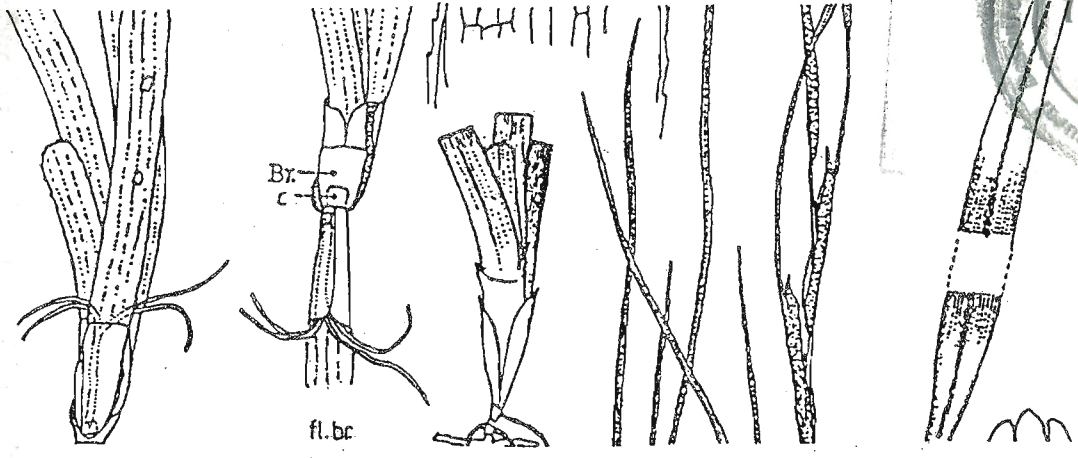


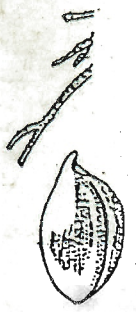
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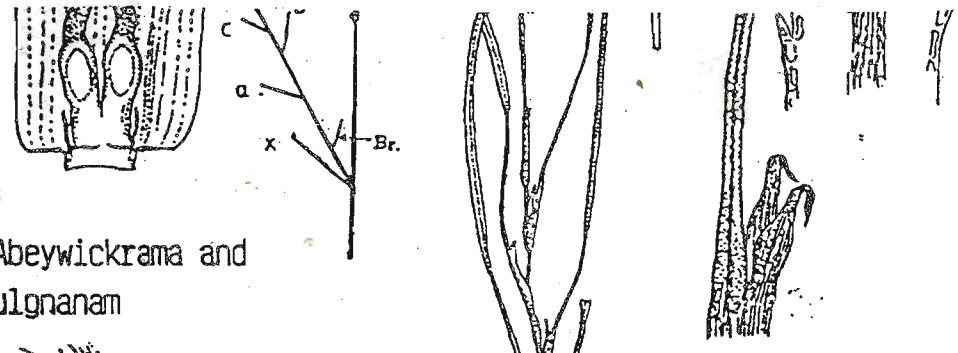


THE MARINE ANGIOSPERMS OF SRI LANKA (SEA GRASSES)



by

B.A. Abeywickrama and P. Arulgnanam



NA-89

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1991  
B.A. Abeywickrema & P. Arulgnanam

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## THE MARINE ANGIOSPERMS OF SRI LANKA

### (SEA GRASSES)

The marine angiosperms constitute a small but well defined group of plants all of which have a grass-like habit and are therefore commonly referred to as "sea grasses". Geologically they date back to a very early period and are considered to have evolved from salt-tolerant, shrub-like, rhizomatous, terrestrial plants which were adapted to submergence under water. In marine habitats the vegetation is dominated by algae and the number of angiospermous plants present in them is very small. Den Hartog (1970) recognises 12 genera with 49 species. All of them are monocotyledonous plants. Seven of the genera are more or less confined to tropical waters. Of these six have been recorded in Sri Lanka. The seventh, Thalassodendron, has been collected from the sea off Pamban island on the northern shore of Palk Strait (15) and this may possibly be present in our waters as well.

These plants are most commonly found in calm waters on sandy, silty or clayey sea beds as in the Gulf of Mannar; lagoons round the Jaffna peninsula and near Puttalam, Negombo and Batticaloa; and in sheltered bays in other parts of the coastline. In relatively quiet shallow seas they may form extensive submarine meadows; elsewhere they are often present as small patches. Sea grasses are absent in habitats subject to strong wave action or to the scouring action of off-shore currents. On firm flat substrates like coral reefs, however, even where exposed to wave action, some of the smaller hardy species may occur side by side with various algae.

Sea grasses are associated with certain other angiospermous plants, which can tolerate a high salinity, near the mouths of some larger lagoons and bays. The associates differ from true sea grasses in that they are more often present in brackish waters or even in fresh waters.

The marine angiosperms are totally submerged rhizomatous hydrophytes which are rooted at the nodes. At low tide some of them may have the leaves floating. The rhizomes range from being slender and filiform, to woody and stout. They produce creeping or erect, short or elongate, branches which bear the normal leaves. The latter show much variation in size and form. They vary from a few centimetres to a metre or more in length. The shape may be oval, oval-oblong, linear, filiform, terete or strap-shaped. Some of the smaller forms have membranous leaves. In the larger ones they are tough and leathery.

Their internal structure is not much different from that of fresh water aquatic plants.

Most sea grasses have submerged flowers and pollination takes place under water. Some have thread-like pollen grains. Certain others have spherical pollen grains but these are coherent to form muciliform chains which increase their floating capacity. In these the pollen is carried to the stigmas of the female flowers by water currents. One species, Enhalus acoroides, shows aerial surface pollination. In this the male flowers break off from the spathe and rise to the surface at low tide. At the same time the stalks of the female flowers elongate to bring the flowers to the water surface. Pollination in them takes place in a manner essentially similar to that in the fresh water aquatic Vallisneria spiralis (4,16).

Sea grasses have their propagules distributed by ocean currents. As a result they have a very wide distribution and there are no species endemic to Sri Lanka.

Sea grasses serve as food for various marine mammals like the dugong (2). They also serve as breeding and nursery grounds for various fishes and crustaceans (14). Dried sea grasses were once used by farmers in North Ceylon as an organic manure.

After the manuscript and the illustrations for this Handbook were finalised Mrs. P.M.A. Jayasuriya, from NARA, brought to us a collection of sea grasses in which three species, viz. Halophila ovata Gaud., Cymodocea rotundata Ehrenb. & Hempr. ex Aschers., and Halodule pinifolia (Miki) den Hartog, which have not previously been recorded from the island, were present. These have now been added and we are very grateful to Mrs. Jayasuriya for providing us with this information. We also wish to thank Professor S. Balasubramaniam for giving information on some additional locations for certain other species.

#### LIST OF THE SEA-GRASSES AND THEIR ASSOCIATES

In this list the first figure after a plant name indicates the publication given in the references at the end of the paper, and the second figure to the page in it. An Asterisk (\*) before a plant name indicates that it is not a true marine angiosperm but an associated species.

##### 1. Hydrocharitaceae

###### 1. Enhalus Rich.

- |                              |        |
|------------------------------|--------|
| 1. E. acoroides (L.f.) Royle | 18:271 |
|------------------------------|--------|

###### 2. Halophila Thou.

- |                               |        |
|-------------------------------|--------|
| 2. H. beccarii Aschers.       | 17:129 |
| 3. H. decipiens Ostenf.       | 4:254  |
| 4. H. ovalis (R. Br.) Hook.f. | 18:271 |
| 5. H. ovata Gaud.             | 4:251  |

###### 3. Thalassia Banks ex Koenig

- |                                     |        |
|-------------------------------------|--------|
| 6. T. hemprichii (Ehrenb.) Aschers. | 17:127 |
|-------------------------------------|--------|

## 2. Najadaceae

- 4. *Najas* L.
- 7. *N. graminea* Del. 17:375
- 8. *N. marina* L. 18:299

## 3. Potamogetonaceae

- 5. *Cymodocea* Koenig
- 9. *C. rotundata* Ehrenb. & Hempr. ex Aschers. 4:166
- 10. *C. serrulata* (R.Br.) Aschers. & Magnus. 17:376
- 6. *Halodule* Aschers.
- 11. *H. pinifolia* (Miki) den Hartog 4:158
- 12. *H. uninervis* (Forsk.) Aschers. 4:147
- 7. *Potamogeton* L.
- 13. *P. pectinatus* L. 17:374
- 8. *Ruppia* L.
- 14. *R. maritima* L. 12:59
- 9. *Syringodium* Kuetz.
- 15. *S. isoetifolium* (Aschers.) Dandy 4:177

The classification used here is that of Engler and Prantl. The names of families, genera, and species, however, have been arranged in alphabetical order. In the descriptions that follow, after the specific name of each plant, the reference to the volume and page in Trimen's "Handbook to the Flora of Ceylon" is given.

