

## TAXONOMY AND DISTRIBUTION OF TERRESTRIAL TREES AND SHRUBS IN THE MANGROVE FORMATIONS IN THAILAND

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### INTRODUCTION

Artificial keys to 53 genera and 74 species belonging to 35 families of trees and shrubs in the mangrove formations of Thailand are given in this paper. Table 1 contains a list of species. The keys are of a provisional nature but, for the first time, they include all the terrestrial trees and shrubs so far recorded from the mangrove formations. Field characters as well as taxonomic characters have been included in the keys. Suggestions and amendments are welcomed. Among the 74 species are included plants that occur inland at the limit of salinity influence, that is, at the transition between mangrove forest and beach vegetation, fresh water swamp forest or peat water swamp forest (Table 2). The botany of the main families in the mangrove forests in tropical Asia has been clearly described by various authors (WATSON 1928, CHAI 1975, PERCIVAL & WOMERSLEY 1975, SANTISUK 1976 and SMITINAND 1976 a, b). In the present study, all arborescent and shrubby species of both the "swampy mangrove" or "true mangrove" and the "back mangrove" or "tidal mangrove" are taken into consideration.

### DEFINITION OF MANGROVE AND RELATED SUBTYPES

At present it is rather difficult to understand what different authors mean by the term "mangrove". In general, "mangrove" can be defined as a complex of plant communities fringing the sheltered tropical shores. A mangrove community is composed of species belonging to several unrelated families but possessing similar physiological characteristics and structural adaptations with similar habitat preferences. Such a community usually has a border of trees which are normally species of *Rhizophora* associated with other tree and shrub species growing zonally under the tidal influence both on sheltered coastlines and estuaries of rivers.

Mangrove forest is variously referred to as "mangal" (MACNAE, 1968), "mangrove" (BLASCO, 1975; ROLLET, 1976), "mangrove swamp" (PERCIVAL & WOMERSLEY, 1975; CHAPMAN 1976), "mangrove forest" (WATSON, 1928; CHAI, 1975; SMITINAND, 1976; SUKWONG et al, 1976), "tidal forest" (SCHIMPER, 1903; CHENGAPA, 1944) or "tidal

\* The Forest Herbarium, Royal Forest Department, Bangkok 10900, Thailand.

Terminology  
Logg



swamp forest" (CHAMPION & SETH, 1968). However, true mangroves may form only a part of the whole tidal zone; they may occur from far below the level of the lowest to above the level of the highest tides, or on coasts where there are no tides at all (DAVIS, 1940). Paradoxically, the term "mangrove forest" does not necessarily imply a forest cover. It can be any sort of formation, arborescent, shrubby, herbaceous or even entirely denuded, as on saline coastal surfaces (BLASCO, 1975).

The mangrove formation can be subdivided into various types. QURESHI (1959), for example, recognized two sub-divisions: swampy mangrove and tidal mangrove. "Swampy mangrove" is situated below the level of high tides and covered by sea water twice or once a day whilst "tidal mangrove" is submerged only by the spring tides and during cyclones, or by exceptional tides. These two terms correspond respectively to "mangroves" and "back mangroves" which are defined by AUBREVILLE (1970) as follows:

The "mangroves" are coastal tropical formations found along the border of the sea and lagoons reaching up to the edges of the rivers to the point where the water is saline, growing in swampy soils and covered by the sea during high tide.

The "back mangroves" are reached by the sea water only at very high tides.

Hence, the terms "swampy mangrove" or "true mangrove" and "back mangrove" or "tidal mangrove" are recognized in the present study.

### SPECIES ZONATION

In the mangrove formation different species occupy different areas or zones which are more or less delimited from each other. This zonation is determined by the interaction of several environmental factors, such as tidal flooding, soil type and salinity of the soil. The zonation will vary in different areas and no two areas will be exactly the same. Mangrove formations can be considered under three broad categories, each of which can be further sub-divided by various criteria. The fringing forests consist of straggling trees or shrubs which form a thin band facing open sea. Behind the fringing forest there is generally well developed forest dominated by tall straight trees, principally members of the Rhizophoraceae. Further to the landward is a transition forest which tends to be floristically more diverse than the other two categories. Markedly different forests develop depending on whether the transition is into fresh water swamp, peat swamp, onto dry land or to salt flat. In some areas, the transition is so gradual that it is hard to define the extent of mangrove forest.

Several authors have recognised distinct zones in the mangrove formations in accordance with various criteria. MACNAE (1968) reviewed the zonation schemes that had been proposed by several authors for the mangroves of the Indo-West-Pacific region. One was based on frequency of inundation, another on the salinity of the soil, and a



third on the generic name of the dominant trees. Using the last criterion, AKSORNKOAE (1976) investigated the pattern of mangrove zonation in some detail in stands along estuaries sheltered from wind and waves in Chanthaburi Province.

The dominance of some species associations in mangrove is probably artificial and more or less subject to modifications due to biotic pressures which favour the unceasing establishment of pioneer species. The appearance of *Acanthus ilicifolius* or even *Excoecaria agallocha* in the *Rhizophora* zone, for example, does not correspond to their optimum ecology. Most mangrove communities in Thailand, as in most regions, are regularly disturbed by legal forest exploitation and uncontrolled illicit cutting which make it difficult to understand the natural dynamics. In the field it should therefore always be verified whether an existing mangrove formation is due to natural factors or in minor or major degree to previous human destruction.

In the current treatment, WATSON's (1928) Inundation Classes for Malaya are adopted to indicate the distribution of various mangrove trees and shrubs in Thailand. The five Inundation Classes are as follows :

Class 1 : \* Areas inundated by all high tides (flooded 56 to 62 times per month);

Class 2 : Areas inundated by medium high tides (flooded 45 to 59 times per month);

Class 3 : Areas inundated by normal high tides (flooded 20 to 45 times per month);

Class 4 : Areas inundated by spring tides (flooded 2 to 20 times per month);

Class 5 : Areas inundated by abnormal of equinoctial tides (flooded up to twice a month).

The terms "swampy mangrove" and "back mangrove" thus roughly correspond to WATSON's Inundation Classes 1-3 and 4-5 respectively. The ecological preferences of the mangrove trees and shrubs in Thailand are tabulated according to WATSON's Inundation Classes in Table 2. In each Inundation Class the species that reach their optimum development have been marked. Very few true mangrove species have wider favourable habitats, e.g. *Xylocarpus granatum* (Classes 3-5). However, the occurrence of *Rhizophora apiculata* and a few other Rhizophoraceae as old trees in Inundation Class 5, which does not correspond to their optimum ecological amplitude, must be due to their being remnants of the previous colonization.

