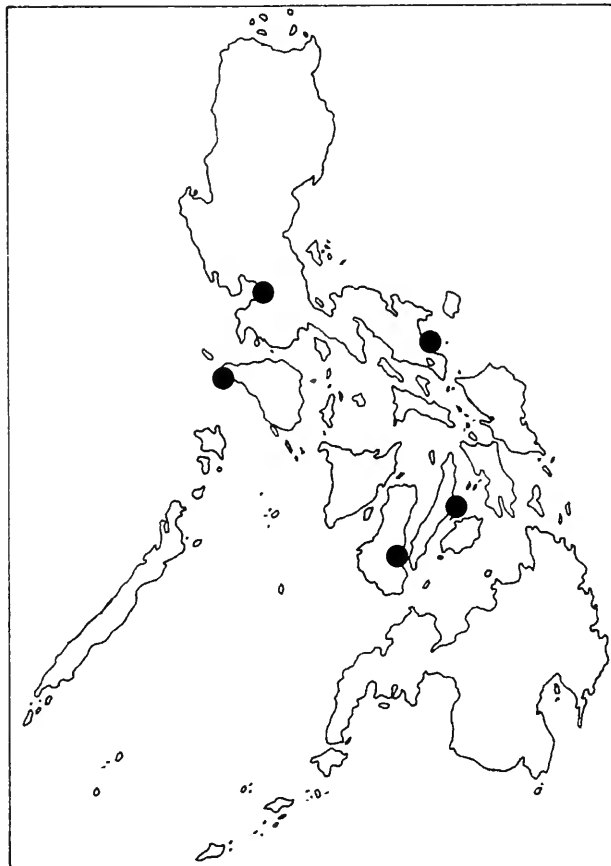
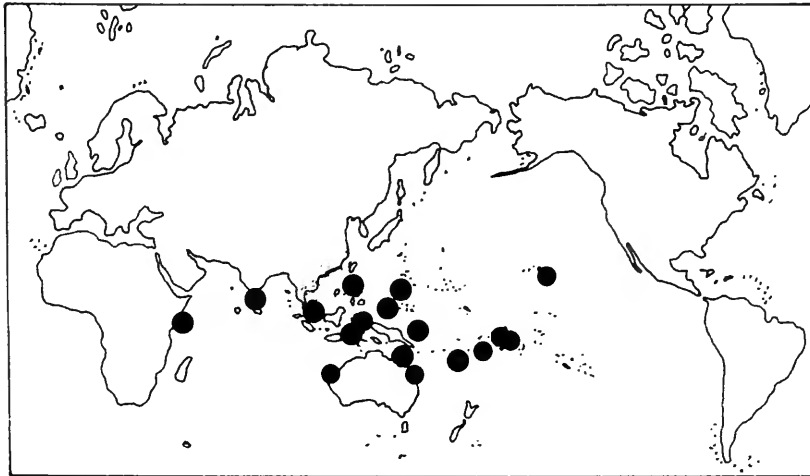


FIGURE 20.—*Halophila minor*: top, world distribution; bottom, Philippine distribution.

Halophila ovata sensu Ostenfeld, 1909:68.—sensu Merrill, 1912:70; 1925:26.—sensu den Hartog, 1970:251. [Non Gaudichaud, 1826 [1829]:430 (= *H. ovalis* (R. Brown) Hooker f.).]

CHARACTERISTICS.—This is probably the smallest of the seagrasses found in the Philippines, with rhizomes barely reaching 1 mm in diameter; internodes 7–20 mm long; usually one root below each erect shoot. Erect shoot short, consisting of a pair of leaves on each node. Leaves with petioles, 2–8 mm long, each enveloped by a pair of transparent, orbicular scales with rounded apices. Leaf blades elliptic or obovate, width 2–3 mm, length 4–7 mm, apices rounded, bases attenuate; margins entire; with 4–7 pairs of cross-veins. Staminate flowers pedicellate, with obtuse, convex tepals; anthers approximately 2 mm long. Pistillate flowers with 3 styles, each up to 15 mm long; ovary ovoid, reaching a length of 3 mm. Ellipsoid, ovoid or globose fruits up to 4 mm long, bearing 2–6 mm long beaks; seeds subglobose, about 0.5 mm long.

The authors follow the remarks of Sachet and Fosberg (1973:441) that the correct name for this species is *Halophila minor*, since *Halophila ovata* is a superfluous name, hence illegitimate.