KEY TO THE GENERA OF MARINE ANGIOSPERMS  
AND ASSOCIATED SALT LAGOON PLANTS  
(based on vegetative characters)

(The numbers in brackets after the generic names refer to the serial numbers given to the genera in the descriptive text that follows)

1. Leaves 50 to 100 cm. long or longer.....Enhalus(1)  
Leaves smaller.....2
2. Leaves oval, oval-oblong or lanceolate.....Halophila(2)  
Leaves linear, filiform, terete or subulate.....3
3. Leaves broadly linear to subulate.....4  
Leaves narrowly linear, filiform or terete.....9
4. Lamina 1 to 4 cm. long.....5  
Lamina longer.....6
5. Leaves petiolate, margin simple or finely  
serrulate.....Halophila(2)  
Leaves not petiolate, margins dentate.....Naias(4)
6. Leaves 0.25 to 3.5 mm broad; veins 1-3 obscure .....Halodule(6)  
Leaves 2-9 mm broad; veins numerous .....7
7. Leaves on long erect shoots.....Thalassodendron\*  
Leaves on short erect shoots.....8
8. Rhizome with internodes 2-7 mm long .....Thalassia(3)  
Rhizome with internodes 1-5 cm long ..... Cymodocea(5)
9. Leaves terete to semiterete .....Syringodium(9)  
Leaves filiform to narrowly linear .....10
10. Stem distichously branched .....Potamogeton(7)  
Stem more or less dichotomously branched.....Ruppia(8)

---

\*Thalassodendron has not been recorded from Sri Lankan waters as yet, but it is possible that this genus may be present in our waters.

## PLANT DESCRIPTIONS

### AND KEYS TO FAMILIES, GENERA AND SPECIES

The delimitation of Plant Taxa is based mainly on reproductive characteristics. Such characteristics have therefore been used in the keys that follow. Collections of sea grasses, however, very often do not have flowers and/or fruits. When vegetative material only is available the genera may be directly identified using the key on page 4. The descriptions, keys to the species and the illustrations could then be used for identification of the species.

#### KEY TO THE FAMILIES

1. Flowers with perianth in one or two whorls. Female flowers with inferior ovaries .....Hydrocharitaceae  
Flowers naked; or ovaries superior if a perianth is present .....2
2. Male flower with a single stamen; female flower monocarpellary.....Najadaceae  
Male flower with 2 or more stamens; female with 2 or more carpels.....Potamogetonaceae

#### 1. HYDROCHARITACEAE

Perennial aquatics. Stems slender to robust, short or elongate. Leaves wholly or partly submerged; alternate, opposite or in whorls; linear to orbicular. Flowers uni- or bisexual; monoecious or dioecious; enclosed in an entire or 2 - leaved spathe. Perianth segments 3 or 6. Male flower with 3 - 15 stamens. Female flower with 2 - 15 carpels; ovary inferior, syncarpous, unilocular. Ovules numerous on raised parietal placentas. Seeds exendospermous.

1. Leaves 50 to 100 or more cm long..... Enhalus  
 Leaves shorter .....2
2. Leaves petiolate; 1.2 to 6.5 cm long .....Halophila  
 Leaves sessile; 7.5 to 30 cm long .....Thalassia

1. Enhalus Rich.

Aquatic. Rhizome stout and covered with remains of scales and old leaves. Leaves linear, in twos or threes. Male inflorescence in a 2-leaved spathe; flowers many, minute, separating and floating on surface when mature; sepals and petals broadly elliptic; stamens 3. Female flower larger, solitary, on elongated spirally twisted stalk; sepals oblong; petals longer, linear; ovary ovoid, incompletely 6-celled; styles 6, bipartite. Fruit ovoid. Seeds large. Monotypic.

1. E. acoroides (L.f.) Royle, Trimen Fl. Ceyl. 6 : 271 (= E. koenigii Rich., Trimen Fl. Ceyl. 4:126.) Fig. 1.

Rhizome stout, 1 to 1.5 cm in diameter. Leaves 50 to over 100 cm long, linear, margins thickened, apex founded and denticulate. Male spathe short-stalked. Female flower with a long, spirally twisted stalk. Ovary papillose.

In shallow waters in northern and north west Sri Lanka. Abundant in Gulf of Mannar and in Jaffna lagoon. It is said to be a common food of turtles and dugongs.

2. Halophila Thou.

Aquatic herbs. Rhizome slender, creeping. Leaves solitary, or in pairs or pseudo-whorls on rhizome or on short branches; basal sheath hyaline;

PLATE 1

Fig. 1 Enhalus acoroides (L.f.) Royle

- a) Habit (x 1/2)
  - aa) bifid appendages on fruit
  - b) Female Flower showing sepals, petals and styles (x 1/2)
  - c) Longitudinal section of fruit with 3 seeds (x 1/2)
  - d) Male spathe (x 1/2)
  - e) Longitudinal section of male spathe, with conical receptacle and numerous flower buds (x 1/2)
  - f) Male flower bud (x 3 1/2)
  - g) Open male flower in drifting position (x 3 1/2)
- (after den Hartog, 1970).

Fig. 2 Halophila beccarii Aschers.

- a) Habit (x 1)
  - b) Single leaf enlarged
- (after den Hartog, 1957).

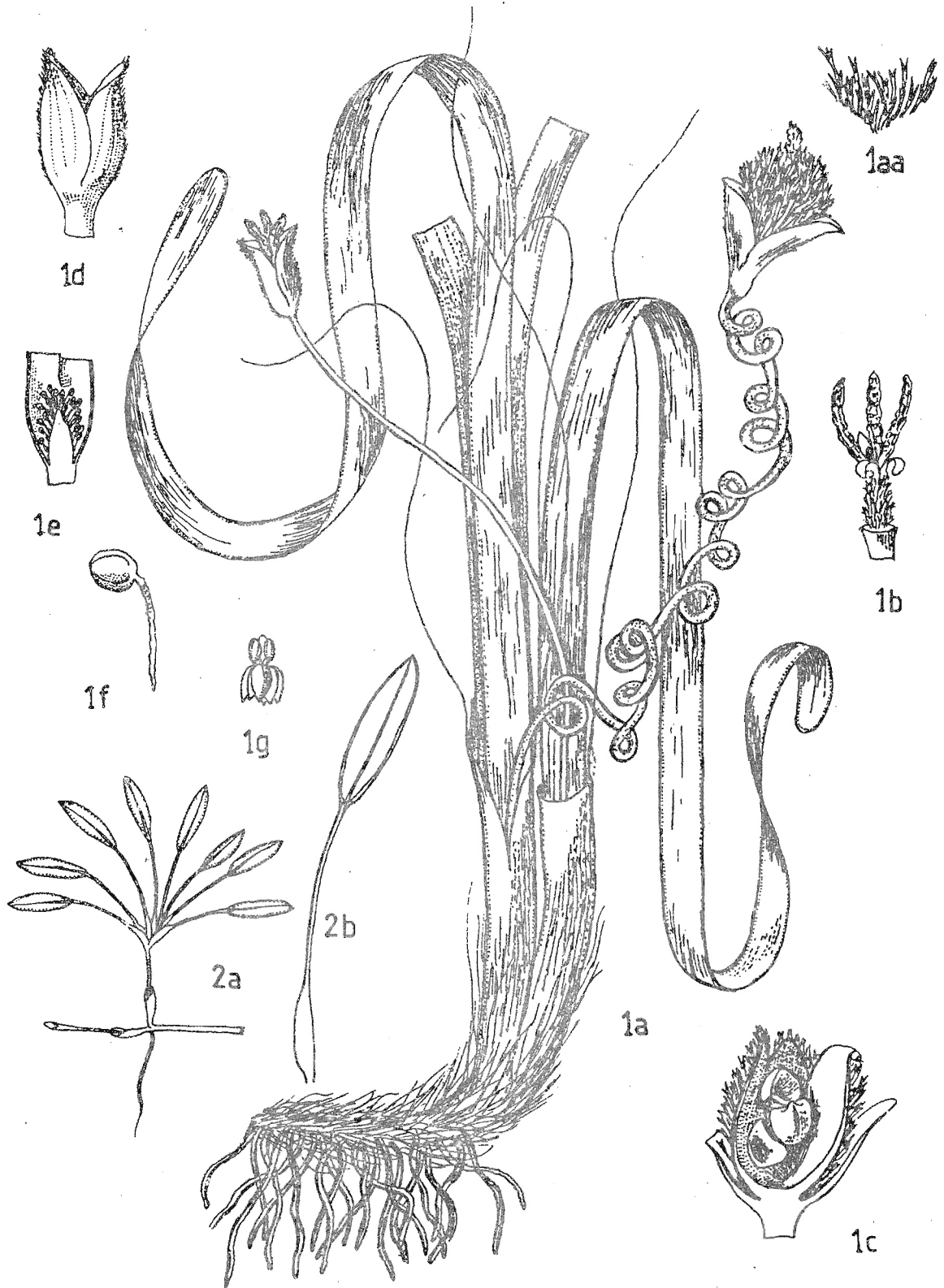


PLATE I

petioles present; lamina oval, oblong or linear. Flowers very small, monoecious, axillary, in 2-leaved hyaline spathes. Male flower stalked; perianth segments 3; stamens 3; Pollen grains coherent to form moniliform chains. Female flower sessile; perianth segments 3; ovary inferior, tricarpellary, syncarpous, unilocular; ovules few to many on 3 placentas. Fruit ovoid or globose; beaked.