A considerable number of mangrove species are found in Thailand. In addition, many species of fresh water swamp, peat swamp or dry land forests also occur in the landward margin of the mangrove forest where tidal influence is slight. In Table 1, mangrove species are characterized as either "true mangroves", which are species typical

\* This Inundation Class is usually devoid of plants, except for only a few colonising species such as *Avicennia alba*, *A. marina*, and *Sonneratia alba*.



of mangrove formation, or "mangrove associates", which are other species found in association with true mangroves more inland in fresh water swamp, peat swamp, salt flat, and dry land forests. Hence, most mangrove associates are found in the back mangrove or in WATSON's Inundation Classes 4 and 5. A number of mangrove associates cannot be said to be strictly halophytic, such as *Cerbera manghas*, *C. odollam*, *Dolichandrone spathacea*, *Hibiscus tiliaceus*, *Planchonella obovata*, *Thespesia populnea*, etc. The complete distribution records of true mangrove species and mangrove associates, particularly trees and shrubs, in the mangrove formations in Thailand are summarized in Table 1.

#### PROVISIONAL AND EXPLANATORY KEYS TO TERRESTRIAL TREES AND SHRUBS RECORDED FROM THE MANGROVE FORMATIONS IN THAILAND

1. Plants without flowers and seeds, reproduced by means of spores (Pteridophyta); large coarse ferns with thick rhizomes and large radiating pinnate leaves in a cluster from the base **Acrostichum** (2 species)
1. Plants with flowers and seeds (Spermatophyta)
  2. Palm-like erect shrub with stiff, fern-like pinnate leaves forming a crown at the apex of the stout trunk; staminate and ovulate strobili large, borne in the centre of leafy crowns, dioecious; ovules naked, borne along the margins of megasporophylls **Cycas rumphii** Miq.
  2. Flowering plants with ovules borne in an ovary
    3. Monocotyledonous plants; leaves parallel-veined
      4. Palm-like, woody tree with aerial prop-roots and elongated, spirally arranged, spiny-toothed leaves **Pandanus odoratissimus** Linn. f.
      4. Palms with large feathery leaves
        5. Unarmed, stemless shrubby palm; leaves erect; fruits in a drooping globose head, ca. 30 cm or more in diameter **Nypa fruticans** Wurm.
        5. Caulescent, spiny palms with erect trunks
          6. Stems stout, densely clustered; trunks with whorls of spines 15-25 m high; leaves with strongly drooping leaflets; fruiting panicle pendulous, fruits globose, dark purple on purplish-red spikes **Oncosperma tigillaria** Ridl.
          6. Stem slender, loosely clustered trunks without spines, 4-10 m high; upper part of stem furnished with persistent spiny leaf stalks and coarsely fibrous leaf sheaths; leaflets not drooping; fruiting panicle erect, fruits oval, ripening orange **Phoenix paludosa** Roxb.

## 3. Dicotyledonous plants; leaves mostly netted-veined

## 7. Leaves trifoliate or pinnate

8. Leaves trifoliate; petioles slender; leaflets elliptic, crenate-dentate; raceme 4-9 cm long; corolla not papilionaceous; low shrub

***Allophylus cobbe* (Linn.) Raeusch.**

## 8. Leaves pinnate or if trifoliate, corolla papilionaceous

9. Leaves bipinnate; leaflets fine, numerous, opposite, oblong-ovate, sessile, 12-18 × 5-7 mm; flowers bright yellow in terminal panicles; pods lanceolate, indehiscent with wing-like margin

***Peltophorum pterocarpum* (DC.) Back. ex K. Heyne**

## 9. Leaves once pinnate, leaflets mostly 2-6 pairs or trifoliate

10. Trees with pneumatophores (except *Xylocarpus gangeticus*); flowers small ca. 4-7 mm long; stamens completely connate into a tube with the anthers facing inwards; fruits large, globose, ca. 7-25 cm diameter

11. Leaves imparipinnate; leaflets 4-6 pairs; flowers unisexual, numerous, in panicle up to 30 cm long; fruits globose ca. 7 cm diameter, pericarp leathery, 3-valved; seeds 3 with orange arils; pneumatophores conical, crowded at the base of stem

***Amoora cucullata* Roxb.**

11. Leaves paripinnate; leaflets mostly 2-4 pairs; flowers bisexual; fruits large, globose, 10-25 cm diameter with many, closely packed, large tetrahedral seeds; pneumatophores peg-like or plate-like, spreading around the base of stem

***Xylocarpus* (3 species)**

10. Trees or shrubs without pneumatophores; flowers larger; stamens free or united into a tube with free filaments on the upper part; fruits flattened capsules or pods (legumes)

12. Leaves opposite, imparipinnate; leaflets slightly oblique at bases; raceme 3-7-flowered, 3-5 cm long; calyx spathaceous; corolla funnel-shaped, 12-17 cm long, white; capsule linear compressed, with numerous thick, corky, lateral-winged seeds

***Dolichandrone spathacea* (Linn. f.) K. Schum.**

12. Leaves alternate or spiral, imparipinnate or paripinnate; flowers regular or irregular; calyx not spathaceous; petals free; ovary unilocular; fruits basically legumes, dehiscent or indehiscent

13. Leaves imparipinnate; leaflets 1-3 pairs or trifoliate, symmetric at bases; corolla papilionaceous



- 14. Leaflets usually 5–7, terminal one largest; raceme lateral, 10–23 cm long; pods compressed, ovoid–ellipsoid, ca.  $6 \times 3.5$  cm, woody with terminal pointed beak, indehiscent; tree 3–8 m high ***Derris indica*** (Lamk.) Bennet
- 14. Leaflets 3; inflorescences lateral, ca. 3 cm long; pods flattened, linear, curved, ca.  $2.5 \times 0.5$  cm, constricted into 2–4 loment; shrub ***Dendrolobium umbellatum*** Benth.
- 13. Leaves paripinnate; leaflets 1–2 pairs (rarely 3), asymmetric at bases; corolla caesalpinaceous
- 15. Leaflets slightly oblique at bases; flowers in terminal clusters; petal 1, with slender claw, pinkish white, later red; fertile stamens 3; pods flattened, oblong,  $12–25 \times 4–5$  cm, valves thin; tree up to 30–40 m high  
***Intsia bijuga*** (Colebr.) O. Ktze.
- 15. Leaflets strongly oblique at bases, unequal-sided with a pronounced asymmetrically placed median nerve; inflorescences axillary; petals 5; fertile stamens usually 10; pods subreniform or arcuate-ovoid, indehiscent  
***Cynometra*** (2 species)
- 7. Leaves simple
  - 16. Leaves alternate or spiral
    - 17. Fleshy tufted undershrub, green to reddish; leaves linear, fleshy, sessile; flowers minute, 1 mm across, in axillary sessile fascicles  
***Suaeda maritima*** (Linn.) Dum.
  - 17. Plants otherwise
    - 18. Stems and branches armed with sharp, long, straight thorns
      - 19. Twigs, leaves and fruits with resinous smell when crushed; leaf margin smooth; flower and fruit solitary; fruit 3–4 angular, ovoid, 2–4 cm long with 3–4 flattened sides, tip bluntly pointed  
***Merope angulata*** (Willd.) Swingle
      - 19. Twigs, leaves and fruits without resinous smell when crushed; leaf margin crenulate; racemes 5–9 cm long; fruit globose, ca. 6 mm diameter  
***Scolopia macrophylla*** (W. & A.) Clos
    - 18. Stems and branches not armed with thorns
      - 20. Flowers apetalous, unisexual, monoecious or dioecious
      - 21. Tree with aerial roots, cut exuding milky sap; leaves leathery; flowers and fruits embedded in an urn-shaped fleshy receptacle (syconium)  
***Ficus microcarpa*** Linn. f.

