

Portraits of Tree Families

M. M. J. van Balgooy

CONTENTS

Introduction	4
Explanation of the ‘Portraits’	5
How to use this book	6
Literature	7
Acknowledgements	7
List of families	8
Glossary and abbreviations	9
List of spot-characters	15
Portraits of tree families (alphabetically arranged)	17
Index of taxa	296

INTRODUCTION

With the publication of the second volume of the series 'Malesian Seed Plants', entitled 'Portraits of Tree Families', I would like to refer to the Introduction of the first volume, 'Spot-characters' for a historical background and an explanation of the aims of this series.

The present book treats 111 families of Malesian seed plants that at least have one tree species with a diameter at breast height of over 10 cm or a height of more than 10 m. This explains why a family such as the *Compositae* is included, with only one tree species (*Vernonia arborea*), while the other Malesian members of this family are predominantly herbaceous.

The families are treated here in a rather broad sense, whereas the modern tendency is to recognise smaller, more homogeneous families. Thus the *Saxifragaceae* as treated here comprise the *Escalloniaceae*, *Hydrangeaceae*, *Iteaceae* and *Parnassiaceae*. The names of inclusive families as well as alternative names are added in the Family List and in the Portrait headings, e.g., *Compositae* (*Asteraceae*), *Euphorbiaceae* (*Bischofiaceae*, *Pandaceae*, *Stylaginaceae*).

It will be clear that this is not a traditional descriptive book on Malesian plant families. It is merely an introduction and an aid to the memory. One should bear in mind that the 'Portraits' of the families are not comparable. Features of no use to recognise the family are not mentioned. For instance, when presence or absence of stipules is variable within a family, they are not mentioned; when the leaf margin can be entire or dentate, the leaf margin is not mentioned.

As was mentioned for Volume 1 (Van Balgooy 1997), also the text of Volume 2 was finished already in 1994. For many families additional spot-characters have been found since, and although I have tried to incorporate these, one still may find discrepancies here. I would greatly appreciate comments from users. These will be incorporated, hopefully, in a future, corrected edition.

EXPLANATION OF THE 'PORTRAITS'

Each family description in this volume contains the following headings:

Always: Characters apply to all Malesian members of the family. This is important to remember, because it will be found that some of the characters mentioned are absent from the Neotropical or African members of the family. Example: *Flacourtiaceae* in Malesia are always woody and non-climbing; outside Malesia, climbing *Flacourtiaceae* are known. It will be noted that large, heterogeneous families have few characters that are always present, whereas small or homogeneous families have many. Compare, for instance, the portraits of *Erythroxylaceae*, *Myristicaceae* and *Saxifragaceae*.

Usually / often: Characters true for the majority of the Malesian members of the family, useful for identification but to be handled with care. Example: Malesian *Rubiaceae* have an inferior ovary, except for a few genera in which the ovary is superior or semi-inferior.

Striking features: All taxa of the family are mentioned that can be readily recognised by unusual or striking features.

Different from: Some taxa are frequently misidentified as members of the family treated. These taxa are mentioned here and it is briefly indicated how they can be told apart. Example: *Diospyros* (*Ebenaceae*) is often found misidentified as belonging to *Annonaceae*.

Distribution: A brief indication of the distribution of the family and some or all genera belonging to it.

Notes: This is a catch-all for information not covered by the previous headings, such as data on ecology, dispersal, uses, etc.

Literature: At least one reference is given, preferably a Flora Malesiana revision, or otherwise a detailed family revision in a local flora.

Spot-characters: This is a coded list of spot-characters found in the families explained in volume 1 of this series and listed in the present volume (p. 15/16). Spot-characters valid for the family may not be repeated for the individual genera. Some families have numerous taxa with spot-characters, others very few. Compare, for instance, *Euphorbiaceae* and *Compositae*.

Illustration(s): Each family is illustrated by at least one drawing. The figures have been chosen from rather variable sources and owing to a sometimes limited choice, the quality of some illustrations is not optimal. Where appropriate, sources have been given.

Most of the terms used are explained in the Glossary. If not, please consult Stearn (1978), De Vogel (1987), or a good dictionary.

HOW TO USE THIS BOOK

Those who hope to identify Malesian plants by the use of this book alone may be disappointed. It is intended for use as an 'aide-mémoire' in the herbarium or in the field by people with a reasonably good knowledge of plants of the area. The 'Portraits' and 'Spot-characters' should always be used in conjunction. In many cases one has to develop an eye for certain characters and a feel for where to look for them. Some perseverance is required to find certain spot-characters; stipules are often caducous, leaves may be too thick or too young for the pellucid dots to be visible, exudate is difficult to observe in a herbarium specimen and may not be mentioned on the label. For additional field characters reference is made to Endert (1928) and Wyatt Smith & Kochummen (1979).

If complete material is available the best way to identify it to family is by using general keys, such as Thonner's analytical key (Geesink et al. 1981) or the key in the Flora of Java (Backer & Bakhuizen van den Brink 1963–1968). Detailed descriptions of Malesian plant families also can be found in Keng (1978) and Heywood (1978). If the material is incomplete, by far the easiest way is to use Hansen and Rahn's punched card system (Hansen & Rahn 1969). I myself use it quite often but have found it to be incomplete for Malesia in many ways. With trees I have found Endert's "Geslachtstabellen" very useful (Endert 1928, 1953). Recently a new manual has been published to identify sterile plants in the field (Keller 1996); it may also be useful in the herbarium, but in testing I found many limitations. The use of all these works is rather time-consuming and the present book is primarily meant as an aid for quick identification, especially of incomplete material.

Some examples to identify incomplete material:

- 1) Suppose you come across a specimen of which you have no clue as to its identity. Start looking for spot-characters carefully. If it has none, do not bother any further. If it has, go through the appropriate list and see if the names there contain a useful suggestion. It is clear that chances of coming upon the right identity increases the more spot-characters the specimen has. For instance, suppose your specimen has opposite pinnate leaves (list 49), glands on the underside of the leaf blade (list 31) and winged seeds (list 102). You will find that this combination of characters is found in *Bignoniaceae*. To make sure consult the 'Portrait' of *Bignoniaceae* and see if all other characters are in agreement with this family.

- 2) Suppose you have a specimen of which you think you know the family but are not quite sure whether certain characters occur in the family. To illustrate this I give a few more examples here.
 - a) Your specimen has opposite simple entire leaves with interpetiolar stipules. You think it belongs to the *Rubiaceae* but the ovary is superior. Consulting the *Rubiaceae* portrait you will find that the ovary is usually inferior but semi-inferior in some species of *Urophyllum* and *Mastixiodendron* and superior in *Gaertnera*. So it may well belong to the latter genus.

- b) You have a specimen with simple opposite leaves and interpetiolar stipules, the ovary is inferior, but you note that the leaf margin is dentate. You are not sure whether there are any *Rubiaceae* with a dentate leaf margin. Consult the *Rubiaceae* portrait and you find that in this family the leaves are always entire. So it must be another family. Under 'Different from', you see *Caprifoliaceae*, *Loganiaceae* and *Rhizophoraceae*. The first has no stipules, the second always has a superior ovary, the last one can have opposite leaves, interpetiolar stipules and an inferior ovary. If you look at the *Rhizophoraceae* portrait you find under 'Striking features' that *Carallia* and *Pellacalyx* may have dentate leaves.

LITERATURE

- Backer, C.A. & R.C. Bakhuizen van den Brink. 1963–1968. Flora of Java I–III. Wolters/Noordhoff, Groningen.
- Balgooy, M.M.J. van. 1997. Malesian Seed Plants. Volume 1, Spot-characters. Rijksherbarium / Hortus Botanicus, Leiden.
- Endert, F.H. 1928. Geslachtstabellen voor Nederlandsch-Indische boomsoorten naar vegetatieve kenmerken. Thesis, Landbouwhogeschool Wageningen. (Ed. 2 by F. H. Hildebrand, 1953.)
- Geesink, R., A.J.M. Leeuwenberg, C.E. Ridsdale & J.F. Veldkamp. 1981. Thonner's analytical key to the families of flowering plants. Pudoc, Wageningen.
- Hansen, B. & K. Rahn. 1969. Determination of angiosperm families by means of a punched-card system.
- Heywood, V. 1978. Flowering plants of the world. Oxford University Press.
- Keller, R. 1996. Identification of tropical woody plants in the absence of flowers and fruits. A field guide. Birkhäuser Verlag, Basel, Boston, Berlin.
- Keng, H. 1978. Orders and families of Malayan seed plants. Kuala Lumpur; Singapore.
- Maas, P.J.M. & L.Y.Th. Westra. 1993. Neotropical plant families. A concise guide to families of vascular plants in the neotropics. Koeltz Scientific Books, Koenigstein, Champaign.
- Stearn, W.T. 1978. Botanical Latin. Ed. 3. David & Charles Inc., Newton Abbott, London.
- Vogel, E.F.de(ed.). 1987. Manual of herbarium taxonomy, theory and practice. Unesco, Jakarta.
- Wyatt-Smith, J. & K.M. Kochummen. 1979. Pocket check list of timber trees. Ed. 3. Malayan Forest Records 17.

ACKNOWLEDGEMENTS

As already mentioned in Volume 1 of this series, many colleagues have encouraged me to embark on an attempt to write a tool for the identification of Malesian seed plants. The late Dr. R. Geesink urged me to do this in the form of keys to the families and genera, but I considered this too tall an order, although I am still hopeful that the present work will form the basis for a multiple access key in future. The idea to compile 'Portraits' – a term suggested by Prof. P. Baas – was inspired by the book of Maas & Westra (1993) on Neotropical plant families.

I am much indebted to the late Prof. C. Kalkman, who critically read the whole text. The following colleagues helped to compile some of the 'portraits': Mr. M. J.E. Coode (Elaeocarpaceae), Dr. J. Dransfield (Palmae), Prof. C. Kalkman (Rosaceae), Dr. P.J.A. Keßler (Annonaceae), Dr. A.J.M. Leeuwenberg (Apocynaceae), Dr. J.F. Veldkamp (Gramineae), Dr. W. Vink (Sapotaceae).

As also done for the text of Volume 1, Mr. L.B.T. Kostermans typed the original version of the 'Portraits' and Ms. E.E. van Nieuwkoop did a great job in preparing text and layout for publication. Ms. J.R. Kruijzer spent much time helping to select illustrations and Mr. J.H. van Os in redrawing several of the figures. Various persons and institutes kindly gave permission to reproduce drawings, for which I am very grateful. My son Richard designed the cover for this volume, as he did also for Volume 1.

LIST OF FAMILIES

(Alternative names or inclusive families are added in brackets directly under the family name here accepted; numbers refer to page numbers)

Aceraceae 19	Crypteroniaceae 87	Lauraceae 147
Actinidiaceae 21 (<i>Saurauiaceae</i>)	Cunoniaceae 89	Lecythidaceae 151 (<i>Barringtoniaceae</i>)
Alangiaceae 23	Cycadaceae 90	Leeaceae 153
Anacardiaceae 25	Daphniphyllaceae 91	Leguminosae 154 (<i>Caesalpiniaceae</i> , <i>Fabaceae</i> , <i>Mimosaceae</i> , <i>Papilionaceae</i>)
Annonaceae 29	Datiscaceae 93	
Apocynaceae 31	Dichapetalaceae 95	
Aquifoliaceae 35	Dilleniaceae 96	
Araliaceae 37	Dipterocarpaceae 98	
Bignoniaceae 39	Ebenaceae 103	Linaceae 163 (<i>Ctenolophonaceae</i> , <i>Hugoniaceae</i> , <i>Ixonanthaceae</i>)
Bixaceae* 43	Elaeocarpaceae 105	
Bombacaceae 45	Ericaceae 107 (<i>Monotropaceae</i> , <i>Pyrolaceae</i> , <i>Vacciniaceae</i>)	Loganiaceae 165 (<i>Antoniaceae</i> , <i>Buddlejaceae</i> , <i>Potaliaceae</i> , <i>Spigeliaceae</i> , <i>Strychnaceae</i>)
Boraginaceae 47 (<i>Ehretiaceae</i>)	Erythroxylaceae 111	
Burseraceae 49	Euphorbiaceae 112 (<i>Bischofiaceae</i> , <i>Pandaceae</i> , <i>Stylaginaceae</i>)	Lythraceae 169
Capparaceae 53 (<i>Cleomaceae</i>)	Eupomatiaceae 119	Magnoliaceae 171
Caprifoliaceae 55 (<i>Carlemanniaceae</i>)	Fagaceae 121	Malvaceae 173
Casuarinaceae 57	Flacourtiaceae 125	Melastomataceae 177 (<i>Memecylaceae</i>)
Celastraceae 59 (<i>Hippocrateaceae</i> , <i>Siphonodontaceae</i>)	Gnetaceae 127	Meliaceae 179
Chloranthaceae 61	Gramineae 129 (<i>Bambusaceae</i> , <i>Poaceae</i>)	Monimiaceae 183 (<i>Atherospermaceae</i>)
Chrysobalanaceae 63	Guttiferae 131 (<i>Clusiaceae</i>)	Moraceae 185
Clethraceae 65	Hamamelidaceae 135	Moringaceae* 187
Cochlospermaceae 67	Hernandiaceae 137 (<i>Gyrocarpaceae</i>)	Myricaceae 189
Combretaceae 69	Himantandraceae 139	Myristicaceae 191
Compositae 71 (<i>Asteraceae</i>)	Icacinaceae 141	Myrsinaceae 195
Coniferales 75 (<i>Araucariaceae</i> , <i>Cupressaceae</i> , <i>Pinaceae</i> , <i>Podocarpaceae</i> , <i>Taxaceae</i>)	Illiciaceae 143	Myrtaceae 197
Connaraceae 81	Juglandaceae 145	Nyctaginaceae 199
Cornaceae 83		Nyssaceae 201
Corynocarpaceae 85		Ochnaceae 203
		Olacaceae 205 (<i>Erythropalaceae</i>)

Oleaceae 207	Sabiaceae 241 (<i>Meliosmaceae</i>)	Theaceae 271 (<i>Bonnetiaceae</i> , <i>Ternstroemiacae</i> , <i>Tetrameristaceae</i>)
Opiliaceae 209	Salicaceae 243	Thymelaeaceae 275 (<i>Gonystylaceae</i>)
Oxalidaceae 210 (<i>Averrhoaceae</i>)	Santalaceae 245	Tiliaceae 277
Palmae 211 (<i>Arecaceae</i>)	Sapindaceae 247	Trigoniaceae 281
Pandanaceae 215	Sapotaceae 251 (<i>Sarcospermaceae</i>)	Trimeniaceae 282
Pentaphylacaceae 217	Saxifragaceae 255 (<i>Escalloniaceae</i> , <i>Hydrangeaceae</i> , <i>Iteaceae</i> , <i>Parnassiaceae</i>)	Ulmaceae 283
Pittosporaceae 219	Simaroubaceae 257	Urticaceae 285
Polygalaceae 221 (<i>Xanthophyllaceae</i>)	Sonneratiaceae 261	Verbenaceae 289
Proteaceae 223	Sphenostemonaceae 263	Violaceae 291
Rhamnaceae 225	Staphyleaceae 265	Winteraceae 295
Rhizophoraceae 229 (<i>Anisophylleaceae</i>)	Sterculiaceae 267 (<i>Byttneriaceae</i>)	
Rosaceae 231	Styracaceae 269	
Rubiaceae 234 (<i>Naucleaceae</i>)	Symplocaceae 270	
Rutaceae 239		

GLOSSARY

Accrescent (of calyx) — increasing in size with age.

Actinomorphic (of flower) — regular, divisible along more than one plane of symmetry.

Alternate (of leaves) — only one at each node, usually arranged in a spiral along the stem.

Androgynophore — column carrying male and female parts of flower.

Androphore — column carrying male parts of flower.

Anemochorous — dispersed by wind.

Anther — pollen-bearing part of the stamen.

Anthocarp — false fruit consisting of true fruit + base of perianth.

Apical — at the tip.

Apocarpous — carpels free (e.g., Annonaceae).

Aquatic — living in water.

Areole (of venation) — space between the veins.

Aril — outgrowth of the funicle, surrounding the seed, usually fleshy.

Arillate — provided with an aril.

Arillode — aril-like structure derived from some other part of the seed.

Axillary (of buds) — in the axil of a leaf.

Baccate — berry-like (fruit).

Balance hairs — attached along their length, having two free ends.

Basifixied (of stamens) — filament attached to base of anther.

- Berry** — a fleshy fruit, seeds embedded in fruit pulp (*Psidium*).
- Bipulvinate** (of petiole) — base and top of petiole swollen.
- Bisexual** (of flower) — containing functionally female and male parts.(= hermaphroditic)
- Bract** — reduced leaf supporting an inflorescence or a single flower.
- Bracteole** — scale-like leaf borne on the pedicel supporting a flower.
- Bulbil** — vegetative bud that acts as a diaspore.
- Buttress** — triangular, often flat, outgrowths at base of tree trunk.
- Caducous** — soon falling off.
- Capitate** — in the form of a head.
- Capsule** — dry dehiscent fruit.
- Carpel** — the units of an ovary or a fruit, which can be free (apocarpous) or fused (syncarpous)
- Caruncle** — a callus-like structure on the seed.
- Catkin** — a spike with unisexual flowers; a male spike falls off as a whole after flowering.
- Cauliflorous** — inflorescences borne on the trunk.
- Chlorophyll** — the green substance present in most plants that enables them to perform CO₂ assimilation with the help of sunlight.
- Choripetalous** — (flowers) with separate petals.
- Collateral** — side by side.
- Colleter** — small sausage-shaped body, e. g. at the lamina base of many *Asclepiadaceae*.
- Connective** — tissue between the thecae.
- Contort** (of corolla lobes or petals) — one margin of each lobe or petal covering the next.
- Corona** — appendages of the corolla, together forming an ‘extra’ corolla.
- Cotyledons** — the first leaf-like structures of a seedling, sometimes remaining in the seedcoat.
- Cymose** — an inflorescence of which the terminal bud produces a flower, branches produced by axillary buds.
- Cystolith** — special cell containing crystals (e.g. of silica).
- Deciduous** — leaves dropped during unfavourable season.
- Decussate** — arranged in opposite pairs that alternatively cross with each other.
- Dehiscent** (of fruit) — splitting open.
- Dentate** (of leaf margin) — provided with teeth.
- dbh** — diameter at breast height, the width of a tree trunk at c. 1.50 m above ground, or just above the buttresses.
- Diaspore** — any part of a plant that serves for propagation (seed, fruit, bulbil).
- Didynamous** — with two long and two short stamens.
- Dimerous** (of stamens) — number of stamens twice that of petals.
- Dimorphic** — appearing in two different forms.
- Dioecious** — female and male flowers on different plants.
- Disk** — a glandular outgrowth of the receptacle, usually producing nectar.
- Distichous** — arranged in two opposite rows.
- Domatium** — hairy or membranous structure on the underside of the leaves, usually in the axil of midrib and lateral nerve.

Dorsifixed — filament attached to the back of the anther.

Drupe — a fleshy fruit consisting of a thin outer layer (exocarp), a fleshy inner layer (mesocarp) and a bony or woody inner layer (endocarp), surrounding the seed(s).

Endemic (of distribution) — a species (or other taxon) confined in its distribution to a limited area, e.g. an island.

Endosperm — nutritive tissue in seed, of mixed maternal and paternal origin.

Endozoochorous — dispersed internally by animals.

Entire (of leaf margin) — smooth, no teeth.

Epicalyx — extra calyx-like segments surrounding the calyx proper.

Epilithic — growing on rocks.

Epipetalous (of stamens) — borne opposite the petals or/on the corolla (oppositipetalous).

Epiphyte — a plant living upon another plant but usually not directly parasitising it.

Epizoochorous — plants dispersed externally on animals.

Exstipulate — without stipules.

Extrafloral nectary — gland outside the flower producing a sugary substance.

Exudate — liquid oozing out from cuts, can be milky, resinous, colourless, etc.

Fascicle — a contracted inflorescence, rachis very short, pedicels often of unequal length.

Female (pistillate) flower — a flower only bearing functionally female parts.

Filament — stalk of an anther, often slender.

Funicle — the connection between placenta and seed.

Gamopetalous — with petals fused.

Geniculate — knee-shaped.

Glaucous — bluish or greyish tinge caused by a thin layer of wax (e.g. on the under-side of leaves).

Gynophore — elongated receptacle bearing the pistil.

Gynostegium — fusion of stigma with stamens.

Hemiparasite — a plant deriving part of its nutrition from a host plant.

Heterostylous — with styles in the same flower of different length.

Hermaphroditic — same as bisexual.

Holoparasite — a plant completely dependent for nutrition on its host.

Hook — a curved woody climbing organ.

Hydrochorous — dispersed by water.

Hypanthium — cup-shaped or tubular receptacle, free from the ovary.

Hypocotyl — part of seedling between root and cotyledons.

Imbricate (of flower parts) — with one part overlapping another.

Imparipinnate (of compound leaf) — with apical leaflet present.

Indo-Australia — tropical Asia, Malesia, tropical Australia (and usually the tropical Pacific).

Indo-Malesia — tropical Asia, Malesia (and the tropical Pacific).

Inferior (of ovary) — with sepals / petals / stamens borne on top of the ovary.

Interpetiolar stipules — stipules fused between two opposite petioles (*Rubiaceae*).

Intrapetiolar stipules — stipules fused, borne between the stem and the petiole.

Intramarginal vein — a vein running inside, and parallel to, the margin of a leaf (*Myrtaceae*).

Isomerous — having the same number of members in successive whorls.

Jaculator — hook-like outgrowth inside the fruit carrying a seed (*Acanthaceae*).

Laticiferous — with milky sap.

Lepidote — covered with scales.

Liana — woody climber.

Ligule — scale-like structure borne on base of blade (*Gramineae*).

Male (staminate) flower — a flower bearing only functionally male parts.

Malesia — the plant-geographic unit covered by the Flora Malesiana project, comprising: Indonesia, Malaysia, Singapore, Brunei, the Philippines and Papua New Guinea.

Margin — the edge of a leaf blade, or other flat organ.

Moniliform (of fruit) — shaped like a string of beads (e.g. *Alyxia*).

monoecious — having male and female flowers on the same plant.

Monopodial growth — elongation growth by a terminal bud.

Mycorrhiza — fungi living in roots of higher plants helping these to obtain nutrients.

Myrmecophilous — provided with structures liked by ants.

Nectary — gland producing sweet exudate, usually inside a flower.

Neotropical — occurring in the tropics of the New World (Central and South America).

Nigrescent — turning black.

Nut — a one-seeded, non-dehiscent fruit with a hard coat.

Obdiplostemonous (of stamens) — number of stamens twice that of sepals and alternating with them.

Opposite (of leaves) — two leaves attached on either side of a stem at the same level.

Orthotropic (of branches) — growing vertically.

Paleotropical — occurring in the tropics of the Old World (Africa, Asia).

Palminerved (of leaves) — with midrib and primary veins meeting at junction of petiole and lamina (*Malvaceae*).

Pantropical — occurring all over the tropics.

Parasite — a plant deriving all or part of its nutrition from a host plant.

Parietal (placentation) — attached to outer wall of ovule.

Paripinnate (of compound leaf) — lacking an apical leaflet.

Pellucid (translucent) dots (in leaf) — clear dots (oil glands) becoming visible when leaf is held against the light, e.g. in *Myrtaceae*, *Rutaceae*, etc.

Peltate (of leaves) — petiole fixed to a point away from the margin.

Penninerved (of leaves) — with one midrib (primary vein) from which secondary veins arise.

Perianth — outer flower parts not differentiated into calyx and corolla.

Petiole — stalk of a leaf.

Pinnae — the leaflets of a compound leaf.

Pinnate leaf — a compound leaf with leaflets arranged along a main rachis.

Placenta — part of the ovary bearing the ovules.

Plagiotropic (of branches) — growing horizontally.

Pneumatophore — breathing roots, e.g. the vertically growing branches of the roots of *Sonneratia*.

Pod — a monocarpellate fruit normally splitting longitudinally into two halves.

Pollination — the process of transferring pollen to the stigma which may lead to fertilization of the ovules.

Pollinium — pollen glued together into a small body.

p.p. — *pro parte*, partially.

Protandrous (flower) — the stamens ripen before the ovary.

Protogynous (flower) — the ovary ripens before the stamens.

Pseudostipules — as here used: stipule-like organs at base of petiole, the basal pair of leaflets in a compound leaf, looking different from normal leaflets.

Pulvinus — more or less swollen joint, e.g. between leaf blade and petiole.

Pyrene (stone) — woody or bony cover around seed, itself usually surrounded by softer tissue.

Quincuncial (in 5-merous flowers) — two petals outermost, two innermost, one partly covering an inner and partly covered by an outer petal.

Racemose (of an inflorescence) — with main axis not terminating in a flower (see cymose).

Receptacle — axis of the flower upon which the flower parts are inserted.

Rhizome — underground, usually horizontally growing stem.

Ruminate (of endosperm) — divided into compartments by ingrowths of seedcoat.

Samara — a winged nut (*Acer*).

Saprophyte — a plant without chlorophyll that obtains its nutrition entirely from leaf litter with the help of mycorrhiza (not parasitic), e.g. *Triuridaceae*.

Sarcotesta — fleshy outer layer of seed.

Scalariform — ladder-like.

Schizocarp (fruit) — breaking apart into 1-seeded indehiscent parts.

Semi-inferior (of ovary) — with sepals/petals/stamens borne halfway along its length or nearly so.

Serial — arranged in a row.

Spadix — a spike with a fleshy axis (e.g. *Araceae*).

Spatha — a large bract completely covering the inflorescence (*Araceae*).

Spike — an inflorescence with sessile flowers arranged on a long rachis.

Spikelet — partial inflorescence consisting of dry scales containing the flower (*Gramineae*).

Spine (thorn) — a stiff sharp organ derived from branches, stipules, leaves, etc.

Spur — a hollow appendage of a flower, usually containing nectar (*Impatiens*).

Spurious (fruit) — false, i.e. not only consisting of the developed ovary.

Stamen — the male part of a flower, consisting of filament and anther, containing the pollen.

Staminode — a non-functional stamen.

Stigma — the apical sticky part of the style, receiving the pollen.

Stiltroots — roots arising above ground from trunk or branches (e.g. in Mangrove trees).

Stipel — appendage at base of a leaflet.

Stipule — a leaf-like appendage at the side of the leaf insertion.

Stolon — a long thin prostrate stem growing on the surface of the ground and producing new plants.

Strobilus — a cone consisting of overlapping scales, as in *Pinus*.

Style — the usually elongated part of an ovary bearing at its top the stigma(s).

Sulcate — grooved.

Superior (of ovary) — free from receptacle, so perianth + stamens inserted between pedicel + ovary base.

Sympetalous — with petals united (see gamopetalous).

Sympodial branching — terminal bud of a branch dies off or slows down and elongation growth is continued from an axillary bud (*Baccaurea*, *Terminalia*).

Syncarp — several fruits grown together to form one single false fruit (*Ananas*, *Artocarpus*).

Synsepalous — with sepals united.

Taxon — any taxonomic unit (e.g. variety, species, family).

Tendril — a thread-like organ used for climbing (*Cucurbitaceae*, *Vitaceae*).

Terminal — at the end (of a branch).

Terrestrial — living on the ground.

Theca (plural thecae) — the pollen-containing parts of an anther.

Triplinerved — a leaf with a midrib and a pair of strong veins reaching leaf tip (*Melastoma*).

Triplinerved at base — leaf with a pair of veins at base not reaching leaf tip.

Umbel — inflorescence consisting of a main axis with several flowers on pedicels of similar length inserted at one point at the tip.

Unguiculate — lower part stalk-shaped (clawed).

Unisexual (flower) — bearing either male or female parts.

Valvate (of flower parts) — adjacent parts touching edge to edge but not overlapping.

Venation — the system of veins in a leaf.

Verticillate (of leaves) — in whorls of three or more.

Vivipary — seeds germinating when fruit is still attached to motherplant (*Rhizophora*).

Zygomorphic (of flowers) — flower consisting of two symmetric halves (*Labiatae*), i.e. with one plane of symmetry only.

Abbreviations and symbols:

* the taxon is represented in Malesia by introduced species only.

CS cross section.

LS longitudinal section.

p.p. (*pro parte*) behind a name means that what is stated applies only to part of the taxon.

s.l. sensu lato, in a broad sense, e.g. *Eugenia* s.l. means *Eugenia* including genera that have been split off from it (*Acmena*, *Cleistocalyx*, *Syzygium*, etc.).

? behind a name means that the data need to be checked.

LIST OF SPOT-CHARACTERS

(Italicised numbers between brackets refer to the page numbers in Volume 1 where
the 105 spot-characters have been explained and illustrated)

Habit

1. Cushion plants (9)
2. Swollen stems (*11*)
3. Monocarpic plants (*13*)
4. Climbers with hooks / tendrils (*15*)
5. Climbers without hooks / tendrils (*17*)
6. Climbers with opposite leaves (*19*)
7. Echlorophyllose plants (*21*)
8. Leafless when flowering (*23*)
9. Ant plants (*25*)
10. Schopfbäume (*27*)
11. Parasites (*29*)
12. Armed plants (*31*)
13. Bulbils (*32*)

Stem or branch

14. Terminalia branching (*33*)
15. Stem flanged (*35*)
16. Swollen nodes (*37*)
17. Twigs white, petiole black (*39*)
18. Serial buds (*39*)

Exudate

19. White or yellow sap (*40*)
20. Black or brown sap (*41*)
21. Red or orange sap (*41*)
22. Dried plants resinous (*42*)

Smell

23. Fenugreek (*43*)
24. Foetid (*43*)

Indument

25. Stellate hairs (*45*)
26. Scales (*46*)
27. Dendroid hairs (*47*)
28. Balance hairs (*47*)
29. Stinging hairs (*47*)
30. Leaves glaucous (*48*)

Leaves with glands

31. Glands on petiole (p) or lamina (l) (*49*)

Stipules

32. Intrapetiolar stipules (*53*)
33. Stipules clasping (*53*)
34. Stipules pectinate (*54*)
35. Stipules peltate (*54*)
36. Stipules striate (*54*)
37. Stipules foliaceous (*56*)

Petiole / rachis

38. Petiole swollen apically (*57*)
39. Petiole wrinkled (*61*)
40. Winged rachis / petiole (*61*)
41. Free rachis tip (*62*)
42. Rachis with swollen nodes (*63*)
43. Petiole strongly swollen at base (*64*)

Lamina

44. Leaves spiral in opposite-leaved families (*65*)
45. Leaves opposite in spiral-leaved families (*67*)
46. Leaves verticillate (*69*)
47. Leaves anisophyllous (*70*)
48. Leaves palmately compound (*73*)
49. Leaves compound opposite (*75*)
50. Leaves 2-, 3- (or 4-)pinnate (*77*)
51. Leaves peltate (*78*)
52. Leaves bullate (*79*)
53. Dicots with large leaves (*80*)
54. Nigrescence (*81*)
55. Dry leaves yellow (*81*)
56. Young leaves red (*82*)
57. Broken leaves with white threads (*82*)
58. Leaves with domatia (*85*)
59. Leaves with dots (*86*)
60. Leaf surface puncticulate (*88*)
61. Leaf surface pustulate (*88*)
62. Leaf surface rough (*89*)
63. Cystoliths (*89*)
64. Leaves triplinerved (*91*)
65. Intramarginal vein (*93*)
66. Double intramarginal vein (*93*)
67. Parallel secondary venation (*94*)
68. Scalariform venation (*95*)
69. Leaves withering red (*95*)

Inflorescence

70. Cauliflorous plants (*96*)
71. Inflorescence fasciculate, leaves distichous (*99*)
72. Inflorescence leaf-opposed (*101*)
73. Inflorescence supra-axillary (*101*)
74. Inflorescence epiphyllous (*102*)
75. Geocarpous plants (*102*)
76. Inflorescence compact (*104*)
77. Inflorescence a condensed raceme (*105*)
78. Flagelliflory (*107*)

Flower

- 79. 3-merous dicots (108)
- 80. Calyx accrescent (108)
- 81. Corolla / petals fimbriate / bifid (111)
- 82. Corolla / petals with appendages (112)
- 83. Stamens opposite the petals (113)
- 84. Staminal tube (114)
- 85. Stamens with appendages (114)
- 86. Anthers basifixated, apical pores (116)
- 87. Anthers opening by valves (116)
- 88. Broad sessile stigma (117)
- 89. Long forked style (118)
- 90. Double forked style (118)
- 91. Excentric style (118)
- 92. Ovary inferior (120)

Fruit

- 93. Fruits blue (122)
- 94. Woody fruits, scattered seeds (122)
- 95. Spiny / muricate fruits (124)
- 96. Compound fruits (127)
- 97. Moniliform fruit (128)
- 98. Fruit winged (128)
- 99. Fruit ridges (131)
- 100. Lagerstroemia capsule (132)
- 101. Three-locular capsule (133)

Seed

- 102. Seeds winged (135)
- 103. Seeds comose (136)
- 104. Seeds arillate (138)
- 105. Ruminate endosperm (138)

PORTRAITS OF TREE FAMILIES

(alphabetically arranged)

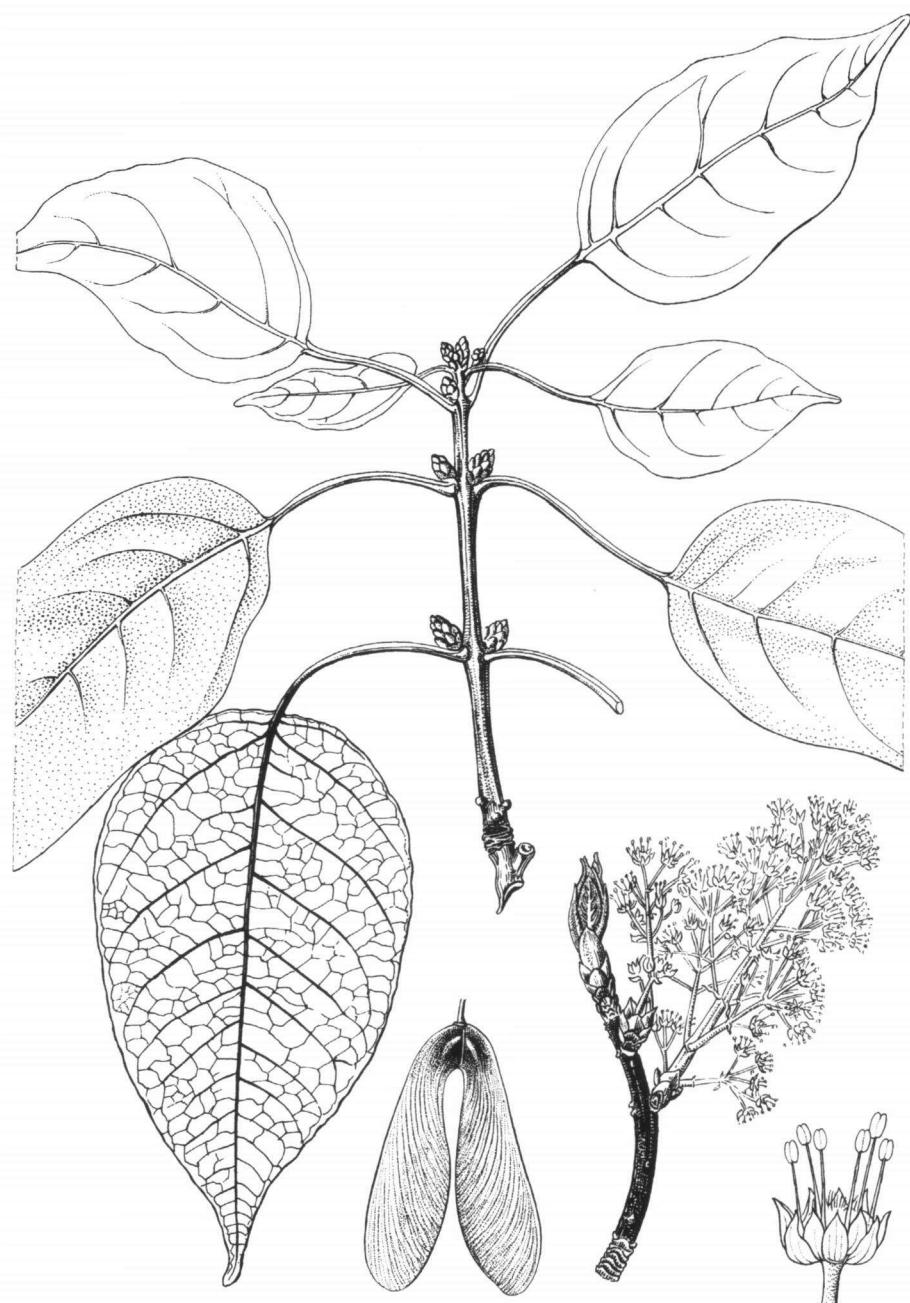


Fig. 1. *Acer laurinum* Hassk., showing habit, flower and fruit.

ACERACEAE

Always: Trees; leaves decussate, simple, entire, 3–5 basal nerves, exstipulate; flowers unisexual, actinomorphic, disk present; ovary superior, 2-locular, 2 ovules per cell.

Usually / often: Leaves glaucous beneath, sepals and petals (4 or 5) free, stamens 8, fruit a double samara.

Different from: Although the family is allied to *Sapindaceae* confusion is not likely, since these have the leaves spiral, usually pinnate.

Distribution: The only genus, *Acer*, is a northern hemisphere genus, 1 species is endemic in Malesian (Sumatra–Sulawesi, Philippines) montane rain forest.

Literature: S. Bloembergen, Fl. Males. I, 4 (1948) 3–4.

Spot-characters: 38, 56, 58, 69, 98.

Illustration: Fig. 1.

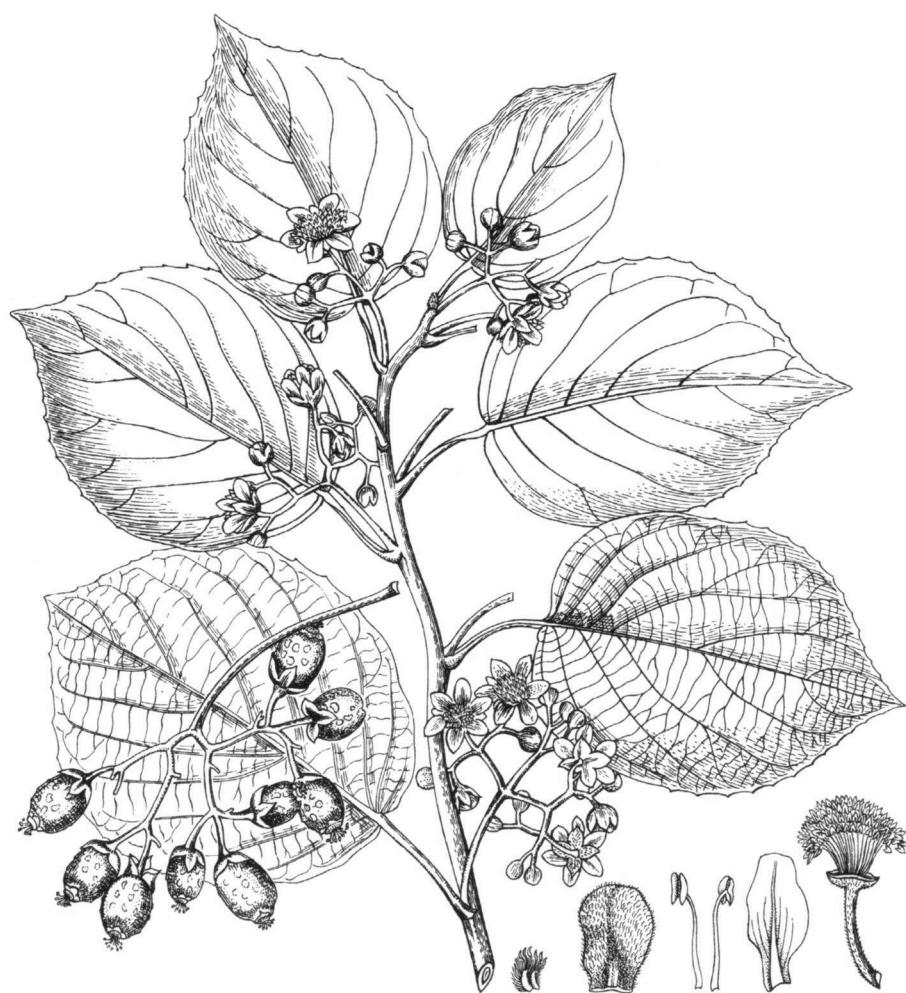


Fig. 2. *Actinidia latifolia* (Gardn. & Champ.) Merr.

ACTINIDIACEAE (SAURAUIACEAE)

Always: Woody; leaves simple, pinninerved, exstipulate; flowers actinomorphic, 5-merous; sepals free, petals fused at base, stamens numerous, fused with base of corolla; ovary superior, styles free, as many as ovary cells, ovules numerous, axillary; fruit a berry.

Usually/often: Trees or shrubs, strigose or spinescent; leaves spiral, dentate; flowers bisexual.

Different from: *Dilleniaceae*: petals free, carpels free, seeds arillate. — *Theaceae*: flowers with a pair of bracteoles; fruit rarely a berry, usually dry.

Distribution: The family widespread in tropics and subtropics. In Malesia 2 genera:

- *Actinidia* (East Asia, West Malesia), climbers;
- *Saurauia* (Neotropics, Indo-Australia), shrubs or trees.

Notes: *Actinidia* and *Saurauia* have been included in other families (*Dilleniaceae*, *Theaceae*) and have also been placed in separate families in their own right. — *Actinidia sinensis** is cultivated for its edible fruit. — Several species of *Saurauia* are (potential) ornamentals.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 4 (1948) 37–39 (*Actinidia*); R.D. Hoogland, Tree Fl. Mal. 4 (1989) 1–8 (*Saurauia*).

Spot-characters: *Actinidia* 5 – *Saurauia* 9, 12, 25, 45, 53, 63, 70, 75, 76.

Illustrations: Fig. 2 & 3.

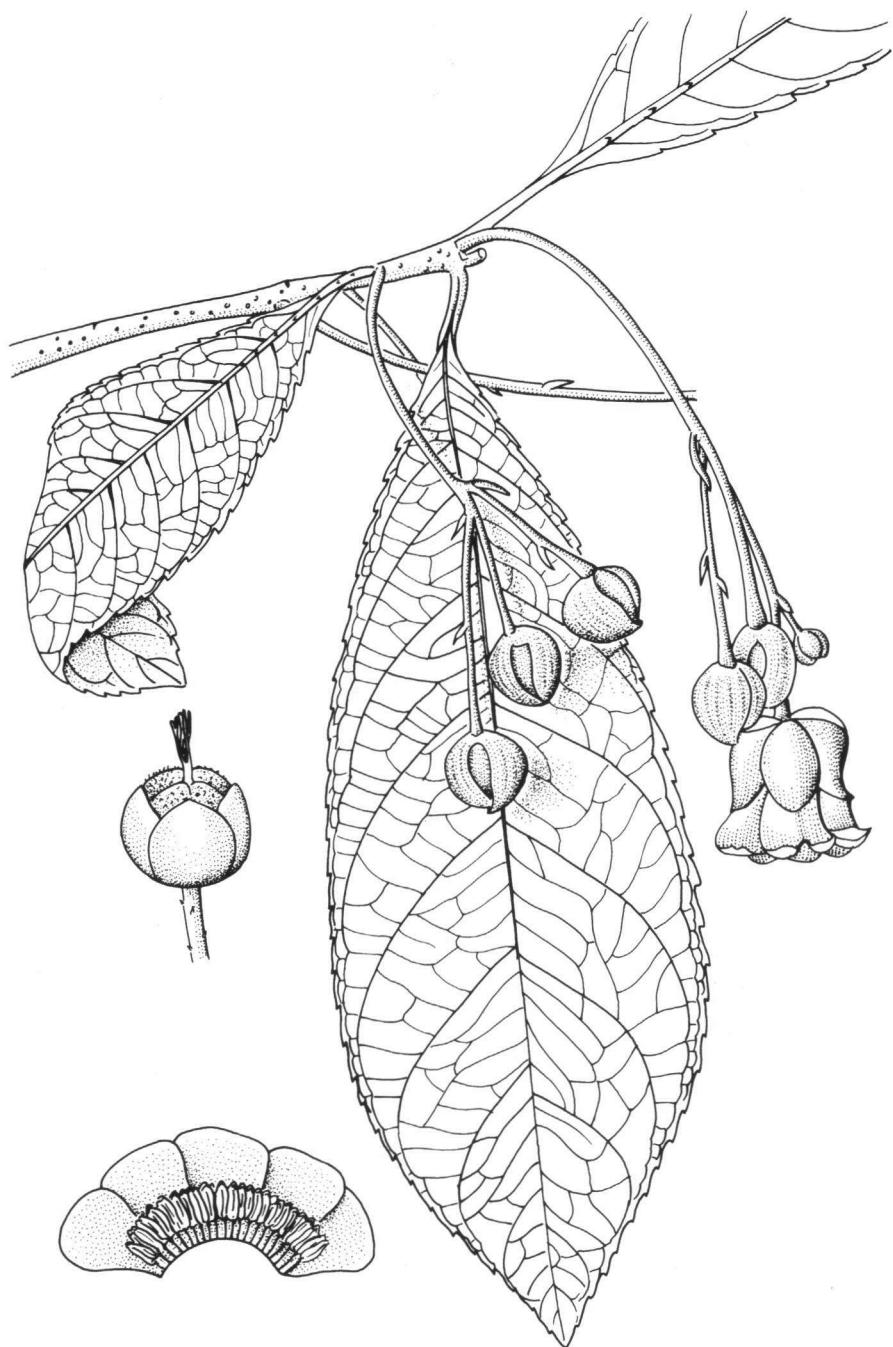


Fig. 3. *Saurauia pendula* Blume, flowering twig.

ALANGIACEAE

Always: Woody; leaves simple, exstipulate; inflorescence cymose; flowers 4–10-merous; petals free, valvate, disk intrastaminal; ovary inferior, 1- or 2-locular, 1 (hanging) ovule per cell.

Usually/often: Trees; leaves alternate or spiral, entire, venation ± palmate; number of stamens twice the number of petals.

Different from: *Cornaceae*: leaves often decussate, stamens as many as petals.

Distribution: The only genus, *Alangium*, widespread from West Africa to Japan and Fiji, several species in Malesia, mostly in lowland and lower montane forest.

Notes: Fruit of several species eaten by birds and mammals.

Literature: S. Bloembergen, Bull. Jard. Bot. Buitenzorg III, 16 (1939) 139–235.

Spot-characters: *Alangium* 25, 38, 55, 58, 64, 92, 99; *A. salvifolium* 5, 12; *A. scandens* 5.

Illustration: Fig. 4.



Fig. 4. *Alangium villosum* (Blume) Wang.

ANACARDIACEAE

Always: Woody; aromatic; bark on cross section with a pale wavy sclerenchymatic band (see also *Burseraceae*); leaves pinnerved, exudate black or turning black or brown upon exposure; exstipulate; disk present, 1 ovule per cell.

Usually/often: Non-climbing, trees or shrubs; ovary superior; leaves spiral (simple or compound), petiole swollen at base, leaf-shape oblanceolate, margin entire; inflorescence paniculate, terminal; flowers small, 5-merous, petals free; style excentric.

Striking features: Leaves opposite (*Bouea*); climber (*Pegia, Rhus nodosa*); fruits winged (*Gluta* p.p., *Parishia, Swintonia*); ovary (semi-)inferior (*Drimycarpus, Pegia*, some *Melanochyla* and *Semecarpus*); fleshy hypocarp (*Anacardium**, *Semecarpus*).

Different from: *Burseraceae*: usually no black sap, flowers often 3-merous, 2 ovules per cell.

Distribution: The family pantropical, most genera well represented in lowland rain forest. In Malesia 21 genera, incl.:

- *Campnosperma* (pantropical, not Africa and Australia), often in swamp forest;
- *Gluta* (Madagascar to New Guinea), lowland dry and peatswamp forest;
- *Mangifera* (India to Solomons), mostly lowland rain forest;
- *Melanochyla* (Malesia), mostly lowland swamp forest;
- *Semecarpus* (India to Fiji), mostly lowland rain forest, also swamp and monsoon forest.

Notes: Several species of *Gluta*, *Melanochyla* and *Swintonia* contain sap which may cause severe and painful irritation of the skin. In Malaysia and Indonesia they are collectively known as Rengas. — Edible fruits: *Anacardium**, *Bouea*, *Mangifera*, *Spondias** p.p. The fruits of several species are eaten by various mammals (bats, pigs, primates).

Literature: Ding Hou, Anacardiaceae, Fl. Males. I, 8 (1978) 395–548; K.M. Kochummen, Tree Fl. Mal. 4 (1989) 9–57; Tree Fl. Sabah & Sarawak 2 (1996) 1–92.

Spot-characters: Anacardiaceae 20, 22, 30, 56, 58 – *Anacardium* 20 – *Androtium* 20 – *Bouea* 20, 45, 79 – *Buchanania* 20 – *Campnosperma* 14, 20, 25, 26, 40, 53, 79 – *Dracontomelon* 20, 91 – *Drimycarpus* 20, 65 – *Euroschinus* 9, 20, 41 – *Gluta* 14, 20, 80, 91, 98 – *Koordersiodendron* 20 – *Lannea* 8, 20, 25 – *Mangifera* 20, 38, 43, 46, 52, 57, 91 – *Melanochyla* 20, 52, 95 – *Nothopegiopsis* 46 – *Parishia* 8, 19, 20, 80, 98 – *Pegia* 5, 20, 91 – *Pentaspadon* 20 – *Pistacia* 20, 40, 41 – *Pleiogynium* 20; *P. timoriense* 19 – *Rhus* 19, 20, 48 – *Semecarpus* 10, 20, 25, 43, 46, 53, 70; *S. aruensis* 9; *S. bunburyanus* 12 – *Spondias* 20, 65, 91 – *Swintonia* 20, 43, 46, 65, 80, 98.

Illustrations: Fig. 5 & 6.

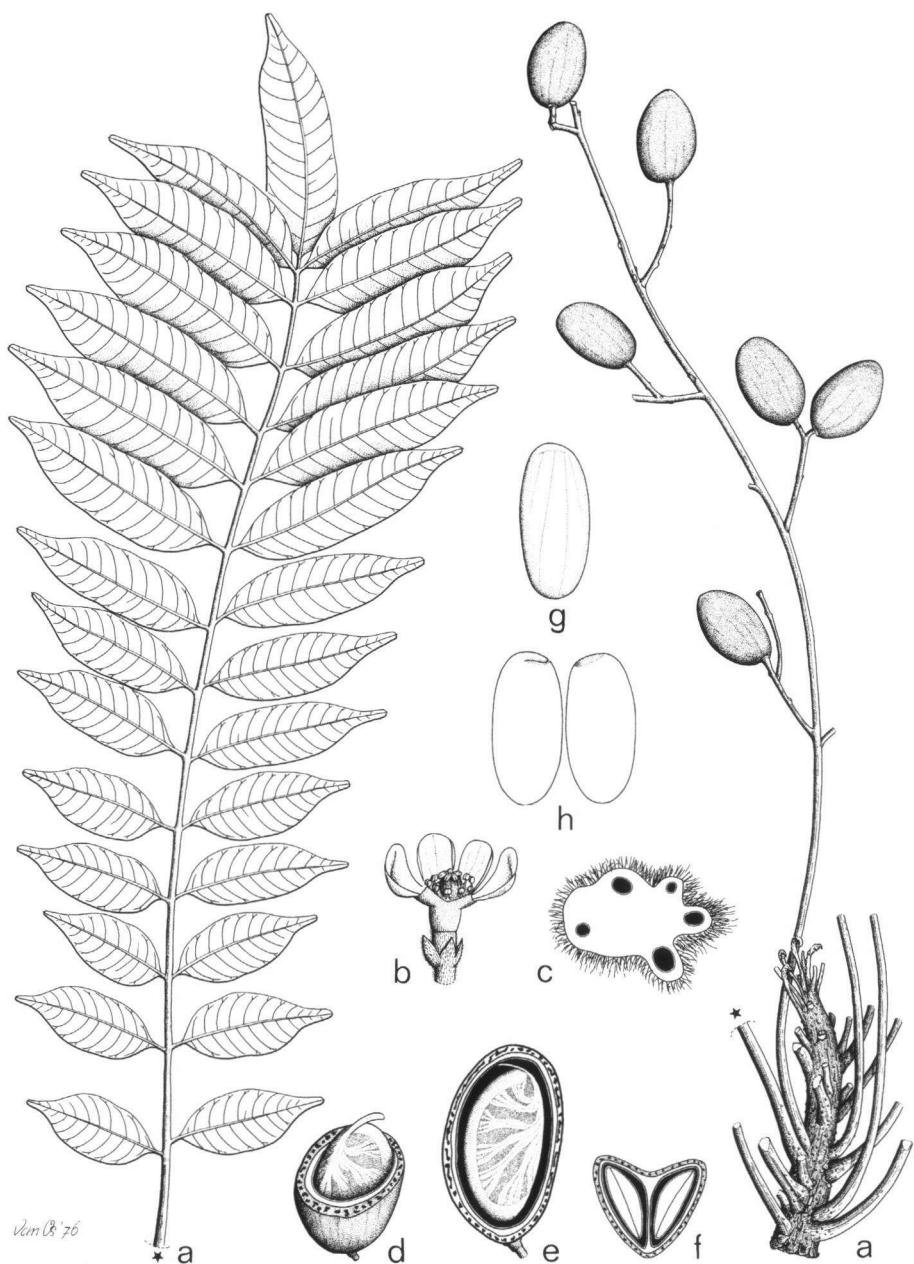


Fig. 5. *Koordersiodendron pinnatum* (Blanco) Merr.: a. branch with leaf and fruits; b. flower; c. CS of gynoecium; d-f. fruit; g & h. embryo.

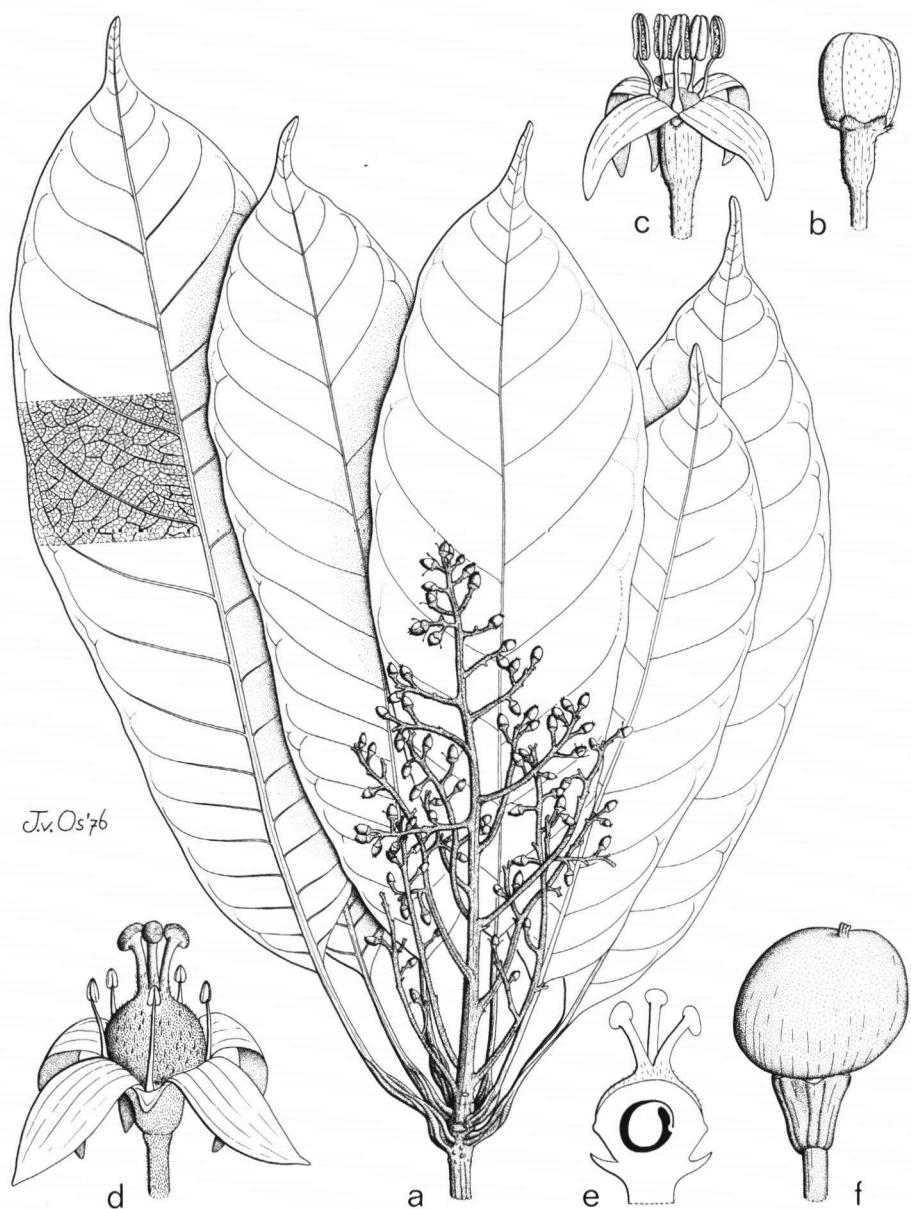


Fig. 6. *Semecarpus bunburyanus* Gibbs: a. branch; b-d. flower; e. ovary; f. fruit.



Fig. 7. *Artobotrys macrantha* Holth., with flower-bearing hooks.

ANNONACEAE

Always: Woody; odoriferous, bark fibrous, medullary rays stellate on cross section (widening outwards), continued in bark; leaves distichous, simple, entire, pinnerved, exstipulate; ovary superior, seed with ruminate endosperm.

Usually / often: Bark blackish, twigs with longitudinal ridges; leaves with minute dots; flowers 3-merous, large, stamens numerous; many free carpels (apocarpous), caulinor or ramiflorous.

Striking features: Fruit a syncarp (*Annona**); climber with hooks (*Artabotrys*); carpels moniliform (*Desmos*, *Dasymaschalon*, *Orophea* p.p., *Xylopia*); carpels dehiscent (*Anaxagorea*, *Xylopia*).

Different from: *Ebenaceae*: not odoriferous, no stellate medullary rays, bark not fibrous, carpels fused. — *Magnoliaceae*: stipules, no stellate medullary rays, weak bark. — *Monimiaceae*: leaves opposite, dentate, weak bark. — *Myristicaceae*: flowers tiny, single carpel, no stellate medullary rays, red sap, weak bark.

Distribution: The family pantropical, well represented in the understorey of tropical lowland rain forest. In Malesia c. 50 genera, incl.:

- *Artabotrys* (paleotropics), lianas;
- *Goniothalamus* (Indo-Malesia), treelets and shrubs;
- *Polyalthia* (paleotropics), trees, shrubs;
- *Uvaria* (paleotropics), scramblers, lianas;
- *Xylopia* (pantropical), trees.

Notes: Pollination mostly by beetles, fruits eaten by various animals including birds and bats. — Edible fruits: *Annona**, *Rollinia**, *Stelechocarpus*, some *Rauwenhoffia* and *Uvaria*. — Fragrant oil: *Cananga*. — Ornamentals: *Cananga*, *Polyalthia*.

Literature: J. Sinclair, Gard. Bull. Singapore 14 (1955) 149–516; K.M. Kochummen, Tree Fl. Mal. 1 (1972) 61–99. — Prof. P.J.M. Maas (U) and Dr. P.J.A. Keßler (L) are studying the family.

Spot-characters: *Annonaceae* 30, 54, 56, 57, 58, 59, 73, 79, 99, 104, 105 – *Anaxagorea* 72 – *Annona* 70, 95, 96 – *Anomianthus* 5 – *Artabotrys* 4, 70; *A. hexapetalus* 12 – *Cyathocalyx* 24, 25, 72 – *Cyathostemma* 5, 70 – *Dasymaschalon* 97 – *Desmos* 5, 75, 97; *D. chinensis* 31 – *Ellipeia* 5 – *Enicosanthum* 70, 75 – *Fissistigma* 5, 72 – *Friesodielsia* 4, 97 – *Goniothalamus* 53, 70, 75 – *Melodorum* 4, 25 – *Mitrella* 5 – *Monocarpia* 65, 72, 95 – *Orophea* 97 – *Petalophus* 78 – *Phaeanthus* 54 – *Platymitra* 39 – *Polyalthia* 24, 52, 70, 85; *P. dolichophylla* 53 – *Popowia* 61 – *Pseuduvaria* 95 – *Pyramidanthe* 5 – *Rauwenhoffia* 4, 25, 97 – *Rollinia* 96 – *Stelechocarpus* 70 – *Uvaria* 4, 21, 25, 39, 70, 75, 95 – *Xylopia* 97.

Illustrations: Fig. 7 & 8.



Fig. 8. *Phaeanthus splendens* Miq. (Courtesy Dr. P.J.A. Keßler).

APOCYNACEAE

Always: Woody, laticiferous; leaves simple, entire, pinninerved; corolla 4- or 5-mersous, sympetalous, lobes contorted in bud, stamens 5, epipetalous, ovary superior, 2-locular.

Usually / often: Leaves decussate, no stipules but sometimes a ridge between leaves of one pair; anthers fused with stigma, stigma club-shaped, hairs or scales in corolla throat; fruit of 2, often separate, carpels; seeds many, often with a tuft of hairs.

Striking features: Leaves spiral (*Cerbera*, *Lepiniopsis*, *Plumeria**, *Thevetia**); leaves whorled (*Alstonia*, some *Alyxia*, *Dyera*, some *Rauvolfia*); intramarginal nerve, black glands underside of leaves (*Chilocarpus*, *Leuconotis*); climber with hooks (*Willughbeia*); inflorescence leaf opposed (*Lepiniopsis*); carpels moniliform (*Alyxia*, *Parameria*); fruit spiny (*Allamanda**).

Different from: *Asclepiadaceae*: mostly herbaceous climbers, often trichomes at base of leaf blade, corolla star-shaped or urceolate, seeds usually flat. — *Loganiaceae*: no milk sap, interpetiolar stipules.

Distribution: The family widespread in tropics and warm temperate zone. In Malesia c. 50 genera, mainly in tropical lowland rain forest, incl.:

- *Alstonia* (pantropical), trees, lowland rain forest;
- *Alyxia* (paleotropical), climbers and shrubs, lowland and montane rain forest;
- *Cerbera* (paleotropical), trees, coastal forest;
- *Dyera* (West Malesia), trees; lowland rain forest and swamp forest;
- *Kopsia* (Indo-Malesia), shrubs and trees, rain forest;
- *Parsonisia* (Indo-Australia) climbers, rain forest;
- *Rauvolfia* (pantropical), shrubs and trees, lowland and lower montane rain forest and monsoon forest;
- *Tabernaemontana* (pantropical), shrubs and trees, mostly lowland rain forest;
- *Willughbeia* (Indo-Malesia), climbers, lowland rain forest;
- *Wrightia* (paleotropical), trees; mostly seasonal forest.

Notes: Fruits water-dispersed: *Cerbera*, *Ochrosia*; wind dispersed: *Alstonia*, *Dyera*; animal-dispersed: *Willughbeia*. — Ornamentals: *Allamanda**, *Carissa*, *Catharanthus**, *Cerbera*, *Kopsia*, *Nerium**, *Tabernaemontana*, *Thevetia**, *Wrightia*. — Edible fruit: *Carissa*, some *Willughbeia*. — Medicinal: *Alstonia*, *Catharanthus**, *Rauvolfia*. — Latex used to prepare chewing gum: *Dyera*. — Timber: *Alstonia*, *Dyera*.

Literature: C.A. Backer & R.C. Bakhuizen van den Brink, Fl. Java 2 (1965) 218–244; T.C. Whitmore, Tree Fl. Mal. 2 (1973) 3–24. — Dr. A.J.M. Leeuwenberg (WAG) is coordinating the revision of Malesian Apocynaceae.

Spot-characters: Apocynaceae 19, 57, 58, 82, 104 – *Aganosma* 5, 6, 102, 103 – *Allamanda* 46, 95 – *Alstonia* 2, 14, 46, 67, 103 – *Alyxia* 5, 6, 46, 47, 67, 93, 97, 105 – *Anodendron* 103 – *Artia* 5, 6 – *Blaberopus* 46 – *Carissa* 12 – *Cerbera* 44, 46, 54 – *Chilocarpus* 6, 31, 65, 97; *C. tuberculatus* 95 – *Chonemorpha* 6, 103 – *Cleghornia* 97 – *Dyera* 46 – *Ecdysanthera* 5, 6, 103, 85 – *Epigynum* 5, 6 – *Holarrhena*

97 – *Ischnocarpus* 5, 6, 81, 103 – *Kibatalia* 103 – *Kopsia* 77 – *Lamechites* 32 – *Lepinia* 44 – *Lepiniopsis* 44, 72, 93, 105 – *Leuconotis* 5, 6, 31, 65 – *Mandevilla* 32 – *Melodinus* 5, 6, 46, 94 – *Micrechites* 5, 6, 32, 103 – *Neokeithia* 97 – *Nerium* 46, 103 – *Ochrosia* 46 – *Parabarium* 6 – *Parameria* 6, 97, 103 – *Parsonia* 5, 6, 46, 95, 103 – *Plumeria* 44 – *Pottsia* 5, 6, 97, 103 – *Rauvolfia* 22, 46 – *Rhynchodia* 5, 6 – *Strophanthus* 5, 6, 103 – *Tabernaemontana* 32, 105 – *Thevetia* 99 – *Trachelospermum* 5, 6, 103 – *Urceola* 5, 6, 97, 103 – *Urnularia* 6, 94 – *Vallaris* 103 – *Voacanga* 54, 94 – *Willughbeia* 4, 6, 94; *W. anomala* 52 – *Wrightia* 46, 86, 103.

Illustrations: Fig. 9 & 10.



Fig. 9. *Willughbeia firma* Blume, with branched hook.

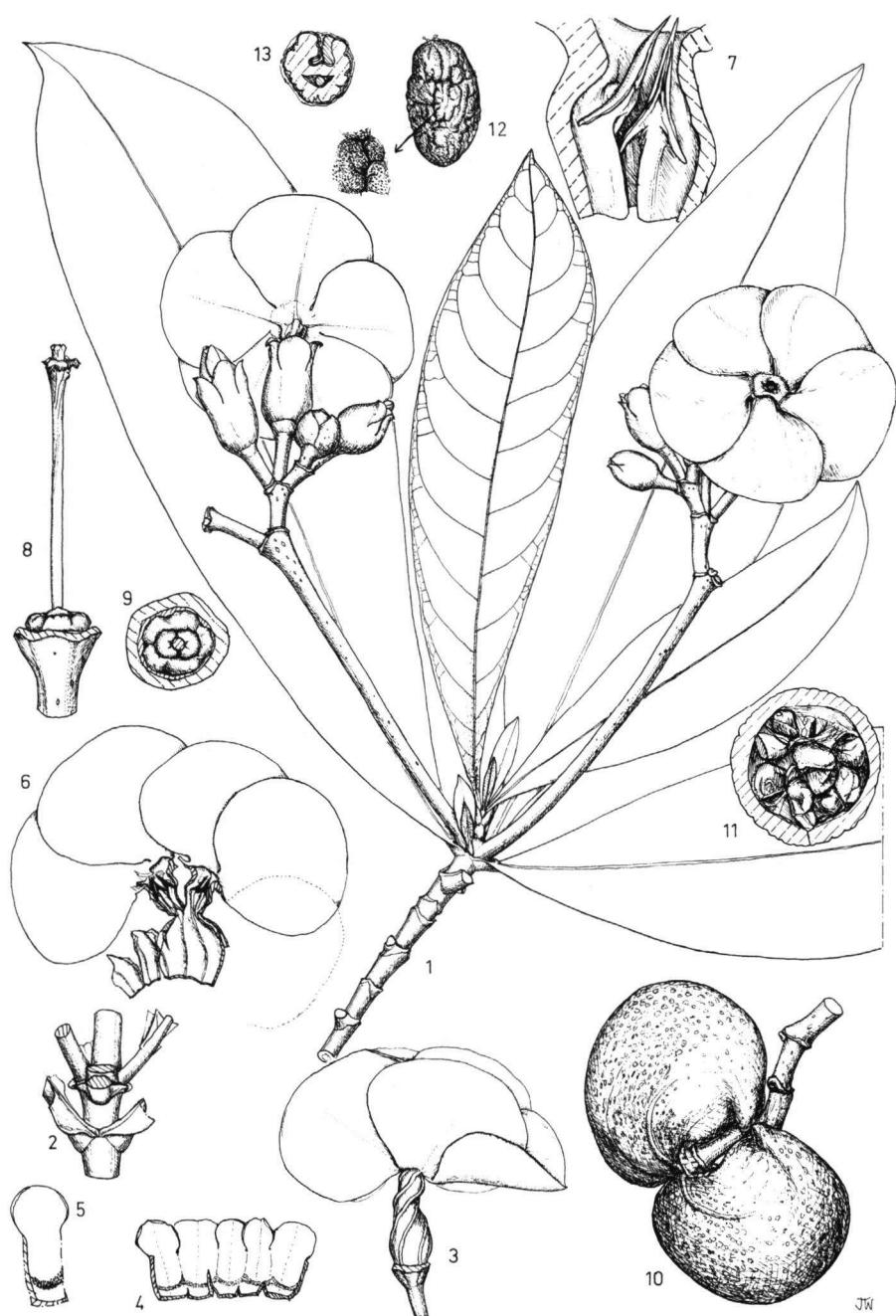


Fig. 10. *Voacanga grandifolia* (Miq.) Rolfe: 1. habit; 2. leafbase; 3–6. flower; 7. anthers; 8 & 9. pistil; 10. fruit; 11. CS of fruit; 12 & 13. seed (Courtesy Vakgroep Planten Taxonomie LU, Wageningen).

JW

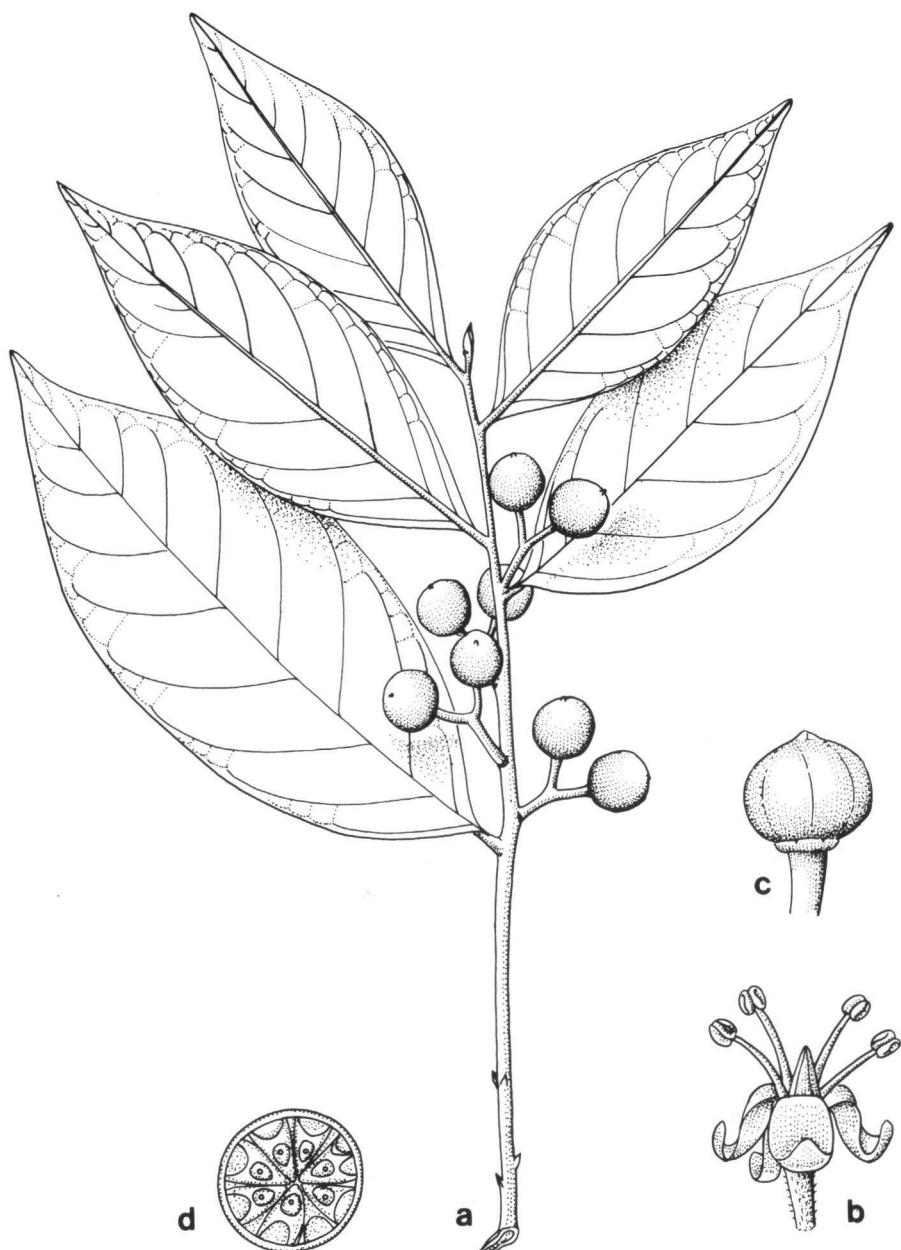


Fig. 11. *Ilex javanica* Koord. & Valeton: a. habit; b. flower; c. fruit; d. idem in CS.

AQUIFOLIACEAE

Always: Woody; leaves simple, pinninerved; disk absent, ovary superior, broad sessile stigma; fruit a drupe with 3–many stones.

Usually / often: Non-climbing, leaves spiral, dentate, drying blackish, black glands underneath, stipules absent; flowers unisexual, sepals and petals 4–9, nearly free, imbricate, stamens isomerous, opposite sepals.

Different from: *Celastraceae*: disk present; leaves usually opposite. — *Icacinaceae*: petals valvate, fruit nearly always one-seeded. — *Rhamnaceae*: stipulate, disk present, stamens opposite petals.

Distribution: World-wide, mainly northern hemisphere. In Malesia 1 genus:
— *Ilex* (world-wide), shrubs, trees, rarely climbers, mainly of montane rain forest.

Notes: *Ilex paraguariensis* (South America) is used to make mate (tea); *I. aquifolium* is a European ornamental plant.

Literature: R. Kiew, Tree Fl. Mal. 3 (1978) 1–9. — Ms. S. Andrews (K) is revising the family for Flora Malesiana.

Spot-characters: 17, 31, 39, 45, 46, 52, 58, 88.

Illustration: Fig. 11.



Fig. 12. *Arthrophyllum diversifolium* Blume.

ARALIACEAE

Always: Woody; stems resinous, with thick pith; leaves spiral; ultimate branch of inflorescence an umbel; sepals absent or small, petals free, caducous, large disk; ovary inferior; fruit a drupe, 1–many-carpellate, one seed in each pyrene.

Usually / often: Plants aromatic; petiole with ligule, leaves compound; inflorescence terminal, endosperm ruminant.

Striking features: Petiole with crests at base (*Osmoxylon* [*Boerlagiodendron*])); climber (*Acanthopanax*); spiny (*Acanthopanax*, *Acanthophora*, *Brassaiopsis*, *Harmsiopanax*, *Trevesia*); leaves bipinnate (*Aralia*, some *Polyscias*); leaves simple pinnatifid (*Aralidium*); fruit 2-carpellate, flat (*Mackinlaya*).

Different from: *Umbelliferae*: never woody in Malesia, fruit a 2-carpellate schizocarp.
— *Cornaceae*: leaves opposite, always simple, not ligulate, flowers not in umbels.

Distribution: The family widespread, both in temperate zone and in the tropics, there often montane. In Malesia 17 genera, mostly in rain forest, incl.:

- *Osmoxylon* (mainly Malesia, east to Vanuatu), shrubs, treelets, rain forest;
- *Polyscias* (paleotropics), shrubs, trees, lowland rain forest, secondary forest;
- *Schefflera* (pantropical, extending to warm temperate zone), shrubs, trees, epiphytes, lowland and montane rain forest.

Notes: Leaves edible: some *Osmoxylon* and *Polyscias*. — Ornamentals: some *Polyscias* and *Schefflera*. — Medicinal: *Panax** (Ginseng).

Literature: W.R. Philipson, Fl. Males. I, 9 (1979) 1–105. — Dr. D.G. Frodin (K) is revising *Schefflera*.

Spot-characters: Araliaceae 33, 58, 79, 89, 92, 105 – *Acanthopanax* 12, 58 – *Anakasia* 10, 53, 76, 96 – *Aralia* 12, 42, 50 – *Aralidium* 54 – *Arthrophyllum* 42, 50 – *Brassaiopsis* 12, 48, 53 – *Dendropanax borneensis* 59 – *Gastonia* 42 – *Harmsiopanax* 3, 10, 12, 51, 53 – *Heteropanax* 50 – *Mackinlaya* 48 – *Macropanax* 48 – *Meryta* 53, 76, 96 – *Osmoxylon* 10, 25, 38, 48, 53, 96 – *Polyscias* 23, 42, 50; *P. mollis* 12 – *Schefflera* 25, 48, 50, 70, 76, 96 – *Tetrapanax* 25 – *Trevesia* 12, 48, 53.

Illustrations: Fig. 12 & 13.

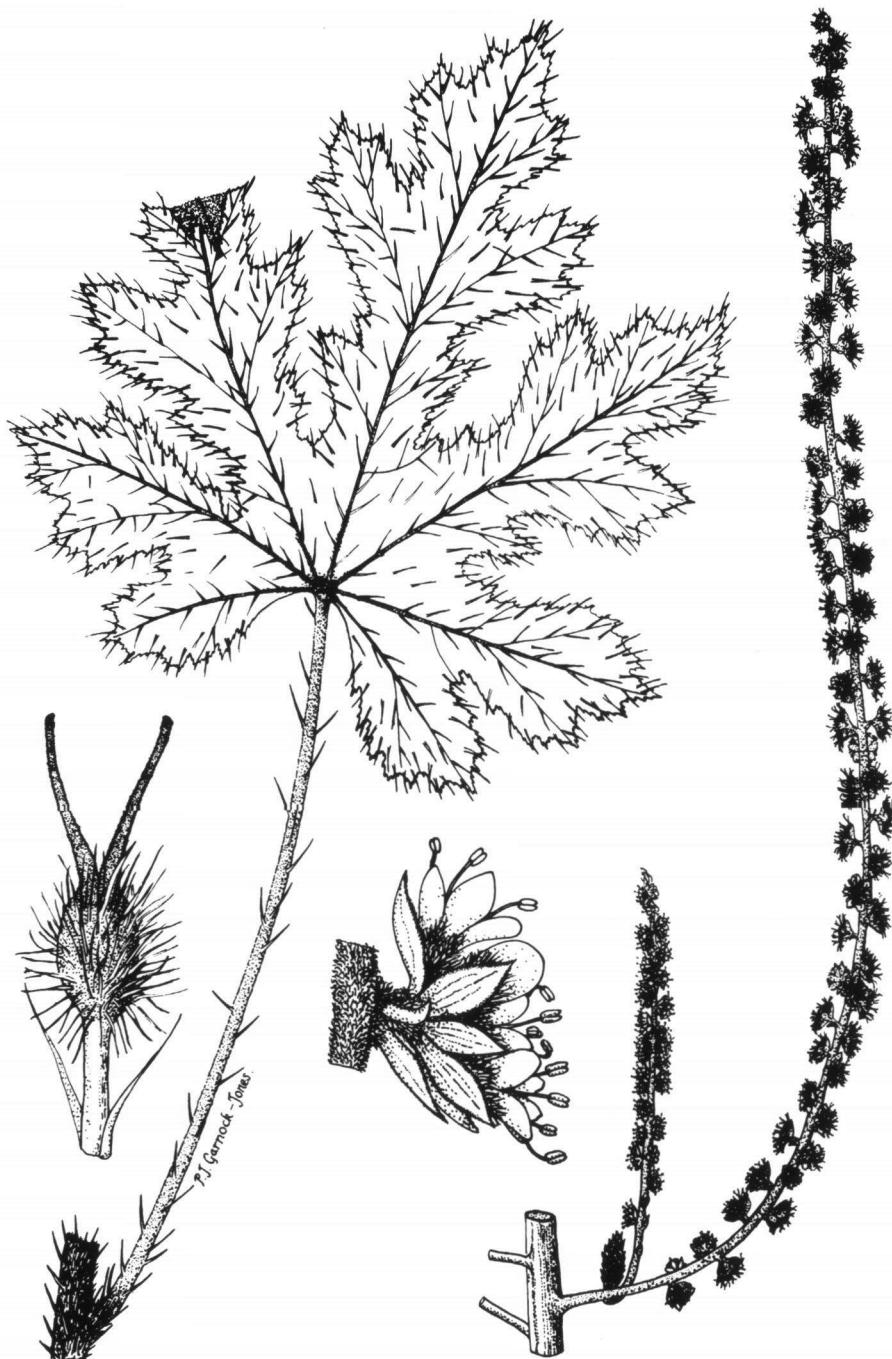


Fig. 13. *Harmsiopanax ingens* W.R. Philipson.

