

# **GLOSSARY**

**GEOGRAPHICAL**

<b>cosmopolitan</b>	found all over the globe
<b>New World</b>	the America's
<b>Old World</b>	Eurasia and Africa
<b>pantropical</b>	occurring in all of the tropical regions of the world

**HABITAT**

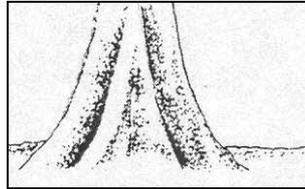
<b>brackish</b>	slightly to very saline/salty, but not having the salinity of seawater
<b>lagoon</b>	(often shallow) body of seawater that is (almost) disconnected from the sea
<b>littoral</b>	the intertidal zone
<b>riparian</b>	along a river or stream
<b>terrestrial</b>	occurring on land
<b>vine forest</b>	certain type of evergreen, tropical forest that is particularly abundant in climbers (e.g. in parts of Queensland, Australia)
<b>wetland</b>	an area that is either permanently, periodically or occasionally covered with fresh, brackish- or saline water, including coastal waters up to a depth of up to 6 metres below MLWL; includes natural and man-made habitats (Ramsar definition)

**HABIT**

<b>annual</b>	plant that completes its life cycle from seed to seed in a single year (or season)
<b>aroid</b>	member of the <i>Araceae</i> family
<b>bryophyte</b>	mosses
<b>clump-forming</b>	growing closely together in a compact cluster or group
<b>dicotyledons</b>	with two cotyledons, i.e. primary leaves of the embryo; includes most seed plants
<b>ephemeral</b>	temporary, soon disappearing
<b>epiphyte</b>	growing on another plant (usually a herb growing on a tree), without being rooted in soil
<b>gregarious</b>	large numbers of the same species occurring together at a single site (not necessarily compact)
<b>halophyte</b>	plant that only occurs in salty, saline areas
<b>hemi-parasite</b>	a plant that partially parasites on a host, but supplements this with its own (often feeble) photosynthesis; can exist without a host
<b>liana</b>	a woody climbing plant, usually of (semi-)tropics
<b>monocotyledons</b>	with one cotyledon, i.e. primary leaf of the embryo; includes groups such as grasses, sedges, orchids and lilies (see dicotyledons)
<b>perennial</b>	plant which lives for more than one year
<b>pitcher plant</b>	a member of the <i>Nepenthaceae</i> family, characteristically with leaf-ends that are modified into vessels, that contain rain water and enzymes, and serve to trap insects
<b>rattan</b>	a climbing palm (or in trade: the stem of the climbing palm), of which most species occur in Southeast Asia; the largest genus is <i>Calamus</i> , of which there are at least several hundred species
<b>scandent</b>	climbing, without use of tendrils, hooks, etc.
<b>sedge</b>	grass-like herb of the <i>Cyperaceae</i> family
<b>succulent</b>	plant with juicy, thick leaves and (often) thickened stems; often occurs in plants adapted to dry and desert conditions, or physiologically dry conditions such as with high salinity
<b>thicket</b>	a thick clump of shrubs, often impenetrable
<b>tussock</b>	grasses or sedges growing closely together in a compact cushion
<b>viviparous</b>	see under FRUIT

**BARK/TRUNK/STEM**

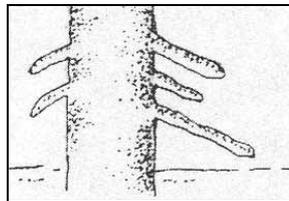
- columnar trees** trunk of tree is tall and straight  
**fissured** deeply grooved  
**flanged** with projecting rim or edge  
**fluted trunk** spreading outward towards the bottom:



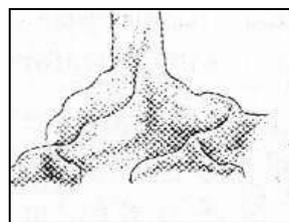
- hypocotyl** that portion of the embryonic stem below the cotyledons (i.e. the primary leaves of the embryo)  
**latex** thick, milky juice  
**lenticel** a special pore in the bark of trees and shrubs, to allow air to pass to inner tissues; often with characteristic shape, colour and size  
**scales** flat, plate-like external structure, formed from the epidermis; often visible only if viewed under magnification

**ROOTS**

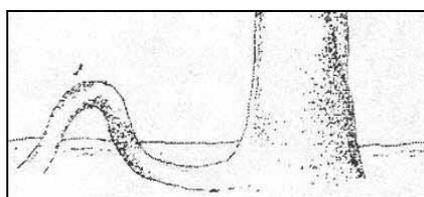
- aerial root** root-like structure that emerges from lower trunk or branches; some may eventually develop into stilt-roots (e.g. in some *Rhizophoraceae*):



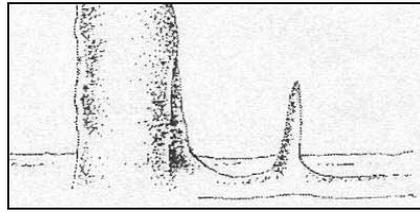
- buttress** roots that branch off above the ground, arching away from the stem before entering the ground; they are not separated from the stem before entering the soil as are stilt-roots:



- cable roots** strong, fairly thin (<1-2 cm  $\phi$ ), horizontally-running roots, often just below soil surface  
**knee root** a loop of a root that emerges above the ground:



**pneumatophore** a root rising above the (waterlogged) soil, that acts as a respiratory organ:



**pseudo-bulb  
(orchid)**

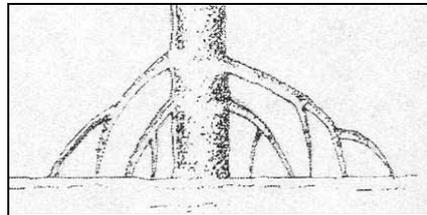
thickened internode of orchids and some other plants, for storage of water and reserves

**rhizome**

thick, horizontal stem, usually underground, sending out shoots above and roots below

**stilt-roots**

growing from the stem above ground and entering the soil, usually for mechanical support:



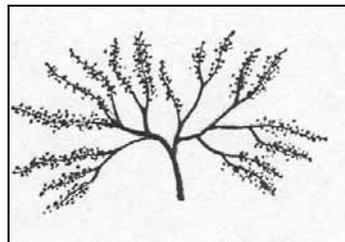
**tuber**

thickened, fleshy, food-storing underground root

## BRANCHES

**dichotomous**

branching that results from division of a growing point into two equal parts, giving repeated forking:



**internodes**

the part between two nodes or joints

**nodes**

knob or joint of a stem at which leaves arise

**stolon**

creeping plant stem or runner, capable of developing rootlets and stem, and ultimately developing new individuals

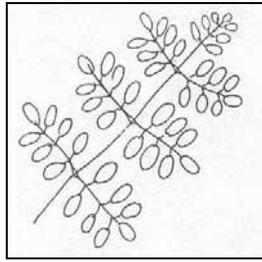
## LEAVES

**alternate**

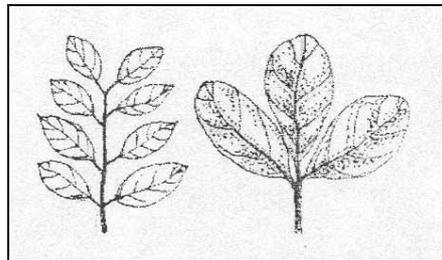
leaves occurring at different levels successively along a stem:



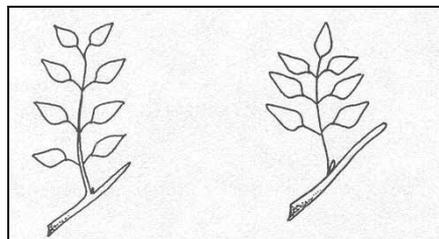
**axil** the point of the upper angle formed between the axis of a stem and a leaf(-stalk)  
**bipinnate** twice divided compound leaf, with leaflets on opposite sides (see pinnate):



**compound leaf** see leaflet  
**deciduous** shedding its leaves periodically (e.g. during dry season)  
**domatium** crevice or hollow in some plants, serving as a lodging for insects (esp. ants) or mites  
**evergreen** not shedding its leaves  
**frond** a leaf, esp. of ferns or palms  
**gall** abnormal outgrowth from plant leaf (or stem) caused by the presence of young insects (e.g. gall wasps)  
**gland** an appendage, or other structure on a plant which secretes sticky or oily substances  
**leaflet** a division of a compound (i.e. subdivided) leaf:

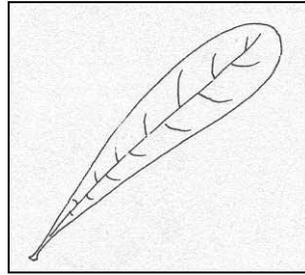


**ligule** a tongue-shaped or strap-shaped organ  
**margin** the edge of a leaf  
**midrib** the central rib or vein of a leaf  
**nerve** a prominent, simple vein or rib of a leaf  
**pinnate** a compound leaf with leaves arranged on opposite sides of an elongated axis; left is even pinnate, right is odd pinnate or imparipinnate:



**secondary leaflets** a (further) division of a leaflet (see above)  
**sheath** organ that (partially) surrounds another organ (e.g. a leaf base)

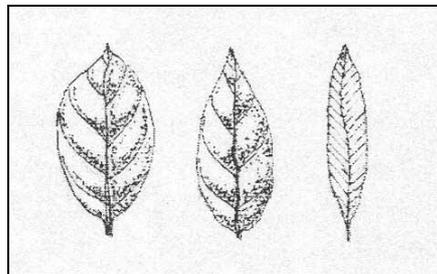
**spat(h)ulate** leaf shaped like a spatula:



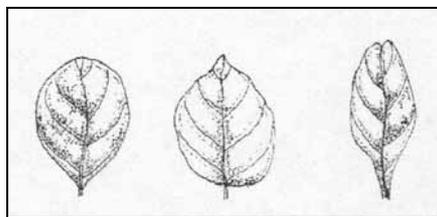
**tendrils** a slender, twining organ used to grasp support for climbing  
**vein** a vascular bundle, usually visible externally, e.g. on the leaf surface  
**whorls (leaves)** a ring-like arrangement of leaves from a common point or node

### LEAF SHAPE

**elliptic/lanceolate/linear-lanceolate:**

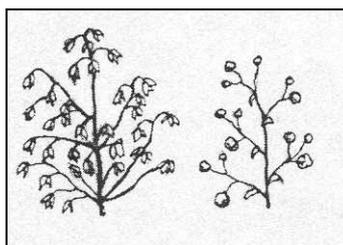


**obovate/ovate:**

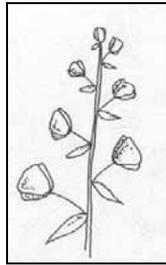


### FLOWER CLUSTER

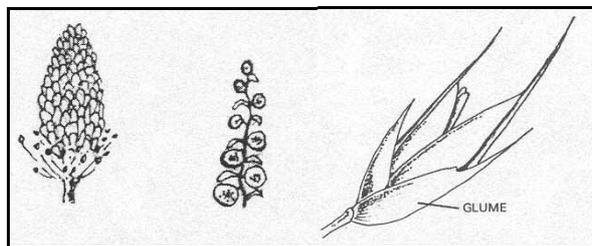
**axillary** positioned in or arising from an axil, which is the point of the upper angle formed between the axis of a stem and any part (usually a leaf(-stalk))  
**catkins** a cluster of flowers consisting of a dense spike of petal-less, unisexual flowers (e.g. in *Salix*)  
**panicle** a branched flower cluster, with flowers maturing from the bottom upwards:



**raceme** an unbranched, elongated flower cluster with flowers maturing from the bottom upwards:



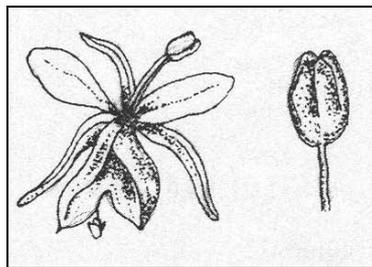
**spike** an unbranched, elongated flower cluster with (sub-)sessile flowers, maturing from the bottom upwards:



**spikelet** a secondary spike  
**terminal** located at the end, e.g. of a branch or twig  
**whorls (flowers)** a ring-like arrangement of flowers from a common point or node

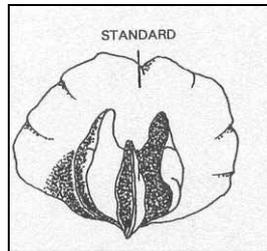
## FLOWER

**anther** the pollen-bearing portion of the stamen; usually expanded and located at the tip/end of this organ:



**calyx** collective term for all the sepals of a flower  
**corolla** collective term for all the petals of a flower  
**disk** an enlargement or outgrowth of the receptacle around the base of the ovary; in the *Asteraceae*, it is the central portion of the flower-head, on which all the individual flowers are implanted  
**epicalyx** a whorl of leaflets at the base of a flowers, outside the calyx (DRAW)  
**filament** the stalk of the stamen, which supports the anther (of the anthers)  
**nectar** a sugary, sticky fluid secreted by many plants  
**petals** (very) modified leaflets that envelope the sexual organs of a flower; often white or coloured  
**pollen** male gametophytes of a seed plant  
**sepals** modified leaflets that form a second envelope around the sexual organs of a flower, outside the envelope provided by the petals; often green or greenish-