1. Leafy shoots 1 - 2 cm long, each with  
6-10 leaves. Lateral veins absent .....H.beccarii  
Leafy shoots very short, each with  
one pair of leaves. Lateral veins  
present.....2
2. Lateral veins in 12-25 pairs.....H.ovalis  
Lateral veins in 3-11 pairs.....3
3. Leafy shoot very short .....H.ovata  
Leafy shoot 1-10 mm long.....H.decipiens

2. H. beccarii Aschers., Trimen Fl. Ceyl. 4 : 129. Fig.2.

Rhizome slender with one root at each node; Leaves closely arranged with 6 to 12 on a short erect shoot 1 to 2.5 cm long; lamina lanceolate or linear; 1.25 to 1.5 cm long, 0.25 - 0.42 cm broad; glabrous; petiole broadened at base into an auricled sheath; apex acute. Two submarginal veins present between midrib and margin. Lateral veins absent. Male flowers terminal, pedicels about 8 mm long. Female flowers with 2 to 3 styles, ovules 2-4; Fruits ovoid, pericarp membranous. Seeds with a reticulate testa.

In lagoons. Very rare. Batticaloa. Negombo.

3. H. decipiens Ostenf., Trimen Fl. Ceyl. 4:129 (as H. ovata p.p.) Fig.3.

Rhizomes thin, fragile, with one root at each node. Leaves in pairs on lateral shoots which are 1 to 10 mm long; petiole triquetrous, 3-15 mm long; lamina oblong - elliptic, 7-14 mm long; apex obtuse or rounded; lateral veins in 6 to 9 pairs. Spathe with one male and one female flower. Fruit broadly ellipsoid.

Very rare; recorded from Chilaw in 6 fathoms of water (H. Nevill, 1897) and Trincomalee (W.H. Harvey), 1853).

4. H. ovalis (R.Br.) Hook.f., Trimen Fl. Ceyl. 6:271; Trimen Fl. Ceyl. 4:129 as H. ovata p.p.; Fig. 4.

Rhizomes 1 to 2 mm thick, filiform, much branched with one or more roots at each node. Leaves solitary or in pairs at the nodes; lamina 1-5 cm long, oval to linear-oblong, apex rounded to subacute; lateral veins in 10 to 25 pairs. Petiole 1 to 5 cm long, base hardly dilated. Male flower with a stalk 1 to 2 cm long. Female flower sessile or with a stalk; ovary ovoid; styles 3. Fruit globose.

Rather common especially in the drier regions in shallow waters. Negombo, Chilaw, Mannar, Kalpitiya, Jaffna, Arippe, Trincomalee, Batticaloa.

5. H. ovata Gaud., Trimen Fl. Ceyl. 4:129 as H. ovata p.p., Fig.5 (Plate III).

Rhizomes thin, slender, with one root at each node. Internodes 1-3 cm. long. Leafy shoots very short, each with two transparent scales at the base. Leaves in pairs. Petiole 0.5 - 2 cm long. Lamina ovate to oblong-

PLATE II

Fig. 3 Halophila decipiens Ostenf

- a) Habit (x 1)
  - b) Male and female flower (enlarged)
  - c) Anther in section showing pollen grains in chains (enlarged)
  - d) Part of chain (enlarged)
- (all after den Hartog, 1957)

Fig. 4 Halophila ovalis (R.Br.) Hook.f.

- a) Habit (x 1)
  - b) Single leaf (x 1)
  - c) Male flower (x 3)
  - d) Female flower (x 3)
- (a,c and d - after Ghafoor 1985; b - after den Hartog).

Fig. 6 Thalassia hemprichii (Nhrenb.) Aschers.

- a) Habit, flowering female plant (x 1)
  - b) Habit, female plant with mature fruit (x 1)
  - c) Habit, male plant bearing 2 flowers, one in anthesis (x 1)
  - d) Stellately split pericarp of mature fruit (x 1)
  - e) Portion of pistil after fertilization, pedicel articulate below ovary (x 1)
  - f) Mature pollen grain (x 100)
  - g) Seed (x 1)
  - h) Seedling 3 weeks old (x 1)
- (all after den Hartog, 1970)

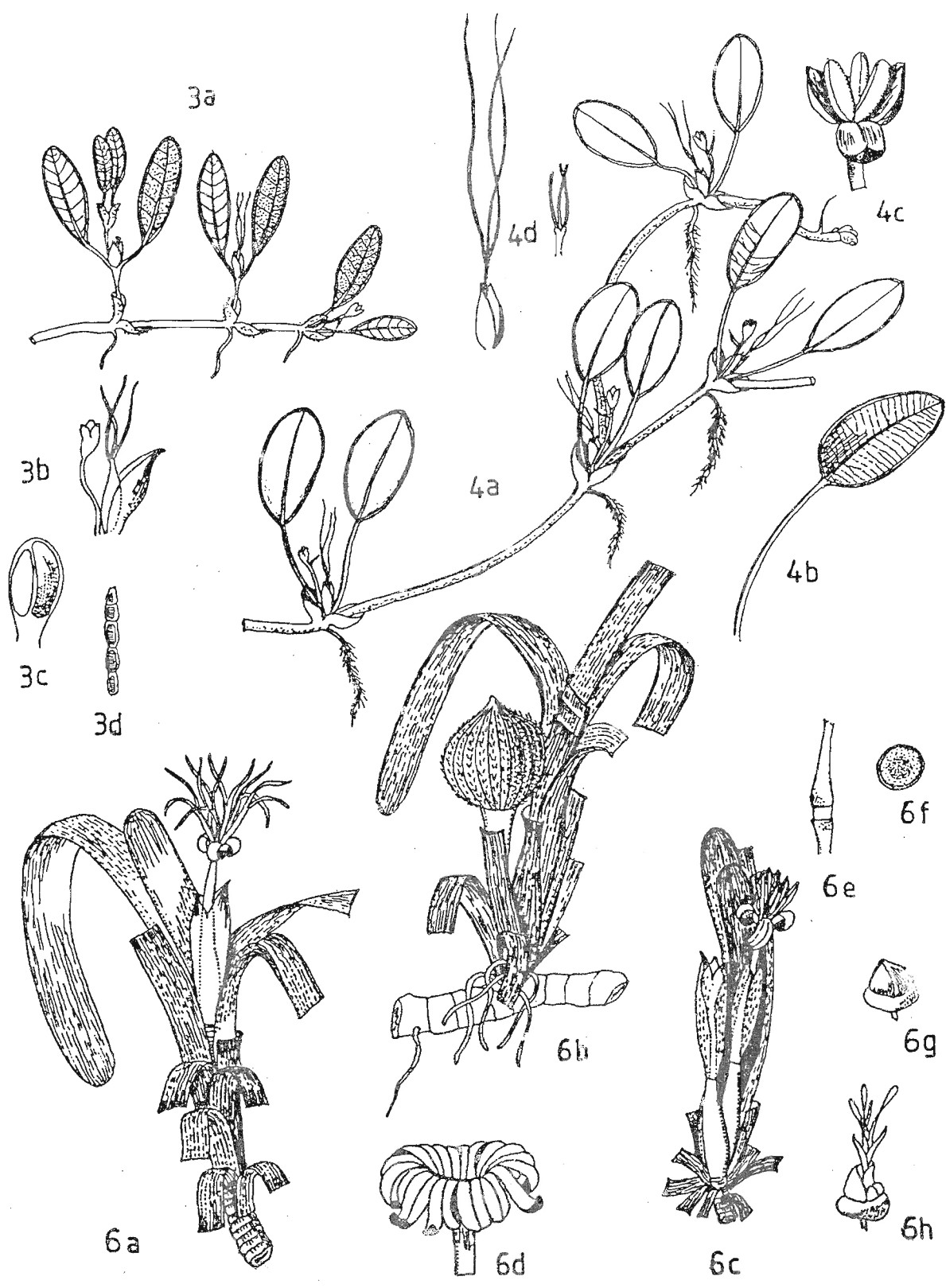


PLATE II

PLATE III

Fig. 5 Halophila ovata Gaud. in Freycin.