NATURAL HISTORY.—*Halophila minor* occurs in sheltered coasts on mud, sand, or coral rubble substrates. The plant seems to prefer muddy bottoms and tolerates heavy sedimentation, as generally found in deep bay localities that are well protected from wave action. In the Philippines, *H. minor* plants were collected from sand-mud or coral rubble substrates during January–May. They were abundant in March–May and bearing flowers and fruits. Flowering plants have been observed in January and in April, including fruits, at New Caledonia. Plants with fruits and flowers were collected from Kenya in July. Den Hartog (1970) suggested that in areas where the plants are reproductive, they are annuals, and in places where they do not flower, they may be perennials. *Halophila minor* have been found growing together with *Halophila ovalis*, *Enhalus acoroides*, *Thalassia hemprichii*, and *Halodule uninervis*. Examination of epiphytes revealed few patches of crus-

tose red algae on leaves of *H. minor* from the Philippines.

PHILIPPINE DISTRIBUTION.—Luzon (Manila Bay, Albay, Mindoro); Visayas (Cebu, Negros).

RANGES.—*Halophila minor* occurs in Kenya, India, Singapore, Indonesia, Papua, New Guinea, Western Australia, Queensland, New Caledonia, Samoa, Fiji, Wallis Islands, Caroline Islands, Mariana Islands, Hawaii.

Halophila ovalis (R. Brown) Hooker f.

FIGURES 21A–C, 22

Caulinia ovalis R. Brown, 1810:339.

Halophila ovalis (R. Brown) Hooker, 1858:45.—Merrill, 1925:26.—Domantay, 1962:275.—Mendoza and del Rosario, 1967:22.—den Hartog, 1970:240.—Cordero, 1981:322.

Halophila ovata Gaudichaud, 1826 [1829]:430.

CHARACTERISTICS.—Plants small, with long and narrow rhizomes, not more than 2 mm in diameter; internodes 5–40 mm long; usually one root present below each erect shoot. Erect shoot short, consisting of a pair of leaves borne on each node. Leaves petiolated; petioles 5–50 mm long, each enveloped by a pair of transparent scales; apex of scale emarginate, the base auriculate. Leaf blades oblong, oval, elliptic or spatulate, occasionally lanceolate or linear, width 4–12 mm, length 8–25 mm, apices rounded, bases cuneate, attenuate or truncate; margins entire; with 12–22 pairs of cross-veins which are often forked. Midrib connected to the intramarginal nerve at the top. Staminate flowers consist of small, elliptic, convex tepals generally obtuse or slightly apiculate; anthers oblong. Pistillate flowers with small ovoid ovaries; 3 long styles. Fruits globose with beaks up to 6 mm long.

NATURAL HISTORY.—*Halophila ovalis* occurs in open or sheltered coasts, from midtide to 10 m deep in Central Philippines. The plant grows on a wide variety of substrate, such as mud, living corals, or coral rubble, and in sand where the plant is occasionally almost completely buried. According to the literature, *H. ovalis* is a euryhaline species that can grow in waters with de-