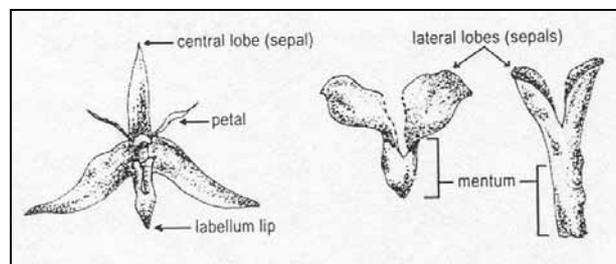
**spur** yellow  
**standard** small, hook-like appendage  
 the upper and usually largest petal of a Papilionaceae flower:



**stigma** portion of the female organs of the flower which is receptive to pollen  
**style** (usually) narrow, stalk-like part of the female organ which connects the stigma to the ovary  
**theca** a pollen sac or cell of the anther (plural = thecae)  
**tube** a hollow, cylindrical structure

### ORCHID FLOWER

**column** the united filaments and style (see below)  
**column-foot** base of the column  
**lip** exceptional base petal of an orchid (see below)  
**mentum** lateral sepals, united into one appendage, that can have very different forms: sac-like, feather-like, globular, etc. (see below)  
**midlobe** the central lobe

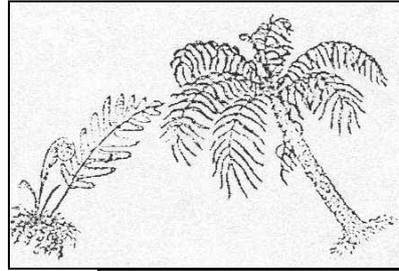


### FRUIT

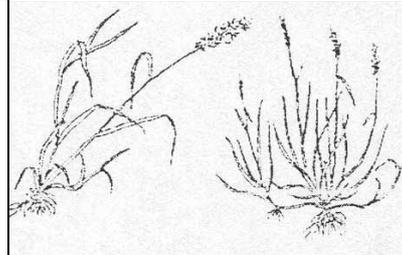
**aril** an appendage growing at or near the hilum of a seed; fleshy thickening of the seed coat (e.g. in *Myristicaceae*)  
**beaked** a narrowed or prolonged tip  
**berry** a fleshy fruit developing from a single female reproductive organ; may be applied to any fruit which is fleshy or pulpy throughout, i.e. without a stony pit or core scar left at former point of attachment  
**hilum** scar left at former point of attachment  
**keeled** with a prominent, longitudinal ridge  
**pod** a dry fruit that opens at maturity, e.g. of legumes (*Leguminosae*)  
**propagule** a structure, such as a seed or spore, which gives rise to a new plant  
**sorus** cluster of sporangia on the surface of a fern leaf (plural = sori)  
**sporangium** spore-bearing case or sac (of fern) (plural = sporangia)  
**spore** reproductive cell of a fern  
**spurred** small, hook-like appendage  
**viviparous** sprouting on the parent plant (e.g. many *Rhizophoraceae*)  
**wing** thin, flat margin bordering the fruit

**THE MAIN PLANT GROUPS:****GROUP A. Ferns (including epiphytic ferns)**  
(*paku, pakis*)

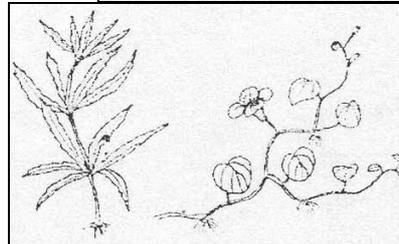
Plants without flowers or stem. Typically, ferns have a woody, root-like rhizome upon which stiff leaf-stalks are directly implanted.

**GROUP B. Grass-like plants**

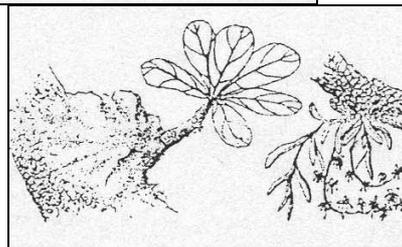
Ground-dwelling herbs, typically with long, linear leaves and inconspicuous flowers.

**GROUP C. Other ground-dwelling herbs.**

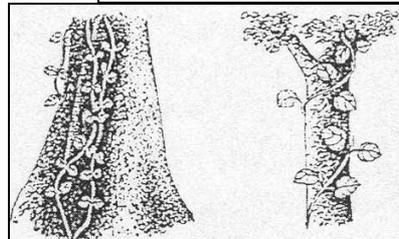
Ground-dwelling herbs, which are not grass-like: i.e., their leaves are not long and linear, and usually have conspicuous flowers. These have soft stems, that are only occasionally woody. Generally they are not taller than two metres.

**GROUP D. Epiphytes (other than ferns)**

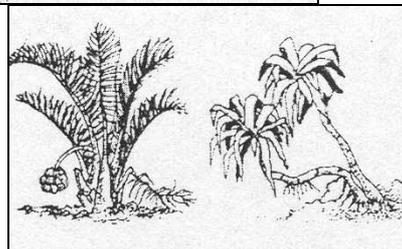
Plants which live on the surface of other plants (usually trees or palms). Epiphytes may be (semi-) parasitic, such as the mistletoes (*bingalo*).

**GROUP E. Vines and climbers.**

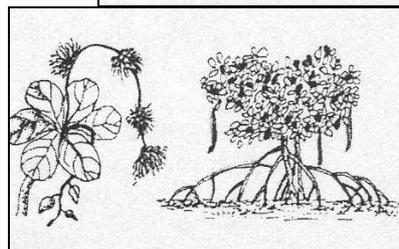
Woody or herbaceous plants that are not self-supporting, but climbing or trailing on some support, such as on trees and shrubs. Note that rattans (*rotan*) are included in the palm section (see Group F.).

**GROUP F. Palms, pandans and cycads**

Stems are woody, straight, and usually tall; unbranched up to the first leaves. Leaves are longer than 1m, and usually divided into many leaflets. This group includes rattans.

**GROUP G. Trees and shrubs**

Large woody plants, either a) tall, with a single main stem or trunk (=tree); or b) smaller, with stems that divide (from the base) into many (sub-) stems (=shrub).





# KEYS

## GROUP A: FERNS

*Note: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.*

- 1 a Ground ferns (growing on the soil): **2**  
b Epiphytic (growing on other plants): **4**
- 2 a Large (> 1 m), woody fern, with a stout main stem, that is erect, covered with large scales, and has thick, fleshy roots; leaves do not have a serrated or toothed edge: **3**  
b Creeping or climbing fern with a green and scaleless root; edges of leaves are sharply toothed: *Stenochlaena palustris* – 3 (Blechnaceae)
- 3 a Tip of sterile leaflets (i.e., the larger, normal leaflets) rounded or blunt, with a short tip: *Acrostichum aureum* – 22 (Pteridaceae)  
b Tip of sterile leaflets long and pointed: *Acrostichum speciosum* – 23 (Pteridaceae)
- 4 a Leaves inserted in a dense spiral, forming a nest-like clump: **5**  
b Other types of ferns: **9**
- 5 a The fern has two, very different types of leaves: **6**  
b Has only one type of leaf: **8**
- 6 a Fertile leaves (with spores on underside) are dichotomously divided into branchlets with a diameter less than 4 cm, pendulous, up to 2 m long: *Platyserium coronarium* – 19 (Polypodiaceae)  
b Fertile leaves are not pendulous: **7**
- 7 a Fertile leaves with distinct leaflets (compound), up to 2 m long: *Drynaria rigidula* – 13 (Polypodiaceae)  
b Fertile leaves lobed, up to 70 cm long: *Drynaria sparsisora* – 14 (Polypodiaceae)
- 8 a Nest-like clump formed by simple, undivided leaves, up to 1.5 m long and with an edge that is not toothed or serrated: *Asplenium nidus* – 2 (Aspleniaceae)  
b The nest-like clump if formed by compound leaves, that are subdivided into leaflets and have a toothed edge: *Asplenium macrophyllum* – 1 (Aspleniaceae)
- 9 a Leaves compound (i.e. subdivided into leaflets): **10**  
b Leaves simple (i.e. not divided) (! note: deeply lobed, but simple leaves sometimes resemble compound leaves): **14**
- 10 a Leaves are pinnate (leaflets not sub-divided again): **11**  
b Leaves are bi-pinnate (leaflets once more sub-divided): **13**
- 11 a Hairs, if present, only on rhizome: *Photinopteris speciosa* – 17 (Polypodiaceae)  
b Hairs on leaf stalk and leaflets: **12**
- 12 a Leaflets are densely covered with hairs on both sides: *Nephrolepis acutifolia* - 11 (Nephrolepidaceae)  
b Leaflets are hairy on one sides: *Ctenopteris moultoni* – 7 (Grammitidaceae)
- 13 a Hairs, if present, only on rhizome: *Davallia divarcata* – 4 (Davalliaceae)  
b Leaf stalk and lower surface of leaf axis covered with (scattered) hairs: *Hymenophyllum holochilum* – 8 (Hymenophyllaceae)
- 14 a Leaves very small and numerous, spirally arranged in pairs of three and covering the entire branch like scales. Sporangia occur at the end of the leafy spikes: *Lycopodium carinatum* – 10 (Lycopodiaceae)

- b Leaves larger, bearing sporangia in clusters (sori) on their lower surface: **15**
- 15 a Leaves lobed or dissected: **16**
- b Leaves entire (not lobed), lanceolate, elliptic or round: **17**
- 16 a Rhizome very slender, about 1 mm diameter. Scales brown with pale edge, about 3 mm long. Leaf stalk very slender, 1-3 cm long: *Davallia parvula* – 5 (Davalliaceae)
- b Rhizome 7 mm diameter, scales, 3-4 mm, edge finely toothed in the narrow part. Leaf stalk up to about 30 cm long: *Phymatodes scolopendria* – 18 (Polypodiaceae)
- 17 a Sterile leaves with a toothed edge: *Pachypleuria angustata* – 6 (Davalliaceae)
- b Sterile leaves with a smooth or wavy edge (*Myrmecophila sinuosa*): **18**
- 18 a Sori growing in elongated clusters or grooves along the edge of the leaves: **19**
- b Sori not arranged in elongated clusters along margin of leaves: **20**
- 19 a Fertile and sterile leaves very different in size and shape. Sterile leaves nearly round, 1cm: *Drymoglossum piloselloides* – 12 (Polypodiaceae)
- b Rhizome with scales nearly black, about 1 cm long with a hair-like tip. Leaves 30-60 by 0.7-2 cm with sori (spore clusters) in marginal groove: *Vittaria elongata* – 24 (Vittariaceae)
- 20 a Fertile leaves long, lanceolate, with a distinct sterile section and a fertile end section with the sori located on the lower surface. Scales of rhizome round, 1 mm: *Pyrrosia longifolia* – 20 (Polypodiaceae)
- b Sori spread evenly on the blade of fertile leaves, with no clear distinction between sterile and fertile sections: **21**
- 21 a Sori evenly spread over the fertile leaves, not arranged in rows. Fertile leaves shorter than sterile leaves but with a longer stalk: *Elaphoglossum amblyphyllum* – 9 (Lomariopsidaceae)
- b Sori arranged in rows along veins or midrib: **22**
- 22 a Sori arranged in one or more rows along the midrib: *Myrmecophila sinuosa* – 16 (Polypodiaceae)
- b Sori arranged in rows along or in between the parallel main veins: **23**
- 23 a Sori linear, in single lines between adjacent main veins, at maturity about 2 mm wide, the lines sometimes interrupted, not reaching midrib or margin of leaf. Rhizome about 2 mm diameter, bearing leaves about 5-10 mm apart, the younger parts densely scaly; scales about 6 mm long, stiff and almost bristle-like: *Selliguea heterocarpa* – 21 (Polypodiaceae)
- b Lines of sori project from the midrib, sloping and running up to the edge of the leaf. Rhizome covered with large, lanceolate scales: *Loxogramma involuta* – 15 (Polypodiaceae)

## GROUP B: GRASSES & GRASS-LIKE PLANTS

*Note: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.*

- 1 a Leaf blades absent (at most a sheath around stem): **2**
- b Leaf blades present: **6**
- 2 a Flower clusters branched (compound): **3**
- b Flower cluster a single, terminal spike: **4**
- 3 a Stem 50-200 cm tall, 5-20 mm wide at base, flower cluster 5-10(-15) cm long, dense and much branched: *Scirpus lacustris* – 39 (Cyperaceae)
- b Stem 60-150 cm tall, 3-10 mm wide at base, flower cluster 2-8 cm long, loose and less compound: *Scirpus litoralis* – 40 (Cyperaceae)