- (a) Habit of plant (x 1)
- (b) Plant apex (x 5)
- (c) Middle portion of leaf (x 10)
- (d) Scale (x 5)
- (e) Apex and base of leaf (x 10)

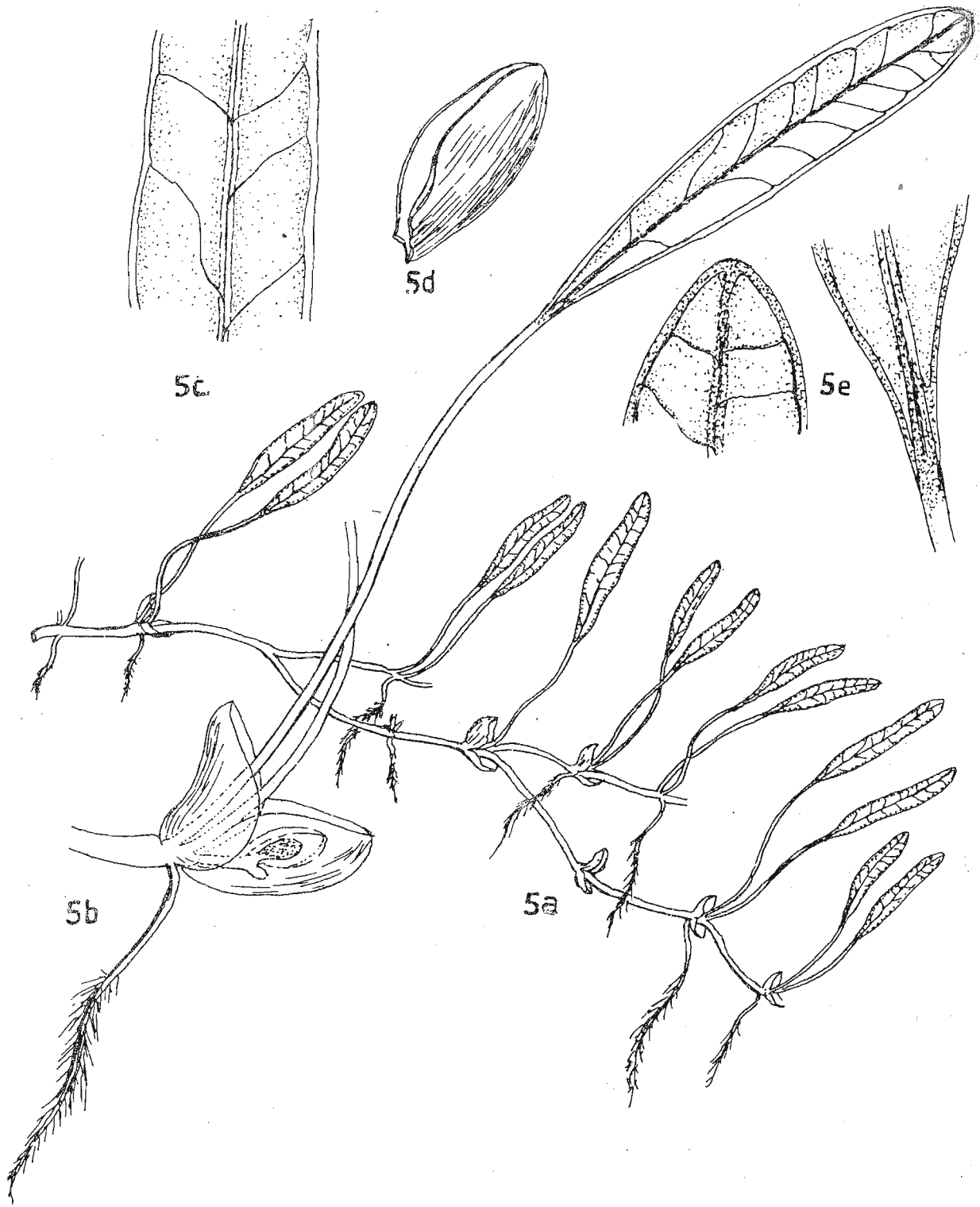


PLATE III

elliptic, 7 - 20 mm long or longer, 3 - 5 mm wide; apex obtuse or pointed; base contracted towards petiole. Lateral veins in 3-11 pairs, connected to intramarginal vein. Spathes obovate to suborbicular. Fruit ellipsoid, ovoid or globose.

Negombo lagoon.

### 3. *Thalassia Banks ex Koenig*

Aquatic herbs. Rhizome with very short internodes and fine longitudinal grooves. Roots one at each node. Leaves 2-6 on short lateral shoots, differentiated into a pale basal sheath and a green, linear, often falcate lamina; margin entire; apex obtuse and finely serrulate. Veins 9-17, parallel. Flowers stalked, monoecious. Male flowers with spathe leaves connate on one side, solitary or in pairs; perianth segments 3; stamens 3 to 12; pollen grains spherical, cohering to form moniliform chains. Female flowers subsessile, solitary; perianth segments 3; ovary 1 to 3 locular, ovules numerous on parietal placentas. Fruit globose, echinate, beaked, splitting when ripe into several stellately spreading segments. Seeds few to several. Species 2; one in the Indian Ocean.

6. *T. hemprichii* (Ehrenb.) Aschers., *Trimen Fl. Ceyl.* 4:127, Fig. 6.

Rhizomes 3 to 6 mm thick with internodes 2.5 to 7 mm long. Roots densely woolly with matted root hairs. Leaves on short lateral branches arising at intervals of 5 to 30 internodes; linear, 10 to 40 cm long, 4 to 10 mm broad; falcate, apex rounded and sometimes finely serrulate; veins 10 to 17. Flowers stalked. Male flowers usually with 6 to 9 stamens. Female flower with a conical ovary; styles 6, each bifid; Fruit roughly echinate.

Common in Jaffna area; also recorded from south western coasts but rare.

## 2. NAJADACEAE

Herbaceous aquatics. Stems slender and much branched, rooted or free floating. Leaves subopposite or whorled; with sheathing, expanded bases. Lamina simple and linear, margins toothed.

Flowers very small, axillary, solitary or in small clusters, uni-sexual. Male flowers with a delicate 2-lipped perianth and 1 stamen. Female flower naked and monocarpellary; ovule single and basal. Fruit indehiscent. Seeds exendospermous.

This has one genus, Najas, with 2 species in our coastal waters.

### 4. Najas L.

Characters same as for family

1. Stems not winged. Leaves finely toothed ..... N. graminea  
Stems with interrupted toothed  
wings. Leaves coarsely toothed..... N. marina

#### 7. N. graminea Del., Trimen Fl. Ceyl. 4:375; Fig. 7.

Plants slender, delicate. Rhizomes rooting at the nodes. Erect shoots 30 to 60 cm long, smooth, densely leaved at apices giving a plumose habit. Leaf sheathing at base, sheath auricled; lamina linear, 1.5 to 2.5 cm long, 0.4 to 0.6 cm broad; margins finely toothed. Flowers solitary or 2 to 4 together. Female flower with 2 stigmas. Fruit ellipsoid, oblong, drawn out at the apex.

In shallow lagoons especially in brackish water. Rather common. Also present in fresh waters. Northern coasts, Trincomalee, Batticaloa, Kurunegala, Peradeniya.

#### 8. N. marina L., Trimen Fl. Ceyl. 6:299; Fig. 8.

Rhizome somewhat stout, brown. Erect branches with interrupted, membranous, green, toothed wings. Leaf base dilated to form a sheath.

PLATE IV

Fig. 7 Naias graminea Del.

- a) Margin of leaf (much enlarged), and base, one half only.
- b) Seed
- c) Male flower showing perianth ending directly above anther in 2 ear-like lobes (much enlarged)
- d) Same (x 12)

(after de Wilde, 1962; Rendle, 1953; and Hashmi & Omer, 1987).

Fig. 8 Naias marina L.

- a) Habit (x 1/2)
  - b) Young shoot (enlarged)
  - c) Flowering shoot (enlarged) showing female flowers
  - d) Leaf, and leaf sheath showing spines in only the upper region (enlarged)
  - 1
  - d) Base of leaf (x2)
  - e) Male flowers in axil of leaf (enlarged)
  - f) Male flower (enlarged)
  - g) Male flower with spathe (enlarged)
  - h) Stamen (enlarged)
  - i) Cross section of male flower (enlarged)
  - j) Longitudinal section of male flower (enlarged)
  - k) Female flower, not enclosed in spathe. Pistil and 3 stigmas (enlarged)
  - l) Longitudinal section of pistil (enlarged)
  - m) Older female flower (enlarged)
  - n) Fruit (enlarged)
  - o) Seed (x 6)
  - p) Germinating seed. 2 stages (x 6). The older one showing ring of root hairs on upper part of radicle, (x 6)
  - q) Seedling 10 days old with shoot, primary root, cotyledon and 2 leaves from the plumule (x 6)
- (after Muenscher, 1944; Hashmi and Omer, 1987; and Hutchinson, 1959)