BIGNONIACEAE

Always: Woody (climbers or trees); leaves or leaflets pinninerved, exstipulate; flowers large and showy, synsepalous, sympetalous; ovary superior, 2-locular, numerous superposed ovules.

Usually / often: Leaves compound, decussate, glands on underside of leaves; 4 didynamous stamens, 1 staminode, fruit a flat woody capsule, with many winged seeds.

Striking features: Leaves simple, whorled, with large glands above at base (*Deplanchea*); leaves bipinnate (*Millingtonia*, *Oroxylum*, *Radermachera*); seeds with corky ridges (*Dolichandrone spathacea*).

Different from: *Gesneriaceae* and *Scrophulariaceae*: rarely woody, never lianas, leaves simple; seeds not winged. — *Verbenaceae*: ovules fewer, never superposed, seeds not winged.

Distribution: The family pantropical, a few species reaching the warm temperate zone.

In Malesia 15 genera, incl.:

- *Deplanchea* (Malesia, Australia, New Caledonia), trees, rain forest;
- *Oroxylum* (India to Sulawesi), trees, secondary forest;
- *Pandorea* (East Malesia, West Pacific, Australia), lianas, rain forest;
- *Radermachera* (Indo-Malesia), trees, rain forest.

Notes: Flowers visited by birds, bats and sphingids; winged seeds, dispersed by wind; *Dolichandrone spathacea* by water. — **Ornamentals:** *Crescentia**, *Jacaranda**, *Kigelia**, *Saritaea**, *Spathodea**, *Tabebuia**, *Tecoma**; some indigenous species of *Deplanchea*, *Pandorea* and *Tecomantthe* are (potential) ornamentals.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 8 (1977) 144–186.

Spot-characters: *Bignoniaceae* 4, 58, 102 – *Crescentia* 44, 94; *C. alata* 40, 48 – *Deplanchea* 31, 38, 46 – *Dolichandrone* 54; *D. spathacea* 49, 81 – *Fernandoa* 31, 49 – *Hieris* 5, 6, 49 – *Jacaranda* 50 – *Kigelia* 52 – *Lamiodendron* 42, 49 – *Millingtonia* 49, 50 – *Neosepicaea* 5, 6, 31, 48, 49 – *Nyctocalos* 5, 31, 48, 49 – *Oroxylum* 42, 49, 50 – *Pajanelia* 49, 98 – *Pandorea* 5, 6, 31, 49 – *Parmentiera* 70 – *Radermachera* 8, 22, 31, 42, 49, 50, 70 – *Saritaea* 4, 6, 49 – *Stereospermum* 8, 40, 31, 49; *S. fimbriatum* 81 – *Tecoma* 49 – *Tecomantthe* 5, 6, 31, 40, 48, 49.

Illustrations: Fig. 14 & 15.



Fig. 14. *Pandorea pandorana* (Andr.) Steenis.



Fig. 15. *Radermachera pinnata* (Blanco) Seem.: a. habit; b. fruit; c. seed; d. flower; e & f. leaflet.

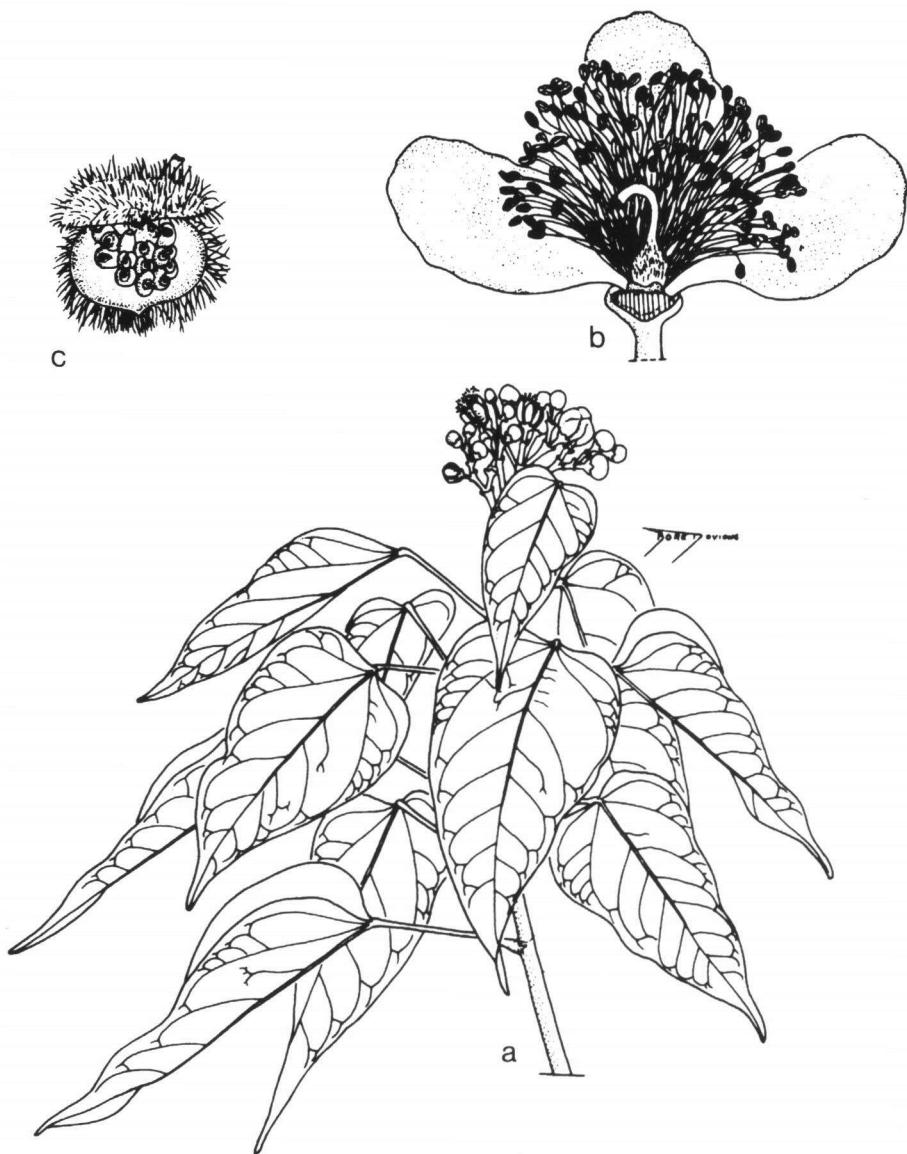


Fig. 16. *Bixa orellana* L.: a. habit; b. flower; c. fruit.

BIXACEAE

Always: Woody; leaves spiral, simple, entire, palminerved, red-dotted; flowers 5-merous, petals free, stamens numerous; ovary superior, 1-locular, ovules many on three parietal placentas; fruit a spiny capsule.

Usually: Small trees, stipules tiny, caducous.

Different from: *Flacourtiaceae*: leaves never red-dotted, fruit not spiny. — *Tiliaceae*: usually stellate hairs, ovary 2–5-locular.

Notes: *Bixa orellana* is the only species of this family, indigenous in the Neotropics, but now pantropical through cultivation. A red dye is prepared from the seeds.

Literature: C. A. Backer, Fl. Males. I, 4 (1951) 239–241.

Spot-characters: 21, 26, 38, 93.

Illustration: Fig. 16.



Fig. 17. *Durio acutifolius* (Mast.) Kosterm. (Courtesy Dr.. P.J.A. Keßler).

BOMBACACEAE

Always: Woody, non-climbing; leaves spiral, entire, stipulate; sepals fused, petals free, stamens numerous, filaments connate at base; ovary superior, 2–5-locular; fruit a capsule.

Usually / often: Trees; leaves simple, pinnerved, with scales or stellate hairs; stamens connate into bundles; fruit spiny, seeds arillate.

Striking features: Armed trunk, leaves digitate, seeds embedded in hairs on fruit wall (*Bombax*, *Ceiba**); leaves notched (some *Neesia*).

Different from: *Cochlospermaceae*: no stellate hairs, filaments free. — *Malvaceae*: leaves often palminerved, seeds hairy. — *Sterculiaceae*: often palminerved, often gynandrophore.

Distribution: The family pantropical. In Malesia 6 indigenous genera, mostly of lowland rain forest, incl.:

- *Bombax* (paleotropics), seasonal forest;
- *Durio* (Southeast Asia, West Malesia), lowland rain forest.

Notes: Pollination is mostly by bats, seeds of several species eaten by various animals.

— Edible fruit: *Durio*. — Hairs (kapok): *Ceiba*. — Timber: *Coelostegia*, *Durio*.

Literature: R.C. Bakhuizen van den Brink, Bull. Jard. Bot. Buitenzorg III, 6 (1929) 161–240; K.M. Kochummen, Tree Fl. Mal. 1 (1972) 100–120. — Prof. E. Soepadmo (KEP) is revising the family for Flora Malesiana.

Spot-characters: *Bombacaceae* 104 – *Bombax* 8, 12, 14, 25, 48 – *Camptostemon* 26, 38 – *Ceiba* 12, 14, 48 – *Coelostegia* 26, 95, 100 – *Cullenia* 95 – *Durio* 26, 38, 70, 95 – *Kostermansia* 95 – *Neesia* 26, 29, 38, 53, 95, 100.

Illustration: Fig. 17.



Fig. 18. *Cordia subcordata* Lam. (Courtesy FRIM, Kepong).

BORAGINACEAE (EHRETIACEAE)

Always: Leaves alternate (rarely partly subopposite), simple; flower 5-merous, calyx persistent, corolla sympetalous.

Usually/often: Leaves rough to the touch by short stiff hairs; inflorescence scorpioid; ovary 2-locular, or 4-locular by false septa, one ovule per cell.

Striking features: Climbers (*Tournefortia*); beach shrub, leaves silvery hairy (*Tournefortia argentea*); tree with winged fruit (*Pteleocarpa*).

Different from: *Gesneriaceae*: leaves mostly decussate, seeds numerous. — *Labiatae*: leaves mostly decussate, ovary 4-locular.

Distribution: The family widespread. In Malesia 15 genera, incl.:

- *Cordia* (pantropical), trees and shrubs, lowland and coastal rain forest;
- *Ehretia* (pantropical), shrubs or trees, lowland rain forest, seasonal forest;
- *Heliotropium* (pantropical), herbs, often weedy;
- *Trigonotis* (Eurasia, E. to New Guinea) herbs, often creeping, subalpine and alpine vegetation.

Notes: Some species planted as ornamentals: *Cordia*, *Myosotis*. — *Pteleocarpa* should perhaps be excluded from *Boraginaceae* (see Veldkamp, 1988).

Literature: I.M. Johnston, J. Arnold Arbor. 32 (1951) 1–26, 99–122; J.F. Veldkamp, Notes on *Pteleocarpa* incertae sedis, Fl. Males. Bull. 19 (1988) 47–50; H. Riedl, Fl. Males. I, 13 (1997) 43–144.

Spot-characters: *Boraginaceae* 58, 82, 95 – *Argusia* 54 – *Cordia* 59, 63, 90 – *Cynoglossum* 95 – *Heliotropium* 54 – *Omphalodes* 95 – *Pteleocarpa* 22, 89, 90, 98 – *Tournefortia* 6, 45, 54 – *Trigonotis* 1.

Illustrations: Fig. 18 & 19.



Fig. 19. *Trigonotis inoblita* F. Muell.: a. habit; b. inflorescence; c. flower (corolla removed); d. corolla inside (Courtesy Dr. P. van Royen).

BURSERACEAE

Always: Woody; very exceptionally climbing; resiniferous, bark with a light coloured wavy sclerenchymatic band, resiniferous ducts on the inside of this; the same feature only known from *Anacardiaceae* (hand lens); leaves imparipinnate, spiral, leaflets penninerved; petals free, disk present; ovary superior, ovules 2 per cell; fruit with 1 seed per cell.

Usually / often: Trunk buttressed; pith in twigs with vascular strands; leaflets entire, pulvinate; dioecious, flowers 3-merous; fruit a drupe.

Striking features: Fruit 3-winged (*Triomma*); pseudostipules (some *Canarium*, *Dacryodes* and *Garuga*); excentric stigma (*Santiria*); leaflets dentate (some *Canarium*).

Different from: *Anacardiaceae* sap turning black (also turning black in a few *Canarium* spp.), 1 ovule per cell. — *Sabiaceae* (*Meliosma*): not resiniferous, petals opposite the sepals, 1 ovule per cell.

Distribution: The family pantropical. In Malesia 8 genera, incl.:

- *Canarium* (paleotropical), lowland rain forest, some in monsoon forest;
- *Dacryodes* (pantropical);
- *Haplolobus* (Borneo to Samoa);
- *Santiria* (paleotropical); all trees of the tropical lowland rain forest.

Notes: The drupes of several species eaten by birds and primates; edible seeds or fruits: some *Canarium*, *Dacryodes*, *Protium*. — Ornamentals: *Canarium* — Resin: some *Canarium*. — Timber: some species of *Canarium*, *Dacryodes* and *Santiria*.

Literature: P.W. Leenhouts, Fl. Males. I, 5 (1955) 209–296; ibid. I, 6 (1972) 917–928; K.M. Kochummen, Tree Fl. Sabah & Sarawak 1 (1995) 45–100.

Spot-characters: *Burseraceae* 19, 58, 99 – *Canarium* 20, 34, 37, 42, 48, 79, 88 – *Dacryodes* 42, 48, 79, 88; *D. nervosa* 25 – *Garuga* 8 – *Haplolobus* 79, 88 – *Protium* 12, 48 – *Santiria* 48, 79, 88, 91, 93 – *Triomma* 20, 88, 98, 102.

Illustrations: Fig. 20 & 21.



Fig. 20. *Canarium australianum* F. Muell.: a. habit; b. flower; c. LS female flower; d. LS male flower; e. fruits; f. CS fruit; g. CS stem.



Fig. 21. *Garuga floribunda* Decne.: a. leaf; b. inflorescence; c. LS flower; d. fruits.

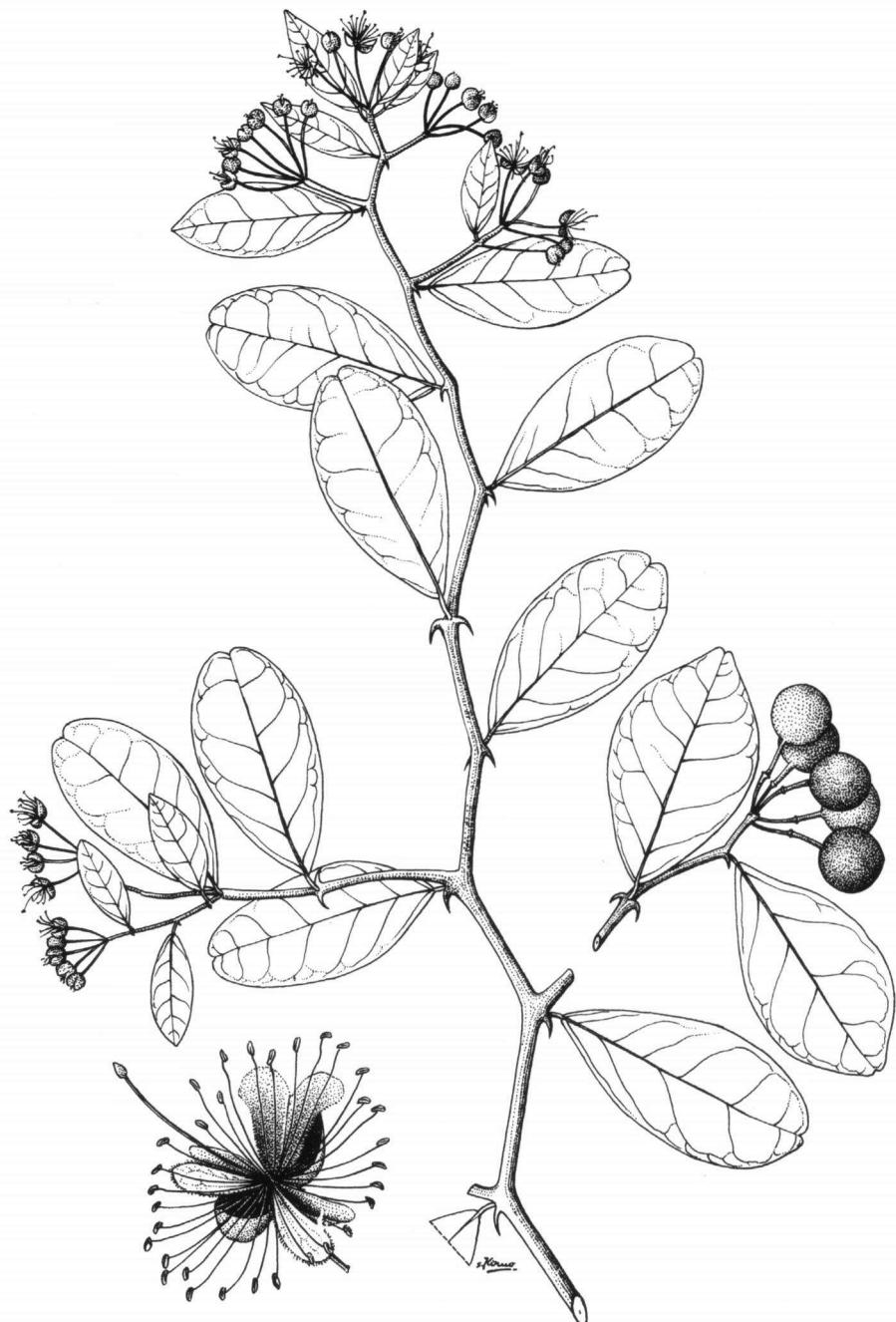


Fig. 22. *Capparis sepiaria* L.

CAPPARACEAE (CLEOMACEAE)

Always: Leaves spiral; flowers (sub)zygomorphic; ovary superior on (andro-) gynophore.

Usually/often: Woody; leaves simple, stipules present; flowers 4-merous, petals free, unguiculate, stamens numerous, ovary 1-locular; fruit a many-seeded berry.

Striking features: Leaves with pellucid dots, sepals 6, petals absent, ovary 3-locular, fruit 1-seeded (*Stixis*); stipular thorns (*Cadaba*, *Capparis*); tree with 3-foliate leaves (*Crateva*).

Different from: *Cruciferae*: herbaceous, ovary 2-locular, flowers actinomorphic.

Distribution: The family widespread in tropics and subtropics, especially in dry regions. In Malesia 5 genera, incl.:

- *Capparis*, thorny climbers or shrubs, rain forest, monsoon forest, savannahs;
- *Cleome*, weeds of open places.

Notes: Ornamentals: *Cleome*, *Crateva*. — Buds of *Capparis spinosa* in Europe used for flavouring food.

Literature: M. Jacobs, Fl. Males. I, 6 (1960) 61–105.

Spot-characters: *Capparis* 4, 12, 25, 59, 73, 80, 94; *C. buwaldae* 9; *C. quiniflora*, *C. zeylanica* 18 – *Cleome* 12, 48 – *Crateva* 31, 94, 48 – *Stixis* 38, 59.

Illustration: Fig. 22.



Fig. 23. *Viburnum coriaceum* Blume: a. habit; b. flower; c. ovary; d. stamen; e. fruit; f. CS of fruit.

CAPRIFOLIACEAE (CARLEMANNIACEAE)

Always: Leaves decussate, pinninerved; inflorescence cymose; flowers sympetalous; ovary inferior, 2–5-locular, with 1 ovule per cell.

Usually / often: Woody, stems and twigs with thick pith; leaves simple, dentate, exstipulate; flowers 5-merous, stamens 5; fruit fleshy (drupe or berry).

Striking features: Herbaceous, flowers 4-merous, stamens 2, fruit a capsule (*Carlemannia*); climber, flower zygomorphic, in pairs (*Lonicera*); leaves imparipinnate, stipulate (*Sambucus*); stellate hairs, glands at base of leaf blade underneath (some *Viburnum*).

Different from: *Rubiaceae*: interpetiolar stipules, raphides, leaves never dentate. — *Valerianaceae*: herbaceous, stamens 3.

Distribution: The family world-wide, especially northern hemisphere. In Malesia 4 genera, incl.:

- *Lonicera* (mainly northern hemisphere), montane forest;
- *Viburnum* (Eurasia incl. Malesia, America), shrubs, trees, mainly montane rain forest.

Notes: Many species cultivated as ornamentals.

Literature: J.H. Kern & C.G.G.J. van Steenis, Fl. Males. I, 4 (1951) 175–194.

Spot-characters: *Caprifoliaceae* 58, 92 – *Lonicera* 5, 6, 18, 31, 52 – *Sambucus* 49 – *Viburnum* 22, 25, 105; *V. punctatum* 60.

Illustration: Fig. 23.

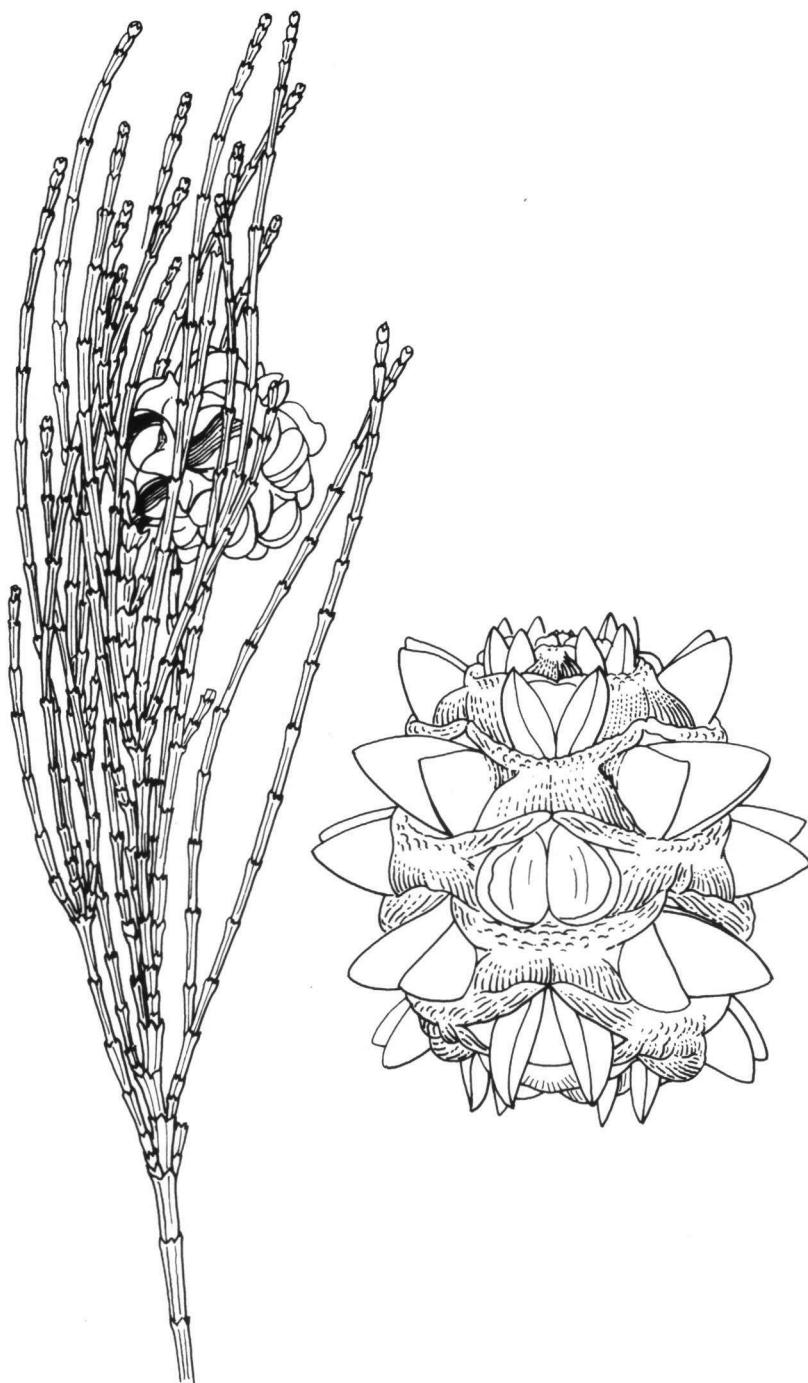


Fig. 24. *Gymnostoma nobile* L.A.S. Johnson.

CASUARINACEAE

Always: Trees; twigs jointed; leaves scaly, in whorls; flowers unisexual, male flowers in slender spikes, female flowers in globular heads.

Usually / often: Fruit a woody cone, seeds winged.

Striking features: Twigs round, scales in whorls of 6 or more (*Casuarina*); twigs quadrangular, scales in whorls of 4 (*Gymnostoma*).

Different from: *Coniferales*: no vessels in wood, twigs not articulate.

Distribution: The family is chiefly Australian and West Pacific. In Malesia 3 genera and several species, in lowland and montane forest.

- *Ceuthorstoma* is endemic in Malesia;
- *Casuarina equisetifolia* is pantropical through cultivation.

Notes: Some species cultivated as ornamental trees; fast growing trees with hard wood; several species produce root nodules with N-binding bacteria.

Literature: R. J. Johns, The flowering plants of Papua New Guinea, Dicotyledons 2 (1988) 121–125. — Dr. L.A.S. Johnson and Dr. K.L. Wilson (NSW) are specialists of the family.

Spot-characters: 46, 76, 95, 96, 102.

Illustration: Fig. 24.



Fig. 25. *Lophopetalum beccarianum* Pierre: a. habit; b. flower bud; c. flower from above; d. LS of flower (petals removed); e. CS of fruit; f. seed; g. flower, sepals and petals removed.

CELASTRACEAE (HIPPOCRATEACEAE, SIPHONODONTACEAE)

Always: Woody; leaves simple; disk present, distinct (except in *Microtropis*); stamens isomerous, opposite the sepals; ovary superior.

Usually / often: Leaves pale grey-green in herbarium; leaves opposite, dentate; stipules small, caducous; petals free, ovary 2–5-celled; fruit capsular, seeds arillate.

Striking features: Pneumatophores (*Lophopetalum*); petiole bipulvinate, scalariform venation (*Bhesa*); lianas (*Celastrus*, *Hippocratea*, *Reissantia*, *Salacia*); ovary many-celled (*Siphonodon*); seeds winged (*Kokoona*, *Lophopetalum*).

Different from: *Aquifoliaceae*: disk absent, stigma broad, sessile; fruit a drupe with 3 or more pyrenes. — *Flacourtiaceae*: leaves spiral, ovary 1-locular, parietal placentation. — *Rhamnaceae*: leaves rarely opposite; stamens opposite the petals.

Distribution: The family pantropical, some species reaching the temperate zone. In Malesia 17 genera, incl.:

- *Euonymus* (widespread), shrubs or trees, lowland and montane rain forest;
- *Lophopetalum* (Indo-Australia), trees, lowland dry and swamp forest;
- *Salacia* (pantropical), lianes, mostly lowland rain forest.

Notes: Limited use of timber: *Kokoona*, *Lophopetalum*, *Siphonodon*. — Fruits and seeds of many species eaten by birds and mammals.

Literature: Ding Hou, Fl. Males. I, 6 (1962) 227–291; ibid. I, 6 (1964) 389–421.

Spot-characters: *Celastraceae* 58, 85, 104 – *Bhesa* 36, 38, 68 – *Celastrus* 5, 101 – *Euonymus* 5, 6, 57, 81, 95 – *Glyptopetalum* 73 – *Kokoona* 88, 101, 102 – *Loeseneriella* 5, 102 – *Lophopetalum* 31, 81, 101, 102; *L. sessilifolium* 15 – *Maytenus* 101 – *Microtropis* 17; *M. kinabaluensis* 39 – *Perrottetia* 31 – *Pleurostylia* 91 – *Reissantia* 101, 102 – *Salacia* 5, 6, 22, 39, 79, 94; *S. macrophylla* 59; *S. papuana* 19 – *Sarawakodendron* 22, 77, 103 – *Siphonodon* 70, 94.

Illustrations: Fig. 25 & 26.



Fig. 26. *Salacia maingayi* Laws.: a. branch; b. flower; c. CS of flower.

CHLORANTHACEAE

Always: More or less woody, erect, twigs with swollen nodes; leaves simple, decussate (incl. verticillate), dentate, pinninerved, interpetiolar ridge or stipule; ovary inferior; fruit a 1-seeded drupe.

Usually/often: Inflorescence terminal, flowers reduced (without perianth).

Striking features: Drupes ripening white (*Chloranthus*); ripening red (*Sarcandra*).

Different from: *Acanthaceae*: flowers well developed, cystoliths. — *Piperaceae*: leaves mostly alternate, entire, ovary superior.

Distribution: The family has a patchy distribution, absent from Africa, Australia, Europe, North America. In Malesia 4 genera, incl.:

— *Ascarina* (East Malesia, Pacific), trees; montane rain forest.

Notes: Medicinal use: *Chloranthus erectus* (*C. officinalis*); leaves used as tea: *C. spicatus*.

Literature: B. Verdcourt, Fl. Males. I, 10 (1986) 123–144.

Spot-characters: *Chloranthaceae* 16, 32, 92 – *Chloranthus* 85.

Illustration: Fig. 27.



Fig. 27. *Chloranthus erectus* (Buch.-Ham.) Verdc.

CHRYSOBALANACEAE

Always: Woody, non-climbing; leaves alternate, simple, entire, pinninerved, stipulate; flowers with a hollow receptacle (hypanthium); sepals 5, petals 5, free; ovary superior, style lateral or basal; fruit a drupe.

Usually/often: Flowers zygomorphic, stamens numerous, endocarp with 'plugs' that allow germinating seedling to escape.

Striking features: Glands at base of lamina (*Maranthes*, *Parastemon*); leaves white hairy, venation scalariform, fruit warty (*Parinari*); fruits flat (*Hunga*).

Different from: *Rosaceae*: leaves often serrate, flowers actinomorphic, ovary often inferior, style terminal.

Distribution: The family pantropical. In Malesia 7 genera, nearly all confined to lowland and lower montane rain forest, incl.:

- *Atuna* (Malesia, Pacific);
- *Maranthes* (pantropical);
- *Parinari* (pantropical).

Notes: The family was formerly included in the *Rosaceae*. — The fruits of many species are eaten by birds. — Some species produce timber.

Literature: G. T. Prance & F. White, The genera of Chrysobalanaceae. Phil. Trans. Roy. Soc. London B, 320 (1988) 1–184; G. T. Prance, Fl. Males. I, 10 (1989) 635–678.

Spot-characters: *Atuna* 68, 105 – *Kostermanthus* 105 – *Maranthes* 31, 68 – *Parastemon* 31, 91 – *Parinari* 14, 26, 31, 33, 68.

Illustration: Fig. 28.

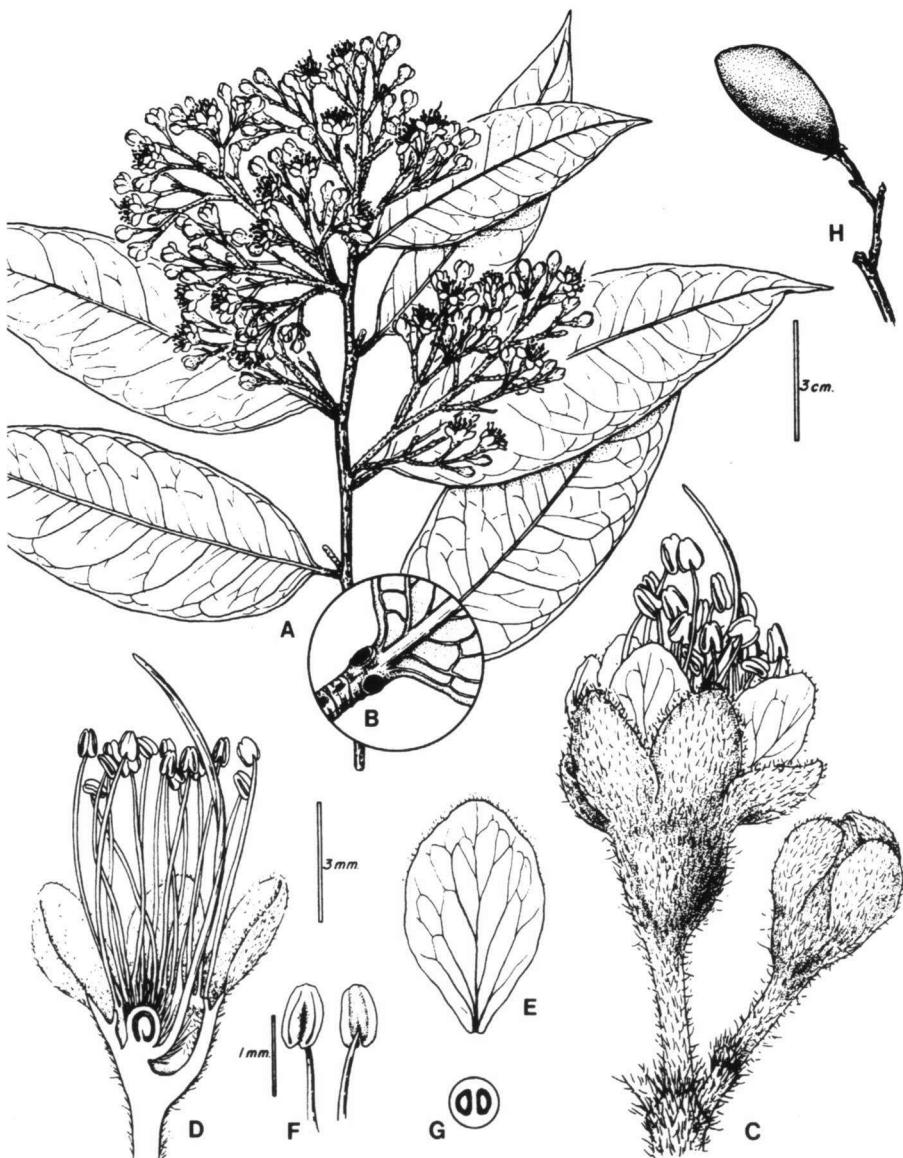


Fig. 28. *Maranthes corymbosa* Blume: A. branch; B. glands on petiole; C. flower; D. CS of flower; E. petal; F. stamens; G. CS of fruit; H. fruit.

CLETHRACEAE

Always: Woody, non-climbing; leaves spiral, simple, glandular dentate, pinninerved, exstipulate; petals more or less free; stamens twice the number of petals; ovary superior, 3-celled, ovules numerous, axillary; fruit a capsule.

Usually/often: Leaves crowded, stellate hairy; inflorescence a terminal raceme, flowers 5-merous.

Different from: *Ericaceae*: petals fused, ovary 5-locular, hairs not stellate.

Distribution: The only genus, *Clethra*, occurs chiefly in the northern hemisphere. In Malesia 13 species, mainly primary and also secondary montane forest.

Notes: Potential ornamentals.

Literature: H. Sleumer, Fl. Males. I, 7 (1971) 139–150.

Spot-characters: 25, 58.

Illustration: Fig. 29.



Fig. 29. *Clethra pachyphylla* Merr.: a. habit; b. flower; c. petal; d & e. stamens; f. LS of flower; g. fruit; h. seeds.

COCHLOSPERMACEAE

Always: Woody, non-climbing; leaves spiral, simple, palmatilobed, stipules caducous; flowers bisexual, actinomorphic, 5-merous, yellow; sepals and petals free, imbricate; stamens numerous; ovary superior, 3–5-locular; fruit a capsule, seeds numerous, covered by woolly hairs.

Usually / often: Deciduous.

Different from: *Bixaceae*: flowers red, capsule bristly. — *Bombacaceae*: scales or stellate hairs, sepals united.

Distribution: The only genus of the family, *Cochlospermum*, is pantropical. In Malesia 3 species, of which one native in New Guinea, the other two occasionally planted.

Notes: Ornamental trees, in areas with seasonal climate.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 4 (1949) 61–63; H.H. Poppendieck, Bot. Jahrb. 101 (1980) 191–265.

Spot-characters: 21, 58, 103.

Illustration: Fig. 30.



Fig. 30. *Cochlospermum religiosum* (L.) Alston.



Fig. 31. *Combretum sundaicum* Miq.: a. habit; b. flower; c. fruit.

COMBRETACEAE

Always: Woody; leaves simple, entire, penninerved; ovary inferior, 1-locular.

Usually/often: Leaves spiral with fine pellucid dots; glands at base of lamina or on petiole; calyx valvate; petals 4 or 5, free; stamens twice the number of petals, disk present; 2 ovules; fruit 1-seeded, winged.

Striking features: Climber, fruits crowned by accrescent sepals (*Calycopteris*); trees with sympodial horizontal branching, leaves crowded, no petals (*Terminalia*); leaves opposite, with scales, fruit winged (*Combretum*); petiolar spines (*Quisqualis*).

Distribution: The family pantropical. In Malesia 5 genera, incl.:

- *Combretum* (pantropical), climbers, lowland rain forest;
- *Lumnitzera* (paleotropics), shrubs or treelets, mangrove;
- *Terminalia* (pan-tropical), trees, lowland rain and monsoon forest.

Notes: *Terminalia* fruits dispersed by water and bats. — **Ornamentals:** *Combretum*, *Quisqualis*, *Terminalia*. — **Timber:** *Terminalia*.

Literature: A.W. Exell, Fl. Males. I, 4 (1954) 533–589; M.J.E. Coode, Manual of the forest trees of Papua / New Guinea, part 1 (revised), Combretaceae (1969) 86 pp.

Spot-characters: *Combretaceae* 58, 68, 92 – *Calycopteris* 5, 6, 80, 98 – *Combretum* 5, 6, 8, 22, 26, 46, 59, 98 – *Quisqualis* 4, 5, 6, 12, 46, 98 – *Terminalia* 8, 12, 14, 31, 46, 59, 69, 98, 99.

Illustrations: Fig. 31 & 32.



Fig. 32. *Terminalia zollingeri* Exell: a. habit; b. hermaphrodite flower; c. male flower; d. LS of hermaphrodite flower; e. fruit; f. endocarp.

COMPOSITAE (ASTERACEAE)

Always: Exstipulate; flowers in an involucrate head, petals fused, style bifid; ovary inferior, 1-locular, 1 ovule.

Usually / often: Herbaceous, leaves spiral; two types of flower: inner actinomorphic, tubular (disk florets), outer zygomorphic (ray florets), calyx transformed to hairy pappus.

Striking features: Trees (*Vernonia arborea*, some *Olearia*, some *Senecio*).

Different from: In flower not likely to be confused with other families.

Distribution: The family world-wide. In Malesia c. 70 genera, few species in rain forest. Most Malesian species are widespread weeds:

- *Bidens* (cosmopolitan), herbs, mostly weeds;
- *Blumea* (paleotropics), herbs and shrubs, open places, also forest;
- *Dichrocephala* (paleotropics), herbs, forest floor;
- *Eupatorium* (pan-tropical, mostly American), shrubs, secondary forest;
- *Vernonia* (widespread), herbs, shrubs, lianas, trees, open places and forest;
- *Wedelia* (pan-tropical), shrubs, some coastal.

Notes: Many species (mostly non-Malesian) cultivated ornamentals: *Aster**., *Cosmos*, *Dahlia**., *Zinnia**. — Edible leaves: *Cichorium**, *Cosmos**, *Erechtites** (p.p.), *Lactuca** (p.p.), *Pluchea*. — Medicinal use: *Artemisia*.

Literature: C.A. Backer & R.C. Bakhuizen van den Brink, Fl. Java 2 (1965) 362–437; J.Th. Koster, various papers in *Blumea* and *Nova Guinea*.

Spot-characters: *Compositae* 19, 49, 58, 59, 76, 85, 92 – *Acanthospermum* 95 – *Ambrosia* 95 – *Anaphalis* 23, 103 – *Artemisia* 60 – *Bidens* 50, 95 – *Blumea* 103 – *Conyza* 103 – *Cosmos* 50, 95 – *Crassocephalum* 103 – *Crepis* 8 – *Emilia* 103 – *Erechtites* 103 – *Erigeron* 103 – *Eupatorium* s.l. 23, 103 – *Glossogyne* 95 – *Gnaphalium* 103 – *Grangea* 15 – *Gynura* 103 – *Inula* 103 – *Lactuca* 1, 103 – *Laggera* 15, 103 – *Launaea* 103 – *Microglossa* 103 – *Mikania* 5, 6, 103 – *Olearia* 25, 62 – *Pluchea* 103 – *Pterocaulon* 15, 103 – *Rhamphogyne* 1 – *Rhynchospermum* 103 – *Senecio* 25, 103 – *Sonchus* 103 – *Sphaeranthus* 15 – *Tetramolopium* 103 – *Verbesina alata* 15 – *Vernonia* 5, 103 – *Wedelia asperima* 62 – *Xanthium* 95 – *Youngia* 103.

Illustrations: Fig. 33, 34, 35.



Fig. 33. *Arrhenechthites novoguineensis* (S. Moore) Mattf. subsp. *novoguineensis*: A. flowering branch; B. flowerhead; C. disk flower; E. marginal flower; F. style top.

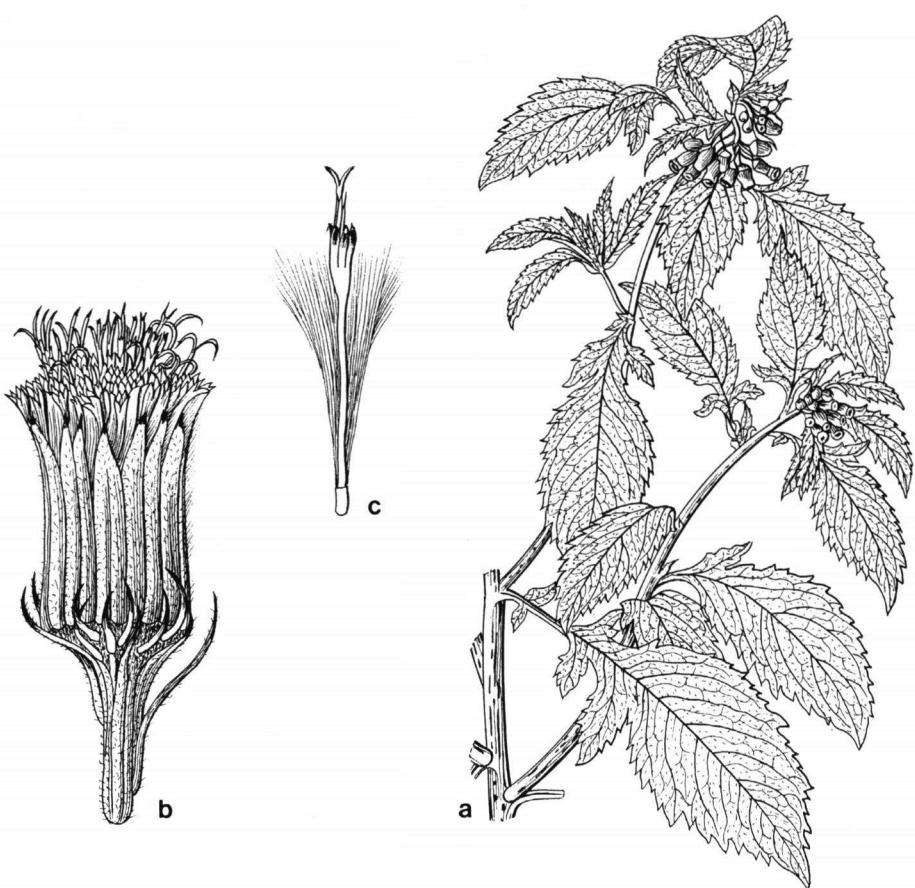


Fig. 34. *Crassocephalum crepidioides* (Benth.) S. Moore: a. habit; b. flowerhead; c. disk flower.

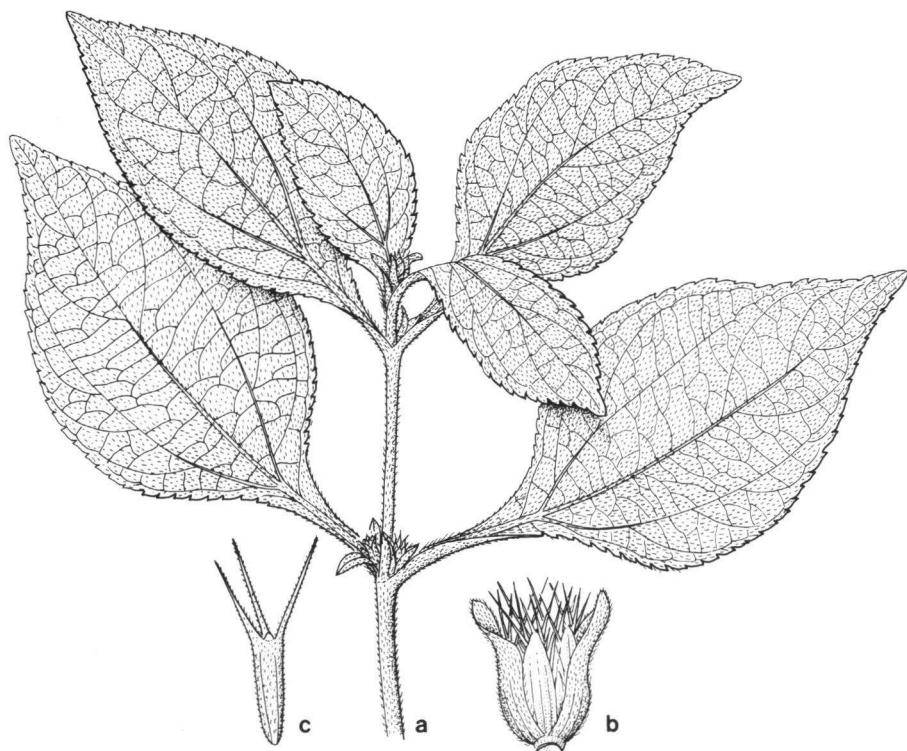


Fig. 35. *Synedrella nodiflora* (L.) Gaertn.: a. habit; b. flower; c. fruit.

CONIFERALES

Always: Woody; non-climbing; wood vesselless, resinous; leaves simple, entire; flowers in unisexual strobili (plants dioecious or monoecious).

Usually / often: Trees, leaves spiral, venation longitudinal.

Striking features: Leaves needle-like, in bundles (*Pinus*); leaves needle-like, spiral (*Araucaria cunninghamii*, some *Dacrycarpus*, *Dacrydium* and *Falcatifolium*); leaves scale-like, spiral (some *Dacrycarpus* and *Dacrydium*); leaves scale-like, opposite (*Libocedrus*); twigs flat, resembling leaves (*Phyllocladus*); leaves broad, opposite, parallel venation (*Agathis*, terminal bud rounded, and *Nageia*, terminal bud acute); female flowers simple (*Podocarpaceae*, *Taxus*).

Different from: *Casuarinaceae*: twigs jointed, true flowers.

Distribution: The Coniferales are widespread. The Malesian species belong to 5 families:

- *Araucariaceae* (*Agathis*, *Araucaria*);
- *Cupressaceae* (*Libocedrus*);
- *Pinaceae* (*Pinus*);
- *Podocarpaceae* (*Dacrycarpus*, *Dacrydium*, *Falcatifolium*, *Nageia*, *Phyllocladus*, *Podocarpus*, *Prumnopitys*);
- *Taxaceae* (*Taxus*).

Most species occur in montane rain forest, also in lowland and peat-swamp forest.

Notes: Pollination is by wind; many species have seeds eaten by birds; *Pinus* has winged seeds. — Several species produce excellent softwood timber; the wood is also used for pulp and veneer. — Resin (copal): *Agathis*, *Cupressus**; turpentine: *Pinus*. — Some species planted as ornamentals: *Agathis*, *Araucaria*, *Dacrydium*, *Pinus*.

Literature: D.J. de Laubenfels, Fl. Males. I, 10 (1988) 337–453.

Spot-characters: *Coniferales* 76, 104 – *Agathis* 96, 102 – *Araucaria* 96 – *Dacrycarpus imbricatus* 47 – *Pinus* 96, 102 – *Podocarpus* 59.

Illustrations: Fig. 36, 37a, b, 38a, b, 39, 40.

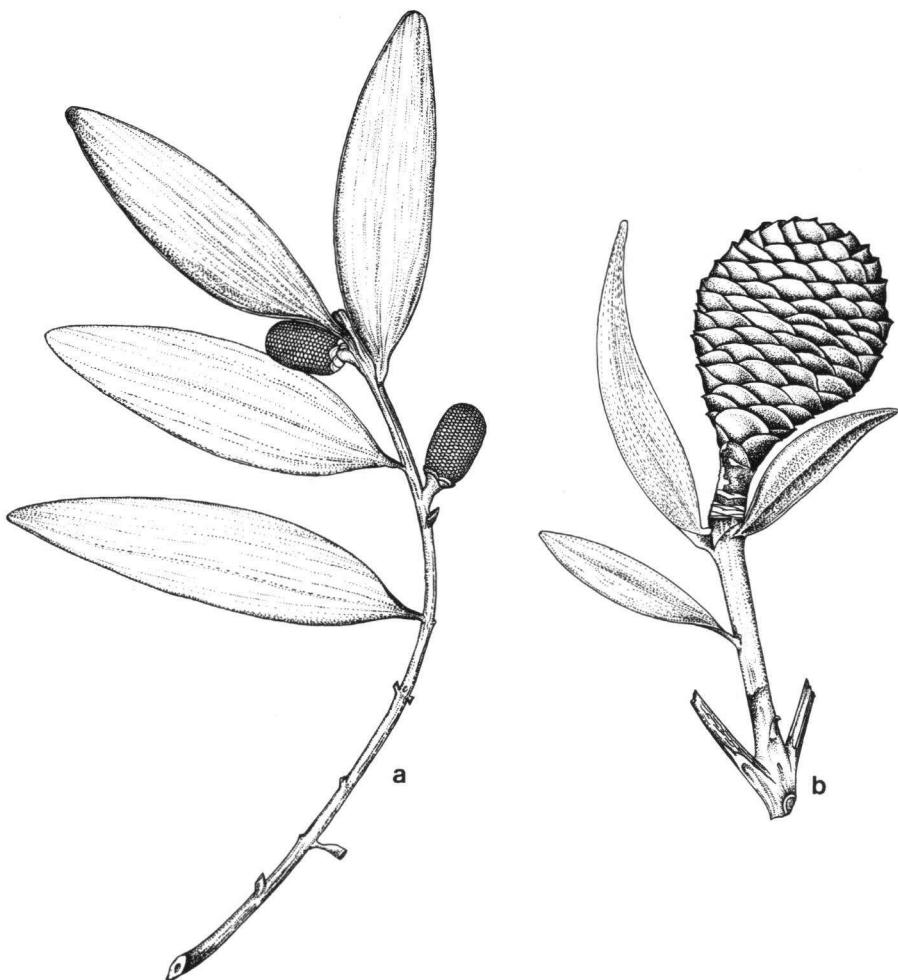


Fig. 36. *Agathis labillardieri* Warb.: a. twig with male cone; b. twig with female cone.

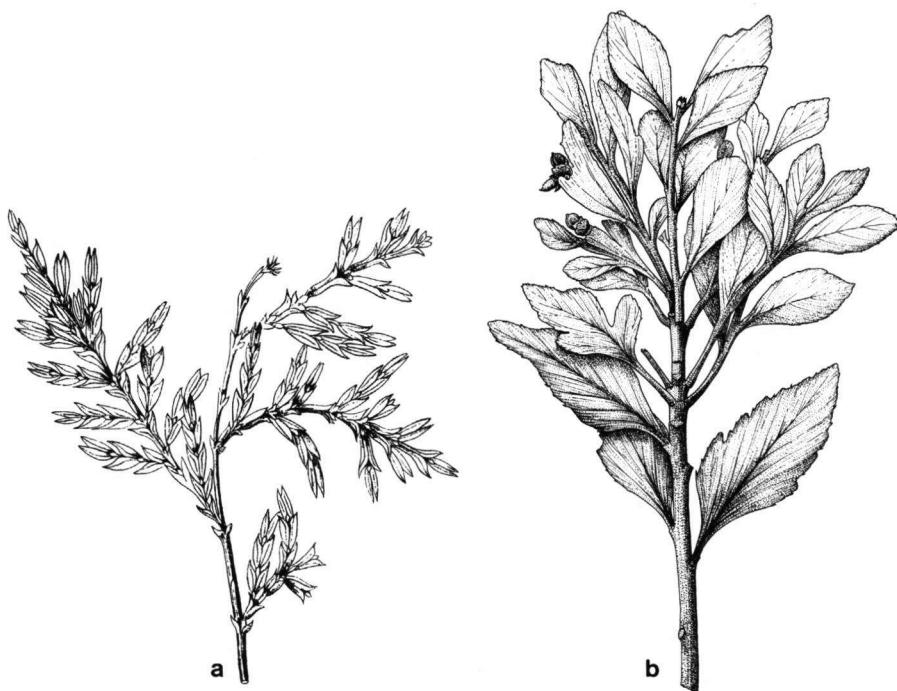


Fig. 37a. *Libocedrus papuana* F. Muell. — Fig. 37b. *Phyllocladus hypophyllus* Hook. f.

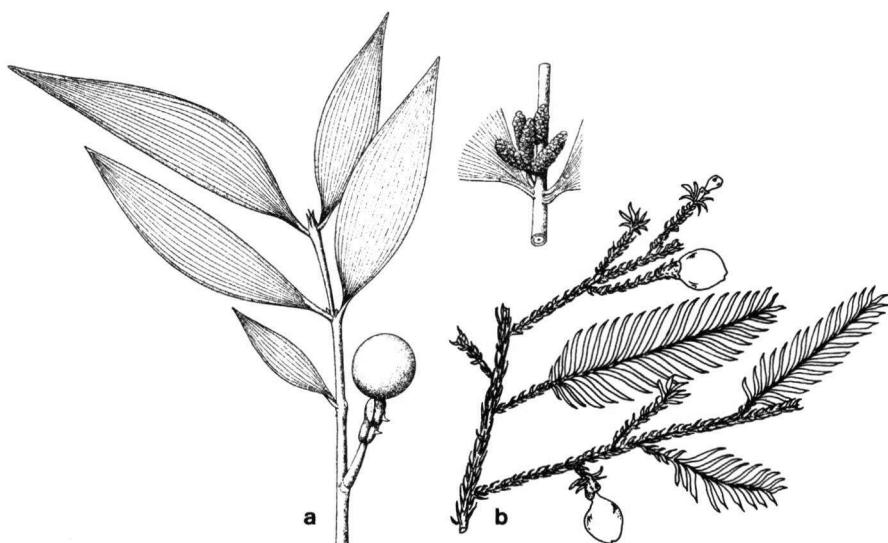


Fig. 38a. *Nageia wallichiana* (Presl) O. Kuntze. — Fig. 38b. *Dacrycarpus imbricatus* (Blume) de Laub.

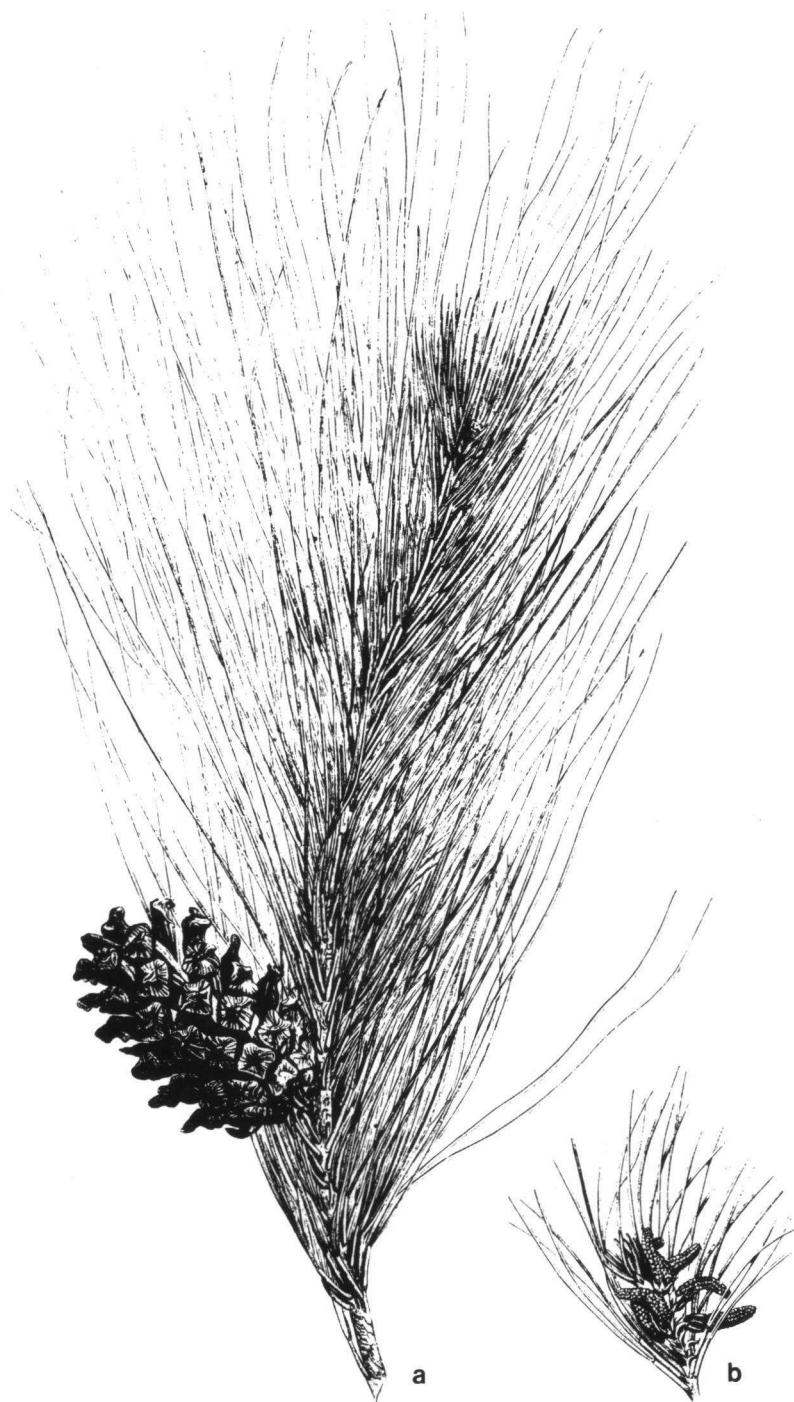


Fig. 39. *Pinus merkusii* Jungh. & de Vriese: a. twig with female cone; b. male cones.



Fig. 40. *Taxus sumatrana* (Miq.) de Laub.

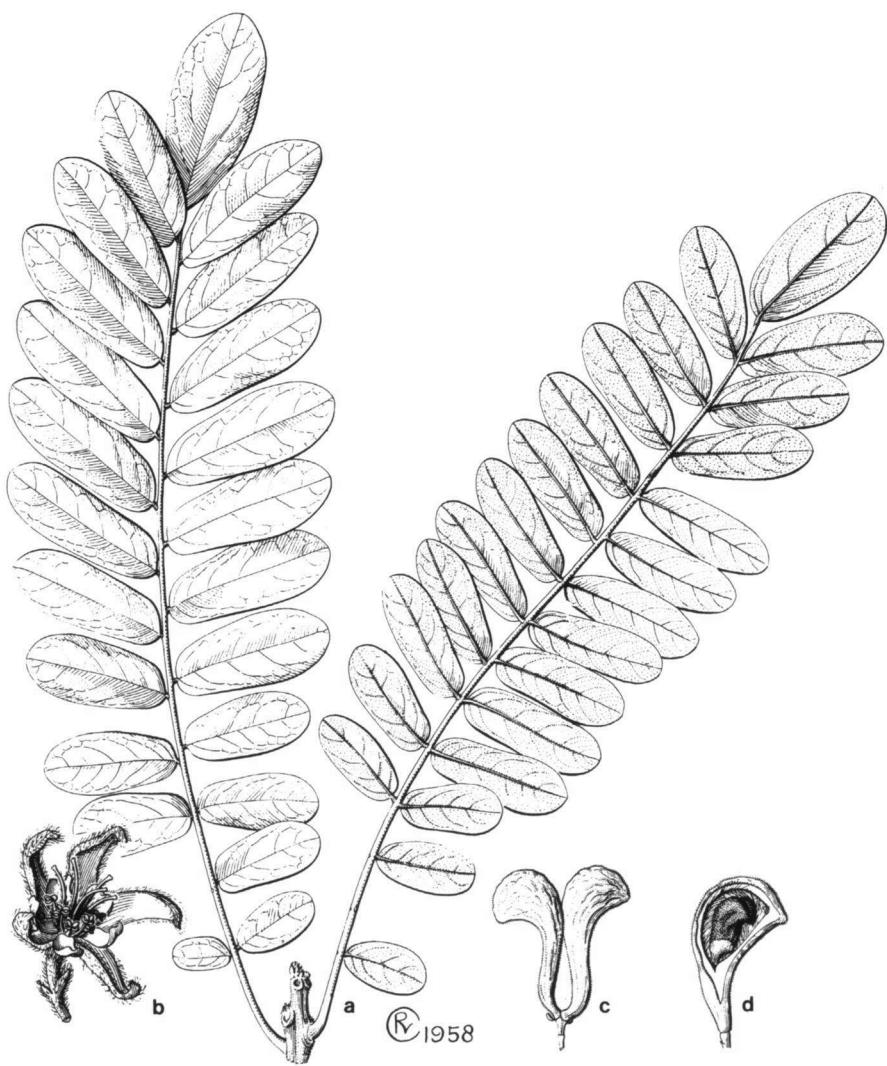


Fig. 41. *Cnestis platantha* Griff.: a. habit; b. flower; c. fruit; d. idem opened.

CONNARACEAE

Always: Woody; leaves spiral, entire, penninerved, exstipulate; sepals and petals free; ovary superior, two collateral ovules; fruit a 1-seeded capsule; seed arillate.

Usually/often: Climbers, leaves imparipinnate; flowers 5-merous; 1–5 free carpels; stamens 10.

Striking features: Tree with unifoliolate leaves (*Ellipanthus*); leaves pellucid punctate (*Connarus*); leaves trifoliolate, dried leaflets with minute pits above, fruit warty (*Agelaea*).

Different from: *Leguminosae*: stipules present, sepals connate, ovules serial, fruit mostly with more than one seed.

Distribution: The family pantropical. In Malesia 6 genera, incl.:

- *Connarus* (pantropical), lianas, shrubs; forest and open places in lowland;
- *Rourea* (pantropical), lianas; forest and open places in lowland.

Notes: Dispersal of the arillate seeds probably by birds. Branches of some climbing species used as ropes.

Literature: P.W. Leenhouts, Fl. Males. I, 5 (1958) 495–541.

Spot-characters: *Connaraceae* 56, 84, 99, 104 – *Agelaea* 5, 48, 50 – *Cnestis* 5 – *Connarus* 5, 27, 48, 59; *C. grandis* 18 – *Ellipanthus* 21, 38, 51; *E. beccarii* var. *peltata* 51 – *Rourea* 5 – *Roureopsis* 5.

Illustrations: Fig. 41 & 42.

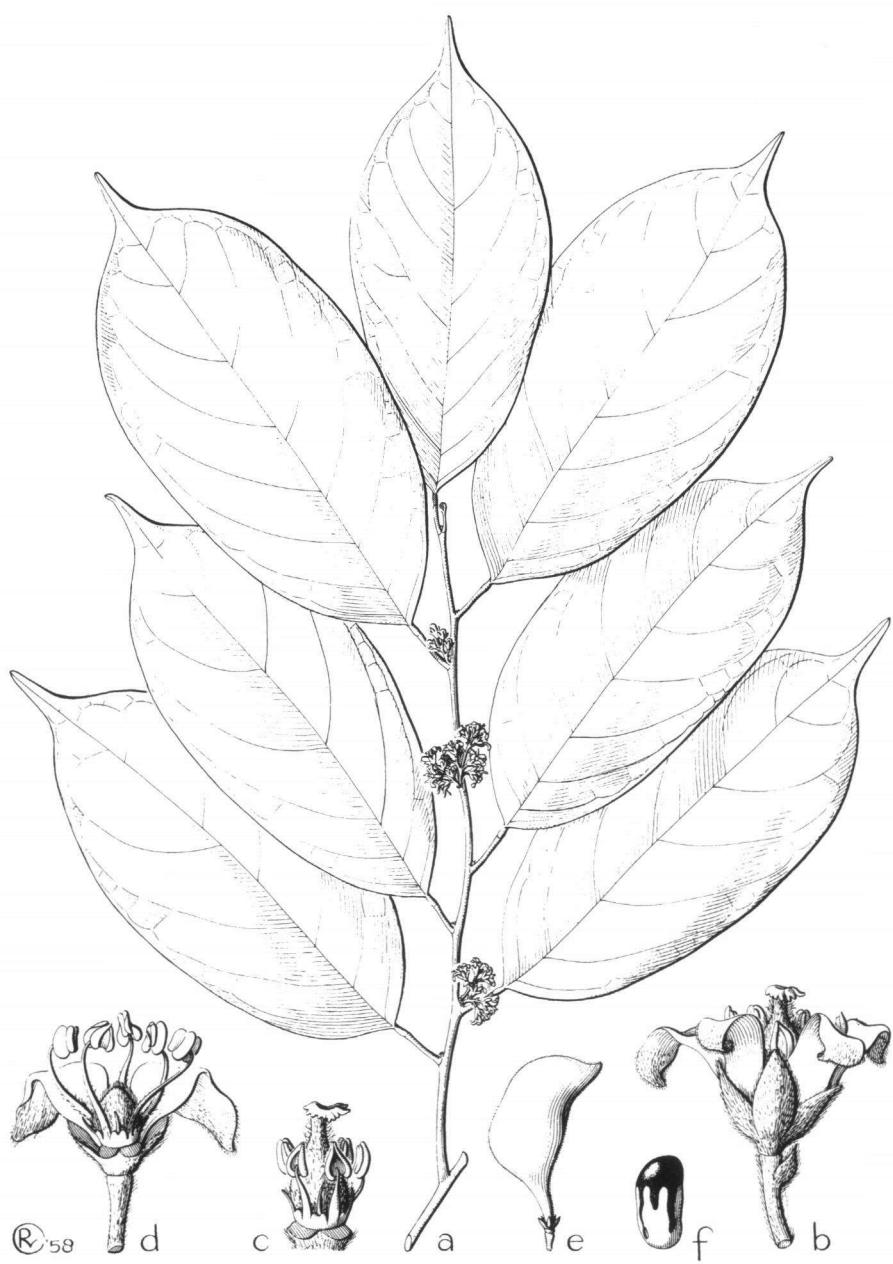


Fig. 42. *Ellianthus tomentosus* Kurz: a. habit; b. female flower; c. same, petals and sepals removed; d. male flower; e. fruit; f. seed.

CORNACEAE

Always: Trees, resinous; leaves simple, entire, penninerved, exstipulate; flowers actinomorphic, bisexual; petals free, valvate, disk present; ovary inferior 1-celled, 1 pendulous ovule; fruit a drupe.

Usually/often: Leaves opposite; inflorescence terminal; flowers 4- or 5-merous, stamens isomerous; ripe fruit blue, endocarp sulcate. Freshly cut bark smells of sugarcane.

Different from: *Alangiaceae*: leaves spiral, stamens twice the number of petals. — *Araliaceae*: leaves ligulate, often compound, plants aromatic. — *Rubiaceae*: stipulate, petals united.

Distribution: World-wide, mainly northern hemisphere. In Malesia 1 genus:

— *Mastixia* (India–Solomons), mainly montane rain forest.

Notes: Some species may reach considerable size but the wood is soft.

Literature: K.M. Matthew, Fl. Males. I, 8 (1977) 85–97.

Spot-characters: *Helwingia* 74 – *Mastixia* 28, 31, 58, 92, 93.

Illustration: Fig. 43.

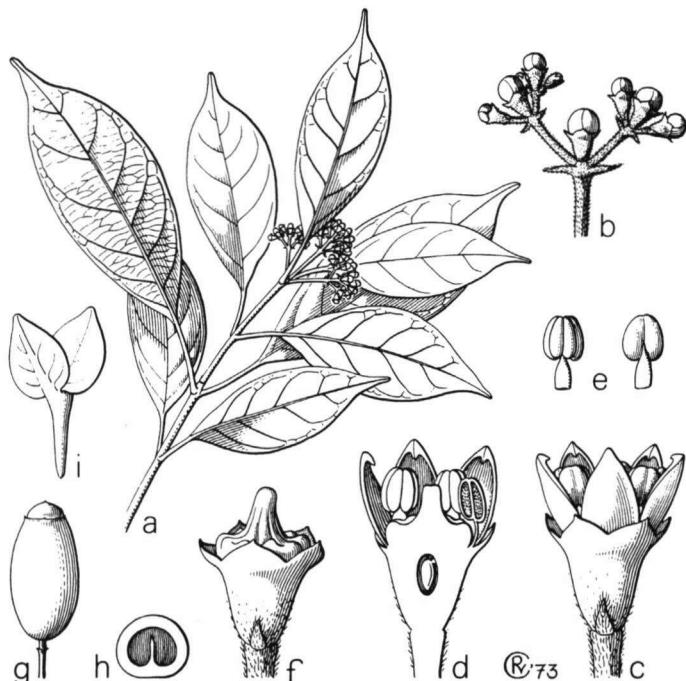


Fig. 43. *Mastixia kaniensis* Melch. subsp. *kaniensis*: a. habit; b. terminal cyme; c. flower; d. idem in LS; e. stamens; f. receptacle; g. fruit; h. idem in CS; i. embryo.



Fig. 44. *Corynocarpus australasicus* C.T. White, with details of flower and fruit.

CORYNOCARPACEAE

Always: Trees; leaves spiral, simple, entire, penninerved, exstipulate; flowers 5-merous, bisexual, outer two calyx lobes small, stamens opposite the petals, staminodes petaloid, disk of 5 glands; fruit a drupe.

Usually/often: Ovary 2-locular, one cell abortive, one pendulous ovule.

Different from: *Anacardiaceae*: resinous sap turning black; rarely with petaloid staminodes. — *Celastraceae*: stipulate, leaves often opposite, dentate, ovary 2–5-celled.

Distribution: The only genus, *Corynocarpus*, is represented in New Guinea, Queensland and the West Pacific; the only Malesian species *C. australasica*, occurs in lowland to montane rain forest.

Notes: In New Zealand the fruit of *Corynocarpus laevigata* is eaten.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 4 (1951) 262–264.

Spot-characters: 17, 46, 59, 83.

Illustration: Fig. 44.

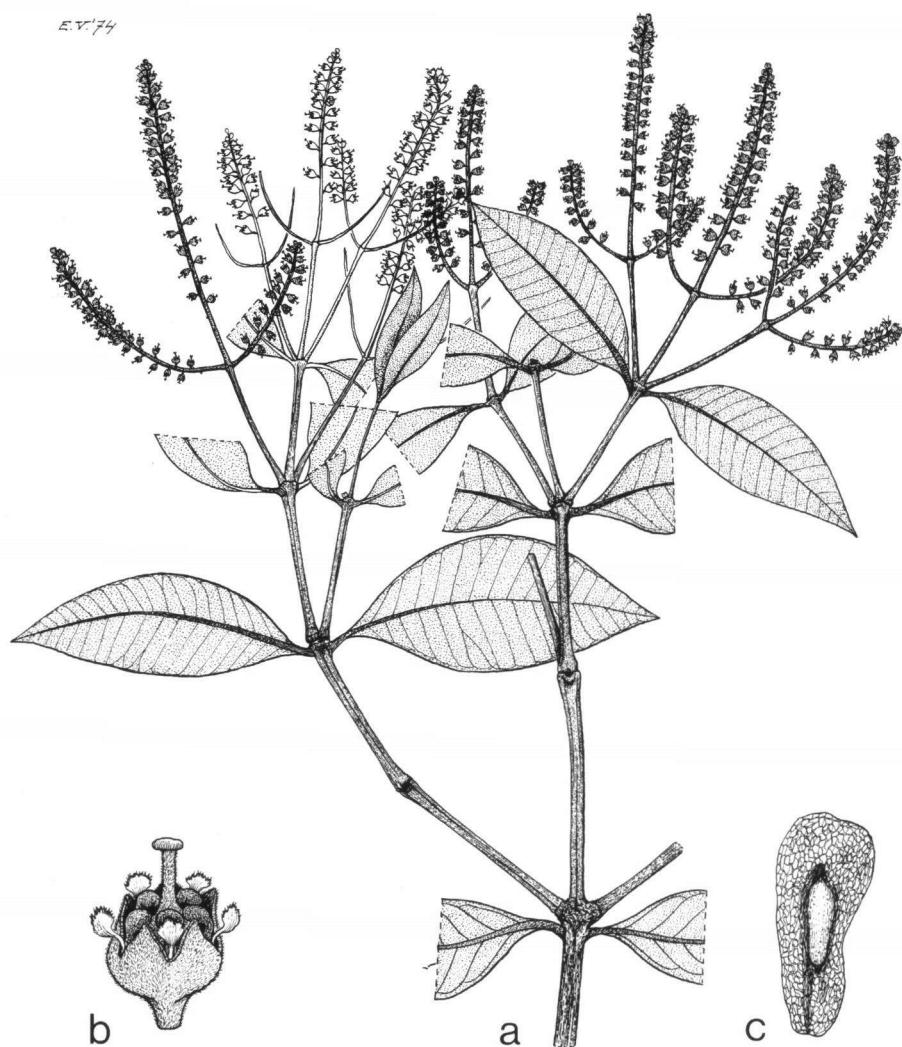


Fig. 45. *Dactylocladus stenostachys* Oliv.: a. habit; b. flower; c. seed.

CRYPTERONIACEAE

Always: Woody, non-climbing; branches thickened at the nodes; leaves decussate, simple, entire, pinninerved; inflorescence a panicle of racemes; fruit a capsule; seeds winged.

Usually/often: Leaves with intramarginal nerve; stipules (if present) minute; flowers hermaphrodite, ovary inferior, petals caducous, rudimentary or absent; stamens enveloped by the petals.

Striking features: Flowers apetalous, ovary superior (*Crypteronia*); tree of swamp forest (*Dactylocladus*).

Different from: *Lythraceae*: inflorescence cymose, hypanthium. — *Melastomataceae*: leaves usually triplinerved, exstipulate, corolla large. — *Myrtaceae*: exstipulate, leaves with pellucid dots, nodes not thickened.

Distribution: The family pantropical. In Malesia 3 genera:

- *Axinandra* (Sri Lanka, West Malesia), trees; lowland rain forest;
- *Crypteronia* (Indo-Malesia), trees; lowland rain forest;
- *Dactylocladus* (Borneo, New Guinea), trees; swamp forest.

Notes: Timber tree: *Dactylocladus stenostachys*.

Literature: R. J. van Beusekom-Osinga, Fl. Males. I, 8 (1977) 187–204; J.T. Pereira, Tree Fl. Sabah & Sarawak 2 (1996) 135–149.

Spot-characters: *Crypteroniaceae* 65, 83 – *Axinandra* 16, 66, 100 – *Crypteronia* 16, 100, 102 – *Dactylocladus* 16, 100, 102.

Illustration: Fig. 45.

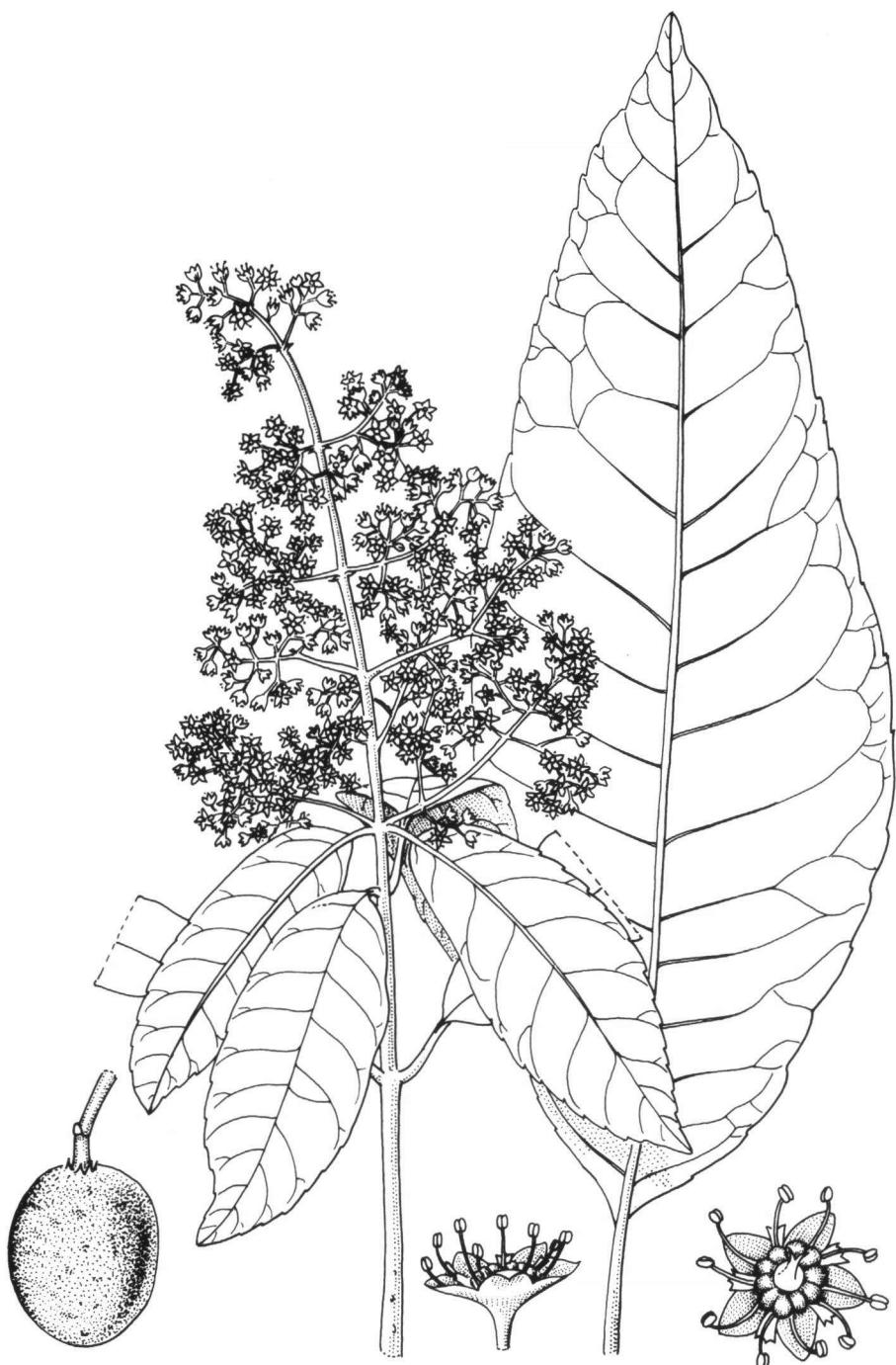


Fig. 46. *Schizomeria serrata* Hochr., showing habit, flower and fruit.

CUNONIACEAE

Always: Woody, non-climbing; leaves opposite (incl. verticillate), penninerved, interpetiolar stipules; sepals and petals free, disk present; ovary more or less superior.

Usually / often: Leaves compound, serrate / dentate, yellowish upon drying; flowers 4- or 5-merous, stamens in 1 or 2 whorls, ovary 2-locular, fruit a dehiscent capsule, seeds winged.

Striking features: Flowers apetalous, carpels free, fruit apocarpous (*Acsmithia*); fruit winged (*Gillbeea*); fruit a 1-seeded drupe (*Aistopetalum*; *Schizomeria*); leaves simple, verticillate (all *Acsmithia*, some *Pullea*).

