HYDRO-BIOLOGICAL SURVEY
OF THE
THONDAIMANNAR LAGOON

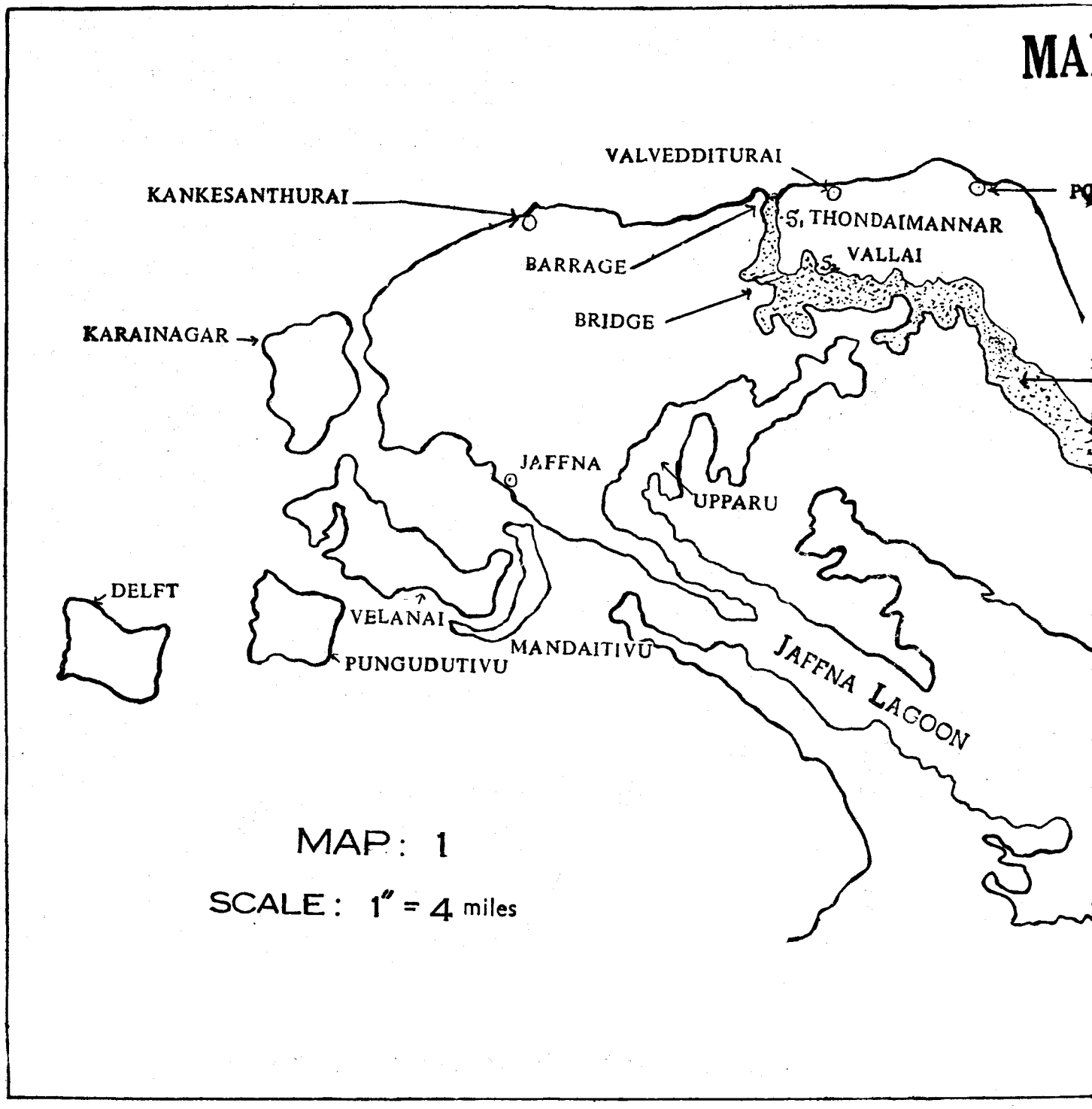
Bulletin No. 7

MANGROVE VEGETATION OF THE LAGOON

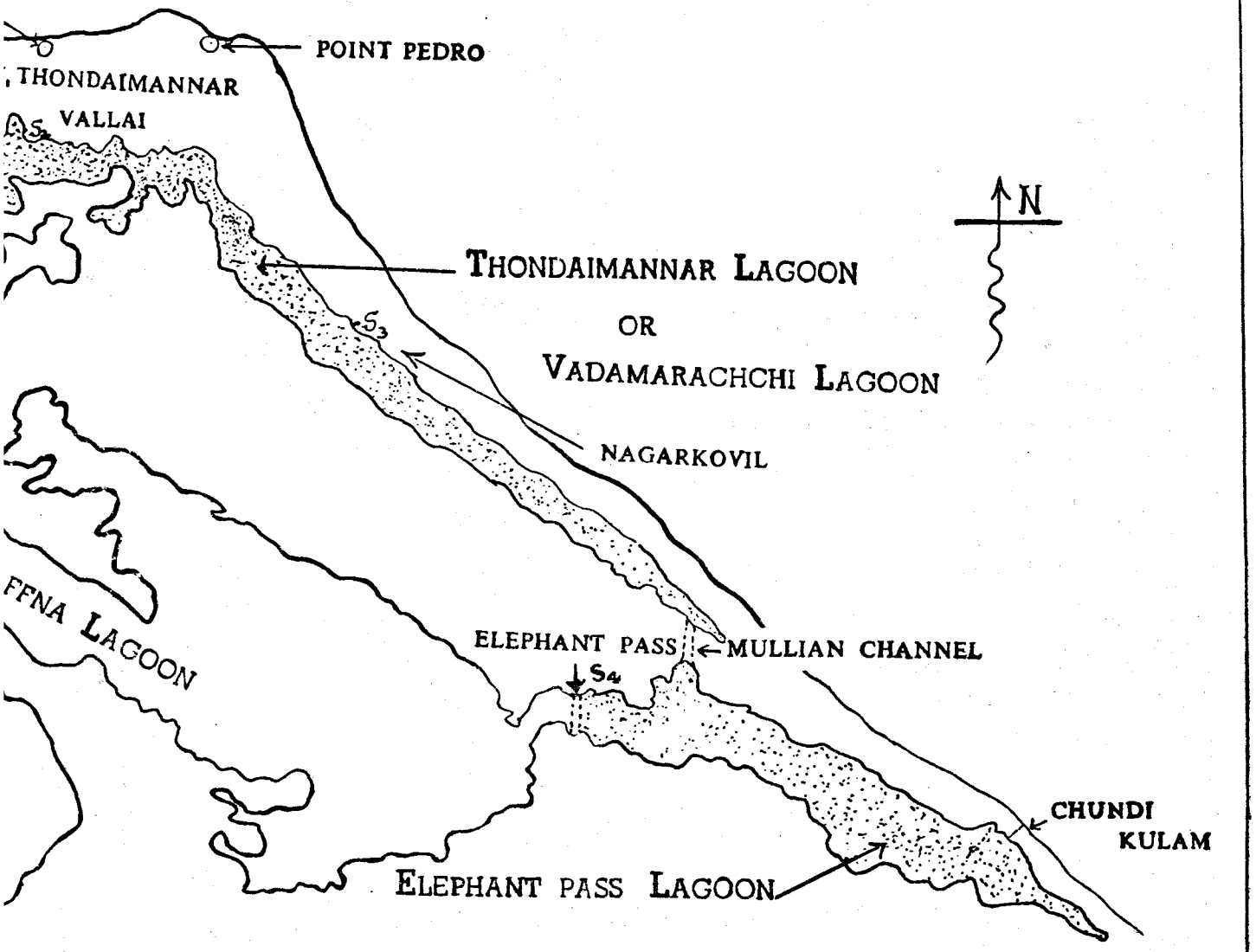
K. S. Kugathasan

MARCH 1969

Published by the Hydro-biological Survey Research Council
of
The Northern Province Science Teachers' Association.


MA
VALVEDDITURAI
KANKESANTHURAI
S. THONDAIMANNAR
VALLAI
BARRAGE
BRIDGE
KARAINAGAR
JAFFNA
UPPARU
DELFT
VELANAI
PUNGUDUTIVU
MANDAITIVU
JAFFNA LAGOON
MAP: 1
SCALE: 1" = 4 miles

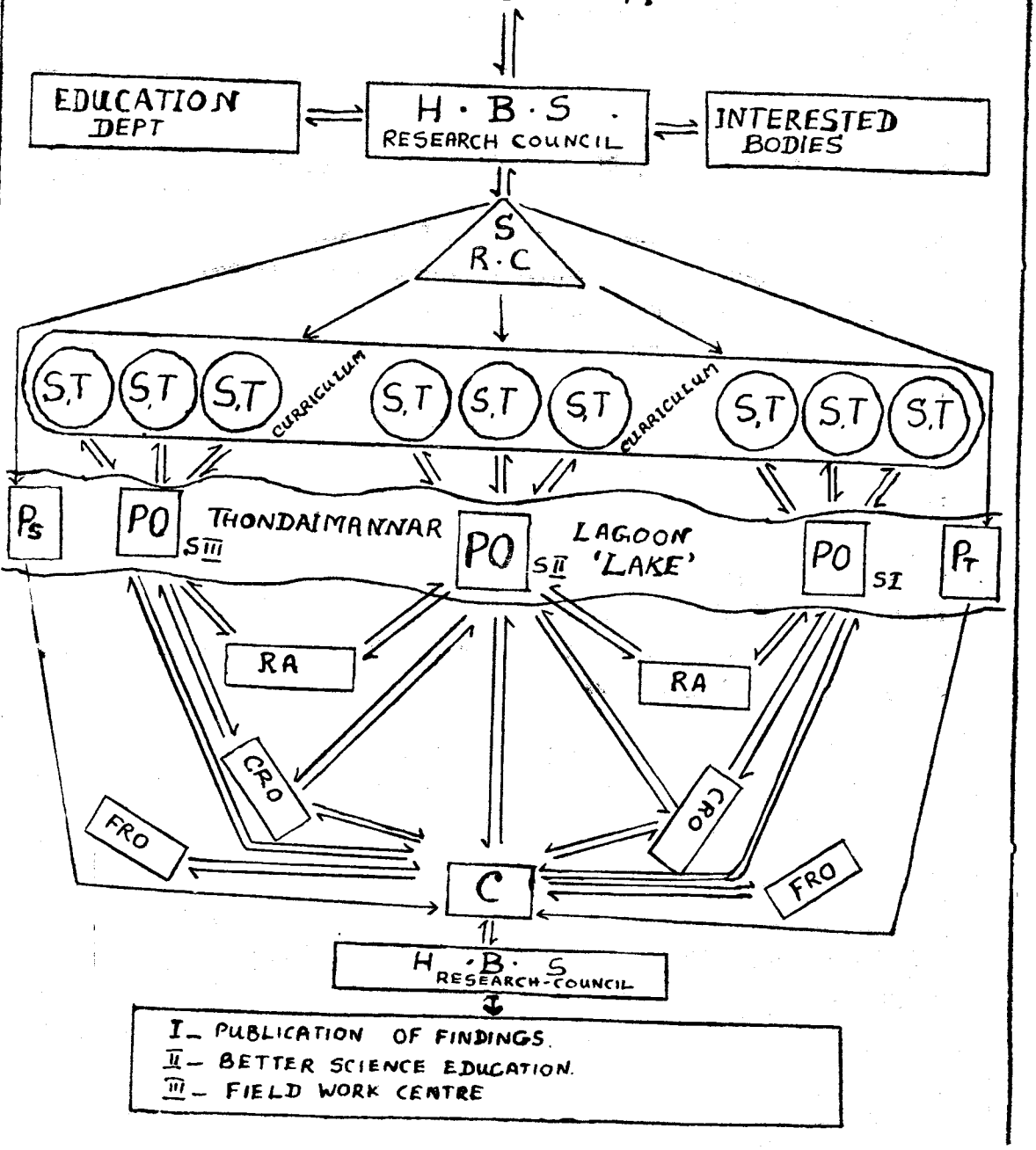
MAP OF THE HYDRO-BIOLOGICAL SURVEY AREA



DIAGRAMMATIC REPRESENTATION OF THE MANIFOLD IMPLICATIONS OF THE

HYDRO-BIOLOGICAL SURVEY PROGRAMME.

N · P · S · T · A



Guide to the understanding of Chart overleaf :

N. P. S. T. A—Northern Province Science Teachers' Association.

H. B. S —Hydro-Biological Survey of Thondaimannar Lagoon.

S. R. C —Secretary, Research Council.

S. T. —Schools; Students and Teachers.

PO. —Project Officers of Stations, I, II, III, etc. (Members of Research Council

Ps. —Individual specific projects at student level.

Pt. — ,, ,, ,, at teacher level.

RA. —Research Assistants (Members of Research Council

CRO. —Ceylonese Research Officers,

FRO. —Foreign ,, ,,

C. —Convener of this programme, (Chairman of the Research Council)

S_1, S_2, & S_3 —Working Stations.

Bulletin No. 7

Mangrove Vegetation of the Lagoon

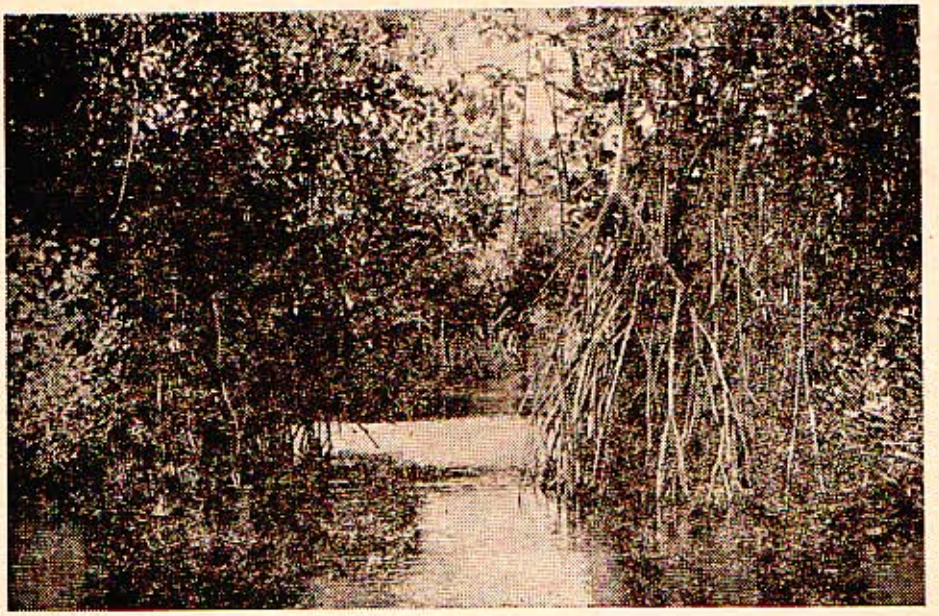
by

K. S. Kugathasan

A guide to the study of the distribution, identification and characterization of the Mangroves of the Lagoon particularly and some common types generally.

MARCH 1969

Published by the Hydro-biological Survey Research Council of The Northern Province Science Teachers' Association.



Mangrove Vegetation At Nagarkovil.

Research Team Amongst The Mangrove

Plate 1.

CONTENTS

SECTION I

(I) PREFACE

(II) INTRODUCTION

SECTION II

DISTRIBUTION OF MANGROVE FLORA.

SECTION III

DESCRIPTION OF MANGROVE FLORA.

SECTION IV

(I) APPENDICES

(II) BIBILIOGRAPHY.

PREFACE

This is an outcome of my seven years study of the Flora of the Thondaimannar lagoon. The main theme of the work is an attempt in elucidating the distribution of the mangrove flora of the lagoon and an explanation to the characterstic distribution of the mangrove flora. A description and explanation for the disturbed nature of the mangrove habitat is also given. The mangrove plants are properly studied and described in detail with necessary diagrams and data. This would serve to indentify the mangrove plants of the Thondaimannar lagoon. A few other common mangrove plants of the Island, though not represented in the Thondaimannar laagoon are also described.

I like to convey my sincere thanks to Dr. K. Balasubramaniam of the University of Ceylon, Peradeniya, and the Systematic Botanist, Royal Botanical Gardens, Peradeniya; for helping me in identifying some of the plants. I also like to thank members of the Hydro–biological Research Council for helping me in the collection of data, for critically going through the manuscript, and for the constructive criticisms. I will be failing in my duty, if I don't make mention of the Advanced Level Biology students of J/Nelliady Madhya Maha Vidyalayam Karaveddi for assisting me in the collection of data.

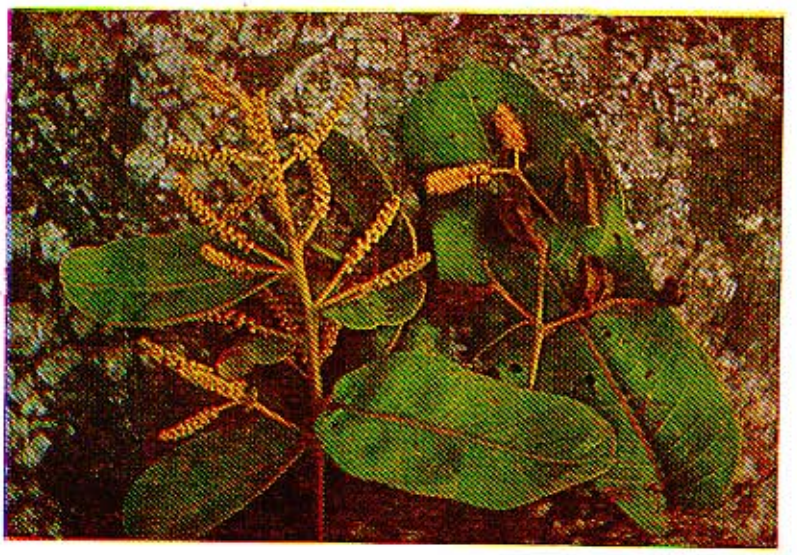
We are able to present this here because of the aid given by the Asia Foundation for the publication of our bulletins. I extend my sincere thanks to them.