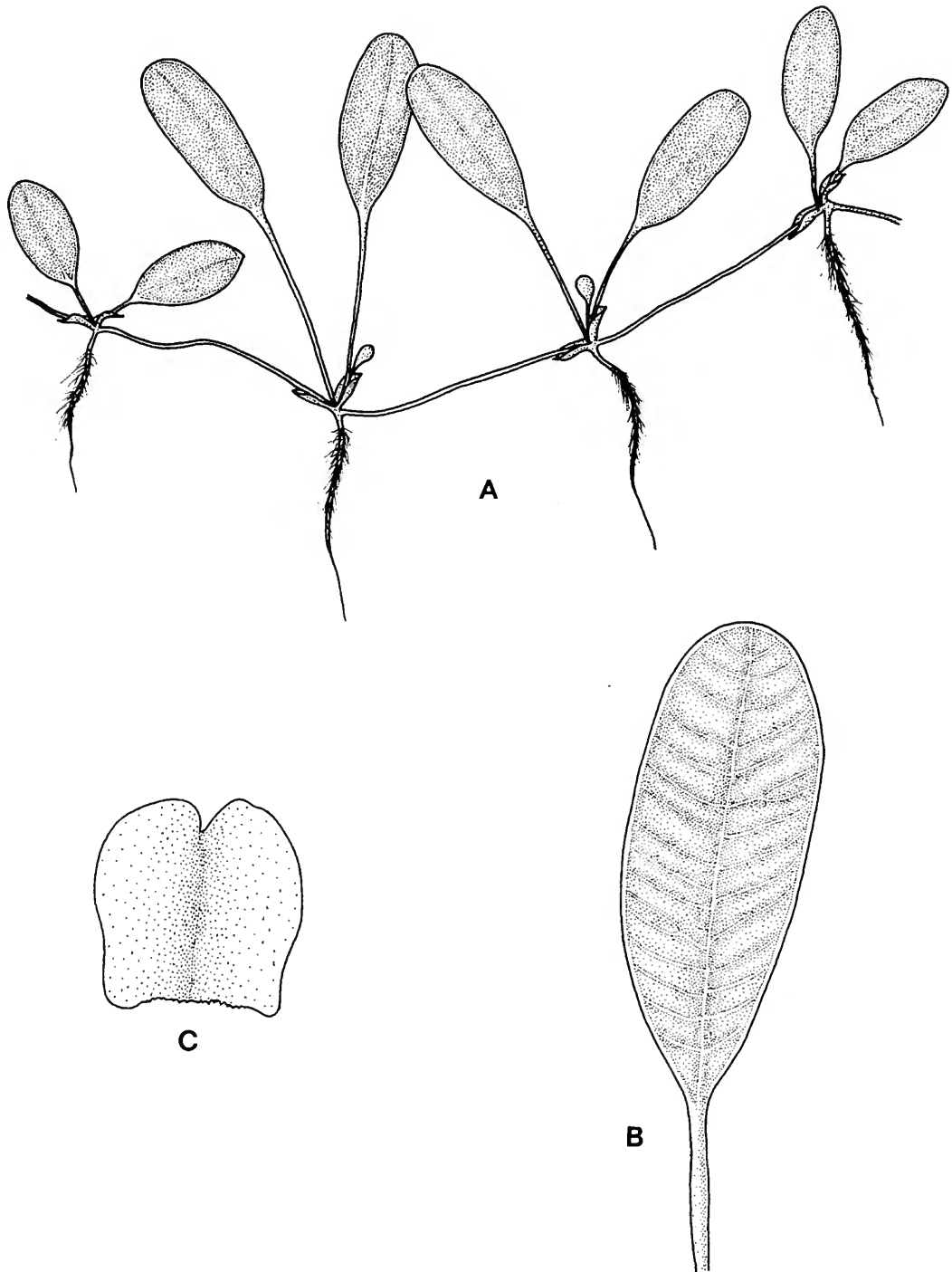


FIGURE 21.—*Halophila ovalis*: A, habit of plant, $\times 2.2$; B, leaf showing cross veins, $\times 5.6$; C, scale, $\times 10.4$.

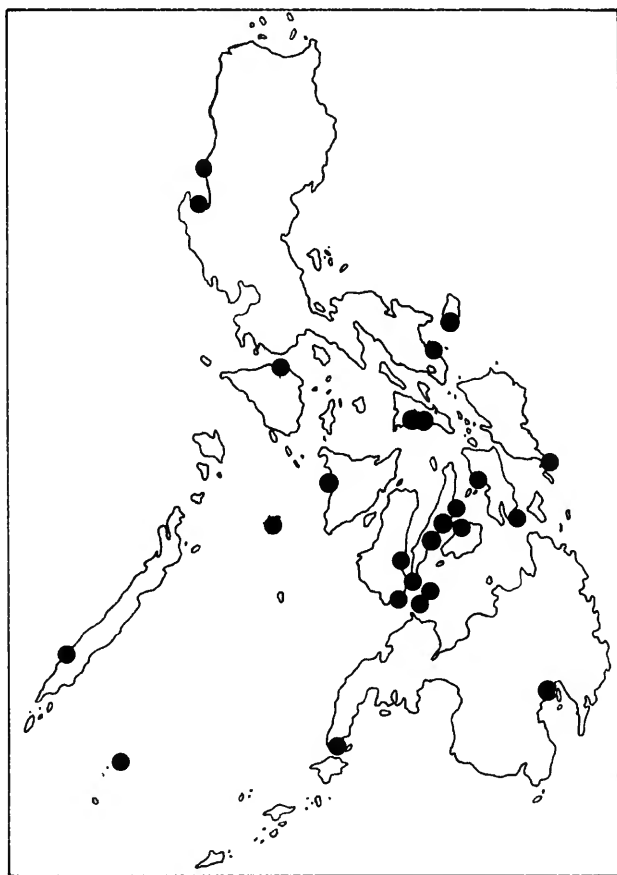
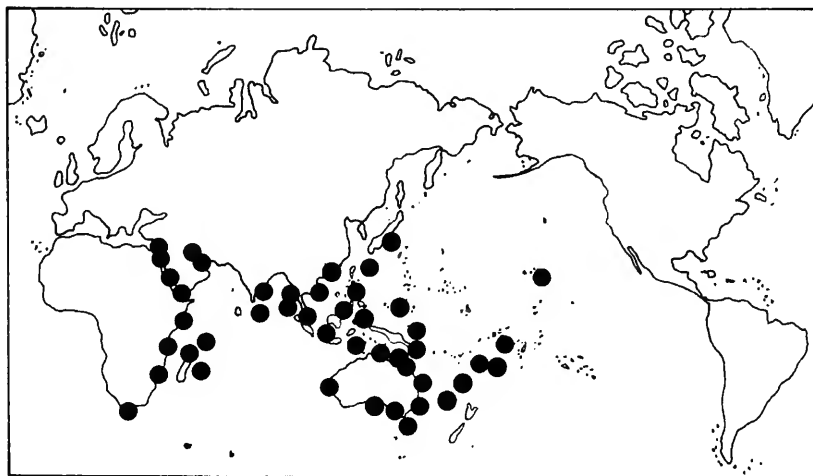