21. Trees or shrubs without aerial roots, cut exuding milky or red sap or watery juice; flowers and fruits otherwise

22. Trees or shrubs with watery juice

23. Twigs more or less zigzag; leaves green, glabrous on both sides; fruits depressed-globose, 12–14-lobed; shrub

**Glochidion littorale** Bl.

23. Twigs not zigzag; leaves shining green above, densely silvery grey scaly beneath; fruits woody, indehiscent nuts, ovoid, conspicuously keeled or ridged; trees

**Heritiera** (2 species)

22. Trees with abundant milky or red sap

24. Tree with red sap; leaves oblong-lanceolate to narrowly oblong; inflorescences amongst and below leaves, lax, much branched, many-flowered panicles, 9–15 cm long; flowers clustered; fruits drupaceous, globose, ca. 2.5 cm diameter, dehiscing in two valves; seeds large with red aril

**Horsfieldia irya** (Gaertn.) Warb.

24. Trees with milky sap; leaves elliptic to obovate or oblong-lanceolate to narrowly oblong, flowers dioecious in axillary or terminal, sessile to subsessile racemes; fruits slightly depressed-globose capsules

25. Branches usually sweeping; leaves elliptic-lanceolate to oblong, margins entire, undulating; racemes terminal on side-branches; capsules 2–3 cm diameter, globose, not lobed

**Sapium indicum** Willd.

25. Branches not sweeping; leaves elliptic to obovate, margins finely and distantly toothed; raceme axillary, sessile capsules ca. 7 mm diameter, 3-lobed

**Excoecaria gallocha** Linn.

20. Flowers petalous, hermaphroditic (rarely unisexual)

26. Flowers unisexual, trimerous; petals campanulate, 2–3 mm long; fruits ellipsoid to globose  $1.0\text{--}1.5 \times 0.5\text{--}1.0$  cm, woody, glabrous, fruiting calyx hairy inside; small tree up to 5 m high

**Diospyros ferrea** (Willd.) Bakh.

26. Flowers hermaphroditic 5–6-merous; petals free or united

27. Trees or shrubs with abundant whitish to yellowish-white sap; leaves often crowded near the ends of branches



28. Twigs and undersurface of leaves dark reddish or golden-brownish hairy; inflorescences 1–12-flowered fascicles; flowers greenish-white ca. 4 mm long; fruits ovoid to obovoid, 1.0–1.5 cm long; small to medium tree, sometimes stunted **Planchonella obovata** (R. Br.) Pierre
28. Twigs and leaves glabrous; inflorescence a large terminal panicle or axillary many-flowered cyme
29. Leaves oblanceolate, narrowly tipped; petioles slender, 2.0–3.5 cm long; inflorescence a large terminal panicle; fruits large drupes, subglobose, paired or solitary, 6–12 cm long; small trees  
**Cerbera** (2 species)
29. Leaves obovate, rounded at apex, subsessile; inflorescence axillary, 8–12-flowered cyme, ca. 5 cm long; fruits small drupe, ellipsoid, 6–8 mm long; shrub **Scaevola taccada** (Gaertn.) Roxb.
27. Trees or shrubs with watery juice; leaves scattered along the branches or crowded near the ends of branches
30. Leaves phyllode-like, elliptic, 5–9 parallel-veined; petioles short, flattened; inflorescences bottle-brush-like spikes; flowers creamy white; fruits woody capsule, sessile, spherical, ca. 4 mm across; bark whitish or light grey, fissured, papery-flaky in course, elongate, shaggy pieces  
**Melaleuca leucadendra** Linn.\*
30. Leaves not phyllode-like
31. Shrub with swollen or conical stem base; leaves leathery, broadly ovate to suborbicular, shining green; petioles slender, 4–8 cm long; flowers white in short panicles **Aegialites rotundifolia** Roxb.\*\*
31. Trees or shrubs without swollen stem bases; leaves leathery or papery
32. Leaves very thick, leathery, glabrous, margins entire
33. Leaves alternate along the branches, bright glossy green above, paler green below; petioles slender; flowers white, many, in terminal axillary umbels; ovary superior; fruits elongate, cylindrical, curved, 2–6 cm long with pointed tip; seeds viviparous; shrub to much-branched treelet up to 7 m high, pneumatophores absent

**Aegiceras corniculatum** (Linn.) Blanco

\* This tree is considered to be a pioneer species of the fresh water swamp and peat swamp forests, usually forming a pure stand in regularly disturbed areas.

\*\* This shrub can be considered as an endangered mangrove species in Thailand. So far only two collections have been recorded, from Krabi (Koh Lanta) and Satun (Koh Tarutao).



33. Leaves tufted towards the ends of branches, fleshy, leathery, green on both sides; inflorescences terminal or axillary racemes or spikes; ovary inferior; fruits compressed-ellipsoid, obtusely angled; seeds not viviparous; trees, pneumatophores usually present **Lumnitzera** (2 species)
32. Leaves papery, margins entire or toothed
34. Ovary inferior
35. Leaves scattered along the branches, margins acutely serrate-dentate; inflorescences terminal on ascending branches; involucre cylindric-campanulate; flowers pale violet; stamens 5; shrub ca. 1 m high  
**Pluchea indica** (Linn.) Less
35. Leaves clustered at the end of branches, margins entire; flowers in terminal or axillary racemes; stamens numerous; trees  
**Barringtonia** (2 species)
34. Ovary superior
36. Leaves lanceolate, undersurfaces brownish-yellow to golden scaly; inflorescences axillary and terminal, short panicles, 1.5–3.0 cm long, silvery brownish scaly; calyx campanulate, irregularly 4–5-lobed; petals (5)–6, free, pink; spreading and leaning shrub to 3 m high  
**Brownlowia tersa** (Linn.) Kosterm.\*
36. Leaves and inflorescences otherwise
37. Leaves heart-shaped to suborbicular, deeply cordate at bases; palmately nerved; epicalyx present; stamens numerous forming staminal column
38. Leaves glabrous above, white or glaucous and finely downy beneath, margins shallowly crenulate, corolla yellow turning orange to red; fruits ovoid to globose capsules, loculicidally dehiscent  
**Hibiscus tiliaceus** Linn.
38. Leaves glabrous on the upper surface, brown scaly beneath, margins entire; corolla yellow with maroon spot at base, turning purplish; fruits woody, depressed-globose, indehiscent  
**Thespesia populnea** (Linn.) Soland. ex Correa

\* A new species record for Thailand. The plant exhibits a shrubby habit along the Andaman coast, forming dense masses in places where the mounds of mud lobster (*Thalassina anomala*) are abundant (Fig. 8).