- 4 a Stem hollow, divided by partitions, 0.8-2m tall: *Eleocharis dulcis* – 30 (Cyperaceae)  
b Stem not divided by partitions, usually filled with pith: **5**
- 5 a Dwarf sedge, 1-7 cm tall, stem round: *Eleocharis parvula* – 31 (Cyperaceae)  
b Small sedge, 25-60 cm tall, stem round at base, bluntly triangular just below the flower cluster: *Eleocharis spiralis* – 32 (Cyperaceae)
- 6 a Stem bluntly to very sharply triangular (occasionally only just below the flower cluster: **7**)  
b Stem round, occasionally flattened or grooved: **18**
- 7 a Spikelet ovoid (or oblong-ovoid), 1½-3 times as long as wide: **8**  
b Spikelet linear, or compressed oblong, 3-15 times as long as wide: **14**
- 8 a Usually large (80-180(-200) cm) sedge, with long (30-80 cm) leaves, also just below or enveloping the compound flower cluster: **9**  
b Small to medium-sized (5-80 cm) sedges, simple to compound flower cluster: **10**
- 9 a Always large sedge (80-200 cm), with large, loose terminal flower clusters: *Scirpus grossus* – 38 (Cyperaceae)  
b Small to large sedge (15-30-180 cm tall, with dense terminal flower clusters: *Scirpus maritimus* – 41 (Cyperaceae)
- 10 a Ligule (tongue-like appendage at base of leaf blade) present: **11**  
b Ligule absent: **13**
- 11 a Leaves much shorter than stem: *Fimbristylis ferruginea* – 34 (Cyperaceae)  
b Leaves 0.5-1 times length of stem: **12**
- 12 a Small sedge (5-30 cm), glabrous, creeping rhizome, simple flower cluster: *Fimbristylis polytrichoides* – 35 (Cyperaceae)  
b Medium-sized sedge (20-80 cm), leaf sheath hairy, flower cluster simple to sub-compound, creeping rhizome: *Fimbristylis sieberiana* – 37 (Cyperaceae)
- 13 a Small to medium-sized sedge (10-50 cm), glabrous, with short rhizome and compound flower cluster: *Fimbristylis cymosa* – 33 (Cyperaceae)  
b Small to medium-sized sedge (10-30 (-60) cm), pubescent to glabrous, flower cluster simple to sub-compound: *Fimbristylis sericea* – 36 (Cyperaceae)
- 14 a Slender stemmed sedges (diameter 1-2mm), with a simple or sub-compound flower cluster: **15**  
b Stout stemmed sedges (diameter 3-10 mm), with compound flower cluster: **16**
- 15 a Spikelet linear-lanceolate, round, 5-15 mm by 2-2½ mm, leaves less than half of stem length, bracts 1-6 cm long, stolons creeping, long: *Cyperus stoloniferus* – 29 (Cyperaceae)  
b Spikelet linear, strongly compressed, 10-20 by 2-2½ mm, bracts up to 30 cm long, creeping rhizome: *Cyperus scariosus* – 28 (Cyperaceae)
- 16 a Leaves few, short (up to 30 cm), large sedge (0.6-1.75 m), spikelets linear, compressed, 10-30 by 1.3-1.8 mm, stem diameter up to 10 mm, flower cluster compound, creeping rhizome, bracts up to 75 cm: *Cyperus malaccensis* – 27 (Cyperaceae)  
b Leaves many, length varying from just shorter to longer than the stem, stem diameter 3-6 mm, no or very short rhizome: **17**
- 17 a Bracts very long, up to 100 cm, stem up to 6 mm diameter, spikelet oblong, compressed, 5-9(-13) by 2-2½ mm: *Cyperus javanicus* – 26 (Cyperaceae)  
b Bracts shorter, 10-30 cm long, stem 3-4 mm diameter, spikelets linear, round, 5-15 by 1-1½ mm: *Cyperus compactus* – 25 (Cyperaceae)

- 18 a Very large, robust plants, 1.5-4 m tall: **19**  
 b Small to medium-large grasses, 0.1-1.5 m: **21**
- 19 a Leaves as long as stem, 1.5-3 m, erect, flower cluster a single terminal cigar-shaped spike 15-30 cm long: *Typha angustifolia* – 51 (Typhaceae)  
 b Leaves alternate, 20-80 cm long, stem 1.5-3(-4) m, flower cluster a large 20-60-(75) cm terminal panicle, not cigar-like but looser: **20**
- 20 a Leaves 20-60 cm long, stem up to 4 m, flower clusters a large, loose silvery plume, 10-30 cm wide and 20-75 cm long: *Phragmites karka* – 47 (Poaceae)  
 b. Leaves up to 80 cm long, stem up to 3 m, flower clusters a long narrow panicle, 25-60 cm long by 4-10 cm wide: *Myriostachya wightiana* – 45 (Poaceae)
- 21 a Ligule long (0.75-4 mm), grasses 0.15-1.5 m tall: **22**  
 b Ligule very short (0.2 mm), grasses, 0.5 m tall: **24**
- 22 a Flower cluster consists of 2 terminal spikes, stem is 0.12-0.5 m, creeping rhizome: *Paspalum vaginatum* – 46 (Poaceae)  
 b Flower cluster is a terminal panicle: **23**
- 23 a Ligule 2-3 mm, irregularly toothed, annual without creeping rhizome, 0.5-1.5 m tall: *Leptochloa neesii* – 44 (Poaceae)  
 b Ligule 3-4 mm, membranous, perennial with or without stolon, 0.5-1.0 m tall: *Diplachne fusca* – 43 (Poaceae)
- 24 a Flower cluster a single 1½-4 cm by 1½ mm spike, 0.1-0.25 (-0.4) m tall, stem filled with pith, creeping rhizome: *Zoysia matrella* – 50 (Poaceae)  
 b Otherwise: **25**
- 25 a Flower cluster 3-9 terminal spikes, each 1½-11 cm long, stems 0.1-0.4 m tall, creeping rhizome: *Cynodon dactylon* – 42 (Poaceae)  
 b Otherwise: **26**
- 26 a Flower cluster a terminal panicle, 4½-12 cm long, with spikelets 2.25-3 cm long, stems 0.25-0.5 m long, hollow: *Sporobolus virginicus* – 48 (Poaceae)  
 b Flower cluster 2-5(-6) alternate spikelets, each 8-18 mm long, stems 0.1-0.45 m tall, solid: *Xerochloa imberbis* – 49 (Poaceae)

## GROUP C: OTHER GROUND-DWELLING HERBS

*Note 1: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.*

*Note 2: Excluding grass-like herbs and ground-dwelling herbs.*

- 1 a Aquatic plants, usually submerged in the water, rooting or free-floating : **2**  
 b Not so: **6**
- 2 a Aquatic or marsh herb with latex in the long, broad pointed leaves; leaves are alternate and have a smooth edge: *Cryptocoryne ciliata* – 59 (Araceae)  
 b Strict aquatic herbs, without latex. Leaves in clusters or opposite: **3**
- 3 a Opposite, 3-7.5 cm long, thread-like leaves, with a smooth edge: *Ruppia maritima* – 73 (Ruppiaceae)  
 b Leaves in clusters, and with toothed edges: **4**

- 4 a Spines absent on lower side of leaf; leaf blade has 12-21 spiny teeth along each side: *Najas browniana* – 69 (Najadaceae)  
 b Lower side of leaf has 1-30 spines: **5**
- 5 a Edge of leaf has 1-40 conspicuous, dark brown teeth, each up to half as long as the width of the leaf blade: *Najas indica* 70 (Najadaceae)  
 b Edge of leaf with 2-7 coarse, brown, spiny teeth, each up to as long as the width of the leaf blade: *Najas marina* – 71 (Najadaceae)
- 6 a Plants with copious, thick latex in leaves and stem: **7**  
 b No latex: **10**
- 7 a Long, pointed leaves: **8**  
 b Leaves triangular: **9**
- 8 a Marsh or aquatic herb, 35-50 cm tall, with 15-41 cm long, pointed leaves, and a smooth edge. Flowers are purplish and not scented: *Cryptocoryne ciliata* – 59 (Araceae)  
 b Plant of sandy soils, beaches, swamps, edges of mangroves, 40-60 cm tall. Flowers large (7-12 cm), white, sweet-scented and showy: *Crinum asiaticum* – 57 (Amaryllidaceae)
- 9 a Large plant, 75-140 cm tall, with spiny stem: *Lasia spinosa* – 60 (Araceae)  
 b Large plant, up to 2m tall, with large, ovate to triangular leaves with lobes at the base. The leaf stalk is 30-150 cm long, and not spiny: *Colocasia esculenta* – 58 (Araceae)
- 10 a Plants apparently without leaves: **11**  
 b With leaves: **12**
- 11 a Succulent herb with erect branches, 15-30 cm tall: *Halocnemum cinereum* – 61 (Chenopodiaceae)  
 b Robust herb, 30-60 cm tall, lower part woody, widely forked from base. Leaf sheaths are typically bluish-green: *Salicornia indica* – 62 (Chenopodiaceae)
- 12 a Leaves sub-divided into leaflets. Creeping or scrambling plant, 2-6 m long, with pink flowers and pods: *Canavalia maritima* – 68 (Leguminosae)  
 b Leaves not subdivided into leaflets: **13**
- 13 a Leaves opposite (but sometimes very unequal in size): **14**  
 b Leaves alternate: **20**
- 14 a Prostrate to straggling, succulent herb, with smooth-edged leaves and pink flowers: **15**  
 b Erect or climbing, non succulent herb, leaf edges spiny, toothed or norched, flowers white to pale mauve, violet or yellow: **16**
- 15 a Flowers solitary in leaf axils, with distinct stalk and narrow leaves: *Sesuvium portulacastrum* – 55 (Aizoaceae)  
 b Flowers singularly or in groups in leaf axils, without a distinct stalk, leaves oval to obovate: *Trianthema portulacastrum* – 56 (Aizoaceae)
- 16 a Often climbing herb with a slender stem, thin toothed leaves and yellow flowers. *Wedelia biflora* – 108 (Asteraceae) Note: included among the climbers, as this is its usual habit.  
 b Robust – occasionally straggling – herb or shrublet, with violet, white or mauve flowers: **17**
- 17 a Flowers in a 20-40 cm terminal raceme with many small, deep violet flowers (<10 mm long): *Stachytarpheta jamaicensis* – 74 (Verbenaceae)  
 b Flowers in 5-20 cm long terminal spikes, with white to pale mauve flowers, >2 cm long: **18**
- 18 a Flowers white and small (19-25mm), spines (on leaves) absent, usually straggling to climbing slender stems: *Acanthus volubis* – 54 (Acanthaceae)

- b Flowers white to pale mauve, leaves spiny, plant usually robust, not climbing: **19**
- 19 a Flowers 3.5-4 cm, pale bluish violet to pale violet (seldom white), with one leaflet and two supporting leaflets. Leaves spiny. Fruit 2.5-3 cm long, seeds 10 mm long: *Acanthus ilicifolius* – 53 (Acanthaceae)
- b Flowers 2-2.5(-3) cm, white, with only one leaflet. Leaves spiny. Fruit less than 2 cm long, seeds 5-7 mm: *Acanthus ebracteatus* – 52 (Acanthaceae)
- 20 a Erect succulent plant, up to 45 cm tall, leaves narrow, rounded in cross-section, juicy fleshy tissue, salty to taste: *Suaeda maritima* – 63 (Chenopodiaceae)
- b Straggling ground vines: **21**
- 21 a Leaves 3-lobed, foetid smelling when crushed, flowers with 5 sepals and 5 petals, surrounded by a whorl of fine, threadlike green filaments: *Passiflora foetida* – 72 (Passifloraceae)
- b Leaves not 3-lobed, flower fused to large white, pink or purplish, trumpet-like flowers: **22**
- 22 a Flowers 9-12 cm long, usually white (sometimes purple/violet), fruit 2-2.5 cm long: *Ipomoea tuba* – 67 (Convolvulaceae)
- b Flowers no longer than 5 cm, usually pink, purple or violet, fruit <2 cm long: **23**
- 23 a Fruit 12-17 mm diameter, seeds 6-10 mm long; leaves deeply notched at the top, shaped like a goat's hoof (hence the name): *Ipomoea pes-capre* – 66 (Convolvulaceae)
- b Fruit 6-9 mm, leaves with pointed tip, usually deeply heart-shaped or kidney-shaped: **24**
- 24 a Flowers 3-4.5 cm long, fruit usually 9 mm, leaves 1-7.5 by 1-10 cm, green: *Ipomoea gracilis* – 64 (Convolvulaceae)
- b Flowers 2-3 cm long, fruit 6-7 mm, leaves 2.5-6 by 2-5 cm, usually with purplish edge and spots: *Ipomoea maxima* – 65 (Convolvulaceae)

## GROUP D: EPIPHYTES

Note 1: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.