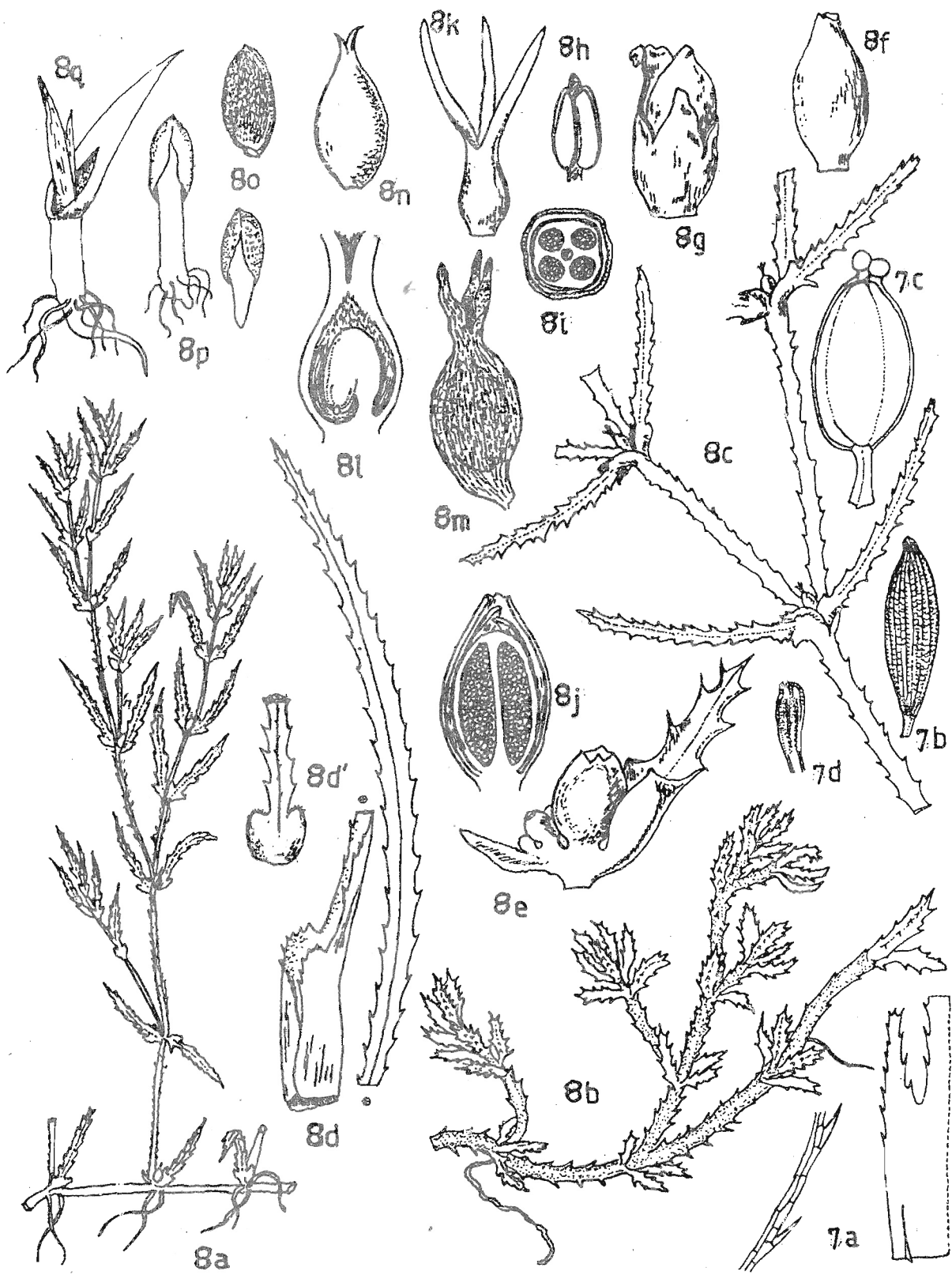


PLATE IV

Lamina linear, 1.25 to 3.8 cm long; margin coarsely toothed; spines or teeth also present on dorsal surface. Spathe of male flower 2 to 3 toothed. Stigmas 2 to 3. Seeds large ovoid.

In brackish waters. Very rare. Kalmunai; Thondaimannar lagoon; Wilpattu National Park.

### 3. POTAMOGETONACEAE

Aquatic herbs with creeping rhizomes rooted at the nodes. Leaf bearing shoots short or elongate. Leaves submerged or floating; alternate or opposite, sheathing at the base; sheath often with a ligule at apex. Lamina ovate or elliptic to linear, lanceolate, subulate or filiform. Flowers small, unisexual or bisexual, solitary or in pairs. Perianth of 4 segments or absent. Stamens 2 to 4, sessile, pollen globose or confervoid. Ovary 2 to 4 carpellary, apocarpous. Each carpel with a single ovule. Fruit indehiscent seeds exendospermous.

This family has three genera of marine grasses and two of their associated genera in the coastal waters of Sri Lanka.

- 1. Flowers with perianth present .....Potamogeton  
     Flowers naked .....2
- 2. Flowers bisexual .....Ruppia  
     Flowers unisexual .....3
- 3. Flowers with anthers attached at different  
     levels on stalk .....Halodule  
     Flowers with anthers attached at same level.....4
- 4. Leaves flat. Flowers solitary .....Cymodocea  
     Leaves terete. Flowers in cymes .....Syringodium

5. Cymodocea Koenig

Rhizomes monopodial, creeping, stout. Leafy branches short and ending in a few leaves. Leaves with sheathing membranous bases. Lamina linear, narrowed at base, apex entire or toothed, veins parallel. Flowers unisexual, solitary, naked. Male flower with 2 anthers which are dorsally connate, attached at same level to stalk. Female flower with 2 free ovaries, each with 2 stigmas. Fruit laterally compressed. Pericarp stony.

1. Leaf apex entire or almost entire .....C.rotundata

Leaf apex serrate to dentate .....C.serrulata

9. C. rotundata Ehrenb. & Hempr. ex Aschers., den Hartog: The Seagrasses of the World, p. 166. Fig.9.

Rhizome rather delicate with internodes 1 - 4.5 cm long. Erect stems short, each with 2 - 7 linear to falcate leaves. Lamina 7 - 15 cm long, 2-4 mm wide; apex obtusely rounded, sometimes slightly emarginate. Veins 9 - 15. Male flowers stalked; anthers about 11 mm long. Female flowers with very small ovaries. Fruit semicircular in outline; laterally compressed with teeth on a median ridge; apex beaked.

Puttalam lagoon.

10. C. serrulata (R.Br.) Aschers. & Magnus, Trimen Fl. Ceyl. 4:376;

Fig. 10.

Rhizome rigid, internodes 0.5 to 5.5 cm long. Erect shoots short, each with 2-5 linear to falcate leaves. Lamina 6 to 15 cm long, 4 to 9 mm broad, apex serrate to dentate. Veins 13 to 17. Male flowers formed at the apices of short shoots.

In shallow sea water; rare. Trincomalee, Karativu island, Mannar, Galle.

PLATE V

Fig. 9 Cymodocea rotundata Ehrenb. & Hempr. ex Aschers.

(a) Vegetative plant (x 2)

(b) Habit with fruit (x 1)

(c) Leaf apex (x 5)

(d) Sheathing base (x 5)

(e) Fruit (x 2)

