

Trees of the Balikpapan–Samarinda area, East Kalimantan, Indonesia

CIP-DATA KONINKLIJKE BIBLIOTHEEK, DEN HAAG

Kessler, P. J. A.

Trees of the Balikpapan-Samarinda Area, East Kalimantan, Indonesia : a manual to 280 selected species / P. J. A. Kessler, Kade Sidiyasa. - Wageningen : The Tropenbos Foundation. - Ill. - (Tropenbos series ; 7)

With index, ref.

ISBN 90-5113-019-8

Subject headings: tree flora ; Borneo.

© 1994 Stichting Tropenbos

All rights reserved. No part of this publication, apart from bibliographic data and brief quotations in critical reviews, may be reproduced, re-recorded or published in any form including print photocopy, microform, electronic or electromagnetic record without written permission.

Cover design: Diamond Communications  
Cover photo (inset): *Shorea balangeran* (Korth.) Burck (photo by M.M.J. van Balgooy)  
Printed by: Krips Repro bv, Meppel

**TREES OF THE BALIKPAPAN-SAMARINDA AREA,  
EAST KALIMANTAN, INDONESIA**

**A manual to 280 selected species**

Paul J. A. Keßler and Kade Sidiyasa

The Tropenbos Foundation  
Wageningen, The Netherlands  
1994

## TROPENBOS SERIES

The Tropenbos Series presents the results of studies and research activities related to the conservation and wise utilization of forest lands in the humid tropics. The series continues and integrates the former Tropenbos Scientific and Technical Series. The studies published in this series have been carried out within the international Tropenbos programme. Occasionally, this series may present the results of other studies which contribute to the objectives of the Tropenbos programma.



Stichting Tropenbos  
Wageningen  
The Netherlands



Balai Penelitian Kehutanan Samarinda  
(Forestry Research Institute Samarinda)  
Indonesia



Rijksherbarium / Hortus Botanicus  
Leiden  
The Netherlands

## CONTENTS

Foreword . . . . .	7
Acknowledgements . . . . .	8
<b>1 . Introduction</b> . . . . .	<b>9</b>
1.1 Area covered by the Manual . . . . .	9
1.2 Scope of the Manual . . . . .	10
1.3 Format of descriptions . . . . .	10
1.4 Identification keys . . . . .	11
A. Synoptical Key to the Families . . . . .	11
B. Key to the Genera . . . . .	15
1.5 Glossary . . . . .	28
1.6 Selected Literature . . . . .	33
<b>2 . Descriptive Part</b> . . . . .	<b>35</b>
Index of scientific names . . . . .	235
Index of vernacular names . . . . .	239
<b>Figures</b> . . . . .	<b>243</b>



## FOREWORD

It is my great pleasure to introduce the valuable document in front of you on the 'Trees of the Balikpapan–Samarinda Area, East Kalimantan, Indonesia'. This manual represents one of the cooperative research products between the Ministry of Forestry of the Republic of Indonesia, the Tropenbos Foundation, Wageningen and Rijksherbarium / Hortus Botanicus, Leiden, The Netherlands, known as the International MOF Tropenbos-Kalimantan Project.

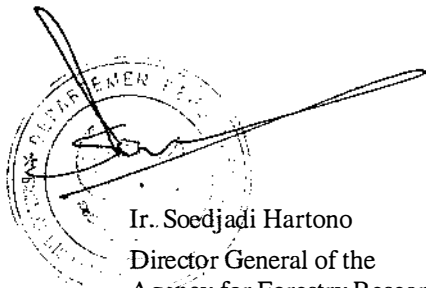
Unlike many other floras this book can be used also without complete sets of flowers and fruits, making it a valuable tool for use in the field. This is one of the objectives of the Agency for Forestry Research and Development, to bring scientific know-how to application in forestry practice.

Indonesia is gifted with an enormous variety of plant and animal life. More and more we realize and appreciate this source of biodiversity, much remains to be learned about this treasure of species richness, new species still awaiting discovery. The present book is one more step in assisting people to perceive this diversity.

Sustainable forest management has become an emotionally packed issue. It is indeed very questionable whether it is possible to manage a resource in a sustainable way when we do not know the constituents of this resource. We therefore must develop our know-how about the forest and its components to support our aim of achieving sustainable forest management in Indonesia. This book is a valuable tool in bringing some of this know-how to the people in the field involved in forest management.

Finally I would like to complement the authors and their staff on the thorough work they have done in good cooperation between the parties. May many more such products follow in the near future.

January, 1994



Ir. Soedjadi Hartono  
Director General of the  
Agency for Forestry Research  
and Development

## ACKNOWLEDGEMENTS

This manual is the result of a cooperative project of the Indonesian Ministry of Forestry (AFRD) and the Dutch Government, formulated in the multidisciplinary International MOF Tropenbos-Kalimantan Programme.

Without the aid and support of many persons and institutions, both in Indonesia and in the Netherlands, it would have not been possible to publish this book. We wish to thank all specialists who kindly helped us in the identification of our collections, especially: F.A.C.B. Adema (Sapindaceae; Papilionaceae), P.S. Ashton (Dipterocarpaceae), M.M.J. van Balgooy and K.M. Kochummen (pre-identification), J.R.M. Buysen (Sapindaceae: *Nephelium*), M.J.E. Coode (Elaeocarpaceae), Ding Hou (Anacardiaceae; Celastraceae; Rhizophoraceae; Caesalpinaceae: *Sindora*), C. Kalkman (Rosaceae: *Prunus*), R. Kiew (Oleaceae: *Chionanthus*), P.W. Leenhouts (Burseraceae; Connaraceae; Loganiaceae; Sapindaceae), R. van der Meijden (Polygalaceae: *Xanthophyllum*), H.P. Nooteboom (Magnoliaceae; Simaroubaceae), C.E. Ridsdale (Rubiaceae), A. Schot (Euphorbiaceae: *Aporosa*; Papilionaceae: *Calerya*), E. Soepadmo (Fagaceae), P.F. Stevens (Guttiferae: *Calophyllum*), I.G.M. Tantra (Sterculiaceae: *Sterculia*), W. Vink (Sapotaceae), P.C. van Welzen (Euphorbiaceae: *Neoscortechinia*; Sapindaceae: *Guioa*), and W.J.J.O. de Wilde (Myristicaceae).

We are very grateful to C. Kalkman and T.C. Whitmore, who critically read earlier versions of the manuscript.

Our tree climbers Ambriansyah and Arifin Zainal untiringly collected, processed and mounted the plant material. Without their help we would not have been able to finish our task in due time.

Last but not least, our artist Priyono, supervised by Mr. J.H. van Os (Rijksherbarium / Hortus Botanicus, Leiden), managed to provide us with the high number of reliable botanical drawings.



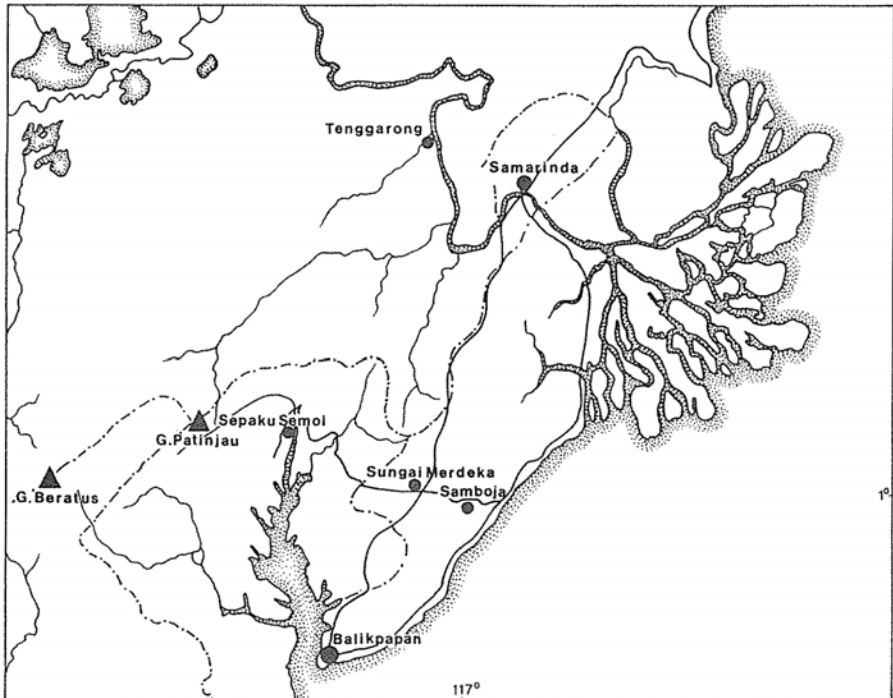
# 1. INTRODUCTION

## 1.1. Area covered by the Manual

As mentioned in the title of the book this Flora covers only a small part of East Kalimantan. Our collecting activities were mainly concentrated on the following sites:

- a. The Wanariset research area
- b. The P. T. ITCI concession area, mainly 12 plots of the 'Growth & Yield' and 'Soil & Site' groups of the Tropenbos Kalimantan project (Van Bremen et al. 1990)
- c. The Bukit Soeharto forest reserve
- d. The Sungei Wain protection forest
- e. The vicinity of Samarinda
- f. The vicinity of Samboja Kuala and Handil II

All these locations are situated approximately between  $0-1^{\circ} 15' S$  and  $116-117^{\circ} 45' E$ . This part of the province is dominated by rugged hills to undulating plains. The altitude ranges between sea-level and 700 m above sea-level.



Map of the research area.

## 1.2. Scope of the Manual

The intended scope of the Manual was a Flora containing c. 250 of the most important tree species, important either economically or ecologically, and the means to identify them by field characters as well as herbarium characters.

During our work in writing a checklist for this area it became evident that it would not be possible to include all species in our Manual, on account of the great botanical diversity. Instead, for the user's convenience, we included a great number of families and genera to make this Manual as user-friendly as possible. From the 84 families with at least one big tree species (defined as either 35 cm dbh or over or 20 m tall) listed by Whitmore et al. (1990) for the whole of Borneo, we included 66; the others are usually not found in the lowlands, are very rare, or are restricted to very special habitats. The same authors also calculated the number of genera, c. 370 in total. Our number of 210 seems low in comparison, but it does represent the real diversity in our collection area. The c. 280 species we described more or less elaborately can of course not be representative for the tree flora of our area. We tried to incorporate all important species as we know from the practice that the user is usually only interested in the species name of the economically important trees and is content with a genus name for the rest of the species.

This book is intended as a first guide to the (primary) lowland forest of East Kalimantan and the authors are fully aware of the shortcomings of this compilation. Foresters, timber licensees and their forestry personnel often find it difficult to identify tree species by their bark, slash and leaf-characters alone and we hope that this book facilitates a quick identification of the tree in question or provides at least some hints as to which family or genus the specimen possibly may belong.

## 1.3. Format of descriptions

- Families, genera, and species are treated in alphabetical order.
- Scientific genus and species names have been cited with their references.
- Synonyms are limited to those used in recent literature on Kalimantan.
- Vernacular names have been incorporated but have been kept to a minimum (language in brackets, B = Dajak Benuag, M = Malay / Indonesian, D = Dajak, K = Kutai).
- Literature (monographs, revisions, floristic accounts) of recent date is included, if published in a readily accessible source.
- Descriptions include field and herbarium characters, especially data on height, bole, shape, bark, slash, twigs, leaves, flowers, and fruits.
- Habitat and Ecology data have been incorporated very summarily.
- If available, data on uses, especially of the timber, have been mentioned.
- All numbers cited under 'material' have been collected during the last three years by our team and are incorporated in the Wanariset Herbarium. Duplicates were sent to Herbarium Bogoriense (BO), Forest Research Herbarium Bogor (BZF), and Rijksherbarium/Hortus Botanicus Leiden (L). Some were also distributed to specialists in different institutes. The following abbreviations are used for the collectors:

W = the tree number in the Wanariset research area  
AA = Ambriansyah & Arifin Zainal  
S = Kade Sidiyasa  
v. B. = van Balgooy  
P. K. = Keßler

Trees with W numbers are usually numbered within our permanent plots in the Wanariset research area, in order to be able to collect flowers and fruits from the same tree.

Drawings have been made of at least one member of most of the genera. All 40 taxa of Dipterocarpaceae are illustrated as it is the most important timber family of Kalimantan.

#### 1.4. Identification keys

Several keys have been constructed which are based primarily on field characters. There is a 'Synoptical Key to the Families' (A), followed by a bracketed 'Key to the Genera' (B). Not all taxa mentioned in the keys (key B and those under the various families/genera) are provided with a full description in this manual; these are marked with an asterisk.

##### A — SYNOPTICAL KEY TO THE FAMILIES

We shall here briefly describe the procedure of determining a plant by means of the synoptical key.

One of the advantages of a synoptical key or polyclave is that one is not forced to start with a certain character. The first step is a thorough analysis of the tree in question. Next, we go through the list of characters and select the one corresponding to the characters found. The list of numbers behind the character is coding those families which express this certain character. The list of numbers is noted down. Next one goes on with other characters and crosses out those numbers of the existing list which do not appear in the new list. One stops choosing new characters when only one number is left.

Example: Imagine we would like to identify *Pimelodendron* (Euphorbiaceae). Description of the plant: "Exudate yellow, leaves spirally arranged, leaf margin toothed." We start with 3b and list 21\*, 24\*, 27\*, then try 7b and we can cross out 21 and 27 as those numbers do not occur in this list. Number 24 remains: Euphorbiaceae. In order to control the result we can now also try character 5d. As before only the Euphorbiaceae remain.

Every time one selects a new character one actually excludes families. As we use vegetative and thus easily accessible characters only, the result will be – due to large and variable families – that one of course cannot always exclude all families. But at least the majority of families is excluded and one can try the key to the genera (B) or start directly with the different keys under the families.

For an enumeration of the families and their numbers, see the list below. Abbreviations of the family names have also been given and are used in key B: Key to the Genera (pages 15–27).

1 Actinidiaceae	(Actin.)	34 Loganiaceae	(Logan.)
2 Alangiaceae	(Alang.)	35 Lythraceae	(Lythr.)
3 Anacardiaceae	(Anacard.)	36 Magnoliaceae	(Magnol.)
4 Annonaceae	(Annon.)	37 Melastomataceae	(Melast.)
5 Apocynaceae	(Apoc.)	38 Meliaceae	(Meliac.)
6 Aquifoliaceae	(Aquif.)	39 Mimosaceae	(Mimos.)
7 Araucariaceae	(Arauc.)	40 Moraceae	(Morac.)
8 Bombacaceae	(Bomb.)	41 Myristicaceae	(Myrist.)
9 Boraginaceae	(Borag.)	42 Myrtaceae	(Myrtac.)
10 Burseraceae	(Burs.)	43 Olacaceae	(Olacac.)
11 Caesalpiniaceae	(Caesalp.)	44 Oleaceae	(Oleac.)
12 Casuarinaceae	(Casuar.)	45 Oxalidaceae	(Oxal.)
13 Celast <sup>r</sup> aceae	(Celast.)	46 Palmae	(Palm.)
14 Chrysobalanaceae	(Chrysob.)	47 Papilionaceae	(Papil.)
15 Combretaceae	(Combr.)	48 Podocarpaceae	(Podoc.)
16 Compositae	(Comp.)	49 Polygalaceae	(Polygal.)
17 Connaraceae	(Connar.)	50 Proteaceae	(Proteac.)
18 Cornaceae	(Cornac.)	51 Rhamnaceae	(Rhamn.)
19 Datisceae	(Datic.)	52 Rhizophoraceae	(Rhiz.)
20 Dilleniaceae	(Dillen.)	53 Rosaceae	(Rosac.)
21 Dipterocarpaceae	(Dipt.)	54 Rubiaceae	(Rubiac.)
22 Ebenaceae	(Eben.)	55 Rutaceae	(Rutac.)
23 Elaeocarpaceae	(Elaeoc.)	56 Sabiaceae	(Sabiac.)
24 Euphorbiaceae	(Euph.)	57 Sapindaceae	(Sapind.)
25 Fagaceae	(Fagac.)	58 Sapotaceae	(Sapot.)
26 Flacourtiaceae	(Flac.)	59 Simaroubaceae	(Simar.)
27 Guttiferae	(Guttif.)	60 Sonneratiaceae	(Sonner.)
28 Hypericaceae	(Hyper.)	61 Sterculiaceae	(Sterc.)
29 Icacinaceae	(Icac.)	62 Theaceae	(Theac.)
30 Juglandaceae	(Jugl.)	63 Thymelaeaceae	(Thym.)
31 Lauraceae	(Laur.)	64 Tiliaceae	(Tiliac.)
32 Lecythydaceae	(Lecyth.)	65 Ulmaceae	(Ulmac.)
33 Linaceae	(Linac.)	66 Verbenaceae	(Verb.)

If more conditions of one character are found in one family, the number is marked with an asterisk.

## Bark

1. *Exudate*
  - a. present: 3, 5, 7, 10, 11\*, 18, 20, 21, 24\*, 27, 28, 38\*, 40, 41, 43\*, 47\*, 48, 57\*, 58
  - b. absent
2. *Type of exudate*
  - a. resinous: 3, 7, 10, 21, 48
  - b. not resinous
3. *Colour of exudate*
  - a. white: 3\*, 5, 7\*, 10\*, 21\*, 24\*, 27\*, 38\*, 40, 43, 58
  - b. yellow: 21\*, 24\*, 27\*
  - c. red: 11\*, 24\*, 27\*, 28\*, 38\*, 41, 47, 57\*
  - d. pink/brown: 3\*, 28\*
  - e. black: 3\*, 21\*
  - f. clear: 3\*, 7\*, 10\*, 11\*, 18\*, 20, 21\*, 27\*, 48

## Leaf

4. *Leaves*
  - a. compound: 3\*, 10, 11, 30, 38\*, 39, 40\*, 45, 46, 47, 55\*, 56, 57, 59\*, 61\*, 66\*
  - b. simple
5. *Position of leaves*
  - a. opposite: 3\*, 5\*, 7, 13\*, 18\*, 24\*, 27, 28, 31\*, 33\*, 34, 35, 37, 40\*, 42\*, 44, 48\*, 51\*, 52, 54\*, 55, 60, 66
  - b. in whorls: 5\*, 12, 31\*, 54\*
  - c. crowded: 3\*, 15, 24\*, 31\*, 32\*, 46, 58\*, 59\*, 61\*, 62\*
  - d. spiral: 1, 2, 3\*, 5\*, 6, 10, 11, 13\*, 14, 16, 17, 19, 20, 23\*, 24\*, 25, 26, 29, 30, 31\*, 32\*, 33\*, 36, 38, 39, 40\*, 41\*, 42\*, 43\*, 45, 47, 48\*, 50, 53, 56, 57, 58\*, 59\*, 61\*, 62\*, 63, 64\*
  - e. alternate (distichous): 4, 8, 9, 18\*, 21, 22, 23\*, 24\*, 36, 40\*, 41\*, 43, 49, 51\*, 58\*, 62\*, 64\*, 65
6. *Compound leaves*
  - a. 3-foliolate: 38\*, 45, 55, 57\*, 61\*, 66\*
  - b. palmately compound: 46\*, 61\*, 66\*
  - c. pinnately compound: 3, 10, 11, 30, 38\*, 40, 46\*, 47, 56, 57\*, 59, 66\*
  - d. bipinnately compound: 39
7. *Leaf or leaflet margin*
  - a. entire: 1\*, 2, 3, 4, 5, 6, 7, 8, 9, 10\*, 11, 12, 13\*, 14, 15, 16, 17, 18, 19, 20\*, 21, 22, 23\*, 24\*, 25\*, 26\*, 27, 28, 29, 30, 31, 32\*, 33, 34, 35, 36, 37, 38, 39, 40\*, 41, 42, 43, 44, 45, 46\*, 47, 48, 49, 50\*, 52\*, 53, 54, 55, 56\*, 57\*, 58, 59, 60, 61\*, 62\*, 63, 64\*, 65\*, 66\*
  - b. toothed: 1\*, 10\*, 13\*, 20\*, 23\*, 24\*, 25\*, 26\*, 30, 32\*, 40\*, 46\*, 50\*, 51, 52\*, 56\*, 57\*, 61\*, 62\*, 64\*, 65\*, 66\*
  - c. lobed: 24\*, 40\*, 50\*, 61\*, 64\*