Note 2: Epiphytic ferns are discussed in Group A

- 1 a Orchids, usually with pseudo-bulbs or tuberous roots, leaves alternate, lanceolate or elliptic, and often with leaf-sheaths extending around the stem: **2**
- b Other types of plants, without the typical orchid flowers, thick roots, leaf-sheaths or pseudo-bulbs: **12**
- 2 a Orchids with small leaves, maximum 1.5 cm long by 0.4 cm broad; only one distant leaf between nodes or per pseudobulb: **3**
- b Orchids with leaves longer than 1.5 cm; often more than one leaf between nodes, not distant but covering stem or bulb, or one leaf per node, but drooping: **4**
- 3 a Plant with pseudo-bulbs, and stiff, elliptic leaves, one per pseudobulb. Flower clusters borne on rhizome, with orange coloured flowers (about 6 mm broad), often with dark red veins: *Bulbophyllum xylocarpi* – 91 (Orchidaceae)
- b Plant without pseudo-bulbs, but with thin, erect stems, measuring about 0.5 cm between nodes, with one leaf each. Flowers occur singularly, pale yellowish (violet-veined): *Dendrobium subulatum* – 96 (Orchidaceae)
- 4 a Plants with clearly distinguishable stems. Plants at least 25 cm large when fully grown: **5**
- b Plants with (very) short, not clearly distinguishable stems, much smaller than 25 cm when fully grown: **8**

- 5 a Leaves small, the largest about 2.5 by 0.7 cm, covering the stem like scales. End part of the plant has club-shaped, sheathing leaves only. Many, single, white flowers (4 x 4 mm), with reflexed sepals and petals: *Dendrobium aloifolium* – 93 (Orchidaceae)  
 b Leaves at least 7.5 cm long, not covering the stem like scales; with a multi-flowered flower cluster. Plants measure up to 75 cm: **6**
- 6 a Flowers large, 8-10 cm across, branches with leaves usually 1-2 m tall, semi-erect: *Dendrobium moschatum* – 94 (Orchidaceae)  
 b Flowers smaller, 2-3.5 cm across, branches usually spreading or drooping, 30-75 cm tall: **7**
- 7 a Widely branched plant, measuring 5-6 cm between nodes. Leaves only one between nodes, 7.5-30 by 0.5 cm. Flower cluster 7 cm long, with yellow-white flowers: *Dendrobium teretifolium* – 97 (Orchidaceae)  
 b Drooping, long stem, branched, with thick roots. Leaves with overlapping leaf-sheaths, 10-25 by 2-3 cm. Flower clusters 20-30 cm long, white flowers (often violet-red blotches). Petals are curved back. Strong aromatic smell: *Aerides odoratum* – 90 (Orchidaceae)
- 8 a Plants with pseudobulbs, often hidden by leaves: **9**  
 b Plants without pseudobulbs: **10**
- 9 a Clearly distinguishable pseudo-bulbs, each with two leaves. Flowers occur singularly; pale yellow, sweet smelling: *Dendrobium pachyphyllum* – 95 (Orchidaceae)  
 b Large plant, up to 80 cm. Pseudo-bulbs hidden by the 45-80 cm by 5 cm leaves. Flowers in clusters, at least 75 cm long: *Cymbidium finlaysonianum* – 92 (Orchidaceae)
- 10 a Plant up to 20 cm long, with a very short, erect stem, bearing 4-6 leaves, the largest about 18 by 2 cm. Flower clusters up to 23 cm long, with flowers greenish or brownish in dense whorls. Petals and sepals are curved back: *Oberonia iridifolia* – 98 (Orchidaceae)  
 b Plants significantly smaller in size, and with leaves about 3 by 0.5 cm. Flower cluster is 7-15 cm long: **11**
- 11 a Flower cluster 7-15 cm long, with very small, tomato-red flowers, the lower ones crowded, the upper whorled; all sepals are curved back. Leaves measure 3.5 by 0.7 cm: *Oberonia laeta* – 99 (Orchidaceae)  
 b Flower cluster up to 7 cm long, flowers in regular whorls of about 8; flowers yellow to orange, lip red-brown, 1-1.5 mm across. Only the lateral sepals are curved back. Leaves measure 3 by 0.4 cm: *Oberonia rhizophoreti* – 100 (Orchidaceae)
- 12 a Plants with a much swollen, usually ant-inhabited base of the stem: **13**  
 b Plants without a much swollen base of the stem: **14**
- 13 a Swollen base of plant is spineless. Leaves measure 5-15 by 2-7 cm. Flowers occur in groups of 3-5 in cavities in the strongly thickened nodes of the stem: *Hydnophytum formicarium* – 101 (Rubiaceae)  
 b The swollen base of the plant is armed with hard spines. Leaves measure 12-16 by 4-8 cm. Flowers occur in pairs in cavities on the stem: *Myrmecodia tuberosa* – 102 (Rubiaceae)
- 14 a Small herbaceous plants with latex, leaves opposite: **15**  
 b Larger shrub-like plants without latex: **18**
- 15 a Large epiphyte, branches 0.8-1.5 m long, leaves 10-15 cm long, pointed, flowers in drooping, terminal, 15-30-flowered clusters: *Hoya parasitica* – 81 (Asclepiadaceae)  
 b Smaller epiphytes, 30-100 cm long, usually creeping or climbing, flowers in leaf axils in clusters of up to 10 flowers: **16**
- 16 a Plant with flat, broadly-oval leaves, covered with a fine 'powder'; leaves are all more-or-less of the same type: *Dischidia nummularia* – 79 (Asclepiadaceae)

- b Climbing or winding plant, with two types of leaves: **17**
- 17 a The two types of leaves are: i) bag-like, 5-12 cm long, and ii) oval-elliptic leaves, 1-2 cm long: *Dischidia rafflesiana* – 80 (Asclepiadaceae)
- b The two types of leaves are: i) round, thick and fleshy, spoon-like, 1.5-4 cm long, and ii) flat and oblong, 1.5-2.5 cm long: *Dischidia benghalensis* – 78 (Asclepiadaceae)
- 18 a Leaves fleshy, with three parallel main veins. Some roots developed into thick, sausage-like tubers; tops of stems are compressed. Flowers and fruit occur on bright, orange-red stalks: *Pachycentria constricta* – 89 (Melastomataceae)
- b Leaves not with three main parallel veins; no roots developed into tubers, roots often not clearly visible: **19**
- 19 a No clear roots, but a slightly swollen base of the stem, where the plant is attached to its host plant - parasitic (Loranthaceae/mistletoes): **20**
- b Roots normal and clearly visible; plants may also occur as terrestrial plants on occasion: **25**
- 20 a Leaves without stalks or with very short stalks (<2 mm), flowers very small, greenish-yellow: *Viscum ovalifolium* – 88 (Loranthaceae)
- b Leaves with distinct stalks, flower tubes at least 10 mm long when mature: **21**
- 21 a Leaves variable, but large, usually 4-20 cm long, flowers not in groups of 3, but often >10: **22**
- b Leaves less than 8.5 cm long, flowers in groups of 3: **23**
- 22 a Flower tubes 13-26 mm long, often in dense clusters of up to 20 flowers; flowers 5-merous: *Dendrophthoe pentandra* – 86 (Loranthaceae)
- b Flower tubes 5-10(-14) mm long, often in clusters of 4-14 flowers; flowers 6-merous: *Macrosolen cochinchinensis* – 87 (Loranthaceae)
- 23 a Leaves fleshy, up to 5 cm long; flowers up to 30 mm long, red, with greenish-yellow base: *Amyema gravis* – 84 (Loranthaceae)
- b Leaves not fleshy, 2.5-8.5 cm long, flowers not more than 20 mm long: **24**
- 24 a Flowers orange, 19-20 mm long; leaf stalk 8-10 mm: *Amyema anisomeres* – 83 (Loranthaceae)
- b Flowers 10-16 mm long; leaf stalk 3-6 mm: *Amyema mackayense* – 85 (Loranthaceae)
- 25 a All leaves simple, occurring in whorls of 3-5 at the upper two nodes of the stem. Flowers large, showy, orange-red and trumpet-shaped: *Rhododendron brookeanum* – 82 (Ericaceae)
- b Leaves compound, usually hand-shaped with 3-7 leaflets; some plants may have simple leaves in the upper part, and compound leaves in the lower parts: **26**
- 26 a Leaves simple in the upper parts, trifoliolate in the lower parts; leaves thinly leathery, leaf edges flat, venation evident to merely obscure; flower clusters larger than the leaf, drooping: *Schefflera lanceolata* – 76 (Araliaceae)
- b Leaves compound, with 3-7 leaflets: **27**
- 27 a Leaves compound, hand-shaped, leaflets 4-6, smooth, ovate-elliptic to obovate-elliptic, not more than 1.5 times as long as broad; flower clusters with some branches as long as or shorter than the elongated main axis; flowers very small; fruits usually splitting into 5-6 parts, yellow or orange, later black: *Schefflera elliptica* – 75 (Araliaceae)
- b Compound leaves, hand-shaped, with 3-7 leaflets; leaflets thin, with narrowed base, pointed tip, and leaf edges coarsely and obscurely toothed; flower clusters in panicles that are large and open; flowers small, ovary 6-8 locular; stamens 6-16: *Schefflera ridleyi* – 77 (Araliaceae)

## GROUP E: VINES & CLIMBERS

Note: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.

- 1 a Leaves apparently absent; thin, thread-like twining climber: *Cassytha filiformis* – 114 (Lauraceae)  
b Leaves present: **2**
- 2 a Leaves simple: **3**  
b Leaves compound: **22**
- 3 a Leaves opposite: **4**  
b Leaves alternate/spirally arranged: **17**
- 4 a Stem with lenticels/warts/dots on older stems: **5**  
b Not as above: **10**
- 5 a Hairs or scales on (young) stems: **6**  
b No such hairs/scales on stems: **8**
- 6 a With leaflets (stipules) at base of the leaf stalk: *Ryssopterys timoriensis* – 126 (Malpighiaceae)  
b No stipules present: **7**
- 7 a Finely grooved, soft hairy (young stems) branchelets with lenticels; fruit globular and covered by orange remains of flower (calyx), 1.5 -2.5 cm: *Olax imbricata* – 223 (Olacaceae) (Note: normally a tree or shrub, and included in group G trees/shrubs)  
b Stem full of warts and short, smoothly hairy; thin fruits, 10-12 cm, with a hooked point: *Gymnanthera paludosa* – 104 (Asclepiadaceae)
- 8 a With leaflets at base of leaf stalk (= stipules); no latex (check bark!): *Tristellateia australasiae* – 127 (Malpighiaceae)  
b No stipules; with latex: **9**
- 9 a Leaf stalk thin; leaf surface and leaf stalk sparsely covered with hairs; stem pale-dotted: *Oxystelma carnosum* – 105 (Asclepiadaceae)  
b Leaf stalk thick; leaves , not hairy; stem with warts: *Finlaysonia obovata* – 103 (Asclepiadaceae)
- 10 a With leaflets at base of leaf stalk (=stipules): *Loeseneriella macrantha* – 109 (Celastraceae)  
b No stipules: **11**
- 11 a Leaf margin notched or toothed: **12**  
b Leaf margin smooth: **13**
- 12 a Hairy on leaves and stem: *Wedelia biflora* – 108 (Asteraceae)  
b Both leaves and stem smooth: *Smythea lanceata* – 130 (Rhamnaceae)
- 13 a Flowers large (4cm long), white with purple-reddish stamens protruding 2 cm beyond the rest of the flower, fruit egg-shaped to round, 1.5 cm diameter: *Clerodendron inerme* – 266 (Verbenaceae)  
Note: the species is more commonly a shrub or small tree, and is described in group G trees/shrubs.  
b Flowers smaller, usually yellow, yellowish-green, or whitish: **14**
- 14 a Flowers in many-flowered clusters (>15-20), small and yellowish green or white: **15**  
b Flowers in smaller clusters of 3-10, yellow: **16**
- 15 a Flowers yellowish-green, fruit ellipsoid,, 2-3 by 7-8 mm, hairy: *Calycopteris floribunda* – 110