Figs. (b) and (c) after Hartog

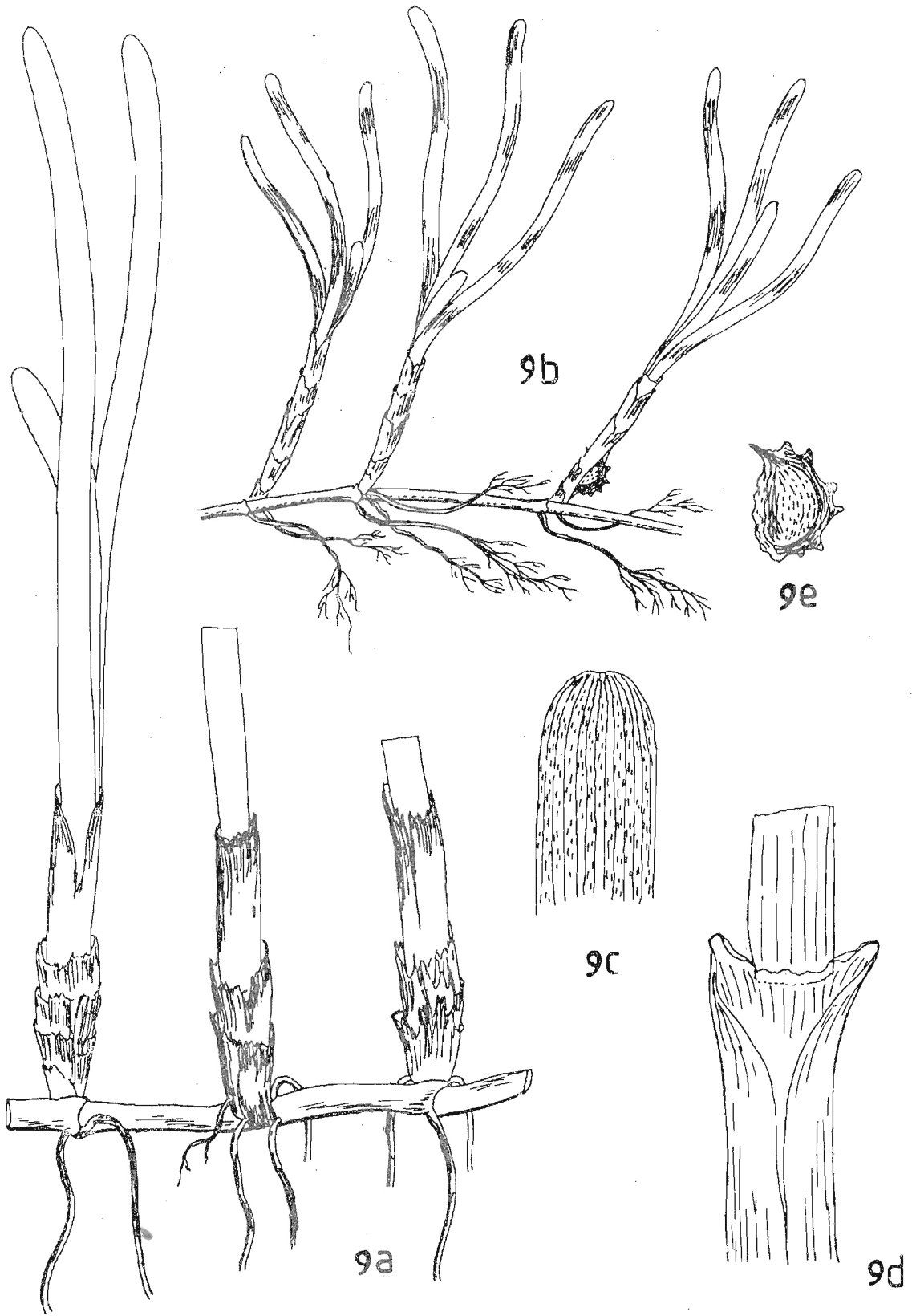


PLATE V

PLATE VI

Fig. 10 Cymodocea serrulata (R.Br.) Aschers. & Magnus

- a) Habit, small shoot contains dark shadow of male flower (x 4/5)
- b) Short shoot with female flower, showing roots, emergent style and patches of encrusting alga on oldest leaf and floral bract (x 4/5)
- <sup>1</sup>  
b) Same with flowering shoot bent back (a,b,c - foliage leaves on axillary shoot from the axil of X, Br, short sheathing bract replacing 1st leaf on axillary shoot, fl. br., leaf-like floral bract subtending gynoecium (x 4/5)
- c) Basal portion of vegetative shoot (x 4/5)
- <sup>1</sup>  
c) Apex of leaf showing serrated tip (enlarged)
- d) Gynoecium with sheath of floral bract opened (x 4)
- e) Gynoecium in side view, showing flattening of carpel, style and intravaginal scale (x 4)
- f) Male flower, sheath dissected away to show stamen (enlarged)
- g) Fruit (enlarged)
- h) Diagrammatic representation of flowering shoot to show arrangements of its parts (compare with 8b)<sup>1</sup>

(after Kay, 1971; Kirkman, 1975; and den Hartog, 1970).

Fig. 12 Halodule uninervis (Forsk.) Aschers.

- a) Habit (x 1)
- b) Habit (x 4)
- c) Basal portion of leaves showing narrowing, and the sheath (x 6)
- d) Portion of base enlarged to show auricles at junction with sheath (x 10)
- e) Apex of leaf showing 3-pronged tip. 2 lateral, and 1 median in which the mid-rib ends (x 50)

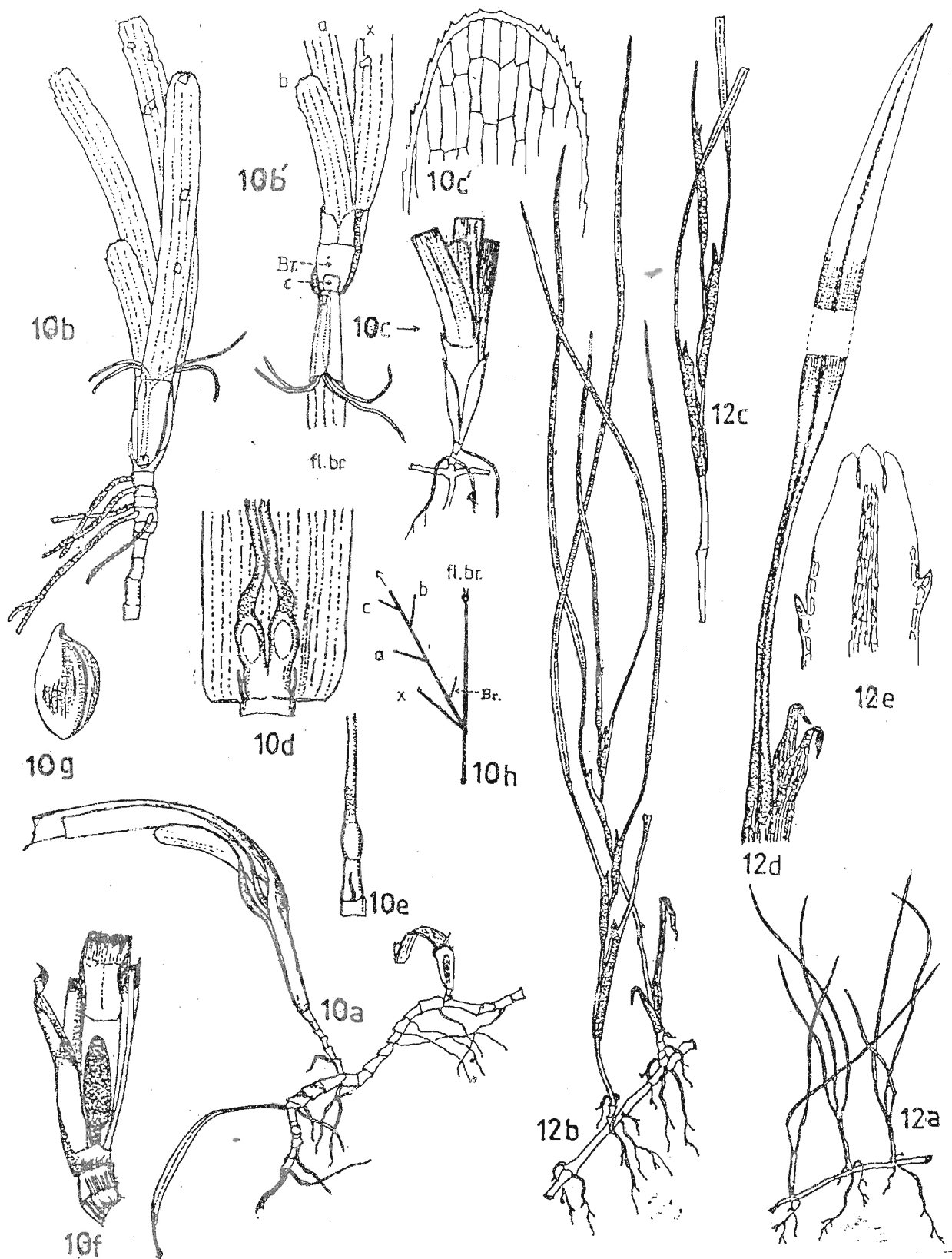


PLATE VI

PLATE VII

Fig. 11 Halodule pinifolia (Miki) den Hartog

- (a) Portion of vegetative plant (x 1 1/2)
- (b) Portion of flowering male plant (x 1)
- (c) Node showing origin of roots (x 5)
- (d) Erect stem showing leaf-sheath and leaves (x 5)
- (e) Apical portion enlarged to show mid-rib (x 10)
- (f) Leaf-apex showing furcate mid-rib, and leaf-tip showing numerous small serratures (enlarged)
- (g) Male "flowers", the anthers attached at different levels on the stalk (x 4)