Different from: *Saxifragaceae*: exstipulate, ovary inferior. — *Staphyleaceae*: glands on top of rachis, ovary 3-locular.

Distribution: A mainly southern hemisphere family; in the tropics mostly montane. In Malesia 9 genera, incl.:

- *Acsmithia* (East Malesia, Australia, West Pacific) trees, shrubs; lowland and montane forest;
- *Caldcluvia* (East Malesia, Australia, New Zealand), trees; montane forest;
- *Weinmannia* (southern hemisphere, throughout Malesia), trees; montane forest, often in open places.

Notes: In many species the dispersal of the tiny seeds presumably is by wind. — Timber: *Caldcluvia*.

Literature: A. Engler, Nat. Pflanzenfam. ed. 2, 18a (1928) 229–262.

Spot-characters: *Cunoniaceae* 32, 49, 58, 79, 89, 96 – *Acsmithia* 46, 52, 102 – *Aistopetalum* 49 – *Caldcluvia* 25, 48, 49, 76, 100; *C. brassii* 52 – *Ceratopetalum* 38, 48, 49, 55; *C. succirubrum* 21 – *Gillbeea* 49, 81, 98 – *Pullea* 31, 46, 52, 76 – *Schizomeria serrata* 21 – *Spiraeanthemum* 102 – *Weinmannia* 40, 48, 52, 103.

Illustration: Fig. 46.

CYCADACEAE

Always: Trees or shrubs, resinous; leaves pinnately compound, spiral, crowded, exstipulate; dioecious, strobili terminal, males in a cone, females solitary in clusters.

Usually / often: Unbranched.

Different from: *Palmae*: not resinous, true flowers.

Distribution: In Malesia the family, consisting of only one paleotropical genus, *Cycas*, occurs mostly in lowland rain forest, also coastal and on limestone.

Notes: Some species are planted as ornamentals; seeds of some species are edible.

Literature: R. Pilger in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 13 (1926) 44–82; K.D. Hill, Austral. Syst. Bot. 7 (1994) 543–567. — Dr. D.J. de Laubenfels (Syracuse, USA) is revising the family for Flora Malesiana.

Spot-characters: 10, 12.

Illustration: Fig. 47.

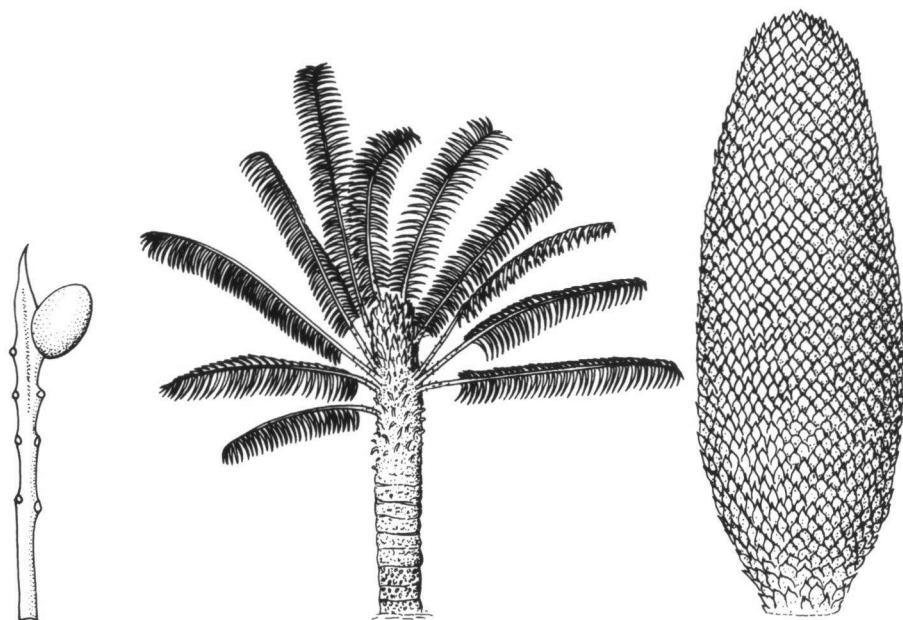


Fig. 47. *Cycas rumphii* Miq., showing seed-bearing carpel, habit and male cone (Courtesy Prof. & Mrs. H. Keng).

DAPHNIPHYLLOACEAE

Always: Woody, non-climbing; leaves simple, spiral, pinninerved, exstipulate; flowers apetalous, unisexual (plants dioecious); ovary imperfectly 2-locular, 2 ovules per cell, 2 stigmas.

Usually/often: Leaves entire, glaucous below.

Different from: *Euphorbiaceae*: stipulate, usually 3-locular, ovule with a caruncle.

Distribution: The only genus, *Daphniphyllum*, was formerly included in the *Euphorbiaceae* and occurs in Southeast Asia and Malesia, mostly in montane forest.

Literature: T.C. Huang, *Taiwania* 11 (1965) 57–98; 12 (1966) 137–234; *Fl. Males.* I, 13 (1997) 145–168.

Spot-characters: 30, 46, 79, 89.

Illustration: Fig. 48.

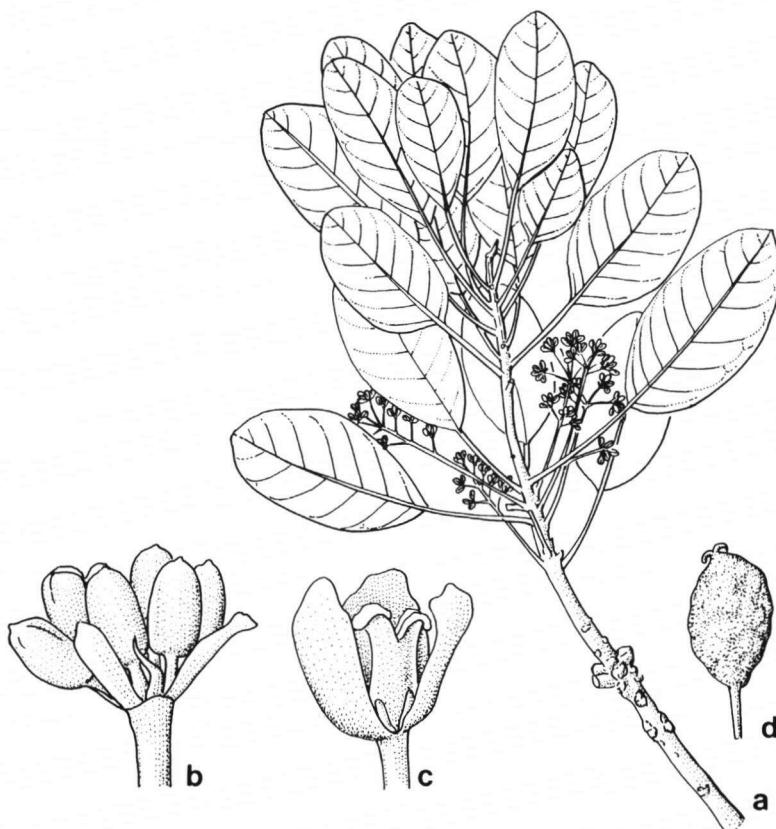


Fig. 48. *Daphniphyllum gracile* Gage: a. habit; b. male flower; c. female flower; d. fruit (Courtesy Department of Forests, PNG).



Fig. 49. *Octomeles sumatrana* Blume.

DATISCACEAE

Always: Trees; leaves simple, spiral, exstipulate; dioecious; flowers actinomorphic; ovary inferior, styles separate; ovules numerous, placentation parietal; fruit a capsule.

Usually/often: Developing large buttresses.

Different from: *Flacourtiaceae*: ovary superior (semi-inferior in *Homalium*).

Distribution: A family of 3 genera of which 2 in Malesia:

- *Octomeles* (Malesia), twigs 3-angular, leaves lepidote, flowers in spikes, lowland rain forest;
- *Tetrameles* (Southeast Asia to Queensland), deciduous, apetalous, seasonal forest.

Notes: The trunks may attain huge size, the wood is soft and is much used to build canoes. The minute seeds are wind dispersed.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 4 (1953) 382–387.

Spot-characters: *Octomeles* 26, 31, 51, 59, 78, 92 – *Tetrameles* 8, 51, 92.

Illustration: Fig. 49.



Fig. 50. *Dichapetalum timoriense* (DC.) Boerl.: a. habit; b. flower; c. petals; d. stamens; e. anther; f. disk; g. ovary; h. fruit; i. CS of fruit.

DICHAPETALACEAE

Always: Woody; leaves spiral, simple, entire, penninerved, stipules small, caducous; inflorescence cymose; flowers 5-merous; petals bifid, free; disk of 5 intrastaminal lobes; ovary 2- or 3-locular, 2 apical ovules per cell.

Usually / often: Leaves with strong looping veins; black glands on underside of leaves, flowers functionally unisexual (plants, monoecious or dioecious); fruit a 1–3-seeded, lobed drupe (fruit flat when only 1 carpel developed).

Different from: *Euphorbiaceae*: never bifid petals.

Distribution: The family and the only Malesian genus, *Dichapetalum*, pantropical. In Malesia 15 species, mostly climbers of lowland and montane rain forest.

Notes: Leaves and young fruits of *Dichapetalum timoriense* are edible.

Literature: P.W. Leenhouts, Fl. Males. I, 5 (1957) 305–316.

Spot-characters: 31, 54, 60, 71, 81, 95, 99, 101.

Illustration: Fig. 50.

DILLENIACEAE

Always: Leaves spiral, simple, pinninerved, exstipulate (but petiolar wings may resemble stipules); sepals persistent in fruit; petals free, stamens numerous, styles free.

Usually/often: Woody; leaves dentate / serrate; flowers yellow; fruit more or less apocarpous, dehiscent; seeds arillate.

Striking features: Herbs (*Acotrema*); climbers (*Tetracera*); petiole winged (*Acotrema*, some *Dillenia*); 'sandpaper' leaves (some *Tetracera*); trees, often stilt-rooted, trunk when slashed produces hissing sound (*Dillenia*).

Different from: *Guttiferae*: leaves opposite, entire, yellow or white sap. — *Ochnaceae*: stipulate. — *Theaceae*: carpels completely united.

Distribution: The family more or less pantropical. In Malesia 5 genera, incl.:

- *Dillenia* (Madagascar to Fiji), trees or shrubs, everwet and seasonal lowland forest;
- *Tetracera* (pantropical), climbers, lowland primary and secondary forest.

Notes: Leaves of some *Tetracera* used for polishing. — Some *Dillenia* spp. planted as ornamental trees; *Hibbertia scandens* is a potential ornamental. — Some species of *Dillenia* have edible fruits. The fruits and arillate seeds of several *Dillenia* spp. are eaten by mammals and birds.

Literature: R. D. Hoogland, Fl. Males. I, 4 (1951) 141–172.

Spot-characters: *Dilleniaceae* 58, 68, 104 – *Acotrema* 40 – *Dillenia* 8, 33, 40, 53, 62, 85; *D. pentagyna* 62 – *Hibbertia scandens* 5, 24, 26 – *Tetracera* 5, 61, 79, 86.

Illustration: Fig. 51.



Fig. 51. *Dillenia indica* L.



Fig. 52. *Dipterocarpus verrucosus* Sloot.: a. leaf; b. inflorescence; c. stipule; d. flowering twig; e. fruits; f. nut.

DIPTEROCARPACEAE

Always: Woody, non-climbing, resinous; leaves simple, alternate, entire, stipulate; flowers 5-merous, petals more or less free, contorted, calyx persistent.

Usually / often: Large trees; secondary and tertiary veins parallel, petiole thickened apically, hairs in fascicles (tufts), domatia present; inflorescence a panicle, the fruits winged (enlarged sepals), stamens numerous, connective elongated, ovary 3-locular.

Striking features: Large amplexicaul stipules (*Dipterocarpus*, some *Shorea*, some *Parashorea*); fruits wingless (several *Vatica*, some *Dipterocarpus* and *Shorea*); dense numerous parallel secondary nerves (*Dryobalanops*, all reaching margin, and some *Hopea*); ovary (semi-)inferior (*Anisoptera* and *Dipterocarpus*); petiole geniculate (*Anisoptera*, *Dipterocarpus*, *Upuna*); bole smooth with horizontal rings, large glands on underside of leaves (*Vatica*).

Distribution: There are 3 subfamilies:

- *Pakaraimaeoideae* (1 monotypic genus South America);
- *Monotoideae* (2 genera Madagascar–Africa);
- *Dipterocarpoideae* (c. 15 genera, Seychelles to South China and New Guinea).

In Malesia 10 genera of which the largest:

- *Dipterocarpus* (c. 70 spp., Sri Lanka to Borneo);
- *Hopea* (c. 100 spp., S. India to New Guinea);
- *Shorea* (nearly 200 spp., India to Moluccas);
- *Vatica* (65 spp., S. India to New Guinea).

Other Malesian genera:

- *Anisoptera* (10 spp., Indochina to New Guinea);
- *Cotylelobium* (6 spp., Sri Lanka, West Malesia);
- *Dryobalanops* (7 spp., West Malesia);
- *Neobalanocarpus* (1 sp., Malay Peninsula);
- *Parashorea* (c. 15 spp., Southeast Asia, West Malesia);
- *Upuna* (1 sp., Borneo).

Notes: Kostermans (1987) raised *Vatica* sect. *Sunaptea* to the rank of genus, *Sunaptea*, and united it with *Cotylelobium*. He also excluded *Monotoideae* and *Pakaraimaeoideae* from *Dipterocarpaceae* (Kostermans 1993). Many species produce valuable hardwood timber: Balau and Meranti (*Shorea*), Keruing (*Dipterocarpus*), Kapur (*Dryobalanops*). Others produce resins (damar): *Dipterocarpus* and *Shorea*; camphor from *Dryobalanops*, oils from *Shorea*.

Literature: C.F. Symington, Mal. For. Rec. 16 (1943); P.S. Ashton, Fl. Males. I, 9 (1982) 237–552; A.J.G.H. Kostermans, Proc. Round Table Conf. Dipt. (1987) 603–627; The Dipterocarpaceae of Sri Lanka (1993).

Spot-characters: *Dipterocarpaceae* 30, 56, 58, 80, 83 – *Anisoptera* 38, 92, 98 – *Cotylelobium* 98 – *Dipterocarpus* 8, 33, 37, 38, 53, 68, 92, 98 – *Dryobalanops* 67, 98 – *Hopea* 36, 67, 68, 98 – *Neobalanocarpus* 68, 98 – *Parashorea* 33, 53, 68, 85, 98 – *Shorea* 8, 22, 25, 33, 36, 37, 38, 39, 52, 53, 68, 98; *S. peltata* 51 – *Upuna* 38, 68, 98 – *Vatica* 27, 31, 53, 98.

Illustrations: Fig. 52–55.

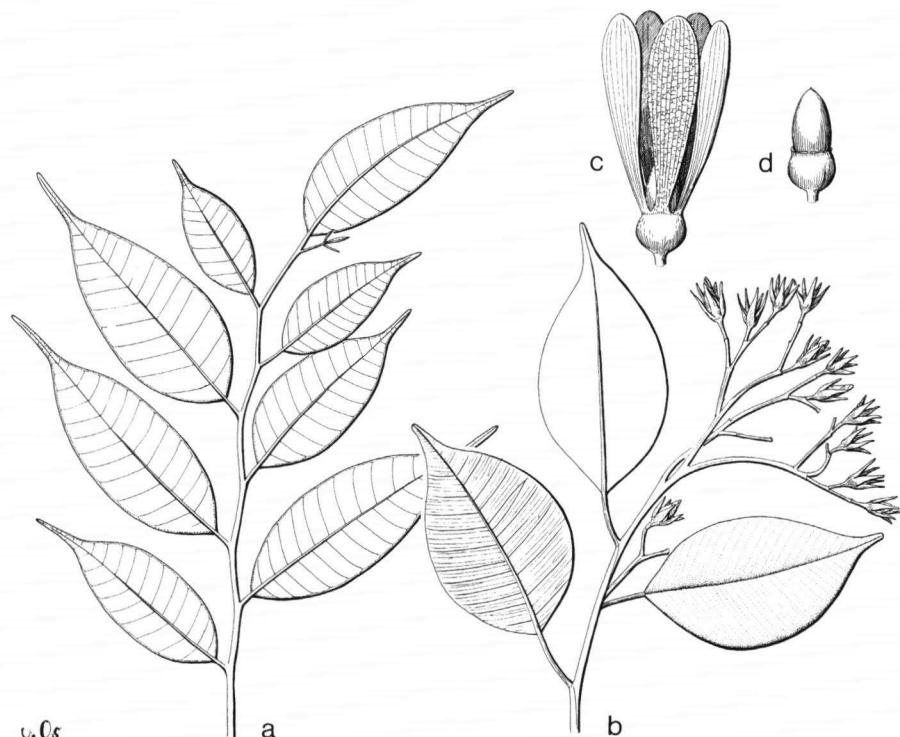


Fig. 53. *Dryobalanops sumatrana* (J.F. Gmel.) Kosterm.: a. habit; b. inflorescence; c. fruit; d. idem, wings removed.

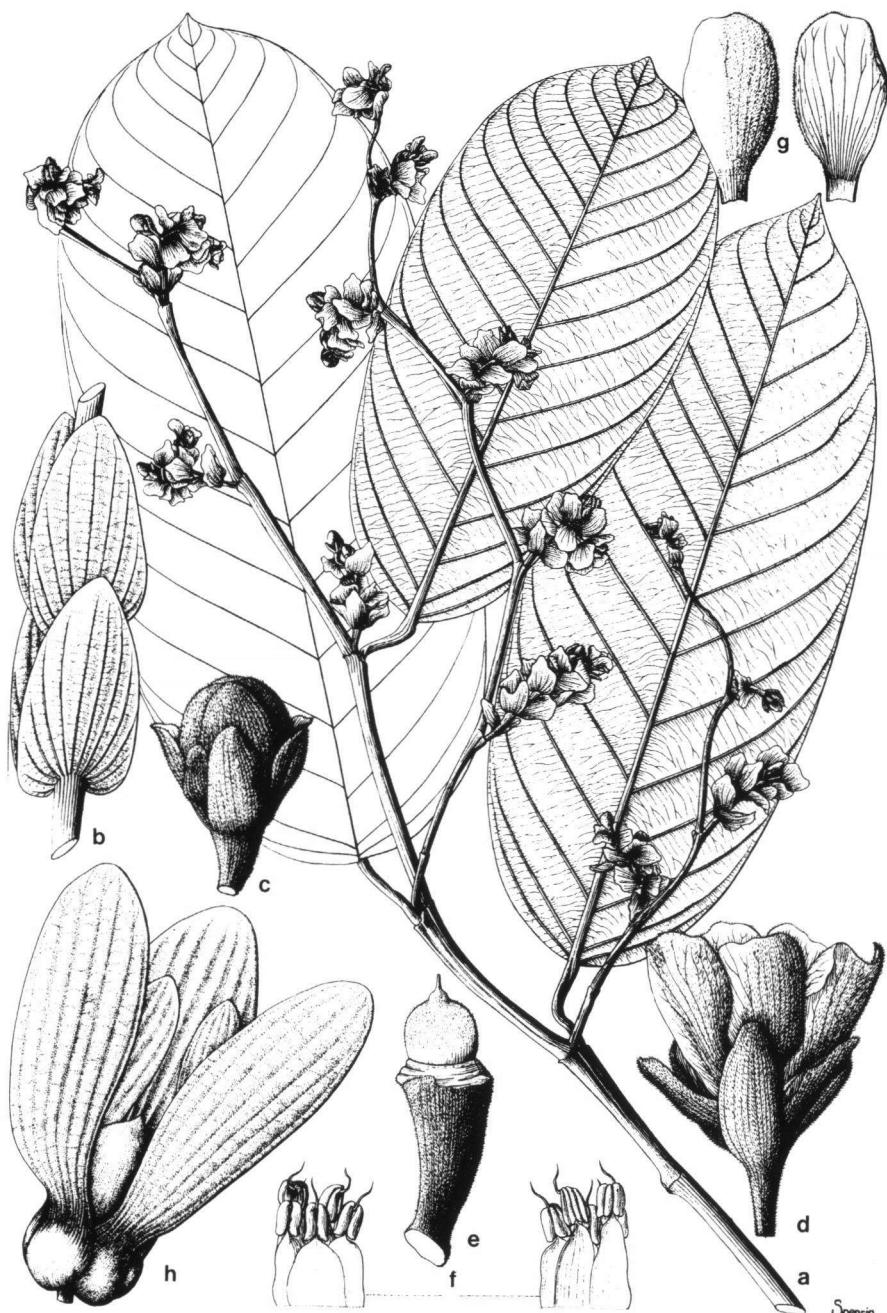


Fig. 54. *Shorea macrophylla* (de Vriese) Ashton: a. habit; b. stipules; c. flowerbud; d. flower; e. pistil; f. stamens; g. petals; h. fruit.



Fig. 55. *Vatica umbonata* (Hook. f.) Burck: a. habit; b & c. young fruits; d & e. mature fruits.



Fig. 56. *Diospyros celebica* Bakh.: a. flowering twig; b. fruit-bearing twig; c. flowers; d. fruits.

EBENACEAE

Always: Woody, non-climbing; leaves simple, entire, pinnerved, exstipulate; dioecious; calyx 3–5-lobed, accrescent in fruit, petals fused, contorted, with brown hairs; ovary superior, with 3 to several cells.

Usually / often: Bark black; leaves distichous, glandular below, often turning blackish upon drying, midrib sunken above; inflorescence fascicled, axillary; fruit a many-seeded berry, seeds with ruminate endosperm.

Different from: *Annonaceae*: twigs with longitudinal ridges, stellate medullary rays, leaves rarely glandular, flowers hermaphroditic. — *Symplocaceae*: leaves usually serrate, not distichous, often turning yellow upon drying; ovary inferior. — *Sapotaceae*: leaves rarely distichous, milky sap; flowers hermaphroditic.

Distribution: The family pantropical. In Malesia only *Diospyros* (incl. *Maba*), many species, mainly lowland rain forest.

Notes: Several species produce excellent hardwood, used for building and carving. — Some species have edible fruits. The fruits of many species are eaten by primates and other animals.

Literature: R.C. Bakhuizen van den Brink, Bull. Jard. Bot. Buitenzorg III, 15 (1936–1955) 1–515; F.S.P. Ng, Tree Fl. Mal. 3 (1978) 56–94.

Spot-characters: *Diospyros* 25, 31, 52, 54, 59, 39, 70, 71, 73, 78, 79, 80, 83, 105; *D. montana* 12; *D. topasia* 55.

Illustration: Fig. 56.

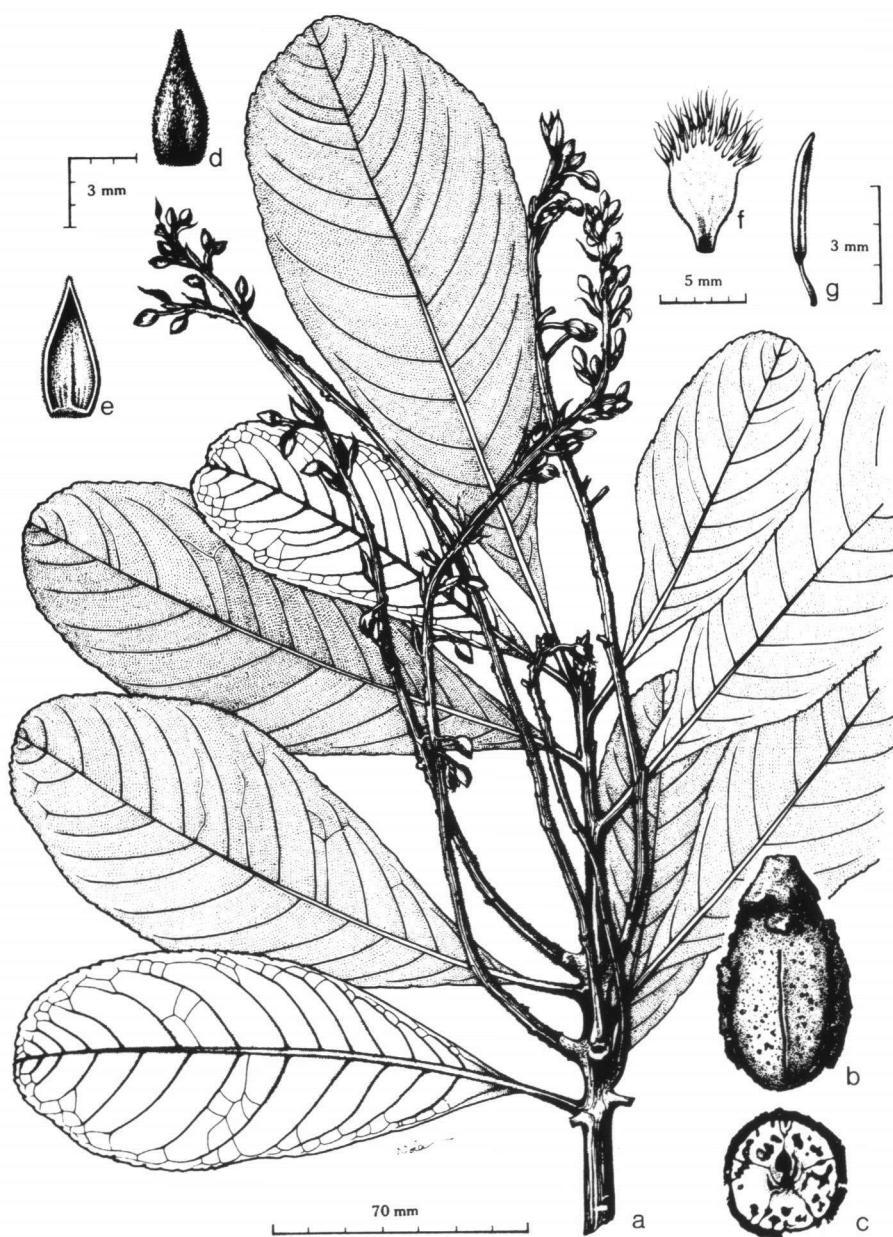


Fig. 57. *Elaeocarpus murukkai* Coode: a. habit; b. fruit; c. idem in CS; d & e. sepal; f. petal; g. stamen (Courtesy Brunonia, Canberra).

ELAEOCARPACEAE

Always: Woody, non-climbing; stipulate, leaves simple (except in some juvenile *Sloanea*); flowers actinomorphic, sepals free valvate, petals free (except some *Sloanea*), anthers basifixd; disk present; ovary superior, 2–5(–7)-locular, style 1; ovules axile in two rows.

Usually/often: Petiole bipulvinate, leaves spiral, serrate, domatia present, inflorescence racemose, flowers hermaphroditic, 5-merous (rarely 4- or 6-merous), petals fimbriate; stamens numerous (> 10).

Striking features: Petals fimbriate (*Aceratium* and *Elaeocarpus*, some *Sloanea*); leaves withering red, drupes blue (most *Elaeocarpus*); leaves opposite (*Aceratium* and *Sericolea*).

Different from: *Sterculiaceae* and *Tiliaceae*: dorsifixd anthers, stellate hairs, mucilage cells. — *Irvingia* (*Simaroubaceae*): stipules leaving annular scar.

Distribution: The family and *Sloanea* pantropical, other Malesian genera:

- *Aceratium* (East Malesia, Pacific, Australia);
- *Elaeocarpus* (widespread in Old World);
- *Dubouzetia* (East Malesia, New Caledonia);
- *Sericolea* (New Guinea).

All genera well represented in rain forest from sealevel to high in the mountains (*Sericolea* and some *Elaeocarpus*).

Notes: Seeds edible in large-fruited *Elaeocarpus*, fruit of *Aceratium oppositifolium* edible. The fruits of *Aceratium* and *Elaeocarpus* eaten by birds and bats. — Wood for building. — Some ornamental trees (*Aceratium* and *Elaeocarpus*).

Literature: M.J.E. Coode, Brunonia 1 (1978) 131–302; F.S.P. Ng, Tree Fl. Mal. 4 (1989) 82–97. — Mr. M.J.E. Coode (K) is revising the family for Flora Malesiana.

Spot-characters: *Elaeocarpaceae* 30, 58 – *Aceratium* 45, 81, 86 – *Dubouzetia* 81, 100, 104 – *Elaeocarpus* 14, 22, 34, 37, 38, 52, 55, 59, 69, 81, 85, 86, 93, 105; *E. gustaviifolius* 53; *E. myrmecophilus* 9 – *Sericolea* 45, 46, 52, 67, 81 – *Sloanea* 14, 37, 38, 81, 95, 100, 104.

Illustrations: Fig. 57 & 58.

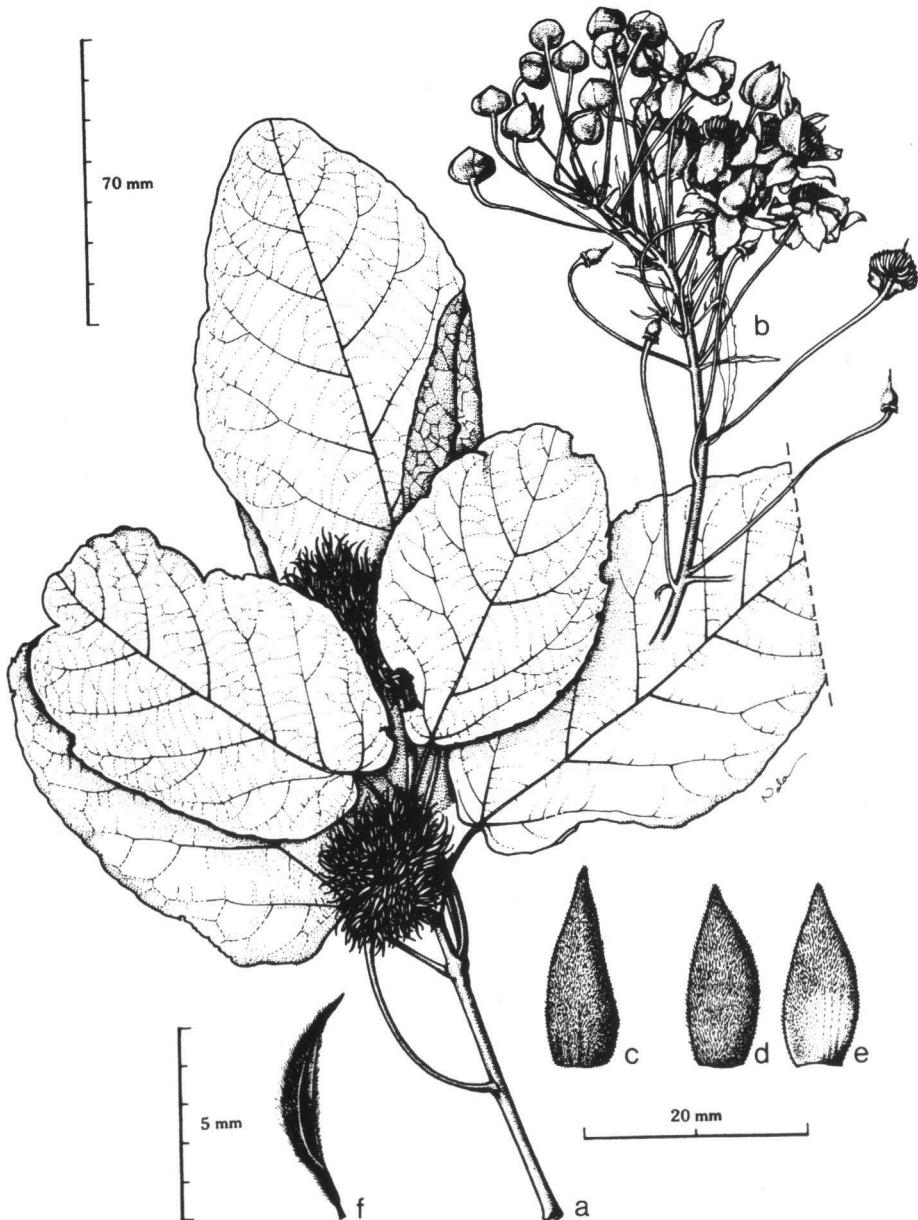


Fig. 58. *Sloanea pulchra* (Schltr.) A.C. Sm. subsp. *morobensis* Coode: a. fruiting twig; b. inflorescence; c-f. sepals (Courtesy Brunonia, Canberra).

ERICACEAE (MONOTROPACEAE, PYROLACEAE, VACCINIACEAE)

Always: Leaves spiral (incl. pseudoverticillate), exstipulate; flowers hermaphroditic, corolla tubular or urceolate, anthers opening by apical pores, style 1; seeds numerous.

Usually/often: Woody; leaves glandular below, venation pinnate, sometimes with 3 or more secondary veins from base; flowers actinomorphic; ovary 5-locular; stamens 10, anthers with appendages.

Striking features: Saprophytes (*Andresia, Monotropastrum*); leaves lepidote (most *Rhododendron*); glands on leaf margin at base (some *Costera, Vaccinium*, rarely *Dimorphantha*).

Different from: *Epacridaceae*: venation parallel.

Distribution: The family world-wide. In Malesia 12 genera incl.:

- *Diplycosia* (Malesia), montane forest, often epiphytic;
- *Gaultheria* (Asia, Australia, America), montane forest, terrestrial;
- *Rhododendron* (mainly northern hemisphere), mostly montane forest, terrestrial or epiphytic;
- *Vaccinium* (widespread), primary and secondary forest, mainly montane, often epiphytic.

Notes: Flowers of *Rhododendron* pollinated by birds and insects. — Several species planted as ornamentals (*Rhododendron*). — Fruits and leaves of some *Vaccinium* edible. Fruits of *Dimorphantha* and *Vaccinium* eaten by birds. — *Gaultheria* produces medicinal oil.

Literature: H. Sleumer, Fl. Males. I, 6 (1966) 469–914.

Spot-characters: *Ericaceae* 56, 64, 86 – *Agapetes* 2, 31, 92 – *Andresia* 7 – *Cheilotheca* 79 – *Costera* 92 – *Dimorphantha* 31, 92 – *Diplycosia* 31, 64, 93 – *Gaultheria* 31, 64, 85 – *Monotropastrum* 7 – *Rhododendron* 25, 26, 46, 60 – *Vaccinium* 2, 31, 85, 92, 93.

Illustrations: Fig. 59 & 60.

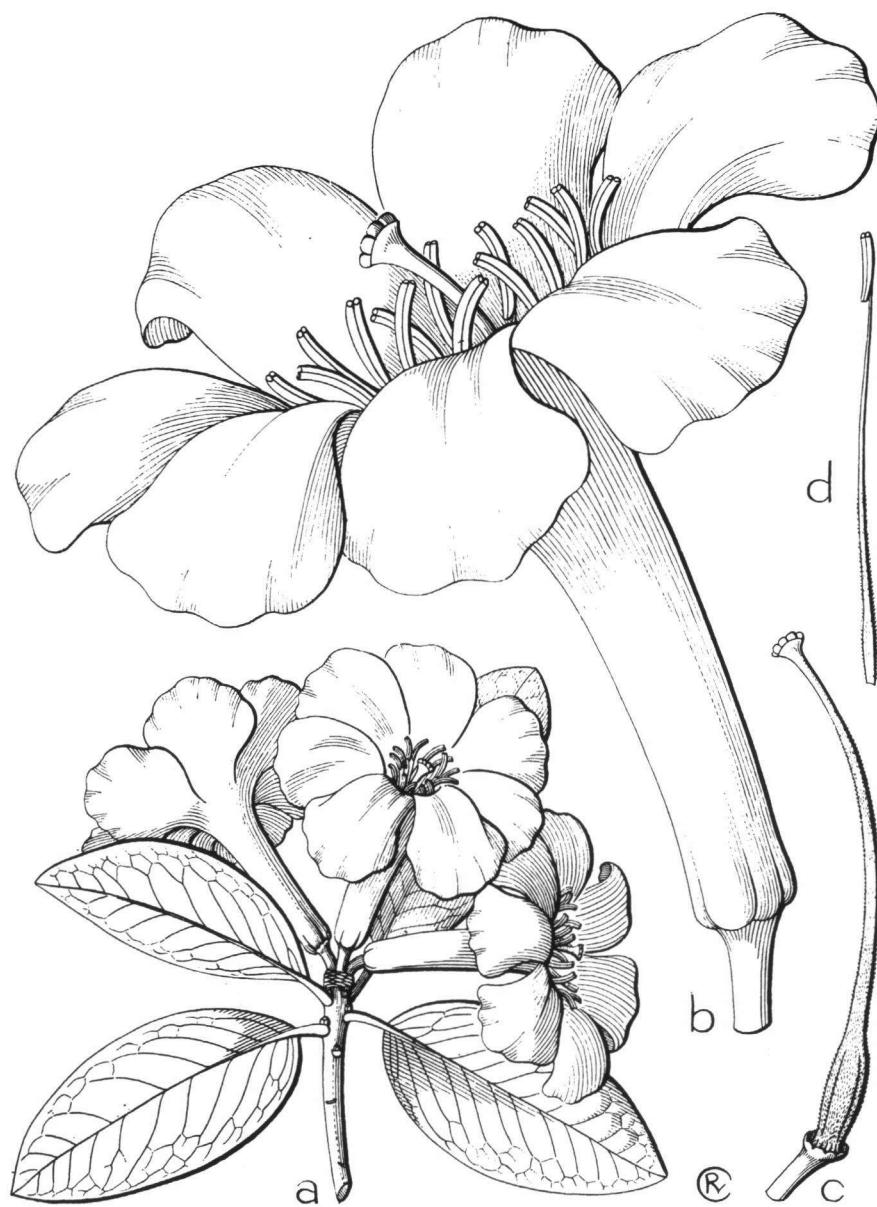


Fig. 59. *Rhododendron konori* Becc.: a. habit; b. flower; c. pistil; d. stamen.

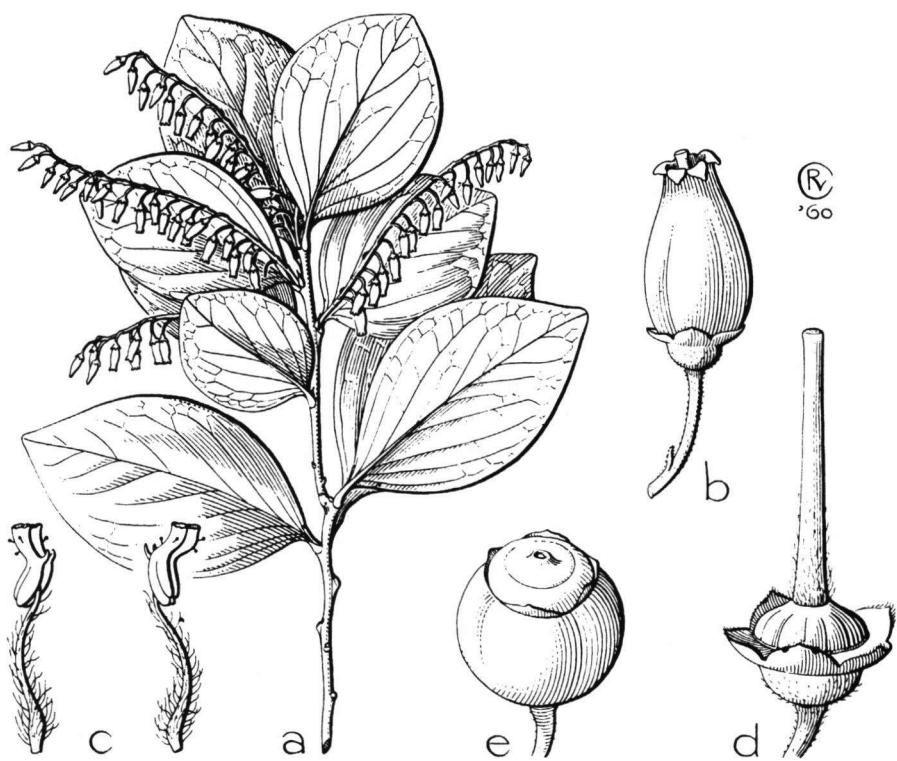


Fig. 60. *Vaccinium bancanum* Miq.: a. habit; b. flower; c. stamens; d. pistil; e. fruit.

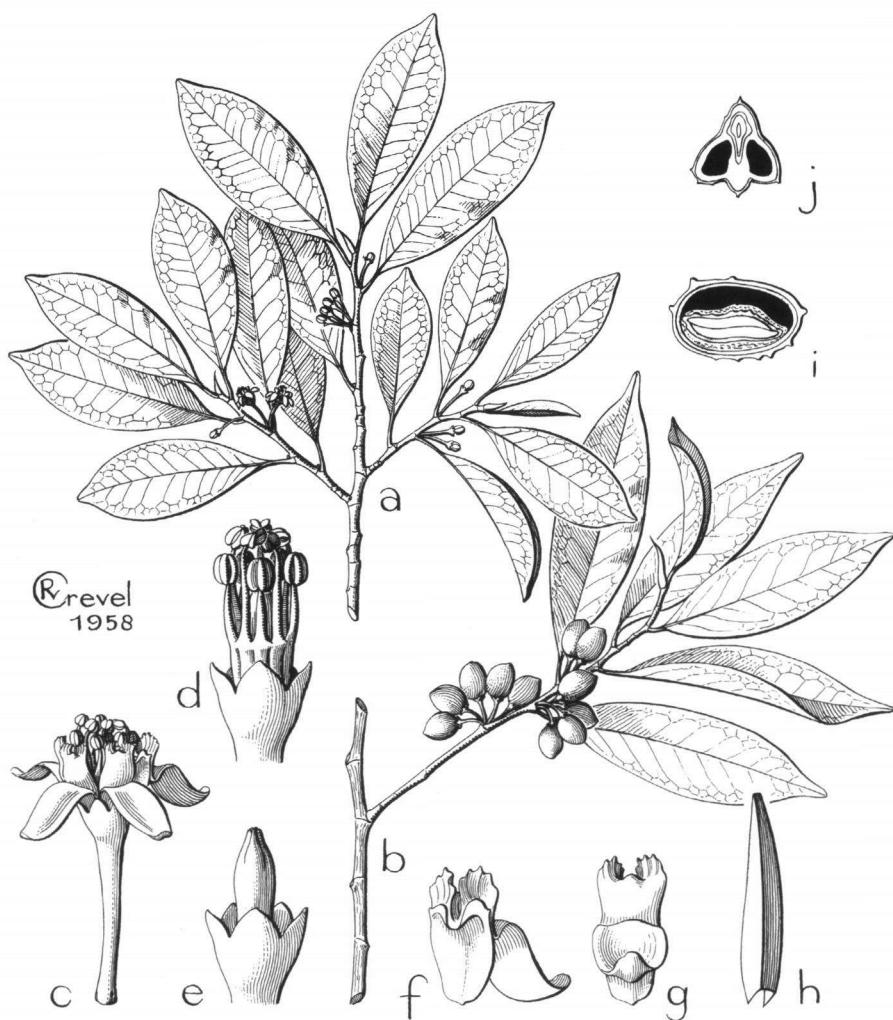


Fig. 61. *Erythroxylon ecarinatum* Burck: a. habit; b. fruiting twig; c. flower; d. idem, petals removed; e. style; f & g. petal; h. stipule; i. CS of fruit; j. CS of fruit of *E. cuneatum* (Miq.) Kurz.

ERYTHROXYLACEAE

Always: Woody, non-climbing; leaves simple, alternate, entire, pinninerved, with thin lines parallel to the midrib, stipules connate intrapetiolar, leaving annular scar; flowers 5-merous, actinomorphic, bisexual, calyx lobes imbricate, petals quincuncial, with a scale at base; stamens 10, filaments connate at base; ovary superior, 3 styles; fruit a drupe.

Usually/often: Young twigs flat; flowers in axillary clusters; 5 long, 5 short stamens; ovary 3-celled, 1 pendulous ovule per cell.

Different from: *Linaceae*: stipules not connate, petals without a scale.

Distribution: The only genus, *Erythroxylum*, is pantropical; in Malesia it is represented by two native species.

Notes: *Erythroxylum coca** and *E. novogranatense** from South America are the source of cocaine. These species are also planted as ornamentals. — The wood of the native species is locally used as timber. — Several species show flower dimorphism.

Literature: J.P.D.W. Payens, Fl. Males. I, 5 (1958) 543–552.

Spot-characters: 33, 82, 84.

Illustration: Fig. 61.

EUPHORBIACEAE (BISCHOFIACEAE, PANDACEAE, STYLAGINACEAE)

Always: Stipules present; flowers unisexual, plants monoecious or dioecious (some *Aporosa* spp. have bisexual flowers); ovary superior; ovules 1 or 2 per cell, pendulous; ovule with ventral raphe.

Usually/often: Woody; laticiferous; leaves spiral, simple, dentate; glands on petiole/leaf blade; petiole bipulvinate; ovary 3-locular; fruit a capsule, central columella persisting after the valves have fallen; micropyle covered by a caruncle.

Striking features: Leaves in whorls of 3 (*Borneodendron*); climbers with stinging hairs (*Cnesmone*, *Megistostigma*, *Pachystylidium*); numerous small glands on surface of leaf (most *Macaranga*, *Mallotus* and *Octospermum*); leaves digitately compound (*Bischofia*, *Hevea**, *Annesjoa*); twigs mimicking pinnate leaves (*Breynia*, *Flueggea*, *Glochidion*, *Phyllanthus*, *Sauropolis*); inflorescence a cyathium (*Euphorbia*); inflorescence leaf-opposed (*Suregada*); fruit winged (*Hymenocardia*); fruit a drupe (*Antidesma*, stone flattened, sculptured, and *Drypetes*).

Different from: *Buxaceae*: ovule with dorsal raphe. — *Daphniphyllaceae*: exstipulate, ovary imperfectly septate. — *Flacourtiaceae*: stipules often minute or wanting, flowers sometimes hermaphroditic, placentation parietal.

Distribution: The family world-wide; as to number of woody species probably the family best represented in Malesian rain forest. In Malesia 93 genera incl.:

- *Antidesma* (paleotropics), shrubs or trees, lowland and montane rain forest;
- *Aporosa* (Indo-Malesia), shrubs or trees, lowland rain forest;
- *Baccaurea* (Indo-Malesia), shrubs or trees, lowland rain forest;
- *Drypetes* (pan-tropical), trees; mostly lowland rain forest;
- *Glochidion* (pan-tropical), shrubs or trees, mostly secondary forest;
- *Macaranga* (paleotropics), trees; several myrmecophilous, mostly secondary forest;
- *Mallotus* (paleotropics), trees; mostly primary forest;
- *Phyllanthus* (pan-tropical), herbs, shrubs or trees, many weeds, some in rain forest.

Notes: Several genera have been placed in separate families: *Stylinaceae* (*Antidesma*), *Bischofiaceae* (*Bischofia*), *Pandaceae* (*Galearia*, *Microdesmis*). — Several species useful to man: rubber: *Hevea**; edible roots and leaves: *Manihot**; edible fruits: *Aleurites*, *Antidesma*, *Baccaurea*, *Phyllanthus*; castor oil: *Ricinus**; medicinal plants: *Euphorbia*, *Phyllanthus*; ornamentals: *Acalypha*, *Codiaeum*, *Euphorbia*, *Excoecaria*, *Jatropha**

Literature: H. K. Airy Shaw, The Euphorbiaceae of Borneo. Kew Bull. Add. Ser. IV (1975); The Euphorbiaceae of New Guinea, Kew Bull. Add. Ser. VIII (1980); The Euphorbiaceae of Sumatra, Kew Bull. 36 (1981) 239–374. — Dr. P.C. van Welzen (L) is coordinating the revision of the family for Flora Malesiana.

Spot-characters: *Euphorbiaceae* 27, 30, 56, 58, 61, 77, 79, 83, 85, 89, 99, 104 – *Acalypha* 101; *A. brachystachya* 16; *A. lanceolata* 16 – *Actephila* 55, 71, 80, 101 – *Agrostistachys* 10, 22, 36, 53, 101; *A. indica* 18, 33; *A. longifolia* 33 – *Alchornea* 31, 38, 46, 101; *A. borneensis* 70 – *Aleurites* 25, 26, 38, 57 – *Alphandia* 25 – *Andrachne* 35 – *Annesjoa* 48 – *Antidesma* 37, 38, 53, 68, 70, 78, 91 – *Aporosa* 31, 35, 37, 38, 52, 60, 68, 71, 72, 88, 90, 101; *A. frutescens* 55 – *Ashtonina* 31, 38, 55, 101 – *Austrobuxus* 45, 101 – *Baccaurea* 14, 25, 38, 55, 68, 70, 78, 101; *B. angulata* 98; *B. bracteata* 31; *B. macrophylla* 37; *B. trigonocarpa* 99 – *Baliospermum* 63 – *Bischofia* 21, 48 – *Blachia* 80, 101 – *Blumeodendron* 31, 38, 46, 64, 101; *B. kurzii* 22 – *Borneodendron* 21, 25, 26, 46 – *Botryophora* 31, 38, 46, 52, 101 – *Breynia* 54, 71, 80, 101 – *Bridelia* 5, 12, 65, 68, 71 – *Cephalomappa* 25, 26, 38, 76, 95, 99 – *Chaetocarpus* 71, 95, 101 – *Cheirosa* 101 – *Chondrostylis* 31, 101 – *Choriceras* 45 – *Chrozophora* 25, 26 – *Cladogynos* 71, 76, 101 – *Claoxylon* 21, 31, 38, 101 – *Cleidion* 38, 90, 101 – *Cleistanthus* 26, 36, 39, 71, 90, 101 – *Cnemone* 5, 29, 101 – *Codiaeum* 19, 38, 46 – *Croton* 23, 25, 26, 31, 38, 46, 57, 59, 90, 101 – *Dalechampia* 5 – *Dicoelia* 25, 101 – *Dimorphocalyx* 38, 80, 101; *D. muricatus* 95 – *Doryxylon* 25 – *Dryptes* 39, 53, 70, 71, 80; *D. eriocarpa* 34; *D. longifolia* 9; *D. pendula* 9 – *Elateriospermum* 19, 31, 38, 101 – *Endospermum* 9, 14, 21, 25, 31, 38, 51 – *Epiprinus* 31, 46, 76, 80 – *Erismanthus* 32, 45, 80, 98, 101 – *Euphorbia* 12, 19, 101; *E. cotinifolia* 46 – *Excoecaria* 19, 45, 57, 101; *E. indica* 12 – *Fahrenheitia* 21, 25, 31, 38, 57, 78, 101 – *Flueggea* 71, 101 – *Fontainea* 38, 59 – *Galearia* 78; *G. celebica* 70 – *Glochidion* 15, 59, 70, 71, 98, 101 – *Hevea* 19, 48, 57, 101 – *Homalanthus* 19, 31, 38, 51, 69; *H. fastuosus* 9 – *Homonoia* 25, 26, 101 – *Hura* 12, 19 – *Hymenocardia* 12, 26, 31, 38, 98 – *Jatropha* 2, 19 – *Kairothamnus* 71 – *Koilodepas* 25, 31, 52, 76, 101; *K. longifolia* 34; *K. pectinata* 34, 80 – *Lasiococca* 46, 80, 95 – *Leptopus* 71, 101 – *Loerzingia* 38 – *Macaranga* 9, 21, 25, 26, 29, 31, 33, 37, 38, 46, 51, 52, 53, 57, 60, 64, 68, 72, 95, 98, 101; *M. trachyphylla* 62 – *Mallotus* 16, 25, 26, 31, 36, 38, 45, 51, 53, 63, 64, 68, 72, 95, 99, 101; *M. sect. Hancea* 47; *M. sect. Stylosanthes* 23; *M. sumatrana* 98 – *Manihot* 19, 51; *M. esculenta* 99 – *Margaritaria* 71, 101 – *Megistostigma* 5, 29; *M. burmannicum* 98; *M. peltatum* 51 – *Melanolepis* 25, 31, 38, 101 – *Microdesmis* 71, 95 – *Moultonianthus* 32, 37, 45 – *Neoscortechinia* 31, 38 – *Neotrewia* 25, 26, 47 – *Octospermum* 31, 88 – *Omphalea* 4, 5, 19, 38 – *Ostodes* 21 – *Pachystylidium* 5, 25, 29 – *Phyllanthus* 15, 35, 71, 101; *P. acidus* 70; *P. reticulatus* 5 – *Pimelodendron* 31, 38, 46; *P. macrocarpum* 70, 94, 95 – *Plukenetia* 72 – *Pterococcus* 5, 98 – *Ptychopyxis* 38, 101; *P. caput-medusae* 95; *P. costata* 99; *P. grandiflorus* 70 – *Reutealis* 21, 25 – *Richeriella* 101 – *Ricinus* 95 – *Sapium* 14, 19, 31, 69, 101 – *Sauvagesia* 23, 70, 71, 101; *S. androgynus* 12 – *Sebastiania* 71, 95, 101 – *Spathiostemon* 38, 78, 95, 101 – *Stillingia* 19, 67 – *Sumbaviopsis* 25, 26, 101 – *Suregada* 59, 71, 72, 101 – *Syndiophyllum* 32, 45, 59 – *Synostemon* 101 – *Trewia* 25, 31, 45, 47, 64 – *Trigonopleura* 71, 101 – *Trigonostemon* 21, 31, 46, 47, 64, 71, 80, 101; *T. capillipes* 70; *T. diplopetalus* 81; *T. sandakanensis* 53 – *Wetria* 21, 31, 46, 67, 90, 101; *W. macrophylla* 53.

Illustrations: Fig. 62–65.

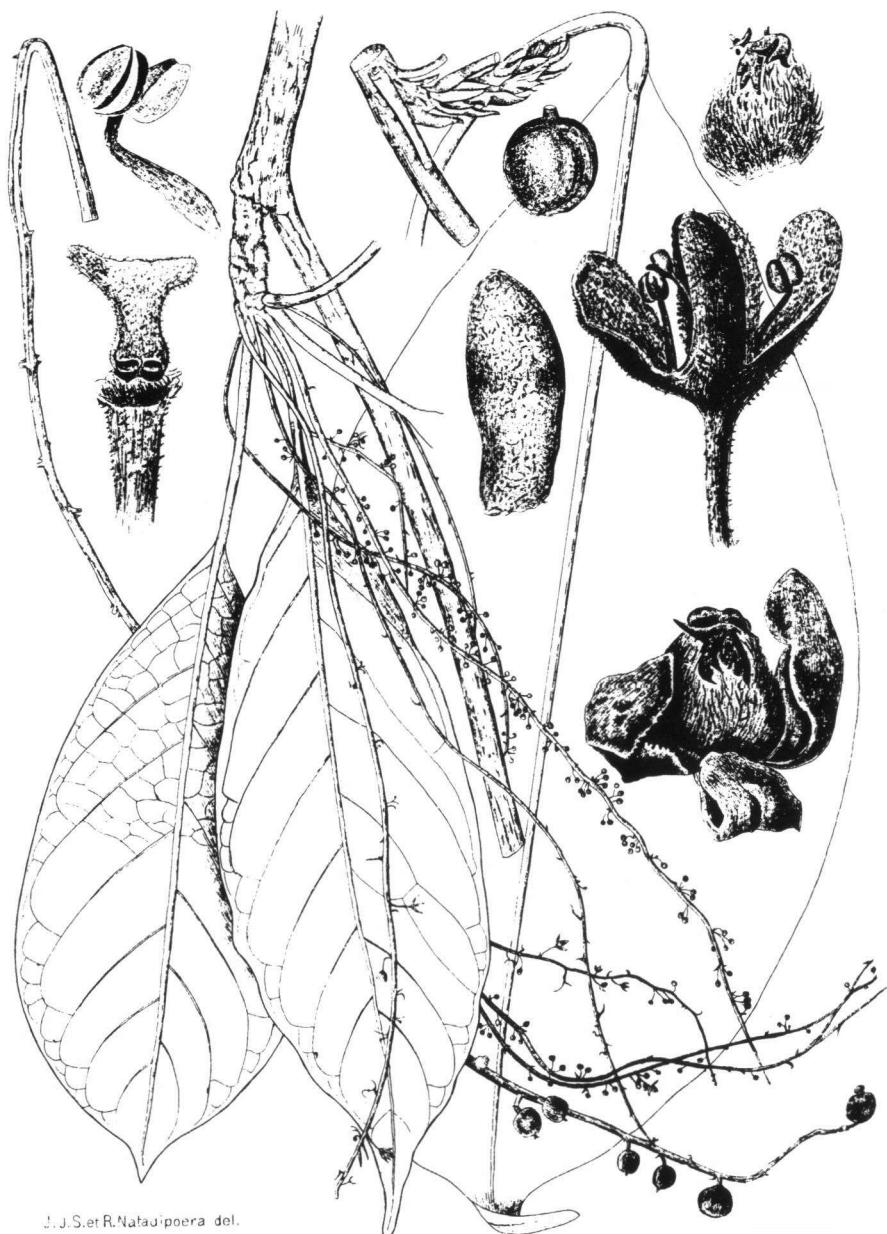


R.Natalepoera del.

Fig. 62. *Antidesma venenosum* J.J. Sm.: a. habit; b. inflorescence; c. flower; d. stamen; e. ovary; f. fruit.



Fig. 63. *Glochidion insigne* J.J. Sm.



J. J. S. et R. Nataipóera del.

Fig. 64. *Baccarea stipulata* J.J. Sm.



Fig. 65. *Mallotus paniculatus* (Lam.) Müll. Arg. (Courtesy Dr. P.J.A. Keßler).



Fig. 66. *Eupomatia laurina* R. Br. (Courtesy Department of Forests, PNG).

EUPOMATIACEAE

Always: Woody, non-climbing; leaves alternate, simple, entire, penninerved, exstipulate; flowers bisexual, actinomorphic; perianth forming a deciduous calyptra, stamens and staminodes many; carpels many, sunk into a broad hypanthium; fruit a truncate berry.

Usually/often: Flowers solitary.

Different from: *Annonaceae*: flowers not calyprate, carpels nearly always free. —

Himantandraceae: lepidote, fruit globular. — *Lauraceae*: flowers not calyprate, anthers opening by valves, fruit 1-carpellate.

Distribution: The only genus, *Eupomatia*, consists of two species, one in E. Australia, the other in E. New Guinea.

Notes: Understorey tree of lowland rain forest, flowers sweet-scented, visited by bees; potential ornamental.

Literature: J.R. Croft, Handb. Fl. Papua New Guinea 1 (1978) 123–126. — Dr. P.K. Endress (Zürich) is revising the family for Flora Malesiana.

Spot-characters: 30, 92.

Illustration: Fig. 66.

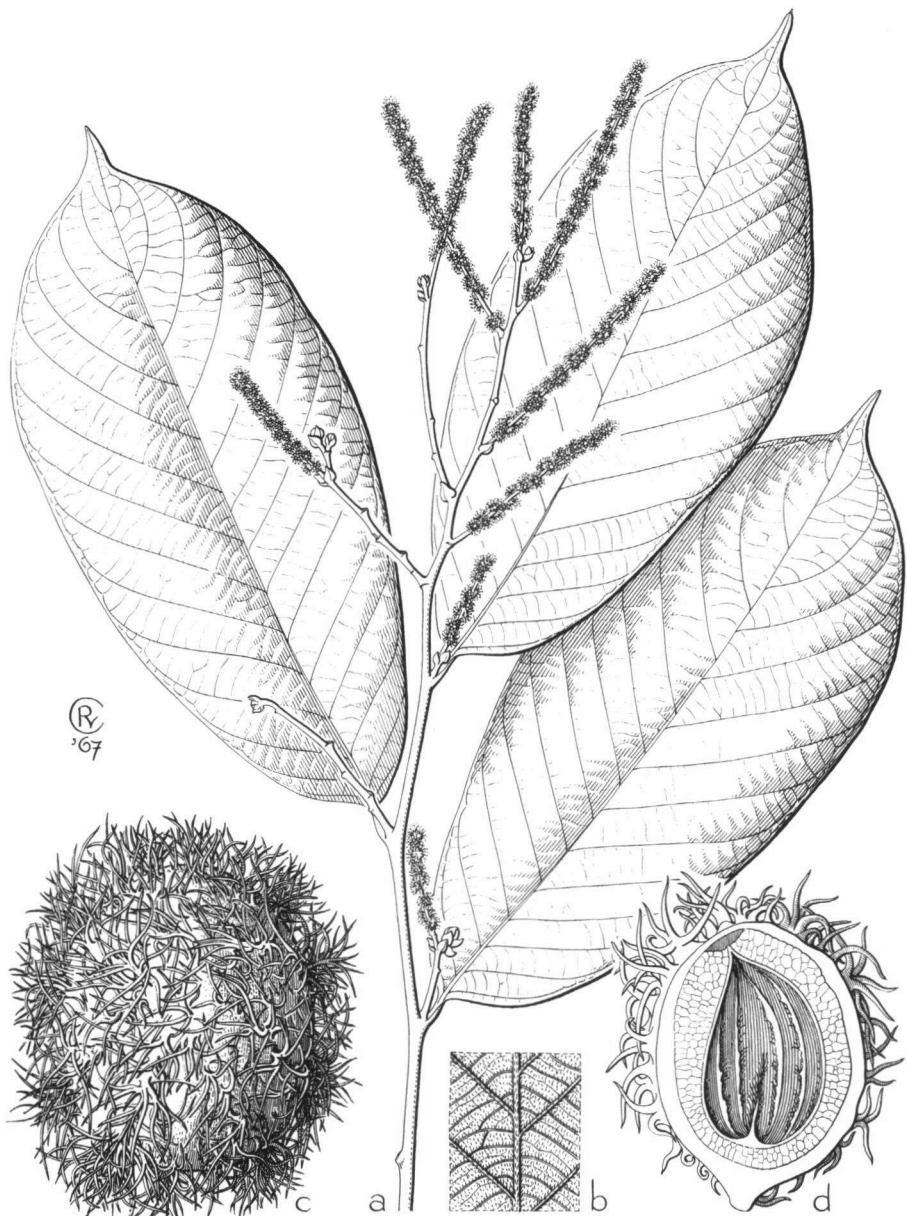


Fig. 67. *Castanopsis hypophoenicia* (von Seem.) Soepadmo: a. habit; b. underside of leaf; c. fruit; d. LS of fruit.

FAGACEAE

Always: Monoecious trees; leaves simple, pinninerved; stipules caducous; ovary inferior, 3–6-locular, ovules 2 per cell.

Usually / often: Bast fibres penetrating into the wood (*Lithocarpus*, *Quercus*); leaves spiral; entire; flowers minute, in catkins; fruit in a woody cupule, often with spines.

Striking features: Leaves 3-verticillate (*Trigonobalanus*); leaves distichous, stipules peltate (*Nothofagus*); leaves crowded, dentate apically (*Quercus*).

Different from: *Myricaceae*: ovary superior, fruit a drupe. — *Lauraceae*: exstipulate, ovary usually superior, cupule (if present) fleshy.

Distribution: The family widespread (not in Africa). In Malesia 5 genera, mostly in montane rain forest:

- *Castanopsis* (South & East Asia, Malesia, California);
- *Lithocarpus* (South & East Asia, Malesia, California);
- *Nothofagus* (New Guinea, Australia, New Zealand, New Caledonia, South America);
- *Quercus* (Eurasia, West Malesia, America);
- *Trigonobalanus* (Southeast Asia, Malesia, South America).

Notes: Edible fruit: *Castanopsis*. — Timber: *Lithocarpus*, *Quercus*.

Literature: E. Soepadmo, Fl. Males. I, 7 (1972) 265–403.

Spot-characters: *Fagaceae* 30, 58, 79, 105 – *Castanopsis* 26, 95 – *Lithocarpus* 22, 43, 95 – *Nothofagus* 22, 26, 35 – *Quercus* 46, 52 – *Trigonobalanus* 25, 46.

Illustrations: Fig. 67–70.



Fig. 68. *Lithocarpus turbinatus* (Stapf) Form.: a. habit; b. female inflorescence; c. terminal bud; d. male flower; e. female flower; f. idem in LS; g-i. fruit; j & k. seed; l. LS of fruit.

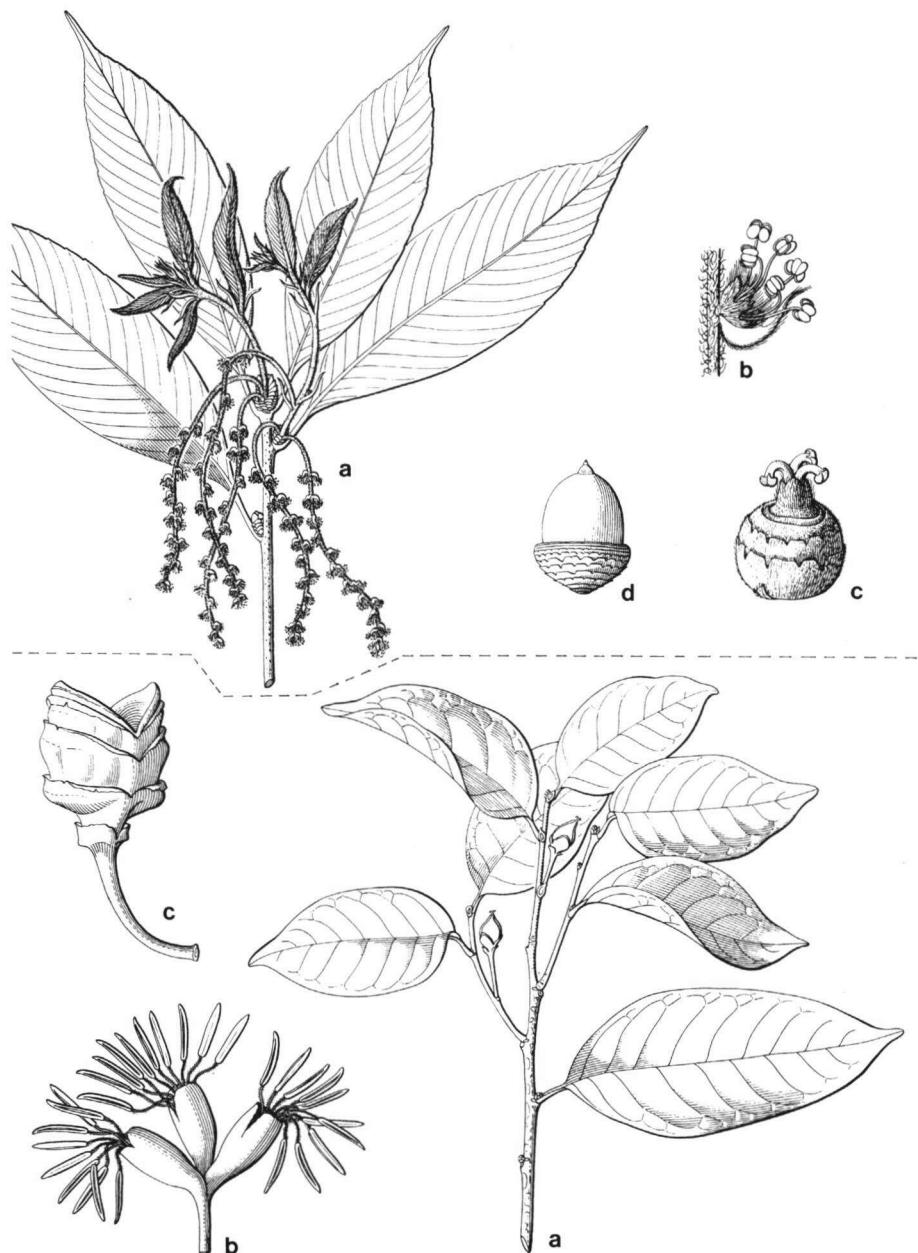


Fig. 69 (above). *Quercus lineata* Blume: a. habit with male catkins; b. male flower; c. female flower; d. cupule and fruit. — Fig. 70 (below). *Nothofagus womersleyi* Steenis: a. habit; b. male flowers of *N. grandis* Steenis; c. cupule of *N. perryi* Steenis.



Fig. 71. *Flacourtiaceae*: a. habit (male); b. habit (female); c. female flower; d. idem in LS; e & f. fruit; g & h. LS of fruit; i. male flower.

FLACOURTIACEAE

Always: Woody, non-climbing; leaves simple; ovary 1-locular with parietal placentation.

Usually/often: Stipules small or absent; leaves spiral or distichous, serrate/dentate, pinninerved, often with basal nerves; glands on petiole and leaf blade; flowers hermaphroditic; petals, if present, often with scale inside; stamens numerous; ovary superior.

Striking features: Leaves bipulvinate (*Ryparosa*, *Trichadenia*, some *Hydnocarpus*); leaves with transparent dots and dashes (*Casearia*); twigs mimic pinnate leaves (*Paropsia*); T-shaped hairs (*Ryparosa*); stem spiny (some *Flacourtie*, *Hemiscolopia*, *Scolopia*, *Xylosma*); intramarginal vein (*Scaphocalyx*); ovary (semi-)inferior (*Homalium*); winged seeds (*Itoa*).

Different from: *Euphorbiaceae*: mostly stipulate; not hermaphroditic; ovary nearly always 3-locular, axile placentation. — *Celastraceae*: leaves not glandular; mostly 2- or more-locular ovary.

Distribution: The family pantropical, some species reaching the warm temperate zone.

In Malesia 19 genera, incl.:

- *Casearia* (pantropical), mostly lowland rain forest;
- *Flacourtie* (Africa to Fiji), everwet and seasonal rain forest;
- *Homalium* (pantropical), lowland rain forest;
- *Hydnocarpus* (Indo-Malesia), lowland rain forest;
- *Ryparosa* (Malesia), lowland rain forest;
- *Scolopia* (paleotropics), primary and secondary lowland forest.

Notes: Edible fruits: *Flacourtie*, *Pangium*. — Medicinal oil: *Hydnocarpus*. — Timber: *Homalium*.

Literature: H. Sleumer, Fl. Males. I, 5 (1954) 1–106.

Spot-characters: *Flacourtiaceae* 58, 61, 83, 104 – *Ahernia* 31, 64 – *Bennettiodendron* 31, 79 – *Casearia* 59, 71, 99, 101; *C. amplexens* 37; *C. auriculata* 37 – *Eleutherandra* 38 – *Erythrospermum* 64, 95, 101 – *Flacourtie* 8, 12 – *Hemiscolopia* 12, 31, 71, 79 – *Homalium* 31, 92 – *Hydnocarpus* 25, 38, 71, 73, 77, 82, 88, 95; *H. polypetala* 70 – *Itoa* 8, 31, 102 – *Osmelia* 38, 59, 64, 101; *O. grandistipula* 37 – *Pangium* 14, 38, 82 – *Paropsia* 82 – *Pseudosmelia* 70 – *Ryparosa* 25, 38, 45, 59, 64, 70, 82, 88; *R. hullettii* (fr.) 23 – *Scaphocalyx* 65, 70, 82, 94 – *Scolopia* 12, 31, 64, 71, 79, 81 – *Trichadenia* 31, 38, 82 – *Xylosma* 31; *X. luzonense* 12.

Illustrations: Fig. 71 & 72.



Fig. 72. *Hydnocarpus woodii* Merr.: a. habit; b & c. fruit; d. fruit in LS; e. seed; f. male flower of *H. crassifolia* Sleum.; g. petal; h. stamen.

GNETACEAE

Always: Woody, twigs with swollen nodes; leaves simple, decussate, entire, exstipulate, pinninerved; dioecious, inflorescence a spike.

Usually / often: Climbers, leaves with translucent lines, dried leaves nigrescent.

Striking features: Trees (*Gnetum gnemon*, *G. costatum*).

Different from: *Celastraceae* (*Salacia*): no swollen nodes, inflorescence never a spike.
— *Guttiferae* (*Garcinia*): milky or yellow sap, inflorescence never a spike.

Distribution: *Gnetum* is pantropical; most Malesian species in lowland rain forest.
A new genus will soon be described from Irian Jaya by R. J. Johns.

Notes: Leaves and seeds of *Gnetum gnemon* edible, bark of several species used for binding.

Literature: F. Markgraf, Fl. Males. I, 4 (1951) 336–347; I, 6 (1972) 944–949.

Spot-characters: 5, 6, 16, 57, 59, 70.

Illustration: Fig. 73.

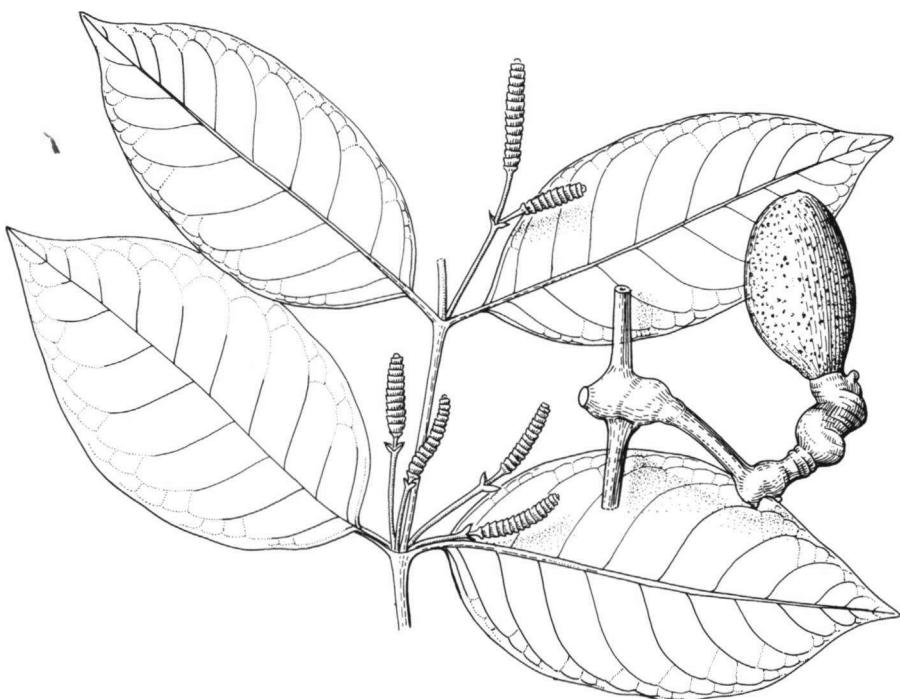


Fig. 73. *Gnetum gnemonoides* Brongn.

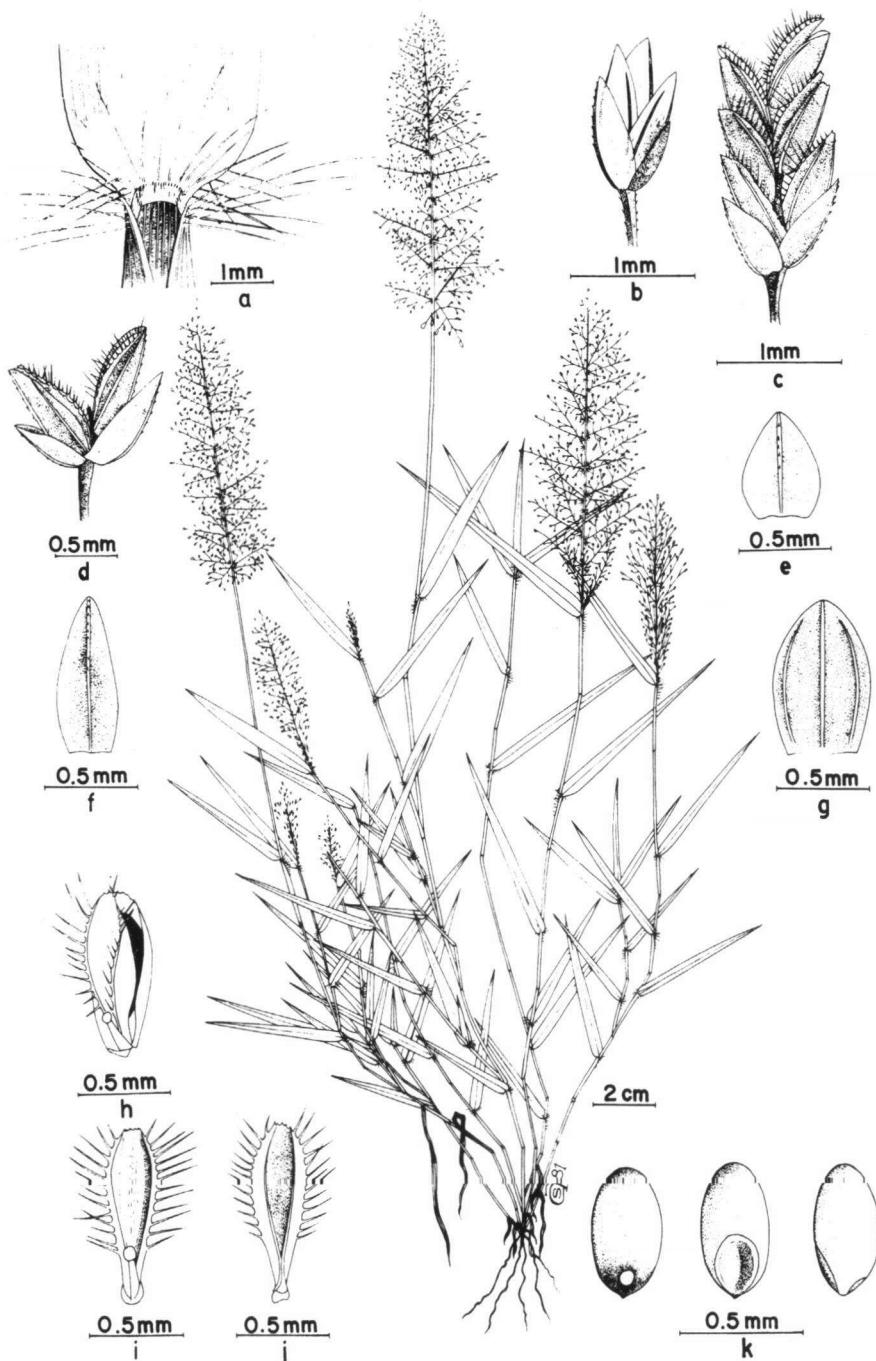


Fig. 74. *Eragrostis tenella* (L.) Beauv. ex R. & S.: a. ligule; b-d. spikelet; e. lower glume; f. upper glume; g. lemma; h. floret; i & j. palea; k. caryopsis (Courtesy Koninklijk Instituut voor de Tropen, Amsterdam).

GRAMINEAE (BAMBUSACEAE, POACEAE)

Always: Leaves simple, entire, consisting of an elongate sheath and a linear blade with a ligule at base; stem jointed; flowers uni- or bisexual with perianth reduced to bristles or scales, each subtended by a pair of bracts (lemma and palea).

Usually/often: Stems hollow, leaves two ranked, fruit an achene.

Striking features: Stem woody (*Bambusoideae*); inflorescence jointed (*Coelorrhachis*, *Rottboellia*); broadleaved forest grass, achenes sticky (*Scrotopchloa*).

Different from: *Cyperaceae*: stem not jointed, mostly solid, often triangular, no ligule, leaves mostly three ranked.

Distribution: Cosmopolitan; in Malesia c. 150 genera from sealevel to alpine zone, best represented in open places, many species weedy.

Notes: Food: *Oryza* (rice), *Zea* (corn), *Andropogon*, *Coix*, *Sorghum*; sugar: *Saccharum*; vegetables: several *Bambusoideae*, *Panicum palmifolium*, *Saccharum edule*. — Medicinal use and spices: *Andropogon*, *Cymbopogon*. — House building, plaiting, etc.: several *Bambusoideae*. — Several species used as ornamentals, for lawns etc.

Literature: N.L. Bor, The grasses of Burma, Ceylon, India and Pakistan (1960); F.A. MacClure, The Bamboos (1966); A. Henty, A manual of the grasses of New Guinea (1969); H.B. Gilliland, Flora of Malaya III (1971). — Dr. J.F. Veldkamp (L) is revising the family for Flora Malesiana except the *Bambusoideae* which are done by Dr. S. Dransfield (K) and Dr. E.A. Widjaja (BO).

Spot-characters: Gramineae 76, 95 – *Bambusoideae* 3, 29 – *Anthoxanthum* 23 – *Danthonia* (*Monostachya*) 1 – *Dinochloa* 5 – *Isachne* 1 – *Muehlenbergia* 23 – *Nastus* 5 – *Poa* 1 – *Racemobambos* 5.

Illustrations: Fig. 74 & 75.