- 37. Leaves elliptic, oblong-lanceolate or oblanceolate, acute at bases; reticulated nerved; epicalyx absent; stamens 5, free, epipetalous
- 39. Twigs swollen at bases easily detached from stem; leaves with pellucid glands, usually with darkish glands along margins; reticulated nerves nearly invisible; racemes umbellate, ca. 6 cm long, axillary; flowers 8, rose pink; drupes ca. 1.5 cm across; shrub ***Ardisia littoralis* Andr.**
- 39. Twigs not swollen at bases; leaves without darkish glands along margins; reticulated nerves more or less visible; drupes small 3–9 mm across; trees ***Rapanea* (2 species)**
- 16. Leaves opposite or subopposite
  - 40. Petals free (rarely apetalous)
    - 41. Leaves opposite with caducous interpetiolar stipules; fruits with viviparous seeds; hypocotyls growing from the fruits while on the trees
    - 42. Stilt roots present, conspicuous and woody, sometimes up to 8 m high; leaves with black dots on lower surfaces; calyx 4-lobed; petals lanceolate ***Rhizophora* (2 species)**
    - 42. Stilt roots absent or inconspicuous and soft; leaves without black dots on lower surfaces; calyx 5–16-lobed, petals bilobed, multifid, or with apical appendages
      - 44. Calyx lobes ovate; petals spreading; stamens 10–12; hypocotyls ridged ***Ceriops* (2 species)**
      - 44. Calyx lobes linear-oblong; petals reflexed; stamens indefinite; hypocotyls smooth ***Kandelia candel* (Linn.) Druce**
  - 41. Leaves opposite to subopposite without interpetiolar stipules; seeds not germinating in the fruits while on the trees
    - 45. Trees with conical or finger-like pneumatophores; leaves very thick, leathery flowers 1 or in groups of 2–8 at the terminal ends; stamens indefinite; ovary half inferior, partially united with the hypanthium; calyx persistent in fruits ***Sonneratia* (4 species)**
    - 45. Low shrubs or shrubby trees without pneumatophores; leaves papery; stamens definite
      - 46. Low shrub; leaves with 5 basal nerves, densely hairy; flowers 4–5 in a corymb; calyx covered with stiff long hairs; petals purple ***Melastoma villosum* Lodd.**



46. Spreading shrub or shrubby tree; leaves otherwise; flowers white or greenish white

47. Spreading shrub to shrubby tree; leaves elliptic-oblong, 1-3×0.3-0.8 cm, subsessile, margins entire; calyx campanulate, lobes 6; petals 6, broadly ovate with slender claw

*Pemphis acidula* J.R. & G. Forst.

47. Shrubby tree; leaves broadly elliptic, 4-8×2-5 cm, sessile, margins remotely crenulate; flowers 4-merous; calyx lobes almost free; petals oblong

*Cassine viburnifolia* (Juss.) Hou

40. Petals more or less united

48. Leaves opposite to subopposite without interpetiolar stipules; ovary superior

49. Trees with finger-like pneumatophores; leaf undersurfaces greyish-white or brownish-yellow tomentose; flowers small, 5-9 mm long; corolla tube very short; fruits with viviparous seeds

*Avicennia* (3 species)

49. Shrubs without pneumatophores; leaves green on both sides; corolla conspicuous; seeds not viviparous

50. Leaf margins usually deeply toothed, and tipped with rigid sharp spines; flowers in terminal spikes; corolla two-lipped, tube short, white, bluish or purplish

*Acanthus* (2 species)

50. Leaf margins entire; flowers in terminal cymes or corymbs; corolla two-lipped or regular

51. Flowers many in flat-topped corymb, 6-15 cm long; corolla tube 3-4 mm long, two-lipped; stamens slightly exerted beyond corolla tube; fruits globose, purplish black

*Premna obtusifolia* R. Br.

51. Flowers few in terminal and axillary cyme, 4-7 cm long; corolla tube slender, 2-3 cm long, not two-lipped; stamens much exerted beyond corolla tube; fruits globose, 4-furrowed, blackish when dry

*Clerodendrum inerme* (Linn.) Gaertn.

48. Leaves opposite with interpetiolar stipules; ovary inferior

52. Leaves very thick, leathery, rounded at apex, acute at base; petioles 1-2 cm long; flowers ca. 1 cm long, white often tinged with pinkish red, in axillary, short, compact inflorescence; fruits cylindrical, 1 cm long, 8-10 grooved

*Scyphiphora hydrophyllacea* Gaertn.

52. Leaves papery, rhomboid ovate, acuminate at apex, broadly heart-shaped at base; petioles slender, 3–5 cm long; panicles in terminal axils; flowers 4–6 cm long, white; fruits depressed-ovoid drupes

***Guettarda speciosa* Linn.**

#### Key to Species of *Acanthus*

1. Flowers blue or purplish blue, usually yellowish at the centre; bracteoles 2, ca. 7 mm long ***A. ilicifolius* Linn.**
1. Flowers usually white but sometimes pale blue; bracteoles caducous. ***A. ebracteatus* Vahl**

#### Key to Species of *Acrostichum*

1. Sterile pinnae round to retuse and shortly mucronate at apex ***A. aureum* Linn.**
1. Sterile pinnae acuminate at apex ***A. speciosum* Willd.**

#### Key to Species of *Avicennia*

1. Leaves elliptic-lanceolate to lanceolate or oblong-lanceolate, acuminate at the apex, glossy green above, greyish-white to whitish-tomentose beneath, usually turning dark brown to black when dry; inflorescences spike-like cymes, 4–7 cm long, terminal and upper axillary; flowers sessile; stamens hardly exerted beyond corolla tube; fruits ovoid, laterally compressed, beak long, slightly curved; bark more or less smooth, dark grey to black, not lenticellate; seashores and tidal river banks near estuaries, on soft mud ***A. alba* Bl.**
1. Leaves elliptic, ovate, elliptic-oblong or obovate, blunt or rounded at apex; greyish-white or brownish-yellow tomentose beneath
  2. Leaves elliptic to elliptic-ovate, glabrous above, greyish-white tomentose beneath, usually turning black when dry; flowers in cymose heads, terminal and upper axillary; fruits broadly ovoid to subglobose, laterally compressed, obtuse, not beaked; bark smooth, pinkish-white to greyish-white, occasionally peeling off in irregular round flakes; seaward fringe, on sandy soil ***A. marina* (Forsk.) Vierh.**
  2. Leaves elliptic, elliptic-oblong or obovate, glossy green above, brownish-yellow tomentose beneath, not turning black when dry; flowers sessile in small crowded cymose heads at the terminal ends; stamens exerted beyond corolla tube; fruits heart-shaped, beak short, straight; bark slightly fissured, grey, brownish-grey to chocolate-brown, often lenticellate; on firm tidal river banks ***A. officinalis* Linn.**



**Key to Species of *Barringtonia***

1. Leaves shortly petiolate to subsessile, apex obtuse or broadly acute, base acute or rounded-truncate, leaf margin entire; inflorescences erect, ca. 12 cm long; fruits broadly pyramidal, 4-angled, 8-12 cm long; rocky seashores

***B. asiatica* (Linn.) Kurz**

1. Leaves conspicuously petiolate, apex acuminate base cordate, leaf margin slightly crenulate; inflorescences pendulous, 30-35 cm long; fruits ovoid to ellipsoid 4-7 cm long; tidal rivers