- (Combretaceae)
- b Flowers yellowish-green, whitish, or greenish-white, fruit ellipsoid 2.5-4 cm long, scaly, with four wings: *Combretum tetralophum* – 111 (Combretaceae)
- 16 a Leaves small, 10-18 mm by 30-60(-80)mm, flowers in clusters of 3-4, fruit 2 by 3.5-4 cm: *Sarcolobus carinatus* – 106 (Asclepiadaceae)
- b Leaves larger, 30-55 by 40-90 mm, flowers in clusters of 5-10, fruit large, 7 by 8 cm: *Sarcolobus globosus* – 107 (Asclepiadaceae)
- 17 a Tendrils present, for climbing: **18**
- b Tendrils absent: **20**
- 18 a Tendrils at the ends of long, lanceolate leaves; fruits small orange berries in large clusters: *Flagellaria indica* – 113 (Flagellariaceae)
- b Tendrils located in leaf axils: **19**
- 19 a Robust woody vine, with ovate to oblong leaves, small flowers (<6mm) and elongated 3.5 cm long fruits with 5 papery wings: *Lophopyxis maingayi* – 125 (Lophopyxidaceae)
- b Herbaceous small vine, with 3-lobed (simple) leaves, large flowers (3-5 cm), and a round, succulent orange berry, 20 mm diameter: *Passiflora foetida* – 72 (Passifloraceae) Note: included among the ground herbs, as this is its more common habit.
- 20 a Leaves in whorls, elliptic to lanceolate, flowers 5-merous, white or yellowish-white, sweet-scented, in whorls of 3; fruit 10-12 by 30-35 cm, usually with 5 wings: *Combretum trifoliatum* – 112 (Combretaceae)
- b Leaves alternate: **21**
- 21 a Leaves broadly heart-shaped, 16-28 by 10-24 cm, flowers greenish-white to yellowish, on a cluster 16-40 cm long; fruit a white berry, 9-10 mm long: *Anamirta cocculus* – 128 (Menispermaceae)
- b Leaves ovate to ovate-elliptic, 6-17 by 4-11 cm, flowers yellowish-green, on a cluster up to 11 cm long; fruit a white or red berry, 4-6 by 7-8 mm: *Hypserpa polyandra* – 129 (Menispermaceae)
- 22 a Leaves conspicuously twice divided into leaflets: **23**
- b Leaves only once divided into leaflets: **24**
- 23 a Leaves pale bluish-green, up to 30 cm long; 2-6 pairs of primary leaflets; minute, undivided leaflets (stipules) located at base of leaf stalk: *Caesalpinia crista* – 118 (Leguminosae)
- b Leaves up to 1 m long, 6-10 pairs of primary leaflets; conspicuous (once or twice divided) leaflets at the base of the leaf stalk: *Caesalpinia bonduc* – 117 (Leguminosae)
- 24 a Leaflets many, 8-17 pairs (i.e. 16-34 leaflets), flower clusters 2-7 cm long, flowers 9-15 mm long, variable in colour, pods oblong, swollen, 2-4(5) cm long, 1-1.5 cm wide: *Abrus precatorius* – 115 (Leguminosae)
- b Leaflets few, numbering 3-14 (<7 pairs): **25**
- 25 a Leaflets always 3, large, woody liana, 8-15 m, flowers in long, pendulous clusters from leaf axils; flowers greenish- white; pods 10-15(-30) cm long, flat and have two wings along suture; densely covered with orange-brown irritant bristles: *Mucuna gigantea* – 124 (Leguminosae)
- b Leaflets 3-14, variable on same plant: **26**
- 26 a With leaflets (stipules) at the base of the leaf stalk: **27**
- b Without stipules: **28**
- 27 a Old stems dark brown or black with many lenticels; 3-7 leaflets: *Dalbergia candenatensis* – 119 (Leguminosae)
- b Old stems light to darkbrown, few or no lenticels; 3-5 leaflets: *Dalbergia menoides* – 120 (Leguminosae)

- 28 a Leaflets 7-11 (3-5 pairs, plus one terminal leaflet); sepals 5, deep purple; petals 5, white to pink; pod, hairy, flat, oblong, pointed, 2 by 5-10 cm: *Derris scandens* – 121 (Leguminosae)  
 b Leaflets usually less than 7: **29**
- 29 a Huge woody climber, flowers greenish, petals tinged reddish at base; pods huge, straight to slightly curved, up to 100-135 cm by 7-15 cm; seeds 4-6 cm in diameter: *Entada phaseoloides* – 123 (Leguminosae)  
 b Pods less than 30 cm long: **30**
- 30 a Leaflets 5-7; flowers green; pod 6-27 cm long, constricted between seeds: *Aganope heptaphylla* – 116 (Leguminosae)  
 b Leaflets 3-7, but most leaves trifoliate; flowers white or pinkish; pod 2-4.5 cm long, not constricted: *Derris trifoliata* – 122 (Leguminosae)

## GROUP F: PALMS, CYCADS & PANDANS

*Note: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.*

- 1 a Climbing, very spiny rattan: *Calamus erinaceus* – 131 (Arecaceae)  
 b Not climbing: **2**
- 2 a Stemless, with 2-9 m long leaves deriving from near the ground: *Nypa fruticans* – 135 (Arecaceae)  
 b With distinct stems: **3**
- 3 a With distinct, tall stilt-roots; leaves 70-250 cm long: *Pandanus tectorius* – 139 (Pandanaceae)  
 b Without stilt-roots: **4**
- 4 a Leaves not sub-divided into leaflets, but large and round: *Corypha saribus* – 133 (Arecaceae)  
 b Leaves elongated, and sub-divided into many leaflets: **5**
- 5 a Leaflets drooping, with a blade 1.8-3.6 m long; stem with many 2.5-6.5 cm long black spines: *Oncosperma tigillarum* – 136 (Arecaceae)  
 b Leaflets not drooping, leaf blades less than 1.6 m long; stem not spiny: **6**
- 6 a Thorns on the leaf stalk: **7**  
 b No thorns on leaf stalk: **8**
- 7 a Leaf elongated, with many leaflets spread along a central stem, pointed upwards sometimes yellowish: *Phoenix paludosa* – 137 (Arecaceae)  
 b Leaf fan-shaped, with leaflets radiating from one central point: *Licuala spinosa* – 134 (Arecaceae)
- 8 a Leathery leaflets are linear-shaped, plant usually 2-5 m tall: *Cycas rumphii* – 138 (Cycadaceae)  
 b Leaves fish-tail (rhomboid) shaped, tall (10-20m) palm: *Caryota urens* – 132 (Arecaceae)

## GROUP G: TREES & SHRUBS

*Note: Bold numbers denote number in key, while normal numbers following a species name correspond with the species number as this is dealt with in this second part of the mangrove guidebook.*

- 1
  - a Trees and shrubs with very small leaves (not to be confused with leaflets of compound leaves), less than 1.5 cm long or apparently absent altogether: **2**
  - b Trees and shrubs with leaves > 1.5 cm long: **4**
- 2
  - a Leaves reduced to tiny, pointed scales arranged in whorls of 6-10 (mostly 7-8) at the joints of the twigs; greenish, needle-like young twigs give the tree the appearance of a conifer; fruit a small cylindrical, woody cone, 1.8 by 1.5 cm: *Casuarina equisetifolia* – 162 (Casuarinaceae)
  - b Leaves conspicuous, but small, 4-15 mm long: **3**
- 3
  - a Small, succulent shrublet, < 1m tall, with linear to rounded or egg-shaped leaves, 4-15 mm long; white flowers, fruit a 9-11 by 4-5 mm berry: *Batis argillicola* – 155 (Batidaceae)
  - b Shrub or small tree, 1-20 (very occasionally 40) m tall, commonly about 6m; mature leaves linear to oval, 3-10 by 6-13 mm, pointed; fruit are cones, 2-4 cm long: *Podocarpus polystachyus* – 227 (Podocarpaceae)
- 4
  - a Leaves simple: **5**
  - b Leaves sub-divided into leaflets (= compound): **113**
- 5
  - a Leaves opposite: **6**
  - b Leaves alternate or spirally arranged: **44**
- 6 Leaves simple and opposite.
  - a Trees with extensively developed, tall stilt-roots (0.5-6m tall): **7** (*Rhizophora* spp.)
  - b Trees or shrubs without stilt-roots or occasionally with small stilt roots (≤1m): **9**
- 7
  - a Leaf stalk 1.5-3 cm, reddish, midrib on underside of leaf reddish; flower stalk short, 0.5-1 cm, always with flowers (or fruit) occurring in pairs; calyx lobes yellowish brown to reddish: *Rhizophora apiculata* – 237 (Rhizophoraceae)
  - b Leaf stalk 2-5.5 cm, green, with a green midrib on underside of leaf; flower stalk 1.5-5.5cm, usually three times forked; calyx lobes pale yellow: **8**
- 8
  - a Leaves up to 10 by 25 cm; hypocotyl (the elongate, pendulous 'fruit') 40-60 cm: *Rhizophora mucronata* – 238 (Rhizophoraceae)
  - b Leaves up to 7 by 12 cm; hypocotyl 25-45 cm: *Rhizophora stylosa* – 239 (Rhizophoraceae)
- 9
  - a Stipules, leaflets at the base of the leaf stalk occur just above where the leaf stalk is attached; these stipules are often shed, leaving a ring-shaped scar: **10**
  - b Stipules absent: **24**
- 10
  - a Stipules usually shed, leaving a ring-shaped scar just above the leaf stalk; fruit expanding while still on the tree to an elongate 'fruit' (= the hypocotyl), >10 cm; usually trees >5m: **11**
  - b Stipules often persistent, connecting both leaf stalks and leaving a scar in between, or two persistent leaflets at base of each leaf stalk; fruit round, or if elongate, < 1cm long; shrubs or small trees <5m: **19**
- 11
  - a Tip of leaf is pointed; flowers and fruit with 8-16 calyx lobes; larger trees, usually with many knee-shaped roots: **12** (*Bruguiera* spp.)
  - b Leaf tip is rounded; flowers and fruit with 5 or 6 calyx lobes; smaller trees up to 15 m tall: **17** (*Kandelia* & *Ceriops* spp.)
- 12
  - a Flowers occur solitary, with one (occasionally two) on each stalk: **13**
  - b With 2-6 flowers on each stalk: **15**

- 13 a Leaves obovate, 3-7 by 5-9 cm; flowers 2-2.5 cm long, yellowish green: *Bruguiera exaristata* – 229 (Rhizophoraceae)  
 b Leaves elliptic-oblong, 3-7 by 8-22 cm; flowers 3-4 cm long, reddish: **14**
- 14 a Leaves up to 7 by 22 cm, leaf stalk often reddish and covered with white, powdery puff. Mature hypocotyl (the 'fruit') 15-25 cm long: *Bruguiera gymnorrhiza* – 230 (Rhizophoraceae)  
 b Leaves up to 6 by 15 cm, with a green leaf stalk, not covered with white 'powder'; mature hypocotyl (the 'fruit') 6-8 cm long: *Bruguiera sexangula* – 233 (Rhizophoraceae)
- 15 a Calyx is 10-lobed, often recurved back ; mature flowers 18-23 mm long; bark brown to grey, with many large, corky, yellow-brown lenticels: *Bruguiera hainesii* – 231 (Rhizophoraceae)  
 b Calyx is 8-lobed; mature flowers up to 12 mm long; bark grey, with only a few small lenticels: **16**
- 16 a Calyx lobes <3 mm, not recurved; hypocotyl (the 'fruit') is smooth; has many small flowers: *Bruguiera parviflora* – 232 (Rhizophoraceae)  
 b Calyx lobes 4-6 mm, often recurved ; hypocotyl rough, and often curved: *Bruguiera cylindrica* – 228 (Rhizophoraceae)
- 17 a Leaves oblong-elliptic to narrow elliptic-lanceolate, up to 13 cm long; leaf stalk 1-1.5 cm; calyx lobes long and slender; hypocotyl (the 'fruit') 15-40 cm long, smooth; no knee-shaped roots: *Kandelia candel* – 236 (Rhizophoraceae)  
 b Leaves ovate to slightly obovate, usually shorter than 10 cm; leaf stalk 1-3.5 cm; calyx lobes short and blunt; hypocotyl usually <25 cm long; with small ridges; often with knee-shaped roots: **18**
- 18 a Calyx lobed curled back in fruit; hypocotyl (the 'fruit') 15-25 (rarely 35) cm long;; petals are each tipped with three small lobes; flowers stalk 1-2 cm long, slender; occasionally with small stilt roots: *Ceriops tagal* – 235 (Rhizophoraceae)  
 b Calyx lobes not curled back on fruit; hypocotyl 9-15 cm long; petals with more than three small lobes on the tip; flower stalk shorter than 1 cm; thick; stilt roots absent: *Ceriops decandra* – 234 (Rhizophoraceae)
- 19 a Sharp, 2-16 mm long spines in leaf axils; flowers small (4mm) and green; shrub with lax branches, fruit a round white berry, 6 mm diameter: *Azima sarmentosa* – 248 (Salvadoraceae)  
 b Shrubs or small trees not armed with spines, flowers white or white slightly tinged with red: **20** (Rubiaceae)
- 20 a Young shoots often reddish and resinous; fruit a small cylinder, 8 mm long and ribbed; flowers white, sometimes tinged with red; calyx tube 5 mm long, with 2-4 mm long corolla protruding; leaves 2-5 by 4-9 cm: *Scyphiphora hydrophyllacea* – 244 (Rubiaceae)  
 b Young shoots otherwise; fruit otherwise: **21**
- 21 a Fruit a round to irregular head with many seeds, 1.5-10 cm long; flowers white, later turning yellowish; corolla tube 10-12 mm long; leaves 3-10 by 5-26 cm: *Morinda citrifolia* – 243 (Rubiaceae)  
 b Fruit not a head with many seeds, smaller than 3.5 cm across: **22**
- 22 a Fruit a hard, almost dry berry, greyish green but later red, 6-7 mm across; corolla is tube shaped, 1-1.5 cm long; leaves 3.5-7.5 by 10-17 cm, often with pointed tip: *Ixora timorensis* – 242 (Rubiaceae)  
 b Fruit larger than 10 mm across: **23**
- 23 a Fruit round but slightly flattened, 15-30 mm across, without a persistent calyx present, but a small rim only: *Guettarda speciosa* – 241 (Rubiaceae)  
 b Fruit round, 2.5-5 across or more, with a persistent, conspicuous calyx present on the top, fruit splitting open to reveal the orange-red pulp: *Gardenia tubifera* – 240 (Rubiaceae)