FIGURE 22.—*Halophila ovalis*: top, world distribution; bottom, Philippine distribution.

creased salinities of 10‰, as in estuaries and brackish lagoons. It is also eurythermic, but cannot survive in waters with temperatures below 10° C. There is a great variability in its morphology (i.e., leaf size and shape, plant size,ervation) which is probably influenced primarily by its environment. In den Hartog's (1970) view, *H. ovalis* represents a "collective species" and only *H. ovata* (= *H. minor*) had been separated from it (Ostenfeld, 1909).

Halophila ovalis is an abundant seagrass in tropical and warm temperate areas, occasionally found in pure stands or mixed with *Thalassia hemprichii*, *Halodule uninervis*, *H. pinifolia*, *Cymodocea rotundata*, or *Enhalus acoroides*. On a sand-bar on the northwestern end of Sumilon Island, Philippines, it was observed that *Halophila ovalis* appeared as a pioneer species on new sand-coral rubble substrate. The plant flowers and fruits during the warmest months. Algal epiphytes found on the leaves of the plant include crustose melobesioids, a few thalli of species of *Acrochaetium*, *Ceramium*, *Hypnea*, *Jania*, and *Polysiphonia*.

PHILIPPINE DISTRIBUTION.—Luzon (La Union, Catanduanes, Pangasinan, Albay, Mindoro, Masbate); Palawan (Cuyo Islands, Quezon); Visayas (Leyte, Negros, Cebu, Panay, Sumilon, Siquijor, Bohol, Samar); Mindanao (Davao, Zamboanga, Bancoran Island).

RANGE.—*Halophila ovalis* is widely distributed in the Indo-West Pacific. It occurs in Egypt, Sudan, Kenya, Tanzania, Mozambique, South Africa, Madagascar, Seychelles, Mauritius, Israel, Saudi Arabia, Yemen, Kuwait, Iran, Bahrain Islands, Sri Lanka, Burma, Andaman Islands, Thailand, Vietnam, Hong Kong, China, Ryukyu Islands, Malaysia, Indonesia, Papua New Guinea, Western Australia, South Australia, Tasmania, New South Wales, Lord Howe Island, Queensland, Northern Territory, Caroline Islands, Hawaiian Islands, Samoa Islands, Tonga Islands, Fiji Islands, New Caledonia, and India.

Halophila spinulosa (R. Brown) Ascherson

FIGURES 23A,B, 24

Caulinia spinulosa R. Brown, 1810:339.

Halophila spinulosa (R. Brown) Ascherson, 1875:368.—Merrill, 1915:2; 1925:26.—Pascasio and Santos, 1930:4.—Domantay, 1962:275.—Mendoza and del Rosario, 1967:22.—den Hartog, 1970:263.

CHARACTERISTICS.—Plants small, with long and narrow rhizomes, not more than 1 mm in diameter; internodes 13–35 mm long; usually one root per node; roots 5–10 cm long, beset with filiform hairs. Erect shoots pedicellate with 2 basal, ovate scales with serrate apex. Sessile leaf blades up to 22 pairs, distichously arranged on erect shoot; blades oblong-linear, semi-amplexicaulous, 20 mm long, 3.5 mm wide; margins serrate; basal portion of one side of blade folded; a few inconspicuous cross-veins present and connected to the intramarginal nerve; tip of conspicuous midrib joining intramarginal nerve.