Finally, I will be satisfied if this gives an incentive to students of Biology to probe more and more into nature, to make more of actual field studies, and to present other biologists with their work.

K.S. K.

PLATE 2 – A

1. Excaecaria agallocha.
2. Lumnitzera racemosa.



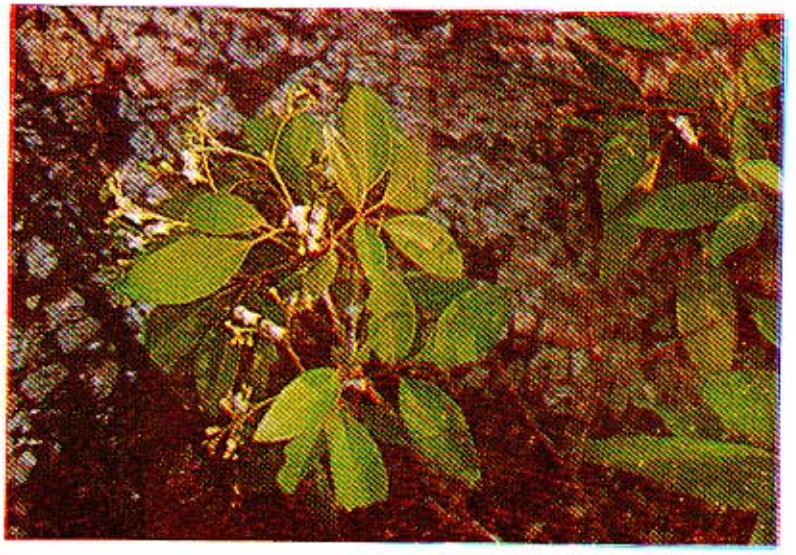


PLATE : 2 – B

1. Terminalia glabra
2. Vitex leucoxylon

PLATE : 2 - C

1. Calophyllum inophyllum.
2. Carreya coccinia.

INTRODUCTION

Mangrove plants

Mangrove plants are a class of Halophytes that grow in saline swamps as salt marsh plants. Mangrove plants are normally seen growing along the coasts in saline swamps, back–waters, tidal flats, and estuaries (mouths of rivers) in the tropics where the soil is subject to periodic immersion in water (inundation). The distribution of mangrove types is according to depth and salinity of the location. (Refer Plate–4). Plants grouped under mangrove vegetation belong to varied families, but they exhibit many points of similarities which are adaptations to the common habitat. Mangrove plants are mostly trees which are stunted in nature. Stragglers, Climbers. shrubs and Under shrubs may also be seen in a typical mangrove habitat but mangrove plants as a class usually have woody stems. The phyrical nature of the soil and the chemistry of the soil is variable. The soil is usually loose and boggy, and soil areartion is poor. The plants are generally exposed to strong wind and sometimes wave action. The soil water is of a very high osmotic concentration and hence even though water is physically present, the soil is described as physiologically dry. The plants are also exposed to excess of sunlight (both direct and reflected) and temperature. To overcome these hazards the plants usually exhibit xerophytic characters and some of them posses special structures for the aeration of submerged and underground organs. It should also be noted that the periodical flooding may be a daily occurrence or the areas may be submerged for long periods and exposed for short periods, or exposed for long periods and submerged for short periods, (ie seasonal). Whatever the case is the soil is normally boggy. Sometimes an upper hard crust may be formed (during the dry seasons) but even then the soil is usually very moist, with less soil air. Also it should be borne in mind that there is always a possibility for the mixing of saline water, or brakish water, and hence the soil has a higher percentage of salinity.

Mangrove plants exhibit many xerophytic characterstics as adaptations to the hazardous environment. Transpiration is usually minimised through the development of adaptational modifications as: by the possession of leathery or fleshy leaves as in Ceriops or Rhizophora ; by the development of a thick cuticle as in Rhizophora ; by the leaves being glabrous and shining as in Lumnitzera; by the leaves being redused as in Tamarix ; by the possession of scale–like leaves as in Salicornia ; by the leaves being shed early in life as in Suaeda or Salicornia ; by the production of juvenile leaves which are coloured (usually due to the presence of more carotin) and shining as in Rhizophora ; or by the leavcs being hairy as in Avicennia or Heritiera. Bud scales (sheathing stipules)

may be seen that protect the buds as in Rhizophora. Almost all plants have structures for the storage of water. Mucilage in some (Rhizophora, Lumnitzera) and latex in others (Excaecaria, Tamarix) serve for the same purpose (reduction of transpiration and storage of water). Mangrove plants tolerate a certain amount of salt in their tissues (osmotically tolerant). But to minimise the Intake of salts, the roots take in water very slowly and sparingly.

Some mangrove plants posses special structures for the ventilation of the submerged and underground organs. These special organs are spongy in nature and posses many pores for aeration called by the general name Lenticels or special name Pneumatothodes or pneumatopores. These pores may be seen on stilt roots, or buttress roots, or knee roots, or erect breathing roots, called pneumatophores.

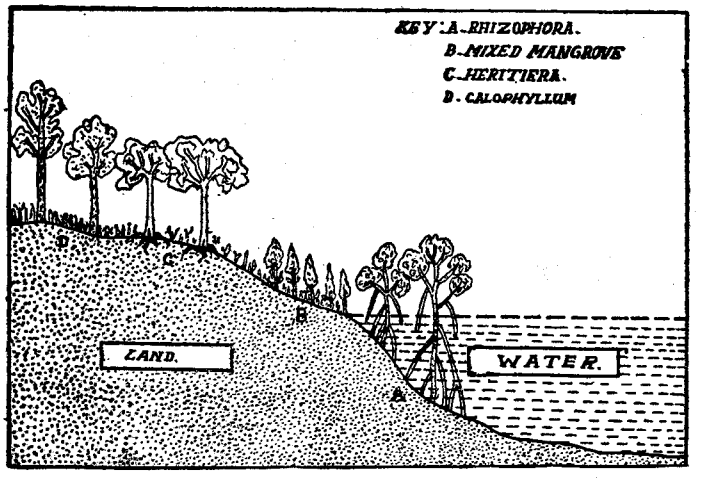
The soil being boggy and unsteady, and wind effect being high, mangrove plants have special modes of fixation. In the case of some the roots go very deep and help In firm anchorage. (Tamarix, Excaecaria). In some the horizontal roots cover very large areas and help in fixation (Avicennia, Lumnitzera). Some posses stilt roots or buttress roots (Rhizophora, Excaecaria).

The fruits and seeds are mostly dispersed by water. The habitat being unsuitable for germination (lack of soil air, high salinity, periodic inundation, and unstable soil), in some plants the fruits germinate when on the trees itself and fall down as seedlings. This method of germination is defined as Vivipary.

In mangrove plants belonging to the Family Rhizophoraceae like Rhizophora, Bruguiera, Ceriops etc. there seems to be only a single cotyledon. This is caused as a result of the usually two or sometimes three or four cotyledons becoming more or less united.

We may define those plants growing in a mangrove habitat as mangroves. But we may have to use this term in a more broader sense, for, in the Thondaimannar lagoon, amongst the real mangrove plants many associates and some others that are not typical mangrove plants but have become established in such areas are seen. Such plants (Intruders and Accidentals) are also considered for description. Some fore–runners of a mangrove habitat and some amphibious plants that are usually seen in such habitats are also described

Some chemical data of the mangrove soil obtained from various points of the lagoon are given at the end. It should be borne in mind that as a result of the fresh–water scheme of the Thondaimannar lagoon the present chemistry of the soil may not fall in line with other typical mangrove soils of the Island.



MARGIN OF DEEP LAGOON

RHIZOPHORA

↓

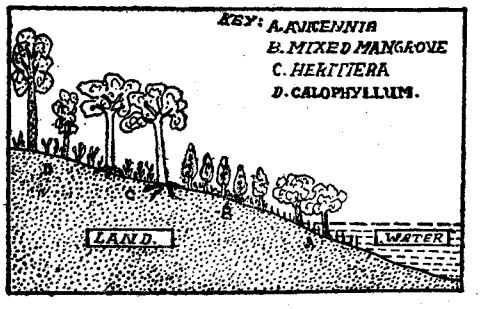
MIXED VEGETATION

↓

LITTORAL WOOD LAND

↙ ↘

FOREST FOREST



ESTUARINE FLAT - MUD FLAT AT MOUTH OF RIVERS. HERE THE LAND GENTLY SLOPES DOWN INTO THE WATER.

MARINE GRASSES OR ENTEROMORPHA.

↓

ACANTHUS ILICIFOLIOUS.

↓

MIXED MANGROVE.

IN OTHER PLACES INSTEAD OF ACANTHUS WE MAY GET AVICENNIA OR SONNERATIA.

AVICENNIA OR SONERATIA.

↓

MIXED MANGROVE.

↓

FOREST.

PLATE - 4 -

ZONATION.

Plate 4 : Zonation

SECTION II

DISTRIBUTION OF MANGROVE VEGETATION IN THE THONDAIMANNAR LAGOON

Paper presented at the C.A.A.S. Sessions — December 1968)

(i) TEXT

(ii) CHECK LIST

(iii) MAP SHOWING DISTRIBUTION

(iv) FREQUENCY COUNTS

Text

Introduction :

I will start with the introduction of the mangrove flora of the area-a qualitative estimation, then give a brief account of the nature of Succession and Zonation in this area, and finally give an account of the mangrove vegetation along the lagoon.

For the sake of convenience, I have classified the plants as :

(i) Mangrove and Mangrove Associates.
(ii) Fore runners.
(iii) Intruders.
(iv) Mud-flat vegetation. (Refer check list)

(i) Mangroves and Mangrove Associates :

Real mangroves come under this group (Refer check list for mangrove and mangrove associates). Plants that are dominant in some areas become an associate in some other areas. For example Lumnitzera racemosa is a real mangrove associate, but forms the dominant vegetation in some areas, and sometimes form closed colonies. The pattern of distribution of these real mangroves and mangrove associates depends mainly on salinity and depth.

(ii) Fore runners :

Before mangroves appear and become established, some other plants play a vital part in forming the habitat. These plants precede the appearance of mangroves, exist along with young mangrove plants for sometime, and may disappear in due course when the mangrove vegetation becomes very thick. Plants like Fimbristylis ferruginea and Cyperus corymbosus activate sedimentation and the accumulation of subsoil necessary for the growth of mangroves. (Refer check list for Fore runners for other examples)

(iii) Intruders :

There are some outsiders that have trespassed into the mangrove territory. These have been classed as intruders (Refer check list for

intruders). Depending on the nature of the soil and salinity (details of salinity described in Fishes of the lagoon-another paper that is being presented), the intruders are varied. Thus some like Clerodendron inerme and Calophyllum inophyllum are halophytic ; Vitex leucoxylon and Terminalia glabra are pond side or river side mesophytes ; where as Typha javanica and Nymphaea nouchali are fresh water hydrophytes.

(iv) Mud-flat vegetation :

Plants like Hydrophylax maritima, Salicornia brachiata, Suaeda nudiflora, Agyneia bacciformis, are seen on mud flats and are classed thus. (Refer check list for Mud flat vegetation)

Succession :

Now I will lead you on to the nature of the succession in this area. There are a number of plants that take part in micro-succession and play a part in establishing a habitat for mangroves. For example at Nagarkovil, along the fringes of the lagoon in shallow areas Fimbristylis ferruginea, Cyperus stoloniferous. Cynodon dactylon and Bacopa monnieri take part in succession; whereas in deeper part, Cyperus corymbosus, Bacopa monnieri and Chara play a part in succession. At Nagarkovil it could be also observed that where areas are getting exposed, in addition to Fimbristylis ferruginea and Cynodon dactylon, Fimbristylis littoralis also appears. Bacopa monnieri will continue to remain if the areas are very moist, and disappear when these areas dry up-(In other words some of these plants are amphibious). In water Fimbristylis ferruginea may exist up to a depth of a foot but is absent beyond that depth. Cyperus corymbosus extends from the shore up to a depth of five feet. Chara is present throughout but always in water. In some areas, in water, Naias marina is also present.

Zonation :

The types of plants in this area may form closed communities or a mixed community; but are seen in definite zones. Lumnitzera racemosa is seen mostly along the shore line, followed by Excaecaria

agallocha" and finally Rhizophora mucronata in the deeper parts. Thus depth of water determines zonation. Pandanus tectorius, if present, is always seen along the shore forming almost the boundary line. Avicennia officinalis is also seen in shallow areas. Thus except Rhizophora mucronata, all the other plants are seen in shallow areas. A few of these plants may be seen in deeper parts as associates-mostly Lumnitzera racemosa sometimes Excaecaria agallocha, and rarely Avicennia officinalis; but always Rhizophora mucronata forms the dominant vegetation.

Distribution :

The Thondaimannar lagoon covers an area of about 15½ sq miles (30 square miles when full during the wet season). It extends to about 3¼ miles, commencing at Thondaimannar (outlet into the. sea), running in a southerly direction to about 3 miles, then turning eastwards and after another 6 miles or so runs in a south-southeasterly direction and ends blindly at a distance of about 3¼ miles from the mouth (Refer map). This is a sea-water lake that functions also as an outlet for surplus rain water. During the rainy season it also becomes connected to Upparu, an inland arm of the Jaffna Lagoon.

As regards the mangrove vegetation of the lagoon, there are no mangroves up to a distance of about 8 miles from the mouth. except for a few patches of Pandanus tectoreus scattered about and three pockets of real mangroves About 1¾ miles from the mouth of the lagoon, towards west, there is a small pocket (Pocket i in map) where there is a patch of Acanthus ilicifolius. About two miles from the mouth and extending for a mile or so, towards the north-eastern shore of the lagoon (Marked X in map) there is a thick patch of Pandanus tectoreus Where the lagoon turns in an easterly direction there is a blind arm in a southerly and westerly direction (Pocket ii in map) along the fringes of which is a fairly large patch (extending to about half a mile) of Lumnitzera racemosa. At a distance of about 7 miles from the mouth of the lagoon is a blind alley of the lagoon (Pocket iii) extending in southerly, westerly and easterly directions This alley is thickly populated with mangroves. The main vegetation is Excaecaria agallocha, with Lumnitzera racemosa, Heritiera littoraliso and Acanthus ilicifolius as associates,

There is a road cutting across in a north-south direction, and on either sides of the road amongst the mangroves Clerodendron inerme is common, Rhizophora mucronata is there, but rare; Ceriops tagal though not very common, is one of the associates. But Tamarix gallica is a common associate. This place is getting silted up, and this may be the cause for the scarcity of Rhizophora mucronata and predominance of Excaecaria agallocha. On open mud flats Salicornia brachiata is present, but rare. Fimbristylis ferruginea. Bacopa monnieri, Heliotropium and Cyperus corymbosus are common. It is rather strange to note the presence of Nymphaea nouchali and Typha javanica in pools of water amongst the mangroves both in the dry season as well as in the wet season. The water lily first appeared here some 5 or 6 years back.

The characteristic mangrove vegetation starts at Mulli (Point 5 in map) which is about 9¼ miles from the mouth of the lagoon, and, ends at Sempianpattu (Point 10 in map) which is about 24¼ miles from the mouth of the Lagoon. At the place where the mangrove vegetation actually starts, the main vegetation is Lumintzera recemosa on the north-eastern shore; and Excaecaria agallocha with Lumnitzera racemosa as an associate on the south-eastern shore: Clerodendron inerme is present along the road and close to the road amongst the mangroves. Here too water lily has appeared in the pools of water.

Further down, from about 10 miles from the mouth of the lagoon up to Amban (Point 7 in map) which is about 14¼ miles from the mouth of the lagoon, the mangrove vegetation is somewhat typical. Along the fringes we get mainly Lumnitzera racemosa then as we go into the lagoon we get mainly Excaecaria agallocha, and then finally in the deeper parts mainly Rhizophora mucronata, Avicennia officinalis and Ceriops tagal are found scattered among this vegetation. Along the fringes of the mangrove vegetation patches of Pandanus tectorius are also seen. But from a distance of about 16 miles (between points 7 & 8 in map, to about 22 miles (between points 9 & 10 in map) from the mouth, the main vegetation is Rhizophora mucronata which is very thick in some places, In these areas the main associates are Lumnitzera racemosa, Excaecaria agallocha and

Ceriops tagal. Ceriops tagal is not very common. In this part of the lagoon water lily appeared along the fringes of the lagoon some 5 or 6 years back, appearing in the wet season when the lagoon is flooded and disappearing in the dry seasson when this portion of the lagoon dries up. In 1964 for the first time we observed the appearance of water lily in the main lagoon itself of this area.

From 22 miles (between points 9 & 10 in map) to 24¾ miles (Point 10 in map) from the mouth of the lagoon, the main vegetation is Lumnitzera racemosa; with Tamarix gallica, Excaecaria agallocha and Heritiera littoralis as associates.

The last 6 or 7 miles. ie from 24¾ miles (Point 10 in map) to 31¼ miles (Point 15 in map) from the mouth, the area is devoid of any mangroves except for a few patches of Pandanus tectorius and few bushes of Lumnitzera racemosa, scattered about. It appears that plants like Calophyllum inophyllum, Cassia marginata and Dodonia viscosa have started to colonize these areas along the shore of the lagoon.

The absence of mangroves from the mouth of the lagoon to a distance of 8 miles, and from 24¾ miles to 31¼ miles is due to the absence of silting owing to the nature of the terrain. Even in these areas where there are blind alleys, where silting is possible, the creation of a mangrove habitat is plausible and hence the presence of mangroves at pockets i, ii, iii, In the areas where mangrove population is thick, there had been silting and mangroves have become established. In these areas where silting continues and areas get elevated, Rhizophora mucronata has been and is being replaced by Excaecaria agallocha.