8. *Shape of leaf*
- obovate: 2\*, 3\*, 4\*, 9, 13\*, 15, 20\*, 21\*, 23\*, 24\*, 27\*, 31\*, 32, 40\*, 41\*, 42\*, 50\*, 52\*54\*, 58\*, 62\*
  - different
9. *Lamina of leaf*
- with dots: 4, 22\*, 24\*, 26\*, 27\*, 28, 31\*, 40\*, 41\*, 42, 43\*, 52\*, 55, 63\*
  - without dots
10. *Venation*
- 3-veined at base: 2\*, 24\*, 31\*, 37\*, 40\*, 45\*, 61\*, 64\*, 65\*, 66\*
  - palmetely veined: 2\*, 19, 23\*, 24\*, 61\*, 64\*
  - parallel veined: 7, 46, 48
  - pinnately veined: 1, 2\*, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23\*, 24\*, 25, 26, 27, 28, 29, 30, 31\*, 32, 33, 34, 35, 36, 37\*, 38, 39, 40, 41, 42, 43, 44, 45\*, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 65\*
11. *Tertiary venation*
- ladder-like: 3\*, 4\*, 8\*, 13\*, 14\*, 20, 21\*, 24\*, 26\*, 37\*, 40\*, 43\*, 49\*, 50\*, 58\*, 59\*, 61\*, 63\*, 64\*
  - net-like
12. *Intra-marginal vein*
- present: 11\*, 21\*, 28\*, 42\*, 58\*
  - absent
13. *Looping veins*
- present: 2\*, 3\*, 4\*, 8\*, 16, 21\*, 22\*, 24\*, 27\*, 28\*, 33\*, 40\*, 41\*, 42\*, 52\*, 54\*, 58\*, 59\*, 60
  - absent
14. *Stipules*
- present: 8, 10\*, 11, 13\*, 14, 21, 23, 24\*, 25, 26\*, 32, 33, 34, 36, 39\*, 40, 47, 51, 52, 53, 54, 57\*, 58\*, 59\*, 61, 64, 65
  - absent
15. *Stipules*
- connate: 34, 52, 54
  - free
16. *Stipule scar*
- ring-like: 21\*, 24\*, 36, 40\*, 52, 59\*, 65\*
  - not ring-like
17. *Petiole or petiolule*
- thickened at apex: 8, 21\*, 23\*, 24\*, 26\*, 43\*, 45, 55\*, 61\*, 64\*
  - thickened at base: 3\*, 5\*, 10\*, 11, 25\*, 32\*, 38, 40\*, 56, 66\*
  - thickened at both ends: 10\*, 13\*, 24\*, 61\*, 64\*
  - not thickened: 1, 2, 3\*, 4, 5\*, 6, 7, 9, 12, 13\*, 14, 15, 16, 17, 18, 19, 20, 21\*, 22, 23\*, 24\*, 25\*, 26\*, 27, 28, 29, 30, 31, 32\*, 33, 34, 35, 36, 37, 39, 40\*, 41, 42, 43\*, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55\*, 57, 58, 59, 60, 61\*, 62, 63, 64\*, 65, 66\*

18. *Glands on petiole/base of lamina*  
 a. present: 5\*, 14\*, 15\*, 24\*, 26\*, 39, 49\*, 53\*, 66\*  
 b. absent
19. *Glands on lower leaf-surface*  
 a. present: 14\*, 15\*, 19, 21\*, 22\*, 24\*, 26\*, 30, 40\*, 49\*, 53\*, 57\*, 66\*  
 b. absent
20. *Lower leaf surface*  
 a. glaucous: 4\*, 21\*, 23\*, 24\*, 25\*, 26\*, 27\*, 29\*, 31\*, 36\*, 40\*, 41\*, 49\*, 57\*, 64\*  
 b. not glaucous
21. *Stellate hairs or scales*  
 a. present: 1, 8, 21\*, 24\*, 25\*, 29\*, 30\*, 33\*, 35\*, 38\*, 41\*, 57\*, 61, 64, 66\*  
 b. absent

## B — KEY TO THE GENERA

(Not all taxa mentioned in this key are provided with a full description in the manual; these are marked with an asterisk)

- 1a. Trees without twigs, wood without secondary growth, leaves crowded, flowers 3-merous (Palmae) . . . . . 2  
 b. Trees with twigs, wood with secondary growth . . . . . 5
- 2a. Clustering trees, the trunk with long spines, the leaves pinnate  
*Oncosperma*\* (Palm.)
- b. Trees single, the trunk without spines . . . . . 3
- 3a. Rhachis with 2 yellow bands below, margin of rhachis beset with thick sharp spines, leaves palmate, fruits round, warty, c. 4 cm in diameter  
*Pholidocarpus*\* (Palm.)
- b. Rhachis without bands or spines . . . . . 4
- 4a. Leaves palmate, fruits ovoid, at least 10 cm long, inflorescence among the leaves . . . . . *Borassodendron*\* (Palm.)  
 b. Leaves pinnate, fruits smaller, inflorescence on the trunk . . . *Arenga*\* (Palm.)
- 5a. (1) Cut bark with exudate, sometimes oozing slowly . . . . . 6  
 b. Cut bark without exudate . . . . . 62
- 6a. Exudate orange, red, brown or black . . . . . 7  
 b. Exudate clear, white, creamy or yellow . . . . . 23
- 7a. Exudate black or turning black (Anacardiaceae p.p.) . . . . . 8  
 b. Exudate orange, red or brown . . . . . 11
- 8a. Trees without buttresses or stiltroots . . . . . *Mangifera* (Anac.)  
 b. Trees with buttresses and/or stiltroots . . . . . 9

- 9a. Bole usually with tar-like exudations, bark scaly or flaky or with large dipples  
*Gluta* (Anac.)
- b. Bole usually without tar-like exudations, bark smooth or cracked. . . . . 10
- 10a. Leaf undersurface with distinct papillae, exudate irritating  
*Melanochyla* (Anac.)
- b. Leaf undersurface without papillae, exudate usually not irritating  
*Buchanania* (Anac.)
- 11a. (7) Leaves pinnate . . . . . 12
- b. Leaves simple . . . . . 16
- 12a. Leaves paripinnate, margin of leaflets toothed . . . . . *Pometia* (Sapind.)
- b. Leaves imparipinnate, margin of leaflets entire . . . . . 13
- 13a. Bark fissured to scaly . . . . . 14
- b. Bark smooth . . . . . 15
- 14a. Twigs drooping, often planted . . . . . *Pterocarpus* (Papil.)
- b. Twigs erect, rarely planted . . . . . *Dracontomelon* (Anac.)
- 15a. Plank buttresses thin, spreading. . . . . *Dialium* (Caesalp.)
- b. Buttresses steep, not spreading . . . . . *Callerya* (Papil.)
- 16a. (11) Leaves opposite . . . . . 17
- b. Leaves alternate, spiral, or whorled . . . . . 18
- 17a. Leaves with oil dots . . . . . *Cratoxylon* (Hyper.)
- b. Leaves without oil dots . . . . . *Bouea* (Anac.)
- 18a. Stipules present . . . . . 19
- b. Stipules absent (Myristicaceae) . . . . . 20
- 19a. Lower leaf surface with yellow glandular dots . . . . *Macaranga* p.p. (Euph.)
- b. Lower leaf surface without glandular dots . . . . *Trigonostemon* p.p. (Euph.)
- 20a. Leaves not brittle when dry . . . . . 21
- b. Leaves (very) brittle when dry . . . . . 22
- 21a. Leaves not glaucous beneath, secondary veins looping, flowers in panicles, aril dissected . . . . . *Gymnacranthera* (Myrist.)
- b. Leaves glaucous beneath, secondary veins not looping, flowers clustered on short woody knobs, aril entire . . . . . *Knema* (Myrist.)
- 22a. Leaves not glaucous beneath, male panicles strongly branched, aril entire  
*Horsfieldia* (Myrist.)
- b. Leaves glaucous or not, male inflorescences little branched or fascicled, aril dissected . . . . . *Myristica* (Myrist.)
- 23a. (6) Exudate yellow. . . . . 24
- b. Exudate white, creamy or clear, sometimes resinous . . . . . 27
- 24a. Leaves spirally arranged, margin toothed . . . . . *Pimelodendron* (Euph.)
- b. Leaves opposite, margin entire (Guttiferae) . . . . . 25
- 25a. Leaves with numerous, close, parallel veins . . . . . *Calophyllum* (Guttif.)
- b. Leaves with few, spaced veins . . . . . 26
- 26a. Leaf stalk bases clasping the twig, the apical pair concealing the terminal bud  
*Garcinia* (Guttif.)



- b. Leaf stalk bases not clasping the twig, the apical pair not concealing the terminal bud. . . . . *Mesua* (Guttif.)
- 27a. (23) Leaves compound . . . . . 28
  - b. Leaves simple . . . . . 34
- 28a. Stipules very large, conical, leaving ring-like scars on the twigs, a small pair of leaflets alternating with a large pair *Artocarpus anisophyllus* (Morac.)
  - b. Stipules if present, not leaving ring-like scars on the twigs . . . . . 29
- 29a. Inner bark without resinous smell, petiolules not thickened . . . . . 30
  - b. Inner bark with resinous smell, petiolules thickened (Burseraceae) . . . . . 31
- 30a. At least young parts covered with scales . . . . . *Aglaiia* p.p. (Meliac.)
  - b. Plants glabrous or with simple hairs . . . . . *Parishia* (Anac.)
- 31a. Stipules present . . . . . *Canarium* p.p. (Burser.)
  - b. Stipules absent . . . . . 32
- 32a. Flowers 5-merous, fruit a winged capsule . . . . . *Triomma* (Burser.)
  - b. Flowers 3-merous, fruit a drupe . . . . . 33
- 33a. Fruit with excentric stigma . . . . . *Santiria* (Burser.)
  - b. Fruit with apical stigma . . . . . *Dacryodes* (Burser.)
- 34a. (27) Leaves opposite . . . . . 35
  - b. Leaves alternate, spiral or whorled . . . . . 38
- 35a. Exudate clear, smelling of sugarcane . . . . . *Mastixia* p.p. (Cornac.)
  - b. Exudate resinous or without smell . . . . . 36
- 36a. Exudate white, leaves pinnately veined . . . . . *Tabernaemontana* (Apoc.)
  - b. Exudate clear or white, leaves with several longitudinal veins . . . . . 37
- 37a. Buds round, fresh leaves break when bent . . . . . *Agathis* (Arauc.)
  - b. Buds conical, fresh leaves do not break when bent . . . . . *Nageia* (Podoc.)
- 38a. (34) Exudate clear, resinous (Dipterocarpaceae) . . . . . 39
  - b. Exudate clear or white, not resinous . . . . . 49
- 39a. Petioles thickened at apex . . . . . 40
  - b. Petioles not thickened at apex . . . . . 43
- 40a. Stipules large, clasping the stem, leaves folded in bud, leaf margin wavy (visible in adult leaves as a thin line between the veins), flowers large (up to 5 cm across), fragrant, fruits with 2 long and 3 short wings or rarely all poorly developed (ovary inferior) . . . . . *Dipterocarpus* (Dipt.)
  - b. Stipules usually small, not clasping the stem, leaves not folded in bud, leaf margin not wavy . . . . . 41
- 41a. Bark flaky, young parts multicellular glandular, leaves 9–17.5 cm long, 4–9.5 cm wide, white tomentose beneath, base heart-shaped, fruits with 2 long and 3 short wings (ovary superior) . . . . . *Upuna*\* (Dipt.)
  - b. Bark smooth to fissured, young parts without glands, leaves not white tomentose beneath, fruits with 2 long and 3 short wings (ovary inferior) or 2 long and 3 short wings (ovary superior) . . . . . 42
- 42a. Inner bark always lamellate, wood with silica, fruits with 2 long (3-veined) and 3 short wings (ovary inferior) . . . . . *Anisoptera* (Dipt.)

- b. Inner bark usually not lamellate (except *Shorea lamellata*), wood with or without silica, fruits with 3 long or 2 short wings, rarely all wings poorly developed (ovary superior) . . . . . *Shorea* p.p. (Dipt.)
- 43a. (39) Leaves with numerous closely parallel veins reaching the margin, crushed leaves weakly to strongly aromatic, fruits with 5 more or less equal wings  
*Dryobalanops* (Dipt.)
  - b. Leaves usually without closely parallel veins, if so, than not reaching the margin (dryobalanoid venation), crushed leaves not aromatic . . . . . 44
- 44a. Bark purplish, shallowly fissured with star-like lenticels, leaves with oblique veins (at a sharp angle to the midrib), usually white scaly beneath, fruits with 3 long and 2 short wings (ovary superior) . . . . . *Parashorea*\* (Dipt.)
  - b. Bark usually reddish brown, veins not oblique, fruits with 2 long and 3 short wings, 3 long and 2 short wings, or all equal . . . . . 45
- 45a. Secondary veins looping, tertiary veins indistinct, fruits with 2 long and 3 short wings (ovary superior) . . . . . *Cotylelobium* (Dipt.)
  - b. Secondary veins looping or not, tertiary veins distinct . . . . . 46
- 46a. Bole often hooped, secondary veins looping near marging, with glands near the top of veins, fruits with 5 small, more or less equal wings (sect. *Vatica*) or with 2 long or 3 short wings (sect. *Sunaptea*) . . . . . *Vatica* (Dipt.)
  - b. Bole usually not hooped, secondary veins without glands . . . . . 47
- 47a. Trunk often with stilt-roots or thin buttresses, the bole often tapering, bark smooth, flaky or fissured, venation dryobalanoid (veins closely parallel, but partly not reaching the margin as in *Dryobalanops*), or ladder-like, fruit with 3 short and 2 long wings, or all 5 wings short, nut visible (ovary superior)  
*Hopea* (Dipt.)
  - b. Trunk with steep round buttresses, venation usually ladder-like, fruit with 2 short and 3 large wings, rarely all lobes equal, nut visible (ovary superior) (*Shorea* p.p.) . . . . . 48
- 48a. Bark irregularly fissured or smooth, inner bark lamellate, cream, rays shining, sapwood pale yellow, venation net- and ladder-like  
*Shorea* (sect. *Anthoshorea*; Dipt.), White Meranti group
  - b. Bark scaly or irregularly fissured, inner bark greenish yellow, fibrous, rays shining, sapwood yellow, resin turning black, venation ladder-like, wings usually twisted . . . *Shorea* (sect. *Richetioides*; Dipt.), Yellow Meranti group
  - c. Bark irregularly cracked, scaly or fissured, inner bark brown or yellow, fibrous, rays not shining, sapwood yellow, venation ladder-like  
*Shorea* (sect. *Shorea*, *Pentacme*, *Neohopea*; Dipt.), Balau group
  - d. Bark regularly fissured, inner bark red, fibrous, rays shining, sapwood pinkish or brown, venation ladder-like  
*Shorea* (sect. *Rubella*, *Brachypterae*, *Pachycarpae*, *Mutica*, *Ovalis*; Dipt.), Red Meranti group
- 49a. (38) Stipules absent . . . . . 50
  - b. Stipules present . . . . . 55

- 50a. At least young parts of plant covered with scales, petioles thickened at apex  
*Aglaia simplicifolia* (Meliac.)
- b. Twigs and leaves glabrous or with simple hairs . . . . . 51
- 51a. Leaves in whorls, exudate milky . . . . . 52
- b. Leaves alternate, exudate milky or clear . . . . . 53
- 52a. Trees without buttresses, crown conical, fruits massive, spreading, seeds winged . . . . . *Dyera* (Apoc.)
- b. Trees with buttresses, the crown pagoda-like (branches in horizontal tiers), fruits slender, pendulous, seeds with a tuft of hairs at both ends  
*Alstonia* (Apoc.)
- 53a. Exudate clear, smelling of sugarcane, ovary inferior *Mastixia* p.p. (Cornac.)
- b. Exudate milky, not smelling of sugarcane, ovary superior . . . . . 54
- 54a. Exudate oozing freely, leaf base decurrent, leaves drying black, from coastal forests . . . . . *Cerbera* (Apoc.)
- b. Exudate oozing in droplets, leaf base not decurrent, leaves drying brownish, usually showing scattered black dots on both surfaces, inland forest  
*Ochanostachys* (Olac.)
- 55a. (49) Stipules very large, conical in bud, leaving ring-like scars on the twigs (Moraceae) . . . . . 56
- b. Stipules small or large, never conical . . . . . 58
- 56a. Leaf base 3-veined at base . . . . . *Ficus* (Morac.)
- b. Leaf base pinnately veined . . . . . 57
- 57a. Bole with large lenticels, fruit with persistent bracts  
*Parartocarpus bracteatus* (Morac.)
- b. Bole without large lenticels, fruit without bracts . . . . . *Artocarpus* (Morac.)
- 58a. (55) Twigs and leaves glabrous, petioles with a pair of tiny glands at the junction with the lamina, old leaves withering red . . . . . *Homalanthus* (Euph.)
- b. Twigs and leaves with T-hairs, glands absent (Sapotaceae) . . . . . 59
- 59a. Leaves alternate, tertiary veins descending, sepals 2 by 2 . . . *Payena* (Sapot.)
- b. Leaves spiral, often crowded, tertiary veins net- or ladder-like . . . . . 60
- 60a. Leaves spiral, sepals 5, corolla 5-lobed, stamens 5, staminodes 5  
*Planchonella*\* (Sapot.)
- b. Not this combination of characters, leaves crowded . . . . . 61
- 61a. Midrib often sharp below, sepals 6, in 2 whorls, corolla 6-lobed  
*Palaquium* (Sapot.)
- b. Midrib rounded, sepals 2 by 2, corolla 6–16-lobed  
*Madhuca (Ganua)* (Sapot.)
- 62a. (5) Leaves opposite . . . . . 62
- b. Leaves alternate, spiral, or in whorls . . . . . 91
- 63a. Stipules present . . . . . 64
- b. Stipules absent . . . . . 75
- 64a. Stipules not intrapetiolar . . . . . *Ctenolophon*\* (Linac.)
- b. Stipules intrapetiolar . . . . . 65

- 65a. Stipules connate into an annular ochrea . . . . . *Fagraea* (Logan.)  
 b. Stipules free . . . . . 66
- 66a. Twigs swollen at nodes, stipules early falling, leaving ring-like scars on the twigs (Rhizophoraceae) . . . . . 67  
 b. Twigs not swollen at nodes, stipules persistent or early falling, not leaving ring-like scars on the twigs (Rubiaceae) . . . . . 69
- 67a. Twigs solid, leaf surface with black dots below . . . . . *Carallia* (Rhizoph.)  
 b. Twigs hollow, black dots absent . . . . . 68
- 68a. Stipules imbricate, one margin of each free, ovary superior  
*Gynotroches* (Rhizoph.)  
 b. Stipules flat, without overlapping margins, ovary inferior  
*Pellacalyx* (Rhizoph.)
- 69a. (66) Stipules with many long (more than 1 cm) linear teeth  
*Jackiopsis ornata* (Rubiace.)  
 b. Stipules different . . . . . 70
- 70a. Leaves apparently in whorls of 3 . . . . . *Rothmannia* (Rubiace.)  
 b. Leaves in pairs . . . . . 71
- 71a. Stipules with bifid tips, clasping the terminal bud, trunk latticed  
*Pertusadina eurhyncha* (Rubiace.)  
 b. Stipules with entire margins. . . . . 72
- 72a. Vegetative bud flattened, stipules tightly adpressed into a single plane at shoot tips, their edges not overlapping . . . . . 73  
 b. Vegetative bud more or less conical, stipules either mutually overlapping around the bud or loosely surrounding it . . . . . 74
- 73a. Secondary veins depressed above, not looping near the margin, flower sepals fused . . . . . *Nauclea officinalis* (Rubiace.)  
 b. Secondary veins flat above, looping near the margin, flower calyces free  
*Neonauclea* (Rubiace.)
- 74a. Main branches rather straight, horizontal, leaf pairs along branches mostly in one plane, stipules with 1 or 2 prominent ridges  
*Anthocephalus chinensis* (Rubiace.)  
 b. Main branches ascending, leaf pairs along branches mostly perpendicular to the branch . . . . . 75
- 75a. Branches with pairs of leaves equal in size, stipules cusped, with 2 lateral ridges, twig bark varnished and flaky when dry  
*Ochreinauclea maingayi* (Rubiace.)  
 b. Branches with pairs of leaves unequal in size, stipules triangular  
*Porterandia anisophylla* (Rubiace.)
- 76a. (63) Leaves with intramarginal veins . . . . . 77  
 b. Leaves without intramarginal veins . . . . . 78
- 77a. Leaves without translucent dots . . . . . *Duabanga moluccana* (Sonner.)  
 b. Leaves with translucent dots . . . . . *Eugenia* (Myrtac.)