NATURAL HISTORY.—*Halophila spinulosa* occurs on sand, mud, or coral rubble in the sublittoral zone. The plant may grow together with *Thalassia hemprichii*, *Enhalus acoroides*, *Halophila ovalis*, and *Halodule pinifolia*. Flowering *H. spinulosa* has been observed during March, October, November, and December. Fruits were observed in October. The plant can tolerate brackish water conditions (den Hartog, 1970). The few specimens of *H. spinulosa* examined did not reveal any epiphytes.

PHILIPPINE DISTRIBUTION.—Luzon (Manila Bay, Mindoro, Camarines); Mindanao (Davao).

RANGE.—*Halophila spinulosa* occurs in Malaysia, Singapore, Indonesia, Western Australia, Papua New Guinea, and Queensland.

Thalassia hemprichii (Ehrenberg) Ascherson

FIGURES 25A,B, 26

Schizotheca hemprichii Ehrenberg, 1836:429.

Thalassia hemprichii (Ehrenberg) Ascherson, 1871c:242.—Merrill, 1912:71; 1925:27.—Pascasio and Santos, 1930:1, figs. 1–52, plates 1–5.—Domantay, 1962:276.—Mendoza and del Rosario, 1967:50.—den Hartog, 1970:232, fig. 61.—Cordero, 1981:323, fig. 3.

CHARACTERISTICS.—Plants of moderate size, consisting of a robust rhizome, 2–4 mm in diameter; internodes 3–6 mm long; roots clothed with dense filiform laterals, one per node if present. Erect shoot short, with 2–6 leaves enveloped by