Figures (b) and (g) after Hartog

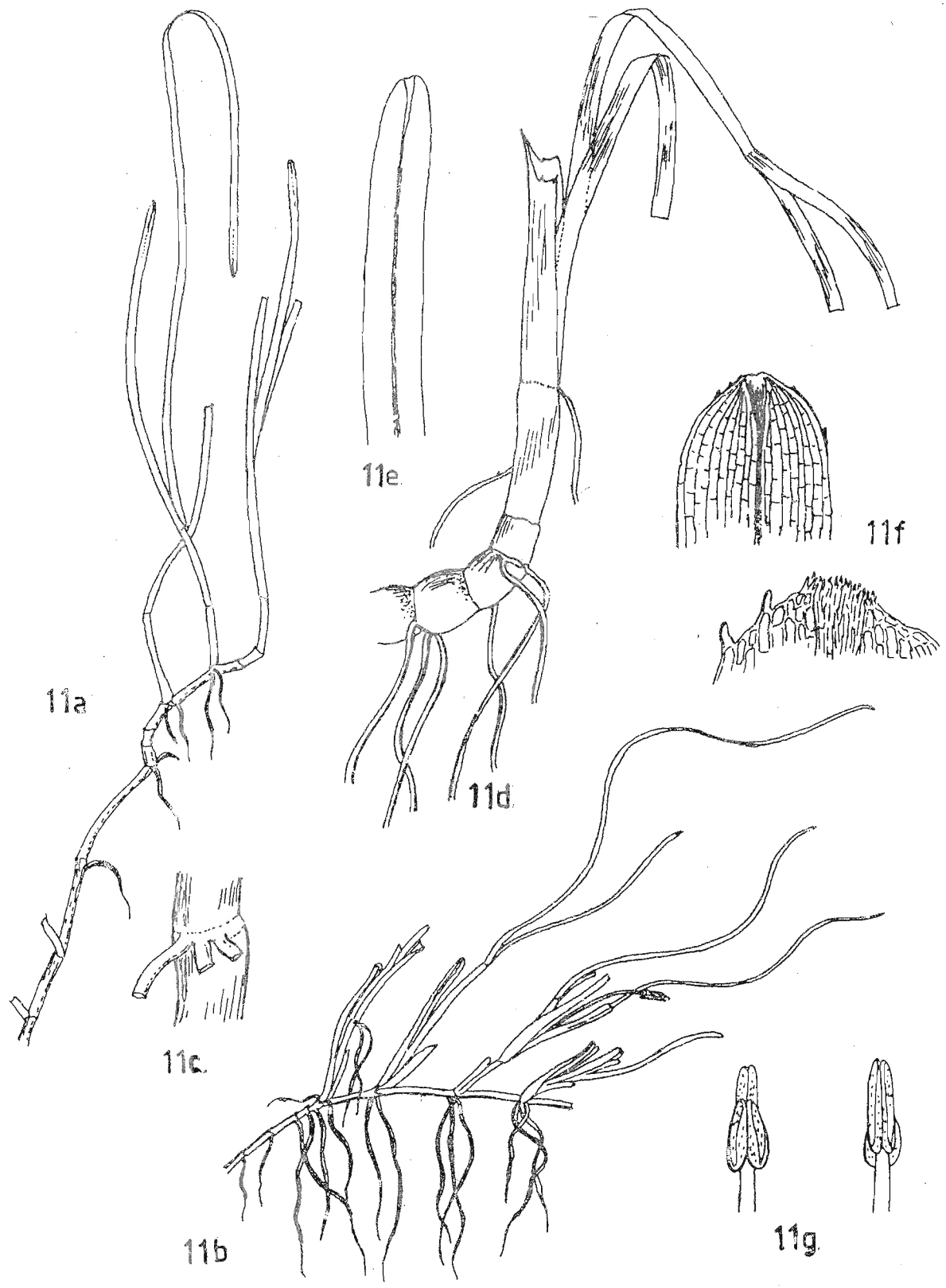


PLATE VII

6. Halodule Aschers.

Rhizomes monopodial, creeping, herbaceous. Leafy branches short, each ending in 1 to 4 leaves. Internodes 0.25 to 6 cm long. Leaf sheath 0.5 to 6 cm long, persisting longer than lamina. Lamina linear, often narrowed at base, margin entire. Veins 1-3. Flowers solitary and terminal. Male flowers stalked with anthers attached at different levels and joined dorsally. Female flower subsessile. Carpels 2, each with a long style. Fruit more or less compressed, pericarp stony.

- 1. Leaf apex tridentate .....H. uninervis
- Leaf apex rounded, margin serrulate.....H. pinifolia

11. H. pinifolia (Miki) den Hartog, in den Hartog: The Sea-grasses of the World, p. 158. Fig. 11 (Plate VII).

Rhizome creeping with 2-3 roots and a short erect stem at each node. Internodes 1 - 3 cm long. Leaf sheath 1 - 4 cm long. Lamina 5 - 20 cm long, 0.6 - 1.5 mm wide, midrib prominent; intramarginal veins inconspicuous and each ending in a small tooth. Leaf apex obtuse with numerous, small, irregular serratures. Male flower on a 10 mm long stalk. Lower anther 2.5 mm long, upper 3 mm long. Female flowers sessile. Style elongated. Fruit ovoid, laterally beaked.

Negombo lagoon; on sandy or muddy bottoms in sheltered bays, and on coral platforms in wave-beaten localities.

12. H. uninervis (Forsk.) Aschers., (= Cymodocea australis Trim. in Trimen Fl. Ceyl. 4:377) Fig. 12. (Plate VI).

Rhizome creeping with 1 to 6 roots and a short erect stem at each node. Internodes 0.25 to 4 cm long. Leaf sheath 0.5 to 3.5 cm long.

Lamina linear, sometimes falcate; 4 to 15 cm long, 0.25 to 3.5 mm. wide; narrowed at base; midrib conspicuous; apex with 2 to 3 teeth. Male flower on a 6 to 20 mm stalk. Female flower with an ovoid ovary, style elongated. Fruit ovoid to globose.

Shallow sea water on south western coast; very rare; said to have been once abundant at Weligama Bay. Also at Negombo.

#### 7. Potamogeton L.

Rhizomes creeping and rooting at the nodes. Leaf bearing axes much branched, submerged or free floating. Leaves sheathing at the base, lamina oval to filiform. Inflorescence spicate, pedunculate, axillary or terminal. Perianth segments 4, uniseriate, segments free, valvate, rounded, clawed at base. Stamens 4 and inserted on claws of perianth segments. Gynoecium superior, carpels 4, free, each carpel with a single ovule. Fruit indehiscent. Seed exendospermous.

13. P. pectinatus L., Trimen Fl. Ceyl. 4:374; Fig. 13. (Plates VIII and IX).

Leafy stems slender, much branched, forming with the leaves tassel-like masses when taken out of water. Lamina filiform, 2.5 to 10 cm long; veins 1 to 3, lower leaves sometimes with 5 veins. Floral axis longer than leaves; flowers few and in interrupted whorls. Fruitlets dimidiate-obovoid; about 4 mm long; shortly beaked.

Locally abundant in coastal lagoons. Kalutara, Negombo, Chilaw, Jaffna.

#### 8. Ruppia L.

Rhizomes creeping and much branched. Leafy axes slender and dichotomously branched. Leaves alternate or subopposite, sheathing at base, lamina

PLATE VIII

Fig. 13 Potamogeton pectinatus L.

- (a) Habit with root stock and tubers (x 1/2); (a<sup>1</sup>) leaf with stipules fused with sheath (x 1)
  - (b) Fruiting branch (x 5)
  - (c) Flower (x 10); (c<sup>1</sup>) perianth segment with stamen; (c<sup>2</sup>) carpels (enlarged)
  - (d) Fruit (x 5)
  - (d<sup>1</sup>) Longitudinal section of fruit showing seed (x 5)
- (a,b,d, after Muenscher, 1944)

Fig. 14 Ruppia maritima L.

- a) Habit (x 1)
- b) Portion of shoot with young fruiting branch showing sessile carpels (x 1)
- c) Portion of plant with older fruiting branches showing stipitate carpels on long peduncles (x 1/2)
- d) A single fruiting branch with a cluster of fruitlets (x5)
- e) A single fruitlet with long stipe (enlarged)
- f) Inflorescence - 2 sessile flowers one above the other on a peduncle, each with 4 stamens and 4 carpels (x 10)
- g) Older inflorescence showing well developed carpels
- h) Single carpel with ovary and sessile stigma
- i) Longitudinal section through same.
- j) Dorsal view of stigma
- k) Side view of stamen
- l) Dorsal view of same showing connective
- m) Embryo (enlarged)
- n) Seedlings - 2 stages (x 2)  
(after Muenscher, 1944; and Aziz, 1975).