***B. racemosa* (Linn.) Spreng****Key to Species of *Bruguiera***

1. Flowers solitary; hypocotyls on fruits cigar-shaped
2. Flowers red to pinkish-red; petal lobes acute; persistent calyx on fruits only ridged at the upper part of the tube; bark dark chocolate-brown, cracks deep and irregular; stipules usually with white resinous sap

***B. gymnorrhiza* (Linn.) Savigny**

2. Flowers frequently yellow, occasionally yellowish-green, greenish or partly pinkish-red; petal lobes obtuse; persistent calyx on fruits conspicuously ridged on the tube; bark grey or pinkish-brown, cracked or fissured; stipules usually without white resinous sap

***B. sexangula* (Lour.) Poir.**

1. Flowers in pedunculate cymes; hypocotyls on fruits cylindrical or cigar-shaped
3. Hypocotyls on fruits cigar-shaped; flowers 1.6-2.5 cm long; calyx tube slightly ridged at the upper part; calyx lobes 10, about as long as the tube, slightly reflexed
3. Hypocotyls on fruits cylindrical; flowers 0.9-1.2 cm long; calyx tube smooth or ridged; calyx lobes 8

***B. hainesii* C.G. Rogers**

4. Calyx tube campanulate, smooth, about as long as the lobes; fruiting calyx lobes completely reflexed; bark smooth, dark brown, conspicuously lenticellate; leaves dark green

***B. cylindrica* (Linn.) Bl.**

4. Calyx tube cylindrical, ridged; calyx lobes 1/4 to 1/5 the length of the calyx, erect in fruits; bark smooth, occasionally slightly grid-cracked, greyish to brownish-grey; leaves greenish-yellow

***B. parviflora* (Roxb.) W. & A. ex Griff.****Key to Species of *Cerbera***

1. Flowers white with yellow throat; corolla tube shorter than lobes; fruits round, usually solitary; frequently on muddy tidal riverbanks
1. Flowers white with red throat; corolla tube much larger than lobes; fruits ovoid, often twinned; frequently on rocky and sandy coasts

***C. odollam* Gaertn.*****C. manghas* Linn.**

**Key to Species of *Ceriops***

1. Leaves mostly narrowly oblong-obovate, usually ascendingly crowded near the ends of branches; inflorescences 4–8-flowered; flowers pedicellate, white; calyx lobes on fruits, reflexed or widely patent; petals with 3 clavate appendages at the apex; hypocotyls 15–35 cm long, hanging vertically downwards on the tree; tree up to 25 m high; bark pinkish  
***C. tagal* (Perr.) C.B. Rob.**
1. Leaves mostly broadly obovate, usually radiating crowded near the ends of branches; inflorescences many-flowered; flowers sessile; calyx lobes on fruits erect or ascending; petals fringed at the apex; hypocotyls 8–15 cm long; projecting in various directions on the tree; shrubby tree to small tree; bark greyish  
***C. decandra* (Griff.) Ding Hou**

**Key to Species of *Cynometra***

1. Petioles 0.8–1.3 cm long; racemes 0.4–0.8 cm long; pods woody-valved, 1–2 cm long, deeply rugose, with a lateral beak; shrub to shrubby tree up to 6 m high  
***C. iripa* Kostel**
1. Petioles 1.5–8 cm long; racemes 1.5–2.5 cm long; pods 2–5 × 1–4 cm with undulated surface to shallowly rugose and subterminal beak; tree up to 30 m high  
***C. ramiflora* Linn.**

**Key to Species of *Heritiera***

1. Plank-buttressed tree, with flattened peg-like pneumatophores, 25–35 m high; fruits compressed ovoid, 4–6 cm long, 3–5 cm broad, with a transverse circular ridge; ventral side rather flattened; dorsal side convex at the centre with a more or less, straight, longitudinal low ridge apically ending in a flattened and broadened, rudder-like beak beyond the body of fruit; leaves scattered along the branches  
***H. fomes* Buch.– Ham.\***
1. Low-branched-tree, 5–12 m high, branches and stem crooked; buttresses thin, plank-like, wavy; pneumatophores absent; fruits woody, ellipsoid, 5–11 × 4–6 cm; ventral side more or less flattened; dorsal side convex with a longitudinal, high, sharp ridge apically ending in a very short rudder-like extension; leaves usually grouped towards the ends of the branches  
***H. littoralis* Aiton**

\* A new species record for Thailand. This species proliferates on the landward areas of the mangrove forests along the Andaman coast, south of Kra Isthmus to La-un District of Ranong. The fruits are very characteristic by their transverse circular ridge, which does not occur in other *Heritiera* species.



**Key to Species of *Lumnitzera***

1. Inflorescences terminal; flowers bright red, pedicellate; leaves crowded towards the ends of branches; medium to large-sized tree up to 30 m high, with knee-shaped pneumatophores; bark dark grey, deeply fissured ***L. littorea* (Jack) Voigt**
1. Inflorescences axillary; flowers white, sessile; leaves usually scattered along the branches; small to medium-sized tree; pneumatophores inconspicuous; bark greyish, scaly ***L. racemosa* Willd.**

**Key to Species of *Rapanea***

1. Leaves oblong-lanceolate, bluntly acuminate at apex; umbels sessile on thick axillary cone-like branches, 3-9 mm long; drupes ca. 3 mm across ***R. porteriana* (Wall.) Mez**
1. Leaves oblanceolate, blunt or retuse at apex; umbels of 3 or more flowers on arrested branches, 3 mm long; drupes ca. 9 mm across ***R. umbellulata* (Wall.) Mez**

**Key to Species of *Rhizophora***

1. Inflorescences 2-flowered, shorter than the petiole, in the axils of leaf-scars; flowers sessile; bracteoles completely connate, cup-shaped; petals glabrous; hypocotyls frequently curved and more or less smooth; bark pinkish-grey to grey, shallowly fissured or inconspicuously narrowly grid-cracked; stipules and petioles frequently red ***R. apiculata* Bl.**
1. Inflorescences up to 8-flowered, longer than the petiole, in the axils of the leaves; flowers pedicellate; bracteoles only connate at their base; petals hairy; hypocotyl usually straight with scattered tubercles; bark dark grey, conspicuously grid-cracked; stipules and petioles rarely red ***R. mucronata* Poir.**

**Key to Species of *Sonneratia***

1. Fruiting calyx flat, expanded, not ridged, lobes spreading not enclosing the base of fruit; calyx lobes greenish-white inside
2. Leaves distinctly narrower than long, elliptic, elliptic-oblong or ovate to obovate; apex bluntly acute to shortly acuminate or obtuse; calyx terete in bud; petals linear, dark red; caducous; filaments red; twigs drooping ***S. caseolaris* (Linn.) Engl.**
2. Leaves obovate to broadly obovate-suborbicular; apex broadly rounded, or slightly broadly retuse; base rounded, shortly contracted into a short petiole; calyx ovoid in bud; petals absent; filaments white; twigs not drooping ***S. griffithii* Kurz**