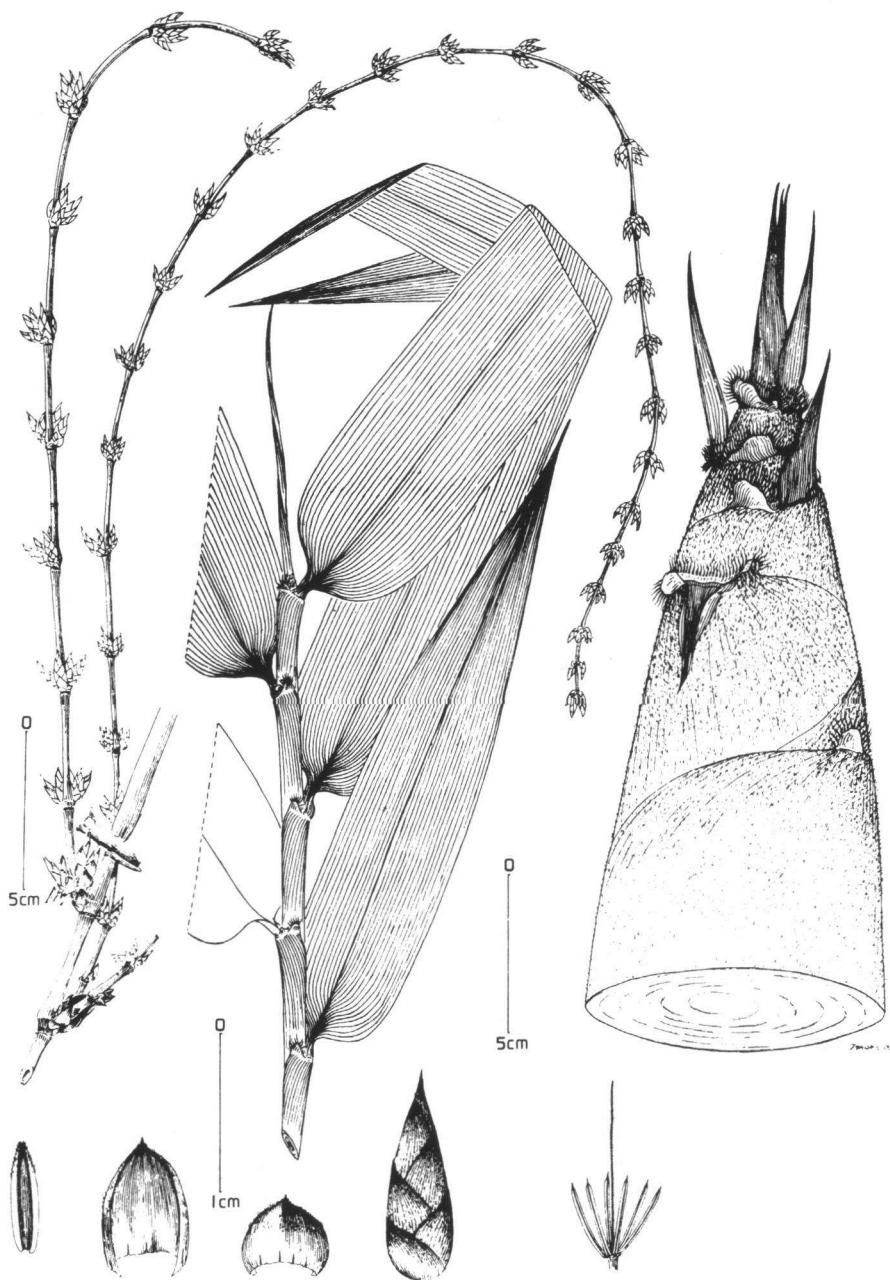


Fig. 75. *Gigantochloa levis* (Blanco) Merr. (Courtesy Reinwardtia, Bogor).

GUTTIFERAE (CLUSIACEAE incl. HYPERICACEAE)

Always: Woody, non-climbing; coloured sap in bark (often yellow); leaves simple, decussate (rarely verticillate), entire, pinninerved, exstipulate; flowers actinomorphic, petals free, stamens numerous; ovary superior.

Usually/often: Leaves with latex glands or canals.

Striking features: Reddish sap, capsule with winged seeds (*Cratoxylum*); leaves with very dense, parallel venation (*Calophyllum*); fine, dark resin ducts crossing the veins, basal excavations and stipule-like structures at base of petiole (*Garcinia*); (sub)shrubs, flowers yellow (*Hypericum*); flowers unisexual (*Garcinia*, *Mammea* and some *Calophyllum*).

Different from: *Celastraceae*: leaves often dentate; no sap; few stamens — *Loganiaceae*: no sap; petals fused; few stamens. — *Theaceae*: leaves spiral, mostly dentate; no sap.

Distribution: The family world-wide, some genera extending to temperate regions. In Malesia 7 genera incl.:

- *Calophyllum* (pantropical), trees; lowland and lower montane forest;
- *Cratoxylum* (Southeast Asia, West Malesia), trees of primary and secondary lowland forest;
- *Garcinia* (paleotropical), mostly trees of lowland to montane rain forest.

Notes: The *Hypericaceae* often considered a separate family. — Several useful plants: *Garcinia* and *Mammea* (edible fruits). — Timber: *Calophyllum* and *Mesua*. — Ornamentals: *Hypericum*, *Mesua*.

Literature: N. K. B. Robson, Fl. Males. I, 8 (1974) 1–29 (*Hypericaceae*); P. F. Stevens, Revision *Calophyllum*, J. Arnold Arbor. 61 (1980) 117–690; T. C. Whitmore, Tree Fl. Mal. 2 (1972) 162–236.

Spot-characters: *Guttiferae* 56, 79, 104 – *Calophyllum* 19, 21, 67 – *Cratoxylum* 19, 59, 100, 102; *C. formosum* 12 – *Garcinia* 5, 6 (SAN 77272); 16, 19, 21, 22, 39, 46, 53, 59, 67, 80, 88, 99 – *Hypericum* 59 – *Kayea* 17, 52; *K. calophylloides* 67 – *Mammea* 19, 53, 59; *M. acuminata* 70; *M. calciphylla* 39; *M. woodii* 39, 70 – *Mesua* 19, 46.

Illustrations: Fig. 76 & 77.

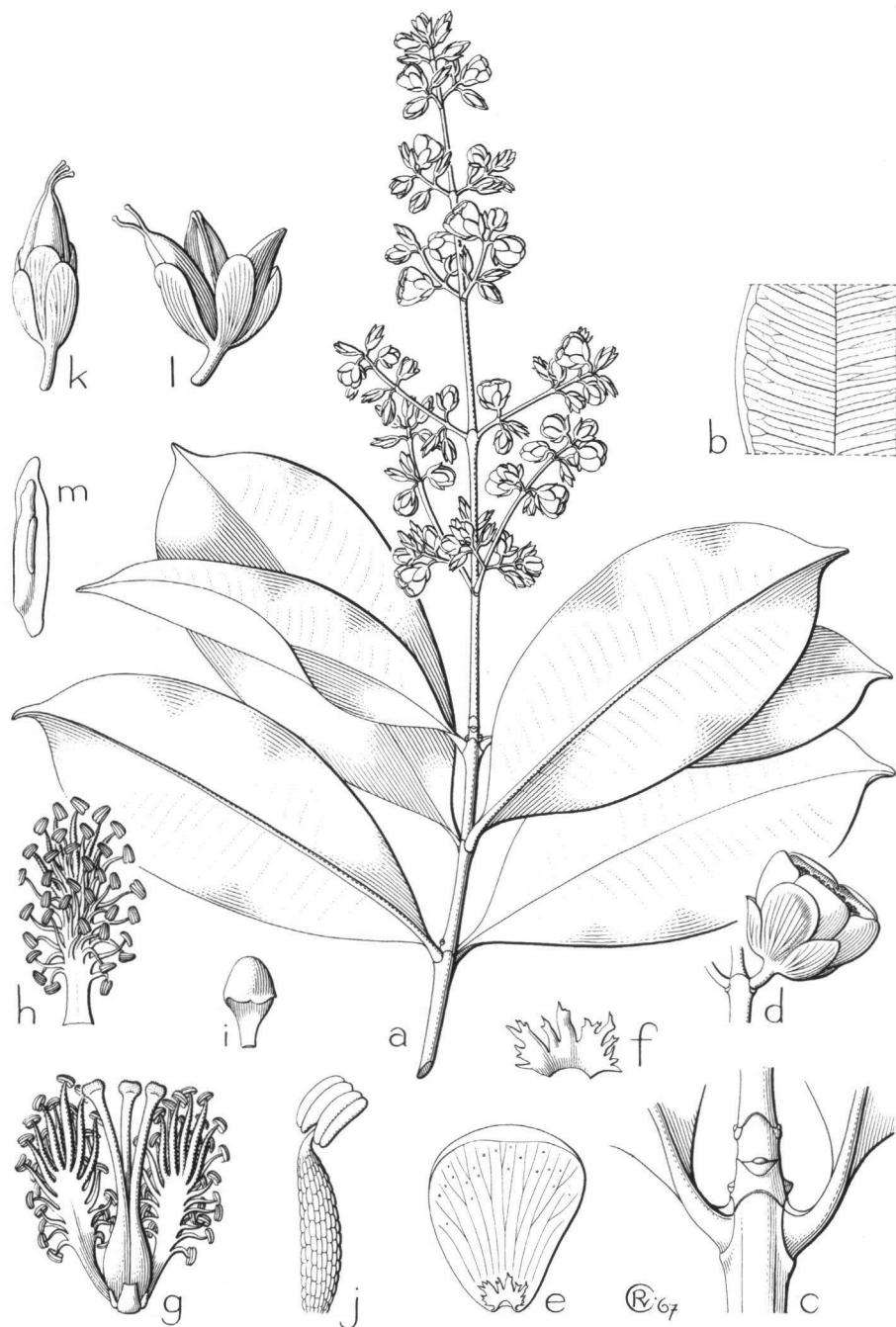


Fig. 76. *Cratoxylum arborescens* (Vahl) Blume: a. habit; b. venation; c. petiole; d. flower; e. petal; f. scale; g & h. staminal phalanges; i. staminodial fascicle; j. stamen; k & l. fruit; m. seed.



Fig. 77. *Garcinia segmentata* Kosterm., showing habit, flower, and details of flower (Courtesy Reinwardtia, Bogor).

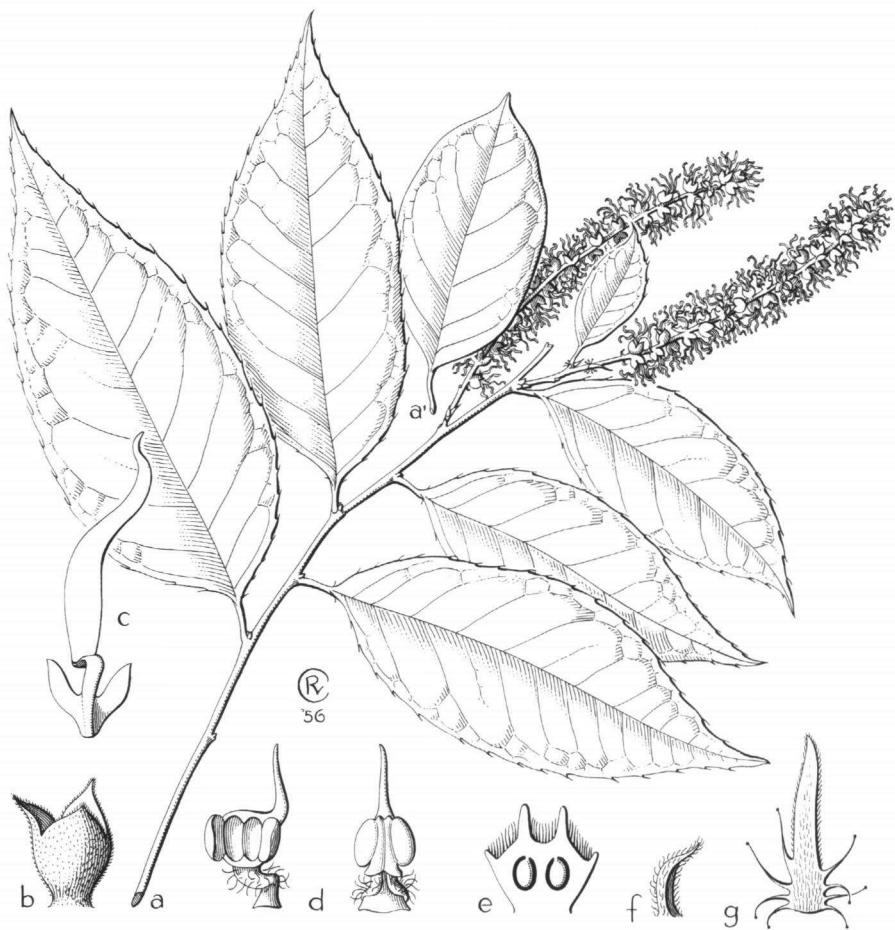


Fig. 78. *Embolanthera spicata* Merr.: a. habit; a'. separate entire leaf; b. calyx; c. petal; d. stamens; e. LS of ovary; f. bract; g. stipule.

HAMAMELIDACEAE

Always: Woody, non-climbing; leaves simple, spiral; flowers actinomorphic, styles 2; fruit a capsule.

Usually / often: Leaves pinnerved, stipules present; flowers unisexual, 4- or 5-merous; petals linear; anthers basifixied, connective with appendage; ovary semi-inferior.

Striking features: Leaves palmnerved (*Exbucklandia*); stipule scar annular (*Maingaya*, *Exbucklandia*); stipules pectinate (*Embolanthera*); seeds winged (*Altingia*).

Different from: *Casuarinaceae*: leaves scaly. — *Euphorbiaceae*: ovary superior.

Distribution: Mainly northern hemisphere, but also in Madagascar and Queensland.

In Malesia 7 genera, incl.:

— *Altingia* (Southeast Asia to Java), large trees, montane forest.

Notes: Timber: *Altingia* (rasamala). — Ornamental trees: *Maingaya*, *Rhodoleia*, *Exbucklandia*. — Young leaves edible: *Altingia*.

Literature: W. Vink, Fl. Males. I, 5 (1957) 363–379; T.C. Whitmore, Tree Fl. Mal. 2 (1972) 237–243.

Spot-characters: *Hamamelidaceae* 30, 58, 89, 92 – *Altingia* 76, 96, 102 – *Distylium* 25, 26, 100 – *Embolanthera* 34, 85, 87 – *Exbucklandia* 16, 33 – *Maingaya* 33, 100 – *Rhodoleia* 14, 25, 38, 76, 81, 96, 100 – *Sycopsis* 25, 26, 76, 87, 100.

Illustration: Fig. 78.

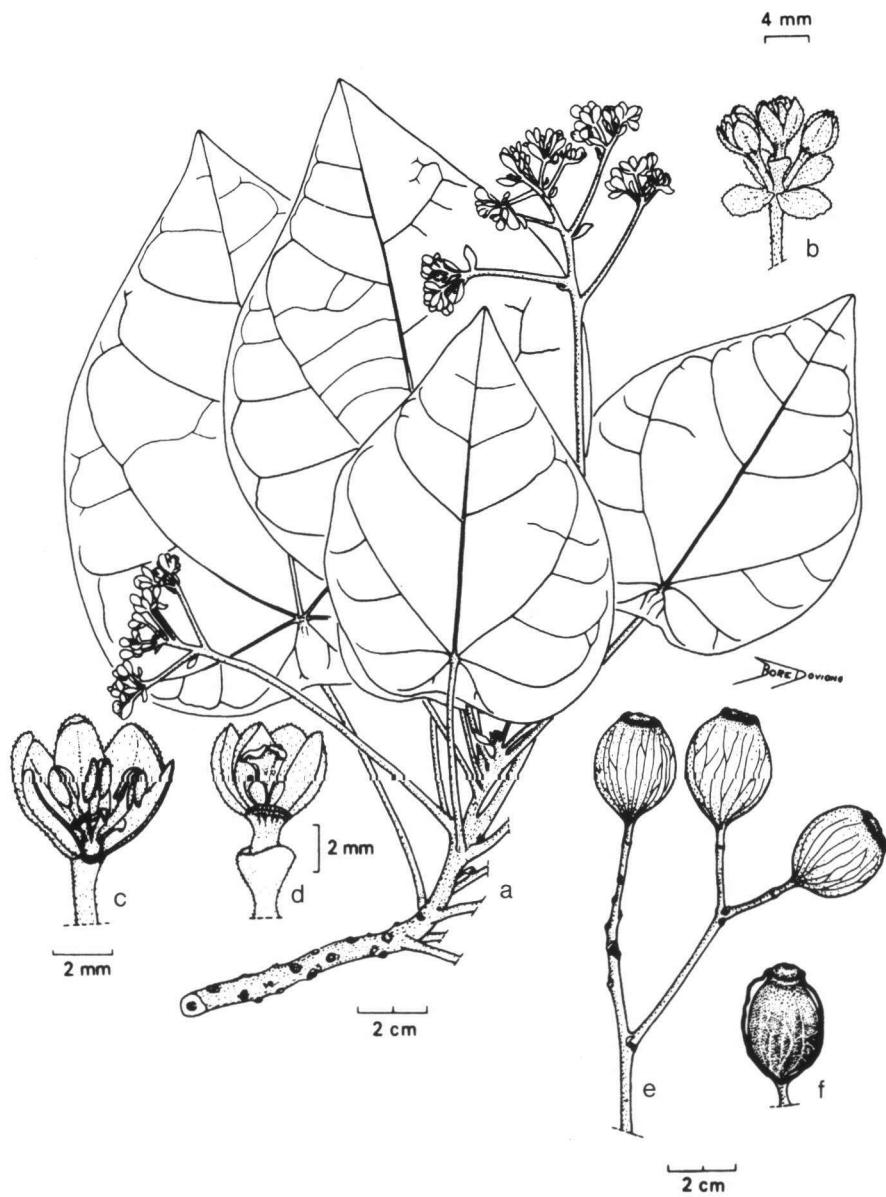


Fig. 79. *Hernandia nymphaeifolia* (Presl) Kubitzki: a. habit; b. inflorescence; c. male flower; d. female flower; e & f. fruit (Courtesy of Forest Department Malaysia).

HERNANDIACEAE (GYROCARPACEAE)

Always: Woody; leaves spiral, entire, exstipulate; flowers actinomorphic, perianth lobes more or less free, anthers opening by two valves; ovary inferior, 1-locular, 1 pendulous ovule; fruit 1-seeded.

Usually / often: Trees; leaves simple; filaments with glands at base; fruit winged or surrounded by an involucre.

Striking feature: Climber with 3-foliolate leaves (*Illigera*).

Different from: *Lauraceae*: ovary rarely inferior, fruit not winged or covered by an involucre.

Distribution: Pantropical; in Malesia 3 genera, incl. *Hernandia* (pantropical) trees, lowland rain forest.

Notes: *Hernandia nymphaeifolia* is a common seashore tree, the fleshy involucre of the fruit is eaten by bats but it also aids in floating.

Literature: K. Kubitzki, Bot. Jahrb. 89 (1969) 78–148; B.E.E. Duyfjes, Fl. Males. I, 12 (1996) 737–761.

Spot-characters: *Hernandiaceae* 58, 79 – *Gyrocarpus* 87, 98 – *Hernandia* 38, 51, 80, 87, 92, 98, 99 – *Illigera* 4, 5, 15, 48, 59, 87, 98.

Illustration: Fig. 79.



Fig. 80. *Galbulimima belgraveana* (F. Muell.) Sprague (Courtesy of Department of Forests, PNG).

HIMANTANDRACEAE

Always: Trees; aromatic; leaves alternate, simple, entire, covered by brown scales, penninerved, exstipulate; flowers bisexual, actinomorphic; perianth a deciduous calyptra; stamens and staminodes petaloid, numerous; carpels free in flower, fused in fruit; fruit a globular berry.

Usually/often: Flowers solitary, axillary.

Different from: *Annonaceae*: not lepidote, flower not calyprate. — *Bombacaceae*: stipulate, flowers with calyx and corolla. — *Magnoliaceae*: stipulate, not lepidote.

Distribution: The only genus, *Galbulimima*, consists of 1–3 species ranging from Sulawesi to New Guinea and East Australia.

Notes: Tree of montane forest, limited use as timber tree; the bark, when chewed, induces hallucinations.

Literature: J.R. Croft, Handb. Fl. Papua New Guinea 1 (1978). — Dr. P.K. Endress (Zürich) is revising the family for Flora Malesiana.

Spot-characters: 26, 59.

Illustration: Fig. 80.

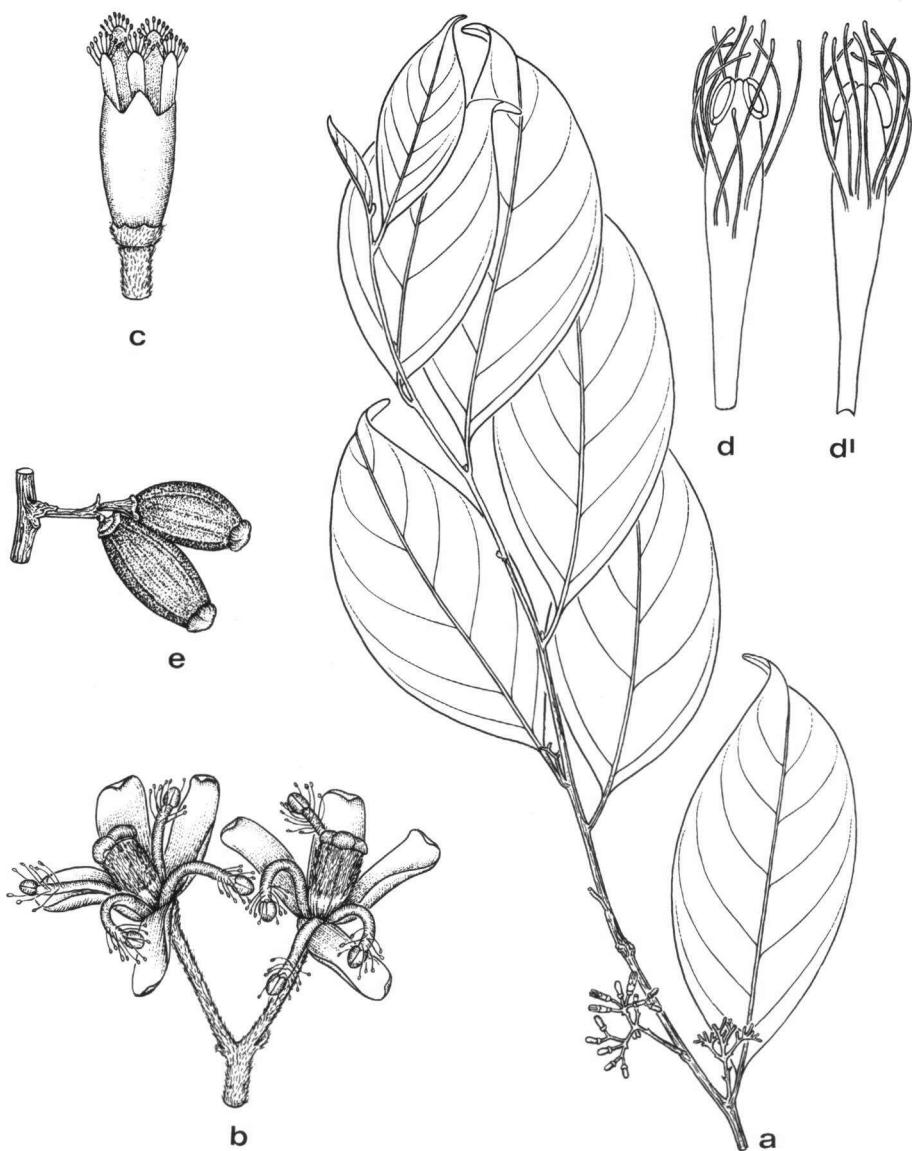


Fig. 81. *Gomphandra javanica* (Blume) Valeton: a. habit; b. female flower; c. male flower; d. & d'. stamens; e. fruits.

ICACINACEAE

Always: Woody; leaves simple, exstipulate; ovary superior, 2 apical ovules; fruit a drupe.

Usually/often: Trees or shrubs; leaves spiral, entire (sometimes lobed), pinninerved, inflorescence cymose; petals free.

Striking features: Climbers with opposite leaves and tendrils (*Iodes*, *Polyporandra*); coarse liana, leaves palminerved (*Phytocrene*); petiole transversely ribbed (*Gonocaryum*); leaves with fine scales below (*Platea*); style excentric (*Apodytes*); caulinflorous tree (*Pseudobotrys*); leaves pellucid-dotted, fruit with fibrous mesocarp (*Merrilliodendron*).

Different from: Lauraceae: 1 ovule, anthers opening by valves.

Distribution: The family pantropical, some species extending to warm temperate regions. In Malesia 20 genera, mostly of lowland and mid-montane rain forest, incl.:

- *Gomphandra* (Indo-Malesia), treelets; substage of primary and secondary forest;
- *Platea* (Indo-Malesia), trees of mid-montane forest;
- *Stemonurus* (Indo-Malesia), trees of dryland and swamp forest.

Notes: A family difficult to recognize. *Cardiopteris* and *Lophopyxis* have been placed in families of their own. — Few uses recorded; timber trees: *Cantleya*, *Platea*.

Literature: H. Sleumer, Fl. Males. I. 7 (1971) 1–87.

Spot-characters: *ICACINACEAE* 28, 58, 59, 61, 79 – *Apodytes* 54, 91, 99 – *Cantleya* 88 – *Citronella* 45, 73 – *Codiocarpus* 88 – *Gomphandra* 77, 88, 99; *G. quadrifida* var. *triplinervia* 64 – *Gonocaryum* 39, 70, 88, 99, 105 – *Iodes* 4, 6, 45, 88 – *Medusanthera* 88 – *Merrilliodendron* 59, 70 – *Miquelia* 5, 88 – *Phytocrene* 5, 29, 70 96, 99 – *Platea* 23, 25, 26, 27, 39, 88 – *Polyporandra* 4, 5, 6, 45, 87, 88 – *Pseudobotrys* 70 – *Pyrenacantha* 5, 88 – *Rhyticaryum* 52, 88 – *Sarcostigma* 5 – *Stemonurus* 22, 85; *S. monticolus* 31.

Illustrations: Fig. 81 & 82.

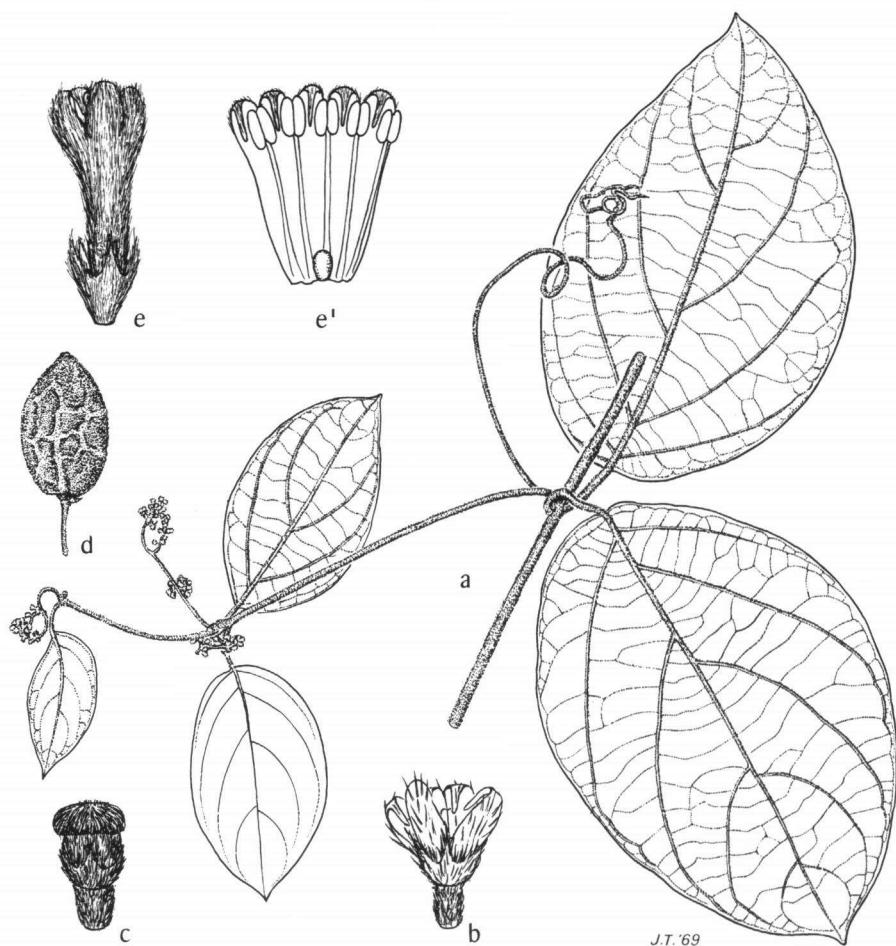


Fig. 82. *Iodes cirrhosa* Turcz.: a. habit; b. male flower; c. female flower; d. fruit; e & e'. male flower (and detail) of *I. philippinensis* Merr.

ILLICIACEAE

Always: Woody; non-climbing, aromatic; leaves simple, crowded, entire, pinninerved, exstipulate; flowers bisexual, actinomorphic, perianth of several free overlapping members; stamens many; fruit of several free carpels, each with 1 seed.

Usually/often: Fruit star-shaped, ripening red, each carpel splitting open on top, seed brown.

Different from: *Magnoliaceae*: stipulate, carpels not arranged in a star. — *Theaceae* (*Ternstroemia*): sepals and petals present, carpels not free.

Distribution: The single genus, *Illicium*, occurs in East Asia and North America; in Malesia it is limited to the West (Sumatra—Philippines).

Notes: The fruits of *Illicium verum** (star anise) are used in cooking. The Malesian species occur in montane rain forest.

Literature: A.C. Smith, *Sargentia* 7 (1947) 1–79; F.S.P. Ng, *Tree Fl. Mal.* 2 (1977) 253–256; R.M.K. Saunders, *Fl. Males.* I, 13 (1997) 169–184.

Spot-characters: 46, 59, 70.

Illustration: Fig. 83.



Fig. 83. *Illicium tenuifolium* (Ridl.) A.C. Sm. (Courtesy FRIM, Kepong).

JUGLANDACEAE

Always: Trees; leaves spiral, paripinnate, exstipulate; flowers small, 4-merous, unisexual (plants monoecious or dioecious) in catkins, ovary inferior, 1-locular, 1 erect ovule; fruit covered by a 3-lobed winged accrescent bract.

Usually/often: Trees deciduous before flowering, scales on young parts; perianth reduced; rachis tip free.

Different from: *Myricaceae*: leaves simple, fruit a drupe. — *Sapindaceae*: inflorescence never a catkin, fruit never covered by 3-winged bract.

Distribution: The family is widespread in the northern hemisphere; in Malesia only *Engelhardia* (Himalaya to New Guinea), mainly montane forest.

Notes: Although some species attain considerable size the wood is of inferior quality.

Literature: M. Jacobs, Fl. Males. I, 6 (1960) 143–154; E. J. F. Campbell, Tree Fl. Sabah & Sarawak 1 (1995) 233–244..

Spot-characters: 26, 41, 58, 78, 92, 98.

Illustration: Fig. 84.



Fig. 84. *Engelhardia rigida* Blume: a. habit; b. male flower.

LAURACEAE

Always: Woody; leaves simple, entire, exstipulate; flowers 3-merous; anthers opening with valves; ovary 1-locular with one apical ovule; fruit a berry or drupe.

Usually / often: Trees; leaves spiral or alternate; often coriaceous, triplinerved, glaucous below; aromatic; ovary superior.

Striking features: Twining parasite (*Cassytha*); leaves mostly opposite, triplinerved (*Cinnamomum*); leaves crowded, often brown-hairy (*Actinodaphne*); ovary inferior (*Cassytha*, *Cryptocarya*, *Eusideroxylon*, *Potoxylon*); fruit stalk swollen, fleshy (*Alseodaphne*, *Dehaasia*); leaves drying blackish (most *Dehaasia*, some *Lindera*).

Different from: *Icacinaceae*: 2 ovules, anthers not opening by valves. — *Monimiaceae*: leaves (sub)opposite, dentate.

Distribution: The family world-wide. In Malesia 20 genera, mostly of the mid-montane rain forest; incl.:

- *Cinnamomum* (Indo-Australia), trees;
- *Cryptocarya* (pantropical), trees of lowland and montane rain forest;
- *Eusideroxylon* (Sumatra and Borneo), large trees, lowland;
- *Litsea* (pantropical), mostly small trees of lowland and montane rain forest.

Notes: Several species produce fruits eaten by various animals. — Many useful plants, incl.: spices: *Cinnamomum*; medicinal uses: *Cryptocarya*, *Cinnamomum*; edible fruits: *Persea americana**; some *Litsea*; timber: *Eusideroxylon* (Ironwood, Ulin), *Cryptocarya*.

Literature: A.J.G.H. Kostermans, Lauraceae. Comm. For. Res. Inst. Indon. 57 (1957); K.M. Kochummen, Tree Fl. Mal. 4 (1989) 98–178.

Spot-characters: Lauraceae 30, 56, 57, 58, 59, 79 – *Actinodaphne* 14, 46, 76, 87 – *Actinolindera* 87 – *Alseodaphne* 46, 87 – *Beilschmiedia* 14, 15, 52, 87 – *Caryodaphnopsis* 64, 87 – *Cassytha* 5, 7, 11, 92 – *Cinnadenia* 87 – *Cinnamomum* 45, 64, 85, 87 – *Cryptocarya* 64, 87, 92, 99; *Cryptocarya* (Davis 759) 9 – *Dehaasia* 54, 87 – *Endiandra* 45, 87 – *Eusideroxylon* 87, 92 – *Hexapora* 87 – *Lindera* 54, 64, 71, 76, 87 – *Litsea* 45, 70, 71, 76, 87, 93 – *Neocinnamomum* 87 – *Neolitsea* 46, 64, 87 – *Notaphoebe* 87 – *Persea* 87 – *Phoebe* 14, 87, 93 – *Potoxylon* 87, 92 – *Triadodaphne* 87.

Illustrations: Fig 85 & 86.

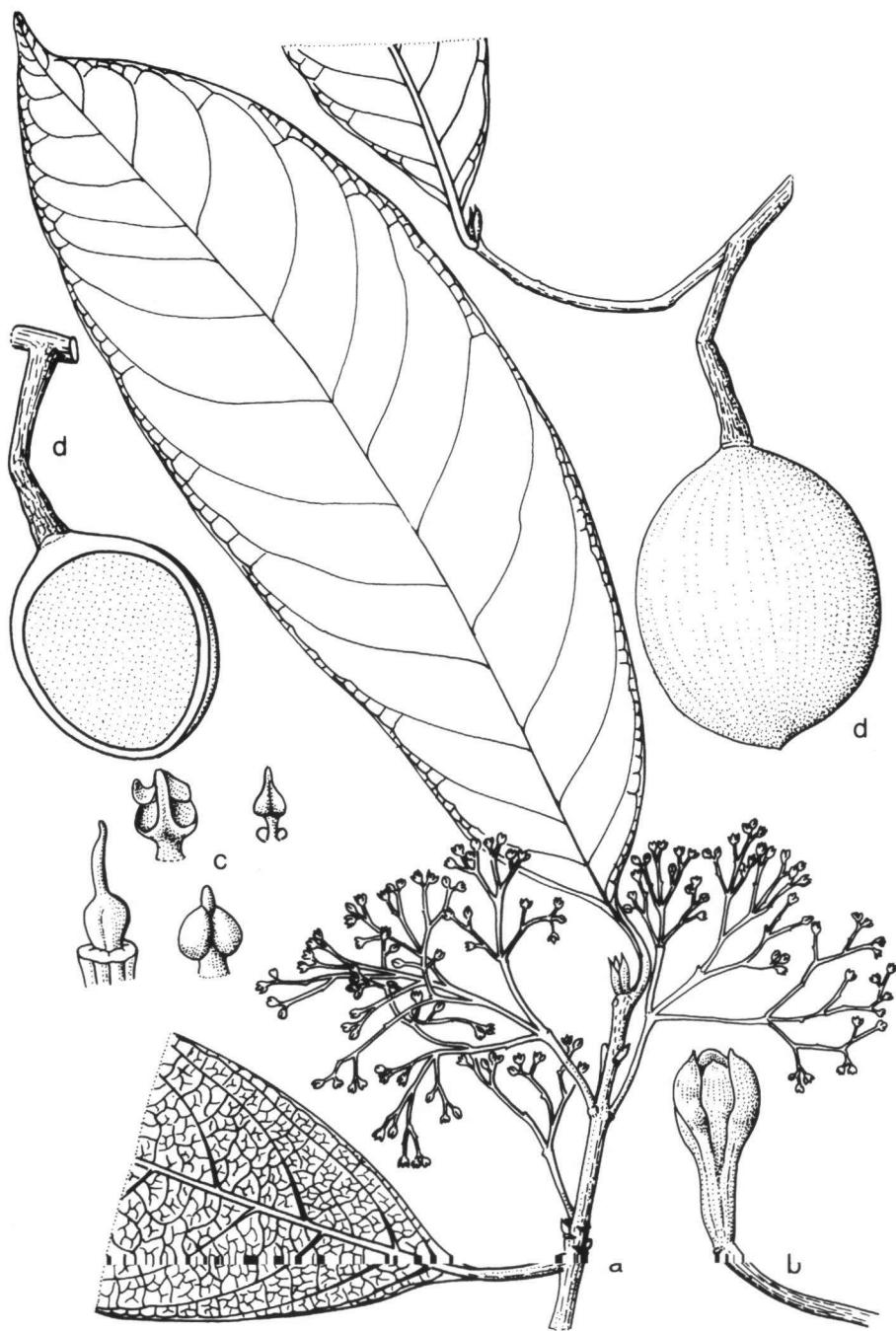


Fig. 85. *Beilschmiedia gigantocarpa* Kosterm.: a. habit; b. flower; c. stamens; d. fruit (Courtesy Reinwardtia, Bogor).



Fig. 86. *Cinnamomum lawang* Kosterm.: a & b. habit; c. stamen; d. pistil (Courtesy Reinwardtia, Bogor).

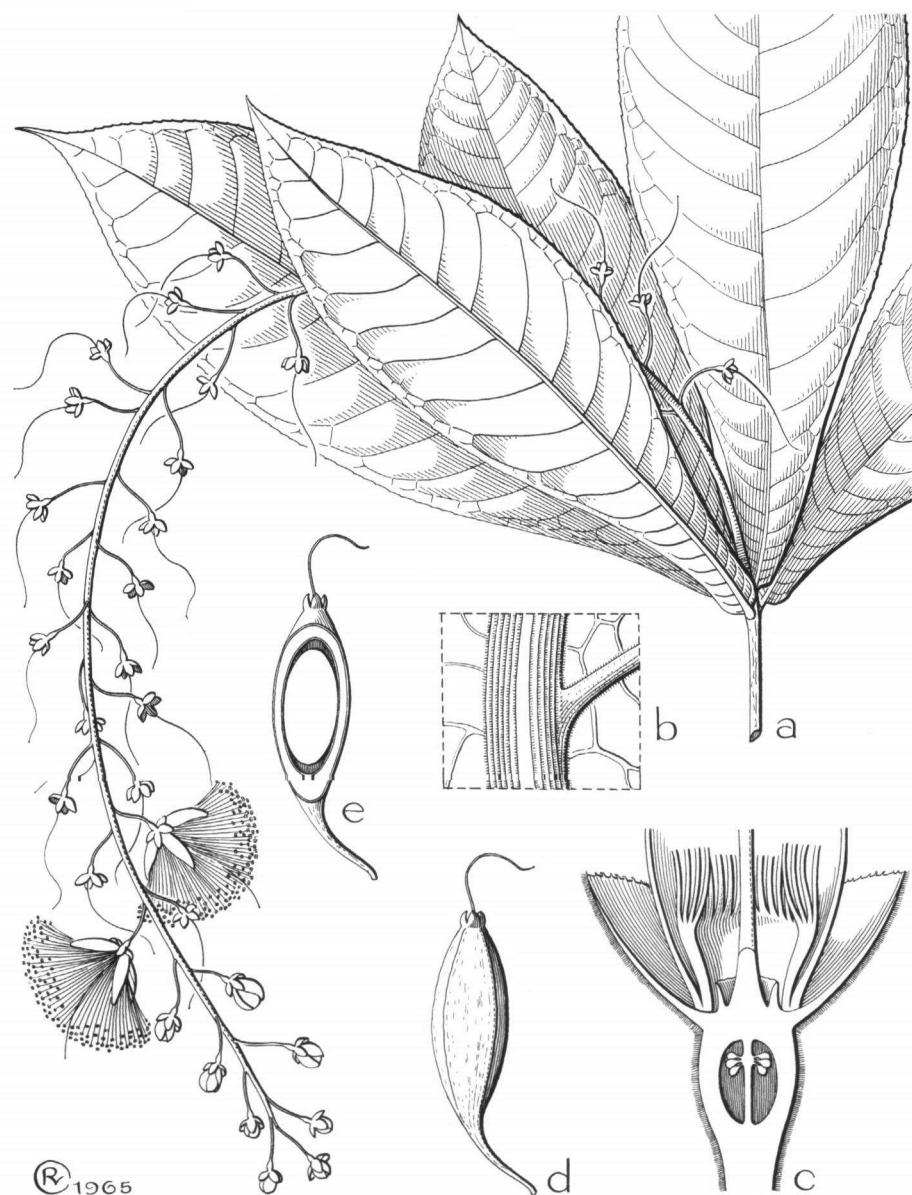


Fig. 87. *Barringtonia fusiformis* King: a. flowering twig; b. detail of leaf; c. LS of ovary; d. fruit; e. idem, in LS.

LECYTHIDACEAE (BARRINGTONIACEAE)

Always: Woody, non-climbing; leaves spiral, simple, pinninerved; flowers hermaphroditic; stamens numerous; ovary (semi-)inferior, 2–6-locular.

Usually/often: Leaves crowded at the end of branches, exstipulate, dentate; fruit with fibrous mesocarp.

Striking features: Winged fruit (*Combretodendron*); tiny stipules, inflorescence racemose (*Barringtonia*).

Different from: *Combretaceae*: leaves entire, often with pellucid dots and glands, ovary 1-locular. — *Myrtaceae*: leaves mostly opposite, entire, pellucid dots.

Distribution: The family pantropical. In Malesia 6 genera, incl.:

- *Barringtonia* (paleotropical), trees; lowland (incl. swamp and littoral) forest;
- *Planchonia* (Malesia, North Australia), trees; lowland rain forest.

Notes: Edible nuts: some *Barringtonia*, *Bertholletia**. — Ornamentals: *Barringtonia*, *Couroupita**, *Gustavia**. — Fish poison: *Barringtonia*.

Literature: K. Kartawinata, Bull. Bot. Survey India 9 (1965) 162–187 (*Planchonia*); J.P.D.W. Payens, Blumea 15 (1968) 157–263 (*Barringtonia*). — Dr. K. Kartawinata (CIFOR, Bogor) is revising the family for Flora Malesiana.

Spot-characters: *Abdulmajidia* 92 – *Barringtonia* 10, 14, 43, 46, 53, 92 – *Bertholletia* 94 – *Chydenanthus* 70, 78, 92 – *Combretodendron* 92 – *Couroupita* 70, 92, 94 – *Planchonia* 92.

Illustration: Fig. 87.

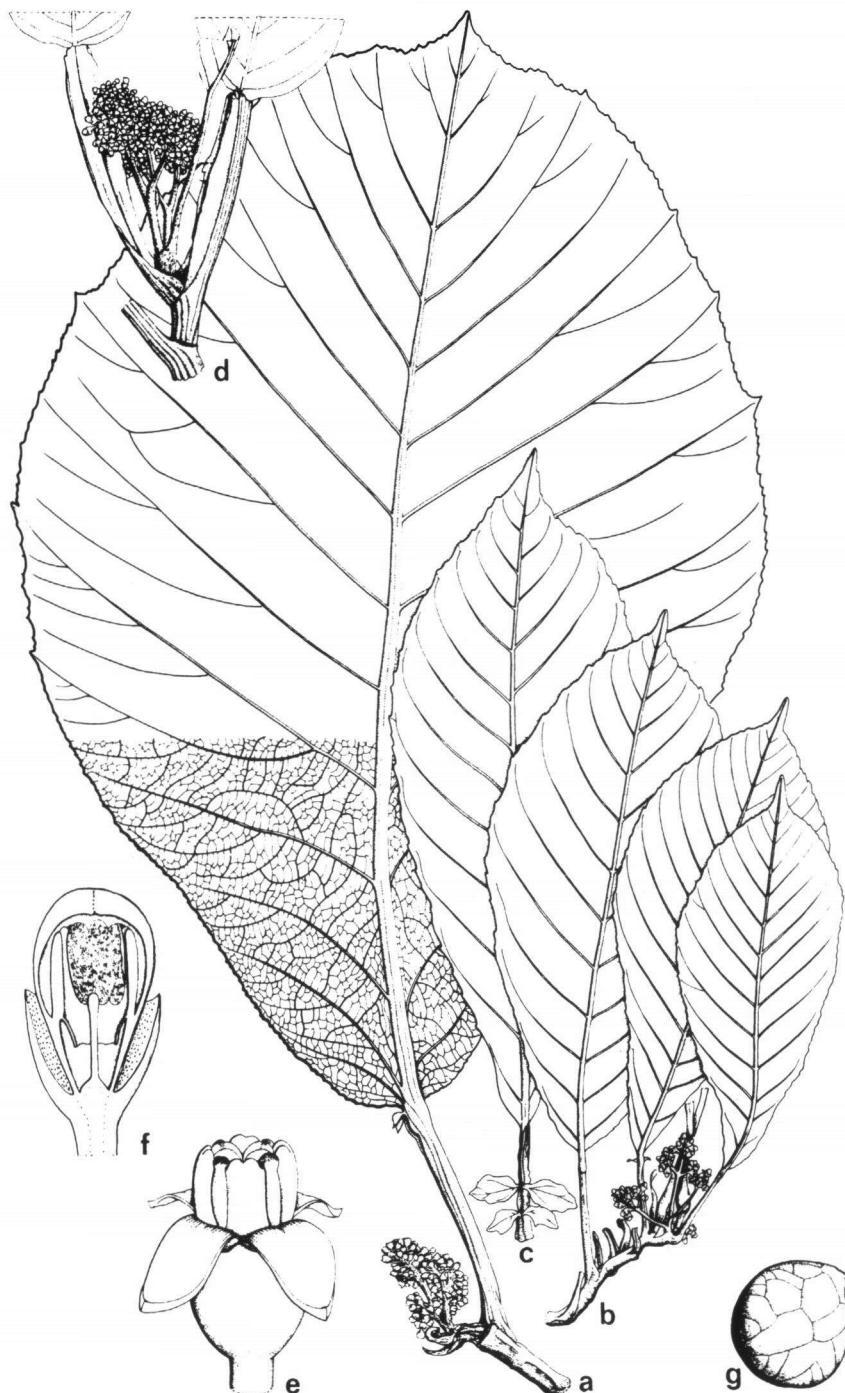


Fig. 88. *Leea magnifolia* Merr.: a & b. habit; c. leaf; d. inflorescence and stipules; e. flower; f. idem, in LS; g. embryo.

LEEACEAE

Always: Leaves distichous, dentate, base of petiole expanded to form clasping stipular structures; inflorescence leaf-opposed; flowers bisexual, actinomorphic, 4- or 5-merous, choripetalous, staminodial tube joined to corolla; ovary 4–8-locular, 1 ovule per cell; fruit a berry, seeds with ruminate endosperm.

Usually / often: Woody; leaves imparipinnate, rachis noded; underside of leaf with pearl glands.

Different from: *Vitaceae*: climbers with tendrils, no staminodial tube.

Distribution: The only genus, *Leea*, is distributed throughout the Paleotropics, from Africa to Fiji; in Malesia 25 species, mostly in the understorey of lowland and lower montane forest.

Notes: Some species used medicinally, a few species planted as ornamentals. *Leea* is often placed in the *Vitaceae*.

Literature: C.E. Ridsdale, Fl. Males. I, 7 (1976) 755–782.

Spot-characters: 10, 12, 14, 33, 40, 42, 50, 84, 105.

Illustration: Fig. 88.

LEGUMINOSAE
(FABACEAE, incl. CAESALPINIACEAE, MIMOSACEAE, PAPILIONACEAE)

Always: Inflorescence racemose (sometimes strongly reduced); pedicel implanted on swelling of rachis; ovary superior, 1-locular, parietal placentation.

Usually / often: Leaves compound, stipulate; fruit a pod (dry capsule dehiscing with two valves); flowers hermaphroditic, sepals and petals connate at base; ovary stipitate; ovules in two rows; root nodules with N-fixing bacteria.

Striking features: Climber, pods with stinging hairs (*Mucuna*); shrub, pod moniliform (*Sophora*); fruit a berry (*Dialium*, *Euchresta*, *Tamarindus*); herb with two-armed hairs and pods bent downward (*Indigofera*).

Different from: *Connaraceae*: exstipulate, sepals free, 2 collateral ovules.

Distribution: The family world-wide. In Malesia 120 genera.

Notes: The subfamilies of the *Leguminosae* are often considered separate families, distinguished as follows:

- *Mimosoideae*: leaves nearly always bipinnate, flowers actinomorphic, small, in dense heads or spikes, stamens usually numerous.
- *Caesalpinioideae*: leaves usually pinnate, also bipinnate or simple, flowers slightly zygomorphic, usually large, in racemes or simple spikes, stamens usually 10, usually united.
- *Papilioideae*: leaves palmate, pinnate or simple, flowers zygomorphic, stamens nearly always 10 of which 9 united.

The family displays a wide range of habits (herbs, climbers, and trees of various size and architecture) and is represented in various vegetation types. Many species are important food trees for animals and many species are useful to man. — Food plants: *Arachis**, *Archidendron*, *Canavalia*, *Dialium*, *Glycine max**, *Inocarpus*, *Lablab*, *Pachyrhizus**, *Parkia*, *Phaseolus*, *Psophocarpus**, *Sesbania*, *Tamarindus*, *Vigna*, *Voandzeia**. — Medicinal plants: *Abrus*, *Cassia*, *Tamarindus*. — Ornamentals: *Acacia*, *Amherstia**, *Caesalpinia*, *Calliandra**, *Delonix**, *Erythrina*, *Leucaena**, *Maniltoa*, *Pongamia*, *Samanea**, *Strongylodon*. — Timber trees: *Cynometra*, *Dalbergia*, *Dialium*, *Intsia*, *Kalappia*, *Koompassia*, *Paraserianthes*, *Pericopsis*, *Pterocarpus*, *Sindora*.

Literature: Anonymous, tropical Legumes: resources for the future, Nat. Ac. Sc. (1979); B. Verdcourt, A manual of New Guinea Legumes. Bot. Bull. Lae no. 11 (1979); R. M. Polhill & P.H. Raven (eds.), Advances in Legume Systematics 1 & 2 (1981); I. Nielsen, Fl. Males. I, 11 (1992) 1–126 (*Mimosaceae*); Ding Hou, K. Larsen & S.S. Larsen, Fl. Males. I, 12 (1996) 409–730 (*Caesalpiniaceae*).

Spot-characters: *Leguminosae* 2, 14, 30, 48, 56, 72, 76, 84, 99, 104 – *Acacia* 4, 5, 9, 12, 31, 50, 97 – *Acrocarpus* 50 – *Adenanthera* 50 – *Aeschynomene* 35 – *Aganope* 5 – *Airyatha* 5, 97 – *Albizia* 12, 31, 50 – *Arachis* 75 – *Archidendron* 31, 41, 42,

50, 70; *A. aruense* 9; *A. ellipticum* 18; *A. pteropum* 40 – *Archidendropsis* 50 – *Astragalus* 41 – *Atylosia* 31 – *Bauhinia* 4, 5, 38 – *Bowringia* 5 – *Bracteolanthus* 4 – *Butea* 98; *B. monosperma* p.p. 2 – *Caesalpinia* 4, 5, 12, 37, 45, 50, 59, 95; *C. oppositifolia* 6, 32, 49 – *Cajanus* 31 – *Callerya* 4, 5, 21, 70 – *Cassia* 24, 86; *C. javanica* 12, 35 – *Cathormion* 12 – *Centrosema* 36 – *Clitoria* 5 – *Crotalaria* 15, 59 – *Crudia* 31 – *Cynometra cauliflora* 70 – *Dalbergia* 4, 5, 8, 21, 98 – *Delonix* 50 – *Derris* 5, 97, 98; *D. thyrsiflora* 59 – *Desmodium* 37, 38, 68, 97 – *Dialium* 21 – *Dichrostachys* 12 – *Diodea* 5 – *Dunbaria rubella* 31 – *Entada* 4, 5, 50 – *Erythrina* 8, 12, 97, 98; *E. variegata* 25 – *Euchresta* 93 – *Flemingia* 31, 68 – *Fordia* 70, 73 – *Gleditschia* 12 – *Indigofera* 27, 28, 85 – *Inga edulis* 40 – *Inocarpus* 21, 40 – *Kalappia* 21, 98 – *Kingiodendron* 59 – *Koompassia* 98 – *Kunstleria* 5 – *Lasiobema* 4, 38 – *Lathyrus* 4 – *Leucaena* 50 – *Lysiphyllum* 4 – *Macropsychanthus* 5 – *Mastersia* 5, 54 – *Millettia* 5, 21; *M. unifoliolata* 38 – *Mimosa* 4, 50, 95 – *Monarthrocarpus* 5 – *Mucuna* 5, 29, 54, 70, 78 – *Neocolletia* 75 – *Neptunia* 50; *N. oleracea* 2 – *Ormosiopsis* 95, 97 – *Padbruggea* 5 – *Pararchidendron* 50 – *Paraserianthes* 50 – *Parkia* 8, 50, 78 – *Parkinsonia* 12, 41, 97 – *Peltophorum* 50 – *Phanera* 38 – *Phylacium* 5 – *Piliostigma* 38 – *Pisum* 4 – *Pithecellobium* 50 – *Pseudarthria* 37 – *Psoralea* 31, 59 – *Pterocarpus* 21, 98 – *Pterolobium* 5, 12, 98 – *Pueraria* 5 – *Pycnospora* 5 – *Rhynchosia* 38 – *Rhynchosia* 5, 31 – *Samanea* 50 – *Saraca* 70 – *Sarcodum* 5 – *Schizolobium* 98 – *Schleinitzia* 50 – *Schrankia* 95 – *Serianthes* 50 – *Sindora* 95 – *Sophora* 97 – *Spatholobus* 5, 36, 98 – *Strongylodon* 5, 70, 78 – *Sympetalandra* 59 – *Tadehagi* 33, 39 – *Tamarindus* 97 – *Tephrosia* 5, 67 – *Trifidacanthus* 12 – *Vigna* 5, 75 – *Voandzeia* 75 – *Wallaceodendron* 50 – *Zornia* 95.

Illustrations: Fig. 89–94.

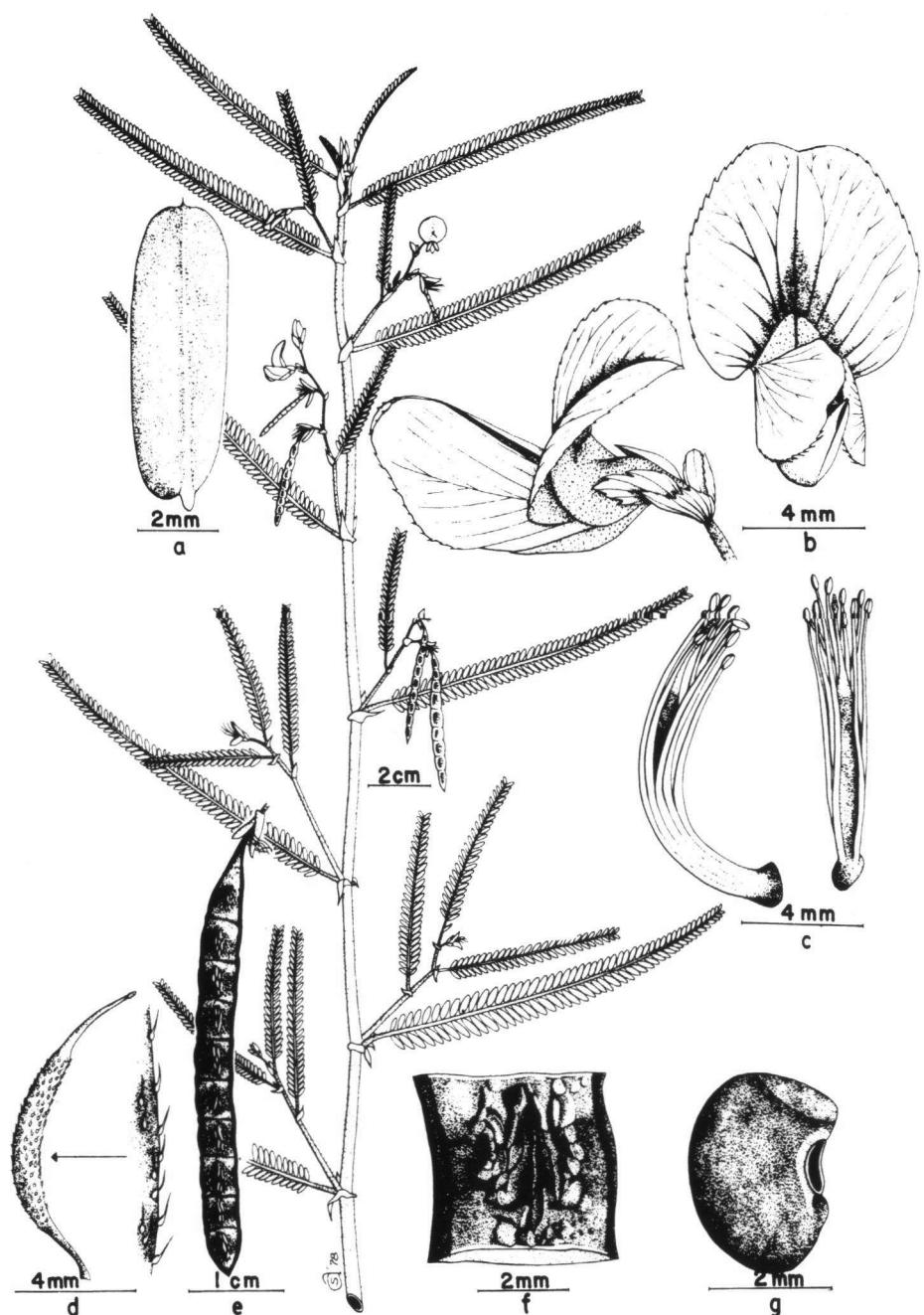


Fig. 89. *Aeschynomene indica* L.: a. leaflet; b. flower; c. staminal tube; d. pistil; e. pod; f. detail of pod; g. seed (Courtesy Koninklijk Instituut voor de Tropen, Amsterdam).

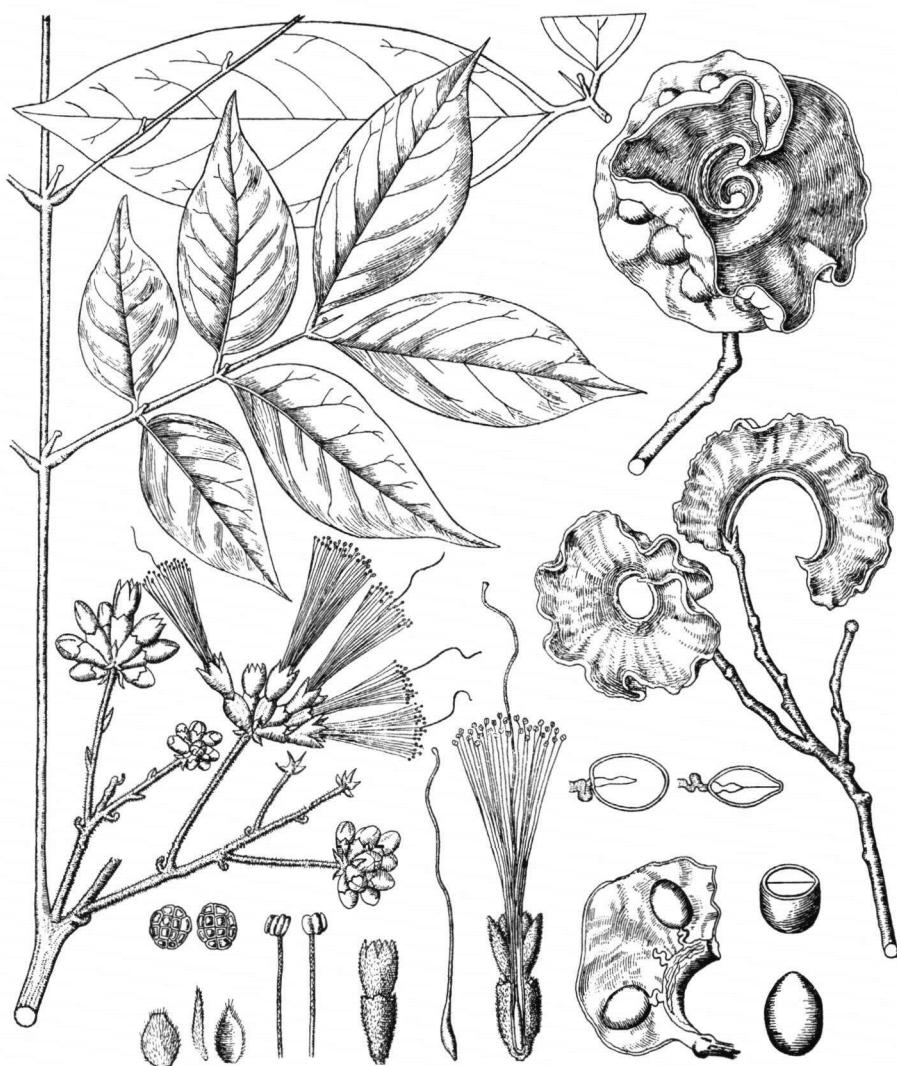


Fig. 90. *Archidendron grandiflora* (Benth.) Nielsen, habit with flowers and pods.



Fig. 91. *Cynometra malaccensis* Meeuwen: a. flowering twig; b. CS of flower; c. fruits.

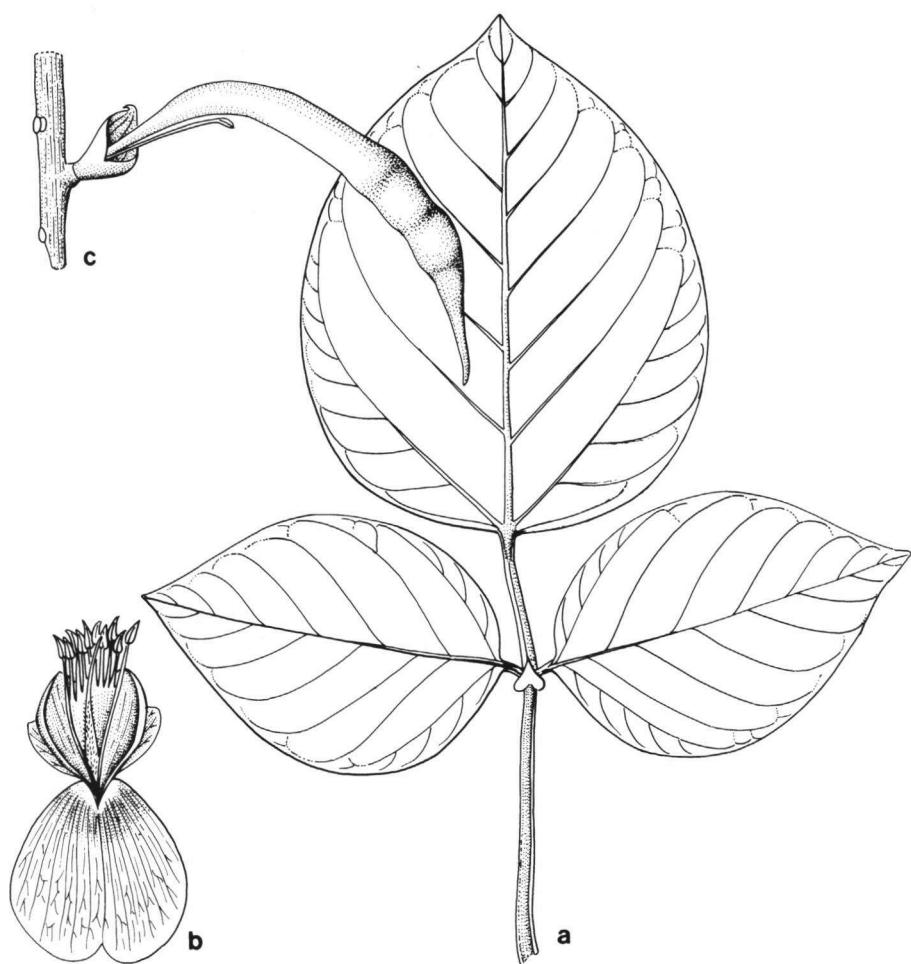


Fig. 92. *Erythrina subumbrans* Hassk.: a. leaf; b. flower; c. pod.

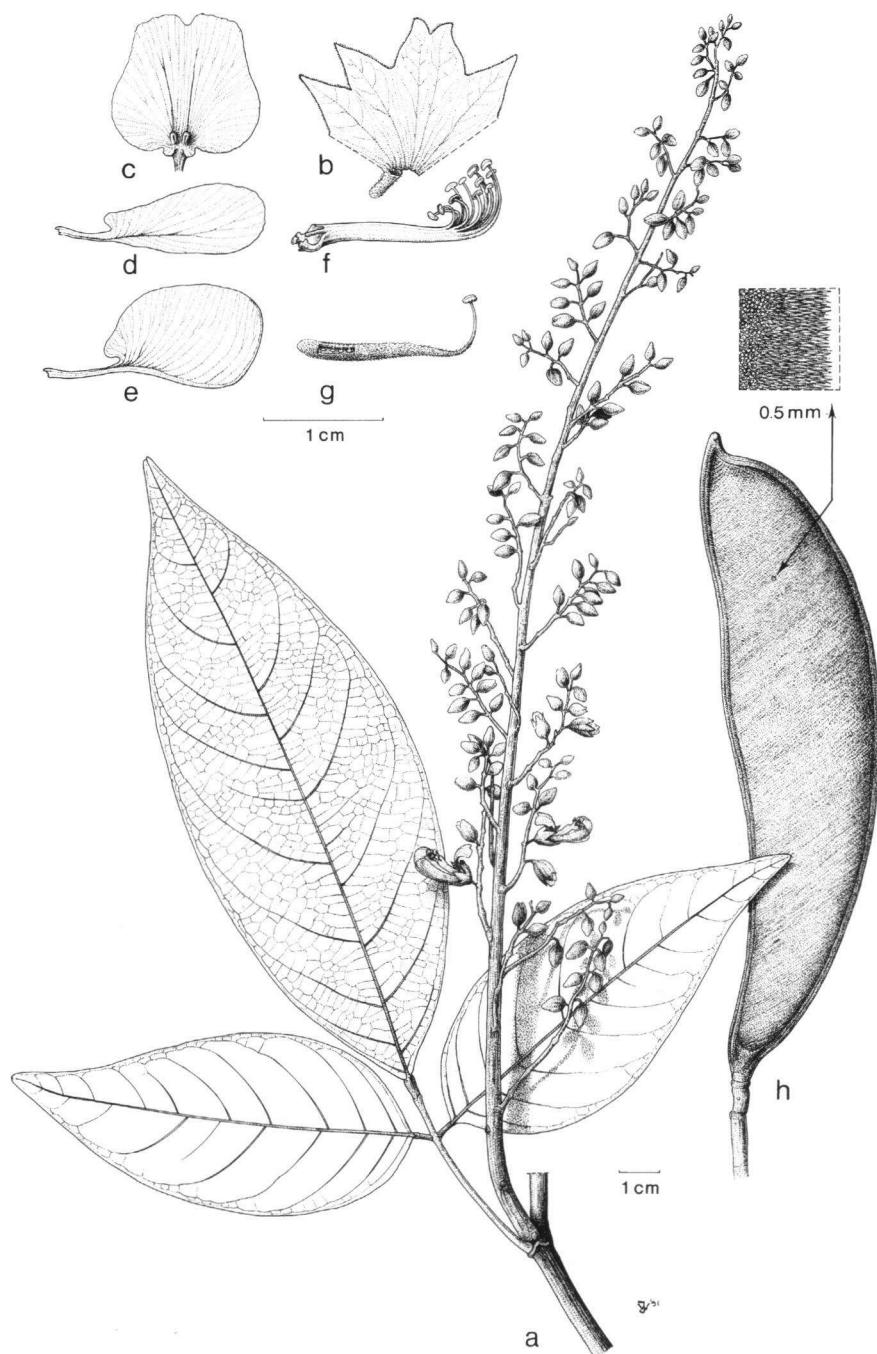


Fig. 93. *Fordia albiflora* (Prain) Dasuki & Schot: a. habit; b–g. details of flower; h. pod.

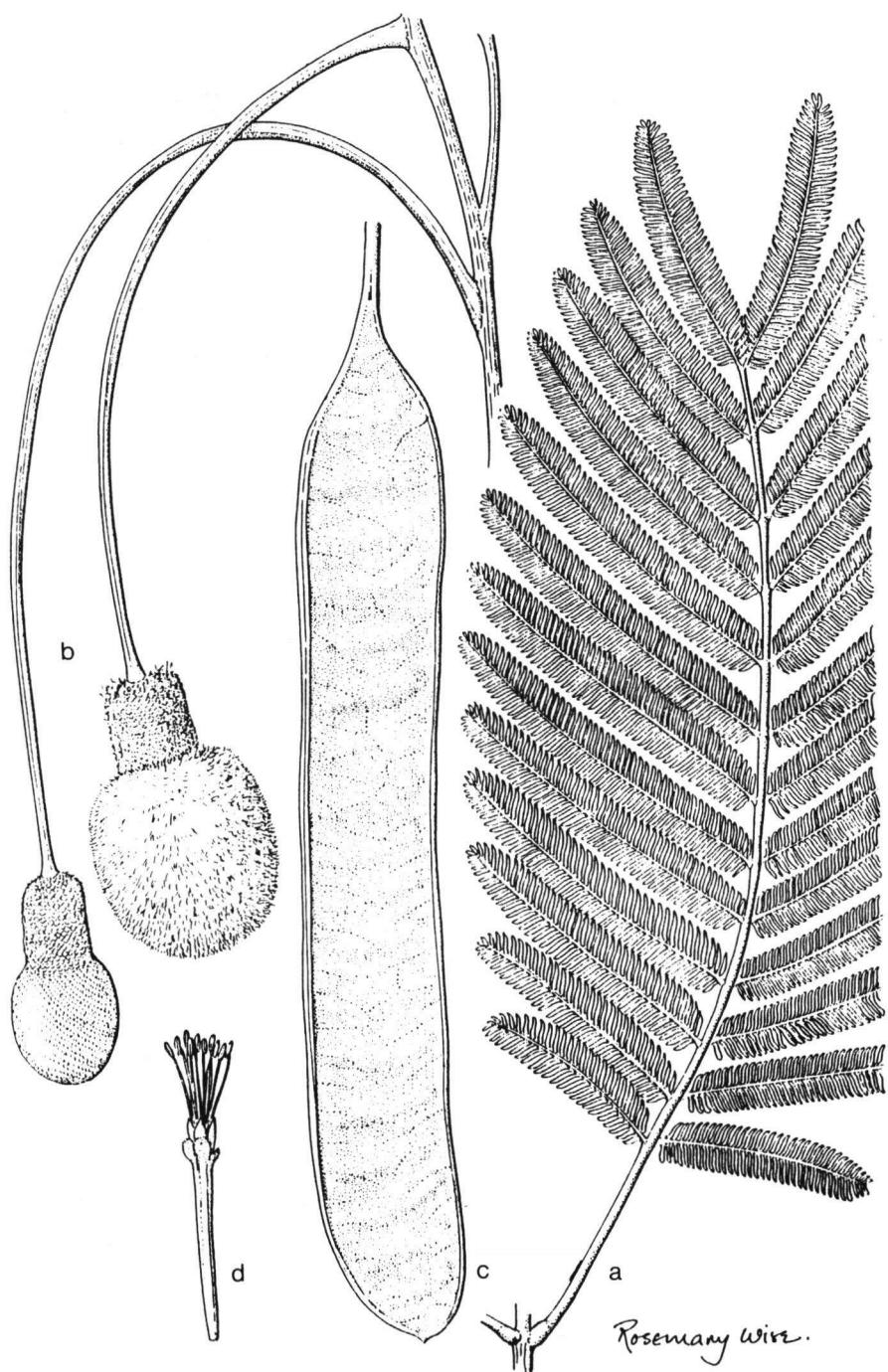


Fig. 94. *Parkia timoriana* (DC.) Merr.: a. leaf; b. inflorescence; c. pod; d. flower.

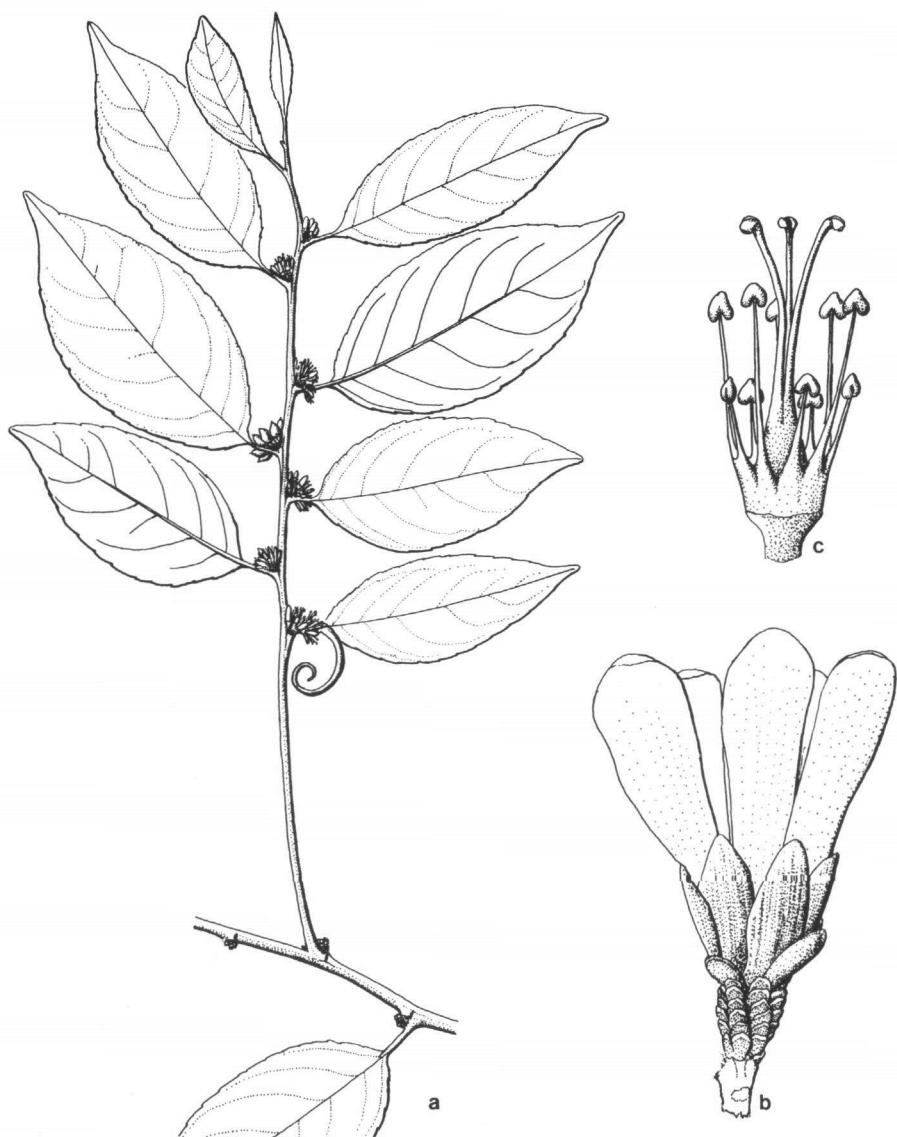


Fig. 95. *Indorouchera contestiana* (Pierre) Hall. f.: a. habit with hook; b & c. details of flower.

LINACEAE (CTENOLOPHONACEAE, HUGONIACEAE, IXONANTHACEAE)

Always: Woody; leaves simple, pinnerved, stipulate; flowers bisexual, 5-merous, actinomorphic; ovary superior.

Usually/often: Leaves spiral; sepals and petals more or less free, quincuncial; stamens 10, filaments connate at base, 5 long, 5 short; fruit a capsule, the climbing species (*Hugonia*, *Indorouchera*, *Philbornea*) provided with hooks.

Striking features: Trees, leaves opposite, wig-like aril (*Ctenolophon*); stipules pectinate (*Hugonia*); climber with hooks, fruit a drupe (*Indorouchera*).

Different from: *Malpighiaceae*: T-hairs, petals clawed. — *Oxalidaceae*: the climbers without hooks, the trees usually with compound leaves, fruit usually a berry.

Distribution: Scattered throughout the tropics; in Malesia 5 genera, mostly of primary lowland rain forest.

Notes: Also treated as four separate families: *Ctenolophonaceae* (*Ctenolophon*), *Hugoniaceae* (*Hugonia*, *Indorouchera*, *Philbornea*), *Ixonanthaceae* (*Ixonanthes*) and *Linaceae* (not represented in Malesia by native species). — *Ctenolophon* produces timber, *Linum**¹, oil and fibres.

Literature: A.M.N. van Hooren & H.P. Nooteboom, Fl. Males. I, 10 (1988) 607–619 (*Linaceae*); 629–634 (*Ctenolophonaceae*); R. Kool, Fl. Males. I, 10 (1988) 621–627 (*Ixonanthaceae*).

Spot-characters: *Ctenolophon* 25, 26, 104 – *Hugonia* 4, 34, 98 – *Indorouchera* 4, 22 – *Ixonanthes* 100, 102 – *Philbornea* 4.

Illustrations: Fig. 95 & 96.

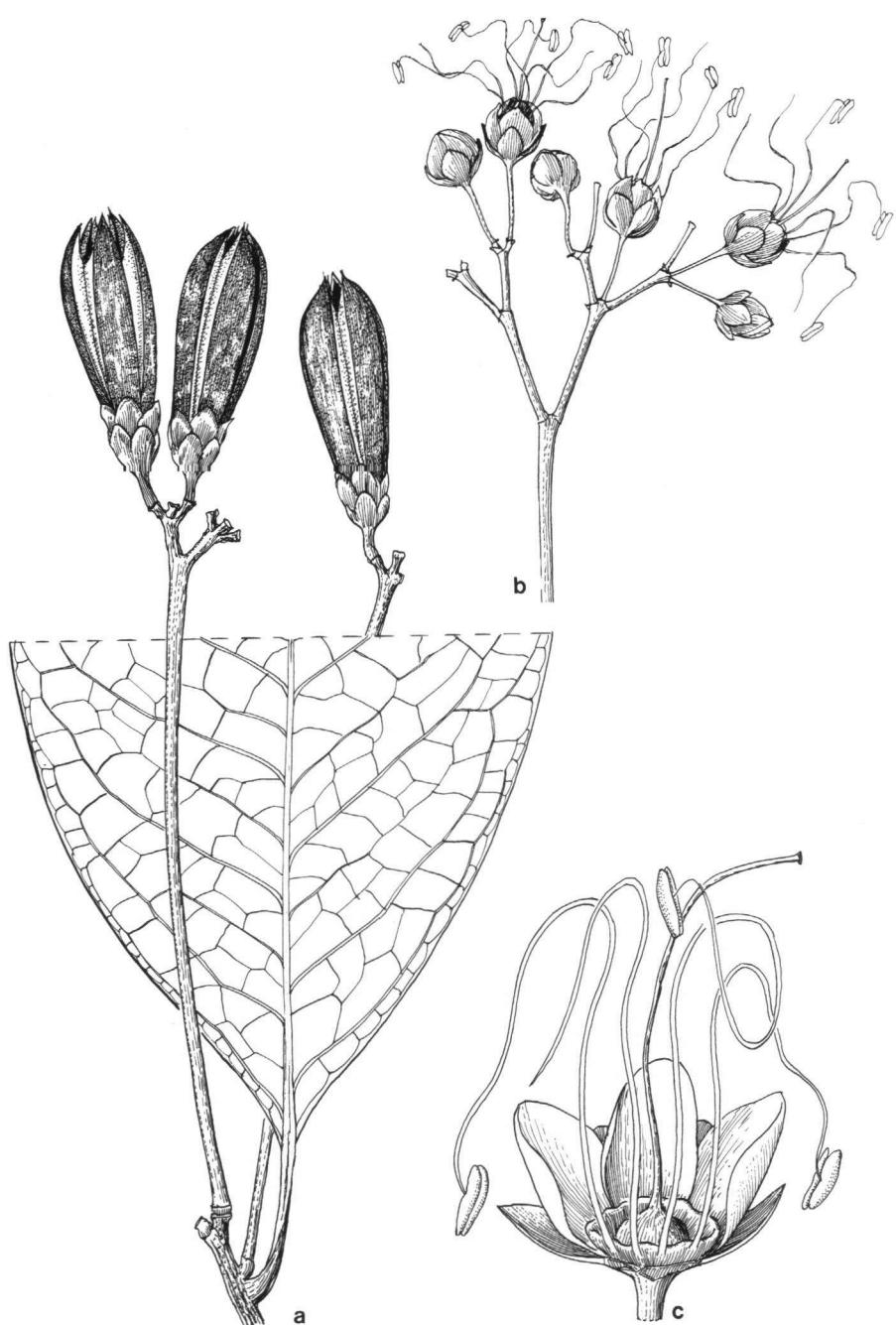


Fig. 96. *Ixonanthes reticulata* Jack: a. fruits; b & c. flowers.