78a.	Leaves palmately compound	79
b.	Leaves simple	81
79a.	Leaves with translucent dots, leaves 3-foliolate	<i>Euodia</i> (Rutac.)
b.	Leaves without translucent dots	80
80a.	Petioles and petiolules strongly thickened	<i>Teijsmanniodendron</i> (Verb.)
b.	Petioles and petiolules not thickened	<i>Vitex</i> (Verb.)
81a.	(78) Leaves 3-veined	82
b.	Leaves pinnately veined	84
82a.	Bark with aromatic smell	<i>Cinnamomum</i> (Laur.)
b.	Bark without aromatic smell	83
83a.	Leaves with translucent dots, silky beneath	<i>Rhodamnia cinerea</i> (Myrtac.)
b.	Leaves without dots, glabrous, or if hairy not silky	<i>Pternandra</i> (Melast.)
84a.	(81) Twigs white, petioles black when dry	<i>Chionanthus</i> (Oleac.)
b.	Twigs and petioles different	85
85a.	Inner bark bright yellow	<i>Kokoona/Lophopetalum</i> (Celast.)
b.	Inner bark different	86
86a.	Leaves usually drying yellow, venation indistinct	<i>Memecylon</i> (Melast.)
b.	Leaves drying black or brown, venation distinct	87
87a.	Inner bark without aromatic smell	88
b.	Inner bark with aromatic smell	90
88a.	Petioles without thickenings, leaves withering red	<i>Lagerstroemia</i> (Lythr.)
b.	Petioles with black thickenings at both ends, leaves not withering red	89
89a.	Reduced leaf of each opposite pair needle-like, stipule-like, petioles up to 2.5 cm long	<i>Mallotus penangensis</i> (Euph.)
b.	No reduced leaves present, petioles 2.5–5 cm long, leaf margin often whitish	<i>Blumeodendron</i> (Euph.)
90a.	(87) Petioles c. 1 cm long, c. 3 mm in diameter, leaves hairy and glaucous beneath	<i>Litsea oppositifolia</i> (Laur.)
b.	Petioles 1.5–2 cm long, leaves glabrous beneath drying greenish	<i>Beilschmiedia dictyoneura</i> (Laur.)
91a.	(62) Leaves pinnate, bipinnate or trifoliolate	92
b.	Leaves simple	109
92a.	Leaves trifoliolate	<i>Sarcotheca</i> (Oxal.)
b.	Leaves pinnate or bipinnate	93
93a.	Leaves bipinnate (Mimosaceae)	94
b.	Leaves simply pinnate	95
94a.	Flowers in small heads arranged in panicles, pods usually coiled, dehiscent	<i>Archidendron</i> (Mimos.)
b.	Flowers in a single large head, pendent from a long stalk, pods non-dehiscent	<i>Parkia</i> (Mimos.)
95a.	Leaves paripinnate	96
b.	Leaves imparipinnate	103

- 96a. Leaves with golden yellow scales . . . . . *Engelhardia* (Jugl.)  
 b. Leaves glabrous or with simple or stellate hairs . . . . . 97
- 97a. Leaves without free rhachis tip . . . . . 98  
 b. Leaves with free rhachis tip (Sapindaceae) . . . . . 99
- 98a. Margin of leaflets thickened, stipules present . . . . . *Sindora* (Caesalp.)  
 b. Margin of leaflets not thickened, stipules absent *Dysoxylum* p.p. (Meliac.)
- 99a. Leaflets with tufted hairs . . . . . *Dimocarpus* (Sapind.)  
 b. Leaflets without tufted hairs . . . . . 100
- 100a. Leaflets with round flat glands . . . . . *Xerospermum* (Sapind.)  
 b. Leaflets without flat glands . . . . . 101
- 101a. Leaflets papillate beneath . . . . . *Nephelium* (Sapind.)  
 b. Leaflets not papillate . . . . . 102
- 102a. Domatia present . . . . . *Mischocarpus pentapetalus* (Sapind.)  
 b. Domatia absent . . . . . *Lepisanthes* p.p. (Sapind.)
- 103a. (95) At least young parts of the plant with scales . . . . . *Aglaia* p.p. (Meliac.)  
 b. Plants glabrous or with simple or stellate hairs . . . . . 104
- 104a. Petioles strongly thickened at the base, leaving conspicuous leaf-scars on  
 twigs . . . . . 105  
 b. Petioles not thickened . . . . . 106
- 105a. Base of leaflets symmetric, margin usually toothed . . . . . *Meliosma* (Sabiac.)  
 b. Base of leaflets strongly asymmetric, margin entire . . . . . *Dacryodes* (Burs.)
- 106a. Tall forest trees with large buttresses, wood ripple-marked  
*Koompassia* (Caesalp.)  
 b. Small to medium sized trees, wood not ripple-marked . . . . . 107
- 107a. Cut bark usually with an onion smell . . . . . *Dysoxylum* p.p. (Meliac.)  
 b. Cut bark without onion smell . . . . . 108
- 108a. Fruit a drupe, not dehiscent . . . . . *Lepisanthes* p.p. (Sapind.)  
 b. Fruit a pod, dehiscent . . . . . *Ormosia* (Papil.)
- 109a. (91) Leaves alternate . . . . . 110  
 b. Leaves spirally arranged, sometimes crowded at top or whorled . . . . . 131
- 110a. Stipules present . . . . . 111  
 b. Stipules absent . . . . . 117
- 111a. Petioles not thickened at base or top . . . . . 112  
 b. Petioles thickened at base or top . . . . . 114
- 112a. Bark aromatic, leaves whitish, velvety below, margin entire  
*Alphitonia incana* (Rhamn.)  
 b. Bark without smell, leaves whitish or not, leaves serrate or crenate . . . . . 113
- 113a. Leaves pinnately veined, stipules overlapping with one another, leaving a distinct  
 circular scar around the nodes . . . . . *Gironniera* (Ulmac.)  
 b. Leaves 3-veined at base, stipules free from one another . . . . . *Trema* (Ulmac.)
- 114a. (111) Leaf apex notched, inner bark with silky short fibres *Neesia* (Bomb.)  
 b. Leaf apex acute, acuminate or rounded, the inner bark without silky short  
 fibres . . . . . 115



- 129a. Ultimate branches pendent, fruits large, c. 10 cm long, completely enclosed in the enlarged perianth tube . . . . . *Eusideroxylon zwageri* (Laur.)  
 b. Ultimate branches spreading, fruits much smaller . . . . . 130
- 130a. Twigs and leaves reddish brown velvety hairy, fruit entirely included in the enlarged perianth tube, leaving only a minute opening at apex  
*Cryptocarya crassinervia* (Laur.)  
 b. Fruit seated on the enlarged perianth tube, never totally enclosed  
*Litsea* p.p. (Laur.)
- 131a. (109) Leaves in whorls, minute . . . . . *Casuarina* (Casuar.)  
 b. Leaves well developed . . . . . 132
- 132a. Leaf margin crenate to dentate . . . . . 133  
 b. Leaf margin entire . . . . . 149
- 133a. Leaf base or upper half of petiole with 2 glands . . . . . 134  
 b. Leaf base or petiole without glands . . . . . 135
- 134a. Glands 2, on the upper third of the petiole, leaves large (17–30 cm long), indument of stellate hairs only . . . . . *Fahrenheitia* (Euph.)  
 b. Glands 2, at base of the lamina, leaves smaller (usually up to 20 cm long), indument of stellate hairs and scales . . . . . *Croton* (Euph.)
- 135a. At least young parts covered with scales . . . . . *Saurauia* p.p. (Actin.)  
 b. Plants glabrous or hairy, sometimes stellate hairs are present, but never scales . . . . . 136
- 136a. Inner bark with broad hard rays penetrating into the young wood  
*Quercus* (Fagac.)  
 b. Inner bark not penetrating into the young wood . . . . . 137
- 137a. Cut bark produces a hissing sound, usually stiltroots present  
*Dillenia* (Dillen.)  
 b. Cut bark does not produce a hissing sound, stiltroots present or not . . . 138
- 138a. Inner bark red, with dark spots, the fibre ends appearing as golden silky hairs, more or less irritating . . . . . *Schima* (Theac.)  
 b. Inner bark without golden silky irritating fibres . . . . . 139
- 139a. Wood with broad rays . . . . . *Helicia* (Proteac.)  
 b. Wood without broad rays . . . . . 140
- 140a. Outer bark blackish, fibrous, petioles winged, leaves usually obovate, margin finely toothed. . . . . *Planchonia* (Lecyth.)  
 b. Outer bark not blackish, petioles not winged . . . . . 141
- 141a. Old leaves usually withering red, fruits a drupe with a hard stone  
*Elaeocarpus* p.p. (Elaeoc.)  
 b. Old leaves not withering red, fruits a samara or capsules . . . . . 142
- 142a. Bole flaky, leaves 3-veined at base, indument of stellate hairs, fruits a winged samara . . . . . *Pentace* (Tiliac.)  
 b. Leaves 3-veined or not, indument of simple hairs (except *Baccaurea* p.p.), fruits different (Euphorbiaceae p.p.) . . . . . 143



- 143a. Leaves densely or sparsely granular-glandular below . . . . . 144  
 b. Leaves not granular-glandular . . . . . 145
- 144a. Large glands at leaf-base or along margin, stipules usually large, persistent, inflorescence usually axillary, anthers 3–4-locular *Macaranga* p.p. (Euph.)  
 b. Large glands absent, stipules usually small, early falling, inflorescence usually terminal, anthers 2-locular . . . . . *Mallotus* p.p. (Euph.)
- 145a. Stellate hairs or scales present . . . . . 146  
 b. Stellate hairs or scales absent . . . . . 147
- 146a. Branching not *Terminalia*-like, petioles distinctly thickened at both ends  
*Koiloceras* (Euph.)  
 b. Branching often *Terminalia*-like, petioles thickened at apex only  
*Baccaurea* p.p. (Euph.)
- 147a. Leaves 3-veined at base . . . . . *Trigonostemon* (Euph.)  
 b. Leaves pinnately veined . . . . . 148
- 148a. Petioles up to 2.5 cm long, thickened at apex only *Neoscortechinia* (Euph.)  
 b. Petioles 5–8 cm long, thickened at both ends . . . *Dimorphocalyx* (Euph.)
- 149a. (132) Bark peeling off in long scrolls . . . . . *Tristaniopsis* (Myrtac.)  
 b. Bark not peeling off in long scrolls . . . . . 150
- 150a. Torn leaves with fine silky fibres . . . . . *Aquilaria* (Thym.)  
 b. Torn leaves without silky fibres . . . . . 151
- 151a. Inner bark and crushed leaves with a strong smell of garlic  
*Scorodocarpus* (Olac.)  
 b. Inner bark without garlic smell . . . . . 152
- 152a. Inner bark with glistening silky fibres, leaves with translucent dots  
*Gonystylus* (Thym.)  
 b. Inner bark without glistening fibres . . . . . 153
- 153a. Petioles, lower leaf surface, leaf margin or stipules with glands . . . . . 154  
 b. Petioles, lower leaf surface, leaf margin or stipules without glands . . . . . 160
- 154a. Two glands present at the junction of lamina and petiole . . . . . 155  
 b. Glands on the petiole, leaf undersurface, leaf margin or on the stipules . . . . . 157
- 155a. Branches whorled, horizontally spreading (pagoda-tree), leaves crowded at the end of twigs . . . . . *Terminalia catappa* (Combr.)  
 b. Branching pattern different . . . . . 156
- 156a. Leaf base heart-shaped, stipules crowded, linear *Macaranga lowii* (Euph.)  
 b. Leaf base cuneate, stipules 2, intrapetiolar . . . . . *Maranthes* (Chrysob.)
- 157a. (154) Stipules with a large hollow gland . . . . . *Prunus beccarii* (Rosac.)  
 b. Stipules without glands . . . . . 158
- 158a. Leaves palmately veined, with groups of large pitted domatid glands in the axils of the veins . . . . . *Octomeles sumatrana* (Datisc.)  
 b. Leaves pinnately veined . . . . . 159
- 159a. Leaves white hairy below, venation very prominent below, petioles usually with 2 glands at the middle . . . . . *Parinari* (Chrysob.)

- b. Leaves glabrous below, venation papillose below, with a pair of glands on midrib . . . . . *Atuna* (Chrysob.)
- 160a. (153) Petioles thickened at base and/or top . . . . . 161
  - b. Petioles not thickened . . . . . 169
- 161a. Petioles thickened at both ends . . . . . 162
  - b. Petioles thickened either at base or top . . . . . 164
- 162a. Lower leaf surface with coloured, often black dots . . . . . *Aporusa* (Euph.)
  - b. Lower leaf surface without dots . . . . . 163
- 163a. Young parts and leaf undersurface densely scaly, inner bark lamellate
  - Heritiera* (Sterc.)
  - b. Young parts not densely scaly, leaf undersurface glabrous, inner bark not lamellate . . . . . *Bhesa* (Celast.)
- 164a. (161) Petioles swollen at base only . . . . . 165
  - b. Petioles swollen at top only . . . . . 166
- 165a. Growth flushwise, each flush starting with reduced leaves, leaves tufted at the end of the twigs . . . . . *Barringtonia* (Lecyth.)
  - b. Growth more or less continuous, not flushwise . . . . . *Castanopsis* (Fagac.)
- 166a. Inner bark fibrous, with prominent net-like markings . . . . . *Scaphium* (Sterc.)
  - b. Inner bark different . . . . . 167
- 167a. Leaves palmately veined at base, hairs simple . . . . . *Sloanea* (Elaeoc.)
  - b. Leaves pinnately veined at base . . . . . 168
- 168a. Leaves often crowded at top, indument often formed by stellate hairs, stipules usually crowded, persistent . . . . . *Baccaurea stipulata* (Euph.)
  - b. Leaves not crowded at top, hairs simple, stipules 2, subsistent
    - Hydnocarpus polypetala* (Flac.)
- 169a. (160) Buds very long (2–7 cm long), stipules leaving annular scars (Magnoliaceae) . . . . . 170
  - b. Buds small (up to 1 cm long), stipules present or absent . . . . . 171
- 170a. Flowers terminal . . . . . *Magnolia* (Magnol.)
  - b. Flowers axillary on short branches . . . . . *Elmerillia* (Magnol.)
- 171a. Leaves crowded at the end of the twigs . . . . . 172
  - b. Leaves not crowded . . . . . 174
- 172a. Petioles winged . . . . . *Tetramerista* (Theac.)
  - b. Petioles not winged . . . . . 173
- 173a. Leaves in pseudowhorls, leaf buds enclosed by large bud scales which leave circular marking on twigs . . . . . *Actinodaphne glabra* (Laur.)
  - b. Leaves crowded, large bud scales absent . . . . . *Aseodaphne* (Laur.)
- 174a. (171) Lower leaf surface white . . . . . *Sebastiania* (Euph.)
  - b. Lower leaf surface different . . . . . 175
- 175a. Inner bark deep red with broad white radial streaks, leaf bases heart-shaped, 3-veined at base . . . . . *Pterospermum* (Sterc.)
  - b. Inner bark different, leaves never 3-veined . . . . . 176

- 176a. Inner bark with broad, hard rays penetrating the young wood  
*Lithocarpus* (Fagac.)
- b. Inner bark without broad, hard rays ..... 177
- 177a. Stipules present ..... 178
- b. Stipules absent ..... 182
- 178a. Leaf base unequal ..... *Drypetes* (Euph.)
- b. Leaf base symmetrical ..... 179
- 179a. Tall trees (up to 60 m) with steep thin buttresses, twigs with ring-like scars at the nodes ..... *Irvingia malayana* (Simar.)
- b. Trees usually smaller, twigs without ring-like scars at nodes ..... 180
- 180a. Fruits small (up to 5 mm in diameter), flattened, stone pitted  
*Antidesma* (Euph.)
- b. Fruits bigger ..... 181
- 181a. Buttresses present, inner bark deep red ..... *Ixonanthes*\* (Linac.)
- b. Buttresses absent, inner bark whitish ..... *Licania* (Chrysob.)
- 182a. (177) End bud varnished, leaves thickly leathery ..... *Stemonurus* (Icac.)
- b. End bud not varnished ..... 183
- 183a. Stellate hairs or scales present ..... 184
- b. Hairs simple ..... 185
- 184a. Inner bark not aromatic, at least young parts covered with scales  
*Saurauia* p.p. (Actin.)
- b. Inner bark bitter, aromatic, young parts covered with stellate hairs  
*Platea* (Icac.)
- 185a. Twigs white ..... 186
- b. Twigs brown or black, never white ..... 187
- 186a. Fruit a drupe with 8–10 stones ..... *Ilex cymosa* (Aquif.)
- b. Fruit a berry with 1 seed ..... *Dehaasia* (Laur.)
- 187a. Fruit a globose, densely shortly bristly capsule  
*Chaetocarpus castanocarpus* (Euph.)
- b. Fruits without bristles ..... 188
- 188a. Common trees of secondary forest, flowers in heads, fruit an achene  
*Vernonia arborea* (Comp.)
- b. Trees usually from primary forest, flowers not in heads, fruits different 189
- 189a. Leaf base almost peltate, secondary veins 5–10 pairs  
*Ellipanthus tomentosus* (Connar.)
- b. Leaf base rounded to cuneate, never peltate ..... 190
- 190a. Leaves without translucent dots, secondary veins 10–18 pairs  
*Alangium ridleyi* (Alang.)
- b. Leaves with (minute) translucent dots, secondary veins up to 7 pairs  
*Nothaphoebe umbelliflora* (Laur.)

## 1.5. Glossary

- accrescent** — increasing in size during fruiting
- actinomorphic** — flowers divisible in equal parts in an indefinite number of planes
- acuminate** — margins converging more or less abruptly
- acute** — margin converging more or less along a straight line
- alternate (distichous)** — one leaf at each node in two rows, in one plane
- aril** — usually fleshy tissue (partially) surrounding the seed, at least on a small place fused with the seed. This term is used here also for sarcotesta, arillode etc.
- balance hairs** — hairs not attached at base but at some point in the middle
- berry** — middle layer of the fruit wall well developed, with immersed seeds
- bipinnate** — instead of leaflets whole pinnae are arranged along the rhachis
- bisexual** — flowers containing both stamens and ovaries
- bract** — reduced leaf, usually within inflorescences
- calyx** — outer whorl of the perianth, usually green, consisting of sepals
- capsule** — fruit wall usually dry, splitting open in various ways
- cataphyll** — first bract-like leaves at the base of a twig or stem
- compound** — the leaf is composed of several leaflets, sometimes only one (!), but then with an articulation at base: 1-foliolate (in the keys they are treated as simple leaves)
- corolla** — the inner whorl(s) of the perianth, usually coloured (not green!), consisting of petals
- corymb** — rhachis branched, axes and flower stalks unequal, whereby the flowers are placed in a horizontal plane
- cupule** — a cup-like structure consisting of indurated (hard) bracts at the base of the fruit and surrounding at least its lower part (Fagaceae, some Lauraceae)
- cyme** — branched inflorescence in which the central flower opens first (centrifugal), and in which the first branches are opposite
- damar** — aromatic, resinous exudate usually from cut inner bark (Dipterocarpaceae, Araucariaceae, Burseraceae)

- dbh** — diameter at breast height (1.30 m)
- deciduous** — trees standing leafless for a part of the year, usually in the dry season
- dehiscent** — splitting open (fruits)
- dimpled** — bark with shallow, more or less round depressions
- disc** — an usually glandular outgrowth of the receptacle, which often secretes nectar
- domatium/domatia** — structures present in the axils of the midrib and the lower lateral veins. They may be formed by bundles of hairs, pits more or less covered by a membrane, and so on
- dots** — within the leaf tissue various translucent or dark dots or lines present; when looking through the tissue with the aid of a strong lamp and a handlens, the leaf appears as if it is punctured by many more or less regularly spaced pinpricks or lines
- drupe** — outer layer of the fruit wall thin, middle layer fleshy and soft, inner layer stony or woody, enclosing the seed(s)
- dryobalanoid** — venation as in the leaves of *Dryobalanops* (Dipterocarpaceae)
- elliptic** — broadest around the middle, ratio length–width c. 2 : 1
- endosperm** — nutritive tissue within the seed if the cotyledons do not store the nutrients for germination
- entire** — leaf margin without any incision, sometimes wavy
- exudate** — inner bark with a characteristic sap or resin after having been slashed (one has to wait some time, because the sap may ooze out only slowly)
- fimbriate** — provided with more or less hair-like appendages resembling eyelashes
- fissured** — bark with coarse, deep grooves
- flaky** — with large patches of dead bark which fall off the trunk. There is no sharp differentiation between flaky and scaly
- fluted** — bole with many regular ascending channels
- foliolate** — with a certain number of leaflets (e. g. 1-foliolate, 3-foliolate etc.)
- follicle** — dry fruit formed by a single carpel, splitting open along one side only

- glabrescent** — becoming hairless or nearly so
- glands** — appendages of the surface, sometimes also from deeper lying tissues, often found at the base of the lamina or on the petiole
- glaucous** — a bluish or greyish tinge on the lower leaf surface caused by a layer of wax (not of hairs!). If a lighted match is held underneath, the wax will melt and this spot will no longer be glaucous
- hooped** — rings along the trunk of distinct texture (often of lenticels) or colour
- imparipinnate** — compound leaf with pinnate leaflets and one apical leaflet
- indehiscent** — fruit not opening when ripe
- inferior** — ovary not free, but completely embedded in the enlarged receptacle and fused with it, becoming a fruit with a calyx at top
- inflorescence** — arrangement of flowers on a plant
- infrutescence** — inflorescence in fruiting stage
- intramarginal vein** — secondary vein running parallel to the leaf margin; here also used if secondary veins form loopings
- lanceolate** — ratio length–width c. 5 : 1
- latex** — milky, usually sticky or rubbery exudate, usually from inner bark
- lenticellate** — the outer bark covered with spongy points or lines, through which the inner tissue can exchange gasses with the atmosphere
- lobed** — incised to less than half way between margin and midrib
- merous** — partite (e.g. 3-merous, 5-merous etc.), used for flower parts
- mucronate** — midrib projecting beyond the blade as a small, usually stiff point
- nectary** — nectar producing glands within or outside the flower
- oblong** — broadest in the middle with almost parallel sides, ratio length–width 3 : 1
- obovate** — the greatest width is clearly above the middle of the lamina
- obtuse** — blunt or rounded at the base or apex, at an angle of more than 90 degree
- opposite** — two leaves at one node, each on one side, usually in two rows: decussate