1. Fruiting calyx plate-shaped or turbinate, calyx tube more or less ridged; calyx lobes pink to red inside
3. Leaves broadly ovate to suborbicular, dark green; base usually rounded, not tapering; calyx lobes pink inside; petals absent; fruiting calyx plate-shaped, lobes erect enclosing the base of fruit S. ovata Backer
3. Leaves obovate to ovate, light green or glaucous green, gradually cuneate to subtruncate at base; calyx lobes pinkish-red inside; petals linear, white, caducous; fruiting calyx turbinate, tube 1.5–2.0 cm long, lobes entirely reflexed S. alba J. Smith

#### Key to Species of *Xylocarpus*

1. Leaflets broadly ovate, bluntly acute to acuminate at the apex, base symmetric, fleshy leathery; fruits globose, ripening green, resinous; low-branched, crooked, spreading tree; pneumatophores absent; bark brownish-grey, shallowly fissured; sandy coast X. gangeticus (Prain) C.E. Parkins
1. Leaflets oblong, ovate-oblong to obovate-oblong, usually blunt or rounded at the apex, very thick, base asymmetric leathery; fruits globose or obscurely 4-angled, ripening reddish-brown or greenish-brown; straight trees with pneumatophores
2. Leaflets short-stalked to subsessile; inflorescence 8–17 cm long; fruits subglobose, obscurely 4-angled, ripening greenish-brown; tree 25–40 m high, with flattened peg-like pneumatophores; bark thick dark, brown, deeply longitudinally fissured, peeling off in long, reflexed flakes X. moluccensis (Lam.) Roem.
2. Leaflets with conspicuous petiolules; inflorescences 3–6 cm long; fruits globose, ripening reddish-brown; tree 7–20 m high; pneumatophores ridge or plate-like, winding; bark thin, light brown or pinkish-brown, smooth or slightly scaly, with irregularly rounded flakes X. granatum Koenig



Table 1. List of recorded tree and shrub species in the mangrove formations in Thailand (T = tree, S = shrub, ST = shrubby tree, US = undershrub, C = central, SE = southeastern or Chanthaburi region, E = east coast of peninsula, W = west coast of peninsula).

Scientific Name	Vernacular Name	Family	Habit	Distribution		
				C & SE	E	W
1. <i>Acanthus ebracteatus</i> *	Ngueak plaamo	Acanthaceae	S	+	+	+
2. <i>A. illicifolius</i> *	Ee kreng	Acanthaceae	S	+	+	+
3. <i>Acrostichum aureum</i> **	Prong thale	Pteridaceae	S	+	+	+
4. <i>A. speciosum</i> **	Prong nuu	Pteridaceae	S	+	-	+
5. <i>Aegialites rotundifolia</i> *	-	Plumbaginaceae	S	-	-	+
6. <i>Aegiceras carinuculatum</i> *	Lep mue naang	Myrsinaceae	S	+	+	+
7. <i>Allophyllus cobbe</i> **	To sai	Sapindaceae	S	+	+	+
8. <i>Amoora cucullata</i> **	Daeng nam	Meliaceae	T	+	+	+
9. <i>Ardisia littoralis</i> **	Raamyai	Myrsinaceae	S/ST	+	+	+
10. <i>Avicennia alba</i> *	Samae khao	Verbenaceae	T	+	+	+
11. <i>A. marina</i> *	Samae thale	Verbenaceae	T	+	+	+
12. <i>A. officinalis</i> *	Samae dam	Verbenaceae	T	+	+	+
13. <i>Barringtonia asiatica</i> **	Chik le	Barringtoniaceae	T	+	+	+
14. <i>B. racemosa</i> **	Chik suan	Barringtoniaceae	T	+	+	+
15. <i>Brownlowia tersa</i> **	Nam nong	Tiliaceae	S/ST	+	-	+
16. <i>Bruguiera cylindrica</i> *	Thua khao	Rhizophoraceae	T	+	+	+
17. <i>B. gymnorrhiza</i> *	Kongkaang hua sum	Rhizophoraceae	T	+	+	+
18. <i>B. hainesii</i> *	-	Rhizophoraceae	T	+	+	+
19. <i>B. parviflora</i> *	Thua dam	Rhizophoraceae	T	+	+	+
20. <i>B. sexangula</i> *	Prasak dok khao	Rhizophoraceae	T	+	+	+
21. <i>Cassine viburnifolia</i> **	-	Celastraceae	ST/S	-	-	+
22. <i>Cerbera manghas</i> **	Teenpet saai	Apocynaceae	T	+	+	+
23. <i>C. odollam</i> **	Teenpet thale	Apocynaceae	T	+	+	+
24. <i>Ceriops decandra</i> *	Prong khao	Rhizophoraceae	S/ST	+	+	+
25. <i>C. tagal</i> *	Prong daeng	Rhizophoraceae	T	+	+	+
26. <i>Clerodendrum inerme</i> **	Sam ma ngaa	Verbenaceae	S	+	+	+
27. <i>Cynometra iripa</i> **	Taet ling	Leguminosae	S/ST	-	-	+
28. <i>C. ramiflora</i> **	Ma kha	Leguminosae	T	+	+	+

Scientific Name	Vernacular Name	Family	Habit	Distribution		
				C & SE	E	W
29. <i>Cycas rumphii</i> **	Prong thale	Cycadaceae	ST	+	+	+
30. <i>Dendrolobium umbellatum</i> **	Chamaep	Leguminosae	S	+	+	+
31. <i>Derris indica</i> *	Yee nam	Leguminosae	T	+	+	+
32. <i>Diospyros ferrea</i> **	Lambit thale	Ebenaceae	ST/T	+	+	+
33. <i>Dolichandrone spathacea</i> **	Khac thale	Bignoniaceae	T	+	+	+
34. <i>Excoecaria agallocha</i> *	Taatum thale	Euphorbiaceae	ST/T	+	+	+
35. <i>Ficus microcarpa</i> **	Sai yoi bai thuu	Moraceae	T	+	+	+
36. <i>Glochidion littorale</i> **	-	Euphorbiaceae	ST	+	+	+
37. <i>Guettarda speciosa</i> **	Kong kaang huuchang	Rubiaceae	ST	+	+	+
38. <i>Heritiera fomes</i> *	Duhuun bailek	Sterculiaceae	T	-	-	+
39. <i>H. littoralis</i> **	Ngonkai thale	Sterculiaceae	T	+	+	+
40. <i>Hibiscus tiliaceus</i> **	Po thale	Malvaceae	T	+	+	+
41. <i>Horsfieldia irya</i> **	Kruai	Myristicaceae	T	+	+	+
42. <i>Intsia bijuga</i> **	Lumpho thale	Leguminosae	T	+	+	+
43. <i>Kandelia candel</i> **	Rang ka thae	Rhizophoraceae	T	+	+	+
44. <i>Lumnitzera littorea</i> *	Faat daeng	Combretaceae	ST/T	+	+	+
45. <i>L. racemosa</i> *	Faat khao	Combretaceae	S/ST	+	+	+
46. <i>Melaleuca leucadendra</i> **	Samet	Myrtaceae	T	+	+	+
47. <i>Melastoma villosum</i> **	Khlonghleng khon	Melastomaceae	S	+	+	+
48. <i>Merope angulata</i> **	Manao pee	Rutaceae	S	-	-	+
49. <i>Nypa fruticans</i> *	Chaak	Palmae	ST	+	+	+
50. <i>Oncosperma tigillaria</i> **	Lao cha on	Palmae	T	-	+	+
51. <i>Pandanus odoratissimus</i> **	Toei thale	Pandanaceae	ST	+	+	+
52. <i>Peltophorum pterocarpum</i> **	Non see	Leguminosae	T	+	+	+
53. <i>Pemphis acidula</i> **	Thian le	Lythraceae	S	+	+	+
54. <i>Phoenix paludosa</i> *	Peng thale	Palmae	T	+	+	+
55. <i>Planchonella obovata</i> **	Ngaa saai	Sapotaceae	T	+	+	+
56. <i>Pluchea indica</i> **	Khluu	Compositae	S	+	+	+
57. <i>Premna obtusifolia</i> **	Chaa lueat	Verbenaceae	S	+	+	+
58. <i>Rapanea porteriana</i> **	Phrong nok	Myrsinaceae	T	+	+	+
59. <i>R. umbellulata</i> **	-	Myrsinaceae	ST/T	-	-	+
60. <i>Rhizophora apiculata</i> *	Kongkaang bailek	Rhizophoraceae	T	+	+	+
61. <i>R. mucronata</i> *	Kongkaang baiyai	Rhizophoraceae	T	+	+	+