As a result of the steps being taken to convert the lagoon into a fresh water reservoir, the mangrove habitat is getting disturbed. As a result in certain areas we could find the appearance of halophytic intruders like Calophyllum inophyllum, Cassia marginata, Pandanus tectorius, Clerodendron inerme Lawsonia inermis, Salvadora persica, Vitex negundo, Terminalia belerica, Pongamia pinnata (P. glabra); river side or tank side mesophytes like Vitex leucoxylon, Terminalia glabra; and fresh water hydrophytes like Nymphaea nouchali and Typha javanica.

Summary : To sum up, we find that :

(i) The characteristic distribution is restricted to the middle part of the lagoon.

(ii) In this part there are many pockets and the lagoon makes almost a right-angled turn towards west, and silting had been possible.

(iii) Even in other areas where there are pockets silting is possible, and mangroves are present.

(iv) Distribution is mainly controlled by depth.

(v) There are signs of the habitat changing and new forms appearing.

(vi) The absence of mangrove vegetation at both ends of the lagoon is due to the nature of the terrain.

In addition to the mapping out of the mangrove vegetation of the lagoon, further investigations (quantitatively) of the mangroves of the lagoon are being carried out.

Further projects planned from above studies :

1. Roots of mangroves in general with special reference to the root system of Lumnitzera racemosa.
2. Osmotic tolerance of mangroves.
3. Salinity and distribution of mangroves.
4. Changes arising in the pattern of distribution of Flora and Fauna in the Thondaimannar lagoon as a result of (human) interferance in the habitat.
5. A study of the cotyledons of the mangroves (particularly that of Rhizophoraceae.)

Check List

Grouping

(i) Mangrove and Mangrove associates
(ii) Fore runners
(iii) Intruders
(iv) Mud-flat vegetation

(i) Mangrove and Mangrove associates :

1. Rhizophora mucronata (Rhizophoraceae)
2. Lumnitzera recemosa (Combretaceae)
3. Avicennia officinalis (Verbenaceae)
4. Ceriops tagal (Rhizophoraceae)
5. Excaecaria agallocha (Euphorbiaceae)
6. Tamarix gallica (Tamaricaceae or Tamiriscineae)
7. Heritiera littoralis (Sterculiaceae)
8. Pandanus tectorius (Pandanaceae)
9. Acanthus ilicifolius (Acanthaceae)
10. Scyphiphora hydrophylacea (Rubiaceae)

(ii) Fore-runners :

1. Fimbristylis littoralis (Cyperaceae)
2. Enicostema verticillare (Gentianaceae)
3. Blumia sp. (Compositae)
4. Cynodon dactylon (Gramineae)
5. Fimbristylis ferruginea (Cyperaceae)
6. Bacopa monnieri (Scrophulariaceae)
7. Chara sp. (Characeae)
8. Cyperus stoloniferous (Cyperaceae)
9. Cyperus corymbosus (Cyperaceae)

(iii) Intruders

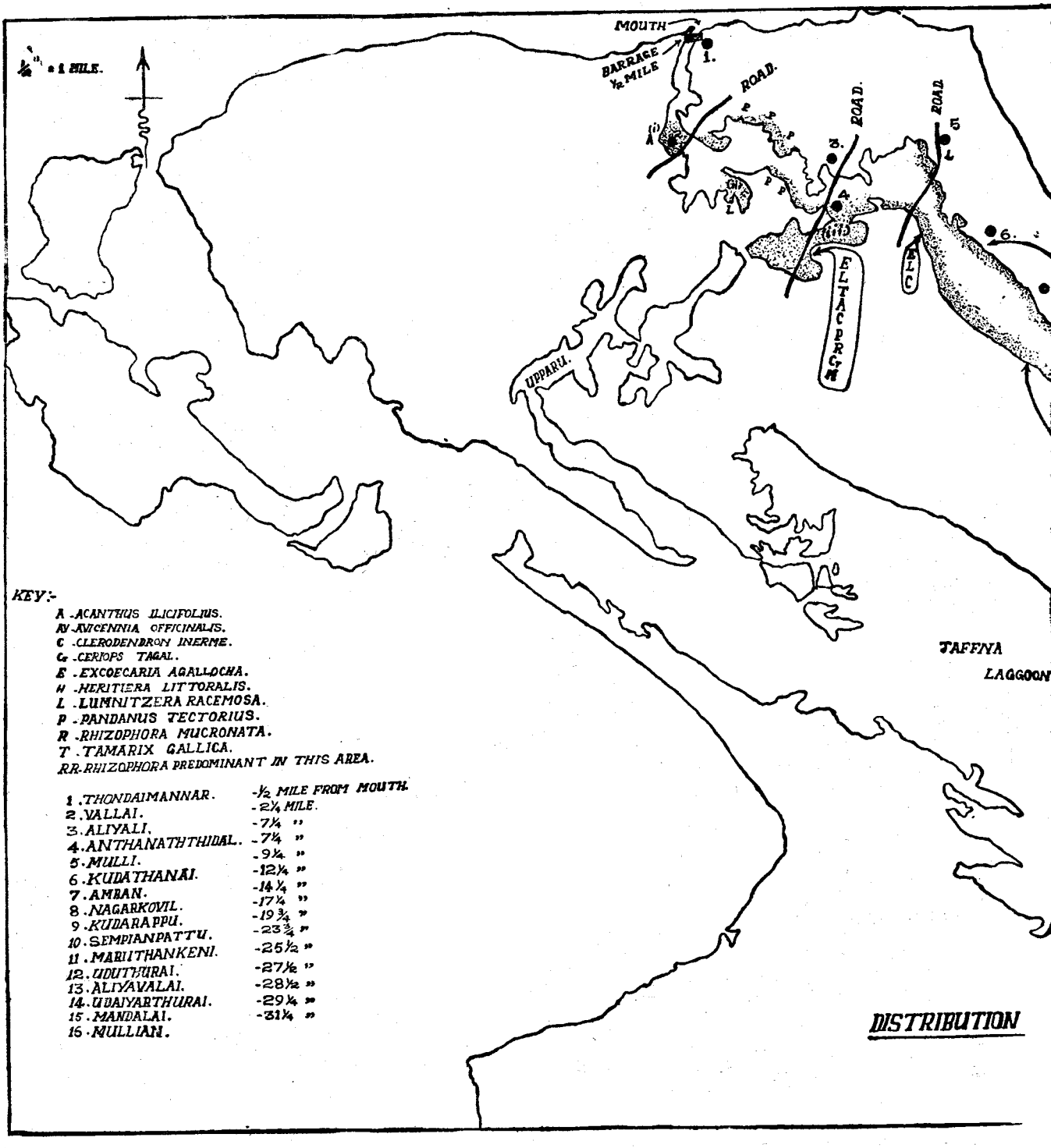
1. Vitex negundo (Verbenaceae)
2. Vitex leucoxylon (,,)
3. Salvadora persica (Salvedoraceae)
4. Clerodendron inerme (Verbenaceae)

5. Careya coccinea (Myrtaceae)
6. Cassia marginata (Leguminosae-Caesalpinoideae)
7. Calophyllum inophyllum (Guttiferae)
8. Terminalia glabra (Combretaceae)
9. Pandanus tectorius (Pandanaceae)
10. Ixora parviflora (Rubiaceae)
11. Terminalia belerica (Combretaceae)
12. Toddalia asiatica (Rutaceae)
13. Lawsonia inermis (Lythraceae)
14. Garcinia spicata (Guttiferae)
15. Zizyphus xylopyra (Rhamnaceae)
16. Pongamia pinnata (P. glabra), (Leguminosae-Papilionaceae)
17. Acacia eburnia (Leguminosae-Mimosidae)
18. Indigofera oblongifolia (leguminosae-Papilionaceae)
19. Lippia nodiflora (Verbenaceae)
20. Indigofera euneaphylla (Leguminosae-Papilionaceae)
21. Asclepias sp. (Asclepidaceae)
22. Euphorbia thymifolia (Euphorbiaceae)
23. Euphorbia hirta (,,)
24. Evolvulus alsinoides (Convolvulaceae)
25. Zornia diphylla (Leguminosae-Papilionaceae)
26. Micrococca mercurialis (Euphorbiaceae)
27. Typha javanica (Typhaceae)
28. Nympheae nouchali (Nymphaceae)

v) **Mud-flat vegetation**

1. Suaeda nudiflora (Chenopodiaceae)
2. Agyneia bacciformis (Euphorbiaceae)
3. Salicornia brachiata (Chenopodiaceae)
4. Fimbristylis littoralis (Cyperaceae)
5. Enicostema verticilare (Gentianaceae)
6. Blumia sp. (Compositae)
7. Fimbristylis ferruginea (Cyperaceae)
8. Sesuvium portulacastrum (Aizeaceae or Ficoideae)
9. Cyperus stoloniferous (Cyperaceae)
10. Cyperus iria (,,)

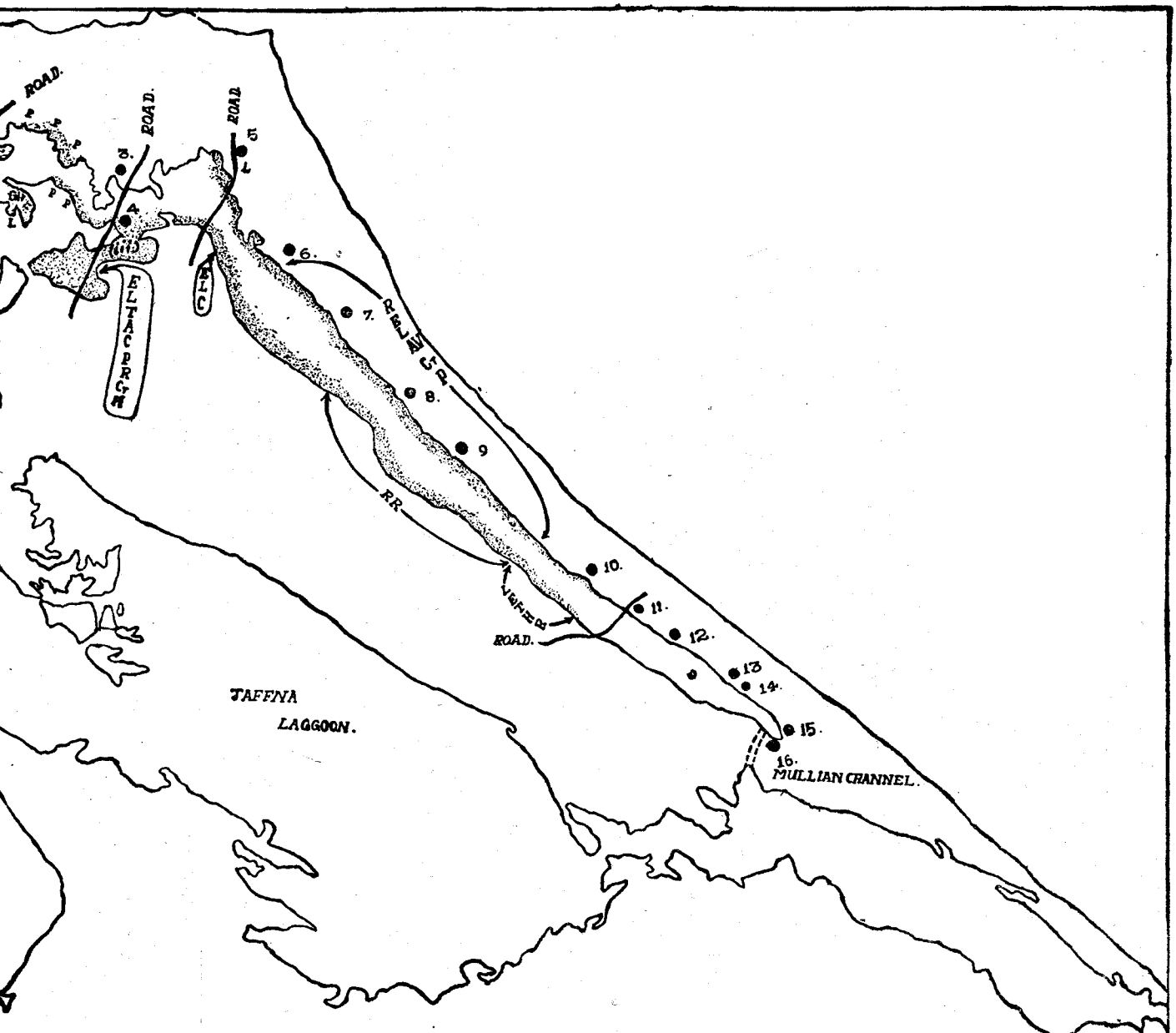
1. Euphorbia thymifolia (Euphorbaceae)
2. Euphorbia hirta (,,)
13. Hydrophylax maritima (Rubiaceae)
14. Aristolochia brachiata (Aristolochiaceae)
15. Cressa cretica (Convolvulaceae)
16. Heliotropium sp. (Boraginaceae)
17. Ammannia sp. (Lythraceae)
18. Lippia nodiflora (Verbenaceae)
19. Cynodon dactylon (Gramineae)
20. Launaea sarmentosa (L. pinnatifida) (Compositae)



KEY:-

A .ACANTHUS ILICIFOLIUS.
AV.AVICENNIA OFFICINALIS.
C .CLERODENDRON INERME.
Cr .CERIOPS TAGAL.
E .EXCOECARIA AGALLOCHA.
H .HERITIERA LITTORALIS.
L .LUMNITZERA RACEMOSA.
P .PANDANUS TECTORIUS.
R .RHIZOPHORA MUCRONATA.
T .TAMARIX GALLICA.
RR-RHIZOPHORA PREDOMINANT IN THIS AREA.

1 .THONDAIMANNAR.	-½ MILE FROM MOUTH.
2 .VALLAI.	-2¼ MILE.
3 .ALIYALI.	-7¼ "
4 .ANTHANATHTHIDAL.	-7¼ "
5 .MULLI.	-9¼ "
6 .KUDATHANAI.	-12¼ "
7 .AMBAN.	-14¼ "
8 .NAGARKOVIL.	-17¼ "
9 .KUDARAPPU.	-19¾ "
10 .SEMPIANPATTU.	-23¾ "
11 .MARUTHANKENI.	-25½ "
12 .UDUTHURAI.	-27½ "
13 .ALIYAVALAI.	-28½ "
14 .UDAIYARTHURAI.	-29¼ "
15 .MANDALAI.	-31¼ "
16 .MULLIAN.	



DISTRIBUTION OF MANGROVE VEGETATION.

SECTION III

Plant No.	Point 4 Anthanaththidal							Point 5 Mulli [North]				Point 5 Mulli [South]						
	I	II	III	IV	V	VI	Total	I	II	III	Total	I	II	III	Total	I	II	III
1	17	10	14	6	8	6	61	8	6	9	23	23	52	15	120	3	—	—
2	7	7	8	10	9	8	49	32	50	34	116	32	9	12	53	21	18	8
3	—	6	1	1	2	7	17	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	5	2	—	7	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	1	5	6	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	10
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

(1) Frequency Counts-Quadrat Method [Quadrat Size–1

Plant No Key.

1. Excaecaria agallocha
2. Lumnitzera racemosa
3. Tamarix gallica
4. Pandanus tectorius
5. Ceriops tagal
6. Acanthus ilicifolius
7. Clerodendron inerme

Point 5 Mulli [South]			Point 6 Kudathanai							Point 7 Amban						
II	III	Total	I	II	III	IV	V	VI	Total	I	II	III	IV	V	VI	Total
52	15	120	3	—	—	2	1	—	6	21	18	15	10	—	—	64
9	12	53	21	18	8	10	14	5	76	26	30	28	18	7	5	114
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	7	10	8	2	12	39	—	—	—	1	13	12	26
—	—	—	—	—	—	—	—	—	—	1	—	2	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

s-Quadrat Method [Quadrat Size—10 yds Sq.]

anus tectorius
ops tagal
thus ilicifolius
dendron inerme

8. Rhizophora mucronata
9. Avicennia officinalis
10. Heritiera littoralis

Plant No.	Point 8 Nagarkovil							Two Miles Off Poi Sempianpattu				
	I	II	III	IV	V	VI	Total	I	II	III	IV	V
1	4	—	2	—	—	1	7	—	—	—	—	—
2	12	5	8	3	2	7	37	19	23	18	15	20
3	—	—	—	—	—	—	—	2	2	—	3	1
4	—	1	—	—	—	—	1	—	—	3	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	3	—	—	1
8	8	12	10	11	12	8	61	1	—	—	1	—
9	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	3	4	—	1

(2) Frequency Counts - Quadrat Method [Quadrat Size - 10Yd Sq].

Plant No Key.

1. Excaecaria agallocha.
2. Lumnitzera racemosa.
3. Tamarix gallica.
4. Pandanus tectorius.
5. Ceriops tagal.
6. Acanthus ilicifolius.
7. Clerodendron inerme.
8. Rhizo
9. Avice
10. Herit

	Two Miles Off Point 9 Sempianpattu.								
Total	I	II	III	IV	V	VI	VII		Total
7	—	—	—	—	—	—	—		—
37	19	23	18	15	20	17	14		126
—	2	2	—	3	1	—	2		10
1	—	—	3	—	—	—	—		3
—	—	—	—	—	—	—	—		—
—	—	—	—	—	—	—	—		—
—	—	3	—	—	1	—	—		4
61	1	—	—	1	—	—	—		2
—	—	—	—	—	—	—	—		—
—	—	3	4	—	1	—	—		8

Quadrat Method [Quadrat Size - 10Yd Sq].

nus tectorius.
s tagal.
nus ilicifolius.
endron inerme.