**ovary** — part of the pistil containing the ovules

**palmate** — digitate, the leaflets arranged like the fingers of a hand, usually in odd numbers (5 or 7)

**palmately veined** — three or more equally developed veins emerging from the base of the lamina and joining the margin

**panicle** — inflorescence in which the main axis bears several side branches with several flowers

**paripinnate** — compound leaf with only opposite leaflets, without a terminal one

**partite (dissected)** — incised to near the midrib

**perianth** — flower leaves, usually differentiated in sepals and petals

**petals** — inner whorl(s) of perianth-leaves, together forming the corolla

**petiole** — leaf stalk

**petiolule** — the stalk of a leaflet of a compound leaf

**pilose** — covered with hairs which are soft, weak, thin and clearly separated

**pinnate** — the leaflets are arranged in two rows along a main axis (rachis), they may be alternate or opposite, there may be a terminal leaflet (imparipinnate) or not (paripinnate)

**pistil** — the female reproductive organ, composed of ovary, style, and stigma

**pneumatophores** — vertical branches of roots, growing upwards through the soil to provide air for the root system

**pod** — dry 1- to many-seeded fruit, dehiscent along margin or indehiscent

**pubescent** — a dense cover of short, weak, soft hairs

**puberulous** — minutely hairy, with a somewhat dense cover of very short soft hairs

**raceme** — unbranched inflorescence, in which the single flowers are borne on stalks along a main axis

**rachis** — main axis of inflorescence or compound leaf

**ruminate** — endosperm strongly folded and firmly coherent, in transverse section looking a bit like a molar tooth of a cow (Annonaceae, Myristicaceae)

- scale** — hairs radiating from one point, united in a mushroom-like structure
- sepals** — the outer whorl of perianth-leaves, together forming the calyx
- sericeous** — silky, densely covered with fine, soft, straight, appressed hairs, with a lustrous sheen and satin-like to the touch
- sessile** — without stalk (flower, leaf)
- setose** — bristly, having long, erect, rigid hairs or bristles, harsh to the touch
- simple** — composed of lamina and petiole, without an articulation at base (!), an articulation can be recognized as a transverse suture in the petiole, where the leaf breaks off
- spikes** — unbranched inflorescence, rhachis well developed, flowers sessile
- spiral** — one leaf at each node in a spiral
- stamen** — male reproductive organ, usually consisting of a stalk (sterile filament) and a fertile pollen bearing anther
- staminode** — sterile stamen
- stellate hairs** — short hairs radiating star-like from one point in horizontal directions
- stigma** — the part of the pistil, usually provided with minute papils, which receives the pollen
- stipule** — usually 2 thin, leaf-like scales attached near the base of the petiole, sometimes shed when the leaves starts to unfold (caducous, one can see only the scars on older twigs) or remaining on the twig (persistent)
- style** — short or long part of the pistil which contains no ovaries and terminates in the stigma(s)
- superior** — ovaries free from all floral parts, except the very base, in fruiting stage the calyx of its scars at base
- terete** — circular in cross-section
- thyrses** — inflorescence with a clearly branched rhachis
- tomentose** — densely covered with matted, short hairs
- umbel** — rhachis absent, flower stalks unequal, flowers in one plane
- zygomorphic** — flowers divisible in equal parts in one plane only



## 1.6. Selected Literature

- Abdurahim Martawijaya, Iding Kartasujana, Kosasi Kadir, Soewanda Among Prawira. 1986. Indonesian Wood Atlas I. Bogor, Forest Products Research and Development Centre.
- Abdurahim Martawijaya, Iding Kartasujana, Y.I. Mandang, Soewanda Among Prawira, Kosasi Kadir. 1989. Atlas Kayu Indonesia II. Bogor, Forest Products Research and Development Centre.
- Bremen, H. van, M. Iriansyah & W. Andriesse. 1990. Detailed soil survey and physical land evaluation in a tropical rain forest, Indonesia. Ede, The Tropenbos Foundation.
- Cockburn, P.F. 1976, 1980. Trees of Sabah, I–II. Sandakan, Forest Department.
- Endert, F.H. 1953. Sleutel op de boomgeslachten in Indonesië. Den Haag, Ministry for Overseas Territories, mimeographed.
- Flora Malesiana, Series I, Spermatophyta. 1955–1994. Leiden, Rijksherbarium / Hortus Botanicus, Leiden University.
- Keßler, P.J. A., Kade Sidiyasa, Ambriansyah & Arifin Zainal. 1992. Checklist for a tree flora of the Balikpapan–Samarinda area, East Kalimantan, Indonesia. Wageningen, The Tropenbos Foundation.
- Kochummen, K.M. 1979. Pocket Check List of Timber Trees. Ed. 3. Kepong, Forest Research Institute Malaysia.
- Meijer, W. 1974. Field guide to trees of West Malesia. Lexington, University of Kentucky.
- Meijer, W. & G.H.S. Wood. 1964. Dipterocarps of Sabah. Sandakan, Forest Department.
- Seeber, G., H.J. Weidelt, V.S. Banaag. 1985. Dendrological characters of important forest trees from eastern Mindanao. Schriftenreihe der GTZ 73.
- Tree Flora of Malaya, I–IV. 1972–1989. Kepong, Forest Research Institute Malaysia.
- Whitmore, T.C., I.G.M. Tantra & U. Sutisna (eds.). 1989. Tree Flora of Indonesia, Check List for Kalimantan. Bogor, Forest Research & Development Centre.



## 2. DESCRIPTIVE PART

### 1 ACTINIDIACEAE

**SAURAUIA** Willd., Ges. Naturf. Freunde Berlin Neue Schriften 3 (1801) 407.

*Vernacular name* — Sauri (M).

Shrubs to medium-sized trees. Bark greyish brown to reddish, usually smooth. Inner bark red, granular. Sapwood cream. Heartwood white to pale brownish. Scales or long, thick hairs always present, at least in young parts. Twigs often hollow. Stipules absent. Leaves simple, spiral, margin toothed to entire. Petioles short. Flowers solitary or in few to many-flowered cymes, corymbs, or panicles, axillary on leafy shoots or clustered on old wood. Sepals 5, corolla deeply 5-lobed, stamens numerous, attached to inside of the corolla tube, ovary 3–6-celled. Fruits more or less fleshy, partly or fully covered by the persistent sepals, ultimately splitting open, seeds numerous, minute, embedded in slimy sweet-tasting jelly.

*Habitat & Ecology* — Mainly on hillsides and along streams, in primary and secondary forest.

*Uses* — The timber is useless; in India some species are used in erosion control due to their ability to grow quickly from cuttings. The fruits are edible but rather tasteless.

*Note* — Of the genus *Saurauia* at least five species are reported for our area.

### 2 ALANGIACEAE

**ALANGIUM** Lam., Encycl. Méth. Bot. 1 (1783) 174.

*Literature* — Bloemb., Bull. Jard. Bot. Buitenzorg 16 (1939) 139–235.

Trees or shrubs. Stipules absent. Leaves simple, spiral, 3-veined, palmately or pinnately veined at base, margin entire. Inflorescences axillary. Flowers sessile or stalked, bisexual, sepals 4–10, fused, petals 4–10, free, stamens 4–10 or numerous, filaments hairy inside, disc between stamens and ovary, ovary inferior, 1- (or 2-) celled, each cell with 1 ovule. Fruit a drupe, often with longitudinal grooves, crowned by persistent sepals and disc. Seed(s) 1 (or 2), with thick smooth or grooved endosperm — Eight species reported for Kalimantan.

*Uses* — The timber is of no commercial use.

#### KEY TO THE SPECIES

- 1 a. Leaves palmately or 3-veined at base ..... 2
- b. Leaves entirely pinnately veined ..... 3
- 2 a. Leaf base strongly unequal ..... *A. griffithii*\*
- b. Leaf base rounded or wedge-shaped ..... *A. longiflorum*\*
- 3 a. Internodes between adult leaves tomentose ..... *A. havilandii*\*
- b. Internodes glabrous ..... *A. ridleyi* / *A. javanicum*\*

(*Alangiaceae*/*Anacardiaceae*)

*Alangium ridleyi* King, J. As. Soc. Beng. 71, II (1902) 78. — Fig. 1

*Vernacular name* — Lajik kuning (K).

Trees up to 25 (–40) m tall, 25–45 cm in diameter, often with flat and curved stilt-roots. Internodes between adult leaves 1.8–7.5 cm long, 3–9 mm thick, glabrous. Petioles 1.5–4 cm long, glabrous. Leaves obovate-oblong or oblong, 8–40 cm long, 5–20 cm wide, leathery, glabrous, base rounded to wedge-shaped, apex more or less acuminate, secondary veins 10–18 pairs, pinnately arranged. Inflorescences glabrous, 6–15-flowered. Flowers 6-merous, 1.8–2.7 cm long, calyx glabrous, petals glabrous outside, pilose inside, stamens with bearded filament apex, style pilose on longitudinal stripes, stigma conical, ovary 1-celled. Fruits in dry state ovate, flattened, rounded or slightly acute at base, more acute towards the apex, 2.7–3.7 cm long, 1.8–2.2 cm in diameter, usually glabrous, and with 10–14 rounded ribs and deep grooves between them.

*Habitat & Ecology* — Usually hill side on low undulating country.

*Distribution* — Endemic in Borneo.

*Note* — *Alangium ridleyi* is closely related to *A. javanicum* (Blume) Wangerin and it may be a form of this widespread and polymorphic species.

*Material* — W 395.

### 3 ANACARDIACEAE

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 395–548.

Small to large trees. Exudate clear or coloured, eventually turning black on exposure, smelling of resin. Stipules absent. Leaves simple or compound, imparipinnate, usually spiral and entire. Petioles usually thickened at base. Inflorescences usually terminal panicles with small flowers (less than 0.5 cm across). Flowers bisexual and/or unisexual (male and/or female flowers on the same plant), 5-merous, disc present, ovary usually superior, 1–5-celled, each cell with 1 ovule, usually only one fertile. Fruit a 1–5-celled, 1–5-seeded drupe, sometimes with enlarged, persistent calyx lobes or petals. — Sixteen genera reported for Kalimantan.

*Note* — *Gluta*, *Melanochyla*, *Semecarpus*, and *Swintonia* have thin black sap, which can cause severe skin irritation! Species of these genera are collectively called Rengas.

#### KEY TO THE GENERA

- 1a. Leaves pinnate . . . . . 2
- b. Leaves simple . . . . . 4
- 2a. Leaves crowded with many, usually 10–16 pairs of leaflets  
*Koordersiodendron*\*
- b. Leaves spiral with fewer, usually less than 10 pairs of leaflets . . . . . 3

(Anacardiaceae)

- 3a. Cut bark with brown exudate, fruit wingless (with 5 scattered style-scars), 5-celled . . . . . *Dracontomelon*
- b. Cut bark with white exudate, fruit 4-winged (enlarged calyx lobes), 1-celled  
*Parishia*
- 4a. Leaves opposite . . . . . *Bouea*
- b. Leaves spiral or crowded . . . . . 5
- 5a. Leaves large (at least 30 cm long), spiral, covered with scales, base with ear-like appendages . . . . . *Camptosperma*\*
- b. Leaves small or large, spiral or crowded, glabrous or hairy, never scaly, never with ear-like appendages . . . . . 6
- 6a. Fruit seated on a fleshy axis . . . . . *Semecarpus*\*
- b. Fruit not seated on a fleshy axis . . . . . 7
- 7a. Fruit small (less than 1 cm across), more or less compressed, not winged  
*Buchanania*
- b. Fruit either larger or winged . . . . . 8
- 8a. Fruit 5-winged (persistent enlarged petals) . . . . . 9
- b. Fruit not winged . . . . . 10
- 9a. Calyx persistent in fruit . . . . . *Swintonia*\*
- b. Calyx falling off early . . . . . *Gluta* p. p. (*Melanorrhoea*)
- 10a. Fruits less than 3 cm across, hairy . . . . . *Melanochyla*
- b. Fruits larger than 3 cm across, glabrous . . . . . 11
- 11a. Fruit usually more than 5 cm across, smooth . . . . . *Mangifera*
- b. Fruit usually less than 5 cm across, surface irregular . . . . . *Gluta* p. p.

**BOUEA** Meisn., Pl. Vasc. Gen. (1837) Tab. Diagn. 75 & Comm. 55.

KEY TO THE SPECIES

- 1a. Leaves small, usually 2–15 cm long, 1–5 cm wide, terminal vegetative buds lanceolate or narrowly lanceolate, 5–10 mm long . . . . . *B. oppositifolia*
- b. Leaves large, usually 14.5–30 cm long, 5–8 cm wide, terminal vegetative buds broad ovoid to ovoid, 4–6 mm long, estimable fruit tree . . . . . *B. macrophylla*\*

*Bouea oppositifolia* (Roxb.) Meisn., Pl. Vasc. Gen. (1837) Comm. 55. — Fig. 2

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 466.

*Vernacular name* — Pani-pani (M).

Trees up to 32 m high, c. 75 cm in diameter. Bark grey, green, light brown to red, fissured. Twigs slightly 4-angular, usually flat towards the nodes, terminal vegetative buds lanceolate to narrowly lanceolate, 5–10 mm long, 1.5–2.5 mm wide. Leaves opposite, simple, entire, 2–15 cm long, 1–5 cm wide (in sterile specimens up to 22.5 cm long and 5.5 cm wide), elliptic to elliptic-oblong, lanceolate, or obovate to oblanceolate, leathery, glabrous, base acute to wedge-shaped, apex acumi-

(Anacardiaceae)

nate, secondary veins 8–14(–16) pairs, tertiary venation hardly visible, net-like. Petioles 0.5–1 cm long. Inflorescences axillary, rarely also terminal, paniculate, 2.5–6 cm long. Flowers male and bisexual (male and bisexual flowers on the same plant), calyx 3–5-lobed, broadly ovate, 0.5–0.75 mm long, petals 3–5, overlapping, oblong or obovate-oblong, up to 2.25 mm long, up to 1 mm wide, glabrous, lengthwise keeled, stamens 3–5, filaments awl-shaped, glabrous, anthers ovoid-oblong, ovary ovoid or subglobular, 1-celled, 1-ovuled, puberulous or glabrous, style short, stigma round, flat, sterile pistil minute in male flowers. Drupe 1-celled, broadly ellipsoid (when fresh), c. 2.5 cm long, 1.5 cm in diameter, yellow, orange, or red when ripe. Seed with seed wall adherent to the inner layer of the fruit wall.

*Habitat & Ecology* — Usually in lowland forest up to 600 m altitude.

*Distribution* — Andaman Islands, Burma, Thailand to S. China, Malay Peninsula, Sumatra, Borneo.

*Uses* — Fruits are edible.

*Material* — W 186, W 665, W 746, v.B. 5964.

**BUCHANANIA** Spreng. in Schrader, J. Bot. 2 (1801) 234.

Small to medium-sized trees, bole with or without buttresses. Leaves spiral, simple, entire, petioled or sessile. Inflorescences axillary (also terminal?), paniculate. Flowers bisexual. Fruit a 1-celled drupe (often with an undeveloped seed), stone thick, woody or bony. — Four species reported for Kalimantan.

*Uses* — Timber moderately hard to hard, sapwood and heartwood not differentiated.

KEY TO THE SPECIES

- 1 a. Leaves usually sessile, petioles sometimes up to 1.5 cm long, filaments papillose, fruits oblique, almost heart-shaped . . . . . *B. sessifolia*
- b. Leaves with a distinct petiole 1.5–4 cm long, filaments glabrous, fruits more or less lens-shaped . . . . . *B. insignis*

***Buchanania insignis*** Blume, Mus. Bot. Lugd. Bat. 1 (1850) 184.

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 415.

*Vernacular names* — Merasam (M), mahurong (M).

Trees 10–25(–35) m tall, 20–70 cm in diameter, occasionally with up to 4 m tall buttresses. Leaves oblanceolate, obovate-oblong, or elliptic-lanceolate, 9–40 cm long, 3–12.5 cm wide, slightly hairy beneath, especially on the midrib, base gradually narrowing, apex short acuminate or acuminate, secondary veins 10–25 pairs, tertiary venation net- to ladder-like. Petioles 1.5–4(–6) cm long. Panicles 7–24 cm long, hairy, glabrescent. Flowers white, calyx falling off early, lobes broad-ovate, up to 1 mm long, petals oblong, ovate- or elliptic-oblong, up to 4 mm long, 1–1.5 mm wide, stamens with glabrous filaments, carpels 1.5–2 mm long. Drupe red, more or less lens-shaped, 7–10 mm in diameter.

*Habitat & Ecology* — Chiefly in the lowlands, up to 400 m altitude, occasionally on limestone.

*Distribution* — Borneo, Philippines.

*Uses* — See genus description.

*Material* — S 544.

***Buchanania sessifolia*** Blume, Mus. Bot. Lugd. Bat. 1 (1850) 184. — Fig. 3

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 418.

*Vernacular name* — Rengas bukit (D).

Trees up to 42 m tall, c. 80 cm in diameter, occasionally buttressed. Leaves obovate-oblong, oblanceolate, or spatulate, 7.5–31 cm long, 4–10.5 cm wide, hairy beneath, especially on the midrib and the secondaries, base wedge-shaped or gradually narrowing, apex short-acuminate or acuminate, secondary veins 12–25 pairs, tertiary venation net- to ladder-like. Petioles usually absent, sometimes up to 1.5 cm long. Panicles 4.5–34 cm long, hairy, glabrescent. Flowers white or whitish-yellow, calyx persistent, lobes half-circular or triangular, up to 1 mm long, petals oblong, ovate- or elliptic-oblong, up to 2 mm long, 1–1.5 mm wide, stamens with papillose filaments, carpels c. 1 mm long. Drupe red, oblique, almost heart-shaped, 10–13 mm long.

*Habitat & Ecology* — In lowland forests, on dryland.

*Distribution* — Thailand, Laos, Malay Peninsula, Anambas, Natuna, Sumatra, Borneo.

*Uses* — The wood is used for house construction although not very durable. The sour fruit is eaten.

*Material* — W 674, S 492, S 666.

**DRACONTOMELON** Blume, Mus. Bot. Lugd. Bat. 1 (1850) 231.

***Dracontomelon dao*** (Blanco) Merr. & Rolfe, Philipp. J. Sc., Bot. 3 (1908) 108. — Fig. 4

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 470.

*Vernacular names* — Da(h)u (D), sengkuan (M).

Deciduous trees 25–35(–55) m tall, 0.9–1.5 m in diameter. Buttresses up to 5 m high, c. 2.5 m long. Bark greyish brown, scaly, peeling in irregularly patches, inner bark with brown exudate. Leaves spiral, imparipinnate with 4–9 pairs of leaflets, rhachis 6–25(–44) cm long. Petioles 3–16(–23) cm long. Leaflets opposite, almost opposite, or alternate, entire, parchment-like to thinly leathery, elliptic-oblong, oblong, ovate-oblong to lanceolate, 4.5–20(–27) cm long, 2–7(–10) cm wide, usually glabrous on both sides, lower surface with hairy domatia, base obliquely rounded, apex shortly acuminate, secondary veins 3–10 pairs, tertiary venation net-like. Petioles 0–0.4 cm, the terminal one 0.25–1.75 cm long. Inflorescences paniculate, axil-

(Anacardiaceae)

lary or terminal, up to 50 cm long. Flowers white or greenish white, bisexual, calyx 5-lobed, lobes ovate-oblong, 4–5 mm long, petals 5, valvate, but overlapping at the apex, oblanceolate, 7–10 mm long, 1.5–2 mm wide, stamens 10, those opposite the calyx lobes longer than those alternate with them, filaments awl-shaped, glabrous, pistil 5.5–6.5 mm long, ovary 5-celled, hairy, styles 5, fused at the apical part, stigmas capitate, stigmatic face lateral. Drupe 5-celled (each cell with a distinct operculum), globular, 1.75–2.5(–3.5) cm in diameter, larger when fresh, dingy brown, inner layer of fruit wall woody, hard, stone lens-shaped, 1–1.75 cm in diameter, often smooth, sometimes slightly irregularly 5-angular. Seed wall free from fruit wall.

*Habitat & Ecology* — Scattered in evergreen to slightly deciduous lowland forests, at low altitudes up to 500 m. Sometimes planted as village trees.

*Distribution* — India to Solomons.