**LOGANIACEAE (ANTONIACEAE, BUDDLEJACEAE, POTALIACEAE,
SPIGELIACEAE, STRYCHNACEAE)**

Always: Leaves decussate (incl. verticillate), simple; interpetiolar ridge sometimes resembling interpetiolar stipules; flowers actinomorphic, hermaphroditic, sympetalous; ovary superior.

Usually / often: Woody; leaves entire, flowers 5-merous.

Striking features: Climbers (*Gardneria*, some *Fagraea*, most *Strychnos*); plants with hooks and triplinerved leaves (*Strychnos*); excavations at base of petiole (*Fagraea*).

Different from: *Apocynaceae*: milky sap, swollen stigma. — *Rubiaceae*: interpetiolar stipules, ovary inferior, often raphides.

Distribution: The family pantropical, some species extending to the warm temperate zone. In Malesia 11 genera, incl.:

- *Fagraea* (Sri Lanka to Polynesia), lowland and montane rain forest;
- *Strychnos* (pantropical), lowland rain forest, also open vegetation.

Notes: The family is here treated in the traditional sense. Lately it has been divided into several families. — Medicinal plants: *Spigelia* (vermifuge). — Ornamentals: *Buddleja*, *Fagraea*. — Poison: *Gelsemium*, *Strychnos*.

Literature: P.W. Leenhouts, Fl. Males. I, 6 (1962) 293–387; I, 9 (1982) 567–568; K.M. Wong & J.B. Sugau, Tree Fl. Sabah & Sarawak 2 (1996) 189–224.

Spot-characters: *Buddleja* 25 – *Fagraea* 5, 6, 14, 19, 22, 32, 61; *F. crenulata* 12; *F. racemosa* 31 – *Gardneria* 5, 6, 92 – *Gelsemium* 5, 6, 90, 102 – *Geniostoma* 54 – *Mitrasacme* 46 – *Neuburgia* 32 – *Spigelia* 46 – *Strychnos* 4, 6, 54, 64, 94.

Illustrations: Fig. 97 & 98.



Fig. 97. *Fagraea fragrans* Roxb.: a. habit; b. corolla with stamens; c. pistil; d. petioles.



Fig. 98. *Stychnos colubrina* L.: a. twig with inflorescence and hooks; b–e. details of flower; f. fruits; g & h. seed.



Fig. 99. *Lagerstroemia ovalifolia* Teijsm. & Binn.

LYTHRACEAE

Always: Leaves opposite (incl. verticillate), entire, simple, exstipulate; flowers bisexual, ovary superior, 1–6-celled; fruit a capsule, seeds numerous.

Usually/often: Woody; flowers actinomorphic, hypanthium present, calyx cup-shaped, lobes valvate, petals clawed, free, crinkled.

Striking features: Herb, petals wanting (*Ammania*).

Different from: *Crypteroniaceae*: flowers unisexual. — *Melastomataceae* (*Meme-cylon*): ovary inferior. — *Myrtaceae*: leaves with translucent dots, ovary inferior. — *Sonneratiaceae*: ovary partly fused with calyx, 12–15-celled.

Distribution: Pantropical; in Malesia 5 indigenous genera, incl.:

- *Lagerstroemia* (Indo-Australia), trees and shrubs, lowland everwet and monsoon forest.
- *Pemphis* (paleotropics), trees and shrubs, littoral forest and mangrove.

Notes: The family is sometimes united with *Crypteroniaceae* and *Sonneratiaceae*. —

Ornamentals: *Cuphea**, *Lagerstroemia*, *Lawsonia**. — Timber: *Lagerstroemia*. — Dyes: *Lawsonia**.

Literature: B. Everett & T.C. Whitmore, Tree Fl. Mal. 2 (1983, repr.) 276–280.

Spot-characters: *Lythraceae* 58, 83, 92 – *Lagerstroemia* 25, 27, 69, 100, 102.

Illustration: Fig. 99.

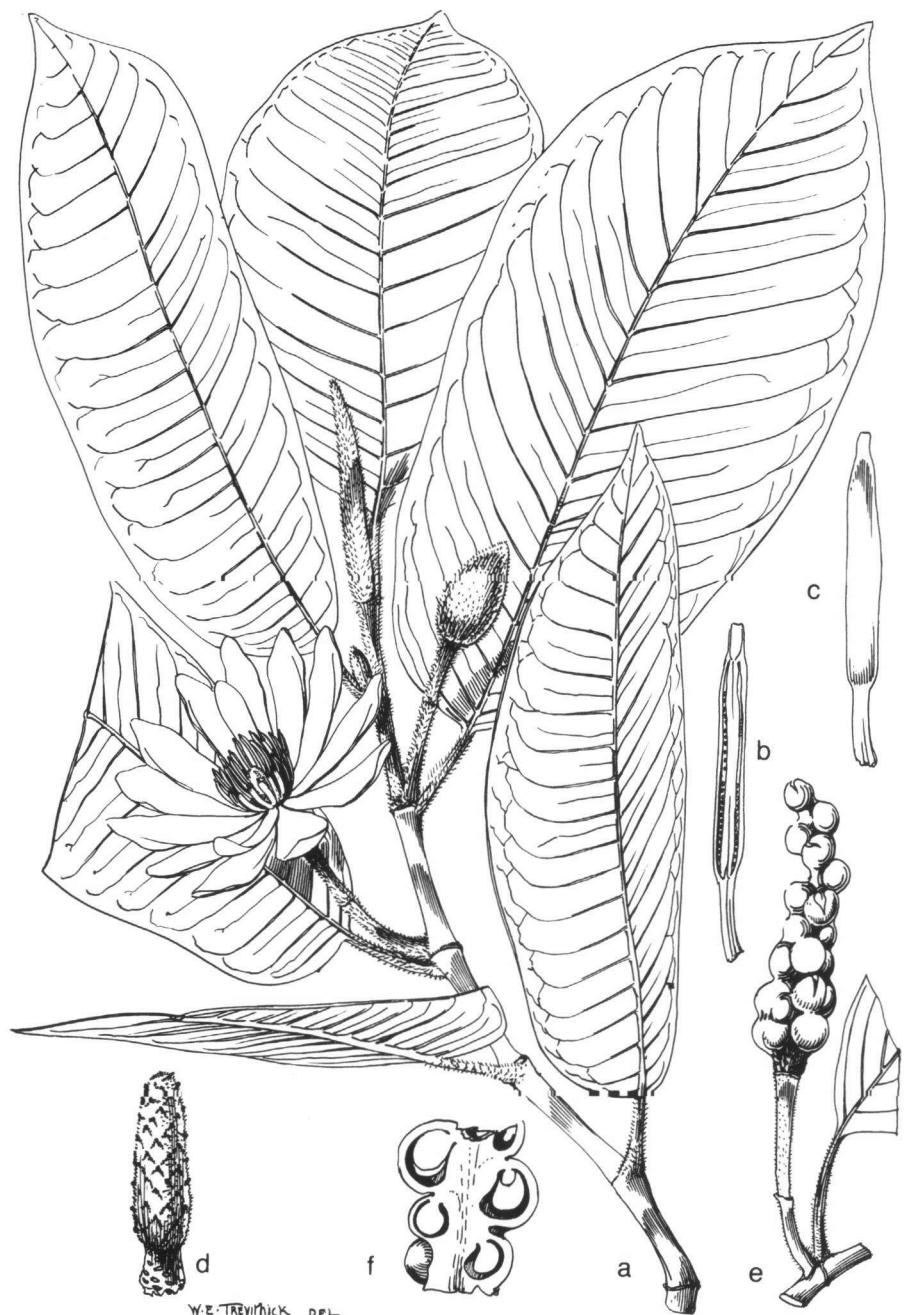


Fig. 100. *Elmerillia tsiampacca* (L.) Dandy: a. twig with flowers and stipule scars; b & c. stamens; d. ovary; e & f. fruit.

MAGNOLIACEAE

Always: Woody, non-climbing; leaves spiral, simple, entire, pinninerved; stipule amplexicaul, leaving ring-like scar; flowers solitary, hermaphroditic, tepals free, in several series, imbricate; with free stamens in basal part and free carpels in upper part.

Usually/often: Flowers terminal, large, aromatic; fruit more or less woody, dehiscent, ripe seeds dangling from thin threads (spirally thickened vessels of funicle).

Striking features: Stipules adnate to petiole (*Magnolia* sect. *Blumiana*).

Different from: *Annonaceae*: exstipulate, twigs on cross section with radial medullary rays. — *Himantandraceae*: no stipules, fruit a berry. — *Lauraceae*: exstipulate, flowers much smaller, never apocarpous. — *Winteraceae*: exstipulate, flowers unisexual.

Distribution: The family chiefly in northern hemisphere. In Malesia 5 genera, best represented in montane rain forest, incl.:

- *Elmerillia* (East Malesia);
- *Magnolia* (incl. *Aromadendron*, *Talauma*; Asia incl. Malesia, America);
- *Manglietia* (Southeast Asia, West Malesia);
- *Michelia* (Indo-Malesia);
- *Pachylarnax* (Southeast Asia, West Malesia).

Notes: Ornamental plants: *Magnolia** p.p., *Michelia*. — Timber trees: *Elmerillia*, *Manglietia*, *Michelia*.

Literature: H.P. Nooteboom, Fl. Males. I, 10 (1988) 561–605.

Spot-characters: *Magnoliaceae* 30, 37, 58, 72, 79, 104 – *Elmerillia* 33 – *Magnolia* 33, 43, 53, 85 – *Manglietia* 33 – *Michelia* 33, 43 – *Pachylarnax* 33.

Illustrations: Fig. 100 & 101.

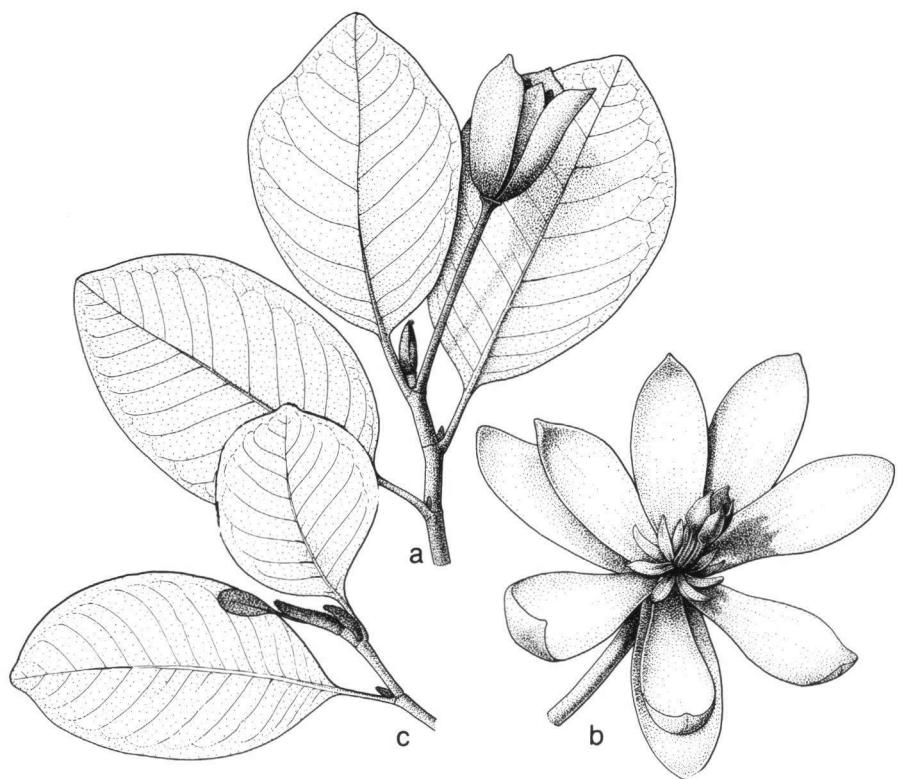


Fig. 101. *Magnolia carsonii* Dandy ex Noot. var. *drymifolia* Noot.: a & b. habit; b. flower.

MALVACEAE

Always: Non-climbing; leaves spiral, simple, no domatia, stipulate; flowers 5-merous, actinomorphic, hermaphroditic; sepals connate, petals free, stamens numerous, filaments fused in a tube, and this fused to base of petals; ovary superior.

Usually/often: Shrubs, bark fibrous; leaves entire (but often lobed), palmnerved, stellate hairs; epicalyx, petals contort, fruit a capsule.

Striking features: Gland on midrib below (*Hibiscus*); fruit spiny (*Urena*).

Different from: *Bombacaceae*: leaves pinninerved, no epicalyx. — *Sterculiaceae*, *Tiliaceae*: leaves often with domatia, gynandrophore usually present, stamens usually fewer and not fused to corolla.

Distribution: World-wide, best represented in the tropics. In Malesia 7 native genera, incl.:

- *Abutilon* (pantropical), herbs and shrubs, open places;
- *Hibiscus* (pantropical), shrubs and trees, lowland, mostly open places;
- *Sida* (pantropical), herbs or shrubs, often weedy.

Notes: Several genera represented by introduced, naturalized species. Several species useful to man. — Ornamentals: *Hibiscus*, *Malvaviscus*, *Pavonia**, *Thespesia*. — Medicinal use: *Sida*. — Edible plants: *Abelmoschus*, *Hibiscus*. — Binding and clothing: *Hibiscus*, *Gossypium**.

Literature: J. van Borssum Waalkes, Malesian Malvaceae revised, Blumea 14 (1966) 1–213.

Spot-characters: *Malvaceae* 25, 58, 84 — *Hibiscus* 26, 31, 37, 38 — *Sida* 38, 95 — *Thespesia* 19, 26, 38 — *Urena* 95.

Illustrations: Fig. 102 & 103.

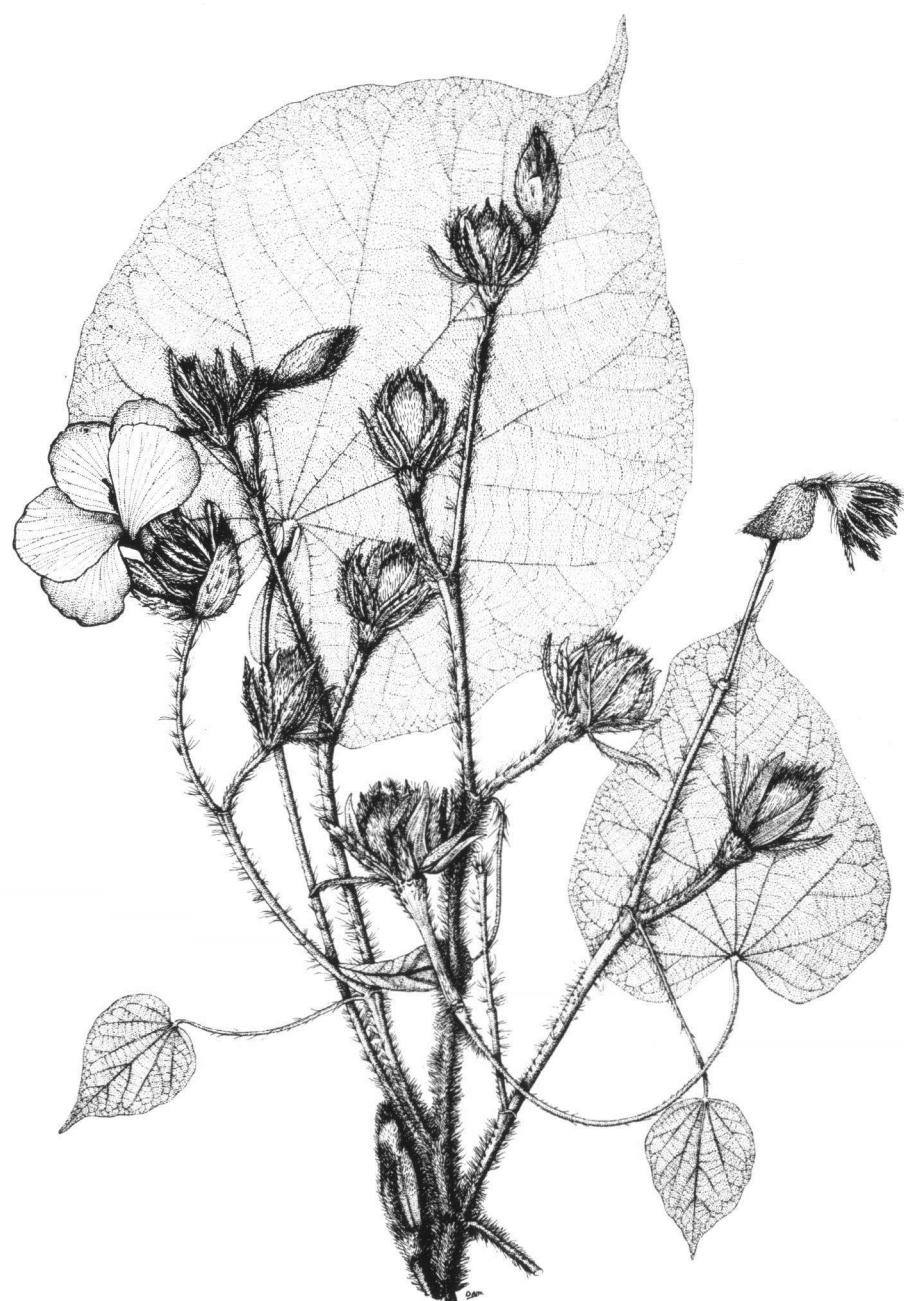


Fig. 102. *Hibiscus macrophyllus* Roxb. ex Hornem.



Fig. 103. *Urena lobata* L.

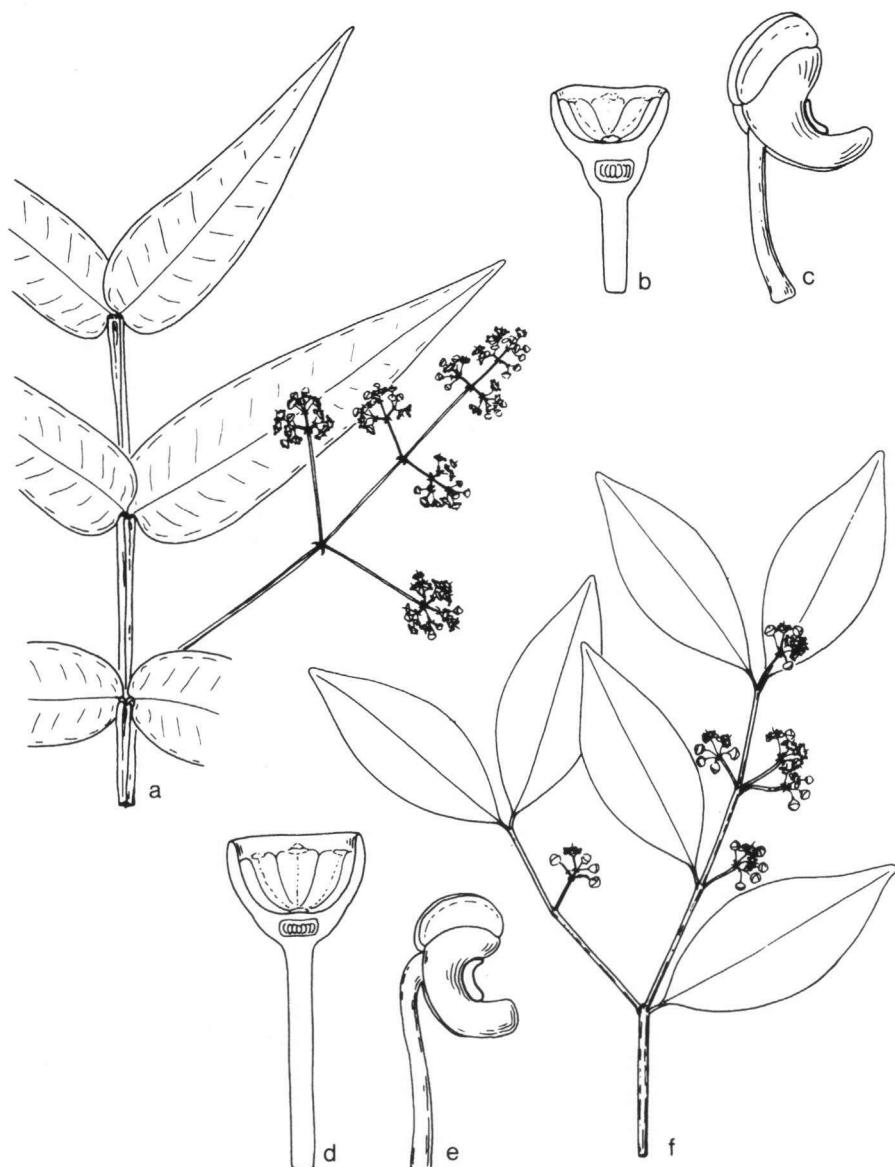


Fig. 104. *Memecylon laruei* Merr.: a. habit; b. LS of pistil; c. stamen. — *M. monchyanum* Backer:
a. habit; b. LS of pistil; c. stamen. (Courtesy Gardens' Bulletin, Singapore).

MELASTOMATACEAE (incl. MEMECYLACEAE)

Always: Leaves decussate (incl. verticillate), simple, exstipulate; flowers choripetalous; connective variously prolonged or appendaged; ovary (half) inferior.

Usually / often: Woody; leaves triplinerved; flowers hermaphroditic, petals showy; anthers opening by apical pores; ovary 4- or 5-celled with numerous axile ovules.

Striking features: Herbs with 3-merous flowers (*Sonerila*); epiphyte, with auricled leaves (*Pogonanthera*); pseudostipules (*Dalenia*, *Dissochaeta*; *Medinilla*, rare); epiphyte with urn-shaped fruits (*Pachycentria*); fruit 1-locular, 1- or 2-seeded, top with star-shaped ridges, leaves usually pinninerved, venation often indistinct (*Memecylon*).

Different from: *Myrtaceae*: leaves with pellucid dots, stamens numerous. — *Cyperoniaceae*: twigs thickened at the nodes, petals usually minute or absent, anthers without appendages.

Distribution: The family pantropical. In Malesia 36 genera, incl.:

- *Astronia* (Malesia, Pacific), trees; lowland and montane rain forest;
- *Medinilla* (paleotropics), climbers, epiphytes, shrubs, lowland and montane rain forest;
- *Melastoma* (Indo-Malesia), shrubs, most common in disturbed habitats;
- *Memecylon* (paleotropics), shrubs, treelets, lowland and mid-montane rain forest;
- *Pternandra* (Malesia), treelets, undergrowth of lowland rain forest;
- *Sonerila* (Indo-Malesia), herbs, forest floor.

Notes: Members of the family often very common in forest undergrowth, many species epiphytic or climbing. — Pollination often by bees; fruits of some species eaten by birds. — Ornamentals (potential): *Medinilla*, *Melastoma*, *Phyllagathis*, *Sonerila*, *Tibouchina**. — Edible fruit: *Bellucia**. — *Memecylon* is sometimes placed in a separate family.

Literature: R.C. Bakhuizen van den Brink, A contribution to the knowledge of the Melastomataceae occurring in the Malay archipelago, Rec. Trav. Bot. Nérnl. 40 (1945) 1–391; J.F. Maxwell, Tree Fl. Mal. 4 (1989) 179–198. — Dr. S. Renner (University St. Louis, USA) is coordinating the revision of the family for Flora Malesiana.

Spot-characters: *Melastomataceae* 58, 64, 68, 83, 86, 92 — *Anerincleistus* 47 — *Astronia* 25, 26, 59, 63 — *Astronium* 63 — *Bellucia* 70 — *Blastus* 31, 47 — *Catanthera* 5, 6, 25, 44 — *Clidemia* 93 — *Creochiton* 5, 6, 25 — *Cyanandrium* 95 — *Dalenia* 5, 32 — *Diplectria* 5, 6, 32 — *Dissochaeta* 5, 6, 16, 25, 26, 32 — *Driesenia* 47 — *Hederella* 44 — *Macrolenes* 5, 6, 16, 25, 31, 85, 95 — *Medinilla* 2, 5, 6, 15, 25, 32, 44, 46, 47 — *Melastoma* 27, 44, 63; *M. beccarianum* 95 — *Memecylon* 15, 55, 59, 61, 65, 93 — *Neodissochaeta* 5, 6 — *Neodriesenia* 31, 47 — *Oxyspora* 52 — *Pachycentria* 2, 9 — *Phyllagathis* 47 — *Pogonanthera* 2 — *Poikilogyne* 15, 47; *P. villosa* 52 — *Pternandra* 15, 16, 95 — *Sonerila* 44, 47, 79.

Illustrations: Fig. 104 & 105.

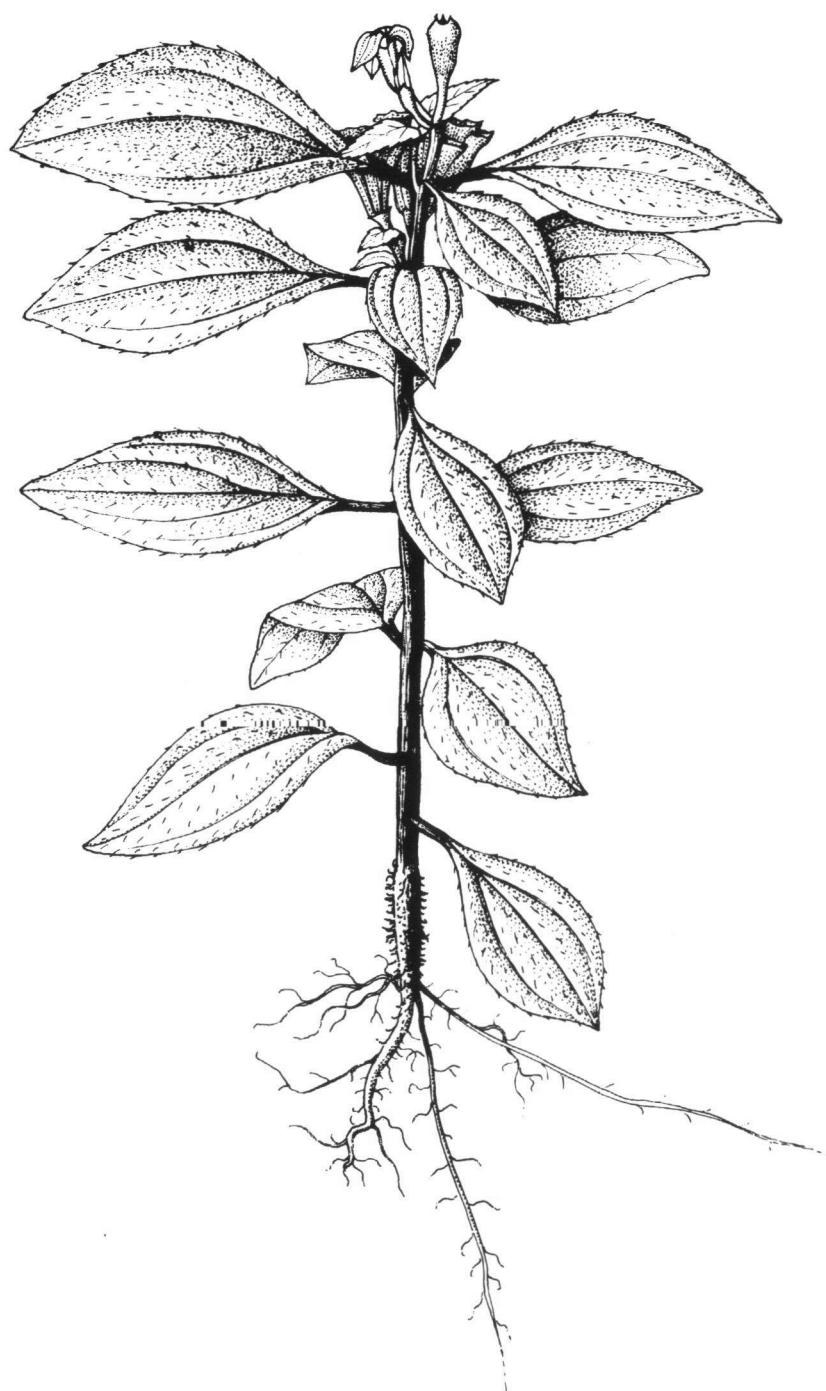


Fig. 105. *Sonerila biflora* Zoll. & Moritzi.

MELIACEAE

Always: Woody, non-climbing; exstipulate, flowers choripetalous; ovary superior.

Usually / often: Trees; leaves spiral, compound; flowers hermaphroditic; filaments forming a tube (nearly free in *Cipadessa*, *Toona*, *Walsura*); stigma broad; placentation axile; seed arillate.

Striking features: Subshrubs (*Munronia*, some *Turraea*); leaves simple or unifoliate (*Vavaea*, sometimes in *Aglaiia*, *Turraea* and *Walsura*); leaves bipinnate (*Melia*); leaves 3-foliolate (*Sandoricum*, sometimes in *Aglaiia* and *Walsura*); leaf-tip continuing growth in adult leaf (*Chisocheton*); brown scales or stellate hairs (*Aglaiia*); milky sap (*Aglaiia*, *Aphanamyxis*, *Chisocheton* (rare), *Lansium*); flowers on the rachis (epiphyllous) (*Chisocheton*, rare); long spicate inflorescence (*Aphanamyxis*).

Different from: *Anacardiaceae*: sap turning black, stamens free. — *Burseraceae*: sap resinous, flowers mostly unisexual, often 3-merous. — *Rutaceae*: leaves with pellucid dots, stamens free. — *Sapindaceae*: leaves often with free rachis tip, flowers often unisexual, stamens free.

Distribution: Family widespread in tropics and subtropics. In Malesia 20 genera, incl.:

- *Aglaiia* (Indo-Australia), trees, common in lowland rain forest;
- *Chisocheton* (Indo-Malesia), trees, mostly lowland rain forest;
- *Dysoxylum* (Indo-Australia), trees, mostly lowland rain forest;
- *Xylocarpus* (paleotropics), trees of mangrove forest.

Notes: Members of the family form an important component of the lowland and mid-montane rain forest, some occur in monsoon forest. — The fruits of many species are eaten by various animals; the seeds of *Xylocarpus* are buoyant. — Several species are useful for man; edible fruits: *Lansium*, *Sandoricum*; ornamentals: *Aglaiia*, *Azadirachta*, *Melia*; timber: *Dysoxylum*, *Swietenia**, *Toona*; seeds of *Swietenia macrophyllum* used medicinally.

Literature: T.D. Pennington & B.T. Styles, A generic monograph of the Meliaceae, Blumea 22 (1975) 419–540; D.J. Mabberley & C.M. Pannell, Tree Fl. Mal. 4 (1989) 199–260; D.J. Mabberley, C.M. Pannell & A.M. Sing, Fl. Males. I, 12 (1995) 1–407.

Spot-characters: *Meliaceae* 10, 25, 58, 84, 104 – *Aglaiia* 19, 25, 26, 38, 59, 70, 78, 88 – *Aphanamyxis* 19, 25, 38, 78, 88; *A. polystachya* 60 – *Chisocheton* 18, 19, 25, 41, 70, 74, 78; *C. myrmecophilus* 9 – *Chukrasia* 41 – *Dysoxylum* 21, 24, 31, 40, 41, 45, 49, 70; *D. caulostachyum* 99 – *Heynea* 25, 31, 42, 59 – *Lansium* 19, 70 – *Melia* 50 – *Munronia* 28, 85 – *Pseudoclausena* 88 – *Reinwardtiodendron* 88; *R. humile* 67 – *Sandoricum* 48 – *Swietenia* 102 – *Toona* 24, 78, 102; *T. sureni* 21 – *Vavaea* 14 – *Walsura* 31, 42, 48, 59, 88; *W. monophylla* 38 – *Xylocarpus* 94.

Illustrations: Fig. 106 & 107.



Fig. 106. *Chisocheton lasiocarpus* (Miq.) Valeton.

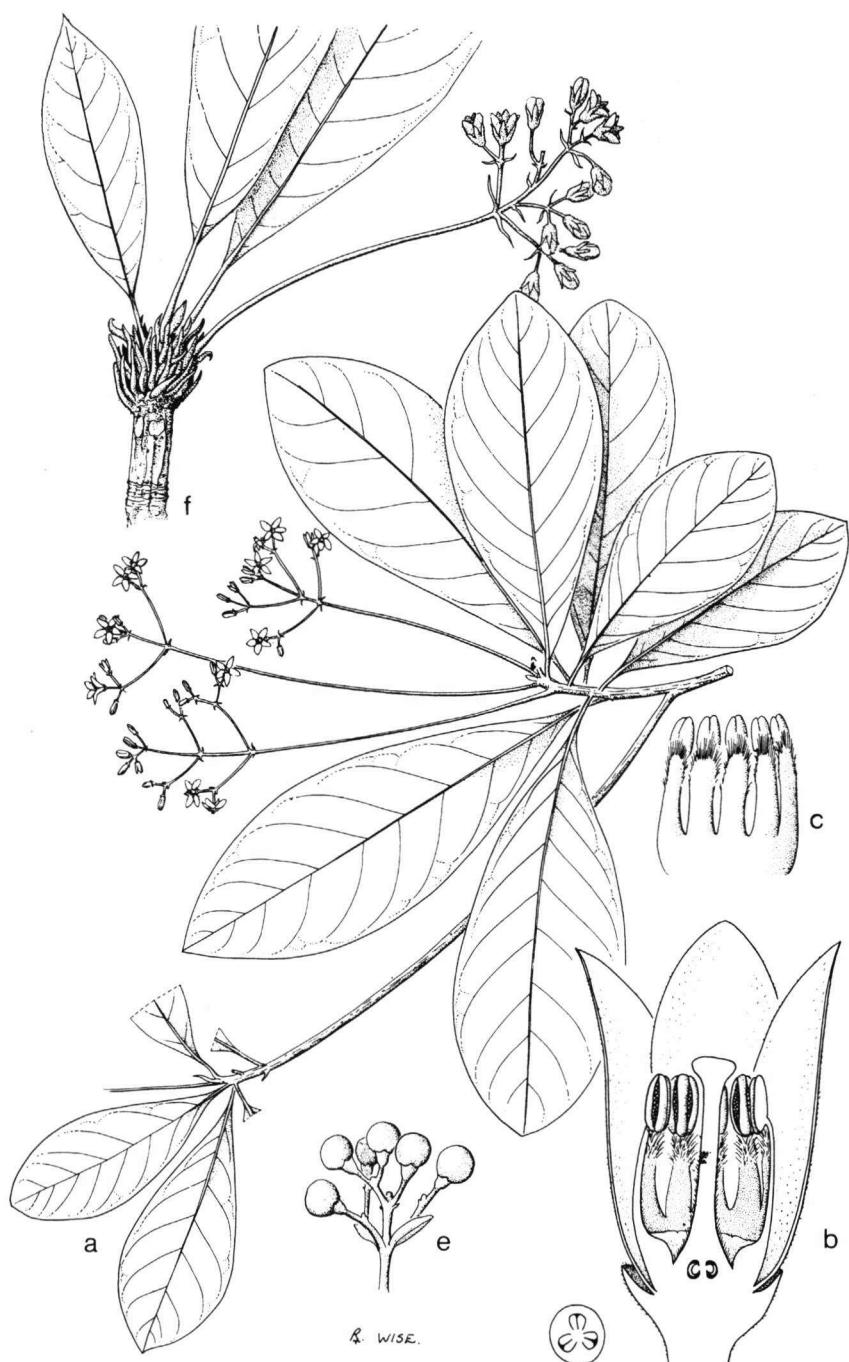


Fig. 107. *Vavaea amicorum* Benth.: a & f. habit; b. LS of flower; c. staminal tube; d. CS of fruit; e. fruits.

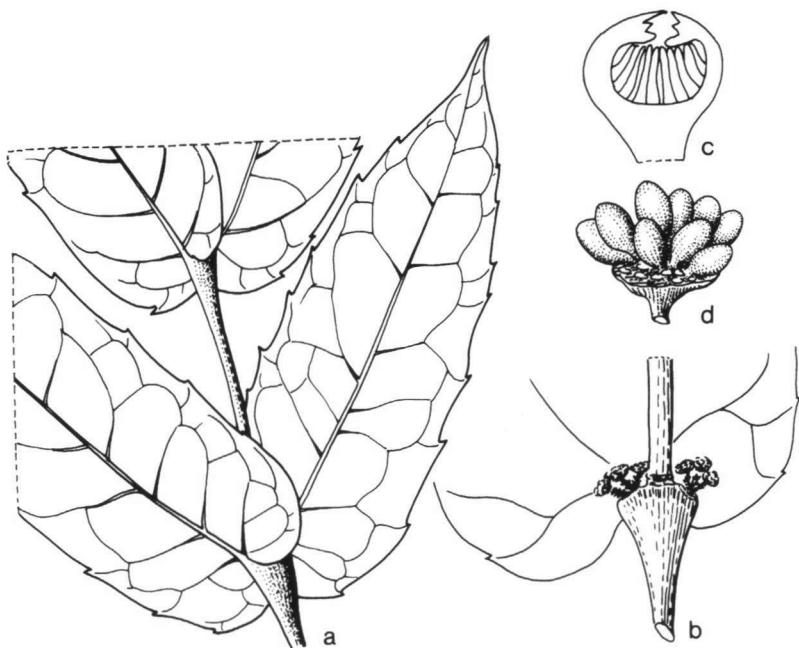


Fig. 108. *Kibara ferox* Philipson: a. leaf from middle branch; b. axillary fascicles of female flowers after anthesis; c. female flower; d. idem in LS.



Fig. 109. *Palmeria womersleyi* Philipson: a. habit of male twig; b. LS of female flower; c. opened receptacle..

MONIMIACEAE (ATHEROSPERMACEAE)

Always: Woody; leaves simple, (sub)opposite, pinninerved, with fine pellucid dots; flowers tepaloid (no distinction between sepals and petals), carpels 1-locular, with one ovule.

Usually/often: Non-climbing; leaves coarsely dentate, secondary veins strongly arching; flowers actinomorphic, unisexual; hypanthium cup-shaped with free stamens or carpels; fruit apocarpous, enclosed by irregularly dehiscent hypanthium.

Striking features: Climber, stellate hairs (*Palmeria*); anthers opening by valves (*Dryadodaphne*).

Different from: *Lauraceae*: leaves entire, rarely opposite, anthers always opening by valves; never apocarpous. — *Annonaceae*: leaves entire, never opposite, medullary rays dilating.

Distribution: The family widespread in the southern hemisphere. In Malesia (best represented in the eastern part) 11 genera, incl.:

- *Kibara* (Indo-Australia), shrubs, small trees, lowland and montane forest;
- *Matthaea* (Malesia), shrubs, mostly lowland forest;
- *Palmeria* (Australia, East Malesia), climbers, mostly montane forest;
- *Steganthera* (Queensland, East Malesia), trees or shrubs, lowland and montane forest.

Notes: *Sphenostemon* and *Trimenia* have been excluded from the *Monimiaceae* and are placed in their own families, *Sphenostemonaceae* and *Trimeniaceae*, respectively.

Literature: W.R. Philipson, Fl. Males. I, 10 (1986) 255–326.

Spot-characters: *Monimiaceae* 59 – *Dryadodaphne* 87 – *Kibara* 9, 46, 47, 96 – *Leviera* 6, 85 – *Palmeria* 5, 6, 25, 64 – *Steganthera* 9, 70.

Illustrations: Fig. 108 & 109.

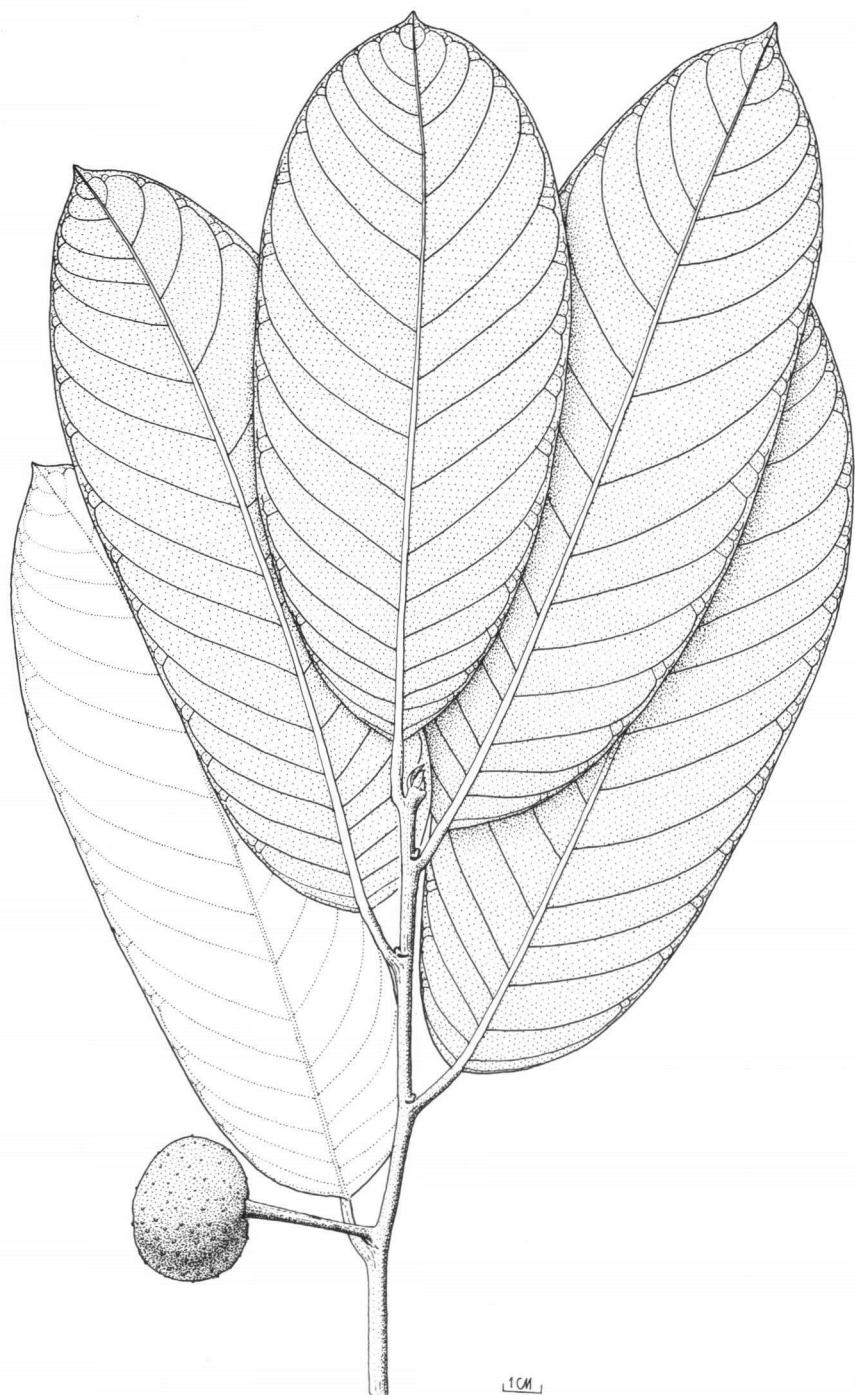


Fig. 110. *Artocarpus dadah* Miq., twig with female inflorescence (Courtesy Dr. P. J. A. Keßler).

MORACEAE

Always: Leaves stipulate; flowers unisexual (plants monoecious or dioecious); ovary superior, 1-locular, 1 pendent ovule; fleshy (spurious) fruit (fruit proper an achene or drupelet).

Usually / often: Woody; leaves spiral, simple, entire, nearly always milky sap; inflorescences condensed into a compact structure in pairs and with a basal bud or single with a basal bud.

Striking features: Herbs (*Fatoua*); climbers or (hemi)epiphytes (*Ficus* p.p., *Maclura*, *Malaisia*); leaves triplinerved at base, stipule cigar-shaped, amplexicaul (*Ficus*); thorny (*Maclura*, some *Streblus*); compound leaves (*Artocarpus*, rare); inflorescence a fig (*Ficus*).

Different from: *Urticaceae*: no milky sap, ovule basal.

Distribution: The family world-wide, majority of the species in the tropics. In Malesia 14 genera, incl.:

- *Artocarpus* (Indo-Malesia), trees; lowland rain forest;
- *Ficus* (world-wide, tropics and subtropics), shrubs, epiphytes, climbers, trees; lowland and montane rain forest, also secondary forest;
- *Streblus* (Old World from Madagascar to Polynesia), shrubs or trees; lowland and montane rain forest, monsoon forest.

Notes: Members of the *Moraceae* are prominent in most vegetation types, especially in lowland rain forest. — The fruits of many species are eaten by various animals; pollination of *Ficus* by fig wasps (see Corner 1988), *Artocarpus* by *Diptera* (flies). — Many useful plants for man: edible fruit: *Artocarpus*, *Ficus*, *Morus*; ornamentals: *Ficus*; timber: *Artocarpus*; poison: *Antiaris*; bark cloth, binding material: *Artocarpus*, *Broussonetia**.

Literature: F.M. Jarrett, studies in *Artocarpus* and allied genera, J. Arnold Arbor. 40 (1959) 113–155; 298–326; 41 (1960) 320–334; E.J.H. Corner, The classification of Moraceae, Gard. Bull. Sing. 19 (1962) 187–252; Wayside Trees of Malaya ed. 3 (1988) 509–558; K.M. Kochummen, Tree Fl. Mal. 3 (1978) 119–168. — Prof. C.C. Berg (Bergen, Norway) is revising the family for Flora Malesiana.

Spot-characters: *Moraceae* 19, 57, 58, 63, 76, 89, 92 – *Antiaris* 96 – *Antiaropsis* 96 – *Artocarpus* 33, 37, 53, 62, 70, 75?, 95, 96 – *Broussonetia* 62, 96 – *Fatoua* 64 – *Ficus* 5, 6, 9, 19, 29, 31, 32, 33, 36, 37, 38, 52, 53, 59, 62, 64, 70, 75, 78, 91, 96; *F. dens-echini* 12, *F. diversifolia* 55 – *Hulletia* 62, 96 – *Maclura* 4, 12, 96 – *Malaisia* 5, 79, 96 – *Morus* 59, 96 – *Parartocarpus* 95, 96 – *Prainea* 96 – *Streblus* 12, 38, 91, 96.

Illustrations: Fig. 110 & 111.

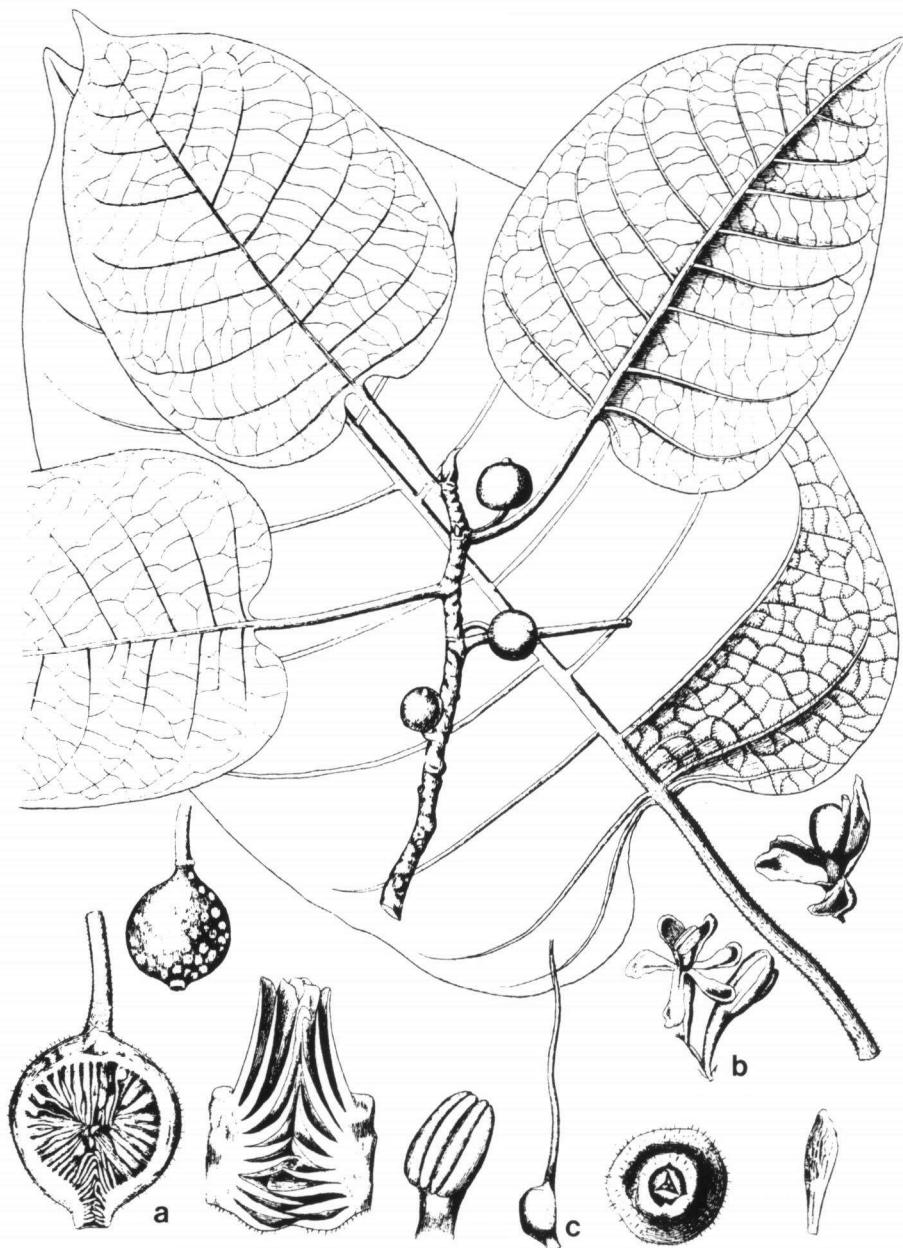


Fig. 111. *Ficus albipila* (Miq.) King: a. LS of fig; b. staminate flower; c. pistillate flower.

MORINGACEAE

Always: Treelets; leaves spiral, 2–4-pinnate, rachis thickened at nodes, exstipulate; flowers bisexual, zygomorphic, 5-merous; petals free, 5 oppositipetalous stamens, 5 staminodes; ovary superior, 1-celled, ovules many on three parietal placentas; fruit a linear capsule.

Usually/often: Deciduous, seeds 3-winged.

Different from: *Bignoniaceae*: leaves opposite, flowers sympetalous. — *Capparaceae*: leaves not pinnate. — *Leguminosae*: stipulate, one placenta.

Distribution: The natural range of the family is from Madagascar to NE Africa and India; in Malesia *Moringa oleifera* is only known in cultivation.

Notes: The young leaves and pods are eaten as a vegetable; roots and bark are used medicinally. — Fruits and seeds are used for water purification.

Literature: C.G.G.J. van Steenis , Fl. Males. I, 4 (1949) 45–46.

Spot-characters: 31, 42, 50, 97, 102.

Illustration: Fig 112.

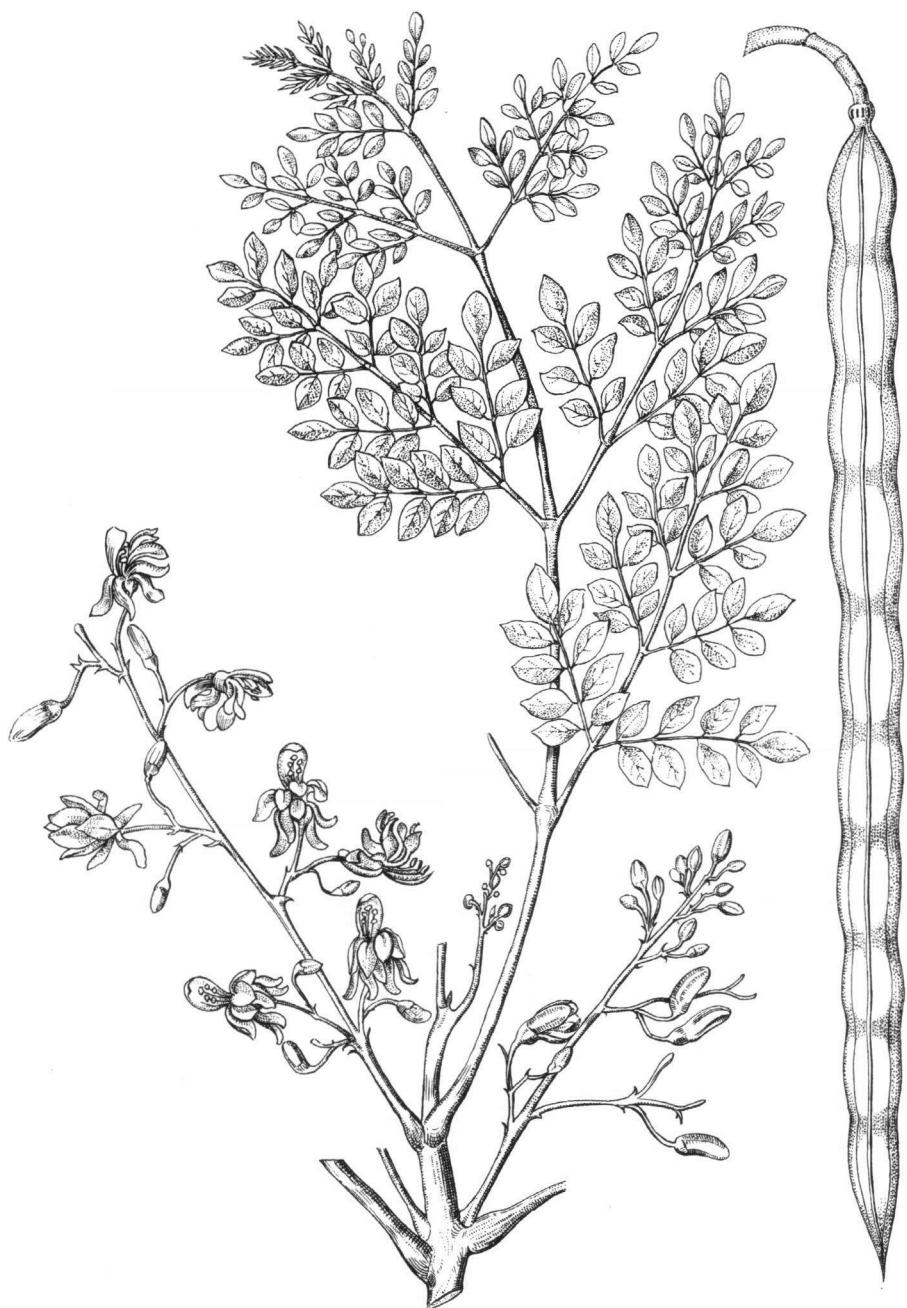


Fig. 112. *Moringa oleifera* Lam., flowering branch and fruit.

MYRICACEAE

Always: Woody; leaves spiral, simple, dentate, pinninerved; flowers unisexual; sepals and petals absent; ovary superior, 1-locular, 1 basal ovule, stigmas 2, papillate; fruit a tuberculate drupe.

Usually/often: Plants aromatic, gland dotted, exstipulate, stamens 2–4.

Different from: *Aquifoliaceae (Ilex)*: sepals and petals present; ovary 3- or more-locular, stigma sessile.

Distribution: The family is mainly confined to the northern hemisphere. *Myrica* extends to Malesia as far east as New Guinea. An endemic genus is known from New Caledonia.

Notes: *Myrica rubra* of Southeast Asia is cultivated for its edible fruits. — In Malesia 2 species have been accepted so far but more may have to be recognised when more adequate material will be available.

Literature: C.A. Backer, Fl. Males. I, 4 (1951) 276–279.

Spot-characters: 26, 52, 95.

Illustration: Fig. 113.

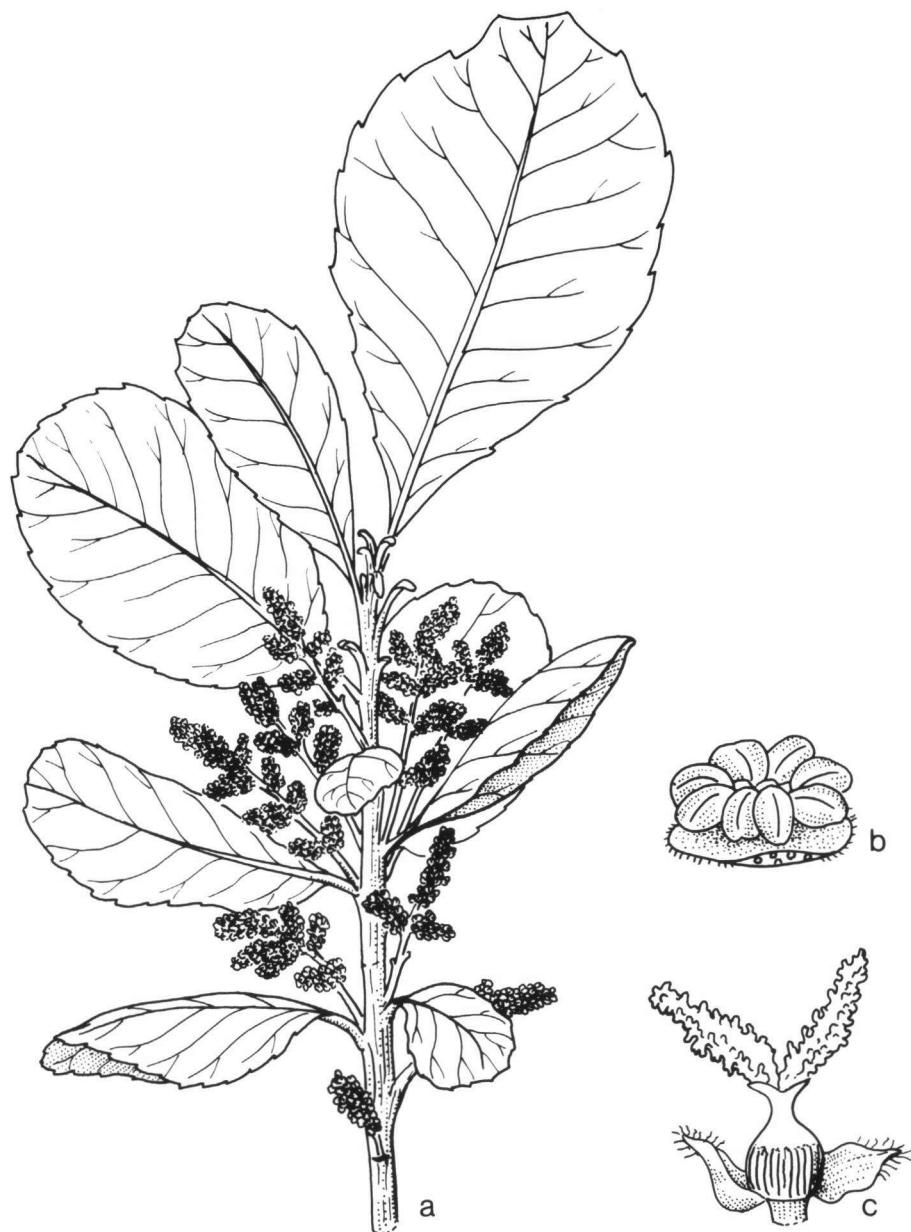


Fig. 113. *Myrica javanica* Blume: a. flowering twig; b. staminate flower; c. pistillate flower.

MYRISTICACEAE

Always: Woody, non-climbing; red sap from cuts (sometimes not very obvious); leaves alternate (mostly distichous), simple, entire, penninerved, exstipulate; flowers unisexual; tepals valvate, connate at base; filaments joined into a column; ovary superior, 1-locular, 1 more or less parietal ovule; seed covered with red aril, endosperm ruminate.

Usually / often: Leaves in herbarium very brittle (except *Gymnanthera*, *Knema*), apical bud slightly curved; inflorescence condensed (fascicled or umbellate on short peduncle), flowers 3-merous, fruit dehiscing with two valves.

Striking features: Inflorescence a many flowered panicle (*Horsfieldia*, *Endocomia*); aril entire, leaves glaucous below (*Knema*); aril irregularly dissected (*Myristica*, *Gymnanthera*).

Different from: *Annonaceae*: no red sap, apocarpous, filaments free, tepals usually imbricate; stellate medullary rays. — *Ebenaceae*: no red sap, ovary 3- or more-locular, calyx accrescent.

Distribution: The family pantropical; in Malesia 6 genera:

- *Endocomia* (Indo-Malesia);
- *Gymnanthera* (Indo-Malesia);
- *Horsfieldia* (Indo-Australia);
- *Knema* (Indo-Malesia);
- *Myristica* (Indo-Australia), mostly common trees of the lowland everwet rain forest;
- *Paramyristica* (Papua New Guinea).

Notes: The arillate seeds are eaten, especially by birds. — Spices: *Myristica*. — Some species used as timber.

Literature: J. Sinclair, Gard. Bull. Sing. 16 (1958) 205–466. — Dr. W. J. J. O. de Wilde (L) finished revising the family for Flora Malesiana.

Spot-characters: *Myristicaceae* 79, 99, 104, 105 — *Endocomia* 21 — *Gymnanthera* 21 — *Horsfieldia* 21, 31, 61; *H. grandis* 62 — *Knema* 21, 27, 30, 71 — *Myristica* 21, 26, 27, 30, 59, 71; *M. myrmecophila*, *M. subalulata* 9 — *Paramyristica* 30.

Illustrations: Fig. 114 & 115.

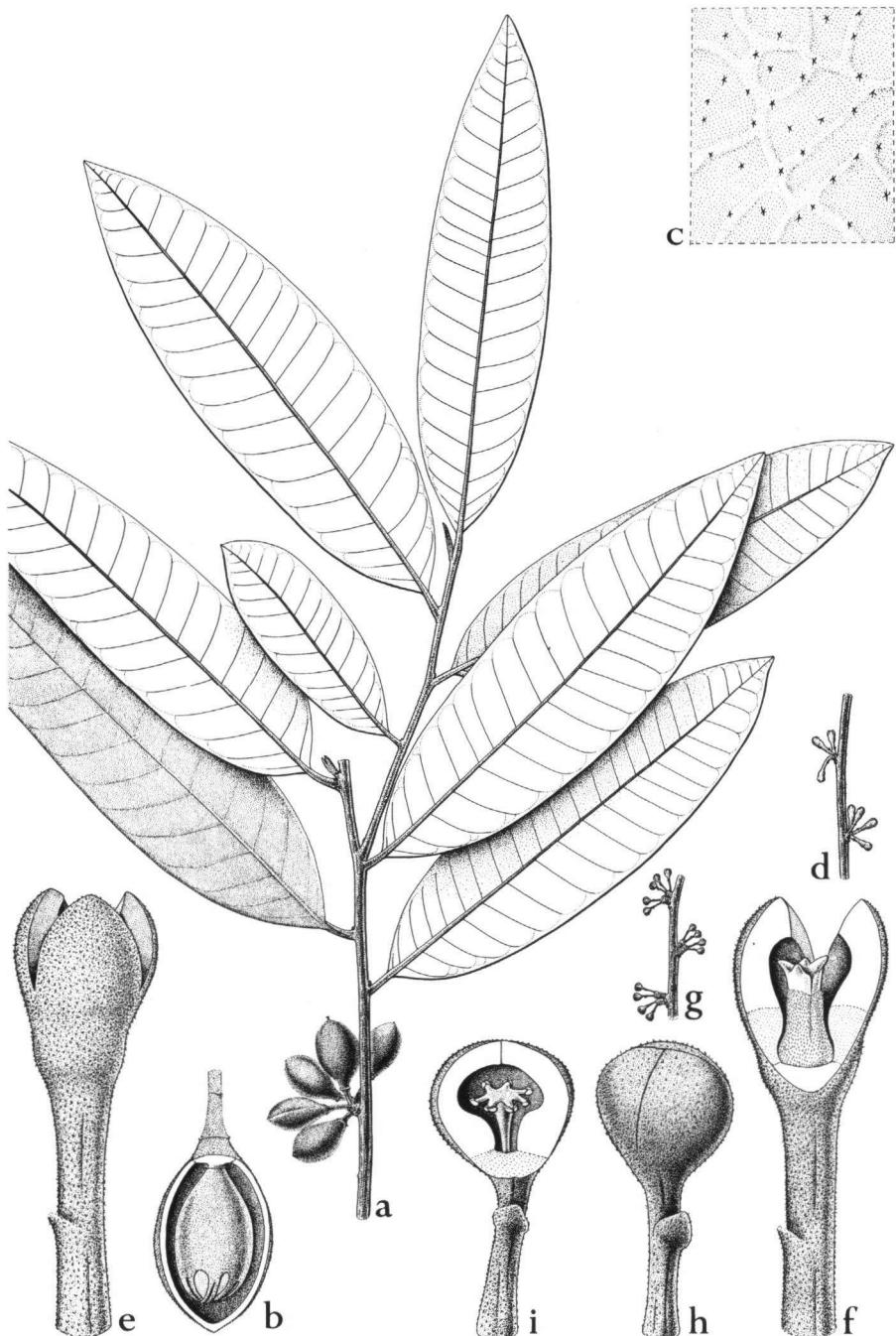


Fig. 114. *Knema mogeana* W.J. de Wilde: a. habit; b. fruit in LS; c. underside of leaf; d. female inflorescence; e & f. female flower; g. male inflorescence; h & i. male flower.

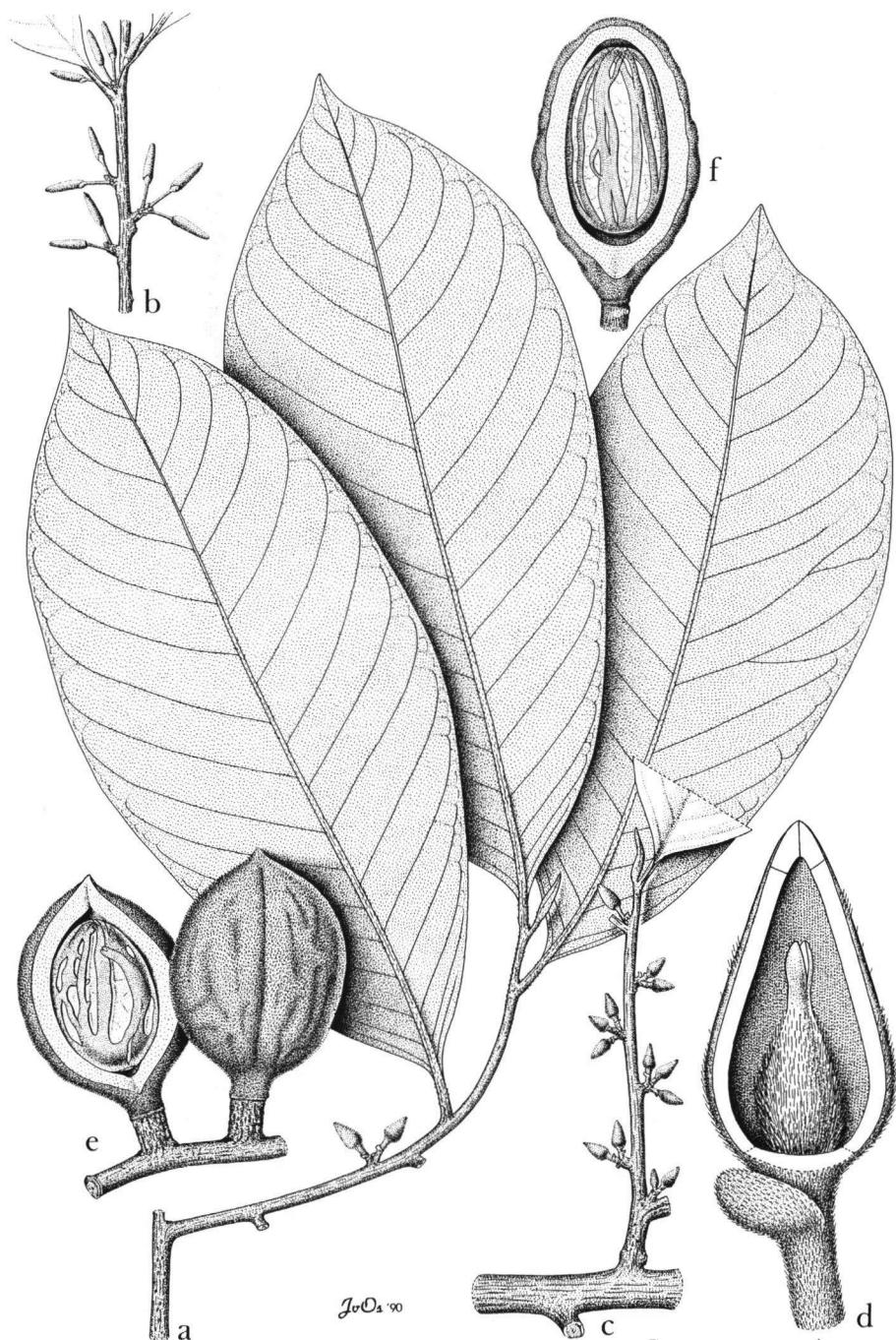


Fig. 115. *Myristica pubicarpa* W.J. de Wilde: a. habit; b. male inflorescences; c. female inflorescences; d. female flower; e. fruit; f. fruit of *M. succedanea* Blume.



Fig. 116. *Ardisia elliptica* Thunb.: a. habit; b. flower; c. fruits.

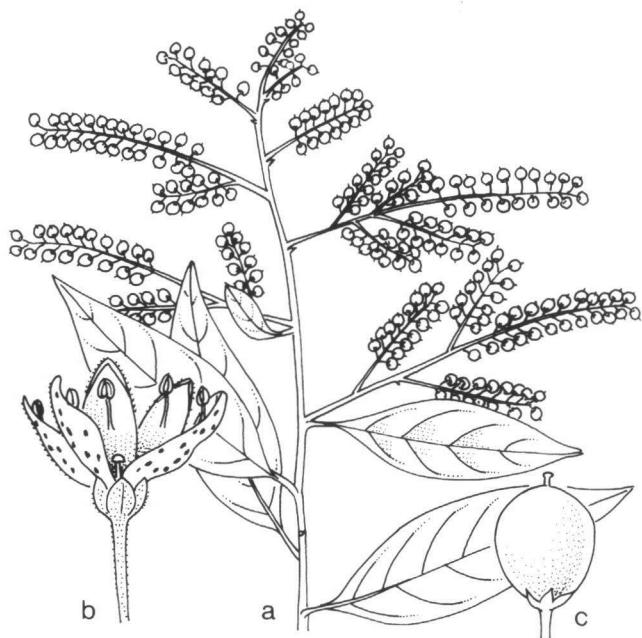


Fig. 117. *Embelia ribes* Burm. f.: a. habit; b. flower; c. fruits.

MYRSINACEAE

Always: Leaves spiral or alternate, simple, pinninerved, exstipulate; petals connate at base, contorted, stamens oppositipetalous; ovary 1-locular.

Usually/often: Woody, innovations rusty-red; leaves with coloured (often red or blackish) dots; flowers 5-merous, hermaphroditic, calyx persistent, often with whitish margin; ovary superior, several ovules on a basal placenta.

Striking features: Leaves without dots, ovary (half) inferior (*Maesa*); climbers (*Embelia*, and *Grenacheria*); plagiotropic branches swollen at base, leaving large scars when shed (*Ardisia*); flowers unisexual in axillary clusters (*Rapanea* [*Myrsine*]); flowers unisexual, little branched plants with large leaves (*Tapeinosperma*); viviparous shrubs of the mangrove (*Aegiceras*); herbs (*Labisia*, some *Ardisia*).

Different from: *Myristicaceae*: red sap, seed arillate. — *Plumbaginaceae*: no dots, ovary with one ovule. — *Ochnaceae*: no dots, stipulate.

Distribution: The family widespread in tropical and warm temperate regions. In Malesia 12 genera, found in a variety of habitats, incl.:

- *Ardisia* (Asia and America), herbs, shrubs, treelets, mostly lowland rain forest;
- *Embelia* (paleotropics), climbers, especially montane rain forest;
- *Maesa* (paleotropics), shrubs and scramblers, lowland and montane, primary and secondary rain forest;
- *Rapanea* (tropics and warm temperate parts of the world), shrubs, treelets, mostly of montane rain forest.

Notes: The family is well represented in the forest undergrowth. — Edible leaves: *Embelia*. — Ornamentals (potential): *Ardisia*, *Conandrium*, *Labisia*.

Literature: C. Mez, Myrsinaceae in Engler, Pflanzenreich 9 (1901); H. Sleumer, Blumea 31 (1986) 245–269; 32 (1987) 39–65, 385–396; 33 (1988) 81–140; B.C. Stone, Tree Fl. Mal. 4 (1989) 264–284. — Prof. C.M. Hu (JPSC) is revising the family for Flora Malesiana.

Spot-characters: *Myrsinaceae* 59, 83, 84, 86 (not *Maesa*) — *Ardisia* 15, 20, 26, 46, 80 — *Discocalyx* 46, 105 — *Embelia* 5, 12, 15, 77 — *Fittingia* 95 — *Loheria* 105 — *Maesa* 5, 19, 92 — *Rapanea* 71, 77 — *Tapeinosperma* 10, 53, 105.

Illustrations: Fig. 116 & 117.



Fig. 118. *Melaleuca cajuputi* Powell.

MYRTACEAE

Always: Woody, non-climbing; leaves simple, entire, pellucid dots (sometimes not distinct), exstipulate; flowers hermaphroditic; ovary inferior (rarely half inferior), stamens inflexed in bud, petals free, imbricate.

Usually/often: Bark flaky; leaves opposite, intramarginal vein; stamens numerous, sometimes in phalanges.

Striking features: Leaves needle-shaped (*Baeckea*); dwarf shrubs (some *Decaspermum* and *Leptospermum*); bark peeling off in long scrolls, leaves spiral (*Tristaniopsis*); leaves spiral, veins longitudinal (*Melaleuca*); leaves triplinerved, whitish hairy underneath (*Rhodamnia*).

Different from: *Lecythidaceae*: leaves spiral, without pellucid dots, often dentate. — *Lythraceae*: no pellucid dots; ovary superior. — *Melastomataceae*: no pellucid dots; stamens few, connective with appendages.

Distribution: The family world-wide. In Malesia represented by 35 genera, incl.:

- *Decaspermum* (Indo-Malesia, Pacific), shrubs or trees, lowland and montane rain forest;
- *Eucalyptus* (mostly Australia, some in East Malesia), trees, mostly seasonal forest;
- *Metrosideros* (Malesia, Pacific), trees, lowland and montane rain forest;
- *Rhodomyrtus* (Indo-Australia), shrubs and trees, lowland primary and secondary forest;
- *Syzygium* (paleotropics), trees, lowland and montane rain forest;
- *Tristaniopsis* (Indo-Australia), trees, rain forest, often along streams, also in secondary forest.

Notes: Members of the family are well represented in all vegetation types but best in montane rain forest. — *Acmena*, *Syzygium* and other Old World genera are by some placed in one pantropical inclusive genus: *Eugenia*. — Many species useful to man: edible fruit: *Eugenia*, *Psidium**; *Rhodomyrtus*, *Syzygium*; spices: *Syzygium*, *Pimenta**; ornamentals: *Callistemon**; *Eucalyptus*; timber: *Eucalyptus*, *Syzygium*; medicinal oil: *Eucalyptus*, *Melaleuca*.

Literature: C.A. Backer & R.C. Bakhuizen van den Brink, Fl. Java 1 (1963) 330–351; K.M. Kochummen, Tree Fl. Mal. 3 (1978) 169–253. — Dr. P.G. Wilson (NSW) is coordinating the family revision for Flora Malesiana.

Spot-characters: Myrtaceae 56, 58, 59, 65, 76, 92 – *Decaspermum* 66 – *Eucalyptus* 25 – *Eugenia* s.l. 15, 17, 46, 60, 70 – *Kjelbergiodendron* 44 – *Leptospermum* 100 – *Lindsayomyrtus* 55 – *Metrosideros* 100 – *Octamyrthus* 70; *O. pleiopetala* 66 – *Rhodamnia* 64 – *Rhodomyrtus* 64, 97 – *Syncarpia* 46 – *Syzygium* 39, 47, 52, 55, 66 – *Tristaniopsis* 44, 46, 100, 102 – *Whiteodendron* 66 – *Xanthomyrtus* 52 – *Xanthostemon* 44, 46, 100.

Illustrations: Fig. 118 & 119.



Fig. 119. *Whiteodendron moultonianum* (W.W. Sm.) Steenis.

NYCTAGINACEAE

Always: Leaves simple, entire, exstipulate; flowers actinomorphic, perianth tubular, undifferentiated; ovary superior, 1-celled, 1 erect ovule.

Usually / often: Leaves (sub)opposite; flowers bisexual; anthocarp in fruit persistent, often viscid.

Striking features: Spiny stem (*Bougainvillea**, *Pisonia aculeata*).

Different from: *Rubiaceae*: stipules, flowers with calyx and corolla, ovary inferior.
— *Verbenaceae*: flowers with calyx and corolla.

Distribution: Pantropical, best represented in South America. In Malesia 2 native genera:

- *Boerhavia* (pantropical), herbs, often weedy;
- *Pisonia* (pantropical), shrubs, trees, rarely climbers, rain forest and open places.

Notes: Ornamentals: *Bougainvillea**, *Mirabilis**, *Pisonia*. — Edible leaves: *Pisonia grandis*. — The fruits of some *Pisonia* spp. are so sticky that birds may get completely covered by them.

Literature: J.F. Stemmerik, Fl. Males. I, 6 (1964) 450–468.

Spot-characters: Nyctaginaceae 84 – *Boerhavia* 99 – *Bougainvillea* 4, 63 – *Mirabilis* 16 – *Pisonia* 22, 46, 54, 70; *P. aculeata* 4, 12; *P. umbelliflora* 19.

Illustration: Fig. 120.

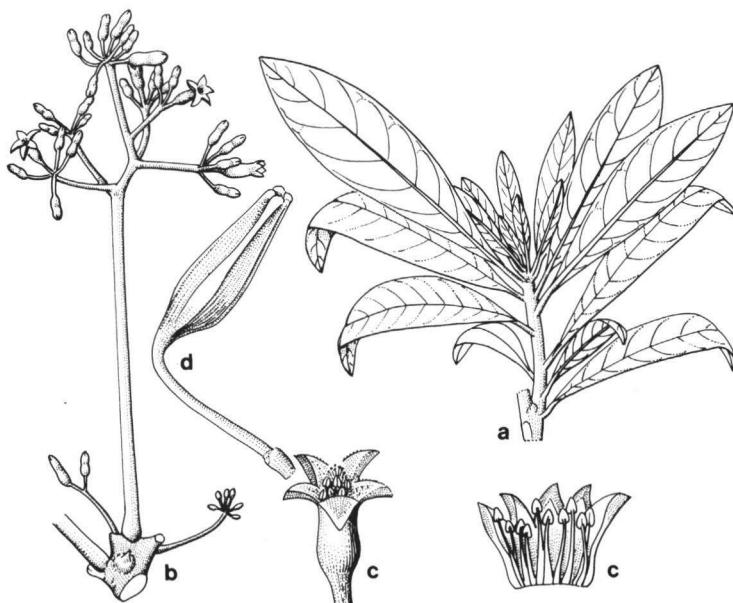


Fig. 120. *Pisonia caulinflora* Scheff.: a. habit; b. inflorescence; c. flower; d. fruits.