8 Rhizophora mucronata.
9. Avicennia officinalis.
10. Heritiera littoralis.

SECTION III

Description of Mangrove Flora

(I) Mangroves and Mangrove Associates

Acanthaceae	Acanthus ilicifolius. L.
Combretaceae	Lumnitzera racemosa, Willd,
Euphorbiaceae	Excaecaria agallocha. L.
Lythraceae	Sonneratia acida. L.
Rhizophoraceae	Bruguiera gymnorhiza. Lam. Carallia brachiata, Merr. Ceriops candolleana. Arn. Rhizophora candelaria. D. C. R. mucronata. L.
Rubiaceae	Scyphiphora hydrophylacea. Gaertn Fruct.
Sterculiaciae	Heritiera littoralis. Dryand.
Tamaricaceae	Tamarix gallica. L.
Verbenaceae	Avicennia officinalis L. A. marina.
Pandanaceae	Pandanus odoratissimus. L.

Acanthus ilicifolius. L

(plates 6 & 8) Acanthaceae.

Sinhalese : Ikili or Katu-ikili : **Tamil:** Kaluthai-mulli.

Origin : Eastern Tropics.

Habit Straggler.

Stem Green.

Roots Stilt roots present, green.

Leaves Simple, large, opposite decussate, oblong-lanceolate, large spines along the margin at the ends of the main veins and mid rib. Thick, fleshy, and glabrous. Pinnately reticulate venation, veins faint. Stipular thorns present.

Infrorescence Spike.

Flowers : In pairs, opposite, each pair about half and inch apart. Bright purplish-blue. Zygormorphic, Bisexual, Bracteate, Complete, Hypogynous, Bracts three, tips spinous, Calyx three, green, free, imbricate, tips slightly spinous, Persistent. Corolla five, gamopetalous, petals fused to form a single cup, Bright purplish-blue. Stamens six, epipetalous, four fertile, two staminodes, Anthers bear brush like hairs (for brush mechanism-pollination mechanism). Pistil-Bicarpellary, Syncarpous, Ovary superior.

Fruit : Capsular.

Lumnitzera racemosa. Willd.

(plates 2 & 7) Combretaceae.

Sinhalese : Beriya **Tamil :** Tipparathai or Potpaththai.

Origin : Tropics, Mainly India and Ceylon.

Habit : A small tree, bushy, much branched.

Bark : Smooth, purplish, dark brown and cracked in old stems.

Stem : Crooked, much branched, not straight.

Roots : Stilt roots present from the base of the stem and bases of lowermost branches. These are in tufts and not so prominent as in Rhizophora. Bushy tufts of slender ageotropic branches from the far spreading horizontal roots. Slender knee formations (Hair-pin roots") also seen. The 'Hair-pin bent' roots arise from the horizontal branches come above ground (ageotropic), become geotropic turn downwards and the free ends go deep dwon in the soil thus (also) helping in anchorage. Sometimes on a first set of hair-pin roots, a second set also appear. Tufts of very slender ageotropic roots arise from these bent roots. The roots are pithy and help not only for anchorage but also for respiration (Aeration).

Leaves : Simple, Alternate (spiral), petiole very short-almost sessile, oblong, thick, fleshy and glabrous, shining, margin crenate, tip retuse, venation pinnately reticulate, veins faint.

Inflorescence : Racemose, simple recemes.

Flowers : White, Regular, Bisxual, Complete, Epigynous. Calyx five, gamosepalous, valvate, green and persistent. Corolla five, white, valvate, gamopetalous. Stamens ten, free. Pistil-Ovary inferior, Ovule one, Pendulous.

Fruit : Indehiscent, firm and fleshy. Well protected for dispersal by water. Five ridges on fruit.

Timber : Hard; for firewood, posts etc. Branches used for fencing in the North.

Note: This is the main mangrove associate in certain areas of the lagoon.

Excaecaria agallocha L. (Plates 5 & 8

(Syn : Sapium insigne. Trim) Euphorbiaceae.

Sinhalese : Tala-kiriya. **Tamil :** Thillai.

Origin : Ceylon and Eastern Tropics.

Habit : Smal tree with milky juice, which blisters the skin.

Bark : Smooth, Ashy-white.

Stem : Straight. Lenticels prominent and many. Lenticels denser from the base of the stem up to 3-4 feet. Latex present.

Roots : Buttress roots commonly seen. Stilt roots occasionally seen from base of stem up to 3 feet, and from base of lower most branches Prominent lenticels on exposed portions of the roots Knee formations, with lenticels may also be seen.

Leaves : Simple, petiolate, exstipulate, spirally arranged. Leaf tip acute, Venation pinnately reticulate Leaves some what thick and glabrous Latex present. Leaves usually shed during the flowering season. Old leaves reddish-brown.

Inflorescence : Mixed Cyathia on axises.

Flower : Unisexual. Female flower represented by a tricarpellary, trilocular, syncarpous ovary on a stalk. Ovary superior. Male flowers represented by stamens on stalks. Each stamen is a male flower.

Fruit : Regma.

Timber : Used for local boats and kattamarans.

Note : Excaecaria is a mangrove associate.

Sonneratia acida L.

(plates-6&8) Lythraceae or Sonneratiaceae

Sinhalese : Kirilla. **Tamil :** Kinnai.

Origin : Estern Tropics.

Habit : Small tree ; overtops other mangroves.

Bark : Brown. Affords tan.

Stem : Branches quadrangular.

Roots : Breathing roots as in avicennia present. The aerial roots may grow to about three feet or more in height. These roots are very light and soft, but firm. Corks are made from these aerials.

Leaves : Opposite, entire, thick, somewhat fleshy, with pinnately reticulate venation. Veins faint.

Flowers : Pink. large, solitary, terminal. Petals fall off soon. Calyx five, gamosepalous, green. Stamens many.

Fruit : Large, globular, fleshy Dispersed by water.

Timber : White, soft.

Notes : This tree is not present in the Thondaimannar lagoon area.

Bruguiera gymnorhiza. Lam.

(Syn. B. sexangula) Rhizophoraceae.

Sinhalese : Pat-kadol **Tamil :** Uppu-kandal

Origin : Eastern Tropics and Africa to Australia.

Habit : Small tree. The tree is somewhat similar to Rhizophora apiculata.

Bark : Brown. Used for tanning.

Roots . The horizontal roots come above the soil forming knee-formations on which lenticels are crowded and help in respiration. stilt roots are few or absent.

Leaves : Simple, petiolate, spiral, thick, fleshy and glabrous. Margin entire. Veins faint, except the midrib. Buds protected by sheathing bud scales.

Flower: Showy, orange-yellow, solitary, axillary, bisexual, regular.

Fruit : Crowned by the sepals. Scarlet. Exhibits vivipary, the embryo reaching from 9-10 inches in length, is six angled. Unlike in Rhizophora here the embryo falls with the fruit.

Timber : Red, hard and strong. Used as firewood, for furniture and for flooring.

Notes : This plant is absent in the Thondaimannar lagoon area.

Carallia brachiata. Merr
(Syn—C. integerrima D. C)

Rhizophoraceae.

Sinhalese : Davata. **Tamil :**

Similar to Avicennia officinalis, but with these differences. Huge trees. Stilt roots are often seen but no pneumatophores. Flowers are creamy-white in colour. Fruit a berry, smooth, red in colour.

Notes : This tree is not represented in the Thondaimannar lagoon area.

Ceriops candolleana Arn. (plates 5 & 8)
(Syn—C. tagal)

Rhizophoraceae.

Sinhalese : **Tamil :** Chiru-kandal.

Origin : Eastern tropics.

Habit : Small tree. Much branched, bushy.

Bark : Dark brown. Cracked.

Roots : Stilt roots from base of stem and lower branches. Lenticels very prominent and dense on them. Buttress roots also present.

Leaves : Simple, petiolate, opposite decussate, thick, leathery, glabrous, pale green. Margin entire. Venation pinnately reticulate.

Flowers : In terminal clusters, almost resembling an umbel. Regular bisexual, complete, hypogynous, with very slender pedicels. Calyx five, green or yellowish-green, valvate, persistent. Corolla five, white, valvate, Stamens five. Pistil-Ovary superior, Ovules usually one.

Fruit : Usually one seeded, Indehiscent. Exhibits viviparous germination. Embryo 2"—3" long.

Timber : Hard and woody. Usually used as poles and posts.

Note : This is an associate, but is a rare one in the lagoon area.

Rhizophora candelaria D. C

(Syn : R. apiculata)

Rhizophoraceae.

Sin : Kadol. **Tamil :** Kandal.

Similar to R. mucronata with this difference - in this plant the flowers are sessile, solitary, crowded close to the tips of the branches.

Note : This plant is absent in the Thondaimannar lagoon area.

Rhizophora mucronata. L. (Plates 5 & 7)

Rhizophoraceae.

Sin : Kadol or Elakadol **Tamil:** Kandal

Origin : Eastern Tropics. Inhabits Ceylon and East Tropics.

Habit : Tree, 25-30 feet, with spreading crown of branches.

Bark : Ashy, cracked, used for tanning and dyeing of nets and sails. The stain from the bark givrs a reddish colour to the lagoon water.

Leaves : Simple, petiolate, opposite, decussate, thick, fleshy, and glabrous. Leaves closely arranged at the shoot tips. Shape ovate, margin entire, tip mucronate, pinnately reticulate venation, veins faint, Black dots closely arranged on under side of leaves. Stipules large, sheathing as bud scales, drops off when leaves open. Young leaves purple.

Inflorescence : Cymose.

Flowers : Regular, bisexual complete, bracteate, hypogynous. Bracts two. persistent. Calyx four, yellow or yellowish green in colour, valvate persistent. Corolla four, white, valvate, deciduous, with conspicuous corolline corona. Stamens 4-8 (usually 6), free. Pistil-carpels 4-8, syncarpous. Ovary superior. Ovules usually one and very rarely two.

Fruit : One seeded, Indehiscent. Exhibits viviparous germination. Embryo 12-18 inches long.

Timber : Hard and woody. Leaf scars and stipular scars seen on twigs. Stem brown, certain areas ashy. Used for fuel, ceilings. Can be used for sleepers and furniture.

Roots : Deep seated and far spreading-helps in fixation and anchorage. Stilt roots from stem and branches for additional support. Lenticels on stilt roots help in aeration.

Germination : (Plate-7) The seed germinates in the fruit while still attached to the tree and produces a hypocotyl that may reach the length of from 1—1½ feet. (The growth of the hypocotyl is actually preceded by the growth of the cotyledons which grow only to a very short length.) When fully formed the seedling drops off. The hypo cotyl is lance shaped with lenticels on it, with a narrow plumular end that gradually dilates and then suddenly tapers off at the radiclar end. When it drops the sharp end sticks into the mud, the seedling soon cuts off roots, becomes fixed add then the plumule starts to grow. When it falls in watern it floats, with the sharp end down and the plumular end well above water, may be carried about by waves and when it touches the ground, roots are produced and the seedling grows. Germination is Rhizophora may take from 3 - 9 months.

Scyphiphora hydrophylacea Gaertn & Fruct.

(Plates - 5 & 8)

Rubiaceae.

Sin.—— **Tamil :** Alaiyathi.

Origin : Old World tropics.

Habit : Small trees or shrubs. Much branched. Resembles Lumnitzera racemosa to some extent.

Bark : Brown. Cracked.

Stem : Slender, much branched, with dense hair, branching as in Lumnitzera racemosa.

Leaves : Small, simple, petioles very short, opposite, decussate closely arranged towards the apices, thick, fleshy, smooth hairs on either side of lamina. Venation pinnately reticulate, veins faint.

Flowers : White, axillary, regular, bisexual, epigynous, pentamerous. Calyx five, green, gamosepalous, valvate, persistent. Corolla five, white, gamopetalous. Stamens five, epipetalous, exserted. Fruit about I/3", within a persistent calyx, obovate—ovoid

Timber : Small, hard, for posts and firewood. Branches used for fencing instead of, or along with, Lumnitzera.

Note : Common associate in certain parts of the Lagoon. Remarkably like Lumnitzera racemosa, with which it grows,

Heritiera littoralis, Dryand.

(Plate 6)

Sterculiaceae.

Sin : Etuna or Ho-mediriya. **Tamil :** Chomunthiri.

Origin : Tropics

Habit : Tree, 20 – 30 feet or more. Spreading, dense canopy.

Bark : Ashy, cracked, vertically furrowed.

Stem : Straight.

Roots : Very prominent and characterstic buttress roots present,

Leaves : Large, leathery, simple, alternate, petiolate - petioles woody and cracked transversely and bent in some. Margin wavy, leaf blade elliptical, tip acute, upper side green and shining, lower side ashy white and shiny, Venation pinnately reticulate. young leaves pink - brown. old leaves yellow.

Inflorescence : Much branched and complicated - panicle.

Flowers : Greenish-pink. Bisexual, regular and Pentamerous. Calyx five. Corolla five. Stamens ten. Pistil-pentacarpellary apocarpous.

Fruit : Hard and indehiscent. Well protected for dispersal by water. Boat shaped with a keel, and often a sail. Drops into the water and sails away before the wind.

Timber : Hard, dark red - brown. for boats:

Note : Heritiera is a halophyte, but may also be seen as a mangrove associate.

Tamarix gallica. L. (Plates—2 & 8)

Tamaricaceae or Tamariscineae.

Sinhalese :—— **Tamil :** Kiranchi or Kiri.

Origin : Ceylon; also India and Africa.

Habit : Small tree or shrub. Much branched and casuarina like. Willowy.

Bark : Grey-brown. Reticulate cracks.

Stem : Bushy.

Roots : Tufts of slender stilt roots from the base of the stem and lower-most branches.

Leaves : Small, scale like, alternate. (spiral), Sessile, and exstipulate.

Inflorescence : Racemose

Flowers : Pink, regular, bisexual, hypogynous. Calyx five, persistent. gamosepalous and valvate. Corolla five, free, valvate. Stamens five, free. Pistil-Ovary superior, uniloeular, with free styles. Placentation basal.

Fruit : A capsule, seeds hairy.

Timber : Small, tough, and durable. Used for ploughs and as fire-wood.

Avicennia officminalis L. (Plate—5 & 8)

Verbenaceae.

Sinhalese : —— **Tamil : Kanna.**

Origin : Eastern tropics.

Habit : Bushy tree.

Bark : White, pealing, smooth, not cracked.

Stem : Straight, nodes prominent in twigs, tender stems angular-4 sided.

Roots : Buttress and stilt roots from base of stem. Pneumatothodes on tips of young buttress roots. Pneumatophores from horizontal roots.

Leaves : Opposite decussate, simple, small, petiolate, leathery, green, shiny. Underside white, shiny (luminous) due to the presence of small velvetty hairs. Margin entire, tip acute, shape oval. Young leaves - brownish orange. Old leaves - lemon yellow.

Inflorescence : Racemose, Compound spike.

Flowers : Orange - yellow, bracteate, regular, hypogynous, complete, tetramerous. Calyx four, free, imbricate. Corolla four, united, valvate. Stamens four epipetalous. Ovary superior. Ovule one.

Fruit : Capsule. Germination viviparous.

Timber : Hard. Useful for buildings, furniture. Commonly used as firewood. Branches much used by fishermen for erecting barricades in shallow waters for catching fish.

Avicennia marina.

Verbenaceae

S nhalese : - **Tamil :** Venkandal.

Similar to Avicennia officinalis but the leaves are larger, elliptical, and more or less like the leaves of Rhizophora apiculata. The trees are small and bushy.

Notes : This tree is absent in the Thondaimannar lagoon Area.

Pandanus odoratissimus L.

(Syn : P. tectorius)

Pandanaceae.

Sinhalese : Mudu-Keyya. **Tamil :** Thalai.

Habit : Tree or bushy shrub.

Bark : Brown.

Stem : Erect, cylindrical, with a thick skin. Branched. Prominent lenticels on stem.

Roots : Roots at base of stem long and deep-feeding. Stilt roots arise from stem, grow at an angle, go deep tnto the soil, and afford additional suport. Prominent lenticels are seen on these roots, The root caps of the aerial roots are also very prominent.

Leaves : Form a crown at the tips of branches. Long, simple, large, glabrous, thick and leathery. Spines along the margin and along the under-side of the mid ribs. White or yellow when young, dark green when mature.

Inflorescence : Spike.

Flowers : Unisexual, trimerous, hypogynous ond incomplete. Wind pollinated. Male spikes produce an abundance of pollen.

Fruit : Composite, large. Green when young, orange when half mature; red when fully matured: The componant parts of the composite fruit break up easily on maturity. Dispersed by water.

(II) Mangrove intruders

Combretaceae	Terminalia belerica. Roxb. [T. glabra. W. & A.]
Guttiferae	Calophyllum inophyllum. L.
Leguminosae.	Cassia marginata. Roxb.
Caesalpinoideae	
Papilionaceae	Pongamia pinnata. Merr.
Myrtaceae	Careya coccina. A. Chev.
Salvadoraceae	Salvadora persica. L.
Verbenaceae	Clerodendron inerme. Gaertn.
	Vitex leucoxylon. L.
	V. negundo. L.

Terminalia belerica Roxb.
(plate-10) Combretaceae

Sinhalese: Bulu **Tamil:** Thantri

Origin: Ceylon, India and Malaya.

Habit: Huge trees, with dence canopy.

Bark: Brown. slightly cracked, cracks even and in vertical strips.

Stem: Buttressed as in T. glabra.

Leaves: Simple, petiolate, alternate thick and leathery. Margin entire. Lamina somewhat rounded. Petioles slightly elongate.

Inflorescence: As in T. glabra,

Flowers: As in T. glabra.

Fruits: Small, rounded, Used for tanning. Dispersal by water. Cotyledons and primary axis edible as in the case of T. catapa.