*Uses* — The timber (sengkuang) is in demand for veneer which is very decorative. The fruits are edible.

*Note* — A second species, *D. costatum* Blume, has been reported for Kalimantan.

*Material* — W 240, W 976, W 993.

**GLUTA L., Mant. 2 (1771) 293.**

Small to very large trees, often with buttresses. Leaves spiral, simple. Inflorescences paniculate, axillary. Flowers bisexual. Calyx cup-shaped, bursting irregularly, falling off early. Fruit a 1-celled drupe, with enlarged wing-like petals or not. — Fourteen species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves sessile, or with a petiole up to 2 cm long, drupes not winged  
*G. renghas*
- b. Leaves with petioles more than 2 cm long, drupes winged (enlarged petals)  
*G. wallichii*

*Gluta renghas* L., Mant. 2 (1771) 293, sphalm. 'benghas'.

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 463.

*Vernacular names* — Rengas tembaga (M), rengas burung (M), rengas tulang jingah (M).

Large trees up to 50 m tall, c. 1.15 m in diameter, sometimes buttressed when old. Bark light fawn-brown, or greyish when old, dippled, scaly, flakes small. Leaves elliptic-oblong, or narrowly elliptic, or oblanceolate, 12–28(–36) cm long, 4–7(–9) cm wide, leathery, glabrous, base wedge-shaped, sometimes more or less heart-shaped, apex obtuse, secondary veins 17–30 pairs, elevated at both sides, tertiary venation net-like. Petioles 0–2 cm long. Panicles 6–25 cm long, glabrous. Flowers: calyx 3–4 mm long, glabrous, petals white, twisted, 7.5–13 mm long, 2–3 mm wide, the basal 2–3 mm fused with the torus, stamens 5, 4–5.5 mm long, filaments



glabrous, anthers oblong, torus cylindrical, 2–3 mm long, ovary almost globular, 1–1.5 mm in diameter, glabrous, stalk 0–0.75 mm, style lateral. Drupe on a centric stalk (c. 0.5 cm long), almost globular, 3.5–5 cm in diameter, pinkish brown with irregular crests and protuberances, without enlarged petals, embryo almost globular, 2–3.5 cm in diameter.

*Habitat & Ecology* — Common in coastal regions, in peat-swamps, occasionally inundated area at low altitudes.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo, Sulawesi, Maluku.

*Uses* — The timber is very strong, durable, reddish brown, and splendid markings.

*Material* — Boschbouwproefstation bb 28070, Endert 1886.

*Gluta wallichii* (Hook. f.) Ding Hou, Blumea 24 (1978) 21. — Fig. 5

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 456.

*Vernacular names* — Rengas manuk (M), rengas daging (M).

Large trees up to 45 m tall, c. 0.7 m in diameter, buttresses 1.5–4 m tall, 0.5–1 m long. Bark greyish brown, flaky, or distinctly wrinkled to fissured. Leaves obovate-oblong, elliptic-lanceolate, or elliptic, 8.5–34.5 cm long, 4–14 cm wide, leathery, glabrous, base wedge-shaped, sometimes obtuse, apex obtuse, acuminate, secondary veins 9–24 pairs, prominent beneath, tertiary venation net- to ladder-like. Petioles 2.5–6 cm long. Panicles 16–33 cm long, pubescent. Flowers: calyx 3–4 mm long, puberulous outside, petals white, overlapping, 4–7 mm long, 1.75–2.5 mm wide, the base free, stamens 5, 2.5–4 mm long, filaments pilose, anthers oblong, ovary almost globular, 1–1.5 mm in diameter, pilose, stalk obscure, style lateral. Drupe on an obscure centric stalk, ovoid to ellipsoid, c. 1.5 cm long, c. 1 cm in diameter, wing-like enlarged petals red, elliptic oblong, or lanceolate, 5.5–8 cm long, 1–2 cm wide, embryo ovoid or broadly ellipsoid, 1 cm in diameter.

*Habitat & Ecology* — Common in peat-swamps, occasionally also on dryland up to 500 m altitudes.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The heartwood is a superior timber but a great objection against its use is that it retains long its rengas-poison quality.

*Material* — W 575, S 613, S 705.

MANGIFERA L., Sp. Pl. (1753) 200.

Small to large trees. Bole without buttresses. Bark shallowly fissured, dippled, or scaly, inner bark pinkish or orange yellow. Leaves spiral, simple, entire, glabrous. Petioles often thickened at base. Young leaves violet. Inflorescences paniculate, terminal and/or axillary. Flowers male or bisexual, both types on the same plant. Drupe with white latex from immature fruits, 1-celled, resinous, middle layer of fruit wall often fleshy and thick, especially in cultivated species, inner layer of fruit wall woody or fibrous. — Fourteen species reported for Kalimantan.

(Anacardiaceae)

KEY TO THE SPECIES

- 1a. Flowers 4-merous, fruits globular . . . . . *M. similis*
- b. Flowers 5-merous, fruits obliquely ovoid . . . . . 2
- 2a. Leaves rigidly leathery, flowers pinkish or deep red, fruits yellowish or greyish green . . . . . *M. foetida*
- b. Leaves thinly leathery, flowers yellowish-white becoming red, fruits dark green . . . . . *M. odorata*

*Mangifera foetida* Lour., Fl. Coch. (1790) 160. — Fig. 6

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 435.

*Vernacular names* — Mangga (M), embacang (D), asam bawang (M), sam pamas (M).

Trees 10–40 m tall, 30–100 cm in diameter. Bark greenish to reddish brown, rough, fissured or scaly. Leaves oblanceolate, elliptic or elliptic-oblong, 14–35 cm long, 15–18.5 cm wide (up to 50 cm long and 20 cm wide in saplings), rigidly leathery, base wedge-shaped to gradually narrowing, apex obtuse, rounded, secondary veins 15–33 pairs, prominent beneath, tertiary veins obscure. Petioles 2–5 cm long (up to 12 cm long in saplings). Panicles terminal, 10–40 cm long, glabrous. Flowers pinkish or dark red, calyx 5-lobed, petals 5, stamens 5, usually 1 fertile, filaments fused at base, anthers ellipsoid, ovary almost globular. Drupe yellowish or greyish green when ripe, smelling and tasting of turpentine, obliquely ovoid, 8–10(–18) cm long, 6–7(–12) cm in diameter, flesh yellow, fibrous, juicy, fragrant.

*Habitat & Ecology* — Escaped or naturalized, also indigenous in lowland Mixed Dipterocarp Forest up to 500 m altitude. Very common in west Kutei and central east Kalimantan.

*Distribution* — Thailand, Indochina, Malay Peninsula, Sumatra, Borneo.

*Uses* — Widely cultivated in Malesia for its sweet-fragrant edible fruits.

*Material* — W 63, W 798.

*Mangifera odorata* Griff., Notul. 4 (1854) 417.

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 437.

*Vernacular name* — Pleihari (M).

Trees 15–35 m tall, 20–80 cm in diameter. Bark grey, smooth or fissured. Leaves elliptic-lanceolate or lanceolate, 9–35 cm long, 3.5–10 cm wide, thinly leathery, base cuneate obtuse, apex shortly acuminate, secondary veins 15–26 pairs, prominent beneath, tertiary venation net-like. Petioles 2–5(–7) cm long. Panicles terminal or sometimes in upper leaf-axils, 12–50 cm long, glabrous. Flowers yellowish white becoming red, calyx 5-lobed, petals 5, stamens 5, 1 (rarely 2) fertile, filaments fused at base, anthers ovoid to oblong, ovary almost globular. Drupe dark green when ripe, obliquely ovoid or broadly ellipsoid, 10–13 cm long, 7–10 cm in diameter, flesh yellow, sweet, fibrous.

*Habitat & Ecology* — Possibly of hybrid origin, thus chiefly found in cultivation.

The lowland forest trees may all be naturalized.

*Distribution* — Sumatra, Java, Borneo.

*Uses* — Grown for its edible fruits, of which good cultivars exist.

*Material* — W 386, W 1035, AA 389.

*Mangifera similis* Blume, Mus. Bot. Lugd. Bat. 1 (1850) 200.

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 429.

*Synonym* — *Mangifera torquenda* Kosterm., Reinwardtia 7 (1965) 21, f. 2.

*Vernacular name* — Asam pipit (M).

Trees 15–32 m tall, 50–100 cm in diameter. Bark brownish, smooth. Leaves elliptic-oblong, lanceolate or obovate-oblong, 7–21 cm long, 2.5–9 cm wide, leathery, base wedge-shaped to gradually narrowing, apex acute to shortly acuminate, secondary veins 14–20 pairs, prominent beneath, tertiary venation net-like. Petioles 1–4.5 cm long (–8.5 cm long in saplings). Panicles terminal, up 8–28 cm long, puberulous. Flowers greenish white, calyx 4-lobed, petals 4, stamens 4, 1 fertile, filaments free, anthers ovoid, ovary almost globular. Drupe yellowish green when ripe, globular, 10 cm in diameter, flesh pale yellowish, sweet acid.

*Habitat & Ecology* — Wild in mixed Dipterocarp forest up to 150 m altitude. Cultivated in Java.

*Distribution* — Sumatra, Bangka, Java, Borneo.

*Note* — *Mangifera similis* is vegetatively similar to *M. quadrifida* but differs from the latter especially in the yellowish green and globular (not dark purple and ellipsoid) fruits.

*Material* — W 605, W 680.

### MELANOCHYLA Hook. f., Fl. Brit. India 2 (1876) 38.

Small to big trees. Leaves spiral, simple, undersurface usually papillose. Inflorescences paniculate, terminal or axillary. Flowers usually unisexual (male and female flowers on different plants), petals puberulous outside, villous or woolly inside. Fruits hairy, 1-celled, the middle and inner layer of fruit wall full of black resin. — Fifteen species reported for Kalimantan.

#### KEY TO THE SPECIES

- 1a. Leaves raised between veins (bullate) above, papillose beneath, petioles 1.5–3 cm long . . . . . *M. bullata*
- b. Leaves not raised between veins above, petioles obscure, 0–1.25 cm long. . . . . 2
- 2a. Leaves glabrous, not papillose beneath, drupe without insect-gall like processes . . . . . *M. auriculata*
- b. Leaves pubescent, papillae distinct beneath, drupe with dense, rusty hairy, insect-gall-like processes . . . . . *M. fulvinervis*

(Anacardiaceae)

*Melanochyla auriculata* Hook. f., Fl. Brit. India 2 (1876) 39. — Fig. 7

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 495.

*Vernacular names* — Rengas lanyuh (D), rengas lisang (M).

Trees up to 30 m high, c. 65 cm in diameter, buttresses up to 2 m tall, 1 m long. Bark grey-brown, smooth, inner bark pinkish, granular with black sap, sapwood whitish. Leaves narrowly obovate or elliptic, 22–62 cm long, 6–15 cm wide, thickly leathery, glabrous on both sides, not papillose on the lower surface, base heart-shaped or with ear-shaped appendages, apex acuminate or cuspidate, secondary veins 25–35 pairs, tertiary venation net- to ladder-like, distinct beneath. Petioles 0–1.25 cm long. Panicles terminal, 15–63 cm long, pubescent. Flowers white. Drupe depressed globular or oblong, 2–3.5 cm long, 2–2.5 cm in diameter, rusty-hairy, apex obtuse or rounded.

*Habitat & Ecology* — In lowland forest, on dry land or in swamps.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 468, W 541, AA 18, AA 65.

*Melanochyla bullata* Ding Hou, Blumea 24 (1978) 31.

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 496.

*Vernacular name* — Rengas berlukup (M).

Trees 10–30 m high, 20–80 cm in diameter, buttresses up to 2.5 m tall, 1.5 m long. Bark grey-brown, smooth or scaly, whitish. Leaves oblanceolate or obovate-oblong, 13–42 cm long, 5–9 cm wide, leathery, glabrous and shining on upper side, tomentose beneath, papillose on the lower surface, base wedge-shaped or gradually narrowing, apex long pointed or acuminate, secondary veins 33–38 pairs, tertiary venation ladder-like, elevated beneath, raised between them (leaves bullate). Petioles 1.5–3 cm long. Panicles terminal, 15–17 cm long. Flowers yellowish. Drupes ovoid 3.5–4.5 cm long, 2–2.5 cm in diameter, thickly velvety, apex acute or shortly acuminate.

*Habitat & Ecology* — In lowland forest, on dry land or in swamps.

*Distribution* — Endemic in Borneo.

*Material* — W 496, AA 46.

*Melanochyla fulvinervis* (Blume) Ding Hou, Blumea 24 (1978) 32. — Fig. 8

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 493.

*Vernacular name* — Rengas bulu (M).

Medium-sized trees 10–25 m high, 20–40 cm in diameter, buttresses up to 2 m tall, 2 m long. Bark red-brown to grey-brown, smooth, inner bark reddish with black sap. Leaves obovate to oblanceolate, 10–38 cm long, 3.5–14 cm wide, leathery, glabrous and shining on upper side, pubescent beneath, papillae distinct, separated

by veins and veinlets into groups on the lower surface, base more or less heart-shaped, or rarely truncate, apex long pointed, sometimes cuspidate, secondary veins 19–22 pairs, tertiary venation net- to ladder-like, distinct beneath. Petioles 0.5–1.2 cm long. Panicles terminal, up to 18 cm long. Flowers yellow. Drupes ellipsoid or almost globular, 3–4 cm long, 2.5–3 cm in diameter, with dense, rusty hairy, insect-gall-like processes up to c. 7 mm long.

*Habitat & Ecology* — In lowland forest, on dry land or in swamps.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 388, W 523.

**PARISHIA** Hook. f., Trans. Linn. Soc. Lond. 23 (1860) 169.

*Parishia insignis* Hook. f., Trans. Linn. Soc. Lond. 23 (1860) 170. — Fig. 9

*Literature* — Ding Hou in Flora Malesiana I, 8 (1978) 545.

*Vernacular name* — Kayu sepak (M).

Tall trees up to 50 m tall, c. 70 cm in diameter, buttresses up to 4 m tall, c. 2 m long. Bark shallowly fissured, finely cracked, inner bark with white exudate. Leaves spiral, imparipinnate, with 4–6 pairs of leaflets, leaflets almost opposite or opposite, entire, ovate-oblong to lanceolate, elliptic or rarely ovate, 4.5–15 cm long, 3–7 cm wide, thinly leathery, base unequal or oblique, rounded obtuse, wedge-shaped or more or less heart-shaped, apex acute to acuminate, secondary veins 4–9 pairs, tertiary venation net- to ladder-like or only net-like. Petiolules, if present, up to 0.5 cm long, the terminal ones 1–3.75 cm. Petioles up to 15 cm long. Panicles axillary and/or terminal, up to 54 cm long. Flowers unisexual (the male and female flowers on different plants), calyx 4-lobed, greatly enlarged in fruit, 2.5–4.5 mm long, the lobes triangular, unequal, petals 4, overlapping, broad-ovate to ovate-oblong, 3–5 mm long, 1.75–3 mm wide, the stamens 4, filaments 2.5–4 mm long, glabrous, anthers ovoid, sterile stamens in the female flowers c. 1.5 mm long, the ovary 1-celled, densely hairy, conical, the style 3-lobed, stigmas 3, capitate. Drupes 1-celled, almost globular, 1–1.5 cm long, 0.75–1.25 cm in diameter, more or less beaked, subtended by the enlarged 4-lobed calyx, tube c. 0.5 cm long, the wings narrowly oblong, 7–8.5(–12.5) cm long, 0.75–1.5 cm wide. Seeds broad ellipsoid or almost globular, c. 0.75 cm in diameter, seed wall fused with the inner layer of the fruit wall.

*Habitat & Ecology* — Lowland forest up to 280 m altitude.

*Distribution* — Andamans, Burma, Thailand, Malay Peninsula, Sumatra, Borneo.

Of the genus *Parishia* four species are reported for Kalimantan.

*Uses* — Very light timber.

*Note* — After the leaves turn red, they fall.

*Material* — W 512, AA 96.

(Annonaceae)

#### 4 ANNONACEAE

Small to tall trees. Buttresses small or absent. Inner bark with conspicuous wedge-shaped fibre bundles, tapering outwards. Stipules absent. Leaves simple, alternate, entire, smelling of etheric oil when crushed, with tiny translucent dots. Flowers small to large, petals up to 8 cm long, actinomorphic, bisexual, 3-merous, stamens few to many, carpels free, 1 to many, sometimes fused (*Annona*). Fruits usually berries. Seeds with ruminant endosperm. — About twenty genera reported for Kalimantan.

##### KEY TO THE GENERA

- 1 a. Leaves glaucous beneath . . . . . 2
- b. Leaves not glaucous . . . . . 3
- 2 a. Young twigs and leaves with long rusty brownish hairs, often stiltroots present, fruits several, elongate, dehiscent, inner fruitwall red, seeds blue  
*Xylopia ferruginea*
- b. Young twigs and leaves glabrous or sometimes with short hairs, stiltroots absent, fruitlets several, shortly cylindrical or globular, indehiscent . *Polyalthia*
- 3 a. Leaves thin, very brittle when dry, base unequal, often heart-shaped  
*Cananga odorata*
- b. Leaves leathery, unequal or not at base . . . . . 4
- 4 a. Leaf base usually unequal, midrib flat or raised above, petals spoon-shaped  
*Cyathocalyx*\*
- b. Leaf base equal, midrib sunken above, petals not spoon-shaped . . . . . 5
- 5 a. Leaves drying brown, up to 16 cm long and 7 cm wide, flowers small, petals up to 1.7 cm long, fruit 1, ellipsoid or globular, seeds 2, large, compressed  
*Mezzettia parviflora*
- b. Leaves drying black, 20–30 cm long, 6–10 cm wide, flowers big, petals up to 4 cm long, fruit(s) 1 or 2, cylindrical, seeds c. 10, in two rows, compressed  
*Monocarpia*

CANANGA (DC.) Hook. f. & Thomson, Fl. Ind. 1 (1855) 129.

*Cananga odorata* (Lam.) Hook. f. & Thomson, Fl. Ind. 1 (1855) 130. — Fig. 10

*Vernacular names* — Kenanga (M), kasar (B).

Medium trees, up to 35 m tall. Bark grey or silvery, smooth. Young twigs minutely pubescent. Leaves oblong to broadly elliptic, 5–20 cm long, 3.5–10 cm wide, papery, very brittle when dry, base heart-shaped, often unequal, apex acuminate, pubescent on midrib and veins or glabrous, often with domatia, secondary veins 8–10 pairs. Petioles 0.5–2.5 cm long. Flowers pendulous, in clusters, often from older branches, greenish yellow, very fragrant, sepals 3, triangular, petals 6, strap-shaped, 3–5(–8) cm long, 3–5(–12) mm wide, a purple spot at the base inside, stamens many, sterile tissue above the anthers produced, lanceolate, acute, carpels numerous, ovules several. Fruits oblong, with 1.5 cm long stalk, jointed at top.

*Habitat & Ecology* — Common in secondary forest and on forest edges, abundant in villages.

*Distribution* — India to N. Queensland.

*Uses* — The scented flowers are used as perfume (ylang-ylang oil).

*Material* — W 229, AA 136.

**MEZZETTIA** Becc., *Nuovo Giorn. Bot. Ital.* 3 (1871) 187.

*Mezzettia parviflora* Becc., *Nuovo Giorn. Bot. Ital.* 3 (1871) 188. — Fig. 11

*Literature* — Heijden & Keßler, *Blumea* 35 (1990) 217–228; Keßler & Heusden, *Rheedea* 3 (1993) 69–71.

*Vernacular names* — Pengitan (K), empanyit (K).

Trees up to 40 m, 20–80 cm in diameter. Buttresses developed or not. Bark rough with irregular cracks, sometimes dippled, shedding in irregular pieces, dark grey with lighter patches. Inner bark orange brown, thick, fibrous, with a dark line between outer and inner bark. Sapwood pale brown to whitish. Twigs glabrous. Leaves leathery, glabrous on both sides, oblong to elliptic or lanceolate, (3.5–)4–11(–16) cm long, 2–4.5(–5.5) cm wide, base acute, apex acuminate, sometimes acute, blunt, midrib flat or slightly prominent above, lateral veins 8–20 pairs. Petioles glabrous, (5–)6–8(–12) mm long, 1–1.5(–2) mm in diameter. Inflorescences 2–4-flowered, on short shoots. Flowers greenish, small, sepals 3.5 mm long, pubescent inside, tips often reflexed, outer petals lanceolate to linear-lanceolate up to 17 mm long, inner petals ovate-oblong, up to 9 mm long, stamens 9–17, staminodes sometimes present, carpel glabrous. Fruits globular to almost globular, 4–7 cm in diameter, smooth, shrunken when dry, glaucous. Seeds 2, 3–4 by c. 2.5 by c. 2 cm.

*Habitat & Ecology* — Mainly on hillsides or ridges and swampy areas.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo, Maluku. Of the genus *Mezzettia* four species are reported for Kalimantan.

*Uses* — The timber is sometimes used in construction, but more often as fuel wood.