Fig. 121. *Nyssa javanica* (Blume) Wang., showing habit, flower and fruit.

NYSSACEAE

Always: Trees; leaves simple, spiral, penninerved, exstipulate; flowers unisexual, 5-merous, actinomorphic; petals free, intrastaminal disk present, ovary inferior, 1-locular, 1 pendent ovule; fruit a drupe.

Usually/often: Leaves entire; inflorescence a head, stamens in two whorls of 8, inner often sterile.

Different from: *Cornaceae*: leaves usually opposite, inflorescence never a head. — *Araliaceae*: leaves often compound, leaf base sheathing, plants aromatic.

Distribution: The only genus, *Nyssa*, represented in East Asia and North America; *N. javanica* is a lowland and lower montane rain forest tree of West Malesia.

Notes: Fruits edible, but often infected by galls.

Literature: J. Wasscher, Fl. Males. I, 4 (1948) 29–31.

Spot-characters: 58, 76, 89, 92.

Illustration: Fig. 121.

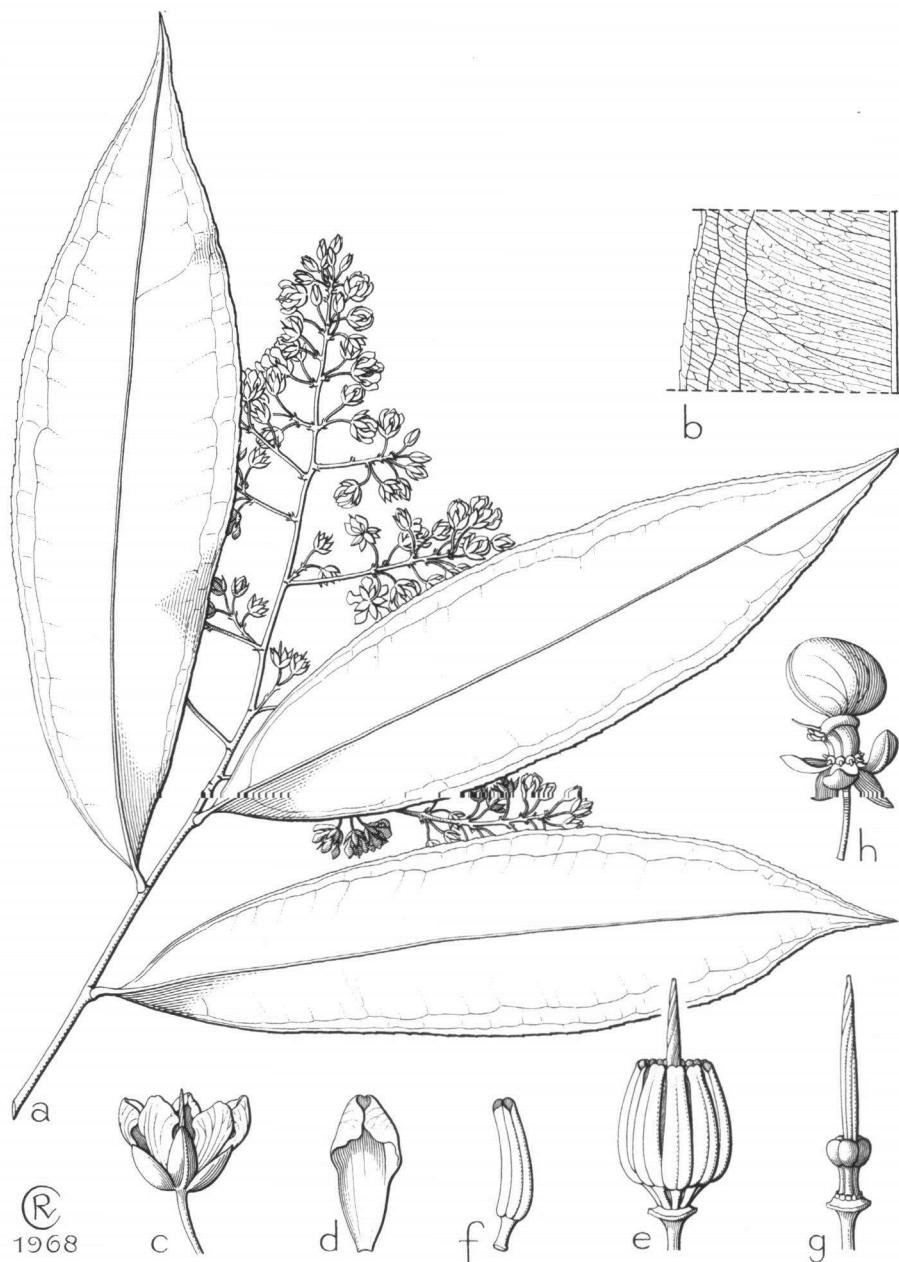


Fig. 122. *Gomphia serrata* (Gaertn.) Kanis; a. habit; b. details of leaf venation; c. flower; d. petal; e & f. stamens; g. pistil; h. fruit.

OCHNACEAE

Always: Woody, non-climbing; leaves spiral, simple, stipulate, glabrous; flowers hermaphroditic, actinomorphic; sepals 5, persistent; petals free, contorted; style excentric.

Usually / often: Leaves dentate, veins closely parallel, stipules dissected; fruit apocarpous.

Striking features: Double intramarginal vein (*Gomphia*); winged seeds (*Schuurmansia*).

Different from: *Myrsinaceae*: dark dots in leaves, no stipules.

Distribution: The family pantropical. In Malesia 8 genera, incl.:

- *Brackenridgea* (Malesia, North Australia, Fiji), trees, lowland (incl. swamp) forest;
- *Gomphia* (paleotropical), shrubs, trees, lowland rain forest;
- *Schuurmansia* (East Malesia), trees, lowland and montane rain forest.

Notes: Ornamentals: *Ochna** (p.p.); several indigenous species have ornamental potential.

Literature: A. Kanis, Fl. Males. I, 7 (1971) 97–119.

Spot-characters: *Ochnaceae* 91 – *Brackenridgea* 64 – *Euthemis* 64, 86 – *Gomphia* 33, 65, 66, 86 – *Indovethia* 34, 67 – *Neckia* 34, 67, 73 – *Ochna* 33, 86 – *Schuurmansia* 10, 34, 46, 53, 67, 102 – *Schuurmansiella* 67.

Illustration: Fig. 122.

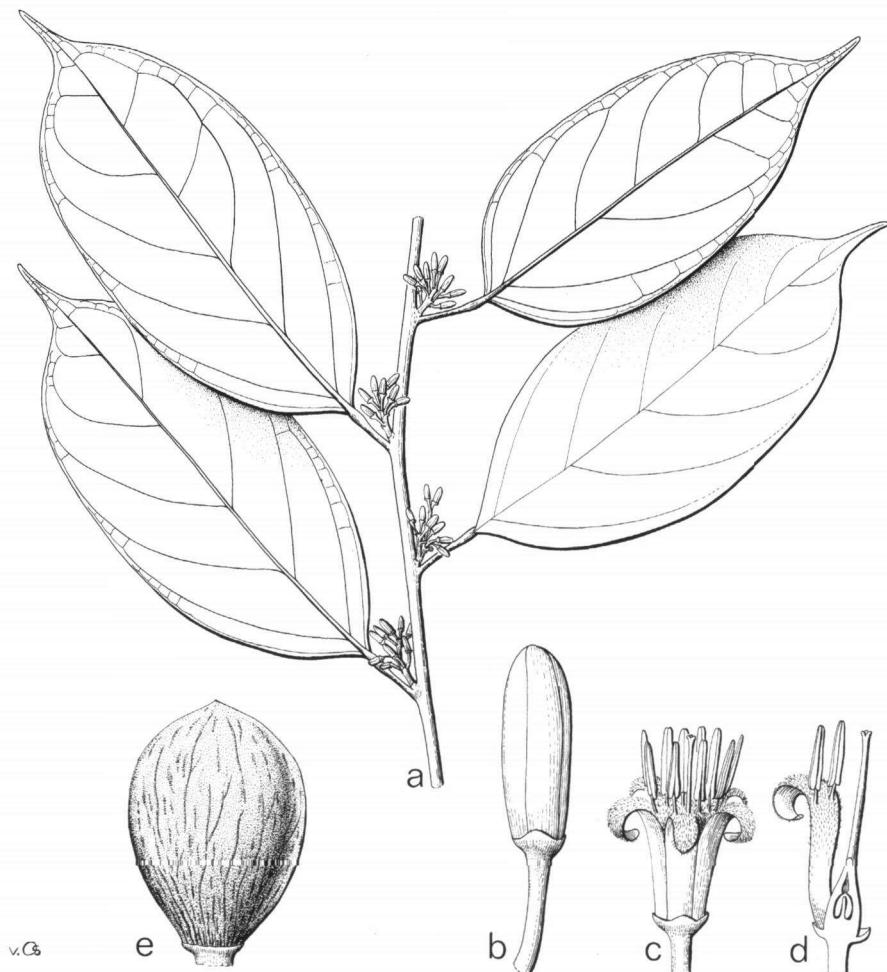


Fig. 123. *Scorodocarpus borneensis* Becc.: a. habit; b. flower bud; c. flower; d. flower, part of petals removed; e. fruit.

OLACACEAE (ERYTHROPALACEAE)

Always: Woody; leaves simple, alternate or spiral, exstipulate; sepals connate; stamens oppositipetalous; ovules pendulous.

Usually/often: Leaves entire, pinninerved, finely tubercled, flowers hermaphroditic, actinomorphic; petals free, valvate, often hairy inside, stamens twice the number of petals, ovary 1-locular or 3–5-locular in the lower half, often (seemingly) inferior; fruit a 1-seeded drupe.

Striking features: Climber with tendrils, leaves palmínerved (*Erythropalum*); spiny shrub, petals bearded inside (*Ximenia*); crushed parts smelling of garlic (*Scorodocarpus*); calyx strongly accrescent in fruit (*Harmandia*); corolla tubular (*Schoepfia*); some milky sap, secondary and tertiary veins parallel (*Ochanostachys*).

Different from: *Opiliaceae*: stamens the same number as tepals, no sepals, ovary superior, 1-locular. — *Santalaceae*: ovary inferior, ovule basal, no petals.

Distribution: The family pantropical; in Malesia 9 genera, incl.:

- *Olax* (paleotropical), shrubs, climbers; mostly monsoon forest;
- *Scorodocarpus* (Southeast Asia, West Malesia), trees, lowland rain forest;
- *Strombosia* (Africa, Indo-Malesia), shrubs or trees, lowland rain forest.

Notes: *Erythropalum* often placed in separate family. Some members hemiparasitic:

Olax, *Ximenia*. — Some species useful for man; edible fruit: *Anacolosa*, *Ximenia*; edible leaves: *Strombosia javanica*; timber: *Ochanostachys*, *Scorodocarpus*, *Strombosia*.

Literature: H. Sleumer, Fl. Males. I, 10 (1984) 1–29.

Spot-characters: *Olacaceae* 11, 58, 61, 79, 83, 92 – *Anacolosa* 19, 31, 59, 71; *A. cauliflora* 70 – *Erythropalum* 4, 64, 93 – *Harmandia* 80, 84, 93, 98 – *Ochanostachys* 19, 31, 57 – *Olax* 4, 12, 81 – *Schoepfia* 64 – *Scorodocarpus* 59, 64, 68, 71 – *Strombosia* 71 – *Ximenia* 12, 54, 71.

Illustration: Fig. 123.

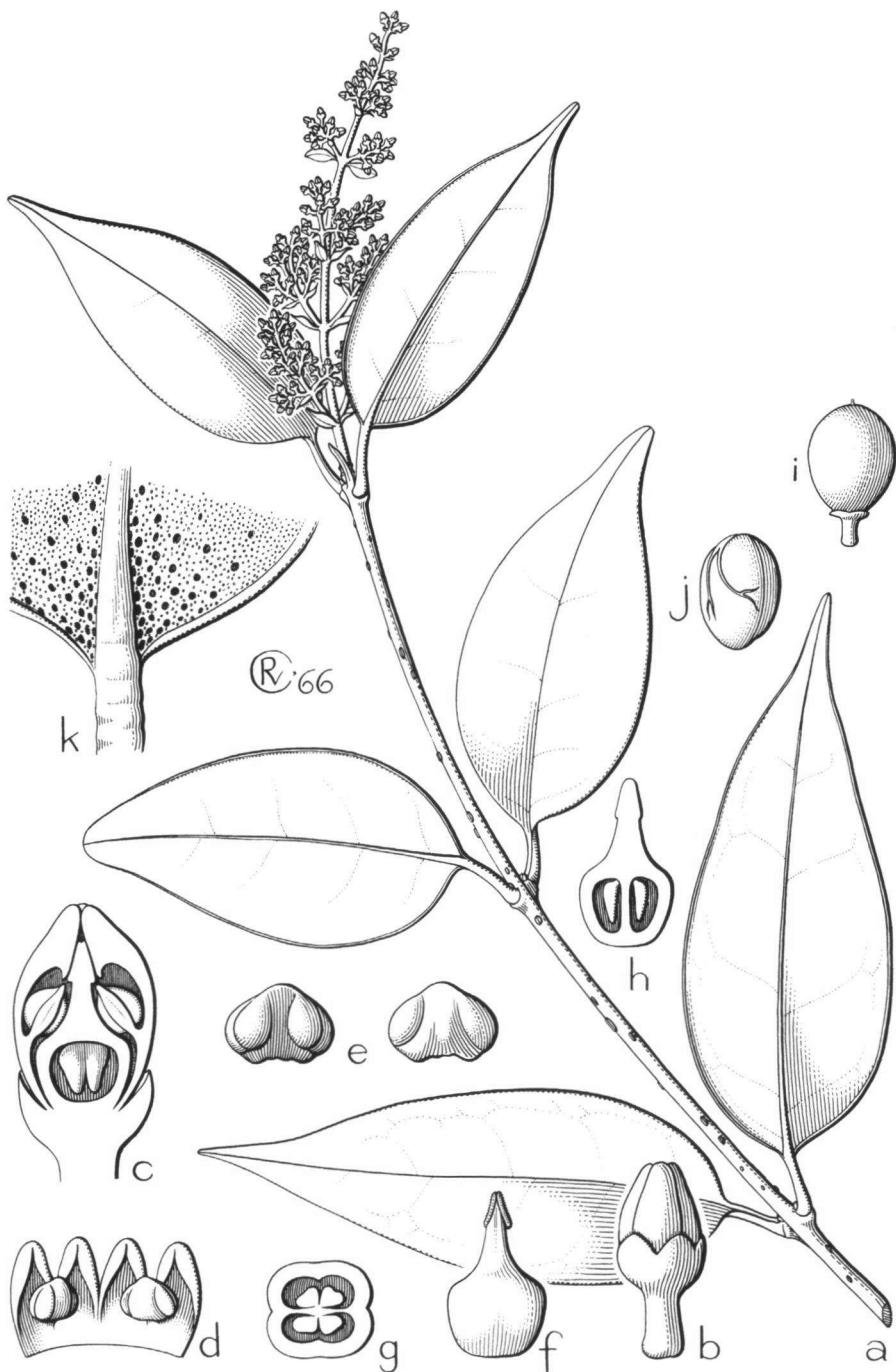


Fig. 124. *Myxopyrum enerve* Steenis: a. habit; b. flowerbud; c. idem in LS; d. corolla; e. anther; f. ovary; g. idem, in CS; h. idem, in LS; i. fruit; j. seed; k. underside of leaf with glands.

OLEACEAE

Always: Woody; leaves decussate, penninerved, exstipulate, flowers hermaphroditic, actinomorphic, sympetalous; stamens 2; ovary superior, 2-celled, 1 or 2 ovules per cell.

Usually/often: Leaves simple, entire; flowers 4-merous.

Striking features: Climbers, leaves with longitudinal veins, leaves glandular below (*Myxopyrum*); leaves pinnate (*Fraxinus*, *Jasminum* p.p., *Schrebera* p.p.); dried plant with pale stem and dark petioles (*Chionanthus*); fruit a deeply 2-lobed berry (*Jasminum*) fruit winged (*Fraxinus*).

Different from: *Apocynaceae*: milky sap, stamens 5. — *Loganiaceae*: stipules or interpetiolar ridge, stamens 4 or 5. — *Rubiaceae*: stipulate, ovary inferior, stamens more than 2.

Distribution: The family world-wide. In Malesia 8 genera, incl.:

- *Chionanthus* (syn. *Linociera*, pantropical), trees or shrubs, lowland and lower montane rain forest;
- *Jasminum* (widespread), climbers or shrubs, lowland and montane forest, some also monsoon forest and secondary vegetation;
- *Myxopyrum* (Indo-Malesia), climbers, lowland rain forest.

Notes: Fragrant flowers: *Jasminum*. — Ornamentals: *Jasminum** (p.p.), *Nyctanthes**.

Literature: C.A. Backer & R.C. Bakhuizen van den Brink, Fl. Java 2 (1965) 212–218.
— Prof. R. Kiew (SING) is revising the family for Flora Malesiana.

Spot-characters: *Oleaceae* 17, 58, 73 – *Chionanthus* 17, 59, 60, 73, 99; *C. acuminatus* 46; *C. pluriflorus* 95 – *Fraxinus* 17, 42, 49, 98 – *Jasminum* 4, 5, 6, 31, 32, 38, 44, 48, 49, 61, 64, 93 – *Ligustrum* 31 – *Myxopyrum* 5, 6, 31, 46, 64 – *Olea* 17 – *Schrebera* 49, 102.

Illustration: Fig. 124.



Fig. 125. *Champereia manillana* (Blume) Merr., showing flowering and fruiting branch and detail of flower (from Flora of Taiwan).

OPILIACEAE

Always: Woody; leaves simple, alternate, entire, pinninerved, exstipulate; flowers actinomorphic; stamens as many as and opposite the tepals, disk present, ovary superior, 1-celled, 1 pendulous ovule.

Usually / often: Leaves drying pale olive, leaf surface finely tubercled, flowers bisexual, tepals free.

Striking features: Climbers (*Cansjera*, *Opilia*); cauliflorous treelet (*Melientha*); dried plant with fenugreek ('maggi') smell (*Urobotrya siamensis*).

Different from: *Olacaceae*: perianth of calyx and corolla, more than 1 ovule. — *Santalaceae*: ovary inferior.

Distribution: Pantropical; in Malesia 7 genera, incl.:

- *Champereia* (Indo-Malesia), shrubs, lowland rain forest, monsoon forest;
- *Opilia* (paleotropics), climbers, lowland deciduous forest.

Notes: *Cansjera* and *Opilia* are root parasites. — Edible leaves: *Champereia*, *Melientha*. — Medicinal uses: *Champereia*, *Urobotrya*. — Fruits of *Champereia* eaten by birds.

Literature: P. Hiepko, Fl. Males. I, 10 (1984) 31–52.

Spot-characters: *Opiliaceae* 11, 61, 83 – *Cansjera* 5, 59 – *Champereia* 23, 88 – *Melientha* 70 – *Opilia* 5 – *Urobotrya siamensis* 23.

Illustration: Fig. 125.

OXALIDACEAE

Always: Flowers actinomorphic; petals free; stamens 10, filaments connate at base; ovary superior, 5-locular, 5 styles.

Usually / often: Woody; leaves compound, spiral, stipules absent; seeds arillate.

Striking features: Herbs with underground tubers, leaves digitately compound (*Oxalis*); subshrubs with paripinnate leaves (*Biophytum*); mature trunk deeply fluted (some *Sarcotheca*).

Different from: *Connaraceae*: ovary 1-locular. — *Linaceae*: leaves simple, the climbing species provided with hooks.

Distribution: World-wide, mainly tropics; in Malesia 5 genera, incl.:
— *Sarcotheca* (W Malesia, Sulawesi), shrubs or trees, primary and secondary forest.

Notes: Fruits of *Averrhoa* and some *Sarcotheca* edible. — Origin of *Averrhoa* unknown, presumably Southeast Asia, but not found wild.

Literature: J.F. Veldkamp, Fl. Males. I, 7 (1971) 151–178.

Spot-characters: Oxalidaceae 84, 104 – *Averrhoa* 70; *A. carambola* 99 – *Biophytum* 41 – *Dapania* 38 – *Oxalis* 48 – *Sarcotheca* 38, 48.

Illustration: Fig. 126.

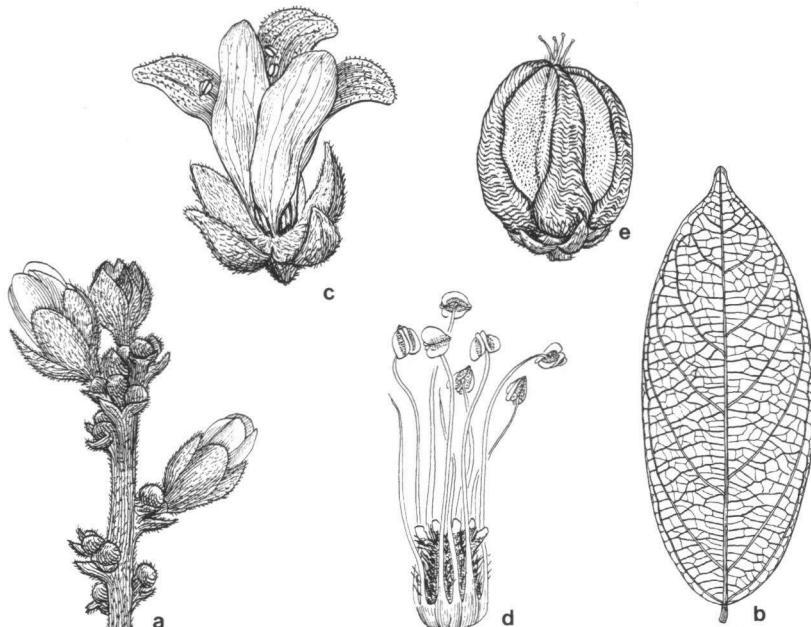


Fig. 126. *Sarcotheca glauca* (Hook. f.) Hall. f.: a. inflorescence, b. leaf; c. flower; d. stamens and ovary; e. fruit.

PALMAE (ARECACEAE)

Always: Woody; leaves plicate in bud, exstipulate, petiole sheathing (sheaths sometimes open); inflorescence covered by large bract (spatha); flowers actinomorphic; ovary superior, 1 ovule per cell.

Usually/often: Stem unbranched; leaves spiral, variously dissected (palmate or pinnate); flowers unisexual, 3-merous, stamens 6, ovary 3-locular; fruit a 1-seeded drupe.

Striking features: Huge simple leaves (*Johannesteijsmannia*); stemless mangrove plant (*Nypa*); monocarpic (dying after flowering) (*Corypha*, some *Metroxylon*); leaves bipinnate (*Caryota*); climbing (rattans).

Different from: *Pandanaceae*: leaves linear, usually 3-ranked, leaf blade spiny; flowers without perianth. — *Cycadaceae*: resinous, inflorescence a unisexual terminal strobilus.

Distribution: The family widespread, largely tropical. In Malesia 52 genera, incl.:

- *Areca* (Indo-Malesia), lowland and lower montane rain forest;
- *Arenga* (Indo-Malesia), mostly lowland rain forest;
- *Calamus* (paleotropical), climber, lowland and lower montane rain forest;
- *Cocos* (pan-tropical), coastal tree, also inland to c. 800 m, often planted;
- *Metroxylon* (Malesia, West Pacific), lowland swamp forest, also often planted;
- *Salacca* (Indo-Malesia), lowland rain forest, some planted.

Notes: A family well represented in various habitats, especially in lowland rain forest.

Many species useful to man. — The growing bud of many species edible; edible fruit: *Arenga*, *Borassus*, *Cocos*, *Salacca*; flour: *Arenga*, *Metroxylon*; sugar: *Arenga*, *Cocos*; oil: *Cocos*, *Elaeis**; (alcoholic)drinks: *Arenga*, *Borassus*. — Stems and leaves of many species used for building, plaiting, binding, production of furniture: rattans (*Calamus*, *Daemonorops*, *Korthalsia*), *Cocos*, *Arenga*, *Nypa*. — Ornamentals: *Areca*, *Cyrtostachys*, *Licuala*, *Livistona*, *Oreodoxa**, *Pinanga*, *Rhaphis**, *Roystonea**

Literature: E.J.H. Corner, The natural history of Palms, London, 1966; J. Dransfield, A short guide to Rattans, Biotrop, Bogor (1974); J.P. Mogea, Palm Indonesia, LBN 13, Bogor, (1978); N. Uhl & J. Dransfield, Genera Palmarum, Ithaca (1987). Dr. J. Dransfield (K) is coordinating the revision of the family for Flora Malesiana.

Spot-characters: *Palmae* 10, 105 – *Actinorrhysis* 70 – *Areca* 70 – *Arenga* 70, 78 – *Borassus* 12 – *Calamus* 4, 12, 19, 52 – *Calospatha* 4, 12 – *Caryota* 70 – *Ceratolobus* 4, 12 – *Corypha* 3 – *Cyrtostachys* 70 – *Daemonorops* 4, 12, 19 – *Eleiodoxa* 12 – *Eugeissona* 12 – *Korthalsia* 4, 9, 12 – *Licuala* 12 – *Livistona* 78 – *Metroxylon* 3, 12 – *Myrialepis* 4, 12 – *Nenga* 70 – *Nypa* 76 – *Oncosperma* 12, 70 – *Pholidocarpus* 12 – *Pigafetta* 12 – *Pinanga* 70 – *Plectocomia* 4, 12, 78 – *Plectocomiopsis* 4, 12 – *Polygonium* 4, 12 – *Retispatha* 4, 12 – *Rhopaloblaste* 70 – *Salacca* 12 – *Wallichia* 70.

Illustrations: Fig. 127 & 128.



Fig. 127. *Calamus adspersus* Blume.

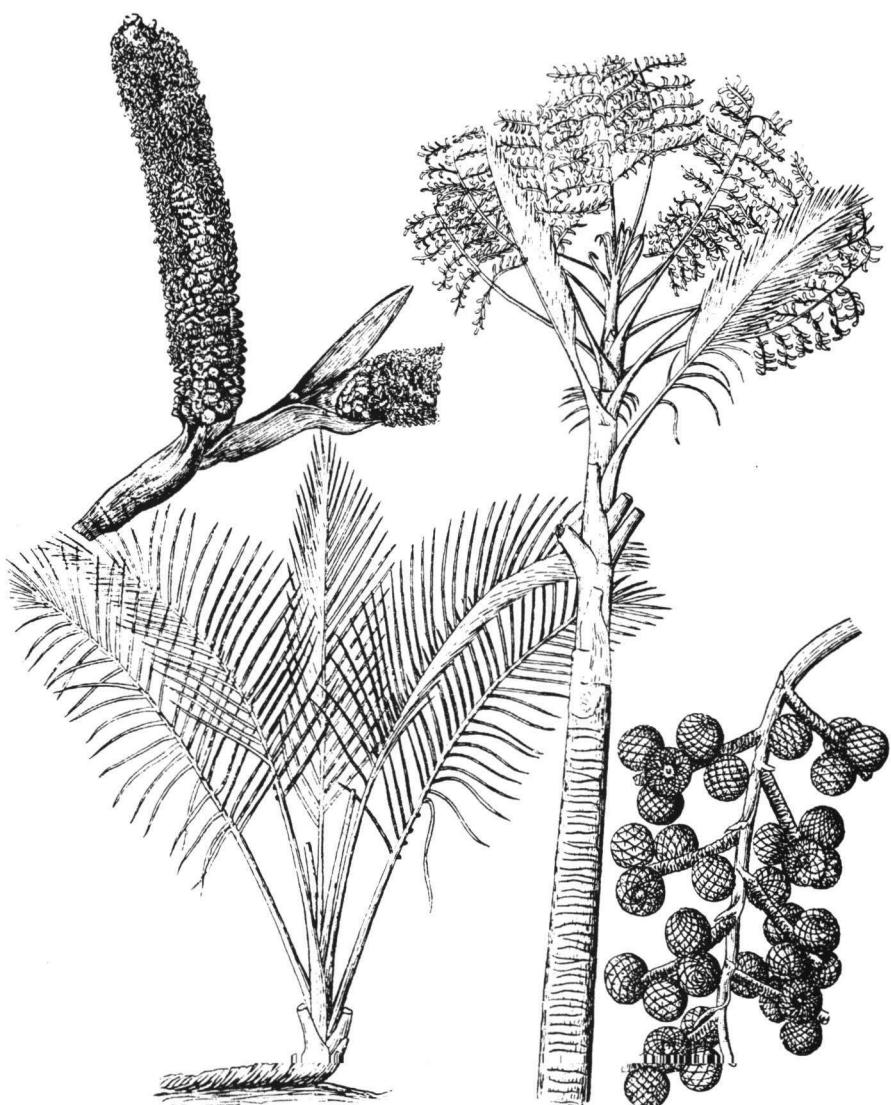


Fig. 128. *Metroxylon sagu* Rottb., showing plant before and during flowering, with inflorescence and infructescence.

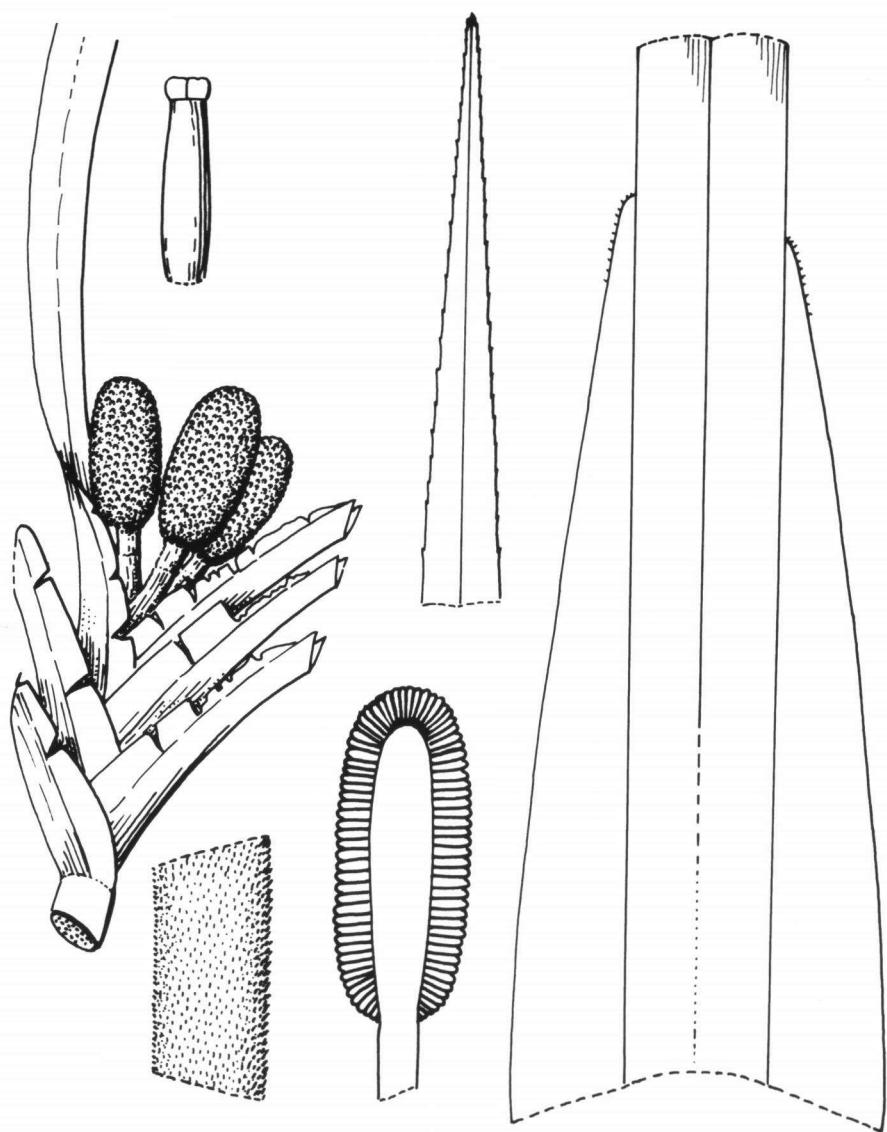


Fig. 129. *Freycinetia kalamantanica* B.C. Stone.

PANDANACEAE

Always: Leaves simple, linear, spiral, exstipulate; plants dioecious, flowers minute, devoid of perianth, in compact spikes ± covered by bracts; stamens numerous, fruit a syncarp.

Usually/often: Woody; leaves three-ranked, spiny; stilt roots (*Pandanus*).

Different from: *Palmae*: leaves usually compound, rarely three-ranked and spiny, flowers with perianth. — *Liliaceae* (*Agavaceae*): leaves not spiny; flowers large with distinct perianth, not in compact spikes.

Distribution: The family consists of three genera, all represented in Malesia:

- *Freycinetia* (Southeast Asia to Polynesia), climbers, mainly rain forest;
- *Pandanus* (Africa to Polynesia), shrubs, trees; rain forest, swamps, sandy beach;
- *Sararanga* (Philippines, New Guinea, Solomons), trees, rain forest.

Notes: *Pandanus* fruits often buoyant. — Leaves used for weaving and thatching:

Pandanus. — Edible fruits: *Pandanus*; colouring and flavouring food: *P. amaryllifolius*; fruits of *Freycinetia* and *Pandanus* eaten by various animals. — Ornamentals: *Pandanus*.

Literature: O. Warburg, Pandanaceae, in Engler, Pflanzenreich Heft 3 (1900) 1–97; several papers by H. St. John and B.C. Stone.

Spot-characters: *Freycinetia* 5, 76, 95, 96 — *Pandanus* 10, 70, 76, 95, 96 — *Sararanga* 10, 76, 96.

Illustrations: Fig. 129 & 130.

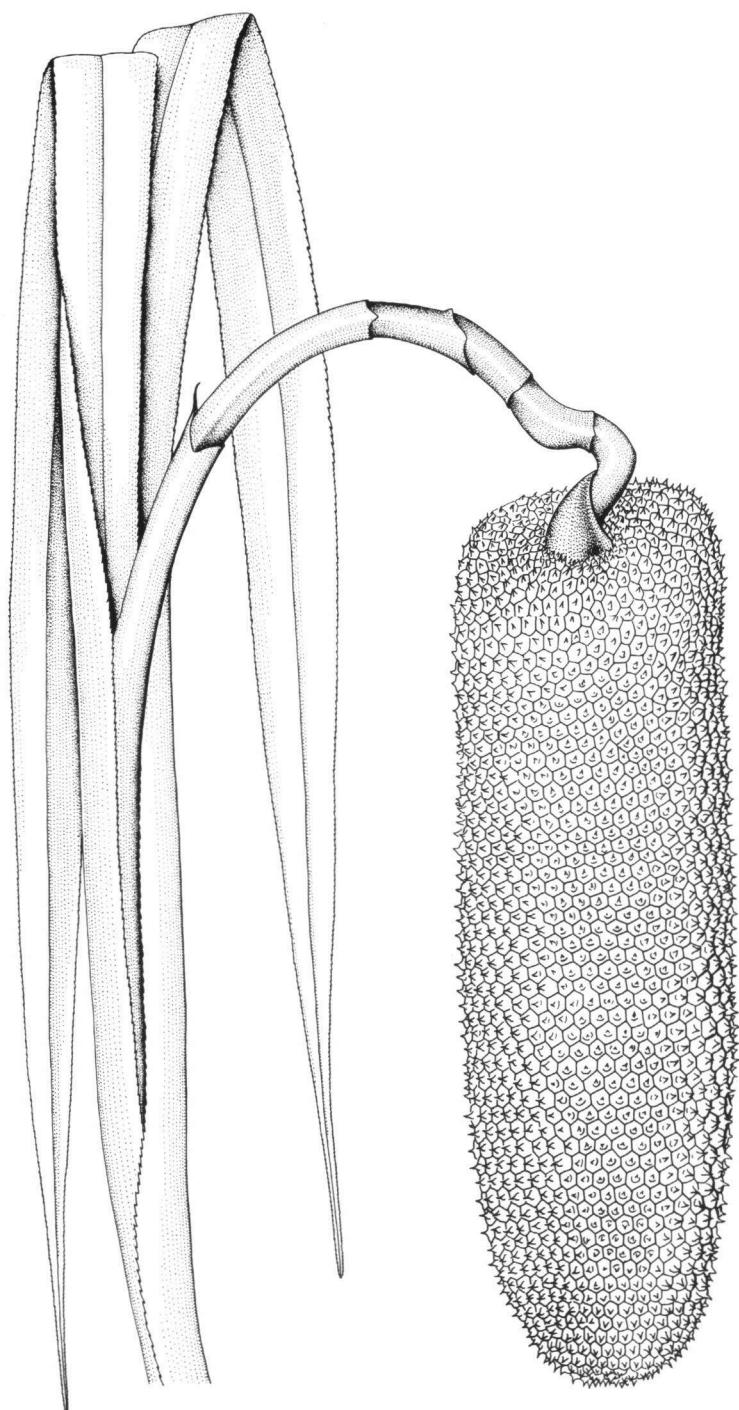


Fig. 130. *Pandanus helicopus* Kurz.

PENTAPHYLACACEAE

Always: Woody, non-climbing; leaves spiral, simple, entire, pinninerved, exstipulate; flowers bisexual, actinomorphic, 5-merous; sepals and petals free; stamens 5, alternipetalous, anthers with terminal pores; ovary superior, 5-celled, 2 ovules per cell; fruit a capsule.

Usually / often: Petals emarginate, seeds winged.

Different from: *Symplocaceae*: stamens many, ovary inferior, fruit a drupe. — *Theaceae*: stamens many, anthers opening by slits (*Eurya*, leaves dentate, dioecious).

Distribution: The only species of the family, *Pentaphylax euryoides*, is confined to Southeast Asia and West Malesia and is found in montane to subalpine forest.

Notes: Sometimes planted as an ornamental.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 5 (1955) 121–124.

Spot-characters: 86, 102.

Illustration: Fig. 131.



Fig. 131. *Pentaphylax euryoides* Gardn. & Champ., showing habit and details of flower.



Fig. 132. *Pittosporum moluccanum* (Lam.) Miq.: a. flowering branch; b. flowerbud; c. LS of flower; d. stamen; e. fruit; f. fruit dehisced.

PITTOSPORACEAE

Always: Woody, non-climbing; leaves simple, pinninerved, spiral, exstipulate; flowers actinomorphic, sepals and petals imbricate, nearly free.

Usually / often: Plants aromatic; leaves partly crowded, entire; flowers 5-merous, bisexual, anthers basifix, placenta parietal; fruit a 2-carpellate capsule; seeds many, in sticky pulp.

Striking features: Spiny shrub, fruit indehiscent (*Citriobatus*).

Different from: *Goodeniaceae*: flowers zygomorphic, sepals and petals united.

Distribution: Old World, mainly tropics, best represented in Australia. In Malesia 3 genera, incl.:

- *Pittosporum* (Canary islands to Hawaii and South Polynesia), shrubs, trees, sometimes epiphytic; lowland to montane rain forest and monsoon forest.

Notes: *Pittosporum* often has bright coloured capsules with contrasting black seeds, which are eaten by birds. — Some species planted as ornamentals.

Literature: K. Bakker & C.G.G.J. van Steenis, Fl. Males. I, 5 (1957) 345–362; I, 6 (1972) 960–963.

Spot-characters: *Bursaria** 12 – *Citriobatus* 12 – *Hymenosporum* 102 – *Pittosporum* 14, 17, 28, 46, 101.

Illustration: Fig. 132.

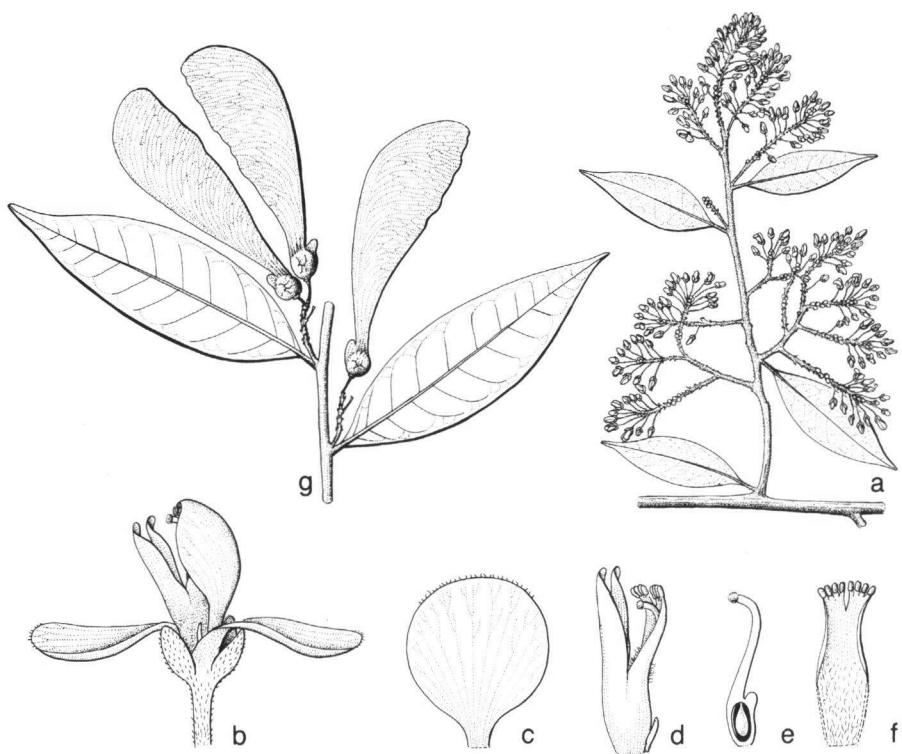


Fig. 133. *Securidaca ecristata* Kassau: a. inflorescence; b. flower; c. keel; d. lateral and upper petals; e. gynoecium; f. staminal tube; g. fruits.

POLYGALACEAE (XANTHOPHYLLACEAE)

Always: Leaves simple, entire, exstipulate; flowers 5-merous, bisexual, anthers basifix, ovary superior.

Usually / often: Leaves spiral with scattered glands below, inflorescence racemose; flowers zygomorphic, filaments connate, ovary 2-locular, style articulate with the fruit.

Striking features: Climbers, glands at the nodes, fruit a samara (*Securidaca*); saprophytes (*Epirixanthes*); tree, flowers actinomorphic (*Eriandra*); leaves turning yellow upon drying (most *Xanthophyllum* spp.).

Different from: *Leguminosae (Papilionoideae)*: leaves often compound, stipulate, ovary 1-locular, stipitate. — *Trigoniaceae*: leaves with dense white indument below, fruit 3-winged.

Distribution: World-wide, especially tropics; in Malesia 6 genera, incl.:

- *Polygala* (world-wide), herbs, shrubs, rarely climbers, rain forest, open places;
- *Xanthophyllum* (Indo-Australia), shrubs or trees, rain forest, mostly lowland.

Notes: *Trigoniastrum* (*Trigoniaceae*) sometimes included in the family, whereas *Xanthophyllum* is also regarded as a separate family. — Limited use as timber: *Xanthophyllum*. — Edible fruit: some *Xanthophyllum*; fragrant roots: *Polygala paniculata**.

Literature: R. van der Meijden, Fl. Males. I, 10 (1988) 455–539.

Spot-characters: *Polygalaceae* 58, 84, 104 – *Epirixanthes* 7 – *Eriandra* 31 – *Polygala* 5, 73 – *Salomonia* 64 – *Securidaca* 5, 98 – *Xanthophyllum* 12, 31, 39, 55, 94; *X. adenotus* 53.

Illustrations: Fig. 133 & 134.



Fig. 134. *Xanthophyllum ellipticum* Korth. ex Miq.

PROTEACEAE

Always: Woody, non-climbing; leaves simple, exstipulate; flowers 4-merous, tepals free; stamens 4, epitepalous; ovary superior, 1-locular; long, often persistent style.

Usually / often: Trees, wood with broad rays; leaves spiral, often turning yellowish when dried, petiole thickened at base; inflorescence a raceme; flowers hermaphroditic; fruit woody (capsule or drupe).

Striking features: Juvenile leaves large, deeply pinnatifid, mesocarp of drupe fibrous (*Helciopsis*); leaves in a whorl, red sap (*Macadamia*); leaves finely pinnately dissected (*Grevillea* p.p., *Stenocarpus* p.p.); seeds winged (*Alloxyylon* [*Oreocallis*], *Stenocarpus*).

Different from: *Loranthaceae*: parasitic shrubs, leaves usually opposite, ovary inferior. — *Helciopsis* often confused with *Aralidium* (*Aralidiaceae*) which has clasping petiole and fleshy berry.

Distribution: The family widespread, chiefly in the southern hemisphere. In Malesia 9 genera, best represented in the eastern part, incl.:

- *Grevillea* (Australia, East Malesia), shrubs, trees, monsoon forest;
- *Helicia* (Indo-Australia), trees, lowland and montane forest;
- *Macadamia* (Sulawesi, Australia), trees, lowland and mid-montane rain forest.

Notes: Several (potential)amentals: *Alloxyylon*, *Finschia*, *Grevillea*, *Macadamia*. — Edible nut: *Macadamia ternifolia**; *Finschia*.

Literature: H. Sleumer, Fl. Males. I, 5 (1955) 147–206; L. A. S. Johnson & B. G. Briggs, Bot. J. Linn. Soc. 70 (1975) 83–182.

Spot-characters: *Proteaceae* 83, 99 – *Alloxyylon* 40, 43, 102 – *Banksia* 46, 96, 102 – *Finschia* 65, 91 – *Grevillea* 40, 102 – *Helicia* 28, 43, 46, 55, 70, 85, 91, 93, 99; *H. bullata* 52; *H. forbesiana* 9; *H. peltata* 51 – *Helciopsis* 43, 70 – *Macadamia* 21, 43, 46, 99; *M. hildebrandii* 78 – *Stenocarpus* 50 – *Turillia* 40.

Illustration: Fig. 135.



Fig. 135. *Helicia robusta* Roxb.: a. habit; b. flowerbuds; c. flower; d. ovary and disk; e & f. anther; g-i. seeds; j. fruit.

RHAMNACEAE

Always: Woody; leaves simple, spiral; flowers actinomorphic, stamens isomerous, opposite the free petals, intrastaminal disk; ovules basal.

Usually / often: Leaves distichous, serrate dentate, palminerved, scalariform tertiary venation, stipules small; fruit a drupe.

Striking features: Climbers with axillary tendrils (*Gouania*) or hooks (*Smythea*, *Ventilago*); fruit a samara (*Smythea*, *Ventilago*) or 3-winged (*Gouania*); scramblers with prickles (*Zizyphus*).

Different from: *Celastraceae*: leaves usually opposite, stamens alternating with petals. — *Euphorbiaceae*: flowers unisexual, stamens not opposite the petals, ovules apical.

Distribution: World-wide; in Malesia 11 genera, incl.:

- *Colubrina* (pantropical), shrubs or trees, lowland secondary and primary forest;
- *Zizyphus* (world-wide), thorny trees or climbers: primary and secondary forest, savannahs.

Notes: Edible fruit: *Zizyphus mauritiana**. — Roadside tree: *Maesopsis**

Literature: C. A. Backer & R. C. Bakhuizen van den Brink, Fl. Java 2 (1965) 80–85; A. Latiff, Tree Fl. Mal. 4 (1989) 197–301. — Dr. C. Schirarend (Hamburg) is revising the family for Flora Malesiana.

Spot-characters: *Rhamnaceae* 58, 83 – *Alphitonia* 26, 68 – *Berchemia* 26, 68 – *Colubrina* 68, 101; *C. anomala* 64 – *Emmenosperma* 68, 101 – *Gouania* 4, 68, 92, 98 – *Maesopsis* 68 – *Rhamnella* 68 – *Rhamnus* 68, 90 – *Sageretia* 68 – *Smythea* 4, 68, 98 – *Ventilago* 4, 68, 98 – *Zizyphus* 4, 64, 68.

Illustrations: Fig. 136 & 137.



Fig. 136. *Colubrina asiatica* (L.) Brongn., showing habit, flower and CS of fruit.

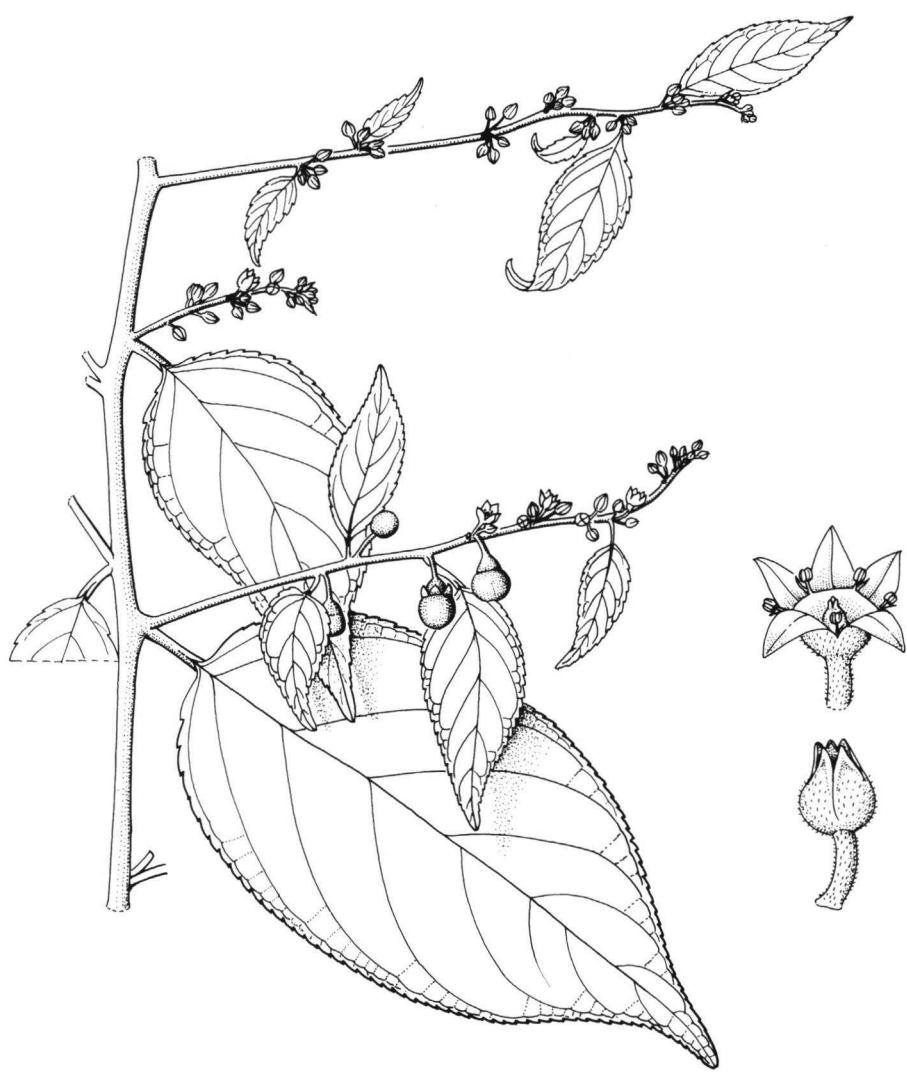


Fig. 137. *Rhamnus nepalensis* (Wall.) Laws.

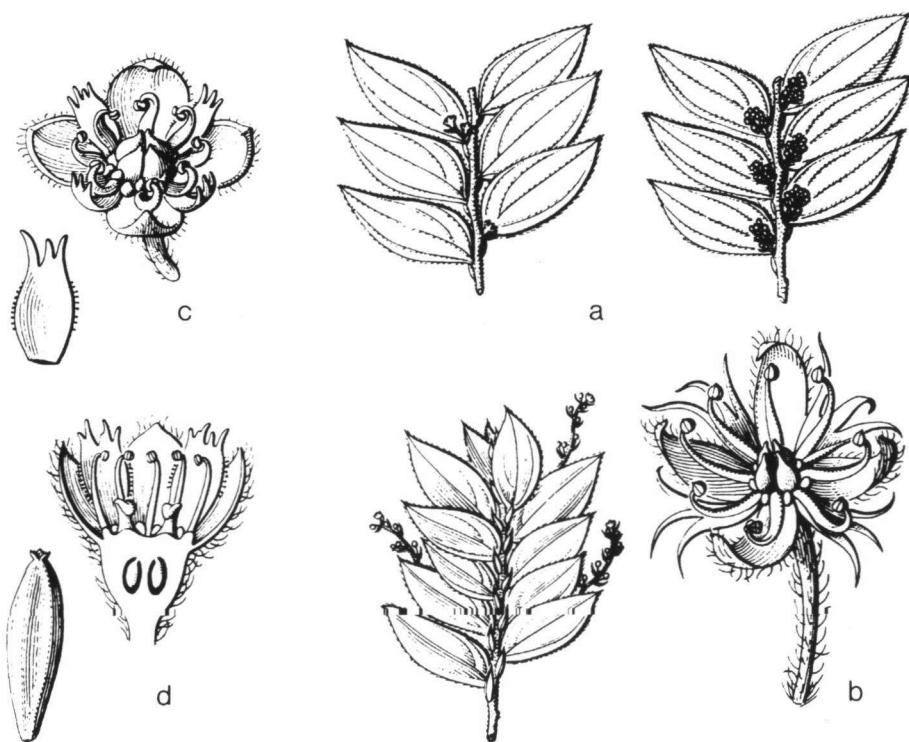


Fig. 138. *Anisophyllea disticha* (Jack) Baill.: a. habit; b & c. male flower; d. LS of female flower.

RHIZOPHORACEAE (ANISOPHYLLEACEAE)

Always: Woody, non-climbing; leaves simple; petals free, flowers hermaphroditic.

Usually / often: Trees, leaves decussate, entire; vegetative bud cigar-shaped, stipules overwrapping, with colleters at the base inside; inflorescence cymose, calyx lobes valvate, petals dissected (not *Rhizophora*); ovary inferior.

Striking features: Leaves distichous, triplinerved (*Anisophyllea*); stellate hairs, twigs hollow (*Pellacalyx*); leaves alternate, fruit 3-winged (*Combretocarpus*); leaves black-dotted below (*Bruguiera*, *Carallia*, *Rhizophora*); stiltroots (*Ceriops*, *Rhizophora*); kneeroots (*Bruguiera*); twigs hollow, ovary superior, fruit a berry (*Gynotroches*); vivipary (hypocotyls growing out while fruit still attached to tree) (*Bruguiera*, *Ceriops*, *Kandelia*, *Rhizophora*); leaves dentate (some *Carallia*, some *Pellacalyx*).

Different from: *Loganiaceae*: sympetalous, ovary superior. — *Rubiaceae*: sympetalous, stipules not overwrapping.

Distribution: The family pantropical, some genera restricted to mangrove forest; 9 Malesian genera:

- *Anisophyllea* (paleotropical), lowland rain forest;
- *Bruguiera* (paleotropical), mangrove;
- *Carallia* (Madagascar to Solomons), lowland and lower montane forest, swamp;
- *Ceriops* (paleotropical), mangrove;
- *Combretocarpus* (West Malesia), peat swamp;
- *Gynotroches* (Southeast Asia to Solomons), lowland primary and secondary forest, montane forest;
- *Kandelia* (Southeast Asia, West Malesia), mangrove;
- *Pellacalyx* (Southeast Asia and Malesia), lowland forest;
- *Rhizophora* (pantropical), mangrove.

Notes: *Anisophyllea* and *Combretocarpus* often placed in a separate family. — The fallen seedlings of the mangrove species are dispersed by the sea. — Tannin is extracted from several mangrove species; wood of some species used for charcoal and timber.

Literature: Ding Hou, Fl. Males. I, 5 (1958) 429–493; V.J. Chapman, Mangrove Vegetation, Vaduz (1976); P.B. Tomlinson, The Botany of Mangroves, Cambridge, Mass. (1986); K.M. Wong & L. Madani, Tree Fl. Sabah & Sarawak 1 (1995) 15–26 (*Anisophylleaceae*); L. Madani & K.M. Wong, ibid.: 321–350 (*Rhizophoraceae*).

Spot-characters: *Rhizophoraceae* 14, 83 – *Anisophyllaea* 18, 47, 55, 64, 65, 79, 81, 92 – *Bruguiera* 31, 32, 81, 92 – *Carallia* 22, 31, 32, 81, 92; *C. caryophylloidea* 67 – *Ceriops* 32, 79, 81, 92 – *Combretocarpus* 22, 26, 31, 79, 92, 98 – *Gynotroches* 32, 81 – *Kandelia* 32, 79, 81, 92 – *Pellacalyx* 25, 32, 91 – *Rhizophora* 25, 32, 81, 92.

Illustrations: Fig. 138 & 139.



Fig. 139. *Bruguiera exaristata* Ding Hou: a. habit; b-d. petals; e. stamen, f. LS of flower; g. CS of ovary; h & i. hypocotyls.

ROSACEAE

Always: Leaves spiral, stipulate (except *Spiraea*); actinomorphic, hypanthium tubular or cupular and more or less enclosing the fruit, style terminal (except *Potentilla*).

Usually/often: Leaves serrate, flowers hermaphroditic, stamens numerous.

Striking features: Leaves drying reddish brown, black glands below, fruit often weakly bilobed (*Prunus*); hooked bristles on hypanthium (*Acaena*, *Agrimonia*); spiny plants (*Rosa* p.p.*; *Rubus*).

Different from: *Chrysobalanaceae*: always trees, flowers more or less zygomorphic, style more or less excentric. — *Symplocaceae*: exstipulate, ovary inferior. — *Saxifragaceae*: usually exstipulate.

Distribution: World-wide; in Malesia 12 native genera, incl.:

- *Potentilla* (world-wide), herbs of montane and alpine habitats;
- *Prunus* (world-wide), trees and shrubs, mainly montane forest;
- *Rubus* (world-wide), spiny scramblers, lowland to montane forest, open places.

Notes: *Chrysobalanaceae* were formerly included in the *Rosaceae*. — Edible fruit: *Eriobotrya japonica**, *Fragaria**, *Malus**, *Rubus* (p.p.*). — Ornamentals: *Rosa**.

Literature: C. Kalkman, Fl. Males. I, 11 (1993) 227–351.

Spot-characters: *Rosaceae* 48, 58 – *Acaena* 95 – *Agrimonia* 37, 95 – *Eriobotrya* 92 – *Malus* 92 – *Neillia* 37 – *Photinia* 31, 69, 92 – *Potentilla* 1, 96 – *Prunus* 31, 34, 35, 59; *P. phaeosticta* 34 – *Pyrus* 92 – *Raphiolepis* 26 – *Rosa* 92 – *Rubus* 4, 34, 96.

Illustrations: Fig. 140 & 141.

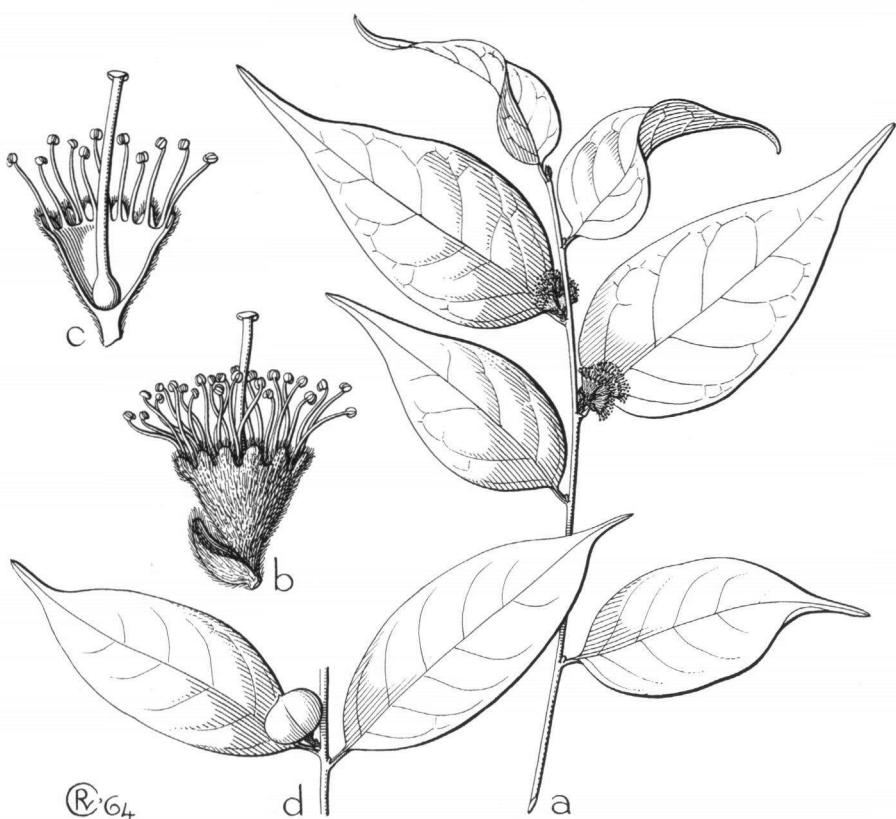


Fig. 140. *Prunus grisea* Kalkm.: a. habit; b & c. flower; d. fruit.



Fig. 141. *Rubus montis-wilhelmi* Royen: a. habit; b-f. details of flower; g. ovary; h. fruit.

RUBIACEAE

Always: Leaves decussate, incl. verticillate (sometimes one leaf of a pair reduced), simple, entire, interpetiolar (rarely intrapetiolar) fused stipules; corolla tubular, stamens isomerous, alternate with lobes.

Usually/often: Leaves with raphides; flowers hermaphroditic, actinomorphic, corolla 4- or 5-lobed; ovary inferior, 2-locular, placentation axile.

Striking features: Herbs, leaves of a pair unequal, flowers like those of *Solanum (Argostemma)*; stipules ochreate, ovary superior (*Gaertnera*); climber with hooks (*Uncaria*); one sepal enlarged and showy (*Mussaenda* [most species], *Mussaendopsis*, *Steenisia* p.p.); epiphytes with swollen hollow stems inhabited by ants (*Anthorrhiza*, *Hydnophytum*, *Myrmecodia*, *Myrmephytum*); cauliflorous treelets (*Praravinia suberosa*, *Versteeghia*); herbs, leaves verticillate, fruit with hooks (*Galium*).

Different from: *Caprifoliaceae*: leaves exstipulate. — *Loganiaceae*: no raphides, ovary superior. — *Rhizophoraceae*: petals free.

Distribution: The family world-wide. In Malesia c. 135 genera (well represented in all vegetation types, but especially in the undergrowth of lowland and montane rain forest), incl.:

- *Gardenia* (paleotropics), shrubs, treelets; lowland rain forest;
- *Hedyotis* (pantropical), herbs, shrubs; lowland and montane rain forest, disturbed places;
- *Ixora* (paleotropics), shrubs, treelets; lowland rain forest;
- *Mussaenda* (paleotropics), shrubs, scramblers; lowland and montane rain forest both primary and secondary;
- *Nauclea* (paleotropics), trees; lowland rain forest;
- *Psychotria* (pantropical), shrubs, climbers, treelets; lowland and montane rain forest;
- *Uncaria* (pantropical), climbers; lowland primary and secondary rain forest;
- *Urophyllum* (paleotropics), shrubs, treelets; lowland and montane rain forest.

Notes: Despite the size of the family, rather few species useful for man. — Medicinal plants: *Cinchona**, *Mussaenda*, *Uncaria*; drugs: *Coffea**, *Uncaria*. — Dyes: *Morinda*, *Rubia*. — Timber: *Anthocephalus* (*Neolamarckia*), *Nauclea*. — Ornamentals: *Gardenia*, *Hamelia**, *Ixora*, *Mussaenda*, *Nertera*, *Pentas**.

Literature: C.A. Backer & R.C. Bakhuizen van den Brink, Fl. Java 2 (1965) 274–357; K.M. Wong, Tree Fl. Mal. 4 (1989) 324–425. Several papers by C.E. Ridsdale.

Spot-characters: Rubiaceae 10, 14, 18, 30, 32, 58, 76, 77 – *Acranthera* 34, 51, 54 – *Adina* 96 – *Aidia* 47, 73 – *Aidiopsis* 5, 6, 47 – *Allaeophania* 5, 6 – *Amaracarpus* 63, 93 – *Anomanthodia* 5, 6 – *Anthocephalus* 96 – *Anthorrhiza* 2, 9, 12 – *Aphaenandra* 5, 6 – *Argostemma* 46, 47, 59, 63, 86 – *Bikkia* 102 – *Canthium* 4, 6, 12, 54 – *Catunaregam* 8, 12 – *Cephalanthus* 46 – *Ceriscoides* 4, 6, 12 – *Cinchona* 102 – *Coelospermum* 5, 6, 46, 96 – *Coffea* 22, 46 – *Coprosma* 46, 54; *C. archboldiana* 1

– *Coptosapelta* 5, 6, 102 – *Cowiea* 73, 76, 78 – *Dichilanthe* 22 – *Dolicholobium* 53 – *Fagerlindia* 4, 6, 12 – *Gaertnera* 46, 73 – *Galium* 37, 46, 64 – *Gardenia* 8, 22, 46, 73, 94 – *Gardeniopsis* 36 – *Greenea* 46, 69 – *Guettarda* 46 – *Gynochthodes* 5, 6, 54 – *Gynopachys* 5, 6 – *Hamelia* 46 – *Hedyotis* 34, 46, 47, 63; *H. pterita* 98 – *Hydnophytum* 2, 9, 54 – *Hymenodictyon* 8, 47, 102 – *Ixora* 46, 54, 70, 78 – *Jackiopsis* 34, 98 – *Kochummenia* 47 – *Lasianthus* 24, 52, 68, 93 – *Lecananthus* 15 – *Lucinaea* 5, 6 – *Mastixiodendron* 22, 92 – *Metadina* 96 – *Meyna* 12, 46 – *Morinda* 5, 6, 46, 54, 96 – *Mussaenda* 5, 6, 46; *M. anisophylla* 47 – *Mussaendopsis* 102 – *Mycetia* 63 – *Myrmecodia* 1, 9, 12, 54 – *Myrmeconauclea* 9 – *Myrmephytum* 2 – *Nauclea* 96 – *Neonauclea* 9, 96, 102 – *Nertera* 63; *N. nigricarpa* 93 – *Oxyceros* 4, 6, 12 – *Paederia* 5, 6, 24, 46; *P. foetida* 25; *P. verticillata* 98 – *Pavetta* 46, 54 – *Pleiocraterium gentianifolia* 1 – *Porterandia* 47, 54, 94 – *Praravinia suberosa* 70; *P. verruculosa* 95 – *Prismatomeris* 36, 76 – *Psychotria* 5, 6, 46, 54, 93, 99; *P. myrmecophila* 9 – *Renellia* 96 – *Rothmannia* 19, 47, 54, 94 – *Rubia* 37, 93 – *Saprosma* 24, 34, 46, 54, 93 – *Steenisia* 98 – *Stichianthus* 70, 73 – *Tarenna* 54 – *Timonius* 31, 59, 67, 99 – *Uncaria* 4, 6, 102 – *Urophyllum* 52, 70 – *Versteeghia* 70 – *Wendlandia* 46, 69, 102.

Illustrations: Fig. 142, 143 & 144.

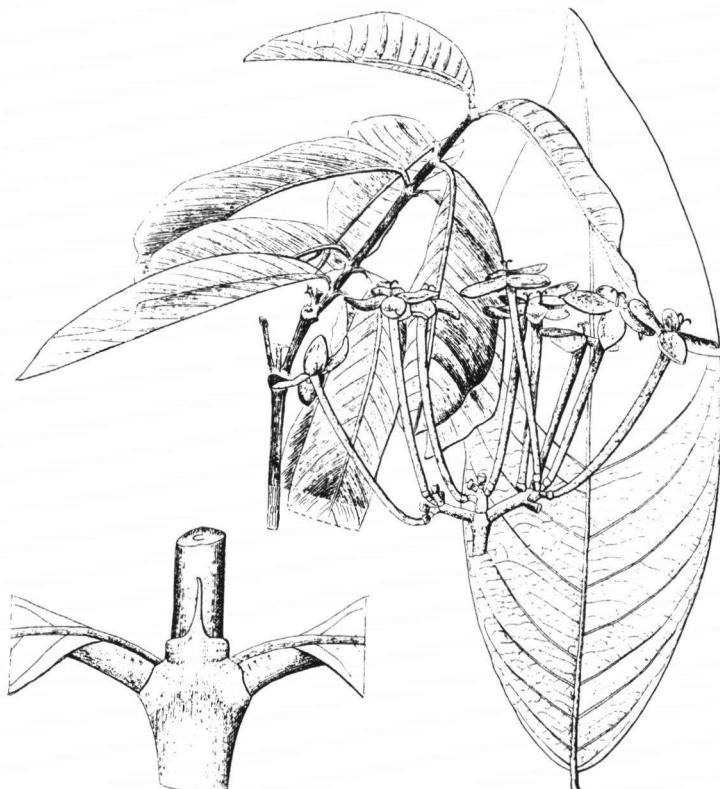


Fig. 142. *Ixora pulcherrima* Teijsm. & Binn., showing habit and intrapetiolar stipule.

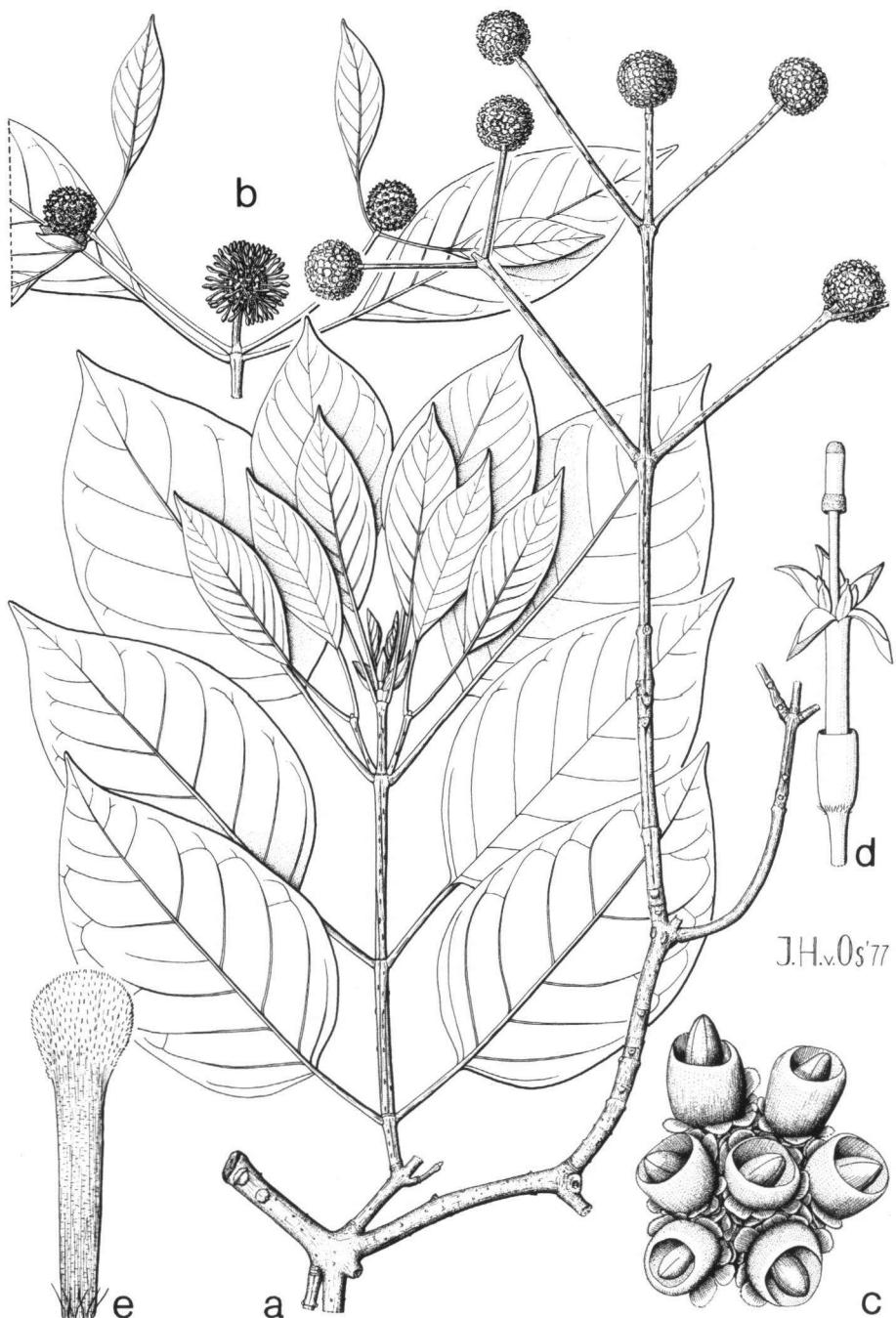


Fig. 143. *Mitragyna tubulosa* (Arn.) Havil.: a. habit; b. flowerheads; c. idem, in detail; d. flower; e. bracteole.



Fig. 144. *Psychotria adenophylla* Wall., showing habit, flower and fruit.

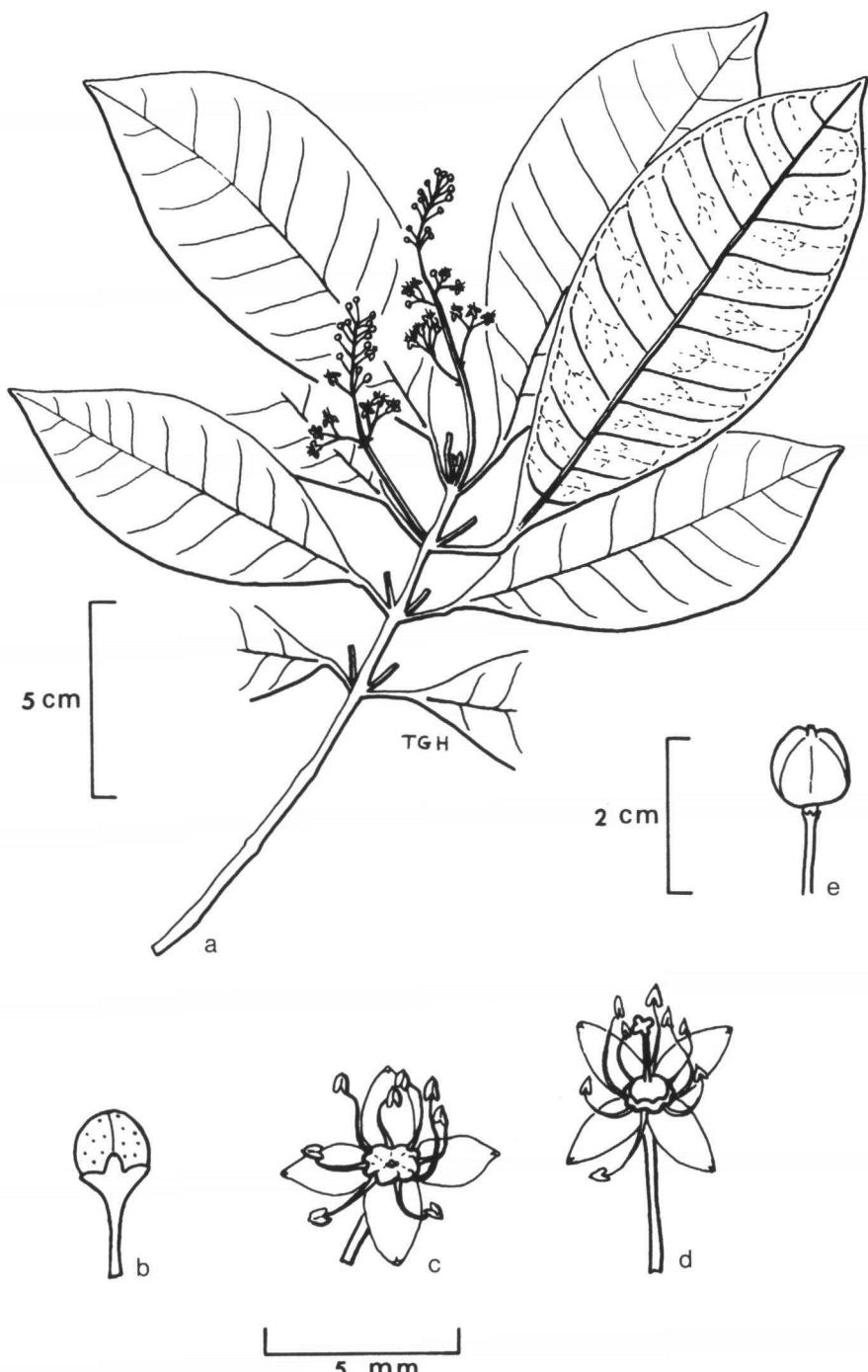


Fig. 145. *Maclurodendron porteri* (Hook. f.) Hartley: a. branch; b. flowerbud; c. staminate flower; d. carpellate flower; e. fruit (Courtesy Gardens' Bull. Singapore).

RUTACEAE

Always: Woody; exstipulate, pellucid dots in leaves (rarely hardly visible); petals free, disk present; ovary superior, 4- or more-locular.

Usually / often: Non-climbing, plants aromatic; leaves compound; flowers hermaphroditic; stigma capitate.

Striking features: Trunk or stem spiny (*Citrus*, *Luvunga*, *Toddalia*, *Zanthoxylum*); fruits and seeds winged (*Tetractomia*); embryo with folded cotyledons (*Micro-melum*); shrubs, leaves simple with stellate indumentum (*Lunasia*).

Different from: *Burseraceae*: no pellucid dots, plants resinous. — *Meliaceae*: rarely pellucid dots, stamens united in a tube. — *Simaroubaceae*: no pellucid dots, carpels usually free.

Distribution: The family widespread, best represented in the tropics. In Malesia 39 genera, incl.:

- *Acronychia* (Indo-Australia), trees, shrubs, lowland and montane rain forest;
- *Citrus* (Indo-Malesia, China), shrubs, treelets; lowland rain forest, often planted;
- *Glycosmis* (Indo-Malesia), shrubs, lowland rain forest, also on limestone;
- *Melicope* (Mascarenes to Polynesia), treelets; lowland and montane rain forest, also secondary forest;
- *Zanthoxylum* (paleotropical), climbers, trees; lowland primary and secondary rain forest, monsoon forest.

Notes: *Rutaceae* occur in a wide range of habitats, including very dry regions and high in the mountains. — Many species useful to man: edible fruits: *Aegle*, *Citrus*, *Fortunella*, *Limonia*; medicinal: *Ruta**; spices: *Citrus*, *Clausena*, *Murraya*, *Zanthoxylum*; ornamentals: *Murraya*, *Skimmia**; timber: *Flindersia*, *Zanthoxylum*.

Literature: J. Swingle, The Citrus Industry (1943); B.C. Stone, Tree Fl. Mal. 1 (1972) 367–387; D.T. Jones, Tree Fl. Sabah & Sarawak 1 (1995) 351–419. — Dr. T.G. Hartley (CANB) is revising the family.

Spot-characters: *Rutaceae* 41, 58, 59, 84 – *Acronychia* 38, 48, 49 – *Aegle* 12, 94 – *Atalantia* 12, 38 – *Boenninghausenia* 50 – *Burkillanthus* 12, 40, 48, 94 – *Citrus* 12, 38, 40 – *Evodia* 38, 40, 48, 49, 70 – *Evodiella* 38, 49 – *Fagara* 40 – *Feronia* 94; *F. elephantum* 12, 40 – *Feroniella lucida* 12 – *Flindersia* 25, 38, 49, 95, 102 – *Geyera* 38 – *Glycosmis* 55 – *Halfordia* 46 – *Hesperethusa* 40; *H. crenulata* 12 – *Limonia* 40 – *Lunasia amara* 25, 26 – *Luvunga* 4, 12 – *Maclurodendron* 38 – *Melicope* 38, 48, 49 – *Merope* 12 – *Merrillia* 40, 94 – *Microcitrus* 38 – *Monanthocitrus* 12 – *Paramignya* 12, 38 – *Pleiospermium* 12, 40 – *Severinia* 67 – *Tetractomia* 14, 38, 48, 52, 98, 102 – *Toddalia* 4, 12, 40 – *Triphasia* 12 – *Zanthoxylum* 4, 12, 38, 40, 85; *Z. ovalifolium* 48.

Illustrations: Fig. 145 & 146.