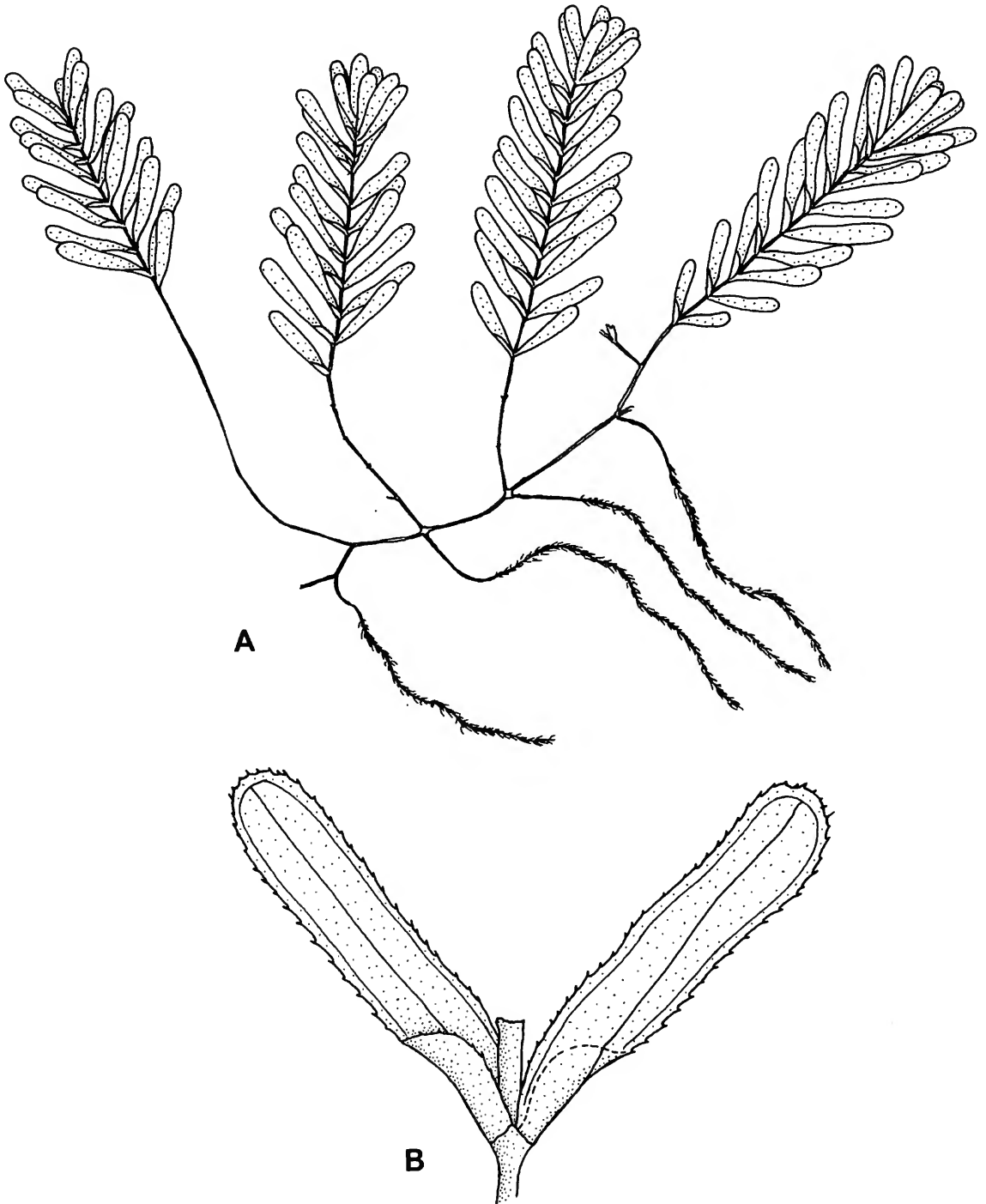


FIGURE 23.—*Halophila spinulosa*: A, habit of plant, $\times 0.95$; B, portion of erect shoot with two amplexicaulous leaves, showing folded basal end, $\times 3.1$.

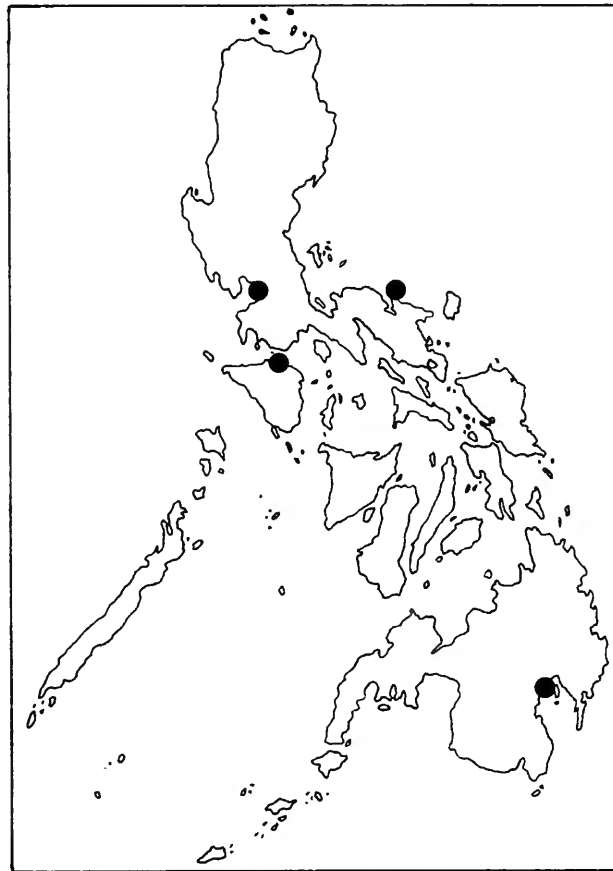
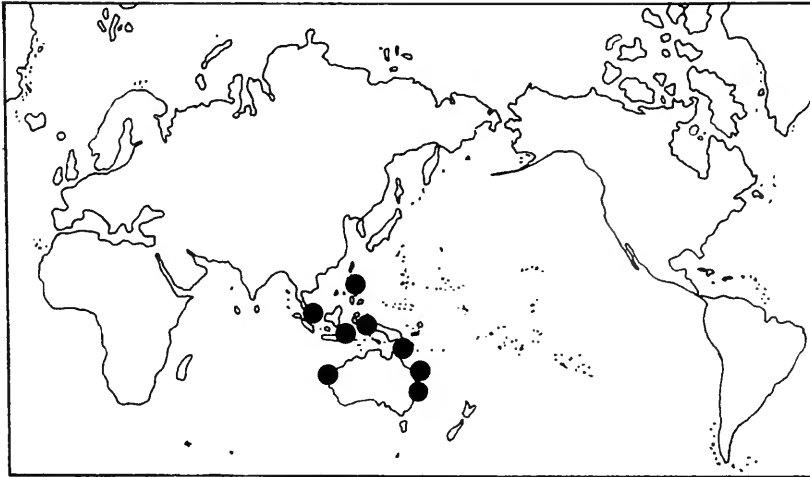


FIGURE 24.—*Halophila spinulosa*: top, world distribution; bottom, Philippine distribution.