*Note* — Fallen leaves yellow.

*Material* — W 313, W 827, W 828.

**MONOCARPIA** Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1865) 12.

Trees up to 35 m tall, up to 60 cm in diameter. Bole cylindrical, bark smooth, grey to black, often hooped. Inner bark orange-brown. Sapwood yellowish. Young twigs velvety or glabrous. Leaves papery or thinly leathery, secondary veins 9–20, sunken or not above, interarching near the margin or not. Flowers solitary, or 2 or 3 together on short stalks, opposite the leaves, bract relatively big, c. 4 mm long, sepals valvate, fused at base only or up to the middle, petals 6, valvate, inner whorl slightly shorter, shortly clawed, stamens numerous, sterile tissue about the anther truncate dilated, carpel(s) 1 or 3, style short, stigma pilose. Fruit(s) 1–3, roundish or cylindrical, fruit wall hard, stony, or fleshy. — Two species reported for Kalimantan.

(Annonaceae)

KEY TO THE SPECIES

- 1a. Young twigs velvety, secondary veins 13–20 pairs, sunken above, clearly interarching c. 3–4 mm before the margin, sepals fused at base only, carpel 1, fruit 1, cylindrical, red when ripe, fruit wall fleshy . . . . . *M. euneura*
- b. Young twigs glabrous, secondary veins 9–10 pairs, not sunken above, only slightly interarching, sepals fused up to the middle, carpels 3, fruit(s) 1–3, globular to cylindrical, yellowish green when ripe, fruit wall leathery to stony  
*M. kalimantanensis*

*Monocarpia euneura* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 12.

*Synonym* — *Monocarpia marginalis* (Scheffer) Sinclair, Gard. Bull. Sing. 14 (1955) 273.

Trees up to 20 m tall, up to 30 cm in diameter. Young twigs velvety. Leaves elliptical, 10–20 cm long, 4–6 cm wide, papery, base rounded to wedge-shaped, apex acuminate, c. 1 cm long, secondary veins 13–20 pairs, sunken above, clearly interarching 3–4 mm before the margin. Flowers solitary, sepals fused at base only, carpel 1, densely velvety. Fruit 1, cylindrical, c. 8 cm long, 5 cm in diameter, glabrous, red when ripe, fruit wall fleshy.

*Habitat & Ecology* — Rare in logged-over lowland Dipterocarp forest.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Material* — S 737, S 837.

*Monocarpia kalimantanensis* Keßler, Rheedeia 3 (1993) 73. — Fig. 12

Trees up to 35 m tall, up to 60 cm in diameter. Young twigs glabrous. Leaves thinly leathery, secondary veins 9–10, not sunken above, only slightly interarching before the margin. Flowers solitary or 2 or 3 together on short-shoots, sepals fused up to the middle, carpels 3. Fruit(s) 1 or 2 (or 3), cylindrical, c. 8 cm long, c. 5.5 cm in diameter, yellowish green when ripe, fruit wall hard, leathery to stony. Seeds c. 12, in two rows.

*Habitat & Ecology* — Frequent in lowland Dipterocarp forest.

*Distribution* — Endemic in East Kalimantan.

*Material* — W 179, W 511, W 670, S 453, S 570, S 571, v.B. 5798.

**POLYALTHIA** Blume, Fl. Javæ Anonac. (1830) 68.

*Literature* — Keßler & Heusden, Rheedeia 3 (1993) 75–82.

Medium-sized trees. Bark greyish white, often hooped. Twigs glabrous. Petals equal in size, stamens many, carpels few to many, stigma globular to elongate. Fruits few to many, stalked. — More than forty species reported for Kalimantan, but most of them are small understory treelets.



KEY TO THE SPECIES

- 1a. Stigmas elongate, inflorescences borne on branches always below the leaves, mainly arising from short shoots, with one terminal flower, fruit globular  
*P. glauca*
- b. Stigmas globular, inflorescences borne from foliate axils and on branches below the leaves, fruit ellipsoid. . . . . *P. sumatrana*

*Polyalthia glauca* (Hassk.) F. Muell., Descr. Notes Papuan Pl. App. (1877) 95, non Boerl. (1899). — Fig. 13

*Literature* — Rogstad, J. Arnold Arbor. 70 (1989) 209.

*Vernacular name* — Banitan (M).

Medium-sized trees up to 35 m high, up to 30 cm in diameter. Bark surface greyish white, smooth, hooped. Twigs glabrous, pale. Leaves oblong-lanceolate, 10–18 cm long, 4.5–6 cm wide, base rounded to acute, apex acuminate, 0.5–2 cm long, glabrous and shining above, glaucous beneath, secondary veins fine, not clearly visible. Flowers on wart-like short shoots, in clusters of 3–10, in the axils of fallen leaves, petals linear oblong, spreading, c. 2 cm long. Fruits globular, red, becoming black, c. 2 cm in diameter, stalk c. 1.5 cm long, seed 1.

*Habitat & Ecology* — Rare, usually on hillsides or ridges in primary forests.

*Distribution* — Andamans, Thailand, Malay Peninsula, Sumatra, Borneo, New Guinea.

*Material* — W 151, W 319, W 865, v.B. 5907.

*Polyalthia sumatrana* (Miq.) Kurz, J. Asiat. Soc. Bengal, Pt 2, Nat. Hist. 43 (1874) 53.

*Literature* — Rogstad, J. Arnold Arbor. 70 (1989) 220.

*Vernacular names* — Banitan putih (M), balal (D).

Medium-sized trees up to 35 m high, up to 30 cm in diameter. Bark surface greyish white, smooth, often hooped. Twigs glabrous, pale. Leaves oblong lanceolate, 9–16 cm long, 2.5–4.5 cm wide, base rounded to acute, apex acuminate 0.5–1 cm long, glabrous and shining above, glaucous beneath, secondary veins fine, not clearly visible. Flowers 1–3, in the axils of fallen leaves, petals linear oblong, spreading, c. 4 cm long. Fruits ovoid, tapering to each end, red, c. 2 cm in diameter, stalk c. 2 cm long, seed 1.

*Habitat & Ecology* — Frequent on hillsides, on ridges and along riverbanks.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Locally used as fuel wood.

*Material* — W 12, W 82, W 440, W 509, S 262, S 449, v.B. 5758, P.K. 612.

(Annonaceae / Apocynaceae)

**XYLOPIA** L., Syst. Nat. ed. 10 (1759) 1241.

*Xylopia ferruginea* (Hook. f. & Thomson) Hook. f. & Thomson, Fl. Brit. India 1 (1872) 83. — Fig. 14

*Literature* — Keßler & Heusden, Rheedea 3 (1993) 88–89.

*Vernacular name* — Banitan merah (M).

Medium-sized trees up to 30 m high, c. 35 cm in diameter. Bole with numerous stilt-roots. Bark surface red to reddish brown, smooth to cracking, lenticellate. Inner bark pinkish brown, sapwood white, heartwood white. Young twigs rusty pubescent. Leaves oblong, 10–20 cm long, 3.5–6 cm wide, base rounded, often unequal, apex pointed, leathery, shining and glabrous above, glaucous and rusty brown beneath, secondary veins 12–14 pairs, midrib sunken above. Flowers 1–3, axillary, petals spoon-like, c. 4 cm long, rusty tomentose outside. Fruits elongate, cylindrical, 10–13 cm long, 0.5 cm in diameter, constricted a little between the 6–8 seeds when unripe, dehiscent at maturity, showing the blue seeds behind the dark red inner fruit wall. — More than fifteen species reported for Kalimantan.

*Habitat & Ecology* — Usually confined to hillsides, near streams and often also in swamps.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 131, W 930, v.B. 5911, P.K. 620.

## 5 APOCYNACEAE

Small to large trees with milksap. Stipules absent. Leaves simple, opposite, whorled, rarely spiral (*Cerbera*), entire. Flowers in cymes or cymose panicles, actinomorphic, often large, bisexual, calyx tubular, corolla tubular, lobes twisted in bud, stamens 5 on corolla tube, anthers often joined to stigma, disc present, ovary superior, usually of 2 more or less free carpels. Fruits usually paired, except *Cerbera*. — Seven genera reported for Kalimantan.

### KEY TO THE GENERA

- 1 a. Leaves spiral, small mangrove trees . . . . . *Cerbera*\*
- b. Leaves in whorls or opposite, trees of dry land or inland swamps . . . . . 2
- 2 a. Leaves opposite, fruits globular . . . . . *Tabernaemontana*\*
- b. Leaves whorled, fruits elongate . . . . . 2
- 3 a. Trees without buttresses, crown conical, follicles massive, spreading, seeds winged . . . . . *Dyera*
- b. Trees with buttresses, crown pagoda-like (branches in horizontal tiers), follicles slender, pendulous, seeds with a tuft of hairs at both ends . . . . . *Alstonia*

ALSTONIA R. Br., Mem. Wern. Nat. Hist. Soc. 1 (1811) 75.

*Literature* — Cockburn, Trees of Sabah 1 (1976) 15.

Small to very big trees. Crown (except *A. angustifolia*) with branches in distant whorls, giving the trees a pagoda-like appearance. Lateral branching *Terminalia*-like. Bole of mature trees commonly coarsely fluted with massive buttresses. Bark smooth, often becoming grid-cracked. Inner bark usually with abundant latex. Wood pale, sometimes yellowish, soft and closely grained. Leaves in whorls of 3–8, stalked, or decurrent. Flowers in cymes, small, white, fragrant. Fruits 2, slender, slightly woody follicles, seeds numerous, small, flat, with a tuft of hairs at both ends. — Six species reported for Kalimantan.

*Uses* — As timber generally too light and soft and therefore very susceptible to staining, insect attack and rapid degradation. The wood is a good substitute for *Dyera* and suitable for similar purposes; excellent for foundry patterns, toys, pencils and cheap plywood.

*Note* — Badly in need of revision.

KEY TO THE SPECIES

- 1a. Leaves in whorls of three, with well-spaced secondary veins at acute angles to the midrib, latex in twigs only ..... *A. angustifolia* var. *latifolia*
- b. Leaves in whorls of 4–8, with crowded, numerous secondary veins at right angles to the midrib, latex in twigs and bole ..... 2
- 2a. Dry leaves with a close and conspicuous raised network of tertiary veins on upper surface ..... *A. scholaris*
- b. Dry leaves with no such network or merely a few scattered veins ..... 3
- 3a. Leaves pointed, 8–12 cm long ..... *A. angustiloba*
- b. Leaves blunt, up to 6 cm long ..... *A. pneumatophora* var. *petiolata*

*Alstonia angustifolia* var. *latifolia* King & Gamble, J. As. Soc. Beng. 75, 2 (1907) 441.

*Vernacular name* — Pulai rawa (M).

Trees up to 15 m tall. Inner bark yellowish, without latex. Wood yellow. Leaves in whorls of three, oblanceolate, 6–14 cm long, 5–6(–8) cm wide, base acute, narrowing towards the base, apex narrowing suddenly to a prominent tip, glabrous, secondary veins distant, c. 12 pairs, at an acute angle to midrib. Petioles c. 2.5 cm long. Peduncle, pedicel, and calyx covered with short, adpressed crisped grey-yellow hairs. Corolla tube c. 5 mm long, petal lobes c. 2.5 mm long. Fruits follicles, 50–70 cm long, seeds pointed at one end.

*Habitat* — Usually in seasonal swamps.

*Material* — AA 811.

(Apocynaceae)

*Alstonia angustiloba* Miq., Fl. Ind. Bat. 2 (1856) 438.

*Literature* — Cockburn, Trees of Sabah 1 (1976) 16.

*Vernacular names* — Pulai gunung (M), pulantan (M).

Tall trees up to 45 m, up to 100 cm in diameter. Bole fluted, buttressed. Bark brown to grey, finely square-scaly. Inner bark mottled brown and yellow, with copious latex. Leaves in whorls of 5–8, elliptic-oblong, 8–19 cm long, 2.5–5 cm wide, leathery, glabrous, base rounded to acute, apex pointed, usually whitish below, secondary veins numerous, crowded, with right angles to midrib. Petioles 2–3.5 cm long. Calyx puberulent, corolla tube 6–7 mm long, petal lobes 3–4 mm long. Fruits follicles, up to 30 cm long, seeds blunt.

*Habitat & Ecology* — Common in primary and old secondary forests.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo, Philippines.

*Material* — W 972, S 279.

*Alstonia pneumatophora* var. *petiolata* Monachino, Pac. Sci. 3 (1949) 153.

*Vernacular name* — Pulai akar napas (M).

Medium to tall trees up to 40 m, up to 80 cm in diameter. Bole prominently fluted, flutes becoming big plank buttresses downwards, sometimes with flying buttresses. Buttresses sometimes spreading as stout tortuous, ground roots with knees (pneumatophores). Bark smooth, sometimes with scaly patches, grey. Inner bark thick, soft, orange-brown, granular, with copious latex. Wood pale. Leaves in whorls of 4–6, oblong, 8–10 cm long, 2–4 cm wide, leathery, rusty brown beneath, base long tapering, apex rounded, blunt, secondary veins numerous, crowded, at right angles to midrib, petioles 2–2.5 cm long. Flowers like *A. angustiloba*. Fruits follicles, up to 30 cm long.

*Habitat & Ecology* — Seasonal swamp or peat swamp forests.

*Distribution* — Malay Peninsula, Sumatra, Borneo, Sulawesi.

*Material* — S 474.

*Alstonia scholaris* (L.) R.Br., Mem. Wern. Nat. Hist. Soc. 1 (1811) 76. — Fig.

15

*Literature* — Cockburn, Trees of Sabah 1 (1976) 16.

*Vernacular names* — Pulai (M), plantan (M), bintihung (M).

Small to tall trees up to 36 m, up to 80 cm in diameter. Bole massively fluted to considerable height. Bark smooth with horizontally enlarged lenticels and hoops. Inner bark brown, usually tinged yellowish, with copious latex. Leaves in whorls of 5–8, elliptic or narrowly obovate, 7–17 cm long, 2–6 cm wide, glabrous, white below, base tapering, apex broadly tipped, secondary veins numerous, crowded, at right angles to the midrib, petioles 2–3 cm long. Fruits follicles, up to 30 cm long. Seeds rounded at both ends.

*Habitat & Ecology* — Common in lowland forests, also in secondary growth.

*Distribution* — From India to S. China to Queensland and Solomons.

*Material* — W 593.

**CERBERA** L., Sp. Pl. (1753) 208.

Small trees, often branching near the base. Bark smooth, grey, with elongate lenticels. Leaves spiral, oblanceolate, base decurrent, drying black, rather fleshy, glabrous, long, wide, secondary veins 15–25 pairs, at right angles to the midrib. Flowers white with coloured eye-mark, large, fragrant. Fruit a large drupe, solitary or paired, thin-fleshy, thickly fibrous inwards. Seed 1, large, enclosed in a woody stone.

*Habitat & Ecology* — Coastal forests, especially in muddy soils.

*Distribution* — India throughout Malesia to Fiji.

*Note* — The two species are easily distinguished by their flowers, but the leaves are very similar.

KEY TO THE SPECIES

- 1a. Flowers with yellow eye, corolla tube shorter than petals, 1.2–2 cm long  
*C. odollam*\*
- b. Flowers with red eye, corolla tube much longer than petals, 2.5–5 cm long  
*C. manghas*\*

**DYERA** Hook. f., J. Linn. Soc. Bot. 19 (1882) 293.

*Dyera costulata* (Miq.) Hook. f., J. Linn. Soc. Bot. 19 (1882) 293. — Fig. 16a & b

*Vernacular names* — Jelutung gunung (D, M), pantung (D), pulu (D).

Huge trees up to 60 m tall, over 260 cm in diameter. Bole columnar, buttresses absent. Bark dark grey, black when wet, smooth. Inner bark thick, mottled, pale brown to whitish, with very copious latex. Wood soft, pale. Twigs stout, coarsely 6–8 ribbed, apical bud covered by a whorl of claw-like glands. Leaves very variable, elliptic, elliptic-oblong, obovate or oblanceolate, 12–15 cm long, 6–8 cm wide, leathery, glabrous, base frequently unequal, rounded or pointed, apex pointed, tipped or not, or rounded, or blunt, margin frequently undulate, secondary veins (12–)17(–20) pairs. Petioles 2–6 cm long, stout, ridged, at the base with a 2 mm long claw-like gland. Flowers 6–10 mm long. Fruits follicles, up to 40 cm long, dehiscent and curling back. Seeds 6 cm long, winged.

*Habitat & Ecology* — Not very common in primary forest, usually in the lowland.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The only species of the family with commercial timber. The wood is very soft but easily treated and is excellent for foundry patterns, toys, boards, pencils, cheap plywood. In Malaya and Kalimantan formerly tapped for the latex which contains 80% resin and 20% rubber. The tree was early replaced by *Hevea brasiliensis* as a source of rubber.

(Apocynaceae / Aquifoliaceae)

*Note* — A second species, *D. polyphylla* (Miq.) Steenis, is reported for Kalimantan.  
*Material* — W 312, W 513.

**TABERNAEMONTANA L.**, Sp. Pl. (1753) 210.

Small to medium trees up to 30 m tall, c. 30 cm in diameter. Bark with latex. Twigs stout or slender, apical bud covered by resin. Leaves opposite, leathery, elliptic to ovate-elliptic, 7–25 cm long, 3–9 cm wide, base rounded to acute, apex short acuminate or pointed, margin revolute, secondary veins 10–22 pairs, a right angle to the midrib. Petioles 1–2 cm long, thickened at base. Flowers in terminal and axillary, long-stalked cymes. Fruit follicles, massive, thick fleshy, twinned, yellow to orange-red, strongly divergent. Seeds embedded in scarlet pulp.

*Habitat & Ecology* — Not very common, usually on alluvial soils along streams.

*Distribution* — Malay Peninsula, Java, Borneo.

KEY TO THE SPECIES

- 1 a. Twigs slender (up to 2 mm in diameter) . . . . . *T. corymbosa*\*
- b. Twigs thick (at least 5 mm in diameter) . . . . . *T. sphaerocarpa*\*

**6 AQUIFOLIACEAE**

**ILEX L.**, Sp. Pl. (1753) 125.

*Ilex cymosa* Blume, Bijdr. (1826) 1149. — Fig. 17

*Vernacular name* — Kamasira putih (M).

Small to medium-sized trees up to 25 m tall. Inner bark thick, yellow-brown, fibrous. Bark of young twigs conspicuously white, lenticellate. Stipules absent. Leaves simple, spiral, entire, elliptic to elliptic-oblong, 5–10 cm long, 3–5.5 cm wide, thinly leathery, glabrous, base wedge-shaped, apex acuminate, secondary veins 6–8 pairs. Petioles 1–1.5 cm long. Flowers in axillary, lax cymes, 2–3 mm in diameter, white or green, actinomorphic, unisexual (male and female flowers on different plants), sepals 5 or 6, petals 6–8, stamens as many as petals, disc absent, ovary superior, stigma broad sessile. Drupes with 8–10 stones, globular to ovoid, 3–4 mm in diameter, ridged when dry.

*Habitat & Ecology* — Common species from lowlands, especially swampy forest but also from belukar.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Java, Borneo. About ten species of the genus *Ilex* are reported for Kalimantan.

*Material* — W 376, W 585, AA 121, S 281, S 633.

**7 ARAUCARIACEAE**

**AGATHIS** Salisb., Trans. Linn. Soc. Lond. 8 (1807) 311.

*Agathis borneensis* Warb., Monsunia 1 (1900) 184. — Fig. 18

*Literature* — Whitmore, Pl. Syst. Evol. 135 (1980) 41–69; De Laubenfels in Flora Malesiana I, 10 (1988) 433; Martawijaya et al., Indonesian Wood Atlas 1 (1986) 10–14.

*Vernacular names* — Agatis (M), damar (D), damar daging (D, M), buno (D).

Huge trees up to 55 m tall and up to 1.60 m in diameter. Bole straight, cylindrical, large branches often turning irregularly upward. Buttresses absent. Bark surface first quite smooth, light grey to reddish brown, peeling with large thin irregular flakes, usually dipped with white or clear resin known as ‘copal’. Sapwood whitish to brownish yellow, sometimes with a pinky tint, without distinct heartwood. Juvenile leaves ovate to lanceolate, up to 14 cm long, c. 4 cm wide, adult leaves opposite, ovate, 6–12 cm long, 2–3.5 cm wide, base wedge-shaped, apex acute, many parallel veins. Petioles up to 5 mm long. Male and female flowers in different cones on the same tree (monoecious). Pollen cones oblong, 4–7 cm long, 2–2.5 cm in diameter, rounded at apex, stalk 2–10 mm long, the apex of the microsporophyll spoon-shaped, 5.5–6.5 by 4–5 mm, apex a broad semicircle. Mature seed cones oval, 6–8.5 cm long, 5.5–6.5 cm in diameter. Seed bracts roughly triangular, but rounded at the upper corner. Seeds 12 by 9 mm, blunt at the upper corner and a broadly rounded wing c. 20 by 16 mm at the other corner.