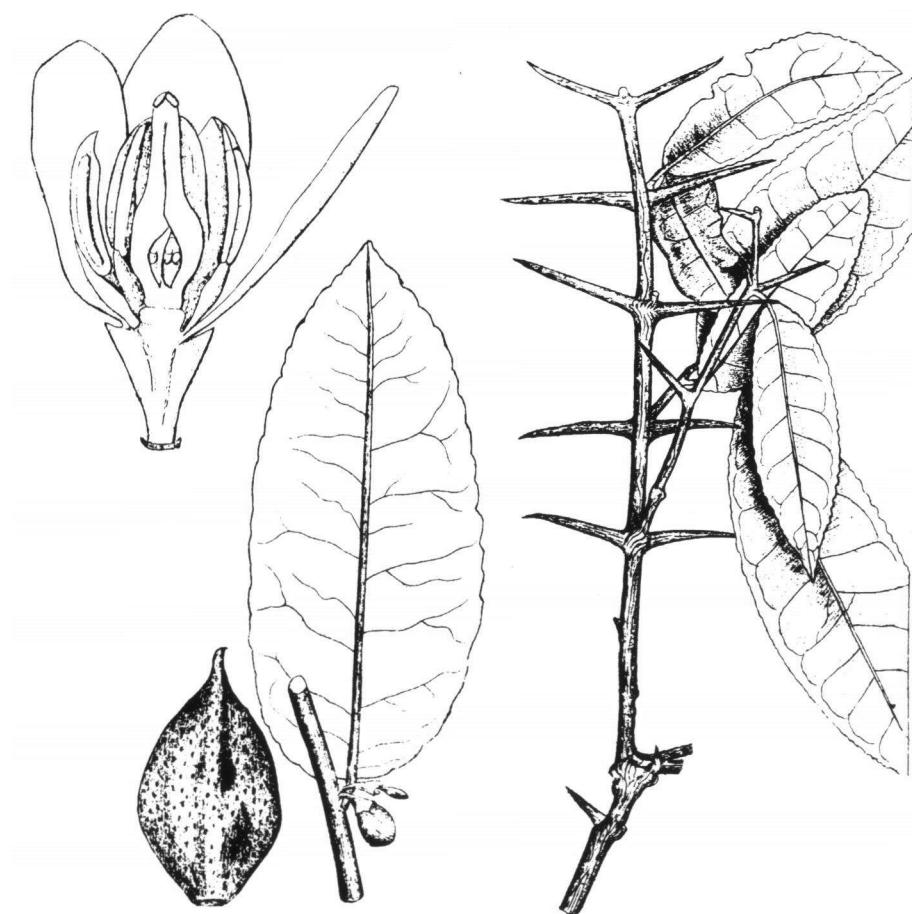


Fig. 146. *Paramignya longispina* Hook. f.

SABIACEAE (MELIOSMACEAE)

Always: Woody; leaves spiral, pinninerved, exstipulate; flowers bisexual, actinomorphic, disk present, ovary superior, fruit a drupe with excentric style.

Usually / often: Leaves, if compound, swollen at nodes, leaflets opposite, margin entire; flowers 5-merous, stamens opposite the petals and these opposite the sepals, in *Meliosma* 3 stamens abortive, ovary 2-locular, fruit with a longitudinal ridge.

Different from: *Anacardiaceae*: resinous, stamens not opposite petals. — *Burseraceae*: resinous, flowers unisexual, stamens not opposite petals. — *Menispermaceae*: venation usually palmate, flowers unisexual. — *Sapindaceae*: leaflets in compound leaves usually alternate; flowers usually unisexual, stamens not opposite petals.

Distribution: Tropics of Asia, and America; in Malesia 2 genera:

- *Meliosma* (Asia–America), trees, leaves usually compound;
- *Sabia* (Indo-Malesia), climbers, simple leaves; both genera in lowland to montane rain forest.

Notes: Affinity of family not clear, often regarded as two separate families: *Meliomaceae* and *Sabiaceae*.

Literature: C.F. van Beusekom & Th.P.M. van de Water, Fl. Males. I, 10 (1989) 679–715.

Spot-characters: *Sabiaceae* 83 – *Meliosma* 42, 52, 78, 82, 85, 93, 99 – *Sabia* 5, 82, 91.

Illustration: Fig. 147.



Fig. 147. *Meliosma veitchiorum* Hemsl.: a. habit; b. flower; c. scale; d. ovary; e. fruit.

SALICACEAE

Always: Shrubs or trees; leaves simple, spiral, dentate; flowers unisexual (plants dioecious), in catkins, perianth absent, ovary superior, 1-locular, ovules several, basal; fruit a capsule, seeds embedded in hairs.

Usually/often: Stipules small or absent.

Different from: *Fagaceae*: fruit cupular.

Distribution: A northern hemisphere family. In Malesia only *Salix* with two species, of which only *S. tetrasperma* truly wild.

Notes: Often found along streams; also planted on dykes and as a fence.

Literature: M. Jacobs, Fl. Males. I, 5 (1954) 107–110.

Spot-characters: 103.

Illustration: Fig. 148.



Fig. 148. *Salix tetrasperma* Roxb.: a & b. habit; c. female inflorescence; d. female flower; e. male flower; f. fruit; g. gall; h. leaf; i. leaf of *S. babylonica* L.

SANTALACEAE

Always: Leaves simple, entire, exstipulate; flowers actinomorphic, simple perianth, stamens isomerous, opposite perianth segments, ovary inferior.

Usually/often: Woody root parasites, leaf venation subpalmate; perianth 4- or 5-lobed.

Striking features: Trees with branched spines on stem, leaves alternate (*Scleropyrum*); trees with opposite leaves, wood aromatic (*Santalum*); leafless root parasites (*Phacellaria*).

Different from: *Olacaceae*: calyx and corolla, ovary usually superior. — *Loranthaceae* and *Viscaceae*: stem parasites.

Distribution: The family world-wide. In Malesia 9 genera, incl.:

- *Dendrotrophe* (Indo-Malesia, Pacific), climber, lowland and lower montane forest;
- *Exocarpus* (Indo-Malesia, Pacific), shrubby root parasite with phyllocladia;
- *Santalum* (East Malesia, Pacific, Australia), trees, monsoon forest.

Notes: *Santalum album* (and other species of *Santalum*) yields the scented sandal-wood, and is often planted for that purpose.

Literature: B.H. Danser, Nova Guinea n.s. 4 (1940) 133–149; R. Pilger, in Engler, Nat. Pflanzenfam. ed. 2, 16b (1935) 52–91; H.U. Stauffer, Revisio Anthobolearum, Mitt. Bot. Mus. Zürich 213 (1959).

Spot-characters: *Santalaceae* 59, 79, 92 – *Cladomyza* 11 – *Dendromyza* 11, 54 – *Dufrenoya* 11 – *Exocarpos* 11 – *Phacellaria* 8, 11 – *Santalum* 11, 54 – *Scleropyrum* 11, 12 – *Thesium* 11.

Illustration: Fig. 149.

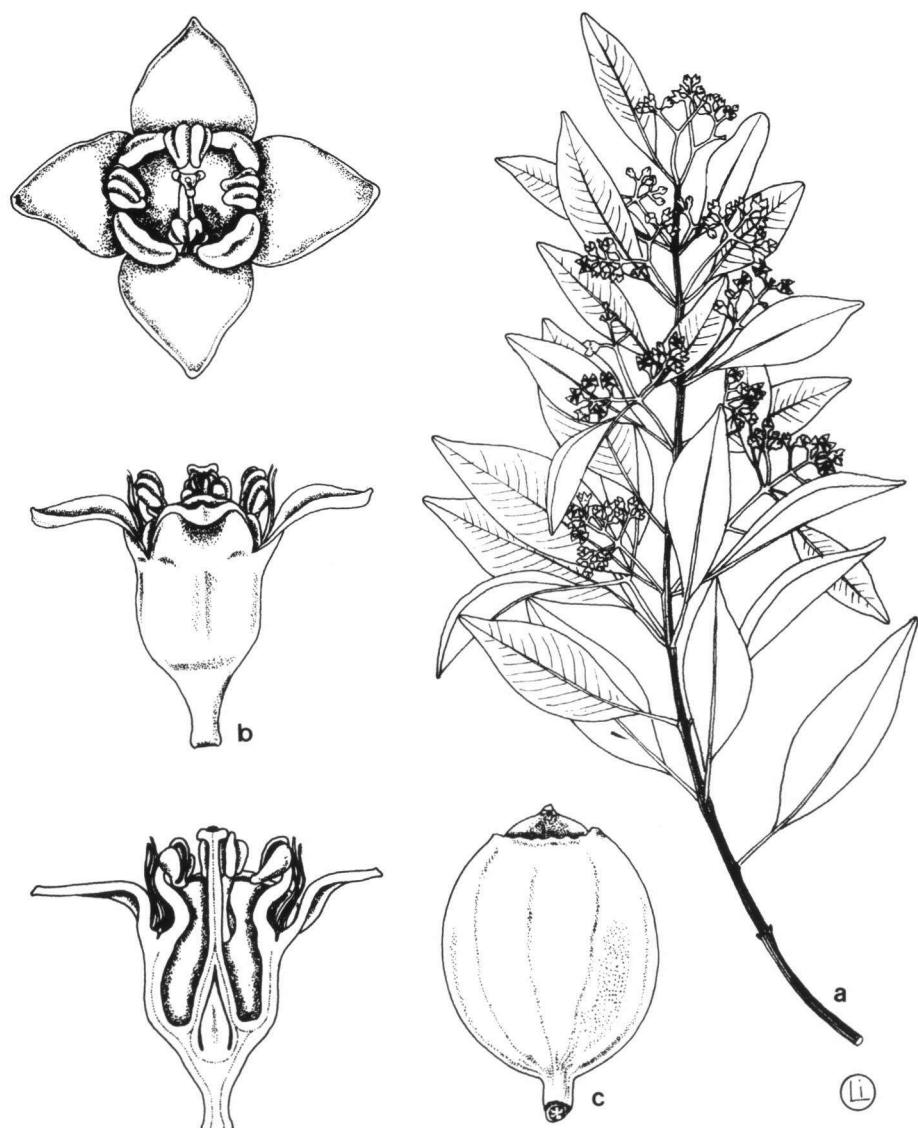


Fig. 149. *Santalum album* L.: a. habit; b. flower; c. fruit.

SAPINDACEAE

Always: Woody, non-climbing (see notes); leaves spiral; ovary superior, stamens free.

Usually / often: Leaves paripinnate, leaflets alternate, rachis tip free, exstipulate; flowers unisexual, plants monoecious or dioecious; disk extrastaminal; seeds with fleshy sarcotesta or aril; style excentric; petals with appendages inside; ovary 3-locular, 1 ovule per cell.

Striking features: Herbaceous climber (*Cardiospermum**); leaves bipinnate (*Tristiropsis*); pseudo-stipules (*Lepisanthes*, *Pometia*, *Rhysotoechia*); leaves simple, glandular, fruits winged (*Dodonaea*); leaves trifoliolate (not always) (*Allophylus*, *Atalaya*, *Paranephelium*); leaves with black glands below (*Xerospermum*); leaves imparipinnate (some *Lepisanthes*, *Paranephelium*, *Sapindus*).

Different from: *Anacardiaceae*: black sap, resinous ducts with on the outside wavy sclerenchymatous ring in bark. — *Burseraceae*: resinous, leaves imparipinnate, 2 ovules per cell, wavy ring as in *Anacardiaceae*. — *Meliaceae*: stamens united, leaves rarely ending in free rachis tip.

Distribution: The family world-wide, but chiefly tropical. In Malesia 37 genera, incl.:

- *Allophylus* (pantropical), shrubs; primary and secondary rain forest;
- *Dodonaea* (pantropical, chiefly Australia), shrubs, trees, open places in lowland and montane rain forest;
- *Harpullia* (Indo-Australia), trees; rain forest;
- *Lepisanthes* (Indo-Malesia), treelets, lowland rain forest;
- *Nephelium* (Indo-Malesia), trees; lowland rain forest, often planted;
- *Pometia* (Indo-Malesia, Pacific), trees; lowland rain forest;
- *Xerospermum* (Indo-Malesia), trees; lowland rain forest.

Notes: The family is well represented in Malesian lowland rain forest; the fruits of many species are eaten by various animals. Apart from the introduced *Cardiospermum* none of the Malesian members is climbing, whereas the large South American genera *Paullinia* and *Serjania* are lianas. — Several species useful for man: edible fruits: *Blighia**, *Dimocarpus*, *Glenniea*, *Lepisanthes*, *Litchi** (p.p.), *Nephelium*, *Pometia*, *Xerospermum*; timber: *Pometia*; ornamental: *Filicium**, *Lepisanthes*; cleaning: *Sapindus*.

Literature: L. Radlkofer, Pflanzenreich Heft 98 (1931–34); S.K. Yap, Tree Fl. Mal. 4 (1989) 434–461; F. Adema, P.W. Leenhouts & P.C. van Welzen, Fl. Males. I, 11 (1994) 419–768; Tree Fl. Sabah & Sarawak 2 (1996) 263–374..

Spot-characters: *Sapindaceae* 25, 30, 41, 56, 58, 82, 89, 91, 104 – *Allophylus* 48 – *Amesiodendron* 101 – *Atalaya* 98 – *Cardiospermum* 4 – *Cubilia* 95 – *Dictyoneura* 40 – *Dimocarpus* 31, 95 – *Dodonaea* 22, 26, 59, 98 – *Filicium* 40 – *Ganophyllum* 26 – *Glenniea* 94 – *Guioa* 40, 59, 98, 101 – *Harpullia* 40, 101; *H. myrmecophila* 9 – *Jagera* 10, 29, 46 – *Lepisanthes* 37, 40, 70, 101 – *Litchi* 28, 95 – *Mischocarpus* 59

– *Nephelium* 21, 95 – *Paranephelium* 95, 101 – *Pometia* 21, 31, 37 – *Sapindus* 40
 – *Sarcopteryx* 59, 98 – *Schleichera* 27, 95 – *Trigonachras* 31, 101 – *Tristira* 98 –
Tristiropsis 50 – *Xerospermum* 31, 95 – *Zollingeria* 98.

Illustrations: Fig. 150 & 151.

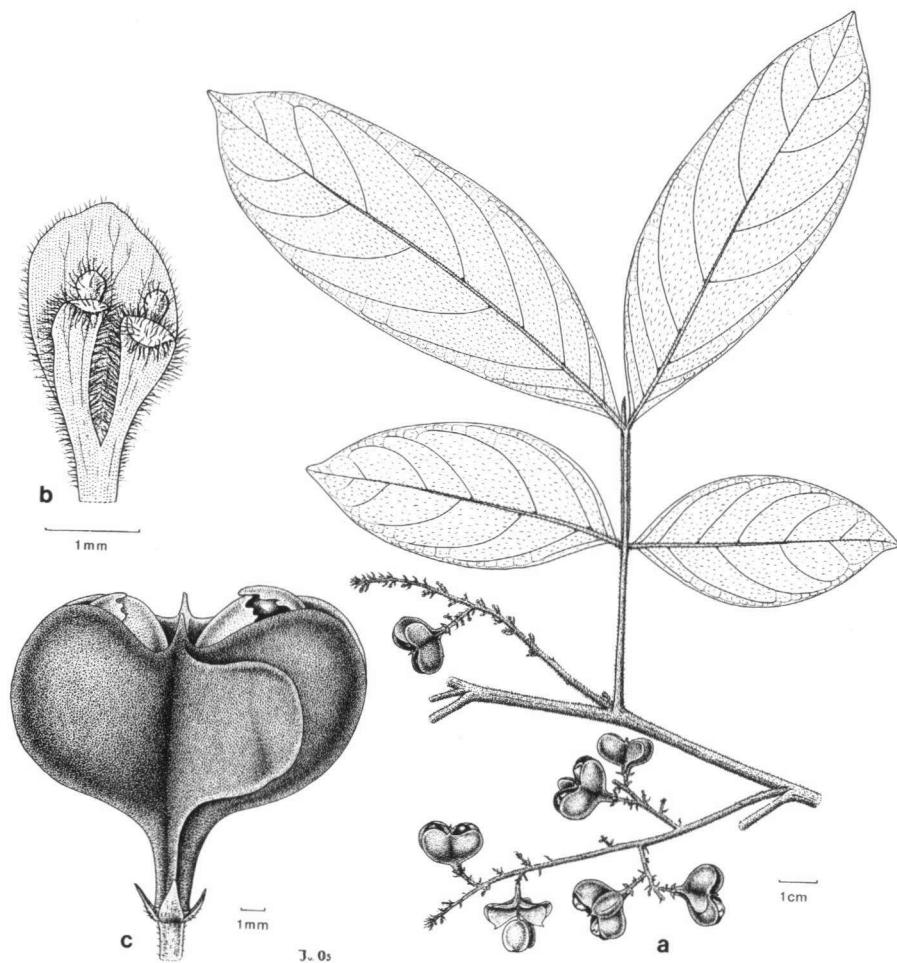


Fig. 150. *Guioa pleuropteris* (Blume) Radlk.: a. fruiting branch; b. petal; c. fruit.

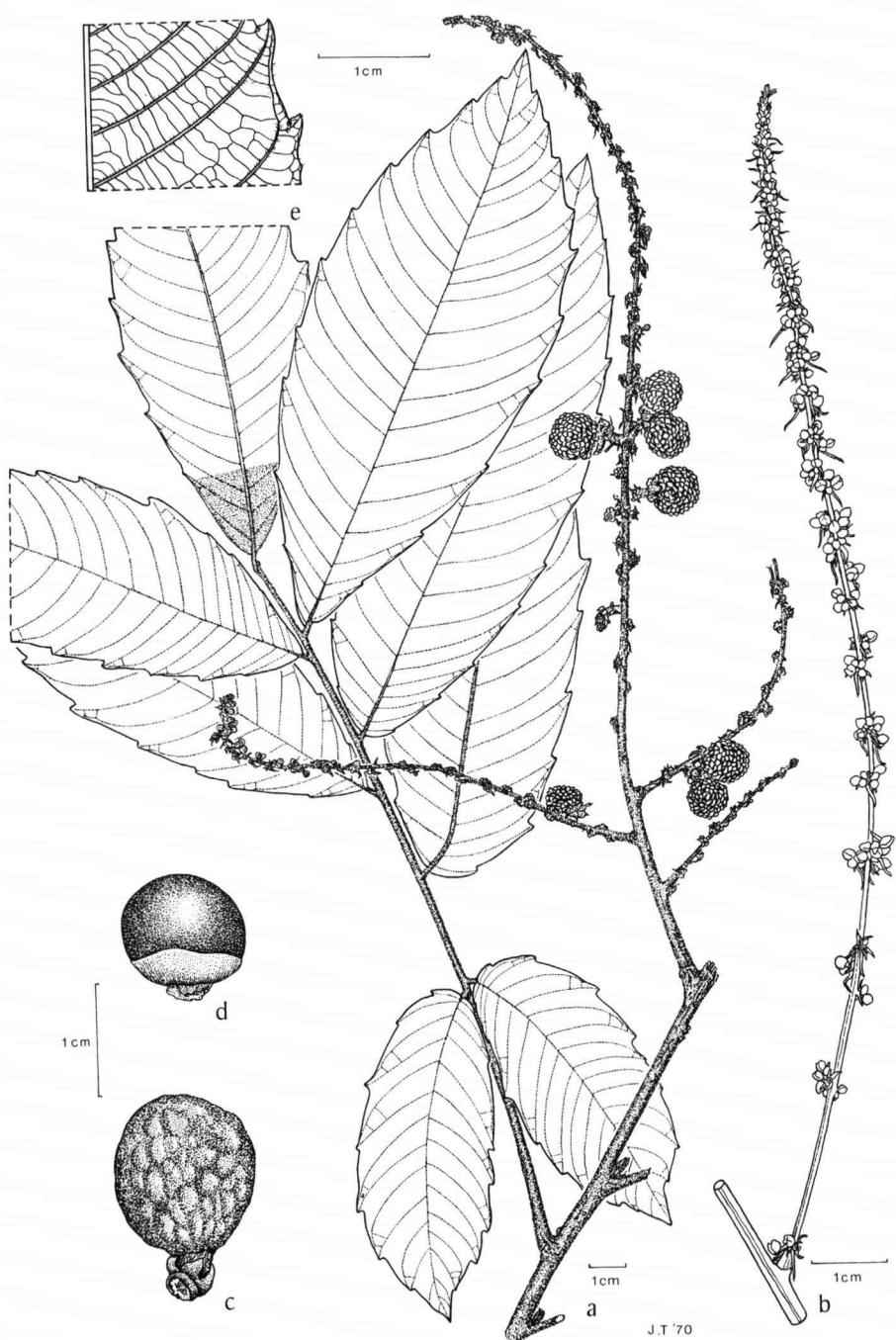


Fig. 151. *Dimocarpus dentatus* Leenah.: a. fruiting branch; b. inflorescence; c. fruit; d. seed; e. detail of leaf.

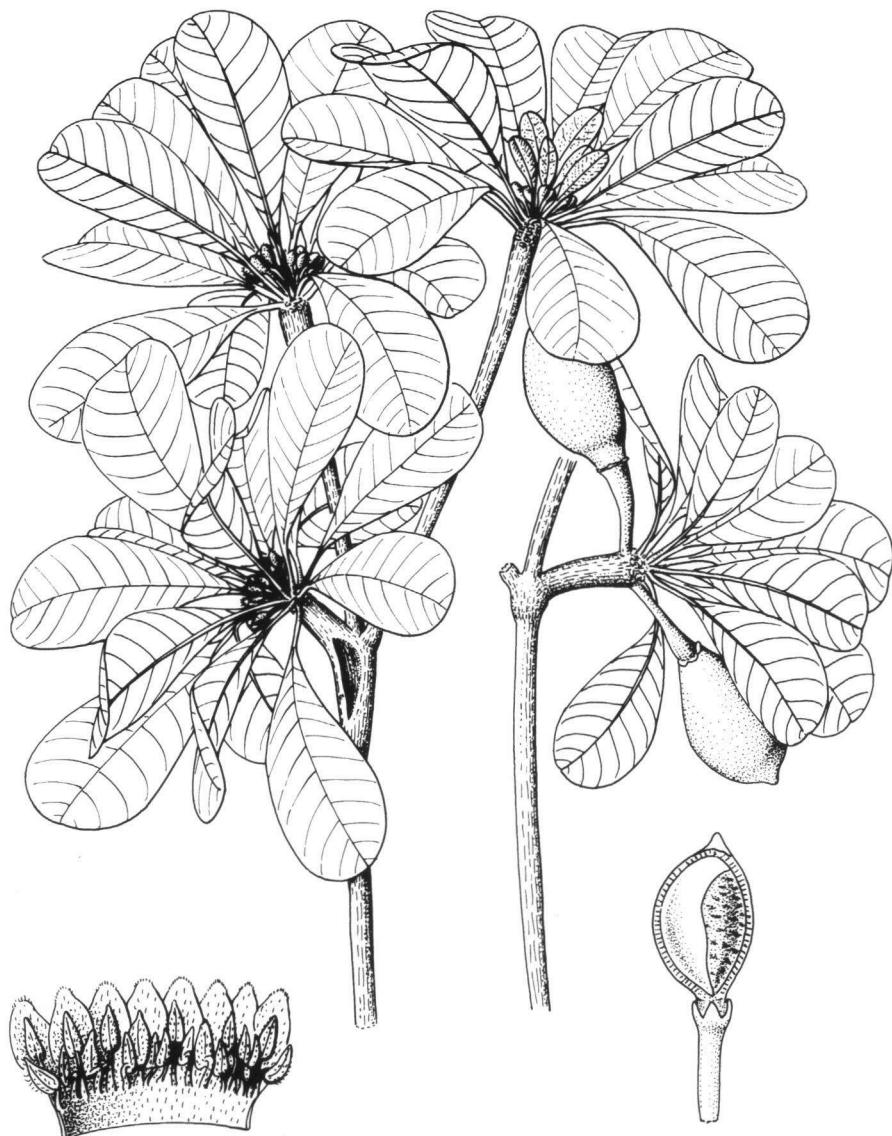


Fig. 152. *Madhuca crassipes* (Pierre) H.J. Lam, showing habit and detail of flower and fruit.

SAPOTACEAE (SARCOSPERMACEAE)

Always: Woody; milky sap, at least in some organ; leaves simple, entire; indumentum, if present, of balance hairs with unequal arms; no extrafloral glands; flowers actinomorphic, sympetalous; ovary superior, 1 ovule per cell, 1 style; seed with brown shining testa.

Usually/often: Leaves spiral, stipulate; indumentum golden to brown; inflorescence an axillary fascicle; flowers hermaphroditic; alternipetalous stamens sterile; disk present (often adnate to ovary); fruit a berry, very hard when dry; seed with a large scar.

Striking features: Leaves opposite, branched inflorescence (*Sarcosperma*); shining part of testa very small (*Burckella*, *Pouteria*); sepals 2 rows of 3 (*Palaquium*); sepals 5, quincuncial (*Planchonella*, also in *Pouteria*); sepals 2 rows of 2 (*Ganua*, *Madhuca*, also in *Payena*); cauliflorous (*Aulandra*, *Magodendron*).

Different from: *Ebenaceae*: no milky sap, no balance hairs, bark and dried leaves often blackish, flowers unisexual. — *Myrsinaceae*: leaves with dark dots, exstipulate.

Distribution: The family pantropical. In Malesia 17 genera, incl.:

- *Madhuca* (Indo-Australia), trees of lowland and mid-montane forest;
- *Palaquium* (Indo-Malesia, Pacific), trees of lowland and mid-montane rain forest, also in swamp forest;
- *Planchonella* (Indo-Australia), trees rarely shrubs, mostly lowland rain forest.

Notes: *Sarcosperma* is often regarded as a separate family (Lam, 1948). — Several good timber trees (Nyatoh): *Palaquium*, *Planchonella*, *Madhuca*; latex (gutta percha): *Palaquium*. — Edible fruits: *Manilkara achras**; *M. kauki*, *Chrysophyllum cainito**; *Pouteria cainito**; some species of *Palaquium* and *Madhuca*. — Ornamental tree: *Mimusops elengi*.

Literature: H.J. Lam, Bull. Jard. Bot. Buitenzorg III, 7 (1925) 1–289; Fl. Males. I, 4 (1948) 32–34. Revisions in Blumea 1930–1962 by several authors; F.S.P. Ng. Tree Fl. Mal. 1 (1972) 388–439; T.D. Pennington, The genera of Sapotaceae, Roy. Bot. Gard. Kew (1991) xi + 295 pp.

Spot-characters: Sapotaceae 19, 25, 33, 45, 57, 65, 68, 71, 83 – *Aulandra* 53, 70 – *Chrysophyllum* 26, 67 – *Ganua pallida* 46 – *Madhuca* 85; *M. sessilis* 46 – *Magodendron* 70 – *Manilkara* 14 – *Mimusops* 67 – *Palaquium* 14, 26, 67, 79 – *Payena* 26, 67 – *Planchonella* 26; *P. keyensis* 70; *P. punctata* 12 – *Pouteria* 14 – *Sarcosperma* 31, 58, 60, 83.

Illustrations: Fig. 152–155.

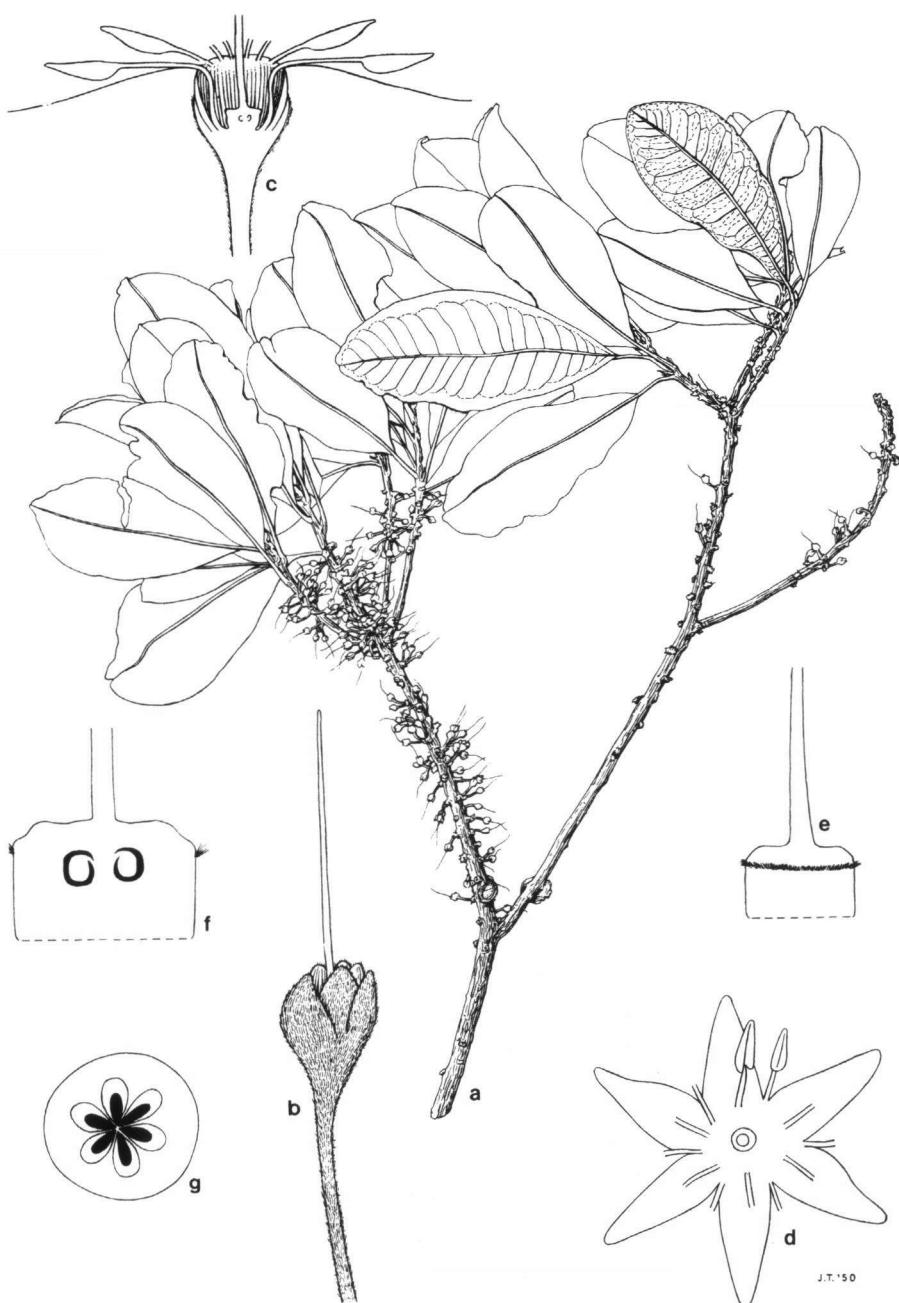


Fig. 153. *Palaquium brassii* H.J. Lam: a. habit; b-f. details of flower; g. CS of fruit.

J.T. '50



Fig. 154. *Payena lucida* DC.: a & d. flowering branch; b, c, e. flower; f. stamens; g. ovary.

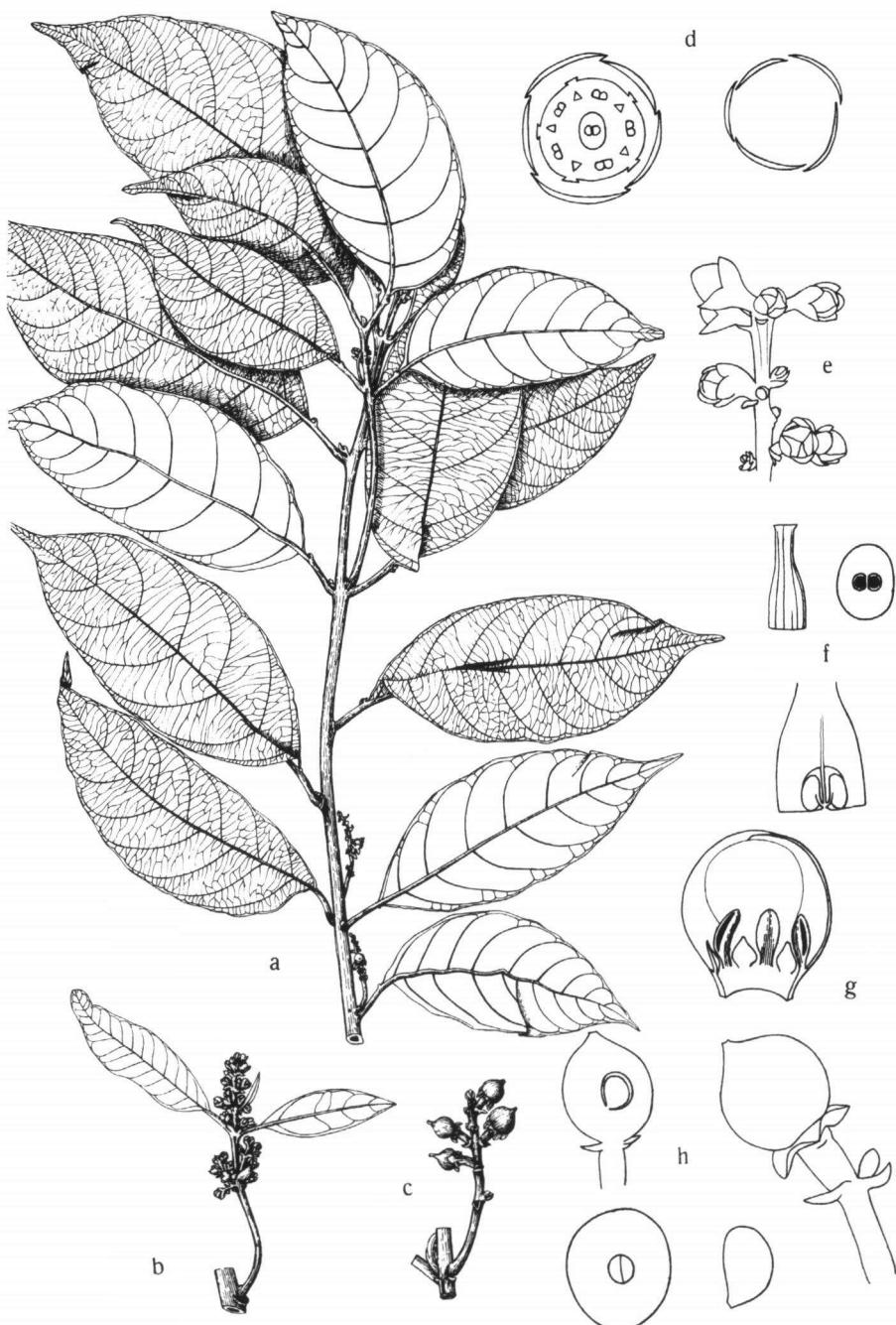


Fig. 155. *Sarcosperma breviracemosum* H.J. Lam: a. habit; b & c. inflorescence; d-g. detail of flower; h. fruit.

SAXIFRAGACEAE

(ESCALLONIACEAE, HYDRANGEACEAE, ITEACEAE, PARNASSIACEAE)

Always: Flowers actinomorphic, disk present.

Usually/often: Woody; leaves simple, exstipulate, serrate/dentate, ovary (semi-)inferior, fruit many-seeded, 2–5 distinct styles.

Striking features: Herb with compound leaves, apocarpous (*Astilbe*); trees/shrubs, opposite simple leaves, 1 style, fruit 1-seeded (*Polyosma*); trees/climbers, leaves with gland dots, often with scales (*Quintinia*).

Different from: *Cunoniaceae*: leaves always opposite, stipulate. — *Rosaceae*: stipulate, ovary superior.

Distribution: World-wide; in Malesia 9 genera, incl.:

- *Polyosma* (Indo-Australia), trees, mostly montane forest;
- *Quintinia* (East Malesia, Australia, Pacific), shrubs or trees, rarely climbers; montane to subalpine forest.

Notes: A heterogeneous family; several genera have been placed in different families.

— Some introduced ornamentals; indigenous species with ornamental potential: *Dichroa*, some *Polyosma*.

Literature: C.A. Backer & R.C. Bakhuizen van den Brink, Fl. Java 1 (1963) 202–203, 506–509; T. Shimizu & M.T. Kao, Fl. Taiwan 3 (1977) 25–51; L.G. Saw, Tree Fl. Mal. 4 (1989) 462–469.

Spot-characters: *Saxifragaceae* 92 – *Astilbe* 50 – *Carpodetus* 52 – *Deutzia* 25, 26 – *Dichroa* 93 – *Hydrangea* 6, 25 – *Itea* 89 – *Polyosma* 31, 55, 59, 89, 93, 105; *P. verticillata* 46 – *Quintinia* 22, 26.

Illustration: Fig. 156.

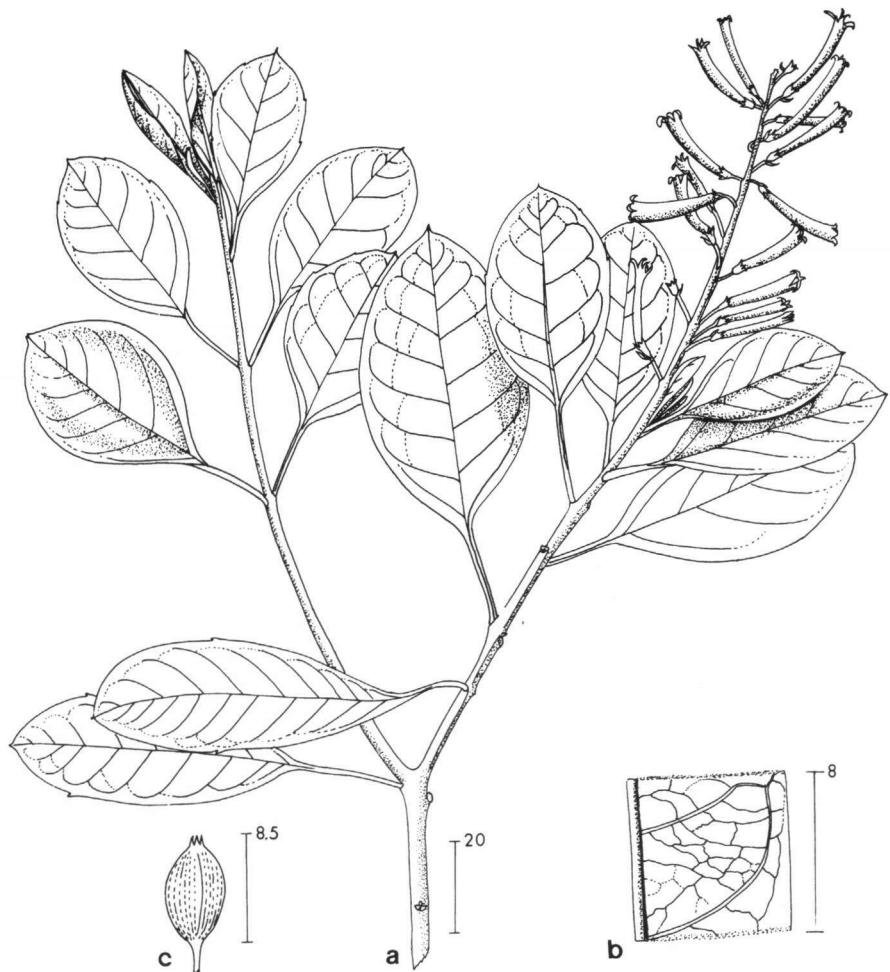


Fig. 156. *Polyosma cestroides* Schltr.: a. habit; b. detail of venation; c. fruit.

SIMAROUBACEAE (IRVINGIACEAE, SURIANACEAE)

Always: Woody; leaves spiral; petals free, ovary superior, disk present.

Usually/often: Non-climbing; plants with bitter taste; exstipulate, leaves glandular; flowers (functionally) unisexual, ovary deeply lobed to apocarpous, 1 ovule per cell.

Striking features: Leaves simple, fruit flat obovate (*Soulamea*); leaves simple, stipule cigar-shaped, leaving annular scar (*Irvingia*); leaves pinnate with large glands at base of leaflets (*Ailanthus*); thorny scramblers (*Harrisonia*).

Different from: *Meliaceae*: stamens mostly united into a tube, plants rarely with bitter taste, ovary not deeply lobed. — *Rutaceae*: plants aromatic, leaves with pellucid dots.

Distribution: The family pantropical. In Malesia 11 genera, incl.:

- *Ailanthus* (Indo-Australia), trees, lowland and montane rain forest;
- *Eurycoma* (Southeast Asia, West Malesia), treelets, lowland rain forest;
- *Irvingia* (Africa, Southeast Asia, West Malesia), tree, lowland rain forest.

Notes: *Irvingia* and *Suriana* are also regarded as families in their own right, *Allantospermum* is also placed in *Ixonanthaceae*. — Several species used medicinally: *Brucea*, *Eurycoma*, *Harrisonia*, *Quassia*. — Ornamentals: *Ailanthus*, *Quassia*. — Timber: *Irvingia*.

Literature: H.P. Nooteboom, Fl. Males. I, 6 (1962) 193–226, 968–972.

Spot-characters: *Simaroubaceae* 58 – *Ailanthus* 31, 79, 98 – *Allantospermum* 99, 101 – *Brucea* 31 – *Eurycoma* 10, 42, 57, 78, 79 – *Harrisonia* 4, 12, 48, 85; *H. perforata* 40 – *Irvingia* 33, 36, 68 – *Picrasma* 37, 42 – *Quassia* 70, 79, 99; *Q. amara* 40; *Q. indica* 31, 78, 98 – *Soulamea* 31, 79, 98 – *Suriana* 91.

Illustrations: Fig. 157 & 158.

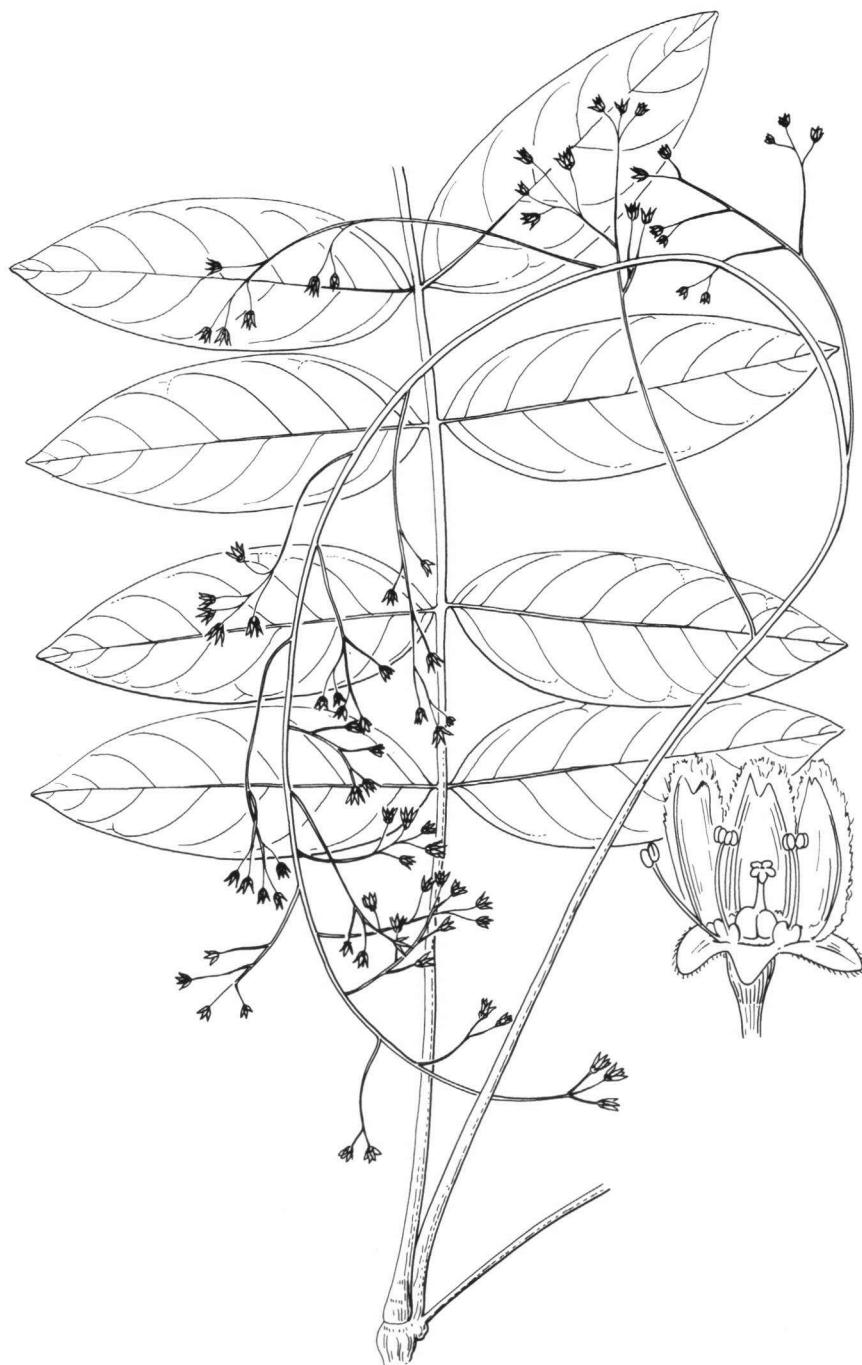


Fig. 157. *Eurycoma longifolia* Jack, showing flowering branch and detail of flower.

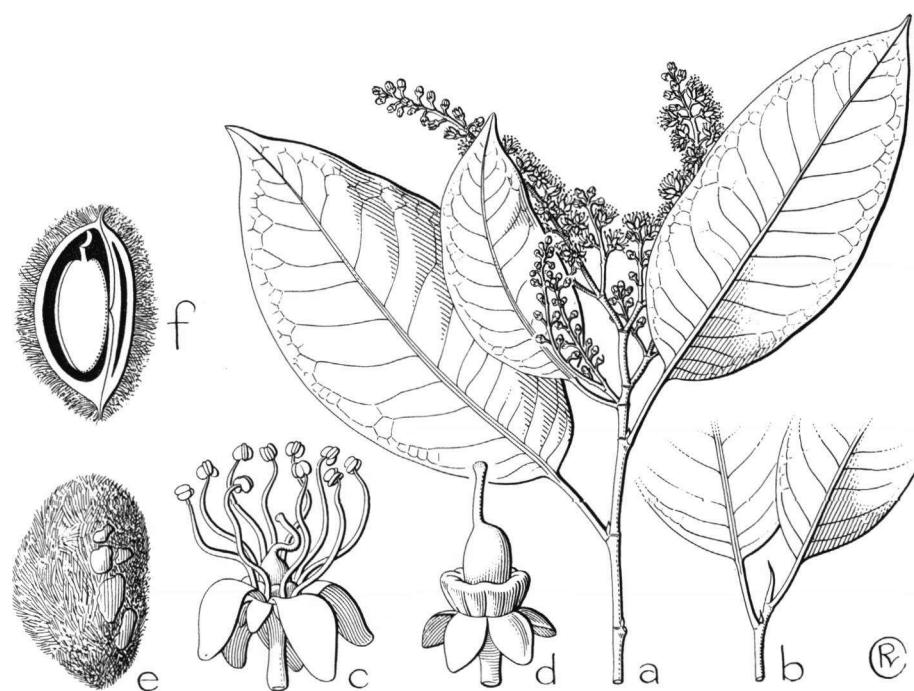


Fig. 158. *Irvingia malayana* Oliv. & Benn.: a & b. habit; c. flower; d. ovary and disk; e. LS of fruit.

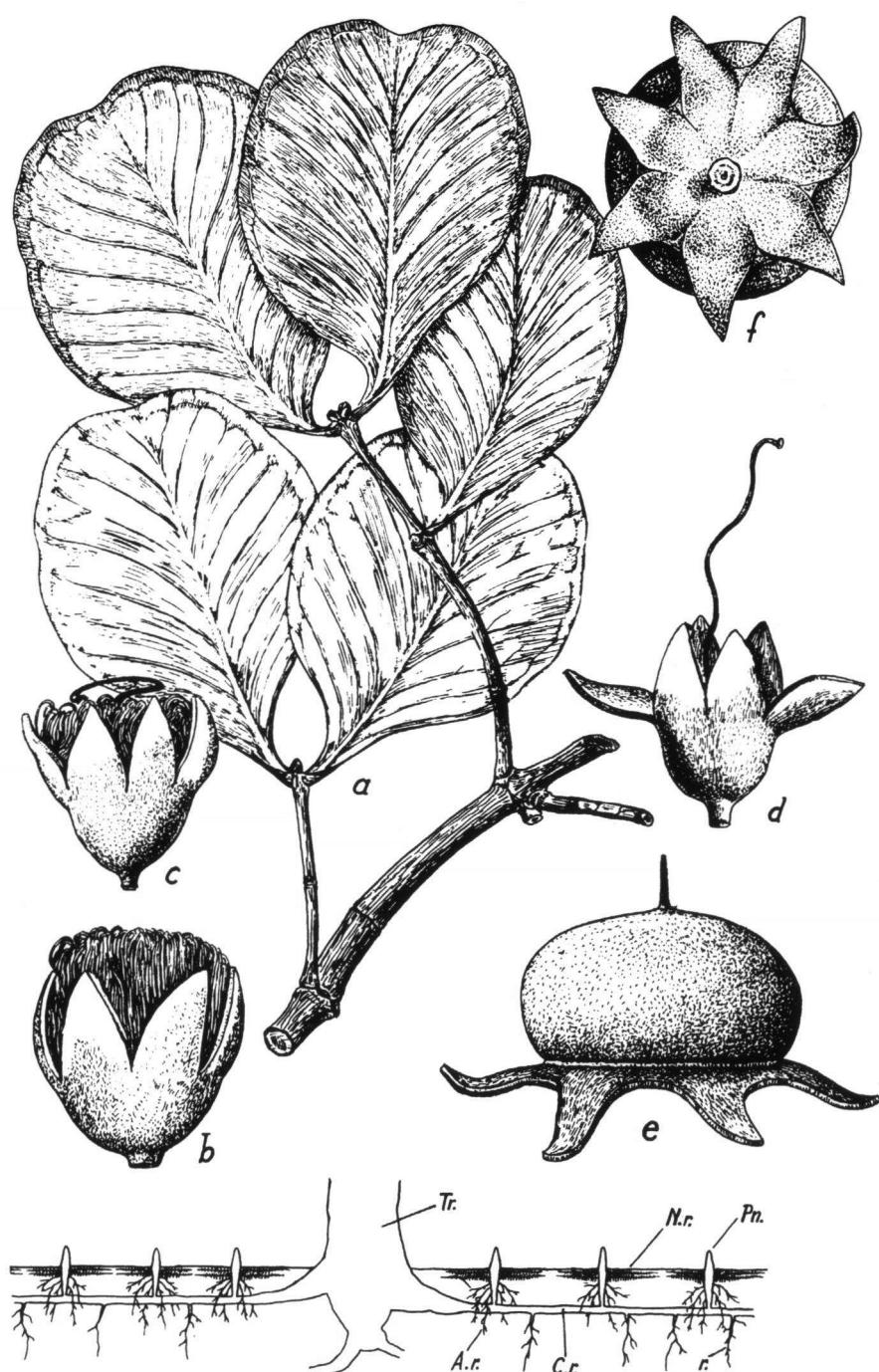


Fig. 159. *Sonneratia griffithii* Kurz: a. habit; b & c. flowers; d-f. fruits and root system.

SONNERATIACEAE

Always: Trees; leaves opposite, simple, entire, exstipulate; flowers hermaphroditic, actinomorphic, calyx lobes valvate, inflexed in bud; ovary superior, 4- or more-celled, fruit broadly attached to persistent calyx, seeds numerous.

Usually / often: Inflorescence terminal; stamens numerous, style 1 with capitate stigma.

Different from: *Crypteroniaceae*: ovary inferior and/or seeds winged. — *Lythraceae*: fruit base not fused with calyx, nodes not thickened.

Distribution: A family of 2 genera:

- *Duabanga* (Indo-Malesia), inland primary and secondary forest, fruit a capsule;
- *Sonneratia* (East Africa to Queensland and Fiji), mangrove trees with pneumatophores, fruit a dry berry.

Notes: *Sonneratiaceae* have sometimes been united with *Crypteroniaceae*, *Lythraceae* and *Myrtaceae*. — Flowers pollinated by bats, fruit of *Sonneratia* eaten by mammals, the seeds are buoyant, the tiny seeds of *Duabanga* are wind-dispersed; some local use as timber.

Literature: C. A. Backer & C. G. G. J. van Steenis, Fl. Males. I, 4 (1951) 280–289; I, 6 (1972) 973–976.

Spot-characters: *Duabanga* 65, 100 – *Sonneratia* 16.

Illustration: Fig. 159.



Fig. 160. *Sphenostemon papuanus* (Lauterb.) Steenis.

SPHENOSTEMONACEAE

Always: Woody; leaves simple, pinnerved, exstipulate; flowers 4-merous, actinomorphic, bisexual; petals absent (in Malesia), disk absent, ovary superior, 2-celled, each with 1 apical ovule, sessile stigma.

Usually / often: Trees; leaves subopposite or whorled, coriaceous, glandular dentate.

Different from: *Guttiferae*: yellow or milky sap, leaves entire. — *Aquifoliaceae*: petals present, ovary 3- to many-celled.

Distribution: The only genus, *Sphenostemon*, occurs in East Malesia (Moluccas, New Guinea), East Australia and New Caledonia; in Malesia 3 species, montane rain forest.

Notes: *Sphenostemon* has been placed in various families.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 10 (1986) 145–149.

Spot-characters: 46, 88.

Illustration: Fig. 160.



Fig. 161. *Turpinia borneensis* (Merr. & Perry) Linden: a. habit; b. open nerves and venation; c & d. flower; e. fruit; f. stamen.

STAPHYLEACEAE

Always: Trees; leaves decussate, dentate, small glands on top of rachis, stipules fused leaving an annular scar; flowers bisexual, actinomorphic, 5-merous; sepals and petals free, imbricate; disk present, ovary superior; fruit a drupe.

Usually/often: Leaves pinnate (leaflets 3–11), rachis swollen at nodes; ovary 3-celled.

Different from: *Bischofia* (*Euphorbiaceae*): leaves spiral, small stipules. — *Sambucus* (*Caprifoliaceae*): sympetalous, ovary inferior. — *Cunoniaceae*: stamens in two rows, ovary usually 2-locular.

Distribution: A mainly northern hemisphere family; in Malesia only *Turpinia* (East Asia, Malesia), lowland and montane rain forest.

Notes: Whitmore (1972) has placed *Bischofia* in the family *Staphyleaceae*.

Literature: B.L. van der Linden, Fl. Males. I, 6 (1960) 49–59; T.C. Whitmore, Tree Fl. Mal. 1 (1972) 446–448.

Spot-characters: *Turpinia* 32, 48, 49, 104; *T. stipulacea* 37.

Illustration: Fig. 161.

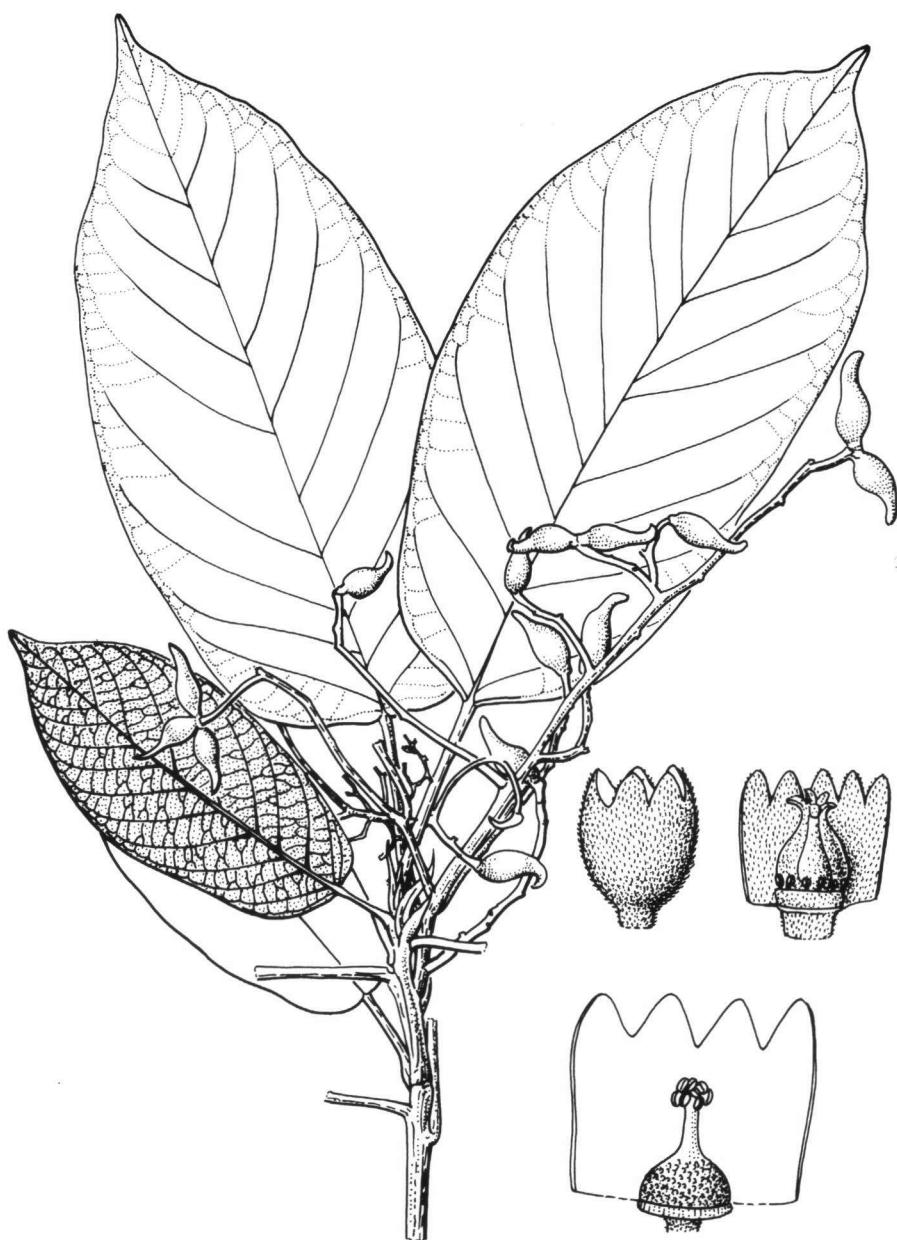


Fig. 162. *Heritiera macrophylla* Wall. ex Kurz, showing habit and detail of flower (Courtesy Reinwardtia, Bogor).

STERCULIACEAE (BYTTNERIACEAE)

Always: Stipulate, leaves alternate, basal nerves; flowers actinomorphic, 5-merous; petals (if present) free, stamens connate, ovary superior.

Usually / often: Woody, non-climbing; leaves simple; stellate hairs or scales; petiole thickened at base and apex (bipulvinate); androgynophore present; stamens few.

Striking features: Climbers with spiny fruits (*Byttneria*); fruit winged (incl. samara) (some *Heritiera*, *Firmiana*, *Pterocymbium*, *Scaphium*); seeds winged (*Pterospermum*, *Pterygota*); leaves palmately compound (some *Heritiera*, some *Sterculia*); fruit twisted (*Helicteres*); fruit an inflated, thin-walled capsule (*Kleinhowia*).

Different from: *Bombacaceae*: stamens numerous, seeds arillate. — *Malvaceae*: many stamens, united in a long tube. — *Tiliaceae*: stamens usually numerous, nearly always free.

Distribution: The family pantropical. In Malesia 20 genera, incl.:

- *Heritiera* (paleotropics), trees, mostly lowland rain forest;
- *Pterospermum* (Indo-Malesia), trees, mostly open places in lowland rain forest;
- *Scaphium* (West Malesia), trees, lowland rain forest;
- *Sterculia* (pantropical), trees, rarely shrubs, lowland and montane, primary, secondary and seasonal forest.

Notes: The family is represented in a variety of habitats; several species are weedy. —

Some useful to man: medicinal use: *Scaphium*; stimulants: *Coca**, *Theobroma**; chocolate products: *Theobroma**; edible seed: some *Scaphium* and *Sterculia*; ornamentals: *Dombeya**, *Sterculia*; timber: *Heritiera*, *Scaphium*.

Literature: K. M. Kochummen, Tree Fl. Mal. 2 (1972) 353–382; I. G. M. Tantra, Peng. Lemb. Penel. Hutan 102 (1976) 1–192 (*Sterculia*).

Spot-characters: *Sterculiaceae* 25, 58, 83, 84, 99 – *Abroma* 29, 72 – *Brachychiton* 29, 38, 64 – *Byttneria* 5, 38, 95 – *Commersonia* 64, 72, 95 – *Firmiana* 8, 14, 38, 98 – *Heritiera* 26, 36, 38, 48, 98 – *Hildegardia* 8, 98 – *Kleinhowia* 98 – *Leptonychia* 64 – *Pterocymbium* 98 – *Pterospermum* 26, 51, 53, 70 – *Pterygota* 102 – *Reevesia* 38 – *Scaphium* 38, 53, 98 – *Sterculia* 8, 10, 14, 38, 48, 51, 53, 64, 70; *S. foetida* (fl.) 24 – *Theobroma* 38, 70.

Illustrations: Fig. 162 & 163.

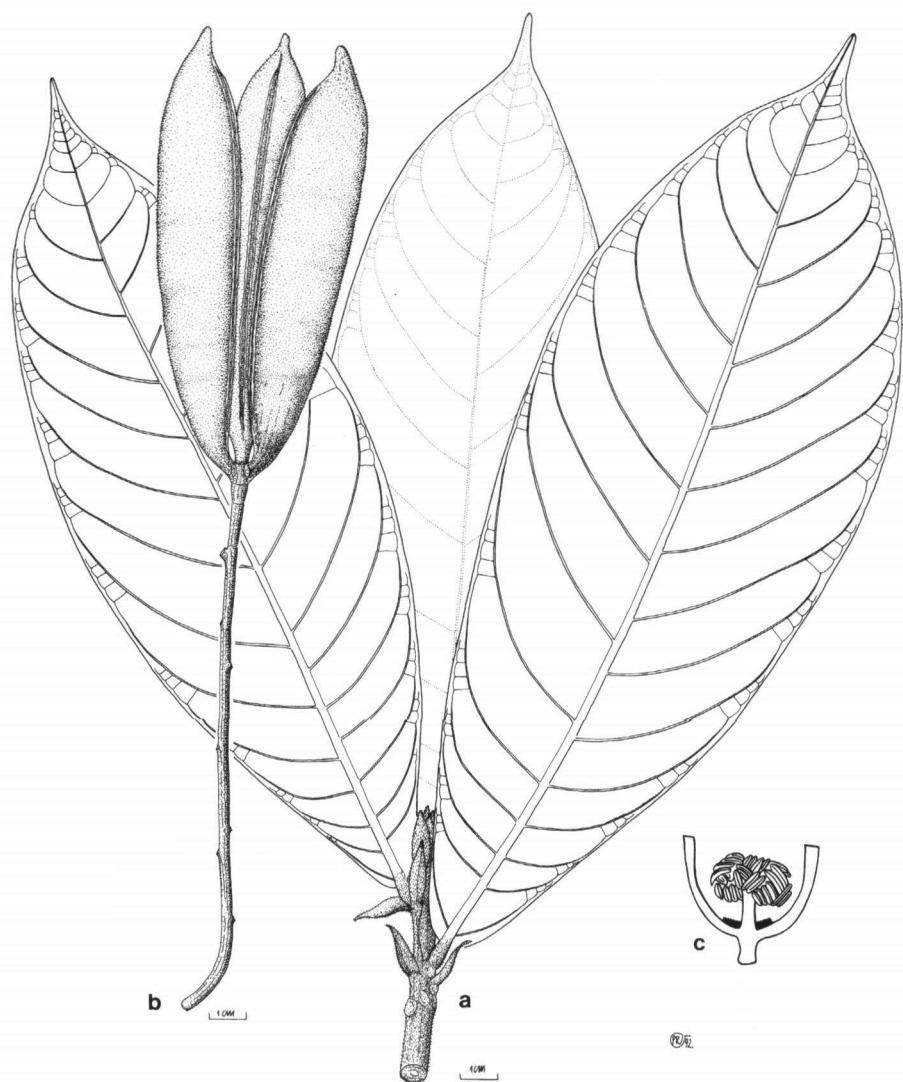


Fig. 163. *Sterculia stipulata* Korth.: a. habit; b. fruit (Courtesy Dr. P.J.A. Keßler); c. flower of *S. schlechteri* Mildbr. in LS.

STYRACACEAE

Always: Trees; leaves spiral, simple, pinninerved, exstipulate; flowers bisexual, actinomorphic, disk absent.

Usually / often: Stellate hairs; leaves whitish beneath, corolla tubular, lobes 4–7, stamens as many or twice as many as corolla lobes, adnate to tube, ovary superior, 3–5-celled, fruit a 1-seeded capsule; plants often galled.

Different from: *Symplocaceae*: no stellate hairs; stamens numerous, ovary inferior.

Distribution: Mainly a northern hemisphere family; in Malesia 2 genera:

- *Bruinsmia* (Malesia), montane forest;
- *Styrax* (northern hemisphere, in Malesia east to New Guinea), lowland monsoon and everwet forest.

Notes: Some species of *Styrax* produce an aromatic resin (menyan) and are cultivated for that reason.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 4 (1949) 49–55.

Spot-characters: *Styracaceae* 58 – *Bruinsmia* 26, 84 – *Styrax* 25, 26, 84.

Illustration: Fig. 164.

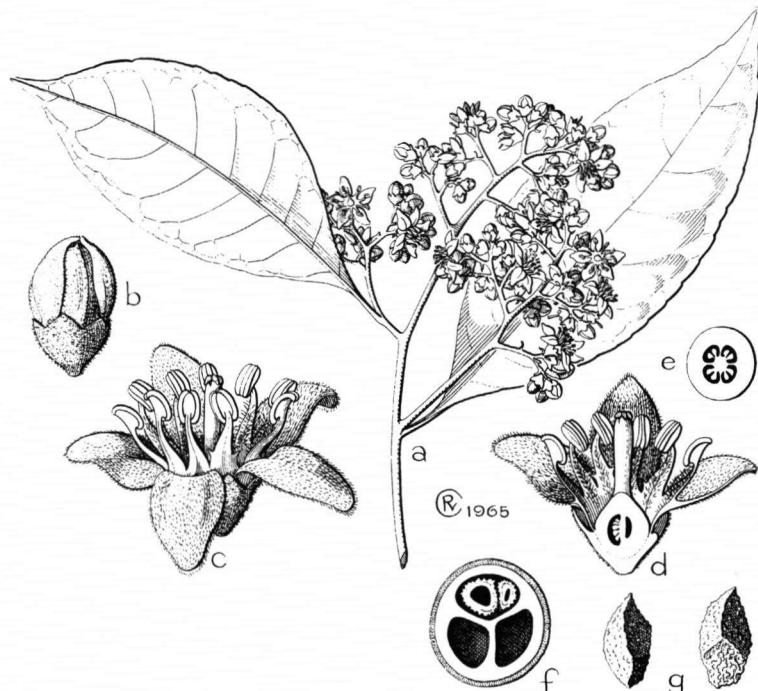


Fig. 164. *Bruinsmia styracoides* Boerl. & Koord.: a. habit; b–d. flower; e. CS of ovary; f. CS of fruit; g. seeds.

SYMPLOCACEAE

Always: Woody, non-climbing; leaves simple, penninerved, exstipulate; flowers actinomorphic; sepals and petals connate (usually at base only), ovary inferior; ovules pendulous 2–4 per cell; fruit a 2–5-celled drupe.

Usually / often: Leaves spiral or alternate, dentate, becoming yellowish green upon drying, midrib sunken above; flowers bisexual, stamens numerous; each flower supported by 1 bract and 2 bracteoles; endocarp sculptured.

Striking features: Leaves pseudoverticillate (*Symplocos verticillifolia*); leaves entire, not turning yellow, filaments forming a long tube (*S. henschelii*, *S. pendula*).

Different from: *Alangiaceae*: petals free, ovule 1 per cell, fruit a berry. — *Ebenaceae*: leaves entire, ovary superior, fruit a berry. — *Rosaceae*: stipulate. — *Theaceae*: placentation axile, fruit a berry or capsule.

Distribution: The only genus, *Symplocos*, is widespread in the tropics of Indo-Australia and America. It is well represented in Malesia from sealevel to c. 4000 m, mostly in rain forest.

Notes: Fossil *Symplocos* has been found in the Eocene of Europe and North America. The leaves of some species are eaten.

Literature: H.P. Nooteboom, Fl. Males. I, 8 (1977) 205–274.

Spot-characters: 45, 46, 52, 55, 71, 84, 93.

Illustration: Fig. 165.



Fig. 165. *Symplocos celastrifolia* Griff. ex Clarke: a. habit; b. flower with bract and bracteoles; c. flower; d. stamen; e. stigma; f. LS of flower; g. CS of fruit; h. LS of fruit.

THEACEAE

(incl. BONNETIACEAE, TERNSTROEMIACEAE, TETRAMERISTACEAE)

Always: Woody, non-climbing; leaves spiral or alternate, simple, pinninerved, exstipulate; sepals and petals free, imbricate.

Usually/often: Leaves dentate; flowers single, 5-merous, axillary, large; stamens numerous, connate with petals at base; ovary superior, 5-locular.

Striking features: Leaves distichous, dentate; flowers unisexual (*Eurya*); leaves pseudo-vermicillate (*Ternstroemia*); leaves with small dark glands below, ovary inferior (*Anneslea*); flowers 4-merous, swamp tree (*Tetramerista*).

Different from: *Guttiferae*: leaves opposite, usually yellow sap.—*Symplocaceae*: ovary inferior, 3 bracts under each flower.

Distribution: The family widespread in tropics and warm temperate regions. In Malesia 11 genera, incl.:

- *Adinandra* (Indo-Malesia), shrubs or trees; lowland and lower montane rain forest, also secondary forest;
- *Eurya* (Indo-Malesia, Pacific), shrubs or trees; mostly montane rain forest, often in open places;
- *Schima* (Southeast Asia, West Malesia), trees; mostly hill and montane forest, often open places;
- *Ternstroemia* (Asia, Malesia, Neotropics), shrubs or trees; lowland and montane rain forest.

Notes: Some genera have been placed in separate families. — The economically most important member of the family is *Camellia sinensis** (tea); ornamentals: *Camellia* p.p.*; *Schima*; some species locally used for timber.

Literature: H. Keng, Tree Fl. Mal. 3 (1978) 275–296; ibid. 4 (1989) 470–471. — Prof. H. Keng (Singapore) is revising the family for Flora Malesiana.

Spot-characters: *Theaceae* 14, 22, 56, 58, 80, 86 — *Anneslea* 31, 60, 92 — *Camellia* 84, 101 — *Eurya* 93 — *Gordonia* 100, 102 — *Schima* 100, 102 — *Ternstroemia* 20, 46, 59 — *Tetramerista* 105.

Illustrations: Fig. 166 & 167.



Fig. 166. *Camellia lanceolata* (Blume) Seem.: a. habit; b. flower; c. fruit.

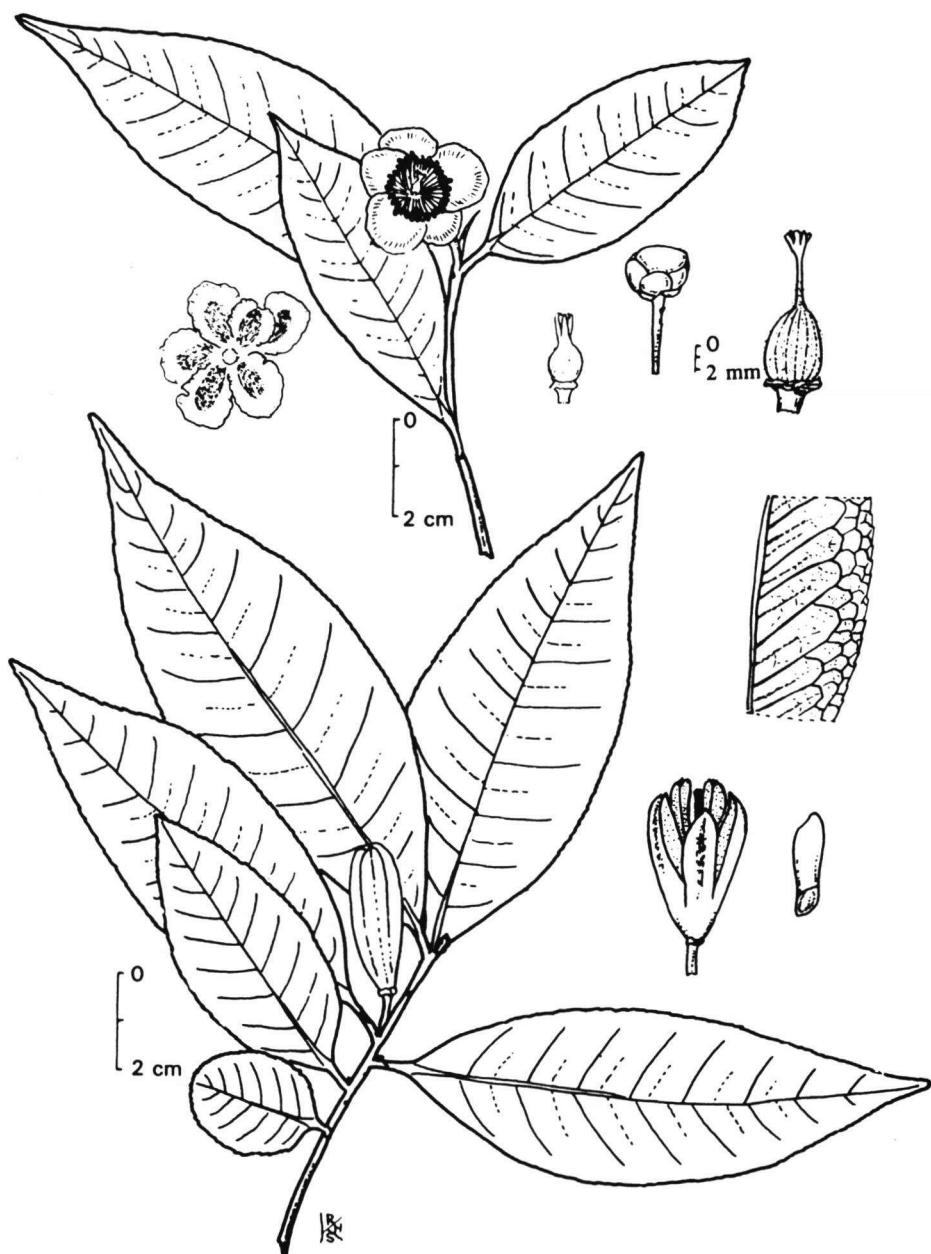


Fig. 167. *Gordonia amboinensis* (Miq.) Merr., showing habit and details of flower and fruit (Courtesy Prof. & Mrs. H. Keng).

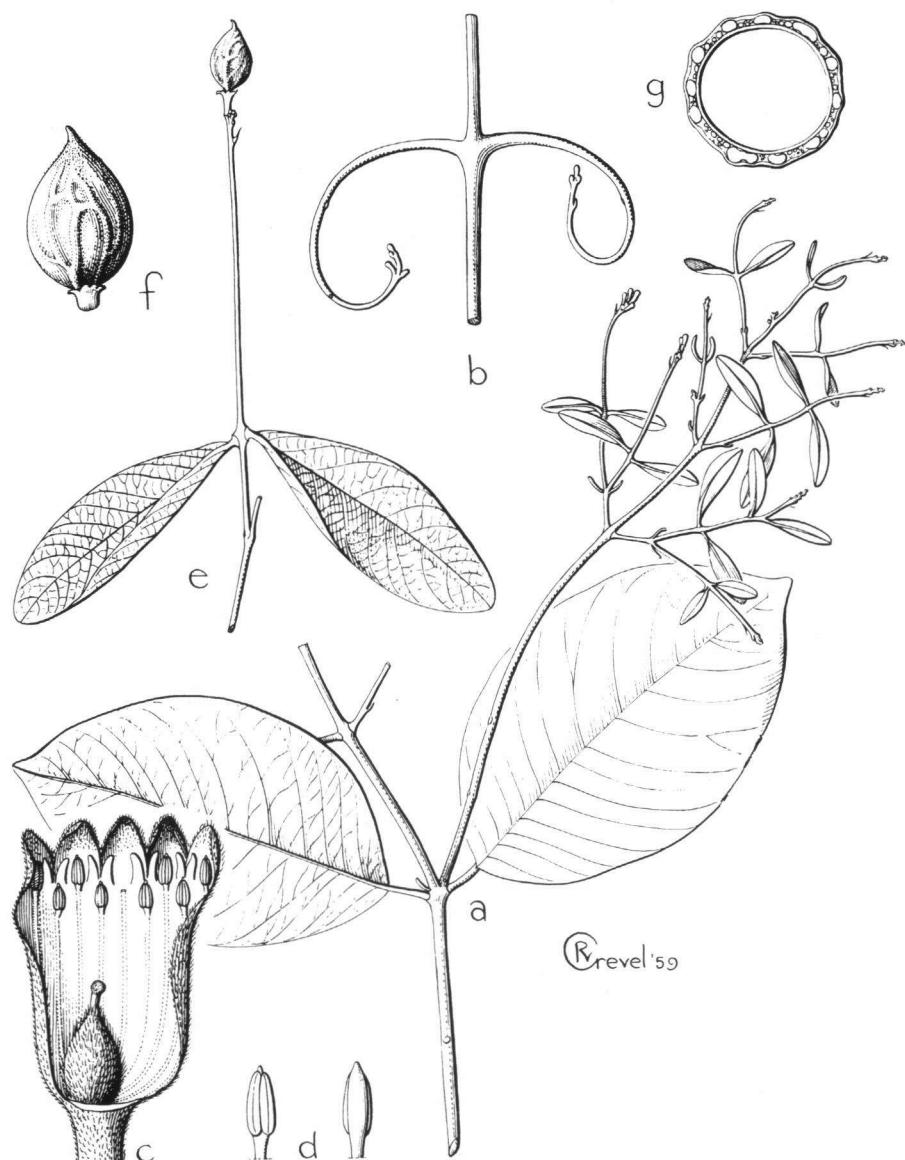


Fig. 168. *Enkleia malaccensis* Griff.: a. habit; b. young twigs; c. flower; d. stamens; e & f. fruit; g. CS of fruit.

THYMELAEACEAE (GONYSTYLACEAE)

Always: Leaves simple, entire, exstipulate; flowers hermaphroditic; tepals united (at least at base), ovary superior, 1 ovule per cell.

Usually / often: Woody; bark with fine, tough, silky fibres; leaves alternate; stamens twice the number of tepals.

Striking features: Herbs (*Pimelea*); climbers (*Enkleia*, *Linostoma*); cauliflorous treelets (some *Phaleria*); leaf margin thickened, intramarginal veins (*Aquilaria*, *Gyrinops*); leaves with pellucid dots, close parallel veins (*Gonystylus*).

Different from: *Icacinaceae*: no silky fibres, petals present. — *Oleaceae*: no silky fibres, corolla present, 2 stamens.

Distribution: The family nearly world-wide, best represented in the southern hemisphere. In Malesia 12 genera, incl.:

- *Aquilaria* (Indo-Malesia), shrubs, trees; mainly lowland rain forest;
- *Gonystylus* (Malesia, Pacific), trees; lowland rain forest, swamp forest;
- *Phaleria* (Indo-Australia, Pacific), shrubs, trees; mostly lowland rain forest.

Notes: Timber: *Gonystylus*; ornamentals: *Phaleria*, *Pimelea*; incense (gaharu): *Aquilaria*.

Literature: H. K. Airy Shaw, Fl. Males. I, 4 (1953) 349–365; Ding Hou, Fl. Males. I, 6 (1960) 1–48.

Spot-characters: *Thymelaeaceae* 82, 104 – *Aetoxylon* 59 – *Amyxa* 59, 60, 67 – *Aquilaria* 57, 67, 88 – *Daphne* 76 – *Enkleia* 4, 6, 68 – *Gonystylus* 31, 59, 67; *G. areolatus* 52, 53 – *Gyrinops* 7; *G. caudata* 67 – *Linostoma* 6, 57, 67 – *Phaleria* 70 – *Pimelea* 76, 91 – *Wikstroemia* 88.

Illustrations: Fig. 168 & 169.