- 24 a Trees with pencil-shaped or conical respiration roots (emerging from the soil): **25**  
 b Trees or shrubs without such roots: **35**
- 25 a Leaves usually white, yellowish, or grey beneath; leaf tip is pointed or rounded; flowers small (3-10(-15) mm), with an orange or yellow corolla; stamens few, yellow; fruit with very short calyx lobes attached; bark not furrowed: **26** (*Avicennia* spp.)  
 b Leaves green beneath, leaf tip rounded; flowers are large (several cm across the stamens), but with the corolla either very small or absent; stamens are numerous, white or reddish; fruit with large calyx lobes attached; bark furrowed: **30** (*Sonneratia* spp.)
- 26 a Leaves usually with rounded tip: **25**  
 b Leaves usually with a pointed tip: **29**
- 27 a Flowers 6-10(-15)mm across when fully expanded; leaves usually with a rounded tip; leaves never whitish below; fruit 2-2.5 cm long, abruptly narrowed to a sharp beak, rust-brown: *Avicennia officinalis* – 154 (Avicenniaceae)  
 b Flowers 3-4 mm across when expanded; leaves sometimes whitish beneath; fruit sometimes beaked, but never rusty-brown: **28**
- 28 a Young twigs, leaf stalks, midrib and lower and upper surfaces of leaves conspicuously covered with fine, yellowish-white, woolly hairs; fruit with a rounded tip or with a short beak, covered with dense, woolly hairs: *Avicennia lanata* – 152 (Avicenniaceae)  
 b Young twigs, leaf stalks, and leaves covered with short (not woolly) yellowish hairs; fruit rounded or at most shortly beaked, greyish-green, never yellowish: *Avicennia marina* – 153 (Avicenniaceae).
- 29 a Leaves silvery grey or white beneath; fruit up to 4 cm long, greyish-green, gradually narrowed to an extended beak; bark greyish, with lenticels: *Avicennia alba* – 150 (Avicenniaceae)  
 b Leaves greenish-yellow beneath; fruit shorter than 3 cm, greenish yellow, without conspicuous beak; bark flaky, peeling in patches, mottled brown or green: *Avicennia eucalyptifolia* – 151 (Avicenniaceae)
- 30 a Calyx 4(-6) lobed; fruit 1.5-2.2 cm diameter; leaves narrow, less than 5 cm wide, gradually tapering towards the tip: *Sonneratia apetala* – 255 (Sonneratiaceae)  
 b Calyx usually 6-8 lobed; fruit 3-7 cm diameter; leaves usually 5 cm wide or wider: **31**
- 31 a Calyx flat, extended horizontally, not enclosing the ripe fruit, which is at most obscurely ribbed: **32**  
 b Calyx cup-shaped, enclosing the base of the fruit, prominently ribbed: **33**
- 32 a Twigs not pendulous; leaves obovate to almost round, very short leaf stalk; midrib green throughout; veins conspicuous, prominent on the upper blade; petals absent: *Sonneratia griffithii* – 257 (Sonneratiaceae)  
 b Twigs slender and pendulous; leaves elliptic-oblong, oval-obovate to narrowly elliptic; leaf stalk short; midrib often red at base; petals usually present: *Sonneratia caseolaris* – 256 (Sonneratiaceae)
- 33 a Tip of fruit not depressed at the base of the style; tube of the fruiting calyx smooth, lobes curved back, petals present; leaves ovate to oblong-ovate, with a short, thick petiole: *Sonneratia alba* – 254 (Sonneratiaceae)  
 b Tip of fruit depressed at the base of the style; tube of the fruiting calyx finely warted; petals absent; leaves broadly ovate, with a distinct narrow leaf stalk: *Sonneratia ovata* – 258 (Sonneratiaceae)
- 34 a Leaves shorter than 5 cm, usually 1-4 cm long: **35**  
 b Leaves longer than 5 cm: **36**

- 35 a Leaves 3-13 by 10-32 mm, elliptic-oblong, covered with fine, flattened hairs; not aromatic when crushed: flowers occur along, rarely in pairs; corolla lobes are white: *Pemphis acidula* – 202 (Lythraceae)  
 b Leaves 1-3 by 2.5-5 cm, obovate hairless, aromatic when crushed; flowers occur in groups of 1-3; corolla absent: *Osbornia octodonta* – 222 (Myrtaceae)
- 36 a Leaves with a large number of uniformly parallel veins, perpendicular to the leaf axis; leaves measure 10-21.5 by 6-11 cm; white, 4-merous flowers, 2-3 cm across: *Calophyllum inophyllum* – 183 (Guttiferae)  
 b Leaves not with such veins: **37**
- 37 a Leaves with 5 conspicuous principal veins (3 central, 2 along leaf margin), flowers 5-merous: **38** (Melastomataceae)  
 b Leaves without 5 conspicuous principal veins: **40**
- 38 a Flowers small, 3 mm across; leaves ovate to narrowly-ovate or lanceolate, 5-10(-14) by 2-4(-6) cm, leaf stalk 1-5(-6.5) cm; flowers on stalkless clusters: *Ochthocharis bornensis* – 207 (Melastomataceae)  
 b Flowers > 2 cm across, leaf stalks <3.5 cm long; flowers on distinctly stalked clusters: **39**
- 39 a Leaf 2-19 cm long, leaf stalk 7-35 mm long; fruit dark reddish purple to almost black, 8-9 mm long; flowers purple, whitish or pink, in groups of about 10, with 2-3 cm long cluster stalk: *Melastoma malabathricum* – 205 (Melastomataceae)  
 b Leaf 3-9 cm long, leaf stalk 6-20 mm long; fruit reddish purple, 12-14 mm long; flowers purple: *Melastoma saigonense* – 206 (Melastomataceae)
- 40 a Flowers smaller than 1 cm: **41**  
 b Flowers usually larger than 1 cm across or long: **43**
- 41 a Fruit round, reddish-orange, 1.5-2 cm diameter, flowers with 4 mm long petals; leaves 1.75-5 by 4-17 cm: *Salacia chinensis* – 165 (Celastraceae)  
 b Fruit ≤1 cm long or across at maximum: **42**
- 42 a Fruit a reddish to almost black, round berry, 5-6 mm diameter; leaves 8-25 by 4-10 cm; flowers 4-5 lobed, ≤5 mm across, greenish-yellow to yellow: *Premna obtusifolia* – 267 (Verbenaceae)  
 b Fruit a corky yellow berry, narrowed at the base, up to 1 cm long; leaves 4-10 by 2-6 cm; flowers 4-merous, 2-3 mm across: *Cassine viburnifolia* – 163 (Celastraceae)
- 43 a Shrub, with copious amounts of white latex exuding if damaged; fruit an inflated capsule, 3-5 by 6.5-8 cm; flowers white, lilac or purple, 2-3 cm across: *Calotropis gigantea* – 147 (Asclepiadaceae)  
 b Shrubs or trees without white latex: **44**
- 44 a Tree, often with short, blunt spines on trunk and main branches; leaves large, 14-25 by 18-45 cm, broadly obovate, without stalks; flowers large >2 cm long, white and trumpet-shaped; fruits oblong, 2.5 cm long: *Fagraea crenulata* – 180 (Gentianaceae)  
 b Tree unarmed; flowers not trumpet-shaped; fruit round, green or cream-coloured, less than 1 cm diameter; flowers 8-20 mm; leaves 3-6 by 5-15 cm; small to large tree: *Acronychia pedunculata* – 245 (Rutaceae)
- 45 Leaves simple, and either alternate or spirally arranged.  
 a Most leaf blades are longer than 15 cm, broader than 6 cm: **46**  
 b Most leaf blades are shorter than 15 cm, less than 6 cm broad: **71**

- 46 a Without coloured sap or latex: **47**  
 b With white, yellowish, or clear sap or latex, the clear sap turning reddish or black after exposure to the air: **64**
- 47 a Leaves heart-shaped: **48**  
 b Leaves not heart-shaped: **49**
- 48 a Leaves heart-shaped, occasionally with a pointed tip, 7-24 cm by 5-16 cm; leaf stalks 6-16 cm; flowers with a 2.5-10 cm long stalk; corolla is 6-7 cm, bell-shaped, light yellow with a purple centre: *Thespesia populnea* – 204 (Malvaceae)  
 b Leaves 5-15 by 8-20 cm, sometimes with a few small teeth along the edges, corolla is large and trumpet-shaped, 3.5-5 cm long, clear orange or pinkish orange: *Cordia subcordata* – 161 (Boraginaceae)
- 49 a Underside of leaf is white, silvery, brown or coppery: **50** (*Heritiera* spp.)  
 b Underside of leaf is green or pale green: **52**
- 50 a Leaf stalk 2-4 cm; lower side of leaf coppery- brown; fruit round, with a folded wing and a beak at the far end of the fruit: *Heritiera globosa* – 260 (Sterculiaceae)  
 b Leaf stalk < 2cm long, lower side of leaf silvery-white to white, fruit egg-shaped, flattened, without a beak at the far end: **51**
- 51 a Fruit knobby with a ridge on the lower side, together with a transverse circular ridge; sometimes with pneumatophores: *Heritiera fomes* – 259 (Sterculiaceae)  
 b Fruit smooth with a rudder-like crest, but without a transverse circular ridge; never with pneumatophores: *Heritiera littoralis* – 261 (Sterculiaceae)
- 52 a Leaf stalks usually very short, <1 cm; trees usually crooked; Flowers with clusters of more than 20 conspicuous, large, white, pink or reddish stamens, at least 4-5 cm across, fruits are woody and angled: **53**  
 b Leaf stalks longer, Flowers unlike this: **56**
- 53 a Flowers occur in short (<20 cm), erect or slightly drooping clusters; flowers 7-15 cm across the stamens: **54**  
 b Flowers occur in pendulous racemes, 20-65(-80) cm long, flowers 4-10 cm across the stamens: **55**
- 54 a Leaves 8-28 cm long, flowers up to 5 cm across the stamens, petals < 1cm long, fruit bluntly 4-angled, 2 by 7 cm: *Barringtonia acutangula* – 187 (Lecythidaceae)  
 b Leaves 17.5-43 cm long, flowers 7-10 cm across the stamens, petals up to 3 cm long, fruit 4- to 6-angled, usually 5-7(-9) by 3-4(-5) cm: *Barringtonia racemosa* – 190 (Lecythidaceae)
- 55 a Leaves 15-45 cm long, flowers 10-15 cm across the stamens, petals up to 7.5 cm long, fruit cube-shaped, 10-15 cm diameter: *Barringtonia asiatica* – 188 (Lecythidaceae)  
 b Leaves 20-35 cm long, flowers 7.5-8 cm across the stamens, fruit conical shaped, 5-7.5 cm long, 3.7-5.0 cm wide: *Barringtonia conoidea* – 189 (Lecythidaceae)
- 56 a Leaf tips rounded (though often with small point): **57**  
 b Leaf tips pointed: **58**
- 57 a Leaves measure 15-25 by 6-12 cm, conspicuous white or pale yellow flowers 2-2.5 cm long, occur on 4 cm long clusters in the axils; fruit 1 cm long, white: *Scaevola taccada* – 182 (Goodeniaceae)  
 b Leaves 8-25 by 5-14 cm, older leaves turning red; flowers small, white or pale green, stemless, occurring in 8-16 cm-long clusters in axils; fruit 5-7cm long: *Terminalia catappa* – 169 (Combretaceae)