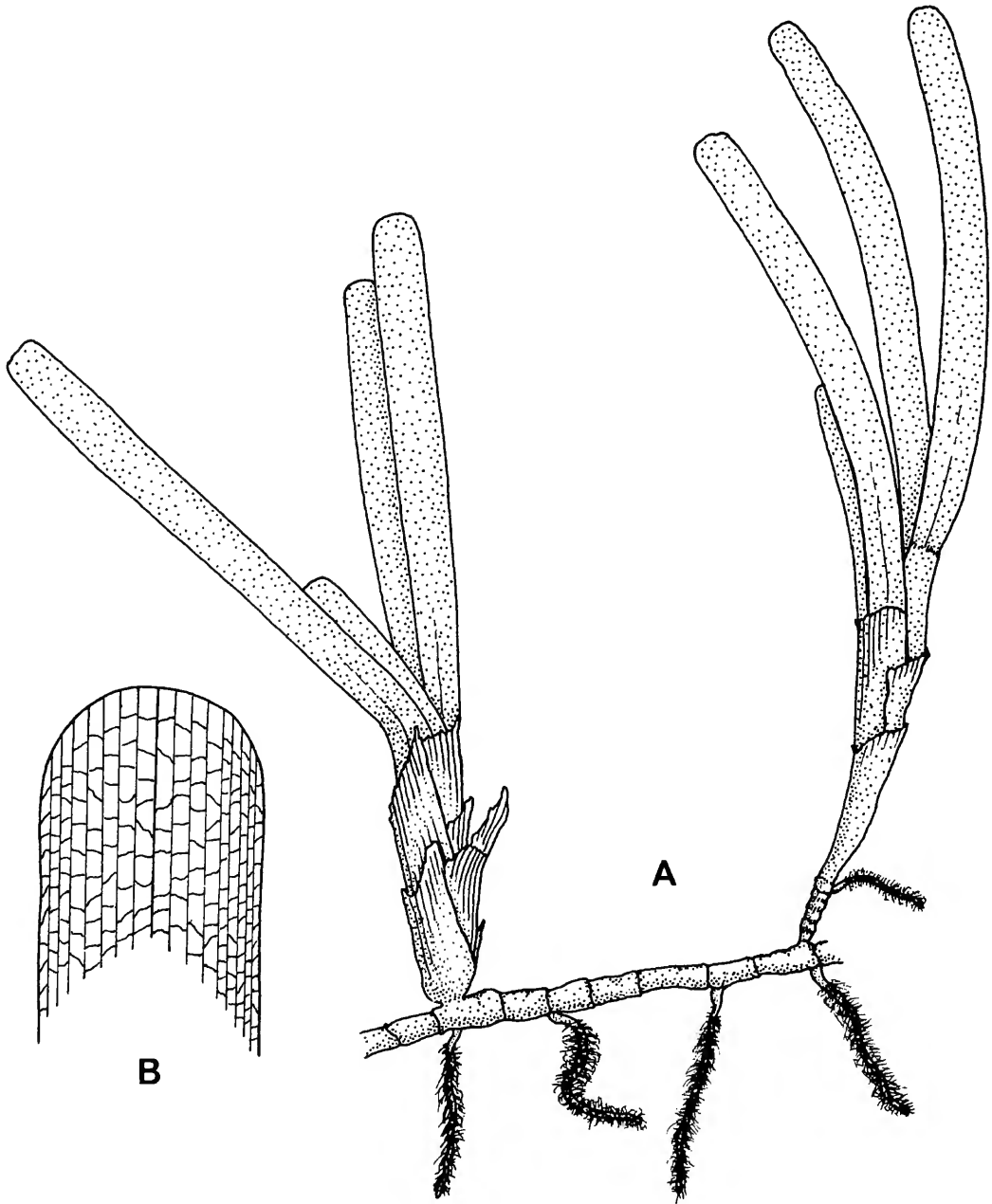


FIGURE 25.—*Thalassia hemprichii*: A, habit of plant, $\times 1.0$; B, upper portion of leaf showing perpendicular nerves connected by cross veins, $\times 4.0$.

3–8 cm-long sheaths; erect shoots sparsely distributed along rhizome. Leaf blades linear and distinctly falcate (particularly in less grazed areas), 4–10 mm wide, 7–40 cm long (commonly less

than 25 cm long), apices rounded, occasionally uneven, margins entire; 10–16 nerves connected by cross-veins; median nerve often conspicuous.