Timber: Used for planking.

Notes: This is not a mangrove, but is seen growing amongst and close to mangrove plants in certain areas of the lagoon especially Nagarkovil area.

Terminalia glabra W. & A. (plates-2&11)
(Syn-T. arjuna. Bedd.) Combretaceae.

Sinhalese: Kumbuk **Tamil:** Maruthu

Origin: Ceylon and India.

Habit: Very large tree.

Bark: Smooth, green; peeling, peels ashy grey. Rich in lime, lime obtained by burning the bark, used for betel chewing.

Stem: Grows to a wide girth; buttressed.

Roots: Prominent buttress roots present.

Leaves: Simple, petiolate, petiole short, arrangement spiral, shape oval, tip cuspidate, margin faintly toothed, teeth broad and blunt. venation pinnately reticulate. Old leaves orange or reddish in colour. Deciduous,

Inflorescence : Compound spike.

Flower : Honey scented ; one of the best for bees. Greenish yellow, regular, bisexual, complete, bracteate, sessile. Calyx five, gamosepalous, valvate, greenish yellow. Corrolla five, polypetalous, valvate, greenish yellow. Stamens ten, free. Pistil-ovary inferior, ovule one, pendulous. Five prominent ridges on ovary. Resin ducts in fruit wall. Hairs between stamens and on pistil. Hairs white, base brown.

Fruit :Five winged, dispersed by water.

Timber : For bridges, furniture.

Notes : This is not a mangrove. Seen along river banks, especially in the dry zone, and on the bunds of tanks and ponds. This plant has become established at various points along the Lagoon.

Calophyllum inophyllum. L.
(Plates-2&11) Guttiferae

Sinhalese : Domba **Tamil** : Punnai

Origin : Ceylon, and Eastern Tropics, to Australia.

Habit : Medium sized or large handsome tree. 50-70 feet.

Bark : Dark and light grey. Thick, rough, and cracked.

Stem : Straight.

Leaves : Handsome, dark, evergreen foliage. Large, opposite, decussate, petiolate, thick, glabrous. Shape oblong. Margin entire. Tip retuse. Finely and closely veined, pinnately parallel vennation. Stipules as bud scales. New leaves pale green, old leaves lemon-yellow. Little latex in leaves.

Inflorescence : Large, cymose.

Flowers: White, fragrant, regular, bisexual, complete, bracteate, hypognous. Calyx four, free, white, deciduous, imbricate (two in, two out). Corolla four, free, white, valvate. Stamens many, in bundles (tetra-adelphous). Pistil-ovary superior, ovule one.

Fruit : Fleshy, one-seeded, spongy layer encloses the seed rendering it light for dispersal by water, Latex in young fruits. Seeds yield abundant, dark green, thick and strongly scented oil, used in some areas for medicine and for burning.

Timber : Tough, pliable, and durable. Used for boats plywood.

Note : Calophyllum is cheifly a halophyte but has become established at various points along the lagoon.

Cassia marginata. Roxb. (Plates-10 & 11)

(Syn C. roxburghii. D. C. Leguminosae – Caesalpinoideae

Sinhalese : Ratu-wa **Tamil :** Vkai

Origin : Ceylon, South India.

Habit : Small graceful tree; 15 to 20 feet. Umbrella shaped with spreading. drooping branches.

Bark : Dark-brown; very hard; deeply and closely cracked.

Leaves : Alternate; paripinnate, pinnately reticulate venation, small notch at the leaf tip. Leaves flatly arranged horrizontal to the ground (branches also mostly horizontal). Stipulate, stipules auriculate, drop off early. Tender leaves and shoots very wooly and soft.

Inflorescence : Racemose-corymbs.

Flowers : Zygomorphic, complete, rose coloured, hypogynous. Bracts three, one large and two small. Calyx five, free, petalloid, imbricate. Corolla five, free, rose coloured, ascendingly imbricate. Stamens ten, free, some complete, some reduced and some represented as, staminodes. Pistil-monocarpellary superior with marginal placentation. Honey disc present below the ovary.

Fruit : A legume. Black when ripe. Cylindrical, 6"—12" in length, partitioned for many brown flat seeds.

Timber : Brown, strong and durable, Useful for posts.

Notes : This is a common plant in the dry and arid zones of Ceylon and South India. It is not a mangrove, but is common along the lagoon at certain points.

Pongamia pinnata. Merr.
(Syn : P. glabra. Vent.)

Leguminosae—Papilionaceae.

Sinhalese : Magul-karanda. **Tamil :** Punku.

Origin : Ceylon, India, and Far-East.

Habit : Small or large trees, with spreading branches.

Bark : Grey, smooth.

Leaves : Imparipinnately compound, glabrous, shiny, spinach green in colour. Used as manure for various crops.

Inflorescence : Racemes, simple, or compound.

Flowers : Pink or white, small, bisexual, hypogynous and complete. Petamerous. Calyx five, brownish purple and gamosepalous. valvate, persistent. Corolla five, free, descendingly inbricate—one standard, two wing, and two keel petals. Stamens ten, united. Pistil monocarpellary, monolocular, with marginal placentation. There is only a single ovule. Ovary superior.

Fruit : A one seeded lugume, but is indehiscent. Flat. Dispersal by water. Seeds yield an oil used in skin diseases and for burning as lamp oil.

Timber : Whitish-yellow, hard, used for posts, wheels, and as firewood

Notes : This is not a mangrove. This is a river bank and sea shore tree of the low-country, but is intruding into the mangrove territory of the Thondaimannar lagoon in some areas.

Careya coccinea. A. Chev. (Plates—2 & 11)
(Syn : C. arborea. Roxb.)

Myrtaceae.

Sinhalese : Kahata. **Tamil:** Kasaddai or Kaiddai

Origin : Ceylon, India, Burma-

Habit : Tree, 25 - 30 feet; short, straight, stem; round top.

Bark : Brown or Dark-ash; thiek and hard; rough; cracked,

Leaves : Large, simple, petiolate, exstippulate, leathery, glabrous; arrangement spiral; venation pinnately reticulate; Laminal margin slightly serrate and wavy; leaf tip cuspidate; new leaves bronze coloured with pink margins ; Old leaves mottled red: deciduous February to March.

Inflorescence : Raceme.

Flowers : Large, stinks; regular, bisexual, bracteate. complete, epigynous, Bracts green, persistent, three; Calyx four, free, imbricate, persistent; Corolla four, greenish-white, free, imbricate; Stamens many, outer whorls pink, inner whorls white, curved inwards in bud, monadelphous; Pistil-ovary inferior, tetracarpellary syncarpous.

Fruit : Many seeded berry.

Timber : Durable; for sleepers, posts, bridge planks etc.

Note : This is not a mangrove. Its habitat is Patanas and Talawas, up to 5000 feet. But many trees have become established along the laggon at Kudarappu, Nagarkovil, Kudaththanai and other neighbouring areas.

Salvadora pe sica L. (Plates—10 & 11)

Salvadoraceae.

Sinhalese : Malitan. **Tamil :** Uvay or Vivai.

Origin : Ceylon, North Africa to India ; Persia.

Habit : Small tree.

Bark : Grey; cracked and rough.

Stem : Erect; Branches weeping.

Leaves : Small, simple, petiolate, pale olive green, oval, opposite decussate, margin entire, tip obtuse, thick, fleshy, glabrous, pinnately reticulate venation, veins faint, stipulate—stipules very small.

Infloroscence : Racemose, Compond raceme.

Flowers : Small, greenish white, regular, complete, hypogynous, tetramerous. Calyx four, gamosepalous, valvate. Corolla four gamopetalous, valvate. Stamens four, epipetalous. Pistil-Bicarpellary syncarpous, monolocular, ovary superior, ovule one.

Fruit : Pinkish - red, berry.

Timber : White, soft, not much used in Ceylon. Twigs and roots commonly used as tooth brush - hence the name "Tooth brush tree".

Notes : Salvadora is mainly a sea-coast plant, but has become established in certain areas of the lagoon.

Clerodendron inerme. Gaertn. (Plates—10 & 11)
Verbenaceae.

Sinhalese : Wal-gurenda. **Tamil :** Pinchil or Pinari.

Origin : Ceylon, India, and Burma.

Habit : Bush ; straggler.

Bark : Ashy-brown.

Stem : Woody; somewhat weak.

Leaves : Simple, opposite, decussate, oval, tip retuse, margin entire. Thin, glabrous. Pinnately reticulate venation. Petiolate, petioles reddish brown.

Inflorescence : Terminal cymose clusters.

Flower : Regular, bisexul, complete, bractcate, pentamerous, hypogynous. Calyx five, green, united, valvate, persistent. Corolla five, white, united, imbricate. Stamens five, epipetalous. filaments pink, bent away from the style and stigma. Pistil-Bicarpellary syncarpous, four lobed. Ovary superior.

Fruit: Dry, stony. Four distinct stones.

Note : Clerodendron is mainly a halophyte, but may be seen amongst mangroves also as small bushes, or sprawling on mangroves.

Vitex leucoxylon. L. (Plate-2)

Verbenaceae.

Sinhalese : Ne-bedda. **Tamil :** Nir-nochchi.

Origin : Ceylon and South India.

Habit : Tree 30 - 50 feet. Large tree with a spreading head. Common in dry regions especially near tanks.

Bark : White or ashy white; smooth or slightly cracked.

Stem : Usually straight.

Leaves : Pale, paler lower sides. Opposite decussate exstipulate palmately compound, leaflets three to five, margin of leaflets entire, leaf tip acute. Venation pinnately reticulate. New leaves almost colourless.

Inflorescence : Dichasial cyme.

Flower : White, with purplish hairs at the throat. Zygomorphic, bisexual, complete, hypogynous, bracteate. Calyx five, gamosepalous, valvate, persistent. Corolla five, white with purplish hairs, gamopetalous, two - lipped, with honey guides. Stamens four, free epipetalous. Pistil-Bicarpellary syncarpous, four, chambered. Ovary superior.

Fruit : Small, Rounded or oval.

Timber : Purple - brown or dark - grey; hard, fine grained, durable; for cart frames.

Note : Not a mangrove. Common near tanks and ponds; Indicates water. Few trees at Kudarappu and neighbouring areas.

Vitex negundo L. (Plates—10 & 11)

Verbenaceae:

Sinhalese: Nika **Tamil:** Nochchi

Origin : Ceylon, India, Afghanistan, East Asia, Philippines and China.

Habit : Shrub or small slender trees; Bushy and much branched. Aromatic.

Stem : Bark smooth, ashy white. Woody.

Leaves : Strongly aromatic. Opposite decussate, cxstipulate, palmately trifoliate, tetra or penta-foliate. Margin of leaflets entire and wavy. Leaf tip acute or acuminate. Venation pinnately reticulate Under side of leaves whitish.

Inflorescence : Mixed-Cymes on racemose axises.

Flower : Light blue. Zygomorphic, bisexual, complete, hypogynous, bracteate. Calyx five, green or whitish, gamosepalous, valvate, persistent. Corolla five, light blue, gamopetalous, two-lipped, with honey guides. Stamens four, free epipetalous. Pistil Bicarpellary syncarpous, four chambered, ovary superior.

Fruit : Small black, rounded.

Note : This is not a mangrove but is a plant common in the Low-country wet and dry - zones along stream sides and costal areas. It has become established along the lagoon at many places.

(III) Mud flat vegetation

Boragineae	Heliotropium scabrum. Retz.
Chenopodiaceae	Arthrocnemum indicum. Moq.
	Salicornia brachiata. Roxb.
	Suaeda nudiflora. Moq.
Euphorbiaceae	Agyneia bacciformis. A. Juss.
Rubiaceae	Hydrophylax maritima. L.
Cyperaceae	Fimbristylis ferruginia. Vahl.
	F. littoralis. Gaud.

Heliotropium. Scabrum Retz. (Plate - 9)
Borageineae.

Sinhalese : **Tamil :**

Spreading herb with deep - feeding roots. Stem soft and fleshy. Leaves simple, slender and long, opposite, thick and fleshy ; hairy whitish green in colour; margin entire venation pinnately reticulate; veins very faint. Flowers white in scorpioid cymes.

Arthrocnemum indicum. Moq.
(Syn : Salicornia indica. Willd.)
Chenopodiaceae.

Sinhalese : **Tamil :** Koddanai.

Similar to Salicornia brachiata with these differences :

(i) Arthrocnemum is not erect but somewhat prostrate, with ascending branches.

(ii) Much branched.

(iii) Pairs of prominent, opposite pinkish, ridge like marks are seen on the stem towards the upper end of each internode.

(iv) Green, or pinkish green, or pinkish in colour.

Notes : This plant is absent in the Thondaimannar lagoon area, but is common in the Islands off Jaffna.

Salicornia brachiata Roxb. (Plates 9 & 13)
Chenopodiaceae.

Sinhalese : **Tamil :** Koddanai.

Habit : Erect herb

Stem : Woody at the base. Cladode. Internodes swollen. Branches few slender and succulent. Green or yellow in colour. Each internode ends in a narrow cup lika which embraces the base of the one above.

Roots : Deep feeding and far spreading.

Leaves : Minute scales, shed early so that the succulent jointed stems are apparently leafless.

Inflorescence : Spike.

Flowers : Bisexual, 3-4 perianth lobes. One, rarely two stamens.

Fruit : Nut; Embryo curved.

Notes : Salicornia brachiata usually grows on mud flats. It often forms closed colonies (mono-specific). It is often confused with Arthrocnemum indicaum from which it could be easily differentiated from its erect nature, fewer branches, and green, light green or yellow colour.

Suaeda nudiflora. Moq.
Chenopodiaceae.

Sinhalese : **Tamil :** Umiri

Habit : Prostrate herb. Amongst support may grow to a height of from 4-5 feet.

Stem : Weak, usually prostrate, woody at base. Branches numerous, erect or prostrate.

Roots : Deep feeding and far spreading.

Leaves : Many, small, simple, oblong, more or less fleshy, flat, becoming cylindrical when fully grown. The leaves are shed early. Colour; light green, green, yellow, and various shades of orange and pink.

Inflorescence : Spike.

Flowers : Bisexual, hypogynous. Perianth lobes green.

Fruit ; Nut. The embryo is rolled up spirally and almost completely fills the seed. Plants become uprooted, or shoots get broken off, bearing mature fruits, and roll in the wind and are dispersed thus.

Notes : This is somewhat common at Thondaimannar and Vallai, but rare elsewhere.

Agyneia bacciformis : A. Juss. (Plate - 9)
Euphorbiaceae.

Sinhalese : Etpitawakka. **Tamil** :

Similar to Phyllanthus niruri, but leaves are larger. Stem is usually reddish in colour. On open ground usually prostrate, but amongst other plants the stem may be ascending-becoming erect aided by the support of the neighbouring plants. Leaves thick and fleshy. Flowers are reddish yellow in colour.

Hydrophylax Maritima : L.
Rubiaceae.

Sinhalese : Mudu-getakola. **Tamil** :

Habit : Trailing, prostrate herb, rooting at nodes. Branches cylindrical, succulent, glabrous, green or pink in colour. Roots-deep feeding.

Leaves : In pairs at nodes, opposite, sessile, simple, small, thick and fleshy, oval, flat, become cylindrical on maturity. Green or pink in colour. Stipulate, with stipules covering up the nodes (sheathing).

Flowers : Bisexual, tetramerous, epigynous. Sessile, solitary, axillary bluish - purple in colour, Corolla funnel shaped, with four lobes. Stamens four. Ovary bicarpellary, bilocular. Stigmas two.

Fimbristylis Ferruginia : Vahl. (Plate - 9)
Cyperaceae.

Sinhalese: **Tamil :**

Origin : Eastern Tropics.

Habit : Small grass 4-5 inches to 1-2 feet in height. Seen in tufts, forming clones.

Stem : Reduced, rhizomious.

Roots : Fibrous, in tufts from the bases of the stems.

Leaves : Slender, needle like.

Inflorescence : Spike of spikelets.
Usually three heads in one group, each unit unbranched.

Flowers : Bisexual, stamens three. Carpels three, syncarpous, superior Style filamentous, stigmas feathery, ovary monolocular. Ovule one. Placentation basal.

Fruit : Nut.

imbristylis littoralis Gaud. (Plate - 9)
Cyperaceae.

Sinhalese : **Tamil :**

Origin : Eastern Tropics.

Habit : Small grass, $1\frac{1}{2} - 2\frac{1}{2}$ inches in height. Seen in tufts, forming clones.

Stem : Reduced, rhizomious.

Roots : Fibrous, in tufts from the bases of the stems.

Leaves : Small, slender, needle like, soft.

Inflorescence : Spike like inflorescence of spikelets. Usually one head at the end of a stalk.

Flowers : Bisexual. Stamens three. Carpels three, syncarpous, superior. Style filamentous, stigmas Feathery. Ovary one—locular. Ovule one, placentation basal.

Fruit : Nut.

(IV) Climbers and Parasites

Asclepidaceae	Pentatropis microphylla. **W. & A.**
Convolvulaceae	Cuscuta reflexa. Roxb.
Leguminosae	
Papilionaceae	Derris uliginosa. Benth.
Loranthaceae	Loranthus falcatus. Linn.
	L. Cuneatus. Heyne.
	Viscum orientale. Willd
Olacineae	Olax scandens. Roxb,

Pentatropis microphylla W & A (Plate 12)

(Syn : Cynanchum acuminatum. Thunb)

Asclepidaceae.

Sinhalese : **Tamil :**

Habit : Climber (Twiner)

Stem : Slender, Weak.

Leaves : Small, simple, oval, opposite, decussate, thick, fleshy, glabrous, Pinnately reticulate venation, veins faint. Young leaves stems. and buds reddish.

Inflorescence : Simple umbels, axillary.