Scientific Name	Vernacular Name	Family	Habit	Distribution		
				C & SE	E	W
62. <i>Sapium indicum</i> **	Samo thale	Euphorbiaceae	ST/T	+	+	+
63. <i>Scaevola taccada</i> **	Rak thale	Goodeniaceae	S	+	+	+
64. <i>Scolopia macrophylla</i> **	Nam taeng	Flacourtiaceae	ST	-	+	+
65. <i>Scyphiphora hydrophyllacea</i> *	Chee ngam	Rubiaceae	ST	+	+	+
66. <i>Sonneratia alba</i> *	Paat	Sonneratiaceae	T	+	+	+
67. <i>S. caseolaris</i> *	Lam phu	Sonneratiaceae	T	+	+	+
68. <i>S. griffithii</i> *	Lam phaen hin	Sonneratiaceae	T	+	-	+
69. <i>S. ovata</i> *	Lam phaen	Sonneratiaceae	T	+	+	+
70. <i>Sueda maritima</i> *	Cha khraam	Chenopodiaceae	US	+	+	+
71. <i>Thespesia populnea</i> **	Pho thale	Malvaceae	T	+	+	+
72. <i>Xylocarpus gangeticus</i> **	Ta bun	Meliaceae	T	+	-	+
73. <i>X. granatum</i> *	Ta buun khao	Meliaceae	T	+	+	+
74. <i>X. moluccensis</i> *	Ta buun dam	Meliaceae	T	+	+	+

\* Trees and shrubs absolutely bound to salt or brackish water (true mangrove species)

\*\* Trees and shrubs belonging to the littoral vegetations and/or inland vegetation which regularly make their appearance in the back-mangroves (mangrove associates)

Table 2. Ecological distribution of trees and shrubs in the mangrove formations in Thailand according to WATSON'S (1928) Inundation Classes.

Species	Watson's Inundation Classes					Adjacent and Inland Vegetation*
	1	2	3	4	5	
1. <i>Acanthus ebracteatus</i>				xxxxxx	xxxxxx	
2. <i>A. ilicifolius</i>				xxxxxx	xxxxxx	
3. <i>Acrostichum aureum</i>			xx	xxxxxx	xxxxxx	
4. <i>A. speciosum</i>			xx	xxxxxx	xxxxxx	
5. <i>Aegialites rotundifolia</i>				xxxxxx	xxxxxx	
6. <i>Aegiceras corniculatum</i>			xxxxxx	xxxxxx		
7. <i>Allophyllus cobbe</i>					xxxxxx	xxxxxxxxxxxx
8. <i>Amoora cucullata</i>					xxxxxx	xxxxxxxxxxxx
9. <i>Ardisia littoralis</i>					xxxxxx	xxxxxx
10. <i>Avicennia alba</i>	xxx	xxxxxx	xxxxxx			
11. <i>A. marina</i>	xxx	xxxxxx	xxxxxx			
12. <i>A. officinalis</i>			xxxxxx	xxxxxx	xxxxxx	
13. <i>Barringtonia asiatica</i>					xxxxxx	xxxxxxxxxxxx
14. <i>B. racemosa</i>					xxxxxx	xxxxxxxxxxxx
15. <i>Brownlowia tersa</i>				xxxx	xxxxxx	
16. <i>Bruguiera cylindrica</i>			xxxxxx	xxxxxx		
17. <i>B. gymnorhiza</i>			xxxxxx	xxxxxx	xxxxxx	
18. <i>B. hainesii</i>			xxxxxx	xxxxxx	xx	
19. <i>B. parviflora</i>			xxxxxx	xxxxxx	xxx	
20. <i>B. sexangula</i>				xxxxxx	xxxxxx	
21. <i>Cassine viburnifolia</i>					xxxxxx	xxxxxxxxxxxx
22. <i>Cerbera manghas</i>					xxxxxx	xxx
23. <i>C. odollam</i>					xxxxxx	xxx
24. <i>Ceriops decandra</i>				xxxxxx	xxxxxx	
25. <i>C. tagal</i>			xxxxxx	xxxxxx		
26. <i>Clerodendrum inerme</i>					xxxxxx	xxx
27. <i>Cynometra iripa</i>					xxxxxx	xxx
28. <i>C. ramiflora</i>					xxxxxx	xxxxxx



Species	Watson's Inundation Classes					Adjacent and Inland Vegetation*
	1	2	3	4	5	
29. <i>Cycas rumphii</i>					xxxxxx	xxxxx
30. <i>Dendrobium umbellatum</i>					xxxxxx	xxxxx
31. <i>Derris indica</i>					xxxxxx	xxxxx
32. <i>Diospyros ferrea</i>					xxxxxx	xxxxxxxxxxxx
33. <i>Dolichandrone spathacea</i>					xxxxxx	xxxxx
34. <i>Excoecaria agallocha</i>				xxxxxx	xxxxxx	
35. <i>Ficus microcarpa</i>					xxxxxx	xxxxxxxxxxxx
36. <i>Glochidion littorale</i>					xxxxxx	xxxxxxxx
37. <i>Guettarda speciosa</i>					xxxxxx	xxxx
38. <i>Heritiera fomes</i>				xx	xxxxxx	
39. <i>H. littoralis</i>				xxx	xxxxxx	xx
40. <i>Hibiscus tiliaceus</i>					xxxxxx	xxxx
41. <i>Horsfieldia irya</i>					xxxxxx	xxxxxxxxxxxx
42. <i>Intsia bijuga</i>					xxxxxx	xxxxxxxxxx
43. <i>Kandelia candel</i>			xxxxx	xxxxxx		
44. <i>Lumnitzera littorea</i>				xxxxxx	xxxxxx	
45. <i>L. racemosa</i>				xxxxxx	xxxxxx	
46. <i>Melaleuca leucadendra</i>					xxxxxx	xxxxx
47. <i>Melastoma villosum</i>					xxxxxx	xxxxxxxxxxxx
48. <i>Merope angulata</i>					xxxxxx	xxxxxx
49. <i>Nypa fruticans</i>			xxxxx	xxxxxx	xxxxxx	
50. <i>Oncosperma tigillaria</i>					xxxxxx	xxxxxx
51. <i>Pandanus odoratissimus</i>					xxxxxx	xxxxxx
52. <i>Peltophorum pterocarpum</i>					xxxxxx	xxxxxx
53. <i>Pemphis acidula</i>					xxxxxx	xxxx
54. <i>Phoenix paludosa</i>					xxxxxx	
55. <i>Planchonella obovata</i>					xxxxxx	xxxxx
56. <i>Pluchea indica</i>					xxxxxx	xxxxxx
57. <i>Premna obtusifolia</i>					xxxxxx	xxxx
58. <i>Rapanea porteriiana</i>					xxxxxx	xxxxxx
59. <i>R. umbellulata</i>					xxxxxx	xxxxx