NATURAL HISTORY.—*Thalassia hemprichii* is com-

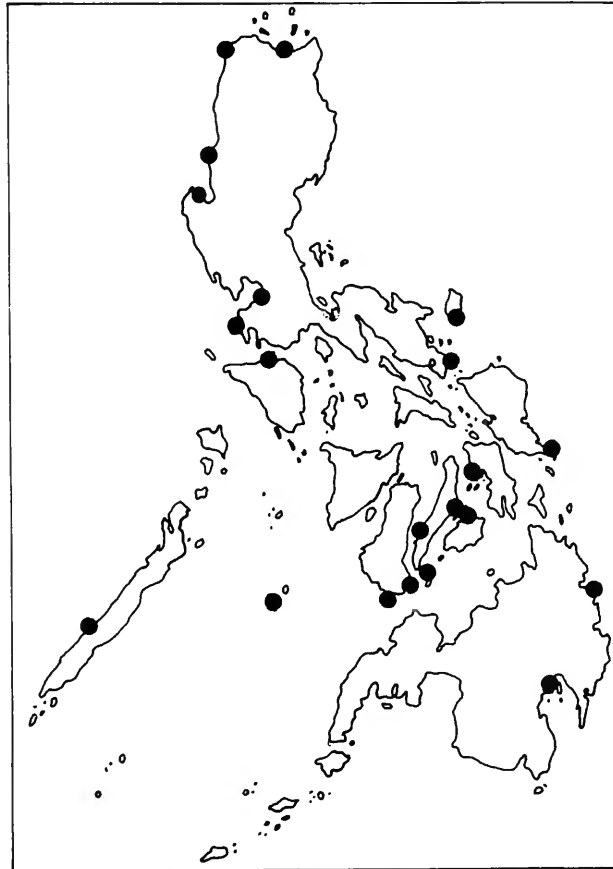
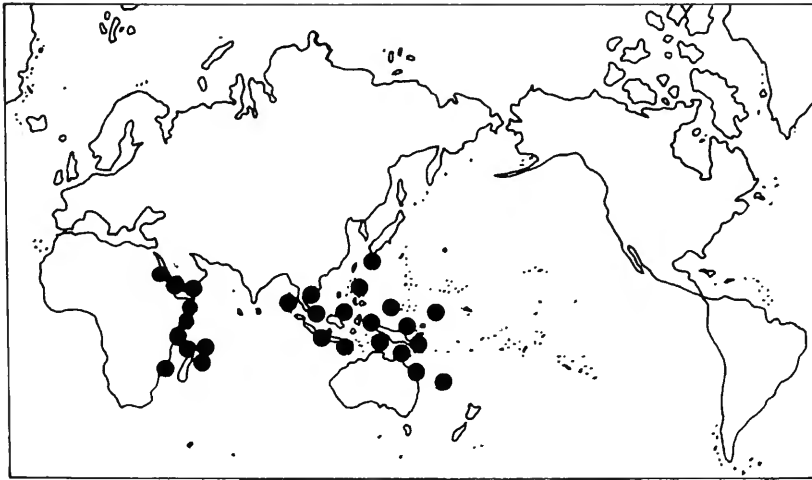


FIGURE 26.—*Thalassia hemprichii*: top, world distribution; bottom, Philippine distribution.

mon on mud-coral-sand or coarse coral-sand substrates, in sheltered habitats in the Philippines. The plant has been observed growing from the base and through fingers of corals at 6 m deep. *T. hemprichii* may be found mixed with *Syringodium isoetifolium*, *Cymodocea serrulata*, *C. rotundata*, *Enhalus acoroides*, *Halophila ovalis*, and *Halodule uninervis*. At several sites in Negros, Philippines, *T. hemprichii* appeared to be "mowed down" in large patches and there was evidence of fish grazing on the leaves of the plant. Algal epiphytes observed on the leaves include species of *Centroceras*, *Cladophora*, *Erythrotrichia*, *Fostiella*, *Giffordia*, *Herposiphonia*, and *Polysiphonia*. Flowering of *T. hemprichii* occurs during January, February, and December in the Philippines.

PHILIPPINE DISTRIBUTION.—Luzon (Manila Bay, Pangasinan, Catanduanes, Albay, Batangas, Cagayan, Mindoro, La Union, Ilocos Norte); Palawan (Quezon); Visayas (Samar, Siquijor, Cebu, Leyte, Bohol, Negros); Mindanao (Surigao, Davao, Cavili Island).

RANGE.—*Thalassia hemprichii* is common in the tropical region of the Indian Ocean and western part of the Pacific. It occurs in Sudan, Eritrea, Somalia, Kenya, Tanzania, Mozambique, Seychelles, Aldabra Islands, Madagascar, Saudi Arabia, Yemen, Andaman Islands, Thailand, Vietnam, Ryukyu Islands, Malaysia, Indonesia, Papua New Guinea, Caroline Islands, Marshall Islands, Bismarck Archipelago, New Caledonia, and Queensland.

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