Flowers : Minute, reddish, bisexual, regular, hypogynous, and complete. Sepals five; Petals five, Stamens five; Carpels two, free.

Fruit : Two follicles from each flower Seeds with an apical tuft of hair (Plumed). Fruits small, smooth, narrowing gradually to a point.

Note : This is a common climber seen on mangroves in the Thondaimannar lagoon.

Custuta reflexa : Roxb

Convolvulaceae.

Sinhalese : **Tamil :**

Origin : Ceylon, India and Malaya.

Habit : Total parasite.

Stem : Long, stout, glabrous, pale yellow.

Leaves : Absent.

Inflorescence : Cymose.

Flowers : White, usually in bunches of two to four. Regular bisexual hypogynous, complete. Calyx 5, free, imbricate. Corolla 5, united. Stamens 5, epipetalous. Pistil-Ovary superior, bicarpellary, bilocular, syncarpous, axile placentation.

Fruit : A capsule.

Derris uliginosa Benth. (Plate - 12)
Leguminosae—Papilionaceae

S nhalese : Kala-wel. **Tamil:** Teki.

Origin : Eastern Tropics

Habit : Woody-climber.

Bark : Brown

Stem : Woody, weak, lenticels on stem dense and prominent.

Roots : Stilt roots at base of stem may be seen.

Leaves : Alternate, pinnately or trifoliately compound. Tip acute. Margin entire. Venation pinnately reticulate. Leaf-lets 3 to 5 or more.

Inflorescence : Racemose, simple or compound racemes. Terminal or Axillary.

Flowers : Irregular, bisexual, hypogynous, complete, light pink. Calyx 5, gamosepalous, valvate, green. Corolla 5, one standard, two wings, two keels, keel petals united along the ventral margin. Stamens ten, one bundle. Pistil - monocarpellary, monolocular, with marginal placentation. Ovary superior.

Fruit : Flat, oval, one seeded dispersed by water.

Notes : Common woody climber on mangrove plants of the lagoon. Has mangrove affinities.

Loranthus longiflorous Desrouss (Plate 13)
(Syn : L. falcatus. Linn)
Loranthaceae

Sinhalese: Pillia **Tamil:** Kuruvichchai

Habit: Partial stem parasite,

Bark : Brown

Stem : Woody, branched.

Roots : Special sucking roots or haustoria present.

Leaves : Opposite, decussate, somewhat oblong. thick, fleshy, glabrous, simple, large, exstipulate. Veins faint, venation pinnately reticulate. Margin entire. Young leaves pale green. Old leaves orange, red, brown, or a mixture of these shades.

Inflorescence : Axlllary, cymose, clusters.

Flowers : Greenish yellow in colour. Bisexual, epigynous, pentamerous, complete, regular, calyx 5, united, valvate. Corolla 5, united, valvate upper portions of corolla tube orange-yellow, corolla tips greenish-yellow. Stamens 5, epipetalous, filaments yellow. Ovary inferior. Style long, green. Fruit a one seeded berry, with juicy sticky pulp. Fruits edible. Seeds dispersed by birds.

Notes : This is a common stem parasite seen on the mangroves.

Loranthus cuneatus Heyne. (Plate - 13)

Loranthaceae.

Sinhalese : Pilila **Tamil :** Kuruvichchai

Origin : Ceylon and South India

Habit : Partial stem parasite.

Bark : Ashy brown

Stem : Woody, slender, branched, branches few.

Roots : Special sucking roots, or haustoria present,

Leaves : Alternate, simple, exstipulate, obovate, thick, fleshy, glabrous. Veins faint. - pinnately reticulate. Margin entire. Tip rounded. Pale green in colour.

Flowers : Axillary, few—one, two or three only in one group. Greenish orange. Bisexual, epigynous, short pedicelled, pentamerous, complete, regular. Calyx 5, gamosepalous valvate. Petals 5, gamopetalous, valvate. Stamens 5, epipetalous, filaments red. Pistil-Ovary inferior ; style long, red; stigma rounded. Fruit a one - seeded berry, with juicy sticky pulp. Fruits edible, seeds dispersed by birds.

Notes : This is a semi - stem parasite seen rarely on mangroves.

Viscum orientale. Willd.
Loranthaceae

Sinhalese : **Tamil :**

Similar to loranthus with these differences. Stem is profusely branched, the branching sometimes resembling the dichotomous type (false dichotomy) Stem green, leaves are oval and dark green in colour. Venation palmately reticulate. Veins very faint. Flowers green. Long corolla tube absent.

Olax scandens. Roxb. (Plate 12)
Olacineae

Sinhalese : **Tamil :** Kadalranhi

Habit : Large shrub or a woody straggler.

Bark : Ashy brown.

Stem : Much branched, some of the main branches thrown out to form long shoots.

Leaves : Opposite, decussate, margin very faintly serrate, tip acute, venation pinnately reticulate.

Inflorescence : Cymose—simple cymes. Axillary.

Flowers : Regular, bisexual, hypogynous, complete, greenish yellow. Calyx 5, gamosepalous, valvate, green, persistent, corolla 5, free, twisted. Stamens 3, free. Pistil tricarpellary syncarpous, ovary superior.

Fruit : Red, berry, edible - very sweet. One seeded.

Timber : Small, not much of any value.

Notes : Has become a mangrove associate in certain areas of the lagoon especially at Kudarappu, Sempianpattu and neighbouring areas. Common in some areas as a woodland flora.

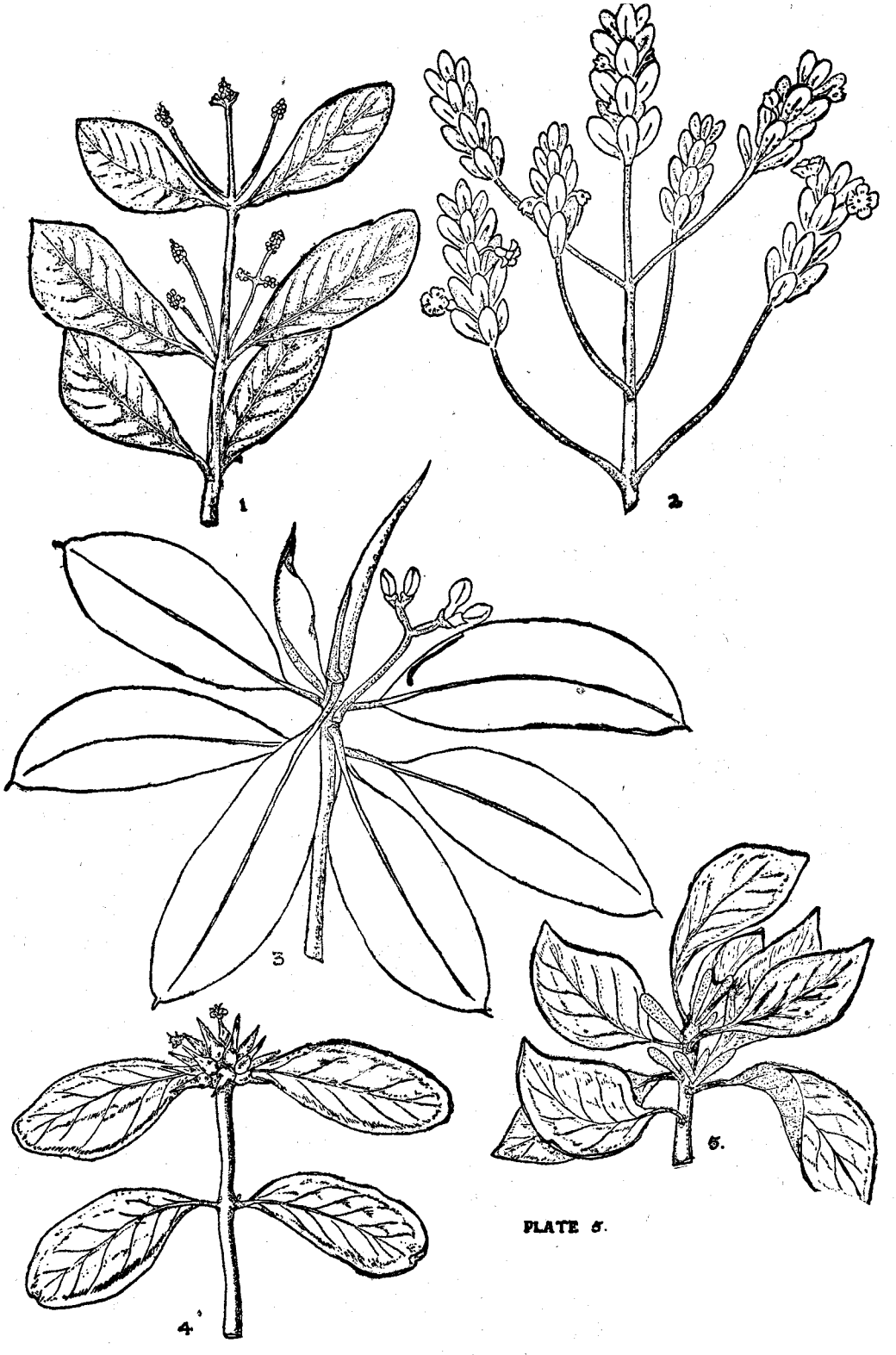


Plate 5 : Habit Sketches - Twigs

1. Avicennia officinalis.
2. Scyphiphora hydrophylacea.
3. Rhizophora mucronata.
4. Ceriops tagal
5. Excaecaria agallocha

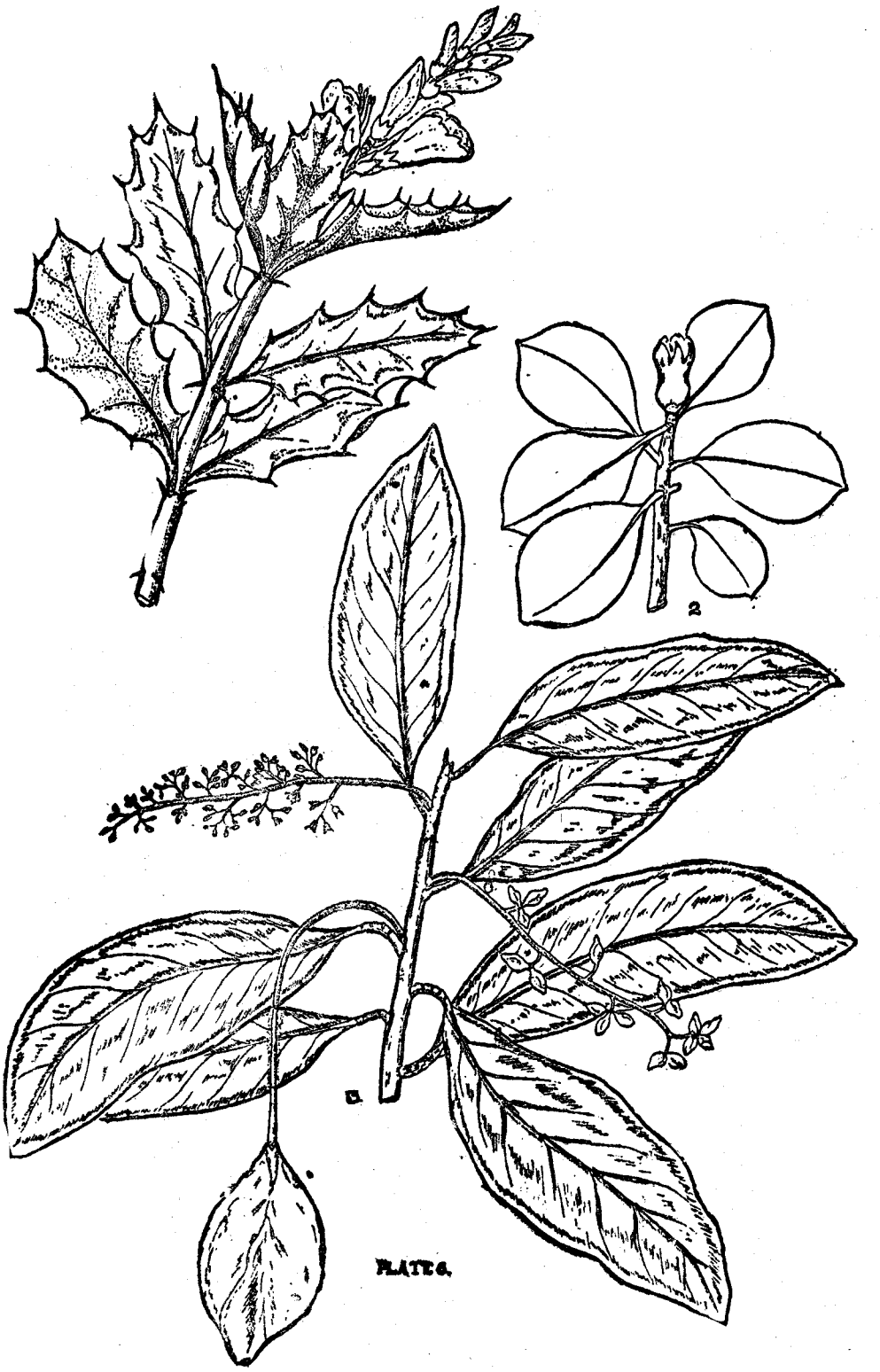


Plate 6 : Habit Sketches - Twigs.

1. **Acanthus ilicifolius**
2. **Sonneratia acida.**
3. **Heritiera littoralis.**

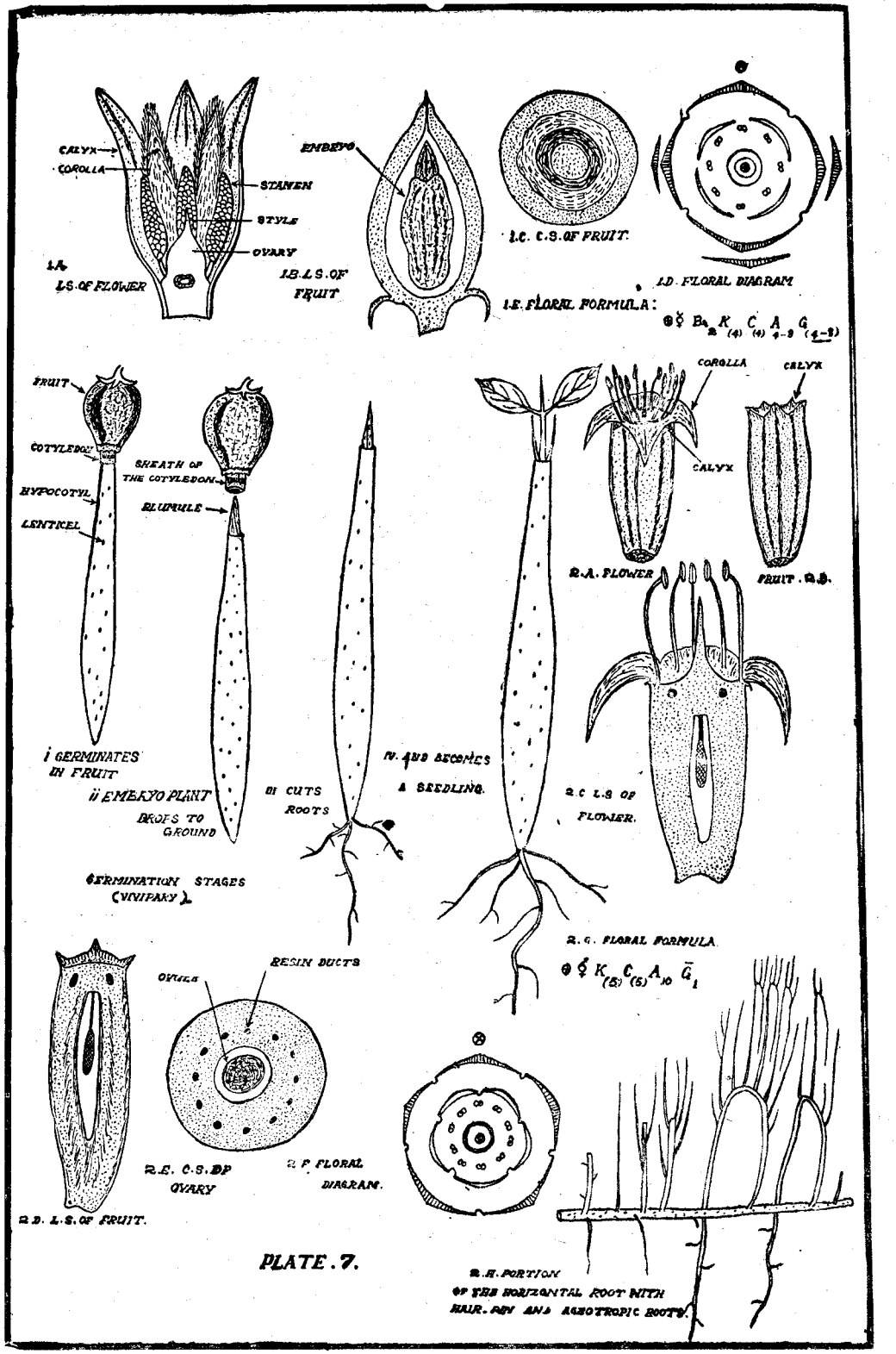


Plate 7 :