- 58 a Stipules present: **59**  
 b Stipules absent: **61**
- 59 a Leaves hand-shaped, with 5-9 lobes, with pointed tips and serrated edges, 15-30(-40) cm in diameter; flower spikes are borne in the axils of the upper leaves and are 15-30 cm long; fruits spherical capsules covered with soft spines, 12-18 mm across: *Ricinus communis* – 178 (Euphorbiaceae)  
 b Leaves not hand-shaped : **60**
- 60 a Stipules large, to 20 mm, and persistent, young leaves not purplish: *Atuna racemosa* – 166 (Chrysobalanaceae)  
 b Stipules smaller, not persistent, young leaves purplish: *Blumeodendron tokbrae* – 173 (Euphorbiaceae)
- 61 a Leaves with (two) conspicuous glands at the base; all parts of plant are very bitter: *Quassia indica* – 253 (Simaroubaceae)  
 b Leaves without conspicuous glands at the base: **62**
- 62 a Bark very dark, to almost black; young leaves reddish: *Diospyros malabarica* – 171 (Ebenaceae)  
 b Bark not very dark; young leaves not reddish: **63**
- 63 a Numerous minute transparent points visible in the leaf blade when held to the light; fruits 4-10 cm long: *Merrilliodendron megacarpum* – 185 (Icacinaceae)  
 b No transparent points in leaves visible when held to light; fruits 2-2.5 by 1.7-2.2 cm: *Hernandia ovigera* – 184 (Hernandiaceae)
- 64 a Latex or sap is white or pale yellow: **65**  
 b Latex or sap clear but soon turning reddish or black: **68**
- 65 a Leaf tips rounded, fruit less than 2 cm across or long, flowers greenish-yellow, 4-12 mm across: *Planchonella obovata* – 251 (Sapotaceae)  
 b Leaf tips pointed, fruit usually much larger than 2 cm; flowers white, often with coloured centre: **66** (*Cerbera* spp.)
- 66 a More than 40 flowers per cluster, corolla tube shorter than 1 cm, fruit egg-shaped: *Cerbera floribunda* – 141 (Apocynaceae)  
 b Less than 30 flowers per cluster, corolla tube 1.5-4 cm long, fruit ovoid to globose: **67**
- 67 a Flower with a yellow centre, not densely hairy inside; flower tube 1.5-2 cm: *Cerbera odollam* – 143 (Apocynaceae)  
 b Flower with a reddish centre, many hairs inside tube; tube 2.5-4 cm long: *Cerbera manghas* – 142 (Apocynaceae)
- 68 a Latex or sap is clear, but soon turns black after exposure; very irritant and painful on skin (careful!); older leaves are black-spotted: *Gluta velutina* – 140 (Anacardiaceae)  
 b Sap is reddish or clear and soon turning red; leaves not black-spotted: **69**
- 69 a Mature leaves up to 52 cm long; flowers occur in spikes; fruits are pods, 5-7 by 5.5-10 cm and yellow when mature, that contain one seed; sap red. *Inocarpus fagifer* – 196 (Leguminosae)  
 b Mature leaves up to 21-35 cm long; flowers and fruit occur on short stalks in the leaf axis; often with (short) stilt-roots: **70**
- 70 a Bark flaky, finely fissured; fruit oblong-ovoid, 3-5 cm, sometimes hairy, yellow-orange when nature. *Myristica hollrungii* – 216 (Myristicaceae)  
 b Bark smooth to slightly fissured; fruit round, up to 2.5 cm across, smooth, ochre-yellow to bright pinkish-orange, with a 2 cm-long stalk; often has knee roots: *Horsfieldia irya* – 215 (Myristicaceae)

- 71 Leaves simple, alternate or spiraled, usually smaller than 15 by 6 cm.  
 a Leaf stalk is expanded into a sheath that encircles the twig: **72** (*Aegialitis* spp.)  
 b Leaf stalk unlike this: **73**
- 72 a Calyx 7-8 mm, corolla is 9-10 lobed; fruits oblong, 3-5 mm by 4-5 mm; leaf 6-9 by 2-5; shrub, 1.5-3 m: *Aegialitis annulata* – 225 (Plumbaginaceae)  
 b Calyx 13 mm, corolla is 12 lobed; fruits 8-10 by 0.5 cm, 5-angular; leaf 4-8 by 4-8.5 cm shrub, 1-3 m: *Aegialitis rotundifolia* – 226 (Plumbaginaceae)
- 73 a Branches and twigs armed with thorns/spines: **74**  
 b Branches and twigs unarmed: **78**
- 74 a Leaves with two orange glands where the leaf stalk is attached to the branch; small tree, up to 10 m tall; spiny trunk and branches, spines may be up to 3 cm; fruit an orange, round berry 6-7 mm: *Scolopia macrophylla* – 179 (Flacourtiaceae)  
 b Leaves without orange coloured glands at the base of the leaf stalk: **75**
- 75 a Leaves smelling of oranges or lemons when crushed, with indented/notched leaf edges: **76** (Rutaceae)  
 b Leaves not smelling of oranges when crushed, leaf edges entire or wavy: **77**
- 76 a Shrubby tree, with thick leathery, aromatic leaves have transparent dots and measure 4.5-16 by 2-7 cm; flowers white, 5-merous, about 2 cm long, fragrant, stamens 10; strongly smelling berry-like fruits are yellow, oblong or ovoid triangular, lemon-like, 2-5 cm long, with 3 flattened sides: *Merope angulata* – 247 (Rutaceae)  
 b Shrub or small tree; leaf blade elliptic, 3.5-6.5(-11) cm by 3-4(-6.5) cm, rather leathery; flowers 12 mm wide and 10-13 mm long, white or tinged with pink; 5 petals; Fruit rounded oblong, green, 12-19 mm wide: *Atalantia monophylla* – 246 (Rutaceae)
- 77 a Shrub, leaves variable: spoon-like or elliptic to elliptic-oblong, rarely round, 2.5-14.5 by 1-9 cm; flowers pale green and whitish along the margins, or entirely white; calyx lobes, 0.5 mm long; petals 2-3.5 by 1-1.5 mm; fruits 2.5-3.5 by 2-3 mm: *Maytenus emarginata* – 164 (Celastraceae)  
 b Shrub, leaves 2.5-5(-10) cm by 1.2-2.5(-6) cm, usually elliptic but variable in shape; flowers small, greenish-white; calyx is cup-like with 4-5 teeth, 0.5-1.5 mm; petals 4(-5), curved back, (5-)8-10(-12) mm by 1.5-2 mm; fruit rounded, pulpy and with a hard stone, yellow to orange (occasionally bright red or scarlet), with green flesh, 15-25(-35) mm by 12-20(-30) mm: *Ximenia americana* – 224 (Olacaceae)
- 78 a Leaves generally heart-shaped or rounded heart-shaped: **79**  
 b Leaves otherwise: **82**
- 79 a Leaves usually light green; flowers in terminal spikes that protrude from the canopy, flowers pink: *Kleinhovia hospita* – 262 (Sterculiaceae)  
 b Leaves usually darker green; flowers not in terminal spikes, not pink: **80**
- 80 a Leaf stalks less than 6 cm long; flowers about 5 mm long, corolla orange; fruits a bi-lobed small nut: *Brownlowia argentata* – 264 (Tiliaceae)  
 b Leaf stalks usually longer than 6 cm, and even up to 20 cm; flowers large, 5-7.5 cm, light yellow with a dark purple centre; fruit not bi-lobed: **81**
- 81 a Leaves usually with 9-11 main veins, blade more rounded, beneath usually densely covered with short hairs; young leaves not scaly; calyx 5-lobed: *Hibiscus tiliaceus* – 203 (Malvaceae)  
 b Leaves usually with 7 main veins, blade more pointed, not covered with hairs beneath; young leaves with brown scales; calyx not lobed: *Thespesia populnea* – 204 (Malvaceae)

- 82 a Trees or shrubs with white latex/sap in leaves and bark: **83**  
 b Without white latex/sap: **87**
- 83 a Older trees many-stemmed, with hanging aerial roots. Leaves small, dark green, with stalks less than 1 cm long. Mature fruit globose, 7-10 mm diameter. *Ficus microcarpa* – 213 (Moraceae)  
 b Older trees or shrubs without hanging aerial roots; leaf stalks 1-2.5 cm long: **84**
- 84 a Leaf edges toothed, leaves generally not longer than 11 cm; two small glands at the base of the leaf blade: **85** (*Excoecaria* spp.)  
 b Leaf edges entire, most leaves rather large, from 10 to 17.5 (-25) cm long;; glands absent: **86**
- 85 a Leaves oval to ovate-oval, withering reddish orange; fruit 3-lobed, less than 1 cm diameter; no thorns on the trunk: *Excoecaria agallocha* – 175 (Euphorbiaceae)  
 b Leaves lanceolate, fruit globose and hard, 3 cm diameter; trunk thorny: *Excoecaria indica* – 176 (Euphorbiaceae)
- 86 a Leaves thick and leathery, (narrowly-)elliptic-oblong to obovate, 5.5-7 by 10-17.5 cm, tip squared, base wedge-shaped; secondary nerves 8-12; figs in pairs in axils, without stalk, round, yellow or yellow-tinged pink, dark red to purplish-red when mature, (7-) 10-15 mm, 3 persistent leaflets at the base, 3-4 mm: *Ficus curtipes* – 212 (Moraceae)  
 b Leaves obovate to elliptic, 2-10 by 3.5-25 cm, with rounded tip and tapered base; leaves velvety beneath; flowers (4- or)5(or 6)-merous, with 10 stamens, 4-12 mm across; corolla 2.5 mm long; berry, sometimes woody, 7.5 by 12 mm, 5 persistent sepals: *Planchonella obovata* – 251 (Sapotaceae)
- 87 a Leaves spatulate (spatula-shaped, see glossary) and thick-fleshy, with a broadly rounded tip: **88** (*Lumnitzera* spp.)  
 b Leaves otherwise: **91**
- 88 a Flowers red or purple, and flower clusters located at the end of branches; fruit 15-20 mm long; often with knee- shaped roots: *Lumnitzera littorea* – 167 (Combretaceae)  
 b Flowers white or yellow; fruit not longer than 15 mm; no knee-shaped roots: **89**
- 89 a Flowers yellow; fruit ellipsoidal, fibrous and woody fruit is distinctly compressed, measuring 10-12 by 3-4 mm: *Lumnitzera racemosa* var. *lutea* – 168 (Combretaceae)  
 b Flowers white: **90**
- 90 a Fruit ellipsoidal, fibrous and woody fruit is distinctly compressed, measuring 10-12 by 3-4 mm: *Lumnitzera racemosa* var. *racemosa* – 168 (Combretaceae)  
 b Five petals are united and like an outstretched hand, densely hairy on the inside, smooth on the outside, 4-5 cm long; white, with purplish marking inside; fruit a white fleshy berry, 5-8 mm diameter: *Scaevola hainanensis* – 181 (Goodeniaceae)
- 91 a Small shrub (< 2 m) with (slightly) pubescent branches, toothed leaf edges, small purple, violet or reddish brown composite flowers: **92**  
 b Shrubs or trees without pubescent branches, no composite flowers: **93**
- 92 a (Pale) purplish or violet flowers, leaves obovate with tapering base, 2.5-9 by 1-5.5 cm; few small, inconspicuous glands, very aromatic, with a sharp, fine-toothed edge: *Pluchea indica* – 148 (Asteraceae)  
 b Reddish brown flowers, obovate to oblong-lanceolate, 3-5 cm by 0.7-1.7 cm, blunt to rounded leaf tip; without a stalk, leaf edges irregularly and sparsely toothed: *Pluchea pteropoda* – 149 (Asteraceae)
- 93 a Leaves obovate and leaf tip (usually) rounded: **94**  
 b Leaves not obovate, but usually elliptic to lanceolate, leaf tip usually pointed: **98**