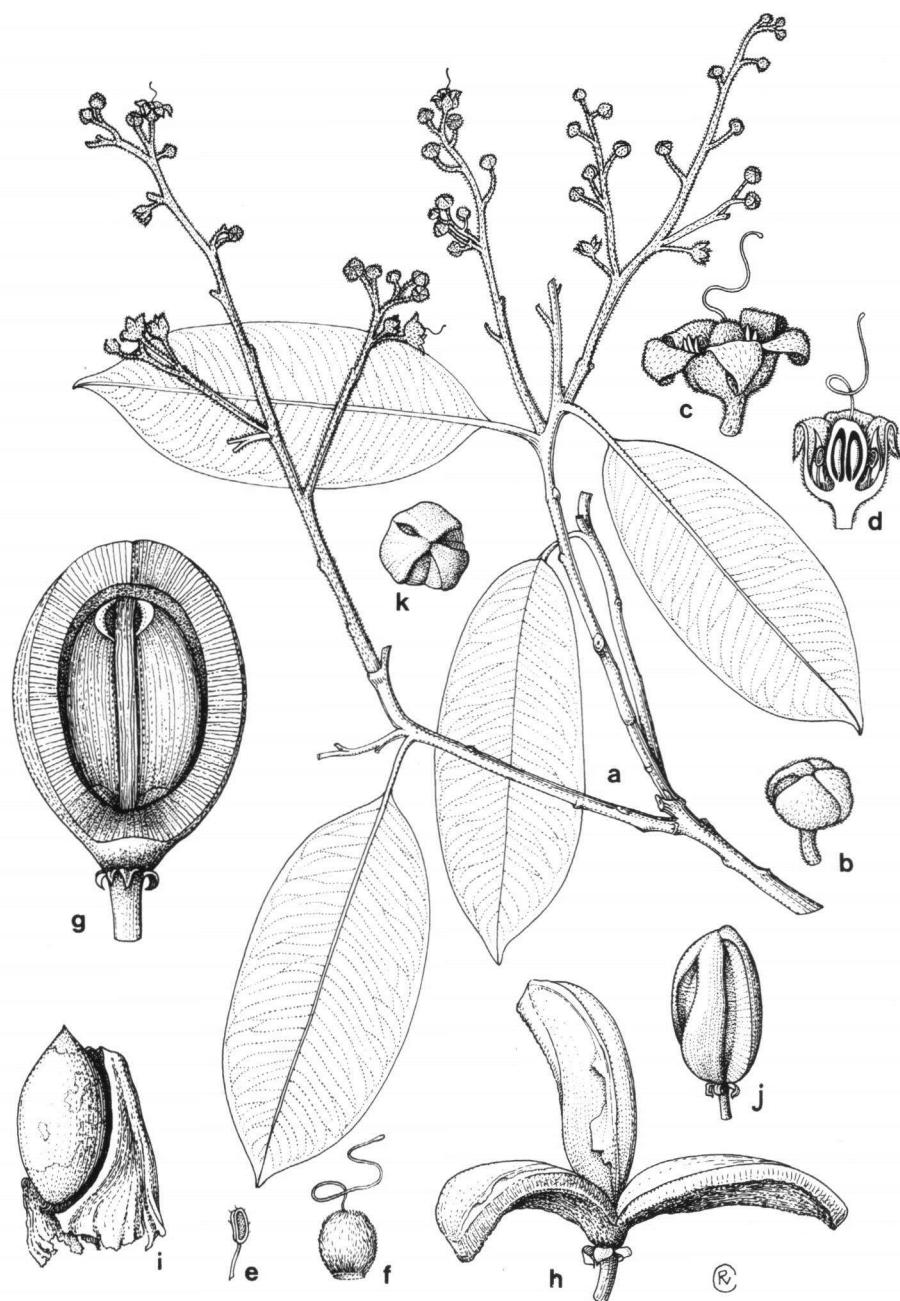


Fig. 169. *Gonystylus velutinus* Airy Shaw: a. habit; b-f. details of flower; g, h, j, k. fruit; i. seed.

TILIACEAE

Always: Woody; leaves simple, alternate or spiral, stipulate; flowers hermaphroditic, actinomorphic; stamens numerous, free or connate only at base, anthers 2-loculate; ovary superior.

Usually/often: Non-climbing; leaves distichous, base oblique, basal nerves, dentate, stellate hairs; petiole swollen apically; sepals free.

Striking features: Scramblers (some *Grewia*); calyx accrescent, wing-like in fruit (*Schoutenia*); capsule bristly (*Triumfetta*); fruit winged (*Colona*, *Berrya*, *Pentace*, *Trichospermum*).

Different from: *Bombacaceae*: stamens often connate into bundles (phalanges), seeds arillate. — *Malvaceae*: long staminal tube, anthers 1-loculate. — *Sterculiaceae*: stamens fewer, united.

Distribution: The family widespread, chiefly tropical. In Malesia 12 genera, incl.:

- *Grewia* (pantropical), shrubs, climbers; primary and secondary lowland forest;
- *Pentace* (Southeast Asia, West Malesia), trees; lowland rain forest;
- *Schoutenia* (Southeast Asia, West Malesia), trees; lowland rain forest;
- *Trichospermum* (incl. *Althoffia*, Indo-Malesia, South America), trees; primary and secondary lowland rain forest.

Notes: The distinction between members of the *Malvales* (*Bombacaceae*, *Malvaceae*, *Sterculiaceae* and *Tiliaceae*) is sometimes very difficult. — Useful plants: timber: *Pentace*, binding material: *Corchorus*, *Trichospermum*; edible fruit: some *Microcos*, *Muntingia** (placement of the latter genus is uncertain).

Literature: M. Burrett, Notizbl. Berlin Dahlem 9 (1926) 592–880; K.M. Kochummen, Tree Fl. Mal. 2 (repr. 1983) 392–412. — Dr. K.P. Savov (Moscou) is revising the family for Flora Malesiana.

Spot-characters: *Tiliaceae* 25, 58, 84 – *Berrya* 38, 64, 98 – *Brownlowia* 26, 38, 51, 64 – *Clappertonia* 95 – *Colona* 37, 38, 59, 64, 98 – *Corchorus* 95; *C. trilocularis* 23 – *Diplodiscus* 26, 53, 64 – *Eleutherostylis* 35 – *Grewia* 26, 38, 64, 68 – *Jarandersonia* 95 – *Microcos* 26, 64; *M. fibrocarpa* 34 – *Pentace* 26, 38, 64, 98 – *Schoutenia* 26, 64, 80, 98 – *Trichospermum* 26, 38, 64 – *Triumfetta* 95.

Illustrations: Fig. 170 & 171.

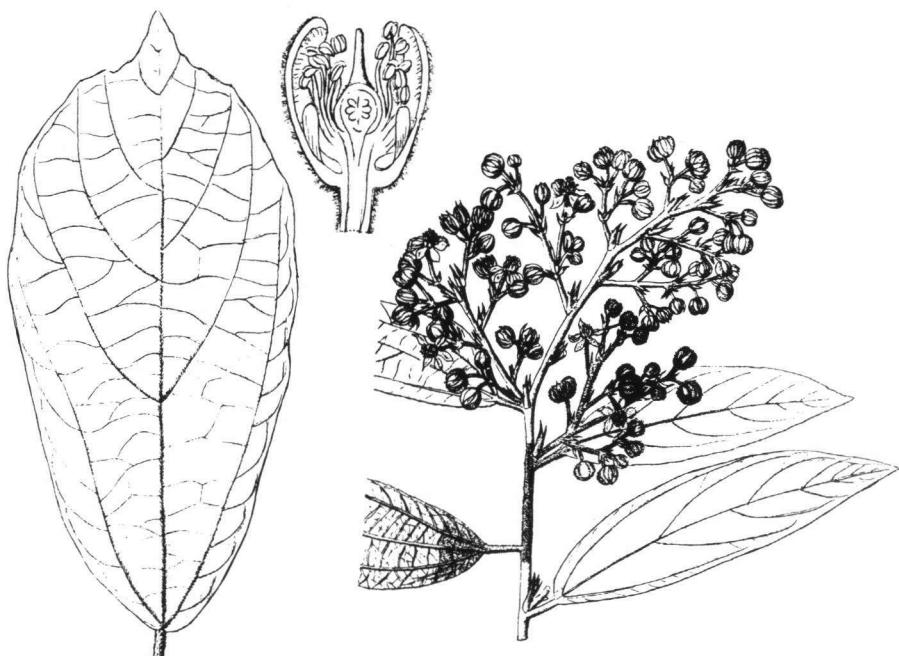


Fig. 170. *Grewia paniculata* Roxb.



Fig. 171. *Pentace triptera* Mast., fruiting branch.



Fig. 172. *Trigoniastrum hypoleucum* Miq.: flowering twig; a–e. details of flower; f. fruiting tip of inflorescence; g. bract with glands; h & i. partial fruit.

TRIGONIACEAE

Always: Trees; leaves spiral, simple, penninerved, entire but margin and tip glandular, undersurface covered with matted white hairs, stipules small; bracts with prominent glands; flowers 5-merous, zygomorphic, bisexual; stamens 6, forming a tube; ovary superior, 3-celled; fruit consisting of 3 samaras.

Different from: *Chrysobalanaceae*: fruit not winged, leaves not gland tipped. — *Polygalaceae*: leaves without white felt, fruit never 3-winged.

Distribution: A family of three genera of which two in the Neotropics. In Malesia only *Trigoniastrum* (West Malesia), lowland forest.

Notes: *Trigoniastrum* was formerly included in *Polygalaceae*. The timber is moderately hard but is not used.

Literature: C.G.G.J. van Steenis, Fl. Males. I, 4 (1949) 58–60; F.S.P. Ng, Tree Fl. Mal. 1 (1972) 449–450.

Spot-characters: 30, 31, 84, 98.

Illustration: Fig. 172.

TRIMENIACEAE

Always: Woody; leaves opposite, simple, exstipulate, with pellucid dots; flowers with several imbricate spirally arranged tepals; stamens several, spiral; ovary superior, 1-celled, 1 pendulous ovule, sessile stigma; fruit a berry.

Usually / often: Trees; leaves serrate; tepals caducous before or at anthesis; flowers unisexual.

Different from: *Monimiaceae*: cup-shaped hypanthium, fruit of several separate carpels (apocarpous).

Distribution: The only genus of the family, *Trimenia*, extends from East Malesia to Southeast Polynesia and East Australia; *T. papuana* is a common member of montane rain forest in East Malesia.

Notes: *Piptocalyx* (lianas, New Guinea and Australia) has been reduced to *Trimenia*; the genus used to be placed in *Monimiaceae*.

Literature: W.R. Philipson, Fl. Males. I, 10 (1986) 327–333.

Spot-characters: *Trimenia* 22, 59, 88, 105; *T. macrura* 5, 6, 60.

Illustration: Fig. 173.



Fig. 173. *Trimenia papuana* Ridl., showing flowering branch and details of flower.

ULMACEAE

Always: Woody, non-climbing; leaves simple, distichous, stipulate; stamens opposite the tepals; ovary superior, 1-celled, 1 pendulous ovule.

Usually/often: Bark fibrous; leaves oblique, triplinerved, dentate; inflorescence often paired and/or with basal buds; flowers unisexual, stigma bifid.

Striking features: Leaves pinnately nerved (*Aphananthe cuspidata*, *Gironniera*); leaves rough, fallen stipules leaving annular scar (*Gironniera*); stipules intrapetiolar connate *Parasponia*); winged fruit (*Ulmus*).

Different from: *Moraceae*: milky sap; inflorescence condensed. — *Urticaceae*: usually cystoliths, style mostly one.

Distribution: The family world-wide. In Malesia 6 genera, incl.:

- *Celtis* (widespread), trees; lowland everwet and seasonal forest;
- *Gironniera* (Indo-Malesia), trees or shrubs; lowland rain forest;
- *Trema* (pantropical), shrubs, small trees; mostly secondary forest.

Notes: *Parasponia* produces root nodules with N-binding *Rhizobium* bacteria; timber: *Celtis*.

Literature: E. Soepadmo, Fl. Males. I, 8 (1977) 31–76.

Spot-characters: *Ulmaceae* 58, 89 – *Celtis* 14, 54, 59, 64, 90; *C. cinnamomea* 24 – *Gironniera* 33 – *Trema* 64; *T. cannabina* 62 – *Ulmus* 98.

Illustration: Fig. 174.

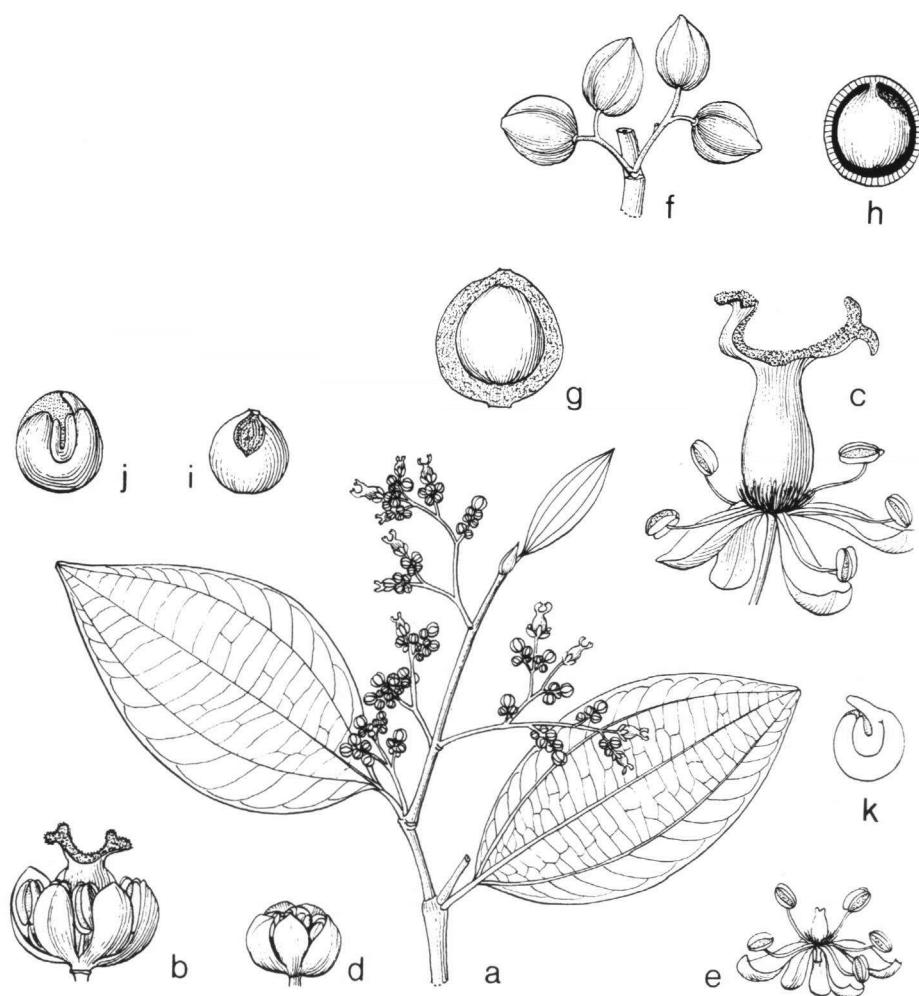


Fig. 174. *Celtis philippinensis* Blanco: a. flowering branch; b & c. hermaphrodite flowers; d & e. male flowers; f. fruits; g & h. fruit in LS; i & j. seed.

URTICACEAE

Always: Leaves simple, stipulate; flowers minute, stamens incurved, opposite the tepals; ovary superior, 1-locular, 1 basal ovule.

Usually / often: Leaves spiral, dentate, triplinerved, cystoliths present; inflorescence condensed, paired and/or with basal bud; flowers unisexual (plants monoecious or dioecious), style 1.

Striking features: Stinging hairs (*Dendrocnide*, *Girardinia*, some *Laportea*, *Urtica*); climbers (*Nothocnide*, *Poikilospermum*); leaves white below (*Gibbsia*, *Leucosyke*, *Maoutia*).

Different from: *Moraceae*: milky sap, ovule apical, styles often 2. — *Ulmaceae*: no cystoliths, stamens erect, ovule apical, styles 2.

Distribution: The family world-wide. In Malesia 25 genera, incl.:

- *Dendrocnide* (Indo-Australia, Pacific), shrubs or trees; secondary and primary forest;
- *Elatostema* (paleotropics), herbs, creepers, rarely shrubs; lowland and montane rain forest, mostly very damp places;
- *Pilea* (pantropical), herbs, floor of rain forest, lowland and montane;
- *Poikilospermum* (Indo-Malesia), woody climbers, mostly lowland rain forest;
- *Villebrunnea* (Indo-Malesia), shrubs or trees; lowland and montane rain forest.

Notes: *Poikilospermum* is by some placed in *Cecropiaceae*. Most Malesian members of the family are herbs or shrubs, growing in a variety of habitats, from sealevel to high in the mountains, also well represented in secondary vegetation. — Useful plants: ornamentals: *Elatostema*, *Pilea*; edible leaves: *Pilea* (some); binding material: *Boehmeria*, *Pipturus*. — The leaves of *Laportea decumana* used as an exterior stimulant in the Moluccas.

Literature: C. A. Backer & R. C. Bakhuizen van den Brink, Fl. Java 2 (1965) 36–51; Chew Wee Lek, Gard. Bull. Sing. 20 (1963) 1–103; 21 (1965) 195–208; 24 (1969) 361–373; 25 (1969) 1–104; 111–178 (revisions of *Poikilospermum*, *Nothocnide*, *Dendrocnide* and *Laportea*); R. J. Johns, The flowering plants of Papua New Guinea, Dicotyledons, 2 (1988) 7–57.

Spot-characters: Urticaceae 58, 59, 62, 63, 76, 89 – *Astrothalamus* 76, 96 – *Boehmeria* 47, 64, 72 – *Chamaibania* 72 – *Cypholophus* 71; *C. chamaephyton* 52; *C. nummularis* 47 – *Debregeasia* 64 – *Dendrocnide* 29, 64, 78, 96; *D. peltata* 51 – *Elatostema* 47, 71, 96 – *Fleurya* 29 – *Gibbsia* 64 – *Girardinia* 29 – *Gonostegia* 71 – *Laportea* 29; *L. decumana* 52 – *Leucosyke* 47, 64, 96 – *Maoutia* 47, 64, 96 – *Pilea* 54 – *Pipturus* 64 – *Poikilospermum* 53, 96 – *Pouzolzia* 64, 71 – *Procris* 26, 71, 96 – *Urtica* 29 – *Villebrunnea* 26, 64.

Illustrations: Fig. 175 & 176.

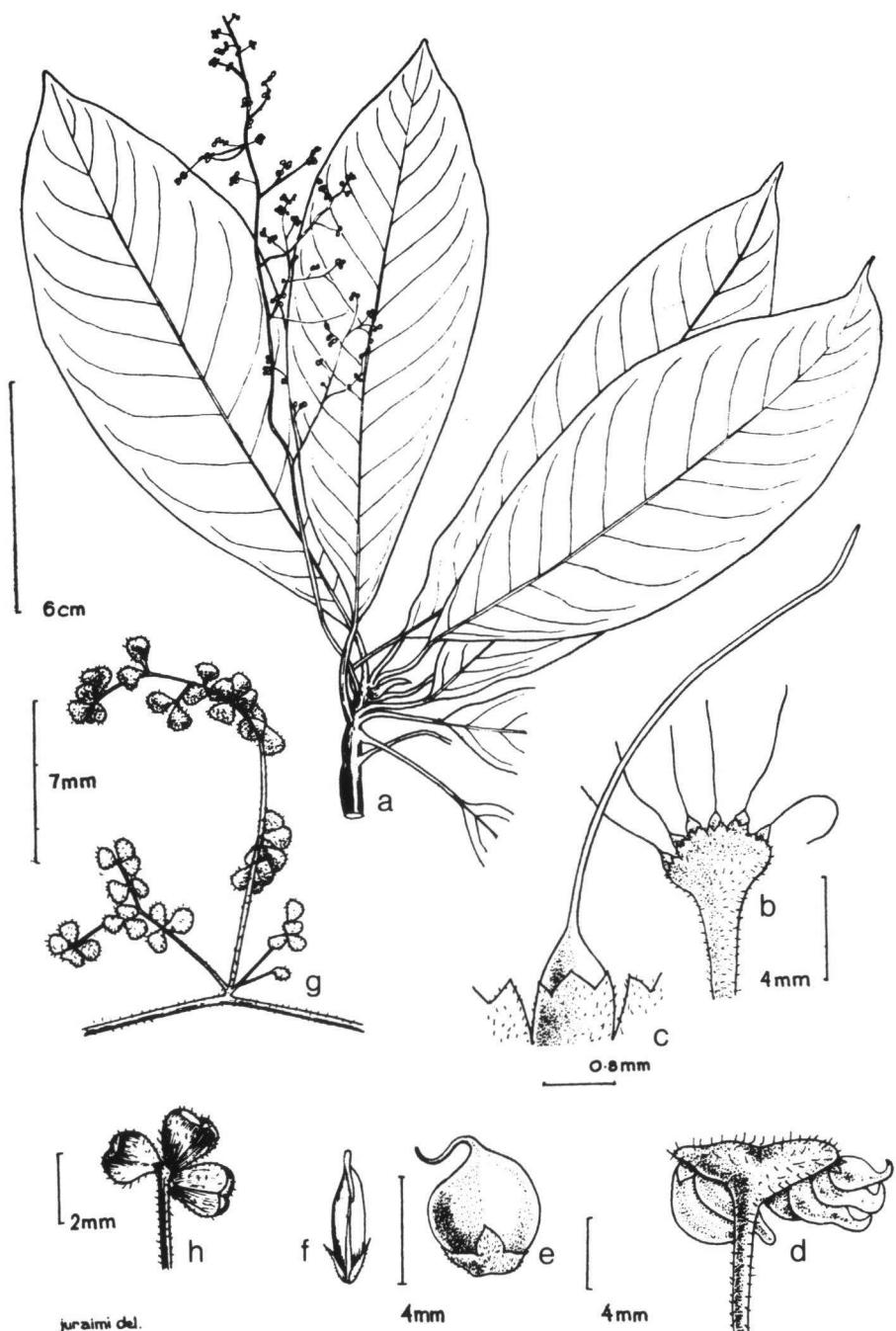


Fig. 175. *Dendrocnide stimulans* (L. f.) Chew: a. habit; b-f. female flowers; g & h. male flowers (Courtesy Gardens' Bulletin, Singapore).



Fig. 176. *Pilea malastomoides* (Poir.) Blume.

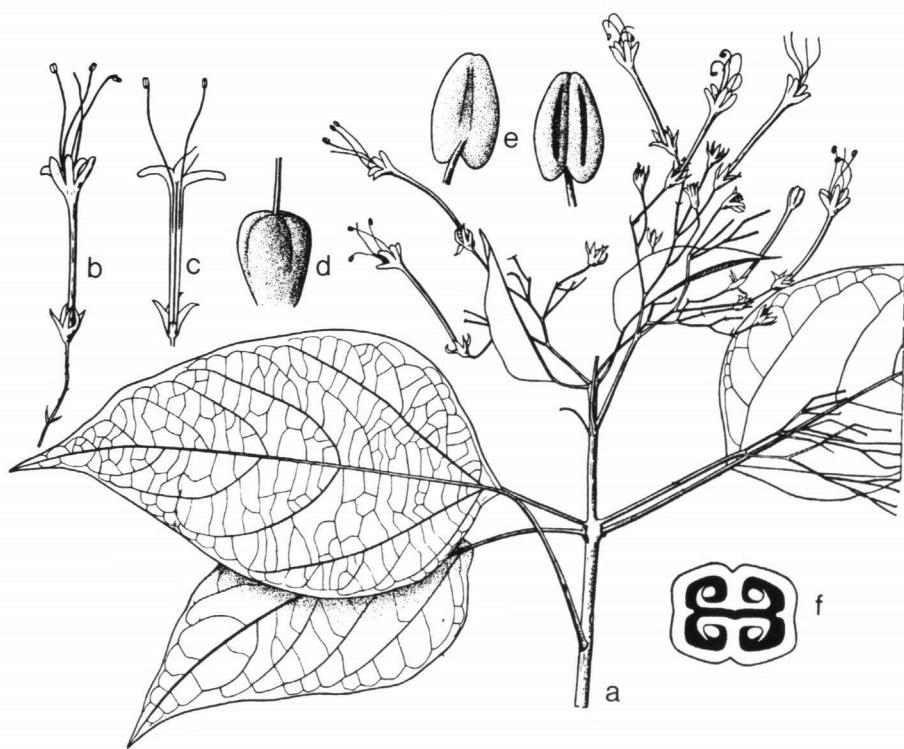


Fig. 177. *Clerodendrum populneum* E. Beer & H.J. Lam: a. habit; b–e. details of flower; f. CS of fruit.

VERBENACEAE (AVICENNIACEAE, SYMPHOREMATAEAE)

Always: Leaves decussate (incl. verticillate), exstipulate; calyx persistent, often accrescent; corolla sympetalous, ± zygomorphic; ovary superior, 4- (or 5-)locular.

Usually / often: Woody, stem quadrangular; leaves simple with glands; fruit indehiscent, 4- (5-8-)seeded.

Striking features: Herbs (*Phyla*, *Priva*, *Premna herbacea*, *Verbena**); climbers: *Congea*, *Faradaya*, *Hosea*, *Petraeovitex*, *Sphenodesme*, *Syphorema*); leaves palmately compound (*Garrettia*, *Hosea*, *Petraeovitex* p.p., *Teysmanniodendron* p.p., *Vitex* p.p.); leaves pinnate, rachis winged (*Peronema*); leaves bipinnate (*Petraeovitex* p.p.); involucre enlarging under capitate inflorescence (*Congea*, *Hosea*, *Sphenodesme*, *Syphorema*); calyx (5-lobed) enlarged in fruit (*Petraeovitex*); thorny (*Gmelina* p.p.); cauliflorous (*Callicarpa*, *Premna*, both rare); petiolules pulvinate (*Teysmanniodendron*).

Different from: *Bignoniaceae*: ovary 2-locular, seeds numerous. — *Gesneriaceae*: flowers clearly zygomorphic, ovary 1-locular, seeds many. — *Labiatae*: usually herbaceous, aromatic, fruit consisting of 4 mericarps.

Distribution: The family world-wide. In Malesia 20 genera, incl.:

- *Avicennia* (widespread), mangrove trees with pneumatophores, viviparous seeds;
- *Callicarpa* (pantropical), shrubs, treelets; lowland, mostly secondary forest;
- *Clerodendrum* (pantropical), shrubs, scramblers; lowland and mid-montane forest;
- *Premna* (pantropical), shrubs, scramblers; lowland and lower montane forest;
- *Tectona* (Southeast Asia, West Malesia), trees; monsoon forest, often planted;
- *Teysmanniodendron* (Indo-Malesia), trees; lowland forest;
- *Vitex* (pantropical), shrubs, trees; lowland secondary and primary forest.

Notes: According to the latest concept *Verbenaceae* is a subfamily of *Lamiaceae*. —

Timber: *Peronema*, *Premna*, *Tectona* (Jati, Teak), *Vitex*. — Ornamentals: *Callicarpa*, *Clerodendrum*, *Congea*, *Lantana**, *Petraea**, *Stachytarpheta**.

Literature: H.J. Lam & R.C. Bakhuizen van den Brink, Bull. Jard. Bot. Buitenzorg III, 3 (1921) 1–116; K.M. Kochummen, Tree Fl. Mal. 3 (1978) 297–313. — Prof. D.J. Mabberley (Sydney) is revising the family for Flora Malesiana, Dr. A. Munir (Adelaide) is revising the family for Australia.

Spot-characters: *Verbenaceae* 58 – *Avicennia* 16, 60 – *Callicarpa* 2, 26, 27, 28, 31, 32, 47, 59, 70, 93; *C. saccata* 9 – *Clerodendrum* 4, 6, 9, 26, 31, 47, 80 – *Congea* 5, 6, 98 – *Faradaya* 5, 6, 31, 46, 64, 70, 80 – *Geunsia* 46, 47 – *Glossocarya* 5, 6 – *Gmelina* 8, 12, 31 – *Holmskioldia* 80 – *Hosea* 5, 6, 31, 60 – *Lantana* 4, 46, 93 – *Peronema* 40, 49 – *Petraeovitex* 4, 5, 6, 49, 80, 98 – *Petrea* 98 – *Premna* 2, 5, 6, 8, 27, 28, 46, 49, 70, 85; *P. foetida* 24 – *Priva* 95 – *Sphenodesme* 5, 6, 98 – *Syphorema* 5, 6, 8, 98 – *Tectona* 8, 53 – *Teysmanniodendron* 31, 38, 40, 48, 49, 60, 99 – *Vitex* 2, 25, 26, 38, 48, 49, 59, 80; *V. limonifolia* 40; *V. negundo* 54.

Illustrations: Fig. 177 & 178.

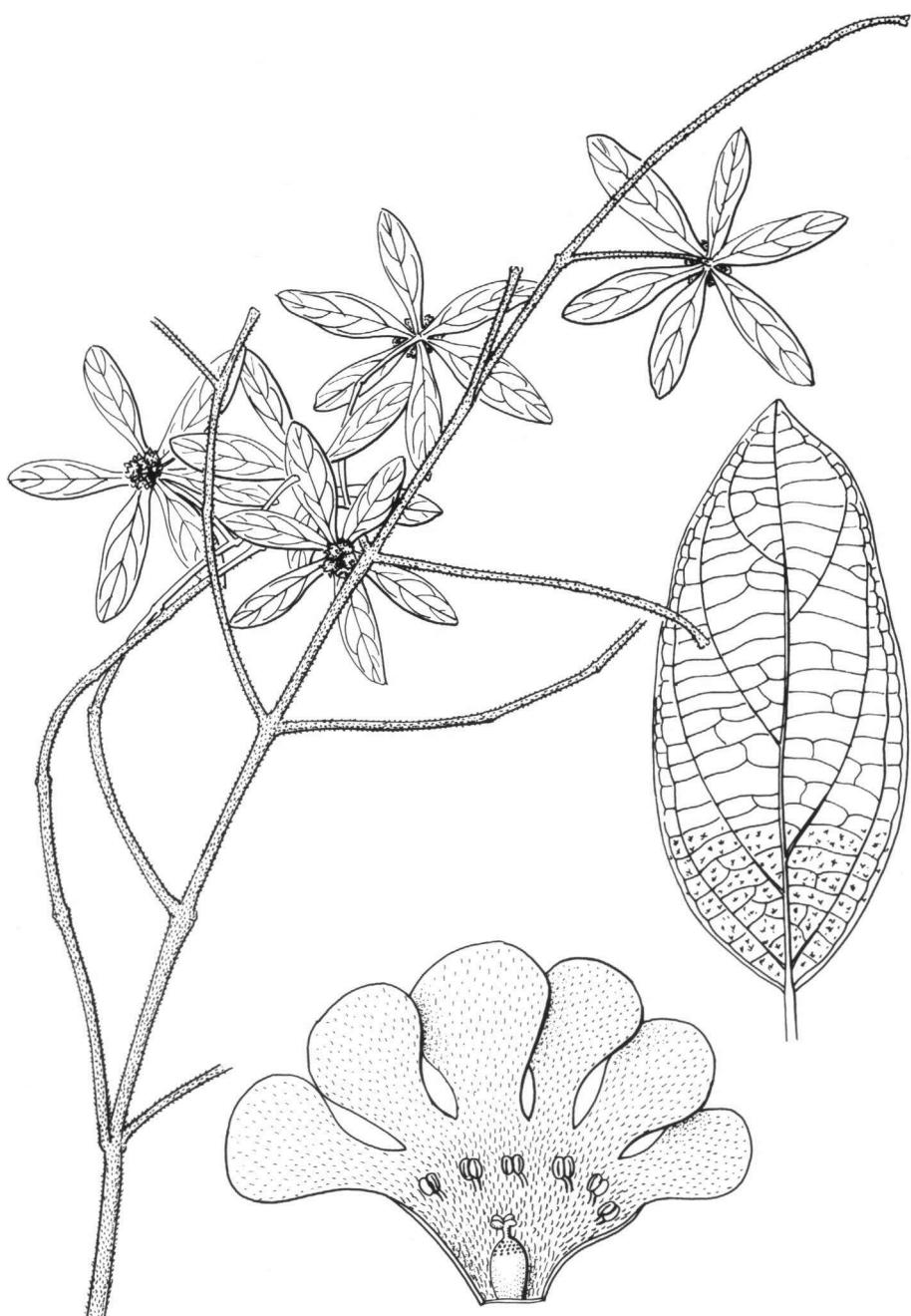


Fig. 178. *Sphenodesme involucrata* (Presl) Rob., showing inflorescence and detail of flower.

VIOLACEAE

Always: Leaves spiral, simple, stipulate; flowers 5-merous, ovary superior, 1-locular, placentation parietal; fruit a capsule.

Usually / often: Woody; leaves dentate; flowers bisexual, zygomorphic; sepals and petals free; filaments connate, connective with an appendage.

Striking features: Liana, seeds winged (*Agatea*); distinct stipular scars (*Rinorea*); fruit with moss-like processes (*Rinorea anguifera*).

Different from: *Euphorbiaceae*: flowers unisexual, placentation never parietal. — *Flacourtiaceae*: stamens numerous, fruit rarely a capsule.

Distribution: Widespread, in Malesia 4 genera, incl.:

- *Rinorea* (pantropical), shrubs or trees; lowland rain forest;
- *Viola* (world-wide), terrestrial herbs, rain forest and alpine vegetation.

Notes: Some introduced species of *Viola* are cultivated as garden plants, a few local species are potential ornamentals.

Literature: M. Jacobs & D.M. Moore, Fl. Males. I, 7 (1971) 179–212.

Spot-characters: *Violaceae* 58, 84, 104 – *Agatea* 5, 85, 101, 102 – *Hybanthus* 85, 101
 – *Rinorea* 36, 55, 68, 71, 85, 101, 102; *R. anguifera* 95; *R. javanica* 9 – *Viola* 85, 101; *V. pilosa* 34.

Illustrations: Fig. 179 & 180.



Fig. 179. *Rinorea horneri* (Korth.) O. Kuntze: a. habit; b. detail of venation; c. stipule; d. flower; e. idem, petals removed; f. stamen; g. ovary; h. fruit; i. seed.

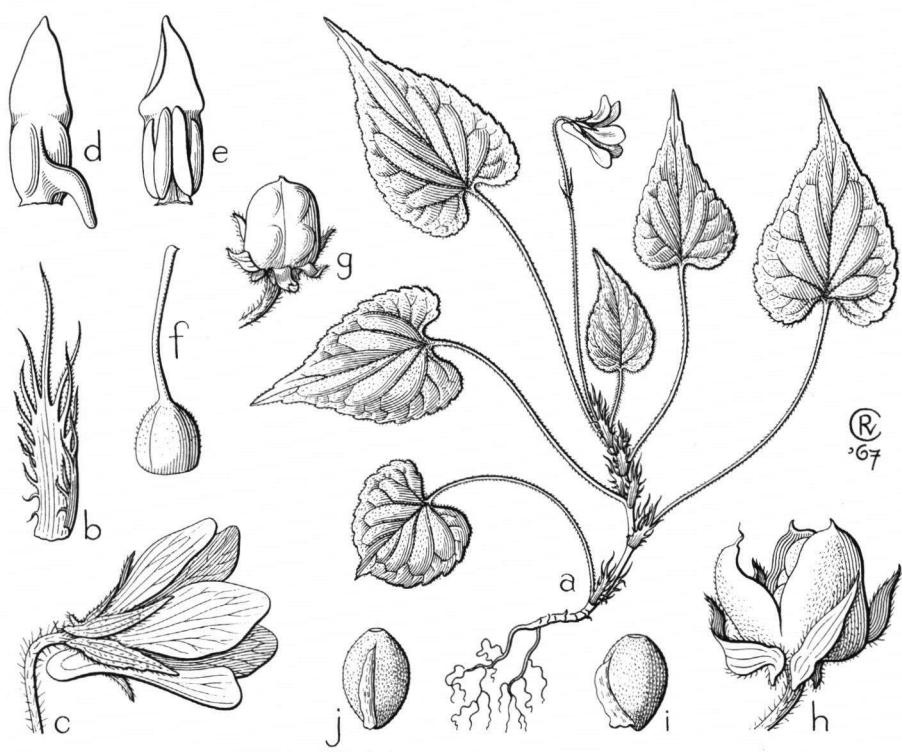


Fig. 180. *Viola pilosa* Blume: a. habit; b. stipule; c. flower; d & e. stamens; f. pistil; g & h. fruit; i & j. seed.



Fig. 181. *Drimys piperita* Hook., entity *subalpina*, with flowering branch (Courtesy Department of Forests, PNG).

WINTERACEAE

Always: Woody, non-climbing, glabrous; leaves spiral, simple, entire, pinninerved, exstipulate; calyx calyptrate, ovary superior.

Usually / often: Leaves with fine pellucid dots, glaucous, sharp tasting; flowers actinomorphic, stamens many, petals free, carpels free.

Different from: *Illiaceae*: leaves crowded, tepals not differentiated, carpels forming a star. — *Magnoliaceae*: hairy, stipulate. — *Myrsinaceae*: leaves usually with large coloured dots, petals contorted.

Distribution: The *Winteraceae* are almost confined to the southern hemisphere; in Malesia 2 genera:

- *Drimys* (Malesia, Australia, South America), shrubs or trees, montane rain forest, alpine vegetation;
- *Zygogynum* (East Malesia, Melanesia, Australia, New Caledonia) trees, montane rain forest.

Notes: *Drimys* is by some authors considered to be confined to South America, the Australian and Malesian species being placed in a distinct genus *Tasmannia*.

Literature: W. Vink, Blumea 18 (1970) 225–354; in Families & Genera of Vascular Plants (eds. K. Kubitski et al.) (1993) 630–638. — Dr. W. Vink (L) is revising the family for Flora Malesiana.

Spot-characters: *Winteraceae* 79 — *Drimys* 30, 46, 59 — *Zygogynum* 30, 52, 59.

Illustration: Fig. 181.

INDEX OF TAXA

Numbers refer to page numbers; an asterisk denotes a figure legend. Names of families treated are in **bold type**. Only taxa mentioned in the families under 'Striking features', 'Distribution', 'Notes', and 'Spot-characters' have been indexed.

- Abdulmajidia 151
- Abelmoschus 173
- Abroma 267
- Abrus 154
- Abutilon 173
- Acacia 154
- Acaena 231
- Acalypha 112, 113
 - brachystachya 113
 - lanceolata 113
- Acanthopanax 37
- Acanthospermum 71
- Acer 19
 - laurinum 18*
- Aceraceae 19**
- Aceratium 105
 - oppositifolium 105
- Acmena 197
- Acranthera 234
- Acrocarpus 154
- Acronychia 239
- Acotrema 96
- Acsmithia 89
- Actephila 113
- Actinidia 21
 - latifolia 20*
 - sinensis 21
- Actinidiaceae 21**
- Actinodaphne 147
- Actinolindera 147
- Actinorhytis 211
- Adenanthera 154
- Adina 234
- Adinandra 271
- Aegiceras 195
- Aegle 239
- Aeschynomene 154
 - indica 156*
- Aetoxylon 275
- Aganope 154
- Aganosma 31
- Agapetes 107
- Agatea 291
- Agathis 75
 - labillardieri 76*
- Agelaea 81
- Aglaia 179
- Agrimonia 231
- Agrostistachys 113
 - indica 113
 - longifolia 113
- Ahernia 125
- Aidia 234
- Aidiopsis 234
- Ailanthus 257
- Airyantha 154
- Aistopetalum 89
- Alangiaceae 23**
- Alangium 23
 - salvifolium 23
 - scandens 23
 - villosum 24*
- Albizia 154
- Alchornea 113
 - borneensis 113
- Aleurites 112, 113
- Allaeophania 234
- Allamanda 31
- Allatospermum 257
- Allophylus 247
- Alloxyロン 223
- Alphandia 113
- Alphitonia 225
- Alseodaphne 147
- Alstonia 31
- Althoffia 277
- Altingia 135
- Alyxia 31
- Amaracarpus 234
- Ambrosia 71
- Amesiodendron 247
- Amherstia 154
- Ammania 169
- Amyxa 275
- Anacardiaceae 25**
- Anacardium 25
- Anacolosa 205
 - cauliflora 205
- Anakasia 37
- Anaphalis 71
- Anaxagorea 29
- Andrachne 113
- Andresia 107
- Andropogon 129
- Androtium 25
- Anericleistus 177
- Anisophyllaea 229
 - disticha 228*
- Anisophylleaceae 229**
- Anisoptera 98, 99
- Annesjoa 112, 113
- Anneslea 271
- Annona 29
- Annonaceae 29**
- Anodendron 31
- Anomanthodia 234
- Anomianthus 29
- Anthocephalus 234
- Anthorrhiza 234
- Anthoxanthum 129
- Antiaris 185
- Antiaropsis 185
- Antidesma 112, 113
 - venenosum 114*
- Antoniaceae 165**
- Aphaenandra 234
- Aphanamyxis 179
 - polystachya 179
- Aphananthe cuspidata 283**
- Apocynaceae 31**
- Apodytes 141
- Aporosa 112, 113
 - frutescens 113
- Aquifoliaceae 35**
- Aquilaria 275
- Arachis 154
- Aralia 37
- Araliaceae 37**
- Aralidium 37
- Araucaria 75
 - cunninghamii 75
- Araucariaceae 75**
- Archidendron 154
 - aruense 155
 - ellipticum 155
 - grandiflora 157*
 - pteropum 155
- Archidendropsis 155**
- Ardisia 195
 - elliptica 194*
- Areca 211

- Arecaceae 211
Arenga 211
Argostemma 234
Argusia 47
Aromadendron 171
Arrhenechthites
 novoguineensis
 subsp. *novoguineensis*
 72*
Artobotrys 29
 hexapetalus 29
 macrantha 28*
Artemisia 71
Arthrophyllum 37
 diversifolium 36*
Artia 31
Artocarpus 185
 dahad 184*
Ascarina 61
Ashtonias 113
Aster 71
Asteraceae 71
Astilbe 255
Astragalus 155
Astronia 177
Astronium 177
Astrothalamus 285
Atalantia 239
Atalya 247
Atherospermaceae 183
Atuna 63
Atylosia 155
Aulandria 251
Austrobuxus 113
Averrhoa 210
 carambola 210
Avicennia 289
Avicenniaceae 289
Axinandra 87
Azadirachta 179
- Baccaurea* 112, 113
 angulata 113
 bracteata 113
 macrophylla 113
 stipulata 116*
 trigonocarpa 113
Baliospermum 113
Bambusaceae 129
Bambusoideae 129
Banksia 223
- Barringtonia* 151
 fusiformis 150*
Barringtoniaceae 151
Bauhinia 155
Beilschmiedia 147
 gigantocarpa 148*
Bellucia 177
Bennettiodendron 125
Berchemia 225
Berrya 277
Berholletia 151
Bhesa 59
Bidens 71
Bignoniaceae 39
Bikkia 234
Biophytum 210
Bischofia 112, 113, 265
Bischofiaceae 112
Bixa orellana 42*, 43
Bixaceae 43
Blaberopus 31
Blachia 113
Blastus 177
Blighia 247
Blumea 71
Blumeodendron 113
Boehmeria 285
Boeninghausenia 239
Boerhavia 199
Bombacaceae 45
Bombax 45
Bonnetiaceae 271
Boraginaceae 47
Borassus 211
Borneodendron 112, 113
Botryophora 113
Bouea 25
Bougainvillea 199
Bowringia 155
Brachychiton 267
Brackenridgea 203
Bracteanthus 155
Brassaiopsis 37
Breynia 112, 113
Bridelia 113
Broussonetia 185
Brownlowia 277
Brucea 257
Bruguiera 229
 exaristata 230*
Bruinsmia 269
styacoides 269*
- Buchanania* 25
Buddleja 165
Buddlejaceae 165
Burckella 251
Burkianthus 239
Bursaria 219
Burseraceae 49
Butea 155
 monosperma 155
Bytneria 267
Bytneriaceae 267
- Caesalpinia* 154, 155
 oppositifolia 155
Caesalpiniaceae 154
Cajanus 155
Calamus 211
 adspersus 212*
Calcluvia 89
 brassii 89
Callerya 155
Calliandra 154
Callicarpa 289
 saccata 289
Callistemon 197
Calophyllum 131
Calospatha 211
Calycopteris 69
Camellia 271
 lanceolata 272*
 sinensis 271
Campnosperma 25
Campstemon 45
Cananga 29
Canarium 49
 australianum 50*
Canavalia 154
Cansjera 209
Canthium 234
Cantleya 141
Capparaceae 53
Capparis 53
 buwaldae 53
 quiniflora 53
 sepiaria 52*
 spinosa 53
 zeylanica 53
Caprifoliaceae 55
Carallia 229
 caryophylloidea 229
Cardiopteris 141

- Cardiospermum** 247
Carissa 31
Carlemanniaceae 55
Carpodetus 255
Caryodaphnopsis 147
Caryota 211
Casearia amplectens 125
 auriculata 125
Cassia 154, 155
 javanica 155
Cassytha 147
Castanopsis 121
 hypophoenicia 120*
Casuarina
 equisetifolia 57
Casuarinaceae 57
Catamatha 177
Catharanthus 31
Cathormion 155
Catunaregam 234
Cecropiaceae 285
Ceiba 45
Celastraceae 59
Celastrus 59
Celtis 283
 cinnamomea 283
 philippensis 284*
Centrosema 155
Cephalanthus 234
Cephalomappa 113
Ceratolobus 211
Ceratopetalum 89
 succirubrum 89
Cerbera 31
Ceriops 229
Ceriscoides 234
Ceuthorstoma 57
Chaetocarpus 113
Chamaibania 285
Champereia 209
 manillana 208*
Cheilosa 113
Cheilotheca 107
Chilocarpus 31
 tuberculatus 31
Chionanthus 207
 acuminatus 207
 pluriflorus 207
Chisocheton 179
 lasiocarpus 180*
 myrmecophilus 179
Chloranthaceae 61
Chloranthus 61
 erectus 61, 62*
 officinalis 61
 spicatus 61
Chondrostylis 113
Chonemorpha 31
Choriceras 113
Chrozophora 113
Chrysobalanaceae 63, 231
Chrysophyllum 251
 cainito 251
Chukrasia 179
Chydenanthus 151
Cichorium 71
Cinchona 234
Cinnadenia 147
Cinnamomum 147
 lawang 149*
Citriobatus 219
Citronella 141
Citrus 239
Cladogynos 113
Cladomyza 245
Claoxylon 113
Clappertonia 277
Clausena 239
Cleghornia 31
Cleidion 113
Cleistanthus 113
Cleomaceae 53
Cleome 53
Clerodendrum 289
 populneum 288*
Clethra 65
 pachyphylla 66*
Clethraceae 65
Clidemia 177
Clitoria 155
Clusiaceae 131
Cnesmone 112, 113
Cnestis 81
 platantha 80*
Coca 267
Cochlospermaceae 67
Cochlospermum 67
 religiosum 67*
Cocos 211
Codiaeum 112, 113
Codiocarpus 141
Coelorachis 129
Coelospermum 234
Coelostegia 45
Coffea 234
Coix 129
Colona 277
Colubrina 225
 anomala 225
 asiatica 226*
Combretaceae 69
Combretocarpus 229
Combretodendron 151
Combretum 69
 sundaicum 68*
Commersonia 267
Compositae 71
Conandrium 195
Congea 289
Coniferales 75
Connaraceae 81
Connarus 81
 grandis 81
Conzya 71
Coprosma 234
 archboldiana 234
Coptosapelta 235
Corchorus 277
 trilocularis 277
Cordia 47
 subcordata 46*
Cornaceae 83
Corynocarpaceae 85
Corynocarpus 85
 australasica 84*, 85
 laevigata 85
Corypha 211
Cosmos 71
Costera 107
Cotylelobium 98, 99
Couroupita 151
Cowiea 235
Crassocephalum 71
 crepidiooides 73*
Crateva 53
Cratoxylum 131
 arborescens 132*
 formosum 131
Creochiton 177
Crepis 71
Crescentia 39
 alata 39
Crotalaria 155
Croton 113
Crudia 155
Crypteronia 87
Crypteroniaceae 87, 169

- Cryptocarya 147
 Ctenolophon 163
 Ctenolophonaceae 163
 Cubilia 247
 Cullenia 45
Cunoniaceae 89
 Cuphea 169
 Cupressaceae 75
 Cupressus 75
 Cyanandrium 177
 Cyathocalyx 29
 Cyathostemma 29
Cycadaceae 90
 Cycas 90
 rumphii 90*
 Cymbopogon 129
 Cynoglossum 47
 Cynometra 154
 cauliflora 155
 malaccensis 158*
 Cypholophus 285
 chamaephyton 285
 nummularis 285
 Cyrtostachys 211

 Dacrycarpus 75
 imbricatus 75, 77*
 Dacrydium 75
 Dacryodes 49
 nervosa 49
 Dactylocladus 87
 stenostachys 86*, 87
 Daemonorops 211
 Dahlia 71
 Dalbergia 154, 155
 Dalechampia 113
 Dalenia 177
 Danthonia 129
 Dapania 210
 Daphne 275
Daphniphyllaceae 91
 Daphniphyllum 91
 gracile 91*
 Dasymaschalon 29
Datiscaceae 93
 Debregesia 285
 Decaspernum 197
 Dehaasia 147
 Delonix 154, 155
 Dendrocnide 285
 peltata 285
 stimulans 286*

 Dendromyza 245
 Dendropanax borneensis 37
 Dendrotrophe 245
 Deplanchea 39
 Derris 155
 thyrsiflora 155
 Desmodium 155
 Desmos 29
 chinensis 29
 Deutzia 255
 Dialium 154, 155
Dichapetalaceae 95
 Dichapetalum 95
 timoriense 94*, 95
 Dichilanthe 235
 Dichroa 255
 Dichrocephala 71
 Dichrostachys 155
 Dicoelia 113
 Dictyoneura 247
 Dillenia 96
 indica 96*
 pentagyna 96
Dilleniaceae 96
 Dimocarpus 247
 dentatus 249*
 Dimorphantha 107
 muricatus 113
 Dimorphocalyx 113
 Dinochloa 129
 Diodea 155
 Diospyros 103
 celebica 102*
 Diplectria 177
 Diplodiscus 277
 Diplycosia 107
Dipterocarpaceae 98
 subfam. Dipterocarpoideae
 98
 subfam. Monotoideae 98
 subfam. Pakaraimaeoideae
 98
 Dipteroncarpus 98, 99
 verrucosus 97*
 Discocalyx 195
 Dissochaeta 177
 Distylium 135
 Dodonaea 247
 Dolichandrone 39
 spathacea 39
 Dolicholobium 235
 Dombeya 267

 Doryxylon 113
 Dracontomelon 25
 Driessnia 177
 Drimycarpus 25
 Drimys 295
 piperita 294*
 Dryadodaphne 183
 Dryobalanops 98, 99
 eriocarpa 113
 longifolia 113
 pendula 113
 sumatrana 99*
 Drypetes 112, 113
 Duabanga 261
 Dubouzetia 105
 Dufrenoya 245
 Dunbaria 155
 rubella 155
 Durio 45
 acutifolius 44*
 Dyera 31
 Dyospyros montana 103
 toposia 103
Dysoxylum 179
 caulostachyum 179

Ebenaceae 103
 Ecdysanthera 31
 Ehretia 47
 Ehretiaceae 47
 Elaeis 211
Elaeocarpaceae 105
 Elaeocarpus 105
 gustavifolius 105
 murukkai 104*
 myrmecophilus 105
 Elateriospermum 113
 Elatostema 285
 Eleiodoxa 211
 Eleutherandra 125
 Eleutherostylis 277
 Ellipanthus 81
 beccarie var. peltata 81
 tomentosus 82*
 Ellipeia 29
 Elmerillia 171
 tsiampacca 170*
 Embelia 195
 ribes 194*
 Embolanthera 135
 spicata 134*
 Emilia 71

- Emmenosperma** 225
Endiandra 147
Endocomia 191
Endospermum 113
Engelhardia 145
rígida 146*
Enicosanthum 29
Enkleia 275
malaccensis 274*
Entada 155
Epigynum 31
Epirinus 113
Epirixanthes 221
Eragrostis tenella 128*
Erechites 71
Eriandra 221
Ericaceae 107
Erigeron 71
Eriobotrya 231
japonica 231
Erismanthus 113
Erythrina 154, 155
subumbrans 159*
variegata 155
Erythropalaceae 205
Erythropalum 205
Erythrospermum 125
Erythroxylaceae 111
Erythroxylum 111
coca 111
cuneatum 110*
ecarinatum 110*
novogranatense 111
Escalloniaceae 255
Eucalyptus 197
Euchresta 154, 155
Eugeissona 211
Eugenia 197
Euonymus 59
Eupatorium 71
Euphorbia 112, 113
cotinifolia 113
Euphorbiaceae 112
Eupomatia 119
laurina 118*
Eupomatiaceae 119
Euroschinus 25
Eurya 271
Eurycoma 257
longifolia 258*
Eusideroxylon 147
Euthemis 203
Evodia 239
Evodiella 239
Exbucklandia 135
Excoecaria 112, 113
indica 113
Exocarpos 245
Fabaceae 154
Fagaceae 121
Fagara 239
Fagerlindia 235
Fagraea 165
crenulata 165
fragrans 166*
racemosa 165
Fahrenheitia 113
Falcifolium 75
Faradaya 289
Fatoua 185
Fernandoa 39
Feronia 239
elephantum 239
Feroniella lucida 239
Ficus 185
albipila 186*
dens-echini 185
diversifolia 185
Filicium 247
Finschia 223
Firmiana 267
Fissistigma 29
Fittingia 195
Flacourtie 125
rukam 124*
Flacourtiaceae 125
Flemingia 155
Fleurya 285
Flindersia 239
Flueggea 112, 113
Fontainea 113
Fordia 155
albiflora 160*
Fortunella 239
Fragaria 231
Fraxinus 207
Freycinetia 215
kalamantanica 214*
Friesodielsia 29
Gaertnera 234, 235
Galbulimima 139
belgraveana 138*
- Galearia** 112, 113
celebica 113
Galium 234, 235
Ganophyllum 247
Ganua 251
pallida 251
Garcinia 131
segmentata 133*
Gardenia 234, 235
Gardeniopsis 235
Gardneria 165
Garrettia 289
Garuga 49
floribunda 51*
Gastonia 37
Gaultheria 107
Gelsemium 165
Geniostoma 165
Geunsia 289
Geyera 239
Gibbsia 285
Gigantochloa levis 130*
Gilbeea 89
Girardinia 285
Gironniera 283
Gleditschia 155
Glenniea 247
Glochidion 112, 113
insigne 115*
Glossocarya 289
Glossogyne 71
Gluta 25
Glycine max 154
Glycosmis 239
Glyptopetalum 59
Gmelina 289
Gnaphalium 71
Gnetaceae 127
Gnetum 127
costatum 127
gnemon 127
gnemonoides 127*
Gomphandra 141
javanica 140*
quadrifida
 var. *triplinervia* 141
Gomphia 203
serrata 202*
Goniothalamus 29
Gonocaryum 141
Gonostegia 285
Gonystylaceae 275

- Gonystylus** 275
areolatus 275
velutinus 276*
- Gordonia** 271
amboinensis 273*
- Gossypium** 173
- Gouania** 225
- Gramineae** 129
- Grangea** 71
- Greenea** 235
- Grenacheria** 195
- Grevillea** 223
- Grewia** 277
paniculata 278*
- Guettarda** 235
- Guioa** 247
pleuroptera 248*
- Gustavia** 151
- Guttiferae** 131
- Gymnacranthera** 191
- Gymnostoma** *nobile* 56*
- Gynochthodes** 235
- Gynopachys** 235
- Gynotroches** 229
- Gynura** 71
- Gyrinops** 275
caudata 275
- Gyrocarpaceae** 137
- Gyrocarpus** 137
- Halfordia** 239
- Hamamelidaceae** 135
- Hamelia** 234, 235
- Haplolobus** 49
- Harmania** 205
- Harmsiopanax** 37
ingens 38*
- Harpullia** 247
myrmecophila 247
- Harrisonia** 257
perforata 257
- Hederella** 177
- Hedyotis** 234, 235
pterita 235
- Helicia** 223
bullata 223
forbesiana 223
peltata 223
robusta 224*
- Helicciopsis** 223
- Helicteres** 267
- Heliotropium** 47
- Helwingia** 83
- Hemisclopia** 125
- Heritiera** 267
macrophylla 266*
- Hernandia** 137
nymphaefolia 136*, 137
- Hernandiaceae** 137
- Hesperethusa** 239
crenulata 239
- Heteropanax** 37
- Hevea** 112, 113
- Hexapora** 147
- Heynea** 179
- Hibbertia** *scandens* 96
- Hibiscus** 173
macrophyllus 174*
- Hieris** 39
- Hildegardia** 267
- Himantandraceae** 139
- Hippocratea** 59
- Hippocrateaceae** 59
- Holarrhena** 31
- Holmskioldia** 289
- Homalanthus** 113
fastuosus 113
- Homalium** 125
- Homonoia** 113
- Hopea** 98, 99
- Horsfieldia** 191
grandis 191
- Hosea** 289
- Hugonia** 163
- Hugoniaceae** 163
- Hulletia** 185
- Hunga** 63
- Hura** 113
- Hybanthus** 291
- Hydnocarpus** 125
polypetala 125
woodii 126*
- Hydnophytum** 234, 235
- Hydrangea** 255
- Hydrangeaceae** 255
- Hymenocardia** 112, 113
- Hymenodictyon** 235
- Hymenosporum** 219
- Hypericaceae** 131
- Hypericum** 131
- Icacinaceae** 141
- Ilex** 35
aquifolium 35
- (Ilex)**
javanica 34*
paraguariensis 35
- Illiciaceae** 143
- Illicium** 143
tenuifolium 144*
verum 143
- Illigera** 137
- Indigofera** 154, 155
- Indorouchera** 163
contestiana 162*
- Indovethia** 203
- Inga** *edulis* 155
- Incocarpus** 154, 155
- Intsia** 154
- Inula** 71
- Iodes** 141
cirrhosa 142*
philippinensis 142*
- Irvingia** 257
malayana 259*
- Irvingiaceae** 257
- Isachne** 129
- Ischnocarpus** 32
- Itea** 255
- Itaceae** 255
- Ixonanthaceae** 163, 257
- Ixonanthes** 163
reticulata 164*
- Ixora** 234, 235
pulcherrima 235*
- Jacaranda** 39
- Jackiopsis** 235
- Jagera** 247
- Jarandersonia** 277
- Jasminum** 207
- Jatropha** 112, 113
- Johannesteijsmannia** 211
- Juglandaceae** 145
- Kairothamnus** 113
- Kalappia** 154, 155
- Kandelia** 229
- Kayea** 131
calophyloides 131
- Kibara** 183
ferox 182*
- Kibatalia** 32
- Kigelia** 39
- Kingiodendron** 155
- Kjelbergiodendron** 197

- Kleinhovia** 267
Knema 191
 mogeana 192*
Kochummenia 235
Koilodepas 113
 longifolia 113
 pectinata 113
Koompassia 154, 155
Koordersiodendron 25
 pinnatum 26*
Kopsia 32
Korthalsia 211
Kostermansia 45
Kostermanthus 63
Kunstleria 155

Labisia 195
Lablab 154
Lactuca 71
Lagerstroemia 169
 ovalifolia 168*
Laggera 71
Lamechites 32
Lamiodendron 39
Lannea 25
Lansium 179
Lantana 289
Laporteia 285
 decumana 285
Lasianthus 235
Lasiobema 155
Lasiococca 113
Lathyrus 155
Launaea 71
Lauraceae 147
Lawsonia 169
Lecananthus 235
Lecythidaceae 151
Leea 153
 magnifolia 152*
Leeaceae 153
Leguminosae 154
 subfam. Caesalpinoideae
 154
 subfam. Mimosoideae 154
 subfam. Papilionoideae 154
Lepinia 32
Lepiniopsis 32
Lepisanthes 247
Leptonychia 267
Leptopus 113
Leptospermum 197

Leucaena 154, 155
Leuconotis 32
Leucosyke 285
Levieria 183
Libocedrus 75
 papuana 77*
Licuala 211
Ligustrum 207
Limonia 239
Linaceae 163
Lindera 147
Lindsayomyrtus 197
Linociera 207
Linostoma 275
Litchi 247
Lithocarpus 121
 turbinatus 122*
Litsea 147
Livistona 211
Loerzingia 113
Loeseneriella 59
Loganiaceae 165
Loheria 195
Lonicera 55
Lophopetalum 59
 beccarianum 58*
 sessilifolium 59
Lophophyxis 141
Lucinaea 235
Lumnitzera 69
Lunasia amara 239
Luvunga 239
Lysiphyllo 155
Lythraceae 169

Maba 103
Macadamia 223
 hildebrandii 223
 ternifolia 223
Macaranga 112, 113
 trachyphylla 113
Mackinlaya 37
Maclura 185
Maclurodendron 239
 porteri 238*
Macrolenes 177
Macropanax 37
Macropsychanthus 155
Madhuca 251
 crassipes 250*
 sessilis 251
Maesa 195

Maesopsis 225
Magnolia 171
 sect. Blumiana 171
 carsonii
 var. drymifolia 172*
Magnoliaceae 171
Magodendron 251
Maingaya 135
Malaisia 185
Mallotus 112, 113
 sect. Hancea 113
 sect. Stylosanthes 113
 paniculatus 117*
 sumatranus 113
Malus 231
Malvaceae 173
Malvaviscus 173
Mammea 131
 acuminata 131
 calciphylla 131
 woodii 131
Mandevilla 32
Mangifera 25
Manglietia 171
Manihot 112, 113
 esculenta 113
Manilkara 251
 achras 251
 kauki 251
Manitoa 154
Maoutia 285
Maranthes 63
 corymbosa 64*
Margaritaria 113
Mastersia 155
Mastixia 83
 kaniensis
 subsp. kaniensis 83*
Mastixiodendron 235
Matthaea 183
Maytenus 59
Medinilla 177
Medusanthera 141
Megistostigma 112, 113
 burmannicum 113
 peltatum 113
Melaleuca 197
 cajuputi 196*
Melanochyla 25
Melanolepis 113
Melastoma 177
 beccarianum 177

- Melastomataceae 177**
- Melia 179
 - Meliaceae 179**
 - Melicope 239
 - Melientha 209
 - Meliosma 241
 - veitchiorum 242*
 - Meliosmaceae 241
 - Melodinus 32
 - Melodorum 29
 - Memecylaceae 177
 - Memecylon 177
 - laruei 176*
 - monchyawanum 176*
 - Merope 239
 - Merrillia 239
 - Merrilliodendron 141
 - Meryta 37
 - Mesua 131
 - Metadina 235
 - Metrosideros 197
 - Metroxylon 211
 - sagu 213*
 - Meyna 235
 - Michelia 171
 - Microchites 32
 - Microcitrus 239
 - Microcos 277
 - fibrocarpa 277
 - Microdesmis 112, 113
 - Microglossa 71
 - Micromelum 239
 - Microtropis 59
 - kinabaluensis 59
 - Mikania 71
 - Millettia 155
 - unifoliolata 155
 - Millingtonia 39
 - Mimosa 155
 - Mimosaceae 154
 - Mimusops 251
 - elengi 251
 - Miquelia 141
 - Mirabilis 199
 - Mischocarpus 247
 - Mitragyna tubulosa 236*
 - Mitrasacme 165
 - Mitrella 29
 - Monanthocitrus 239
 - Monarthrocarpus 155
 - Monimiaceae 183**
 - Monocarpia 29
- Monostachya 129**
- Monotropaceae 107
 - Monotropastrum 107
 - Moraceae 185**
 - Morinda 234, 235
 - oleifera 187, 188*
 - Moringaceae 187**
 - Morus 185
 - Moultonianthus 113
 - Mucuna 154, 155
 - Muehlenbergia 129
 - Munronia 179
 - Muntingia 277
 - Murraya 239
 - Mussaenda 234, 235
 - anisophylla 235
 - Mussaendopsis 234, 235
 - Mycetia 235
 - Myosotis 47
 - Myrialepis 211
 - Myrica 189
 - javanica 190*
 - rubra 189
 - Myricaceae 189**
 - Myristica 191
 - myrmecophila 191
 - pubicarpa 193*
 - subalulata 191
 - succedanea 193*
 - Myristicaceae 191**
 - Myrmecodia 234, 235
 - Myrmeconauclea 235
 - Myrmephytum 234, 235
 - Myrsinaceae 195**
 - Myrsine 195
 - Myrtaceae 197**
 - Myxopyrum 207
 - enerve 206*
 - Nageia 75
 - wallichiana 77*
 - Nastus 129
 - Nauclea 234, 235
 - Neckia 203
 - Neesia 45
 - Neillia 231
 - Nenga 211
 - Neobalanocarpus 98, 99
 - Neocinnamomum 147
 - Neocolletia 155
 - Neodissochaeta 177
 - Neodriessenia 177
- Neokeithia 32**
- Neolamarckia 234
 - Neolitsea 147
 - Neonauclea 235
 - Neoscorchia 113
 - Neosepicaea 39
 - Neotrewia 113
 - Nephelium 247, 248
 - Neptunia 155
 - oleracea 155
 - Nerium 32
 - Nertera 234, 235
 - nigricarpa 235
 - Neuburgia 165
 - Notaphoebe 147
 - Nothocnide 285
 - Nothofagus 121
 - perryi 123*
 - womersleyi 123*
 - Nothopegiopsis 25
 - Nyctaginaceae 199**
 - Nyctanthes 207
 - Nyctocalos 39
 - Nypa 211
 - Nyssa 201
 - javanica 200*, 201
 - Nyssaceae 201**
 - Ochanostachys 205
 - Ochna 203
 - Ochnaceae 203**
 - Ochrosia 32
 - Octamyrtus 197
 - pleiopetala 197
 - Octomeles 93
 - sumatrana 92*
 - Octospermum 112, 113
 - Olacaceae 205**
 - Olax 205
 - Olea 207
 - Oleaceae 207**
 - Olearia 71
 - Omphalea 113
 - Omphalodes 47
 - Oncosperma 211
 - Opilia 209
 - Opiliaceae 209**
 - Oreocallis 223
 - Oreodoxa 211
 - Ornocarpus 155
 - Orophea 29
 - Oroxylum 39

- Oryza 129
 Osmelia 125
 grandistipula 125
 Osmoxylon 37
 Ostodes 113
Oxalidaceae 210
 Oxalis 210
 Oxyceros 235
 Oxyspora 177

 Pachycentria 177
 Pachylarnax 171
 Pachyrrhizus 154
 Pachystylidium 112, 113
 Padbruggea 155
 Paederia 235
 foetida 235
 verticillata 235
 Pajanelia 39
 Palaquium 251
 brassii 252*

Palmae 211
 Palmeria 183
 womersleyi 182*
 Panax 37
 Pandaceae 112
Pandanaceae 215
 Pandanus 215
 amaryllifolius 215
 helicopus 216*
 Pandorea 39
 pandorana 40*
 Pangium 125
 Panicum palmifolium 129
 Papilionaceae 154
 Parabarium 32
 Parameria 32
 Paramignya 239
 longispina 240*
 Paramyristica 191
 Paranephelium 247, 248
 Pararchidendron 155
 Parartocarpus 185
 Paraserianthes 154, 155
 Parashorea 98, 99
 Parasponia 283
 Parastemon 63
 Parinari 63
 Parishia 25
 Parkia 154, 155
 timoriana 161*

 Parkinsonia 155
 Parmentiera 39
 Parnassiaceae 255
 Paropsia 125
 Parsonsia 32
 Pavetta 235
 Pavonia 173
 Payena 251
 lucida 253*
 Pegia 25
 Pellacalyx 229
 Peltophorum 155
 Memphis 169
 Pentace 277
 triptera 279*
Pentaphylacaceae 217
 Pentaphylax euryoides
 217
 Pentas 234
 Pentaspadon 25
 Pericopsis 154
 Peronema 289
 Perrottetia 59
 Persea 147
 americana 147
 Petalophus 29
 Petraevitex 289
 Petrea 289
 Phacellaria 245
 Phaeanthus 29
 splendens 30*
 Phaleria 275
 Phanera 155
 Phaseolus 154
 Philbornea 163
 Phoebe 147
 Pholidocarpus 211
 Photinia 231
 Phyla 289
 Phylacium 155
 Phyllagathis 177
 Phyllanthus 112, 113
 acidus 113
 reticulatus 113
 Phyllocladus 75
 hypophyllus 77*
 Phytocrene 141
 Picrasma 257
 Pigafetta 211
 Pilea 285
 malastomooides 287*
 Piliostigma 155

 Pimelea 275
 Pimelodendron 113
 macrocarpum 113
 Pimenta 197
 Pinaceae 75
 Pinanga 211
 Pinus 75
 merkusii 78*
 Piptocalyx 282
 Pipturus 285
 Pisonia 199
 aculeata 199
 cauliflora 199*
 grandis 199
 umbelliflora 199
 Pistacia 25
 Pisum 155
 Pithecellobium 155
Pittosporaceae 219
 Pittosporum 219
 moluccanum 218*
 Planchonella 251
 keyensis 251
 punctata 251
 Planchonia 151
 Platea 141
 Platymitra 29
 Plectocomia 211
 Plectocomiopsis 211
 Pleiocarpterium gentianifolia
 235
 Pleiogynium 25
 timoriense 25
 Pleiospermium 239
 Pleurostylia 59
 Pluchea 71
 Plukenetia 113
 Plumeria 32
 Poa 129
 Poaceae 129
 Podocarpaceae 75
 Podocarpus 75
 Pogonanthera 177
 Pogonotium 211
 Poikilogyne 177
 villosa 177
 Poikilospermum 285
 Polyalthia 29
 dolichophylla 29
 Polygala 221
 paniculata 221
Polygalaceae 221, 281

- Polyosma** 255
cestroides 256*
verticillata 255
Polyporandra 141
Polyscias 37
mollis 37
Pometia 247, 248
Pongamia 154
Popowia 29
Porterandia 235
Potaliaceae 165
Potentilla 231
Potoxylon 147
Pottia 32
Pouteria 251
cainito 251
Pouzolia 285
Prainea 185
Praravinia 234
suberosa 234, 235
verruculosa 235
Premna 289
foetida 289
herbacea 289
Prismatomeris 235
Priva 289
Procris 285
Proteaceae 223
Protium 49
Prumnopitys 75
Prunus 231
grisea 232*
phaeosticta 231
Pseudarthria 155
Pseudobotrys 141
Pseudoclausena 179
Pseudosmelia 125
Pseuduvoria 29
Psidium 197
Psophocarpus 154
Psoralea 155
Psychotria 234, 235
adenophylla 237*
myrmecophila 235
Pteleocarpa 47
Pternandra 177
Pterocarpus 154, 155
Pterocaulon 71
Pterococcus 113
Pterocymbium 267
Pterolobium 155
Pterospermum 267
Pterygota 267
Ptychopyxis 113
caput-medusae 113
costata 113
grandiflorus 113
Pueraria 155
Pullea 89
Pycnospora 155
Pyramidanthe 29
Pyrenacantha 141
Pyrolaceae 107
Pyrus 231
Quassia 257
amara 257
indica 257
Quercus 121
lineata 123*
Quintinia 255
Quisqualis 69
Racemobambos 129
Radermachera 39
pinnata 41*
Rapanea 195
Rapholepis 231
Rauvolfia 32
Rauwenhoffia 29
Reevesia 267
Reinwardtiodendron 179
humile 179
Reissantia 59
Renellia 235
Retispatha 211
Reutealis 113
Rhamnaceae 225
Rhamnella 225
Rhamnus 225
nepalensis 227*
Rhamphogyne 71
Rhaphis 211
Rhizophora 229
Rhizophoraceae 229
Rhodamnia 197
Rhododendron 107
konori 108*
Rhodoleia 135
Rhodomryrtus 197
Rhopaloblaste 211
Rhus 25
Rhynchoscarpa 155
Rhynchodia 32
Rhynchosia 155
Rhynchospermum 71
Rhysotoechia 247
Rhyticaryum 141
Richeriella 113
Ricinus 112, 113
Rinorea 291
anguifera 291
horneri 292*
javanica 291
Rollinia 29
Rosa 231
Rosaceae 231
Rothmannia 235
Rottboellia 129
Rourea 81
Roureopsis 81
Roystonea 211
Rubia 234, 235
Rubiaceae 234
Rubus 231
montis-wilhelmi 233*
Ruta 239
Rutaceae 239
Ryparosa 125
hullettii 125
Sabia 241
Sabiaceae 241
Saccharum 129
edule 129
Sageretia 225
Salacca 211
Salacia 59
macrophylla 59
maingayi 60*
papuana 59
Salicaceae 243
Salix 243
babylonica 244*
tetrasperma 243, 244*
Salomonia 221
Samanea 154, 155
Sambucus 55
Sandoricum 179
Santalaceae 245
Santalum 245
album 245, 246*
Santiria 49
Sapindaceae 247
Sapindus 247, 248
Sapium 113

- Sapotaceae 251**
- Sapsosma 235
 - Saraca 155
 - Sararanga 215
 - Sarawakodendron 59
 - Sarcandra 61
 - Sarcodum 155
 - Sarcopteryx 248
 - Sarcosperma 251
 - breviracemosum 254*
 - Sarcospermaceae 251
 - Sarcostigma 141
 - Sarcotheca 210
 - glauca 210*
 - Saritaea 39
 - Saurauia 21
 - pendula 22*
 - Saurauiaceae 21
 - Sauropus 112, 113
 - androgynus 113
- Saxifragaceae 255**
- Scaphium 267
 - Scaphocalyx 125
 - Schefflera 37
 - Schima 271
 - Schizolobium 155
 - Schizomeria 89
 - serrata 88*, 89
 - Schleichera 248
 - Schleinitzia 155
 - Schoepfia 205
 - Schoutenia 277
 - Schrankia 155
 - Schrebera 207
 - Schuurmansi 203
 - Schuurmansiella 203
 - Scleropyrum 245
 - Scolopia 125
 - Scorodocarpus 205
 - borneensis 204*
 - Scrotochloa 129
 - Sebastiania 113
 - Securidaca 221
 - ecristata 220*
 - Semecarpus 25
 - aruensis 25
 - bunburyanus 25, 27*
 - Senecio 71
 - Serianthes 155
 - Sericolea 105
 - Sesbania 154
 - Severinia 239
- Shorea 98, 99
 - macrophylla 100*
 - peltata 99
- Simaroubaceae 257**
- Sindora 154, 155
 - Siphonodon 59
 - Siphonodontaceae 59
 - Skimmia 239
 - Sloanea 105
 - pulchra
 - subsp. morobens 106*
 - Smythea 225
 - Solanum 234
 - Sonchu 71
 - Sonerila 177
 - biflora 178*
 - Sonneratia 261
 - griffithii 260*
 - Sonneratiaceae 169, 261**
 - Sophora 154, 155
 - Sorghum 129
 - Soulamea 257
 - Spathiostemon 113
 - Spathodea 39
 - Spatholobus 155
 - Sphaeranthus 71
 - Sphenodesme 289
 - involucrata 290*
 - Sphenostemon 183, 263
 - papuanus 262*
 - Sphenostemonaceae 183, 263**
 - Spigelia 165
 - Spigeliaceae 165
 - Spiraeanthemum 89
 - Spondias 25
 - Stachytarpheta 289
 - Staphyleaceae 265**
 - Steenisia 234, 235
 - Stegathera 183
 - Stelechocarpus 29
 - Stemonurus 141
 - monticulus 141
 - Stenocarpus 223
 - Sterculia 267
 - foetida 267
 - schlechteri 268*
 - stipulata 268*
 - Sterculiaceae 267**
 - Stereospermum 39
 - fimbriatum 39
 - Stichianthus 235
- Stillingia 113
- Stixis 53
- Streblus 185
- Strombosia 205
 - javanica 205
- Strongylodon 154, 155
- Strophanthus 32
- Strychnaceae 165
- Strychnos 165
 - colubrina 167*
- Stylaginaceae 112
- Styracaceae 269**
- Styrox 269
- Sumbaviopsis 113
- Sunaptea 98
- Suregada 112, 113
- Suriana 257
- Surianaceae 257
- Swietenia 179
 - macrophyllum 179
- Swintonia 25
- Sycopsis 135
- Sympetalandra 155
- Sympherema 289
- Sympheumataceae 289
- Symplocaceae 270**
- Symplocos 270
 - celastrifolia 270*
 - henschelii 270
 - pendula 270
 - verticillifolia 270
- Syncarpia 197
- Syndiophyllum 113
- Synedrella nodiflora 74*
- Synostemon 113
- Syzygium 197
- Tabebuia 39
- Tabernaemontana 32
- Tadehagi 155
- Talauma 171
- Tamarindus 154, 155
- Tapeinosperma 195
- Tarenna 235
- Tasmannia 295
- Taxaceae 75
- Taxus 75
 - sumatrana 79*
- Tecoma 39
- Tecomanthe 39
- Tectona 289

- Tephrosia 155
 Terminalia 69
 zollingeri 70*
 Ternstroemia 271
 Ternstroemiaceae 271
 Tetracera 96
 Tectromomia 239
 Tetrameles 93
 Tetramerista 271
 Tetrameristaceae 271
 Tetramolopium 71
 Tetrapanax 37
 Teysmanniodendron 289
Theaceae 271
 Theobroma 267
 Thesium 245
 Thespisia 173
 Thevetia 32
Thymelaeaceae 275
 Tibouchina 177
Tiliaceae 277
 Timonius 235
 Toddalia 239
 Toona 179
 suren 179
 Tournefortia 47
 argentea 47
 Trachelospermum 32
 Tremella 283
 cannabina 283
 Trevesia 37
 Trewia 113
 Triadodaphne 147
 Trichadenia 125
 Trichospermum 277
 Trifidacanthus 155
 Trigonachras 248
Trigoniaceae 221, 281
 Trigoniastrum 221, 281
 hypoleucum 280*
 Trigonobalanus 121
 Trigonopleura 113
 Trigonostemon 113
 capillipes 113
 diplopetalus 113
 sandakanensis 113
 Trigonotis 47
 inoblita 48*
 Trimenia 183, 282
 macrura 282
 papuana 282
Trimeniaceae 183, 282
 Triomma 49
 Triphasia 239
 Tristaniopsis 197
 Tristira 248
 Tristiropsis 247, 248
 Triumfetta 277
 Turillia 223
 Turpinia 265
 borneensis 264*
 stipulacea 265
 Turraea 179

Ulmaceae 283
 Ulmus 283
 Uncaria 234, 235
 Upuna 98, 99
 Urceola 32
 Urena 173
 lobata 175*
 Urnularia 32
 Urobotrya 209
 siamensis 209
 Urophyllum 234, 235
 Urtica 285

Urticaceae 285
 Uvaria 29

 Vacciniaceae 107
 Vaccinium 107
 bancanum 109*
 Vallaris 32
 Vatica 98, 99
 sect. *Sunaptea* 98
 umbonata 101*
 Vavaea 179
 amicorum 181*
 Ventilago 225
 Verbena 289

Verbenaceae 289
 Verbesina alata 71
 Vernonia 71
 Versteeghia 234, 235
 Viburnum 55
 coriaceum 54*
 punctatum 55
 Vigna 154, 155
 Villebrunnea 285
 Viola 291
 pilosa 291, 293*
- Violaceae 291**
 Vitaceae 153
 Vitex 289
 limonifolia 289
 negundo 289
 Voacanga 32
 grandifolia 33*
 Voandzeia 154, 155
 Wallaceodendron 155
 Wallichia 211
 Walsura 179
 monophylla 179
 Wedelia asperima 71
 Weinmannia 89
 Wendlandia 235
 Wetria 113
 macrophylla 113
 Whiteodendron 197
 moultonianum 198*
 Wikstroemia 275
 Willughbeia 32
 anomala 32
 firma 32*
Winteraceae 295
 Wrightia 32

 Xanthium 71
 Xanthomyrtus 197
 Xanthophyllaceae 221
 Xanthophyllum 221
 adenotus 221
 ellipticum 222*
 Xanthostemon 197
 Xerospermum 247, 248
 Ximenia 205
 Xylocarpus 179
 Xylopia 29
 Xylosma 125
 luzonense 125

 Youngia 71

 Zanthoxylum 239
 ovalifolium 239
 Zea 129
 Zinnia 71
 Zizyphus 225
 Zollingeria 248
 Zornia 155
 Zyogynum 295