1. A-F—Rhizophora mucronata
2. A-H—Lumnitzera racemosa

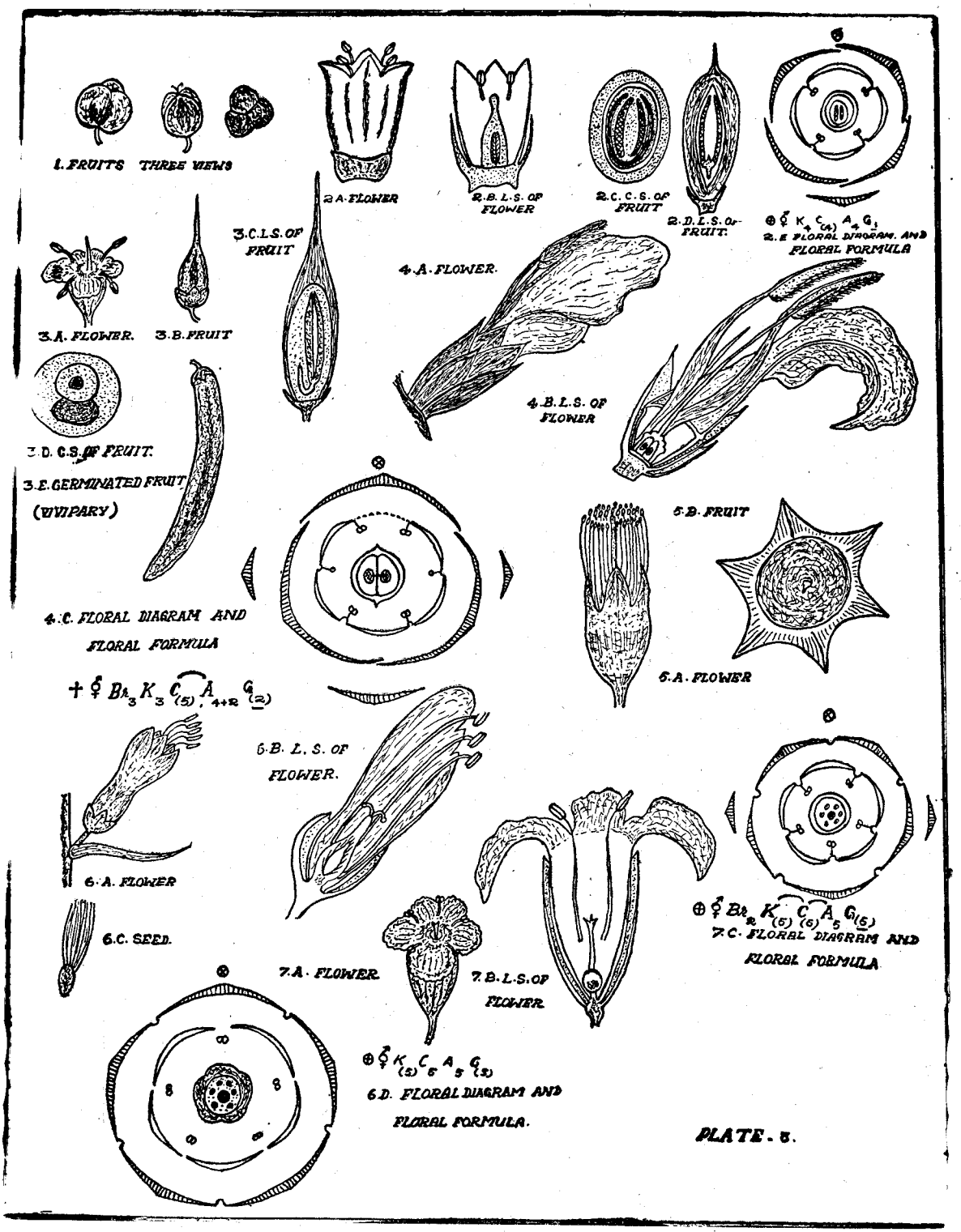


Plate: 8

1. Excaecaria agallocha
2. A—E. Avicennia officinalis
3. A—E. Ceriops tagal
4. A—C. Acanthus ilicifolious
5. A—B. Sonneratia acida
6. A—D. Tamarix gallica
7. A—C. Scyphiphora hydrophylacea.

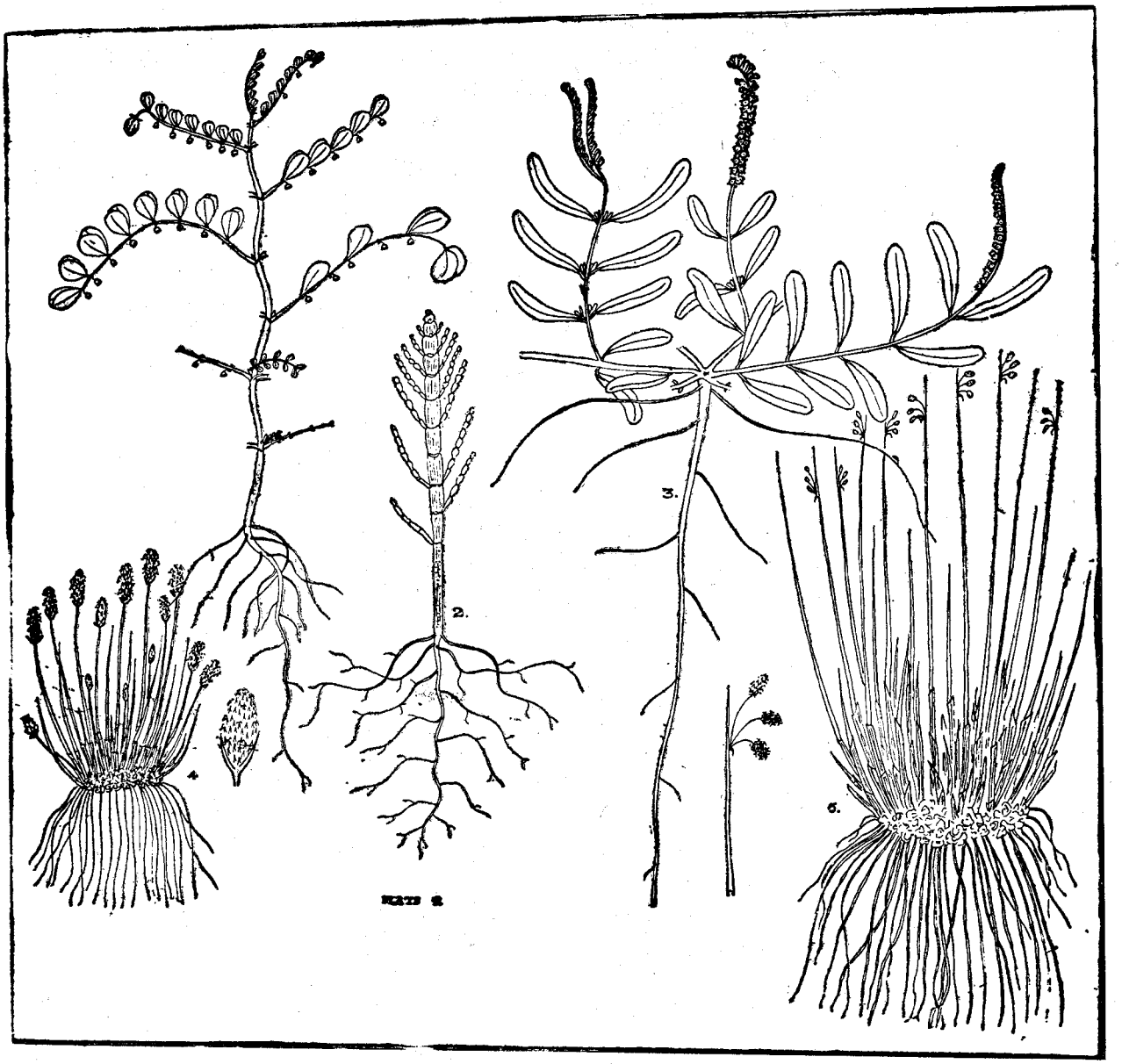


Plate 9 : Habit Sketches

1. Agynaea baccifo·mis
2. Salicornia brachiata
3. Heliotropium scabrum
4. Fimbristylis littoralis
5. F. ferruginia

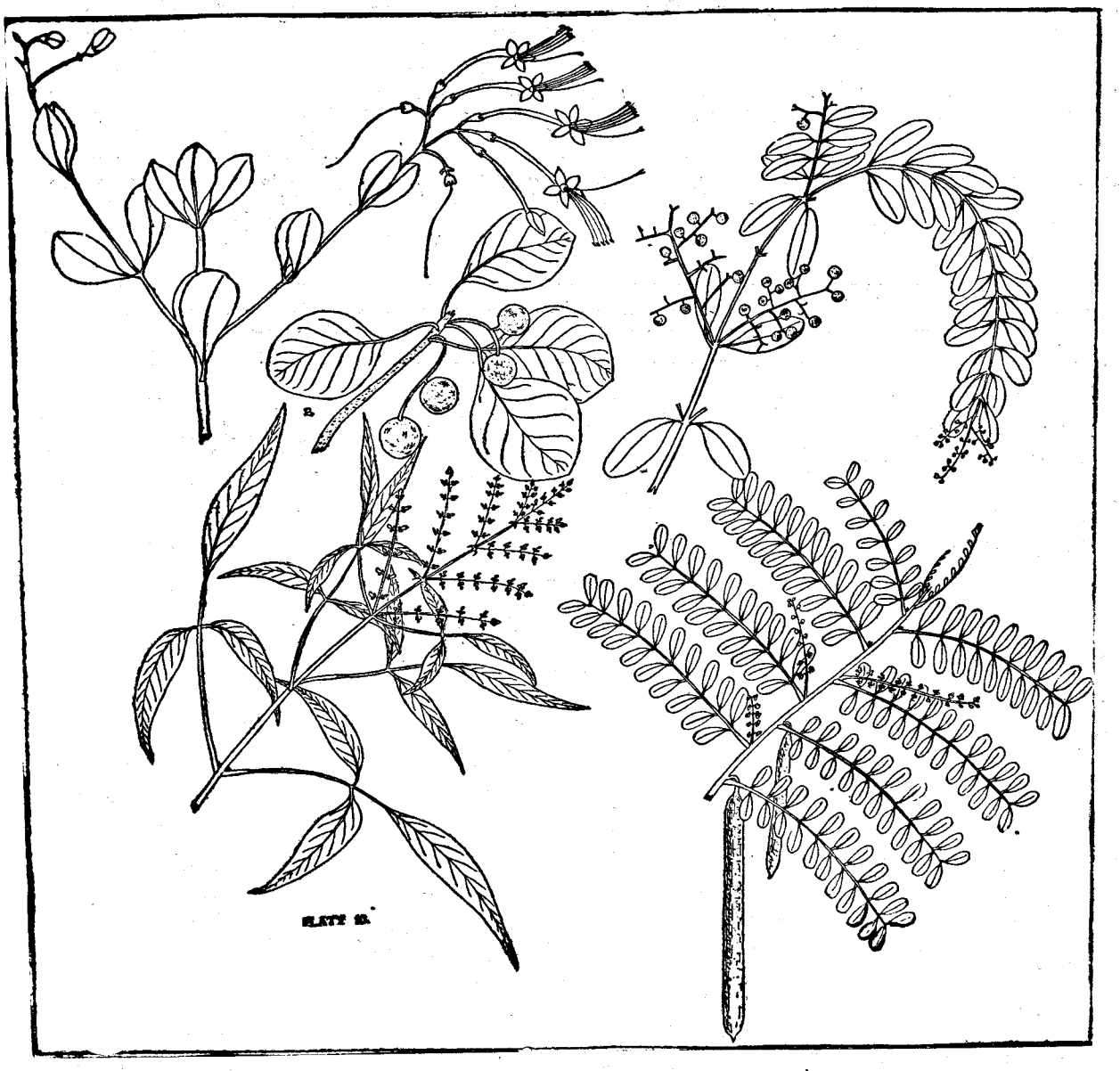


Plate 10 : Habit sketches – Twigs.

1. Clerodendron inerme
2. Terminalia bellerica
3. Salvadora persica
4. Vitex negundo.
5. Cassia marginat

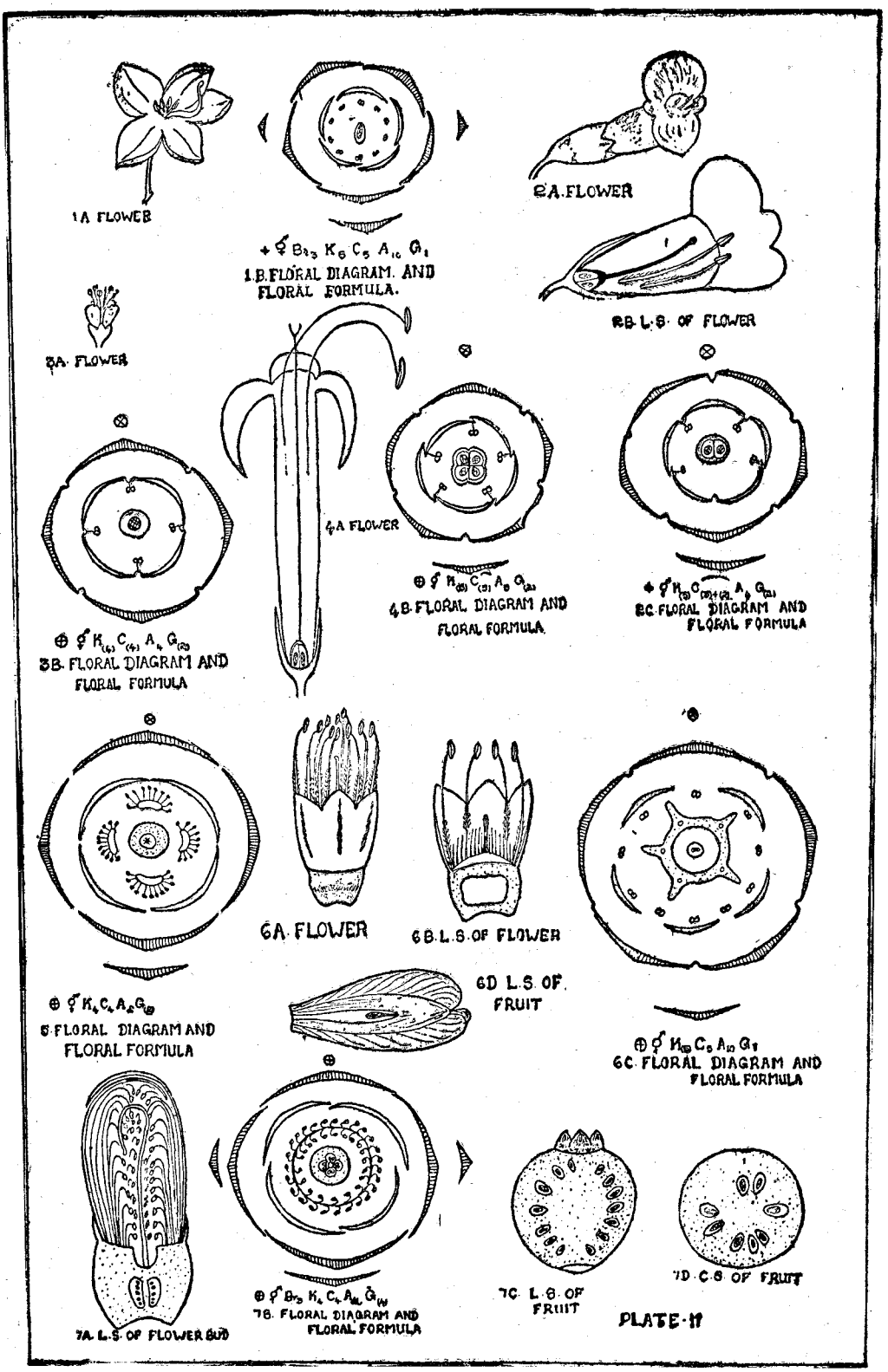


Plate 11

1. A—B. Cassia marginata
2. A—C. Vitex negundo
3. A—B. Salvadora persica
4. A—B. Clerodendron inerme
5. Calophyllum inophyllum
6. A—D. Terminalia glabra
7. A—D. Carreya coccinia