- 94 a Fruits globose to ovoid, 8-22mm diameter, up to 30 mm long: **95**  
 b Fruits elongated, about 5 cm long, usually curved or bent: **97** (*Aegiceras* spp.)
- 95 a Fruits splitting in with 12-15 segments; fruit is red and smooth or partly covered with fine hairs; flowers small, green or yellowish-green, corolla absent: *Glochidion littorale* – 177 (Euphorbiaceae)  
 b Fruits round to oblong, not splitting into segments, surrounded by persistent calyx: **96**
- 96 a Calyx 3 mm long and wide, immediately after flowering; 8-10 mm long and 10-15 mm wide in fruit; 4-5 lobes; corolla 15 mm long, tube 8 mm, straight, 4 lobes, fruit ovoid berry, up to 30 mm long and 22 mm diameter (more usually 8-10 mm diameter): *Cordia cochinchinensis* – 159 (Boraginaceae)  
 b Calyx 3-5 mm long; 3-4 mm wide in flower, 6-10 mm wide in fruit; with short, dense hairs in flower, later smooth; corolla 5-6(-8) mm long, tube 3 mm, fruit an egg-shaped drupe, slimy pulp, 10(-15) mm by 8(-10)mm: *Cordia dichotoma* – 160 (Boraginaceae)
- 97 a Leaves up to 6 by 11 cm; flowers sweet-scented, white, persistent calyx is white to green; white corolla tube is covered with short, soft hairs, 5-6 mm long; fruit is green to red, strongly curved and pointed, 5-7.5 cm long: *Aegiceras corniculatum* – 217 (Myrsinaceae)  
 b Leaves up to 3 by 6 cm; flowers have sour odour, white; persistent calyx is white to green; corolla tubes are about 4 mm long; fruit green to red, only slightly curved, 3 cm long: *Aegiceras floridum* – 218 (Myrsinaceae)
- 98 a Leaves with scales on lower and/or upper surface: **99**  
 b Leaves without scales: **102**
- 99 a Underside of leaf rather shiny and coppery (coloured like red copper); fruit globose, with a folded wing: *Heritiera globosa* – 260 (Sterculiaceae)  
 b Leaf underside not shiny, coppery; fruit not globose: **100**
- 100 a Leaves narrowly elliptic-lanceolate; flowers in clusters on an axis; fruits bilobed and asymmetrical: *Brownlowia tersa* – 265 (Tiliaceae)  
 b Leaves oblong-ovate to broadly elliptic-lanceolate; flowers 3-6 on a spike; fruit an oblong, symmetrical capsule, 8 by 15 mm: **101** (*Camptostemon* spp.)
- 101 a Scales only on lower leaf surface; flowers with more than 5 stamens; fruit is a round capsule, 1 cm long, scaly, with a persistent, scaly calyx and outer calyx: *Camptostemon schultzei* – 158 (Bombacaceae)  
 b Scales on upper and lower surface; flowers with only 5 stamens; fruit a small, pear-shaped capsule, 1-1.5 cm long, scaly, with persistent calyx and epicalyx: *Camptostemon philippinense* – 157 (Bombacaceae)
- 102 a Twigs are swollen at the base, and easily detach; elliptic to obovate, somewhat fleshy leaves are 2.5-5 cm by 8-12; calyx with overlapping lobes, petals are white or pink; 5 stamens; fruit a berry, 5-12 mm across, first reddish-purple, turning black: *Ardisia elliptica* – 219 (Myrsinaceae)  
 b Twigs not swollen at the base: **103**
- 103 a Young leaves white or purplish: **104**  
 b Young leaves not white or purplish: **105**
- 104 a Margins of adult leaves often whitish when leaf is fresh and dry; flowers occur on 5-7 cm-long clusters, sepals 3-5, not overlapping; petals absent; stamens 14-35; fruits round, slightly flattened, about 3.2 cm across, orange when ripe: *Blumeodendron tokbrae* – 173 (Euphorbiaceae)  
 b Leaves 2.5-6.3 by 5-10(-14) cm, elliptic with a blunt tip, dark green and glossy above, pale beneath, 6-8 pairs of veins; flowers 2-3 mm across, greenish-white; fruit an egg-shaped berry, 4(-5) mm long and 3-4 mm wide, pinkish-purple, then black: *Ilex cymosa* – 144 (Aquifoliaceae)

- 105 a Fruits larger than 1.5 cm: **106**  
 b Fruits smaller than 1.5 cm across or long: **108**
- 106 a Flowers yellowish-white, lemon-scented, fruit an elongated berry, 1.5-1.7 by 4-5 cm; leaves oblong or obovate-elliptic; calyx not covering the berry: *Stemonurus ammui* – 186 (Icacinaeae)  
 b Fruit round, flowers white to pinkish: **107**
- 107 a Leaves ovate or elliptic-oblong; many-flowered clusters measure 0.5-3.5 cm, calyx very small; petals are white or pinkish, 10-12 mm long; fruit a round berry 1.7-2.5 cm in diameter, orange calyx almost completely covering the berry: *Olex imbricata* – 223 (Olacaceae)  
 b Leaves elliptic to widely elliptic, calyx bell-shaped, silky white, 3 mm long, deeply 4-lobed; corolla salver-shaped, white, with tube 10 mm by 4 mm, densely white silky outside, smooth inside, 4-lobed; fruit a berry, round, 2.5-3 cm in diameter, silky when young: *Diospyros maritima* – 172 (Ebenaceae)
- 108 a Flowers unisexual, i.e. either male or female: **109**  
 b Flowers bisexual, i.e. with stamens and style: **110**
- 109 a Bark charcoal grey to black, flowers white or pale yellow; male flowers usually in groups of (1-3); calyx 3-lobed, 4 mm long and loosely attached to the 6 mm long, also 3-lobed corolla that is covered with dense hairs; fruits yellow or orange: *Diospyros ferrea* – 170 (Ebenaceae)  
 b Bark grey or brown, male flower cluster a panicle bearing minute, crowded flowers; female flower clusters on a stout stalk, 2.5-3 cm; flowers 4-6 merous, female flowers 5 mm across; fruit round, 6-7 mm diameter, greenish-yellow, ripening deep red: *Ilex maingayi* – 145 (Aquifoliaceae)
- 110 a Leaves scented of ethereal oils (like *Eucalyptus*) when crushed, flowers white, fluffy because of the numerous projecting white stamens, fruit a small, 3mm wide woody capsule: *Melaleuca cajuputi* – 221 (Myrtaceae)  
 b Leaves not scented of ethereal oils, flowers mainly white or whitish, but without numerous projecting stamens: **111**
- 111 a Flowers white with purple spots, leaf blade oblong to elliptic, 2-4 by 5-12 cm; corolla bell-shaped 2-2.5 cm long, more or less fleshy; tube stout, 10-15 mm long, 5-lobed; lobes about 10 mm long; shrublet 1 m tall: *Myoporum bontioides* – 214 (Myoporaceae)  
 b Flowers white or creamy coloured, not spotted; small tree, 7-10(-12)m: **112**
- 112 a Leaves leathery, narrowly elliptic to ovate-elliptic, 12-25(-30) by 36-80 mm; flowers tiny, 3(-5) mm wide, hairy at the mouth, 5-merous, sepals free or shortly fused; petals white; fruit a 1-seeded berry, 5-6 mm wide, pale green, turning pinkish purple: *Rapanea portेरiana* – 220 (Myrsinaceae)  
 b Leaves elliptic, 5.5-15 by 2-6 cm, flowers scented, creamy-coloured to whitish; flower cluster 3-12 cm long; calyx smooth, 1.5-2.5 mm; corolla 4-6 mm long, stamens numerous stamens; fruit is round and pink, green, yellow or dark blue, 4-10 by 3-8 mm: *Symplocos celastrifolia* – 263 (Symplocaceae)
- 113 Leaves compound.  
 a Leaves (often) trifoliolate: **114**  
 b Leaves once sub-divided into leaflets (pinnate): **116**  
 c Leaves twice divided into leaflets (bipinnate): **129**
- 114 a Leaflets not longer than about 5 cm, 1-3 leaflets; calyx cup-shaped, 4-5 mm, corolla purplish mauve to lilac blue, stamens and style protruding; shrublet; fruit round 6 mm: *Vitex ovata* - 268 (Verbenaceae)

- b Leaflets always 3, 10-26 cm long, larger shrubs – medium sized trees: **115**
- 115 a Shrub, 2-4 m; leaflets up to 13 by 26 cm; flowers 2 mm, white; fruit globose, 7.5 by 12.5 cm, orange when ripe: *Allophylus cobbe* – 249 (Sapindaceae)
- b Medium sized tree, 12-15 m, spines on thicker branches; leaflets 10-15 cm long, flowers bright scarlet, in clusters 25-40 cm, flowers 6-8 cm long; fruit a pod, 15-30(-40) cm: *Erythrina orientalis* – 195 (Leguminosae)
- 116 a Leaflets odd in number, with an end, unpaired leaflet (inparipinnate): **117**
- b All leaflets paired (paripinnate): **122**
- 117 a Fruit elongated pod or pod-like, 5-70 cm long; flower trumpet shaped or legume flower: **118**
- b Fruit round or rounded: **120**
- 118 a Flower is large, trumpet-shaped, white or greenish-white 12-18 cm long, 7-12 cm diameter; fruit is horn-like 25-70 by 2-3 cm; tree, 5-20 m: *Dolichandrone spathacea* – 156 (Bignoniaceae)
- b Flowers at most 2 cm long, pods 6-7 cm long: **119**
- 119 a White to pale violet, legume (bean-like) flower, 11-18 mm long; fruit a 2-3 by 5-7 cm pod containing one seed; leaves with 3-7 leaflets: *Pongamia pinnata* – 199 (Leguminosae)
- b White legume (bean-like) flowers, 6 mm long; fruit a 1-1.4 by 2.5-6 cm long pod; leaves 12-15 cm long, with 21-42 leaflets: *Derris pinnata* – 194 (Leguminosae)
- 120 a Leaves 8-18 cm, leaflets linear, up to 0.5 by 7 cm, hard and leathery; flowers small, 5-merous; all parts very bitter to taste; dwarf tree, usually <2m: *Quassia harmanidana* – 252 (Simaroubaceae)
- b Leaves 45-100 cm long: **121**
- 121 a Flowers tiny, <2 mm across, 3 petals; leaves 45 cm long, 5-9 leaflets; fruit about 6-7 mm diameter and round; small to medium-sized tree, up to 15m: *Aglaia cucullata* – 208 (Meliaceae)
- b Flowers <6 mm across, 5 petals; leaves up to 100 cm long, with (7-)11 leaflets; fruit round, 6 mm diameter; small to medium-sized tree, to 15 m tall: *Polyscias macgillivrayi* – 146 (Araliaceae)
- 122 Leaflets paired (paripinnate)
  - a Fruit in flattened pods: **123** (Leguminosae)
  - b Fruit round or irregular in shape: **124**
- 123 a Leaflets usually in 3(-5) pairs; petals light yellow to red; pods flat, irregularly round or ovate, rather diffusely spiny (spines up to 4 mm), 5-7 by 6-10 cm; tree, 10-15 m: *Sindora siamensis* – 201 (Leguminosae)
- b Leaflets usually in 2(-3) pairs; flowers white, later turning orange/reddish; pod, oblong, measuring 4-5(-7.2) by 8.5-15(-28) cm, with a white, fleshy stalk; tree, up to 40m: *Intsia bijuga* – 197 (Leguminosae)
- 124 a Leaves slightly leathery; fruits round, with a smooth exterior, 6-25 cm diameter: **125** (*Xylocarpus* spp.)
- b Leaves not leathery; fruit round, either with a highly wrinkled exterior and 5-6 cm, or smooth and <2.5 cm: **127**
- 125 a Leaflets in 2-4(-5) pairs, ovate to heart-shaped, flower stalks not conspicuously swollen, fruit 6-8 cm diameter, no buttresses or pneumatophores: *Xylocarpus rumphii* – 211 (Meliaceae)
- b Leaflets in 1-3(-4) pairs, obovate to elliptic, flower stalks swollen, fruit 6-25 cm diameter, trees often with buttresses or pneumatophores: **126**

- 126 a Leaflets somewhat elliptic-ovate, not rounded at tip, fruit 6-11 cm diameter, buttresses not ribbon-like; pneumatophores erect: *Xylocarpus moluccensis* – 210 (Meliaceae)  
 b Leaflets usually rounded at the tip, fruit 12-25 cm diameter; buttresses flattened, ribbon-like; pneumatophore absent: *Xylocarpus granatum* – 209 (Meliaceae)
- 127 a Fruit 7-9(-20) mm long, smooth or very sparsely covered with hairs; at first sharply 3-angled, ripening red; contains red seed pulp; stalk 2-2.5 mm; shrub or tree, 3-10(-30) m tall; flowers are small, 1.5 mm diameter, and yellowish-green to greenish: *Mischocarpus sundaicus* – 250 (Sapindaceae)  
 b Fruit an irregular, deeply wrinkled, rounded woody pod, 2-4(-4) cm: **128**
- 128 a Stalk of leaf about 3 mm long; leaflets in 2 pairs, fruit stalk on one side of the pod, 2 by 3 cm, with a distinct beak; shrub or tree, 6 m tall: *Cynometra iripa* – 192 (Leguminosae)  
 b Stalk of leaf 3-15 mm long; fruit stalk in the centre of the pod; pod 3-4 by 2-3 cm, not beaked; tree, up to 25 m: *Cynometra ramiflora* – 193 (Leguminosae)
- 129 Bipinnate leaves.  
 a 1-2 pairs of leaflets, the upper pair being the largest; 6-16 pairs of secondary leaflets per leaflet; pods 2-3 by 10-20 cm, 5-13 seeded; flowers white: *Cathormion umbellatum* – 191 (Leguminosae)  
 b 3-11 pairs of leaflets, flowers yellow: **130**
- 130 a 3-9 pairs of leaflets, all of approximately equal size; 12-36 secondary leaflets per leaflet; pods are 5-6 by 10-15 cm, 4-8 seeded; yellowish-white flowers: *Serianthes grandiflora* – 200 (Leguminosae)  
 b 5-11 pairs of leaflets, with 9-20 pairs of secondary leaflets; flowers bright yellow; fruit is a purplish-brown pod, 2.5 by 6-14 cm, with 1-5 seeds: *Peltophorum pterocarpum* – 198 (Leguminosae)