*Habitat & Ecology* — Scattered in upland rain forest from low elevation to 1200 m altitude. Sometimes in nearly pure stands on low-lying sandy peat soil in many parts of Borneo.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The wood is mainly used for matches, furniture, fine veneer, plywood, and pulp, and generally similar to pine. Heavy exploitation has reduced the economic importance of the genus. Large quantities of the copal resin have been collected for pitch production.

*Note* — Distinguished from *Nageia* (Podocarpaceae) in its round buds; fresh leaves break when bent. A second species, *A. dammara* (Lambert) Rich., is reported from a few mountains in Kalimantan.

*Material* — W 489, AA 39.

**8 BOMBACACEAE**

Medium to huge trees, some parts of the plants, especially the flowers, covered with coppery scales (lepidote). Stipules present, often falling off early. Leaves simple, alternate, entire. Petioles thickened at apex. Flowers actinomorphic, bisexual, epicalyx present, sepals fused, petals free, stamens numerous, ovary superior, (2–)5-celled. Fruit a more or less spiny capsule. — Four genera reported for Kalimantan.

(Bombacaceae)

KEY TO THE GENERA

- 1 a. Leaf apex pointed, fruit wall glabrous inside, seed usually completely covered by a white, yellowish or red aril . . . . . *Durio*
- b. Leaf apex notched, fruit wall hairy inside, seeds hardly covered by a small aril . . . . . *Neesia*

**DURIO** Adans., Fam. Pl. 2 (1763) 399.

*Literature* — Kosterm., Reinwardtia 4 (1958) 65.

*Vernacular name* — The whole genus is called ‘durian’.

Trees, buttresses usually present. Lower leaf surface with a layer of stellate hairs, covered by a layer of fimbriate scales, in some cases the top layer almost absent. Stipules usually falling off early. Inflorescences on young or older branches, or on the bole. Flower bracts scaly, epicalyx closed in bud, splitting into two or three, concave, lobes scaly, usually falling off at anthesis, calyx fused before anthesis, 5-lobed, petals 5, linear to spatulate, in bud twisted, longer than the calyx, falling off after anthesis, stamens numerous, either free or fused in five bundles, or a combination of the two, anthers 1-celled, either opening by a longitudinal slit or by an apical pore, fixed or freely moving (*D. oxleyanus*), staminodes sometimes present, ovary sessile, ovoid or globular, sometimes ribbed, covered with stellate hairs or scales or both, (3–)5(–6)-celled, style well developed, longer than the stamens, stigma globular, small. Fruit capsular, globular to ellipsoid, often sulcate, usually 5-celled, valves dehiscent completely on the tree or when the fruit has dropped, inside smooth, glabrous, outside with slender or thick spines. Seeds ellipsoid in two rows in each cell, arillate, testa brown or black. — Nineteen species reported for Kalimantan.

KEY TO THE SPECIES

A: *Sterile specimens*

- 1 a. Leaves covered with whitish grey stellate hairs, sometimes scattered scales also present . . . . . 2
- b. Leaves densely covered with scales . . . . . 4
- 2 a. Lower surface of leaf glaucous, hairs sparse, with up to 12 pairs of lateral veins . . . . . *D. griffithii*
- b. Lower surface of leaf not glaucous . . . . . 3
- 3 a. Leaves with 15–20 pairs of lateral veins . . . . . *D. oxleyanus*
- b. Leaves with 6–11 pairs of lateral veins . . . . . *D. excelsus*
- 4 a. Secondary veins indistinct below . . . . . 5
- b. Secondary veins clearly visible below . . . . . 6
- 5 a. Leaves large, 15–25 cm long, leathery . . . . . *D. graveolens*
- b. Leaves small, up to 10, lanceolate . . . . . *D. lanceolatus*
- 6 a. Leaves large, 20–35 cm long . . . . . *D. kutejensis*
- b. Leaves smaller, up to 15 cm long . . . . . 7



(Bombacaceae)

- 7a. Leaves with 7–9 pairs of secondary veins . . . . . *D. acutifolius*
- b. Leaves at least with 11 pairs of secondary veins . . . . . 8
- 8a. Scales of the lower leaf surface silvery to golden . . . . . *D. zibethinus*
- b. Scales of the lower leaf surface brown . . . . . *D. dulcis*

B : *Fruiting specimens*

- 1a. Leaves covered with stellate hairs below . . . . . 2
- b. Leaves completely covered with a dense layer of scales below . . . . . 4
- 2a. Leaves glaucous beneath, with up to 12 pairs of lateral veins, at an angle of c. 35–40 degrees with the midrib, fruit small, c. 7 cm long, 2 cm in diameter, seeds black . . . . . *D. griffithii*
- b. Leaves not glaucous beneath, veins usually at an angle of more than 50 degrees with the midrib. . . . . 3
- 3a. Leaves with c. 15–20 pairs of lateral veins, fruit globular, 15–20 cm in diameter, aril creamy to dark yellow, edible . . . . . *D. oxleyanus*
- b. Leaves with c. 6–11 pairs of lateral veins, fruit obovoid, up to 11 cm long, c. 7 cm in diameter, aril red, not edible. . . . . *D. excelsus*
- 4a. Fruit with long pointed spines, 8–20 mm long . . . . . 5
- b. Fruit with pyramidal spines usually less than 10 mm long . . . . . 7
- 5a. Fruit ellipsoid 25 by 12 cm, yellow, dropping unopened, angled, aril orange yellow, edible. Often cultivated. . . . . *D. kutejensis*
- b. Fruit globular . . . . . 6
- 6a. Fruit c. 20 cm in diameter, red, dropping unopened from the tree, aril yellow, edible . . . . . *D. dulcis*
- b. Fruit c. 15 cm in diameter, orange-yellow, opens on the branches, aril red, edible . . . . . *D. graveolens*
- 7a. Lateral veins c. 15 pairs, fruit big, c. 25 cm in diameter, aril edible. Trees often cultivated. . . . . *D. zibethinus*
- b. Lateral veins up to 10 pairs, seeds black, aril not edible . . . . . 8
- 8a. Fruit ovoid to spindle-shaped, up to 6 cm long, spines 1–3 mm long, aril red, covering the entire seed except its apical part . . . . . *D. acutifolius*
- b. Fruit globular, c. 10 cm in diameter, spines c. 6 mm long, aril red to yellow, covering the entire seed . . . . . *D. lanceolatus*

*Durio acutifolius* (Mast.) Kosterm., Tropische Natuur 33 (1953) 34. — Fig. 19

*Literature* — Kosterm., Reinwardtia 4 (1958) 55.

*Vernacular names* — Durian burung (M), tupaloh (D).

Trees up to 28 m tall, sometimes more or less shrub-like, bole straight, up to 50 cm in diameter. Buttresses up to 5 m high, out 50 cm. Bark surface fissured and scaly, strips c. 5 mm wide, outer bark pale brown, inner bark 5–10 mm thick, brown, inside paler, fibrous. Sapwood dirty white, 5–10 cm thick, heartwood light brown. Twigs more or less angular, apex thick, somewhat flattened, densely covered with brown scales. Stipules unknown. Leaves elliptic-oblong, 6–15 cm long, 3–6 cm

(Bombacaceae)

wide, papery, base rounded, apex acuminate, acumen c. 10 mm long, upper surface glabrous, lower surface covered with red-brown scales, secondary veins 7–9 pairs, distinctly looping near the margin, veins prominent, tertiary venation indistinct below. Petioles 1.5–2.5 cm long. Flowers small, c. 1 cm in diameter, axillary, usually solitary, epicalyx splitting into 2 persistent lobes, calyx of 3 sepals, petals 5 or 6, linear, pale yellow, stamens and staminodes many, free, filaments pale yellow, anthers with a pore at the top, ovary ovoid, densely covered with scales and few stellate hairs, abruptly narrowed into a glabrous style, stigma glabrous. Fruits wine-red, spindle-shaped, up to 6 cm long, 3-celled, spines up to 4 mm long, pyramidal, dehiscent on the tree. Seeds glossy, black, aril dark glossy red, covering only the lower part of the seed.

*Habitat & Ecology* — Lowland primary forest, common on the sandy soil along the East coast of Kalimantan.

*Distribution* — Endemic in Borneo.

*Uses* — The fruit is not edible for man and due to the usually small size of the trees the timber is only of local interest.

*Material* — W 107, W 286, P.K. 525.

*Durio dulcis* Becc., Malesia 3 (1889) 243.

*Literature* — Kosterm., Reinwardtia 4 (1958) 68.

*Vernacular names* — Lahung (M), layung (B).

Trees up to 40 m tall, bole straight, up to 80 cm in diameter. Buttresses up to 4 m high, out 1.2 m, concave. Bark surface superficially fissured, rough, hardly peeling off in small rectangular pieces, outer bark dark red-brown, 1–5 mm thick, inner bark 10–25 mm thick, pale red-brown to dark red-brown with white spots. Sapwood white with faint reddish tinge, c. 10 cm thick, heartwood dark brown red. Twigs angular with small brown scales. Stipules unknown. Leaves elliptic to almost obovate-elliptic, 7–15 cm long, 3–7.5 cm wide, papery to thinly leathery, base more or less acute, apex acuminate or abruptly acuminate, acumen slender up to 5 mm long, upper surface glabrous, glossy, lower surface covered with fimbriate scales, secondary veins 11–14 pairs, distinctly looping near the margin, secondary veins and tertiary venation prominent below. Petioles 1–2 cm long. Flowers medium-sized, 3–4.5 cm long, in clusters behind the leaves, epicalyx splitting into 2 lobes, calyx 3–5-lobed, petals 5, pink, stamens in bundles, anthers kidney-shaped, opening by a slit, ovary ovoid, densely covered with closely packed, large scales, abruptly narrowed into a stellate-haired style, stigma glabrous. Fruits dark brown red, globular, 15–20 cm in diameter, spines up to 4 cm long, slender, dropping unopened. Seeds glossy chestnut-brown, completely enclosed in a red, edible aril.

*Habitat & Ecology* — In lowland Dipterocarp forest up to 200 m altitude.

*Distribution* — Endemic in Borneo.

*Material* — S 574.

*Durio graveolens* Becc., Malesia. 3 (1889) 242.

*Literature* — Kosterm., Reinwardtia 4 (1958) 91.

*Vernacular names* — Durian daging merah (M), tuola (B).

Trees up to 45 m tall, bole straight, up to 80 cm in diameter. Buttresses up to 3 m high, out 1.5 m, convex c. 10 cm thick. Bark surface finely cracked and scaly, strips c. 5 mm wide, outer bark dark brown, 1–2 mm thick, inner bark 15–20 mm thick, rusty-brown, inside paler, fibrous. Sapwood whitish, yellowish or pinkish, 3–10 mm thick, heartwood pale red to red. Twigs more or less angular, apex thick, somewhat flattened, densely covered with brown scales. Stipules c. 7 mm long, curved, acute, soon falling. Leaves broad elliptic to oblong, 15–25 cm long, 5–10 cm wide, leathery, base rounded, apex shortly acuminate, acumen c. 6 mm long, upper surface glabrous, lower surface densely covered with coppery-brown scales of two kinds, the bigger ones darker, secondary veins 10–13 pairs, distinctly looping near the margin, tertiary venation indistinct below. Petioles up to 2.5 cm long, more or less angular. Flowers medium-sized, c. 3–4 cm long, on branches, epicalyx splitting into 2 persistent lobes, calyx 3–5-toothed, petals 5, spatula-shaped, white, stamens and staminodes in 5 bundles, filaments brown, anthers kidney-shaped, dehiscent with a slit, ovary ovoid, densely covered with stellate hairs, abruptly narrowed into a stellate-haired style, stigma glabrous. Fruits orange-yellow, globular, c. 15 cm in diameter, 5-valved, spines up to 1.5 cm long, sharp pyramidal, dehiscent on the branches. Seeds glossy brown, completely enclosed in a fleshy, dark red, sweet, non-fragrant, edible aril.

*Habitat & Ecology* — Lowland primary forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Although the fruits are not very tasty they are regularly eaten by local people.

*Material* — W 279, W 678.

*Durio griffithii* (Mast.) Bakh., Bull. Jard. Bot. Buitenzorg. 6 (1924) 227.

*Literature* — Kosterm., Reinwardtia 4 (1958) 61.

*Vernacular name* — (A)lae kuyu (D).

Trees up to 30 m tall, bole straight, angular, up to 60 cm in diameter. Buttresses small, merging into the bole. Bark surface smooth, becoming slightly rough and fissured, outer bark grey to pinkish brown, inner bark c. 5 mm thick, brown, inside paler. Sapwood white or yellowish, c. 5 cm thick, heartwood red-brown. Twigs densely covered with brown scales. Stipules c. 5 mm long, linear, falling off early. Leaves elliptic-oblong or obovate-oblong, 7–22 cm long, 2.5–10 cm wide, papery to thinly leathery, base rounded or acute, apex shortly acuminate, acumen 1.5–2.5 cm long, upper surface glabrous, lower surface glaucous, covered with whitish stellate hairs and scattered coppery-brown scales on them, the secondary veins up to 12 pairs, distinctly looping near the margin, tertiary venation distinct below. Petioles up to 1.5 cm long, cylindrical. Flowers small, up to 1 cm in diameter, axillary, solitary

(Bombacaceae)

or in 2- or 3-flowered cymes, epicalyx splitting into 2 lobes, calyx of 4 white sepals, petals 4–8, linear, yellowish white or greenish white turning orange after anthesis, stamens and staminodes many, free, anthers opening by an apical pore, ovary ovoid with slender spines and peltate scales on top of spines, abruptly narrowed into a glabrous style, stigma glabrous. Fruits scarlet, ellipsoid, c. 10 cm long, 2- or 3-valved, spines up to 2 mm long, sharply pointed, pyramidal, dehiscent on the branches. Seeds glossy black, with a small basal, orange, non-edible aril.

*Habitat & Ecology* — Lowland primary forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is not very durable but rather tough.

*Durio kutejensis* (Hassk.) Becc., Malesia 3 (1889) 251.

*Literature* — Kosterm., Reinwardtia 4 (1958) 82.

*Vernacular names* — Lai (D, Samarinda, Bulungan), lae (B).

Trees up to 25 m tall, up to 40 cm in diameter. Buttresses absent. Bark surface rough, outer bark grey. Twigs cylindrical, sometimes hollow inside, apex somewhat flattened and grooved, densely covered with brown scales. Stipules 1–1.5 cm long, lanceolate, scaly, soon falling. Leaves elliptic-oblong, 20–35 cm long, 6–12 cm wide, leathery, base rounded, apex long pointed, rarely acuminate, acumen slender c. 2.5 cm long, upper surface glabrous, lower surface densely covered with golden-brown scales, secondary veins 14–18 pairs, distinctly looping near the margin, distinct, tertiary venation distinct below. Petioles 2–3 cm long, angular. Flowers large, c. 10 cm long, in 3- or more-flowered irregular racemes on older branches, epicalyx splitting into 2 lobes, calyx 5-toothed, petals 5, spatula-like, beef-red, stamens and staminodes free, filaments red, anthers kidney-shaped, dehiscent with slits, ovary ovoid, angular at base, densely covered with fimbriate scales, abruptly narrowed into a stellate-haired style, stigma papillose. Fruits dirty-yellow, ellipsoid, angled, c. 25 cm long, c. 12 cm in diameter, usually 5-celled, spines up to 1.5 cm long, sharp pyramidal, not dehiscent on the branches. Seeds glossy brown, completely enclosed in a fleshy, yellow, sweet, fragrant, edible aril.

*Habitat & Ecology* — Original habitat in the foothills of the central ranges. Very often cultivated.

*Distribution* — Endemic in Borneo.

*Uses* — The fruits are sold in large quantities during a fixed season. The varieties of which smell and taste is similar to that of the cultivated durian (*Durio zibethinus*) are the most appreciated.

*Material* — AA 119.

*Durio lanceolatus* Mast., J. Linn. Soc. Bot. 14 (1875) 499.

*Literature* — Kosterm., Reinwardtia 4 (1958) 84.

*Vernacular names* — Durian anggung (M), durian pelanduk (M).

(Bombacaceae)

Trees up to 50 m tall, bole straight, up to 80 cm in diameter. Buttresses up to 3 m high, out c. 1.5 m. Bark surface very rough, deeply fissured, strips irregular, 3–5 cm wide, outer bark dark brown, c. 2 cm thick, inner bark dark beefy red, fibrous, 10–15 mm thick. Heartwood dark red. Twigs cylindrical, densely covered with dark brown scales. Stipules unknown. Leaves lanceolate, 6–9 cm long, 1.5–3 cm wide, papery, base acute, apex acuminate, upper surface glabrous, dull, lower surface densely covered with coppery-brown scales, secondary veins 7–10 pairs, distinctly looping near the margin, tertiary venation indistinct below. Petioles 1–1.5 cm long, angular. Flowers medium-sized, c. 3 cm long, in many-flowered cymes, bundled on older branches, epicalyx splitting irregularly into 2 or 3 lobes, calyx 5-toothed, petals 5, spatula-shaped or obovate, pale yellow, stamens and staminodes somewhat fused at base, filaments dirty white, anthers kidney-shaped, dehiscent with a slit, ovary ovoid, slightly angular, densely covered with large yellowish scales, abruptly narrowed into a stellate-haired style, stigma with sparse stellate hairs. Fruits dirty-yellowish, globular, c. 10 cm in diameter, usually 5-valved, spines up to 6 mm long, sharp pyramidal, dehiscent on the branches. Seeds glossy black, completely enclosed in a thin, red yellow, almost tasteless, non-fragrant aril.

*Habitat & Ecology* — The species is restricted to East Kalimantan, on sandy soils, where it is common in the *Shorea laevis*-*Dipterocarpus confertus* forest.

*Distribution* — Endemic in E. Kalimantan.

*Material* — W 623.

*Durio oxleyanus* Griff., Calc. J. Nat. Hist. 5 (1845) 115. — Fig. 20a & b

*Literature* — Kosterm., Reinwardtia 4 (1958) 65.

*Vernacular names* — Kerantungan (M), ketungan (B).

Trees up to 35(–45) m tall, bole straight, up to 1 m in diameter. Buttresses up to 3 m high, out c. 1.50 m. Bark surface deeply fissured, very rough, strips irregular, 2–3 cm wide, peeling off in elongated pieces, outer bark dark brown, 3–10 mm thick, inner bark 15–20 mm thick, red-brown, fibrous. Sapwood whitish or yellowish, with faint reddish tinge, 10 cm thick, heartwood pale red to red. Twigs slightly twisted in appearance, rough with brown scales. Stipules up to 2 cm long, soon falling. Leaves broad elliptic to oblong, 7–20 cm long, 3–7.5 cm wide, papery to leathery, base rounded, apex rounded, long pointed, acute, or acuminate, acumen 5–10 mm long, upper surface glabrous, lower surface velvety with grey stellate hairs, not covered with scales, occasionally small scales along the margin and sometimes along main nerves, midrib densely covered with brown scales, secondary veins 15–20 pairs, distinctly looping near the margin, tertiary venation prominent below. Petioles 1.5–2 cm long. Flowers small, c. 1.5 cm long, in clusters behind the leaves, epicalyx splitting into 2 or 3 lobes, calyx 4-toothed, petals 4, white or pale cream, stamens in bundles alternating with 4 free filaments, anthers drum-shaped, circularly dehiscent, ovary globular, densely covered with stellate hairs, abruptly narrowed into a stellate-haired style, stigma glabrous. Fruits greyish green, globular, 15–20 cm in diameter, 4-valved, spines up to 4 cm long, stiff, broadly pyramidal, slightly curved at least at

(Bombacaceae)

top, dropping unopened. Seeds glossy red-brown, completely enclosed in a fleshy, creamy to dark yellow, very sweet, hardly fragrant edible aril. Seedlings: younger leaves often spatula-shaped, with long pointed apex, acumen slender up to 2 cm long, undersurface with scattered, loose scales on the layer of stellate hairs.

*Habitat & Ecology* — Lowland primary forest, often in moist places near streams.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Sometimes cultivated for the fruits; when planted, this species already flowers at 12 m height. The timber is used for planks.

*Material* — W 644.

*Durio zibethinus* Murray, Syst. Nat. Veg., ed. 3. (1774) 581.

*Literature* — Kosterm., Reinwardtia 4 (1958) 72.

*Vernacular names* — Durian (M), dian (D, Kenyah), kalang (B).