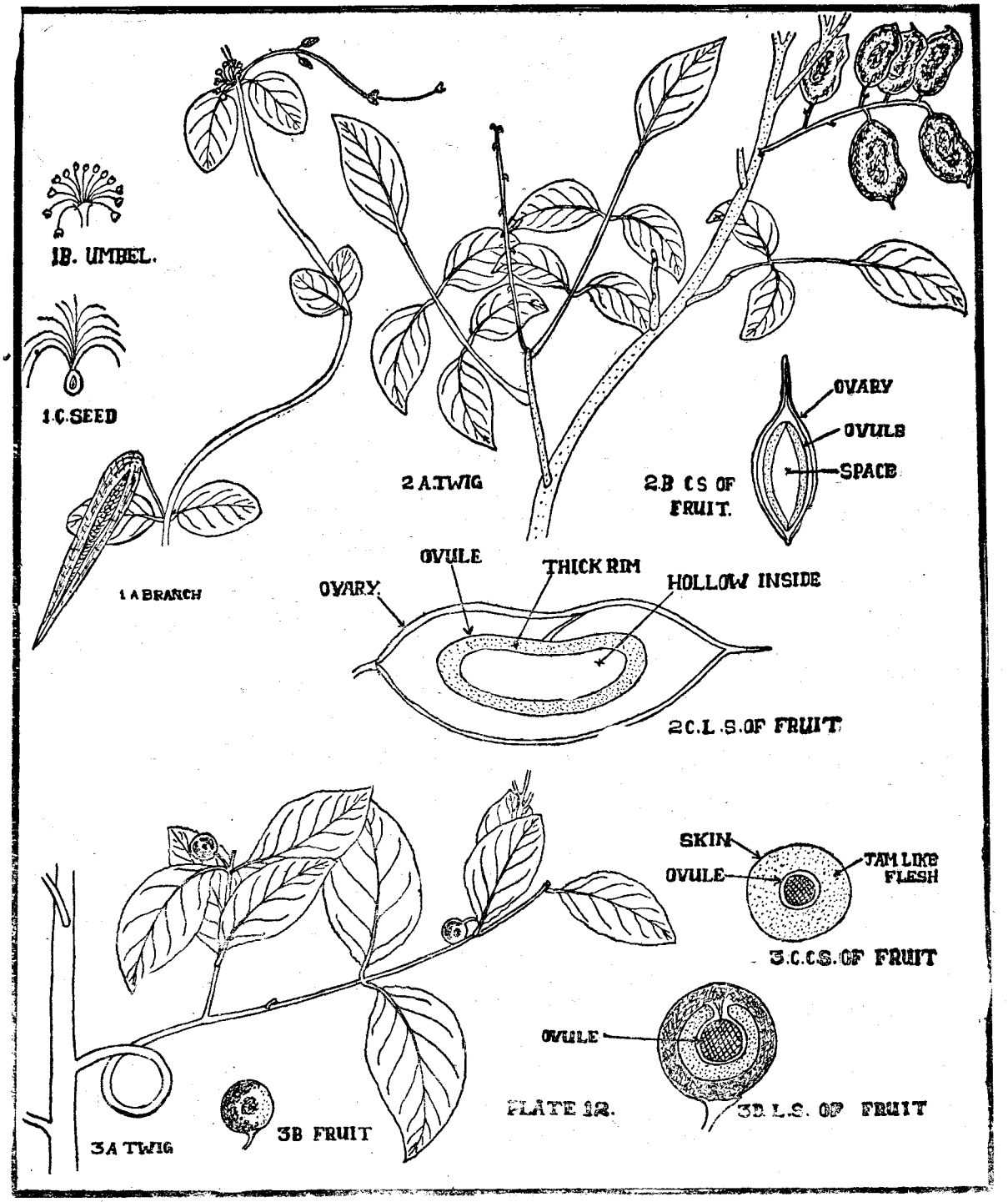


Plate 12

1. A—C. Pentatropis microphylla
2. A—C. Derris uliginosa
3. A—D. Olax scandens

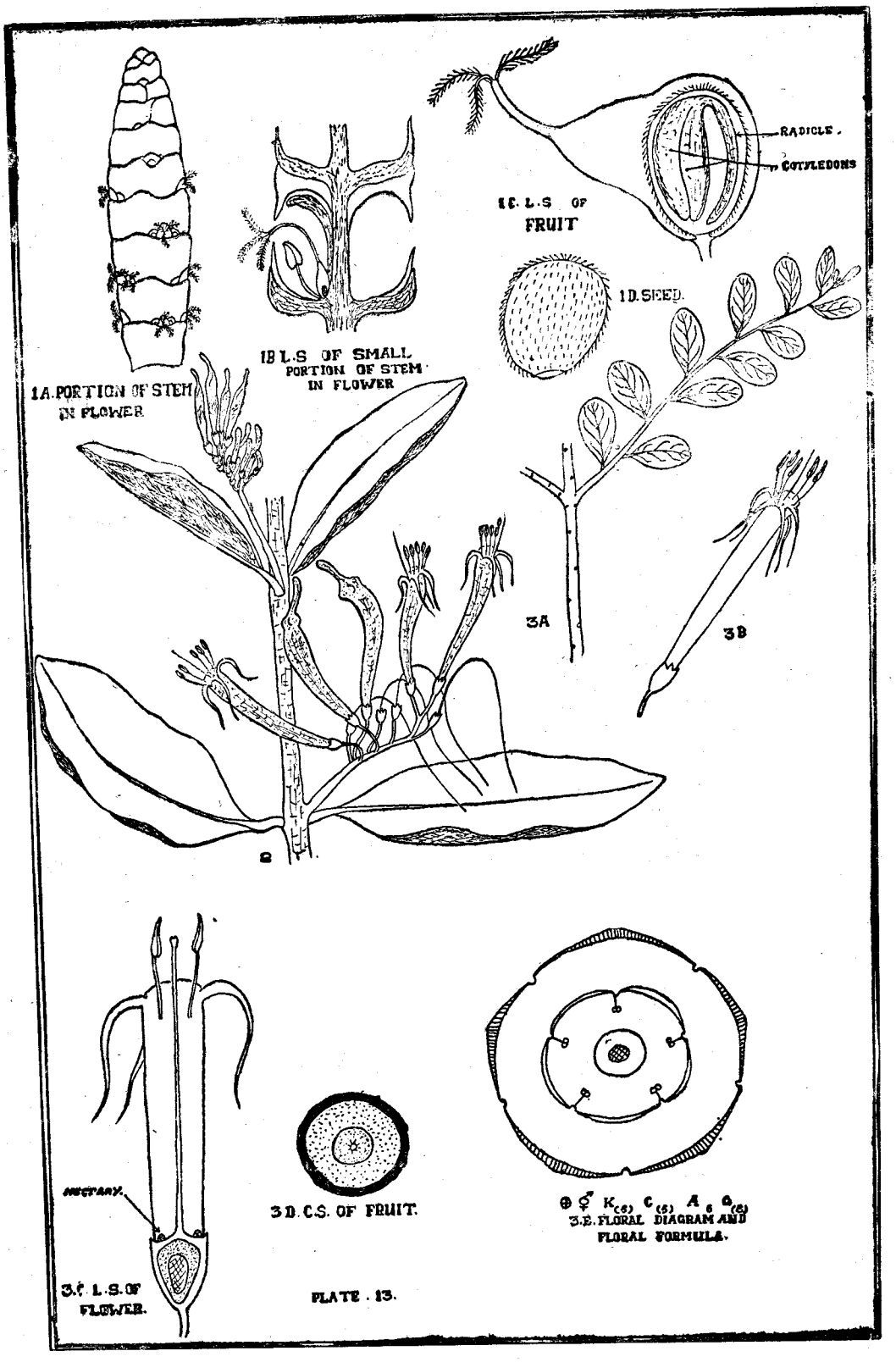


Plate 13

1. A – D. Salicornia brachiata
2. Loranthus falcatus
3. A. Loranthus cuneatus
3. B—E. Loranthus falcatus

SECTION IV

(I) APPENDICES

APPENDIX I

A. MANGROVE VEGETATION - KEY.

B. MUD FLAT VEGETATION - KEY.

APPENDIX II

SOIL ANALYSIS DATA.

APPENTIX III

WATER ANALYSIS DATA.

(II) BIBILIOGRAPHY.

Appendix I. A.

Key to the genera of some common mangrove plants and their associates

	Leaves pinnate.	a.
	Leaves entire	f.
a	Climber	b.
	Shrub	c.
b	Leaf paripinnate, $1\frac{1}{4}$—$1\frac{1}{2}$″ long - Dalbergia candenatensis	
	Leaf imparipinnate, $1\frac{1}{2}$—3″ - Derris uliginosa	
c	Leaf bipinnate, ... Acacia farnesiana.	
	Leaf once pinnate	d.
d	Leaf imparipinnate, 7 or 8 leaflets—Dolichandrone rheedii	
	Leaf paripinnate, 1 or 2 pairs of leaflets	e.
e	Leaf $2\frac{1}{2}$″—4″ ... .. Carapa granata.	
	Leaf $4\frac{1}{2}$″—6″ ... ... Cynometra ramiflora.	
f	Leaf very small, scale like—Tamarix gallica.	
	Leaf not as abve	g.
g	Herb or undershrub	h.
	Tree or large shrub	k.
h	Leaf spiny, rigid—Acanthus ilicifolius	
	Leaf not as above	i.
i	Leaves decurrent—Sphaeranthus indicus.	
	Leaves not decurrent	j.
j	Leaf $\frac{1}{4}$″ ... ... Dyschoriste madurensis.	
	Leaf 1″—$1\frac{1}{2}$″ Sesuvium portulacastrum.	
k	Plants have erect breathing roots in mud or prop roots	l.
	Plants not as above	p.
l	Knee like breathing roots present, emerging from the mud-Bruguiera	
	Knee like breathing roots absent	m.
m	Plants with erect tapering pneumatophores emerging from the mud ...	n
	Erect pnenmatophores absent	o.

n Leaves fleshy, green on both sides—Sonneratia
Leaves not very fleshy, bright green above, silvery white beneath—Avicennia.

o Leaves mucronate ... ... Rhizophora,
Leaf apex rounded or retuse .. Ceriops.
Leaves opposite ... ... q.

p Leaves alternate ... ... s.
Leaves with interpetiolar stipules—Scyphiphora.

q Leaves exstipulate ... ... r.
Leaf large, 4″—6″, lateral veins numerous, close and parrellel—Calophyllum inophyllum.

r Leaf small, 1″—1½″, veins not as above—Clerodendron inerme.
Plants with latex ... ... t.

s Plants with no latex ... ... u.

t Leaf 2½″—3½″, lateral veins inconspicuous—Excaecaria agallocha.
Leaf 5″—10″, lateral veins numerous, distinct ... Cerbera manghas.

u Leaf under 5″ long ... ... v, v_1
Leaf over 5″ long ... ... w.

v Leaf sessile, fleshy, shining—Lumnitzera
Leaf with short petiole, pale green, glaucous beneath ... Aegiceras.

w Leaf glabrous above, covered with silvery scales beneath ... Heritiera littoralis
Leaf not as above ... ... x.

x Leaf shortly acuminate, petiole curved—Samadera indica.
Leaf not as above—Terminalia catappa.
Leaf 1″—2″, small hairs on leaves. Opposite decussate... y.

v_1 Leaves leniar, very long, spines along margin and along ventral side of mid rib ... ... z

y Flowers small, white, axillary, plant resembles Lumnitzera to some extent.....Scyphiphora.

z Leaves form a crown; Multiple fruit, green when young, red when ripe; still roots present..... Pandanus

After Prof. B. A. Abeyawickrema.

Appendix I B.

Key to the mud - flat Vegetation of the Lagoon.

	Leaves simple, entire	A
	Leaves simple, serrate or dentate	B
	Leaves reduced or absent	C
	Leaves slender, Cylindrical	D
A	Oval or rounded, flat or cylindrical, fleshy glabrous	E
	Oval or round, flat, thin or some what fleshy, glabrous	F
	Oval or rounded, flat, small, thin or fleshy ...	G
	Leniar, sessile thin	O
B	Oval, somewhat elongated, slightly fleshy, opposite ...	H
	Fleshy or thin, Hairy or glabrous, Sessile, Alternate...	I
	Thick, hairy, dentate contains latex	J
	Leaves large, somewhat Cordate. toothed, petiolate, alternate, thin	K
	Oval, fleshy, glabrous, pale green, opposite ...	L
	Serrate, slightly fleshy, small, opposite, glabrous ...	M
	Somewhat long, thin or slightly fleshy, pinnatifid ...	N
C	Stem a cladode, erect, few branches, green or greenish yellow Salicornia brachiata.	
	Stem a cladode, prostrate profusely branched, green or pink in colour - Arthrocnemum indicum	
D	1″—1¼″ long, Runner, solitary pink flowers, Fruit a many seeded cupsule (Tap root often tuberous) Sesuvium portulacastrum.	
	1½″—2½″ long, needlelike; Reduced rhizomious, stem tufts of flbrous roots, Flowering head one (spike) at the end of each stalk-Fimbristylis littoralis	
	4″—5″ to 1′—2′ in length, needlelike; Reduced rhizomious stem; Tufts of fibrous roots; Flowering heads (Spikes) usually three at the end of each stalk— Fimbristylis ferruginea.	

E Erect or prostrate herb or small shrub, may reach 4′—5′ amongst support; yellow, orange, red or pink; flowers terminal, racemose.....Suaeda nudiflora

Runner; green or reddish pink; leaves opposite; flowers solitary, axillary; small, sheathing stipule present-Hydrophylax martima

F Erect or prostrate, herb; leaves; alternate on horizontal branches that resemble compound leaves; flowers solitary axillary, yellow; Fruit a tricarpellary trilocular capsule. Plant green or sometimes reddish in colour=Agyneia bacciformis

G Green above, pink below; latex present; Cyathium inflorescence; Stem pink, prostrate—Euphorbia thymifolia.

Small, erect much branched herb; Ashy white ; Funnel like small flowers—Cressa cretica.

Small, erect few branches, herbaceous, green and reddish brown in colour.....Ammannia.

O ½′—1½″ long; stem rhizomeous underground or runner; Inflorescence branched spike - Cynodon dactylon.

½″—2½″ long, thin silicious spine on tip; stem underground-corm, stolons present, Inflorescence short branched spike...Cyperus stoloniferous.

½″—1″ thick, fleshy; Inflorescenc very short branched spike... Cyperus iria.

H Small, erect herb; white flowers in axillary clusters (Verticillaster) Enecostema verticillare.

I Capitulum inflorescence, disc florets alone, various shades of violet. pink or yellow-Blumea.

J Prostrate herb, green; Cyathium inflorescence .. Euphorbia hirta.

K Funnel like, mauve flowers (exhibiting pit-fall mechanism for pollination); basket like septicidal (exhibiting censer mechanism for dispersal of seeds) ..
—Aristolochia brachiata

L White flowers on scorpioid inflorescences; Prostrate herb... Heliotropium.

M Pink flowers on (head like) condensed racemose inflorescences Prostrate, herbaceous, green or slightly pink... Lippia nodiflora.

N Runner; tap root tuberous, flowers yellow, head inflorescence; plumed fruits . Launaea sarmentosa.

Appendix II.

Soil Analysis Data.

Refer Bulletin 4 : Five year report.

Appendix III.

Water Analysis Data.

Refer Bulletin 4 : Five year report.

Bibiliography

1. Worthington. T. B, –Ceylon Trees.
2. Rendle, Alfred Barton –The Classification of flowering plant
3. Gunawardena, D. C. –The Flowering Plants of Ceylon.
4. Senaratna. S. D. J. E. –The Grasses of Ceylon.
5. Pulimood. S. G. and Joshua. A. K. –A Text Book of Botany,
6. Lowson. J. M. & Sahni. B. –Text Book of Botany.
7. Dutta. A. C. –A Class Book of Botany.
8. Macmillan. H. F. –Tropical Planting and Gardening.
9. Fernando, Dorothy –Wild Flowers of Ceylon.
10. Bond. E. T., Thomas –Wild Flowers of the Ceylon Hills.
11. Stork. J. E. & Renouf. L. P. W. –Plant and Animal Ecology.
12. Weaver. J. E. & Clement F. E. –Plant Ecology.
13. Mc Lean. R. C. & Ivimey Cook. W. R.–Practical Field Ecology.
14. Core. E. L. –Plant Taxonomy.
15. Trimen. H. –Hand Book of the Flora of Ceylon (Parts I to V & Plates)
16. Lewis. F. –A Descriptive Catalogue of the more Useful Tress and Flowering plants of the Western and Sabragamuwa Provinces of Ceylon.
17. Parsons. T. H. — An Alphabetical list of Plants in the Royal Botanic Gardens, Peradeniya.
18. Alston. A. H. G. — The Kandy Flora.
19. Willis J. C. — Flowering Plants and Ferns of Ceylon.

Members of the Hydro.—Biological Survey Research Council

1. M Atputhanathan, Convener & Project officer, Station I.
2. K. S. Kugathasan, Project Officer, Station III.
3. K. Selvavinayagam, Project officer, Station II.
4. K. Ponnampalam
5. K. Chitravadivelu, Project Officer, Station I.
6. P. Ganesamoorthy, Project Assistant.
7. S. Roy Kantharaj, ,, ,,
8. R. Ponnampalam ,, ,,
9. T. Puthrasingam ,, ,,
10. V. Rajanayagam ,, ,,
11. P. Sabaratnam ,, ,,
12. K. Shanmugasunderam ,, ,,
13. K. Sivapathasunderam, Project Officer, Station IV
14. N. Sundaramoorthy, Project Assistant.
15. S. Sathiamoorthy ,, ,,
16. P. Satchithanandan ,, ,,
17. P. Manoharan ,, ,,
18. V. Ponnampalam, Secretary–cum–Treasurer, Research Council.
19. S. Sellathurai, Project Assistant.
20. K. Gunaratnam ,, ,,
21. A. Jeganathan ,, ,,

Participating Schools

1. American Mission College, Uduppiddy.
2. Chithambara College, Valvettithurai.
3. Gnanasaria College, Karaveddy.
4. Hartley College, Point-Pedro.
5. Holy Family Convent, Jaffna.
6. Jaffna Central College, Jaffna.
7. Nelliady M. M. V., Karaveddy.
8. Puloly Boys' English School, Point-Pedro.
9. Uduppiddy Girls' High School, Uduppiddy
10. Urumpirai Hindu College, Urumpirai.
11. Vada-Hindu Girls' College, Point-Pedro.
12. Vaideswara Vidyalayam, Jaffna.
13. Vigneshwara College, Karaveddy.
14. Methodist Girls' High School, Point-Pedro.
15. Thondaimannar M. V., Thondaimannar.
16. Mahajana College, Tellipallai.

BULLETINES OF THE

HYDRO-BIOLOGICAL RESEARCH COUNCIL

(THONDAIMANNAR LAGOON)

OF THE NORTHERN PROVINCE

SCIENCE TEACHERS' ASSOCIATION

1. THE IMPACT OF THE RESEARCH PROGRAMME ON SCIENCE EDUCATION
2. FIELD WORK GUIDE
3. BIRDS OF THE LAGOON
4. 5 YEAR REPORT (1963 through 1967)
5. PRAWNS OF THE LAGOON
6. STUDY OF TWO WORMS
7. MANGROVES OF THE LAGOON
8. CARBON-DIOXIDE & OXYGEN GRADIENT OF THE LAGOON WATER
9. FISHES OF THE LAGOON
10. HYDROLOGICAL PARAMETERS OF THE LAGOON AREA
11. PLANTS OF THE LAGOON AREA
12. STUDENTS' PROJECTS

CENTRAL OFFICE
OF THE RESEARCH COUNCIL

NELLIADY M. M. VIDYALAYAM
KARAVEDDY P. O.
CEYLON.

PRINTED AT THE ASIRVATHAM PRESS, JAFFNA.