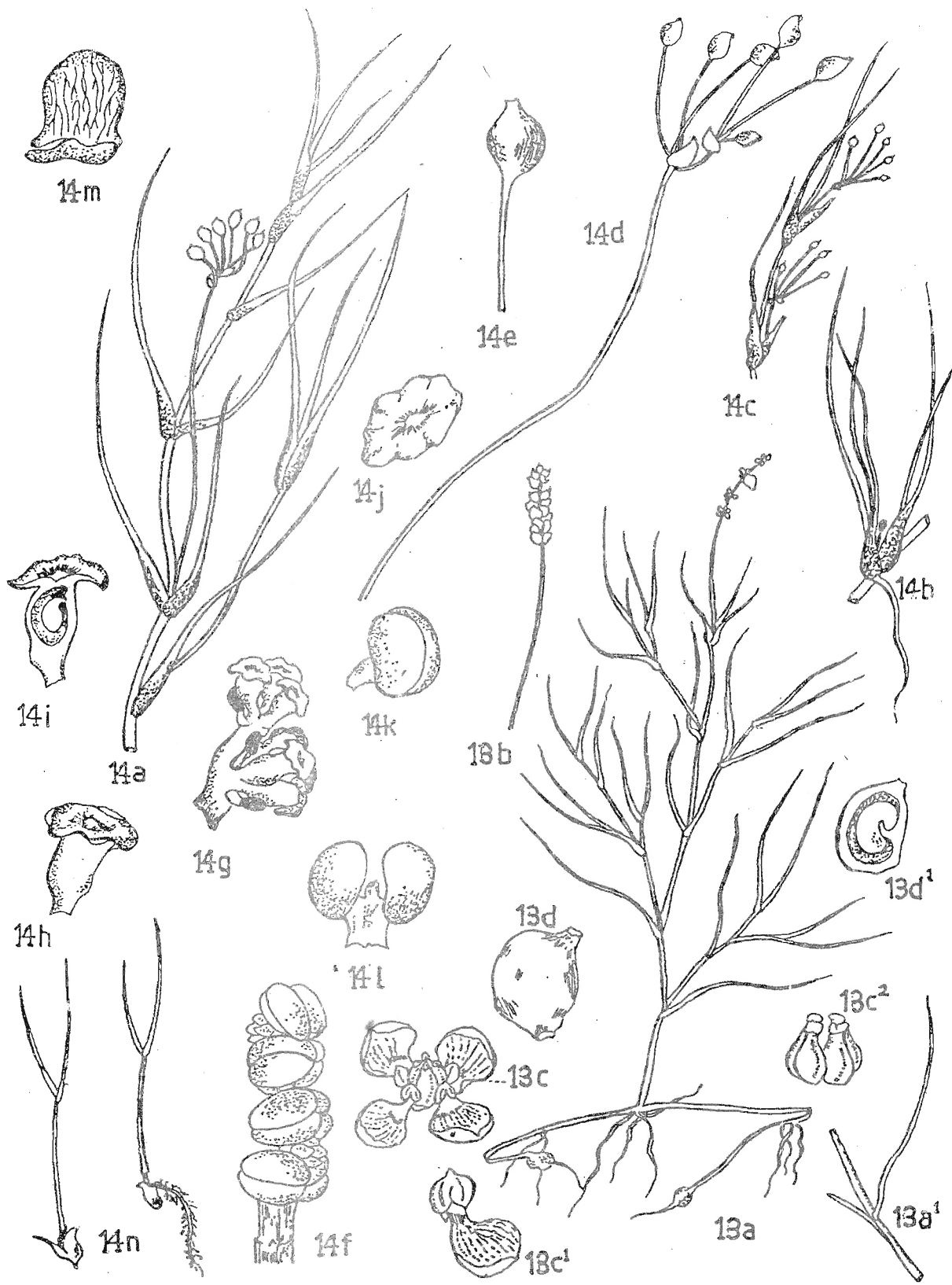


PLATE VIII

PLATE IX

Fig. 13 Potamogeton pectinatus L.

- (a') Flowering branch (x 1)
- (b') Portion of stem showing position of leaf and sheath on stem (x 3)
- (c') Leaf sheath (x 5)
- (d') Leaf apex (x 5)
- (e') Young inflorescence inside sheath (x 3)
- (f') Same separated from sheath (x 3)
- (g') Flower buds, and single bud top-view (x 5)
- (h') Flower bud viewed from bottom (x 5)
- (i') Mature flower (x5)
- (j') a single carpel as seen in 2 views (x 10)
- (k') Two perianth segments inner view (x 10)
- (l') Perianth segment with anther (x 10)
- (m') A single carpel and anther from bud (x 10)
- (n') Fruit (x 10)
- (o') Seed, 2 views (x 10)



PLATE IX

PLATE X

Fig. 15 Syringodium isoetifolium (Aschers.) Dandy

- a) Habit of sterile plant (x 1)
- b) Leaf, cross-section (x 20)
- c) Habit of flowering plant (x 1)
- d) Male flower (x 4)
- e) and f) Female flower (x 4)
- g) Fruit (x 4)

(all after den Hartog, 1970)

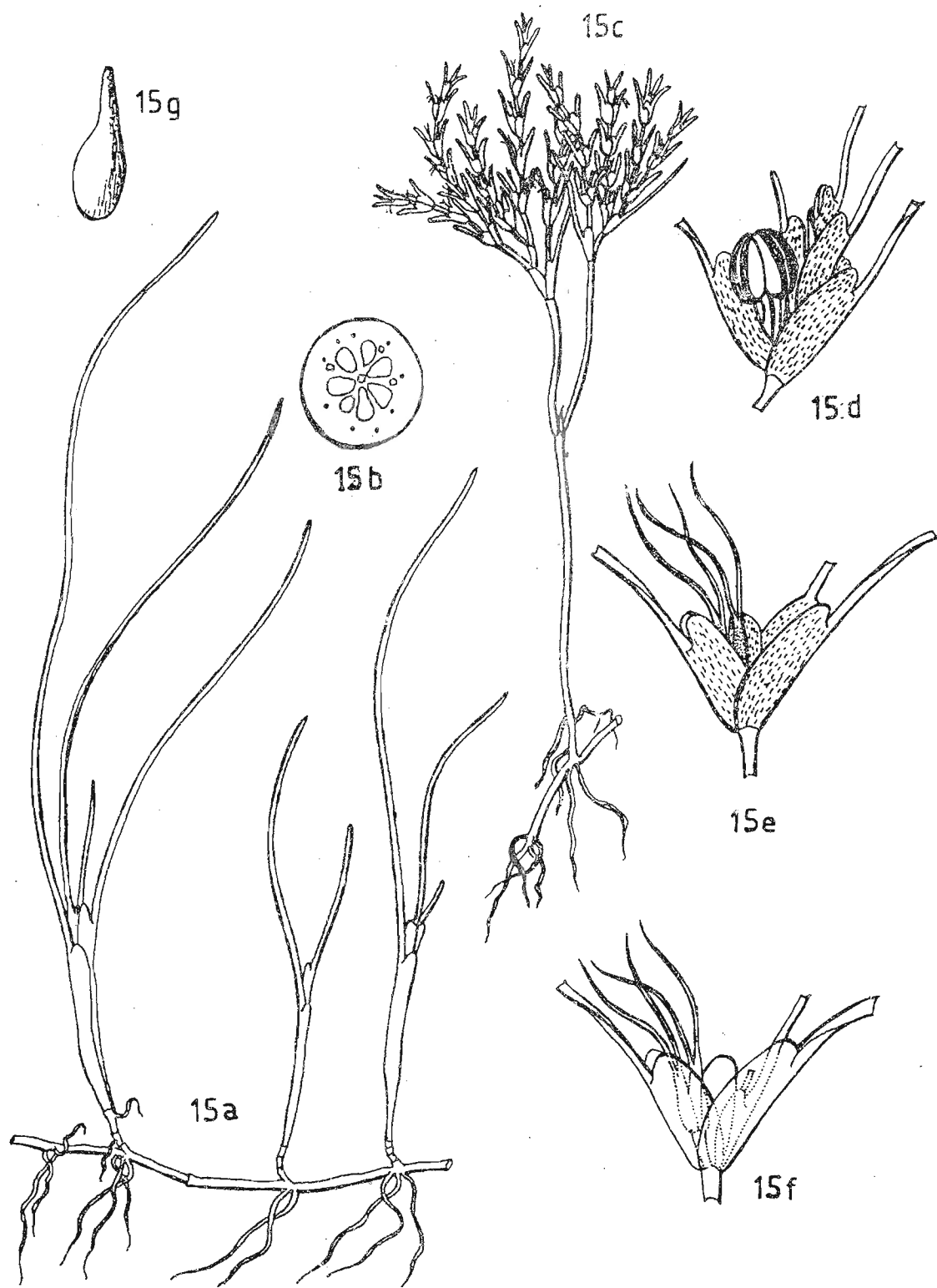


PLATE X

filiform. Flowers small and bisexual; within sheathing leaves on a short peduncle which later elongates. Perianth absent. Stamens 2, sessile. Gynoecium of 4 free carpels, each with a single pendulous ovule. Fruits indehiscent, becoming long stalked with maturity. Seed exendospermous.

14. R. maritima L., (= R. rostellata Koch, Trimen Fl. Ceyl. 4:374; Fig. 14.

Leafy axes 60 cm long or longer forming tangled masses. Leaves filiform, 2.5 to 7.5 cm long. Flowers usually in pairs. Fruitlets stalked when mature, ovoid and beaked.

Very rare; only recorded from Matalan in Northern Province by Nevill in 1889.

#### 9. Syringodium Kuetz.

Rhizome creeping, herbaceous, branching monopodial; with at each node short erect branches bearing 2 to 3 leaves. Internodes 1 to 4 cm long. Leaf sheath prominent and persisting after leaf blade has fallen. Lamina subulate, often narrowed at base. Inflorescence cymose. Flowers enclosed by reduced leaves with very prominent sheathing bases. Male flower stalked, stamens 2, attached to stalk at same level and dorsally connate at the lower ends. Female flower with 2 free carpels, each with a short style and a bifid stigma. Fruitlets obliquely ellipsoid to obovoid, shortly beaked; pericarp stony.

15. S. isoetifolium (Aschers.) Dandy, (= Cymodocea isoetifolia Aschers., Trimen Fl. Ceyl. 4:377) Fig. 15.

Rhizomes with internodes 1.5 to 3.5 cm long. Leaf sheath 1.5 to 4 cm long; lamina 7 to 30 cm long, 1 to 2 mm broad. Sheaths of the reduced leaves in inflorescence up to 7 mm long. Male flower with a 7 mm long stalk. Female flower sessile. Fruit obliquely ellipsoid, beaked.

In shallow sea water, rather common. Weligama, Galle, Bentota, Negombo, Puttalam, Mannar, Batticaloa.

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