Species	Watson's Inundation Classes					Adjacent and Inland Vegetation*
	1	2	3	4	5	
60. <i>Rhizophora apiculata</i>		xxxxxx	xxxxxx	xxx		
61. <i>R. mucronata</i>	xxx	xxxxxx	xxxxxx			
62. <i>Sapium indicum</i>					xxxxxx	xxxxxx
63. <i>Scaevola taccada</i>					xxxxxx	xxxxxx
64. <i>Scolopia macrophylla</i>					xxxxxx	xxxxxx
65. <i>Scyphiphora hydrophyllacea</i>			xxxxxx	xxxxxx		
66. <i>Sonneratia alba</i>	xxxxxx	xxxxxx	xx			
67. <i>S. caseolaris</i>			xx	xxxxxx	xxxxxx	
68. <i>S. griffithii</i>			xxxxxx	xxxxxx	xxxxxx	
69. <i>S. ovata</i>			xxxxxx	xxxxxx	xxxx	
70. <i>Sueda maritima</i>					xxxxxx	
71. <i>Thespesia populnea</i>					xxxxxx	xxxxxx
72. <i>Xylocarpus gangeticus</i>					xxxxxx	xx
73. <i>X. granatum</i>			xxxxxx	xxxxxx	xxxxxx	
74. <i>X. moluccensis</i>				xxxxxx	xxxxxx	

\* Beach vegetation, fresh water swamp forest, peat swamp forest or salt flat.





Figure 1. *Aegialites rotundifolia* Roxb., showing the very characteristic long and slender petioles (Tarutao National Park, Satun).



Figure 2. Thorny stem of *Scolopia macrophylla* (W. & A.) Clos (Trat).



Figure 3. *Sonneratia griffithii* Kurz at deciduous time in March 1982 (La-un, Ranong).



Figure 4. Stem base of *Kandelia candel* (Linn.) Druce.





Figure 5. Fruiting calyx of *Sonneratia ovata* Backer in comparison with that of *S. griffithii* Kurz (Fig. 6) (Palian, Trang, July 1982).

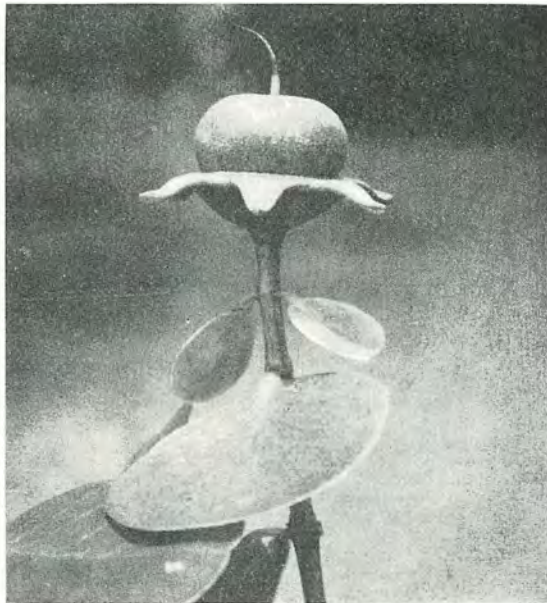


Figure 6. Fruiting calyx of *Sonneratia griffithii* Kurz (Kantang, Trang; Oct. 1982).



Figure 7. Leaf and mature fruits of *Heritiera fomes* Buch.- Ham. (left) and *H. littoralis* Aiton (right) (La-un, Ranong).

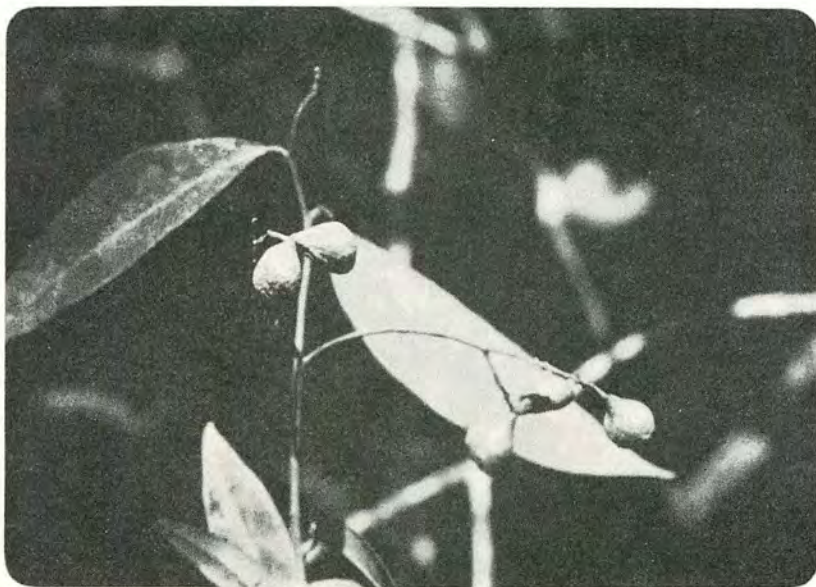


Figure 8. Mature fruits and leaf undersurface of *Brownlowia tersa* (Linn.) Kosterm. (Krabi, October, 1982).





Figure 9. Stand of *Heritiera fomes* Buch.—Ham. on the firm bank of the La-un tidal river. The straight tree with new flushes of leaves in between the two leaning *H. fomes* is *Xylocarpus moluccensis* (La-un, Ranong).



Figure 10. *Heritiera fomes* Buch.—Ham., showing a plank-buttress and the numerous, flattened, peg-like pneumatophores. A newly-formed mound of mud lobster (*Thalassina anomala*) is to the bottom left.



Figure 11. Winding plate-like pneumatophores of *Xylocarpus granatum* Koenig at low tide (Kanom, Nakhon Sri Thammarat).



Figure 12. Crowded conical pneumatophores of *Amoora cucullata* Roxb. at low tide (Kanom, Nakhon Sri Thammarat).



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