Trees up to 35 m tall, bole straight, up to 80 cm in diameter. Buttresses steep. Bark surface very rough, coming off regularly in small flakes, outer bark dark red brown, c. 2 cm thick, inner bark dark red. Sapwood pale pink, heartwood dark red. Twigs cylindrical, densely covered with dark brown scales. Stipules slightly sickle-shaped, acuminate, 5–10 mm long, falling off early. Leaves elliptic or lanceolate-elliptic, 10–15 cm long, 3–4.5 cm wide, papery, base acute, apex acuminate, upper surface glabrous, glossy, lower surface densely covered with silvery or golden scales, secondary veins c. 15 pairs, distinctly looping near the margin, venation indistinct below. Petioles 1–1.5 cm long, angular. Flowers medium-sized, c. 5 cm long, in many-flowered cymes, fasciculate on older branches, epicalyx splitting irregularly in 2 or 3 lobes, calyx 5- or 6-toothed, petals 5, spatulate, narrowed into a conspicuous claw, white, stamens fused in 5 free bundles, anthers kidney-shaped, dehiscent with a slit, ovary ovoid, 5-ribbed, densely covered with scales, abruptly narrowed into a stellate-haired style, stigma glabrous. Fruits green to yellow, globular, ovoid, or ellipsoid, up to 25 cm long, usually 4–6-valved, spines up to 1 cm long, sharp, broadly pyramidal, indehiscent on the branches. Seeds chestnut-brown, completely enclosed in a thick, white or yellow, soft, sweet, fragrant aril.

*Habitat & Ecology* — Cultivated in the whole of Malesia except New Guinea.

*Distribution* — Possibly wild in Sumatra and Borneo.

*Uses* — The aril is in high esteem and also the seeds are eaten. The timber is used for indoor construction and cheap furniture. Impregnated wood is excellent for packing cases etc.

*Material* — AA 685.

*NEESIA* Blume, Fl. Indica 1 (1828) VII, in nota.

*Neesia synandra* Mast. in Hook. f., Fl. Brit. India 1 (1874) 352. — Fig. 21a & b

*Literature* — Soepadmo, Reinwardtia 5 (1961) 488.

*Vernacular name* — Durian ha-ha (M).

(Bombacaceae/Boraginaceae)

Trees up to 30 m tall, c. 70 cm in diameter. Buttresses up to 2 m high, out 50–100 cm. Bark smooth or superficially cracked, peeling off, strips c. 1 cm wide, outer bark dark brown, inner bark dark-brown, c. 1.2 cm thick. Sapwood dirty white, heartwood light-brown. Twigs stout, lenticellate, with stellate hairs and scales on younger parts, leaf-scars protruding. Stipules leathery, ovate-lanceolate, 2–5 cm long, 1–1.5 cm wide, acute, base truncate. Leaves ovate-oblong or elliptical, 25–60 cm long, 16–25 cm wide, base truncate or heart-shaped, apex notched, papery to leathery, upper surface sparsely covered by stellate hairs and long-fimbriate scales, mainly on the nerves, lower surface densely covered by stellate hairs and scales, secondary veins 20–25 pairs. Petioles up to 10 cm long, 0.7 cm in diameter, prominently thickened at apex. Inflorescences cymose, usually in axils of fallen leaves. Flowers up to 1.5 cm long, epicalyx bell-shaped, 3-lobed, calyx depressed, forming a flat disc of 1–1.5 cm in diameter, margin erect, petals 5, free, lanceolate, c. 1 cm long, acute, staminal tube 0–0.5 cm, anthers globular or kidney-shaped, ovary ovoid, stigma disc-like, margin stellately haired. Fruits ellipsoid to almost globular, obtuse, glaucous, c. 16 cm long, 12 cm in diameter, woody, 5-angled capsule, outside tessellate like the shell of a tortoise, splitting almost to the base before falling, inside densely covered by golden irritant hairs. Seeds smooth, blackish with a small thick caruncle.

*Habitat & Ecology* — Scattered through Malay Peninsula and Borneo, usually in wet places near streams.

*Distribution* — Malay Peninsula, Borneo. Of the genus *Neesia* seven species are reported for Kalimantan.

*Material* — W 176, v. B. 5947.

## 9 BORAGINACEAE

**PTELEOCARPA** Oliv., Trans Linn. Soc. Lond. 28 (1873) 515.

*Pteleocarpa lamponga* (Miq.) Bakh. ex Heyne, Nutt. Pl. Ned. Indië ed. 2 (1927) 1309. — Fig. 22

*Vernacular names* — Mentugal (D), tubulo (D).

Medium to large trees to 37 m, c. 50 cm in diameter. Bole straight. Bark smooth to shallowly fissured. Inner bark pale brown, lamellate. Wood pale yellow. Stipules absent. Leaves simple, alternate, entire, obovate, 3–10 cm long, 1–4 cm wide, papery, base tapered, apex acuminate, secondary veins 4–7 pairs. Petioles 0.7–1.5 cm long. Inflorescence terminal, paniculate, many-branched. Flowers bright yellow, calyx persisting in fruit, corolla 5-lobed, basally united into a tube, stamens 5, arising from the mouth of the corolla tube, ovary superior, 2-celled. Fruits flat, winged, dry (samara), broadly elliptic to circular, c. 5 cm in diameter. Seed 1, elongate.

*Habitat & Ecology* — Lowlands up to 600 m altitude, in hilly primary and secondary forests.

*Distribution* — Sumatra, Borneo.

(**Boraginaceae / Burseraceae**)

*Uses* — Ornamental trees, timber used for house construction.

*Note* — Within this family also *Cordia subcordata* Lam. reaches tree size.

*Material* — W 584, S 581.

**10 BURSERAACEAE**

Medium to large buttressed trees. Exudate clear or white, resinous. Stipules absent or present. Leaves imparipinnate, spiral, leaflets opposite, usually entire. Petioles often thickened at base and petiolules often thickened at both ends. Inflorescence a panicle with many small (less than 0.5 cm across) flowers. Flowers actinomorphic, unisexual (male and female flowers on different plants), usually 3-merous, sepals valvate, fused, petals valvate, free, ovary superior, 3(-5)-celled. — Seven genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Flowers 5-merous ..... 2
- b. Flowers 3-merous ..... 3
- 2a. Fruit a 3-winged woody capsule ..... *Triomma*
- b. Fruits a drupe ..... *Scutinanthe brunnea*\*
- 3a. Leaflets toothed and/or stipulate ..... *Canarium* p.p.
- b. Leaflets entire, exstipulate ..... 4
- 4a. Fruit with exocentric stigma ..... *Santiria*
- b. Fruit with apical stigma ..... 5
- 5a. Drupe with thick bony inner layer of the fruit wall, seated on an enlarged cup-like calyx ..... *Canarium* p.p.
- b. Drupe with thin inner layer of the fruit wall, calyx lobes small (nodes of rachis thickened and petiolules always strongly thickened at both ends) . *Dacryodes*

**CANARIUM** Stickm., Herb. Amb. (1754) 10 (erroneously *Cenarium*).

Medium to large, buttressed trees. Twigs nearly always containing medullary, vascular strands. Leaves often with stipules at the base of rachis or on it, often soon dropping. Leaf stalk thickened at the base. Margin of leaflets entire or toothed. Inflorescences axillary or terminal panicles. Flowers 3-merous, unisexual (male and female flowers on different plants). Fruits seated on the persistent enlarged calyx. Stone hard, woody, round or triangular in cross section, with 3 cells, often reduced to 2 or 1. Seeds 1 per cell. — Twenty species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Stipules awl-shaped ..... *C. pilosum* subsp. *pilosum*
- b. Stipules not awl-shaped ..... 2
- 2a. Leaflets tomentose beneath ..... *C. littorale*
- b. Leaflets glabrescent beneath ..... *C. megalanthum*



*Canarium littorale* Blume, Bijdr. (1826) 1164.

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 256.

*Vernacular names* — Bekatan (D), rupai (D).

Trees 3–15(–40) m tall, 20–70 cm in diameter. Bark smooth to dipped and scaly, lenticellate. Outer bark thin, inner bark pink to red-brown, lamellate, oozing slight droplets of cloudy sticky resin. Sapwood yellow. Twigs rusty-red tomentose. Stipules falling off early, partly on base of rhachis, kidney-shaped. Leaflets 4 or 5 pairs, ovate to oblong-lanceolate, 3–27 cm long, 1–9 cm wide, leathery, densely tomentose, margin entire, or with scattered teeth near the tip, base wedge to heart-shaped, apex shortly acute-acuminate, secondary veins 9–22 pairs, often partly arching near the margin. Inflorescences terminal, 5–40 cm long. Flowers densely ferruginously pubescent, 8–13 mm long. Fruits ellipsoid, rounded triangular in cross section, 4.5–7 cm long, 1.5–3 cm in diameter, stone acutely triangular in cross section, seeds 1 or 2.

*Habitat & Ecology* — Lowland Dipterocarp forest, sometimes in swamps.

*Distribution* — Indochina, Malay Peninsula, Java, Sumatra, Borneo.

*Uses* — One of the principal sources of kedondong timber. The seeds of *C. littorale* f. *rufum* are edible.

*Material* — W 155, v.B. 5914.

*Canarium megalanthum* Merr., Philipp. J. Sc. 30 (1926) 81. — Fig. 23

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 274.

*Vernacular names* — Kamatoa (D), m(e)ritus (M), rarawa damar (D).

Trees up to 40 m tall, 60–70 cm in diameter. Bark flaky, lenticellate. Outer bark brittle, inner bark lamellate, red, oozing a clear resin. Sapwood yellow. Twigs rusty tomentose, stipules almost persistent, deeply 3- or 4-lobed, stiff, densely and minutely rusty tomentose. Leaflets 4 or 5 pairs, obovate, lanceolate or oblong, 9–20 cm long, 4.5–8.5 cm wide, leathery, base wedge- to heart-shaped, margin entire, apex gradually to abruptly acute acuminate, secondary veins (10–)13–19 pairs, usually distinctly arching close to the margin, raised below, prominent. Inflorescence pseudoterminal to terminal, up to 25 cm long, main branches up to 9 cm long with c. 10 flowers. Flowers pubescent, male 11 mm, female 13–15 mm. Fruits ellipsoid, sometimes acute, bluntly triangular in cross section, 5–5.5 cm long, 3.5–4 cm in diameter, stone triangular in diameter, seed 1, spindle-shaped.

*Habitat & Ecology* — Generally rare, but widely distributed in lowland forests up to 200 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Note* — The bark is very similar to that of *Dipterocarpus* species.

*Uses* — The wood is said to be hard, the seeds are edible.

*Material* — W 465, W 567, AA 15.

(Burseraceae)

*Canarium pilosum* Benn. in Hook. f., Fl. Brit. India 1 (1875) 533.

subsp. *pilosum*

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 281.

*Vernacular name* — Kenari batu (M).

Trees up to 30 m high, 20–45 cm in diameter. Bark smooth, lenticellate. Inner bark lamellate, brown. Twigs densely woolly pubescent, stipules persistent, awl-shaped, up to 2 cm long. Leaflets (1–)2–4(–6) pairs, ovate to oblong-lanceolate, 4–25 cm long, 1.5–10 cm wide, parchment-like, the base rounded to broadly wedge-shaped, the apex from acute to long-tipped, secondary veins 8–15 pairs, often more or less arching. Inflorescences axillary to pseudoterminal, 4–26 cm long, rather few-flowered. Flowers densely pubescent, 1–1.25 cm long. Fruits oblong to ovoid, shouldered, mostly rounded triangular in cross section, 2.5–3.5 cm long, 1–1.5 cm in diameter, stone smooth, the sides concave to faintly keeled, the seed nearly always 1.

*Habitat & Ecology* — Swamps and hills up to 700 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The wood is said to be durable against insects and is used in house construction.

*Material* — W 6, W 825.

**DACRYODES** Vahl, Skrift. Dansk Nat. Hist. Selsk. 4 (1810) 116.

Small to tall trees with small and often sharp buttresses. Stipules absent. Petiolules always thickened at both ends. Leaflets entire, base strongly unequal, often with a long and slender acumen, broadening and rounded at apex. Inflorescences axillary and/or terminal. Flowers unisexual, 3-merous. Fruits 1-seeded drupes. Stones containing 1 fertile and 2 reduced cells, calyx falling off early. Seeds round in cross section. — Nine species reported for Kalimantan.

*Uses* — Generally the wood of this genus is used in house construction. The fruits (middle layer of fruit wall) of some species are edible.

KEY TO THE SPECIES

- 1a. Leaflets glabrous . . . . . 2
- b. Leaflets hairy, at least on the stalks . . . . . 3
- 2a. Petioles usually short (up to 9.5 cm long), secondary veins prominently looping 2–3 mm before the margin . . . . . *D. rugosa*
- b. Petioles usually long (more than 16 cm), secondary veins not looping, usually reaching the margin . . . . . *D. rostrata*
- 3a. Twigs persistent tomentose, leaflets drying dull brown on both sides . . . . . *D. rubiginosa*
- b. Twigs glabrescent, leaflets drying olive-green underneath . . . . . *D. costata*

*Dacryodes rostrata* (Blume) H.J. Lam, Ann. Jard. Bot. Buitenzorg 42 (1932) 203.  
— Fig. 24

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 225.

*Vernacular names* — Keramu berparuh (M), kembayau (M), kumbi (D), merading (M), tinjau (D, M).

Trees 10–25 m tall, 20–50 cm in diameter. Buttresses small, steep. Bark cracking and scaly, often with smears of black resin. Inner bark pinkish to red, mottled, oozing little clear to white resin. Twigs glabrous except the rusty brown tomentose tip. Leaflets 2–8(–10) pairs, glabrous. Petioles terete, 6–15 cm long. Leaflets ovate to oblong, 3.5–20 cm long, 1.5–10 cm wide, rigid, parchment-like, base very oblique, apex usually abruptly acuminate, acumen up to 2 cm long, 1–2 mm wide, midrib and veins prominent beneath, veins 5–20 pairs. Panicles axillary, together usually pseudoterminal. Flowers tomentose, 2–4 mm long. Fruits ovoid to oblong, slightly oblique, 1.75–3.5 cm long, 0.75–1.75 cm in diameter, somewhat contracted at the apex, ripening through yellow to deep mauve-black.

*Habitat & Ecology* — In primary forest up to 500 m altitude, usually on hillsides and ridges, occasionally in swamps.

*Distribution* — Endemic in Borneo.

*Note* — Saplings ooze white sap from the inner bark when cut.

*Material* — W 445, W 565.

*Dacryodes rubiginosa* H.J. Lam, Ann. Jard. Bot. Buitenzorg 42 (1932) 204.

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 225.

*Vernacular names* — Keramu bulu (M), kembayau (M), bengaya (M).

Trees 20–35 m tall, 25–60 cm in diameter. Buttresses small, spreading. Bark smooth to dippled and scaly, lenticellate. Inner bark pink, lamellate, oozing white resin. Twigs densely tomentose. Petioles much flattened at the base, 3–8.5 cm long. Leaflets 2–4 pairs, ovate to obovate to oblong, 4–20 cm long, 2–7 cm wide, parchment-like, densely pubescent, base wedge-shaped to rounded, apex rather abruptly, shortly, and bluntly acuminate, midrib and veins prominent beneath, veins 10–13 pairs. Panicles terminal. Flowers tomentose, 2.5–3 mm long. Fruits ellipsoid, 2–2.5 cm long, 1–1.25 cm in diameter, rounded at base and apex.

*Habitat & Ecology* — Mainly on ridges in lowland primary forest.

*Distribution* — Malay Peninsula, Borneo.

*Note* — The leaflets of saplings are much larger (up to 22 cm long), the rachis is very long and the distance between successive pairs of leaflets is c. 7 cm.

*Material* — W 477, AA 27, S 567.

*Dacryodes rugosa* (Blume) H.J. Lam, Ann. Jard. Bot. Buitenzorg 42 (1932) 203.  
— Fig. 25

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 221.

(**Burseraceae**)

*Vernacular names* — Kembayau burung (M), maraputih (M), rajang (D, M), watuk (M).

Trees 5–20(–35) m tall, 10–40 cm in diameter. Buttresses absent. Bark flaky with a few large lenticels, often with hoop marks, inner bark pale yellowish orange, mottled with dark flecks, with a strong aromatic smell. Twigs pubescent. Petioles terete to flattened at base, 3–9.5 cm long. Leaflets 2–4 pairs, obovate or ovate to oblong-lanceolate, 6–22 cm long, 2.5–11 cm wide, parchment-like, pubescent, often raised between veins, base oblique, wedge-shaped to rounded, apex more or less abruptly acuminate, acumen 0.5–3.5 cm long, 1–3 mm wide, midrib and veins prominent usually prominent beneath, veins 7–12 pairs. Panicles axillary, together pseudoterminal. Flowers more or less glabrous, 1.5–2.5 mm long. Fruits ovoid, slightly oblique, 1.5–2.5 cm long, 0.75–1.5 cm in diameter, rounded at base and apex, red.

*Habitat & Ecology* — Usually in lowland primary forest.

*Distribution* — Sumatra, Java, Borneo.

*Note* — Sterile specimens are sometimes difficult to distinguish from *D. costata*.

However, the leaf rhachis is not so strongly flattened and the nodes are usually more thickened.

*Material* — W 183, W 494, W 595, AA 44, S 601, v.B. 5960.

**SANTIRIA** Blume, Mus. Bot. 1 (1850) 209.

Medium to large trees. Buttresses absent or small. Outer bark thin, brown, inner bark pink, soft, lamellate, or yellow-white, hard, mottled and granular. Resin white to colourless, often darkening on drying. Stipules absent. Leaves compound. Inflorescences axillary, rarely terminal. Flowers unisexual, 3-merous. Fruits brightly coloured, usually seated on persistent calyx, stigma off-centred, sometimes nearly basal. Outer layer of fruit wall rather thin and firm, almost smooth, stone thinly woody, containing 1 fertile and 2 sterile cells. Seeds almost round, not angled. — Eleven species reported for Kalimantan.

*Uses* — The timber is similar to that of *Canarium* and *Dacryodes*. Some species are an important source of Burseraceae timber.

KEY TO THE SPECIES

- 1a. Leaflets densely hairy beneath . . . . . *S. tomentosa*\*
- b. Leaflets glabrous or only slightly hairy beneath . . . . . 2
- 2a. Reticulations distinct on upper surface . . . . . *S. oblongifolia*
- b. Reticulations faint on upper surface . . . . . 3
- 3a. Tertiary veins always parallel to secondary veins . . . . . 4
- b. Tertiary veins always transverse to secondary veins . . . . . 5
- 4a. Base of leaflets almost equal, midrib depressed above . . . . . *S. griffithii*
- b. Base of leaflets almost always unequal, midrib raised or flattened above  
*S. rubiginosa*

- 5a. Young twigs, rhachis and leaflet stalks drying whitish, leaflets drying greenish, rhachis terete at base . . . . . *S. apiculata*\*
- b. Young twigs, rhachis, leaflets stalks and leaflets drying dark brown, rhachis sharply flattened to channelled at base . . . . . *S. laevigata*\*

*Santiria griffithii* (Hook. f.) Engl., Bot. Jahrb. 1 (1881) 43. — Fig. 26

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 236.

*Vernacular names* — Bunjau (D), buno (D), marjajat (D), bumbum gunung (M).

Trees 12–35(–45) m tall, 50–80 cm in diameter. Buttresses up to 1.5 m tall. Bark smooth to rough, lenticellate. Outer bark thin, papery, red when scraped, inner bark yellowish, mottled, oozing pale gum-like resin. Sapwood cream. Twigs warty. Leaflets 5–10 pairs, not strictly opposite, lanceolate to oblong, 3–10 cm long, 1–3.5 cm wide, base rounded or broadly wedge-shaped, equal, apex more or less gradually narrowed into a short to rather long and slender, blunt tip, secondary veins 11–15 pairs, distinctly arching near the margin. Inflorescences axillary, up to 20 cm long. Flowers 4–10 mm long, yellowish with white petals. Fruits almost sessile, obliquely globular, blue, 8–16 mm in diameter.

*Habitat & Ecology* — Not common, usually confined to lowland swamps.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Note* — Closely resembles *S. rubiginosa*.

*Uses* — The wood is rather hard and durable.

*Material* — W 215, v.B. 5893A, P.K. 635.

*Santiria oblongifolia* Blume, Mus. Bot. 1 (1850) 211. — Fig. 27

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 233.

*Vernacular name* — Asem garunggang (M).

Trees 15–20(–40) m tall, 40–90 cm in diameter. Often with buttresses. Bark irregularly fissured, scaly, often with black resin. Inner bark pink or yellow brown, lamellate, oozing pale gum-like resin. Sapwood white. Twigs glabrous. Leaflets 3–5 pairs, oblong to ovate, 8–17 cm long, 3–6 cm wide, base rounded or wedge-shaped, apex gradually to rather abruptly, short and bluntly acuminate, secondary veins 9–16 pairs, slightly curved but not arching. Inflorescences either axillary, together pseudo-terminal or terminal, 15–40 cm long. Flowers 2.5–4 mm long, sparsely pubescent to glabrous. Fruits oblique, oblong-ellipsoid to globular, 1–2 cm in diameter.

*Habitat & Ecology* — In dry lowland Dipterocarp forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Important timber tree, the wood is used for indoor construction. The fruits are edible.

*Material* — W 191, W 487, AA 37, v.B. 5976.

(Burseraceae)

*Santiria rubiginosa* Blume, Mus. Bot. 1 (1850) 213.

var. *rubiginosa*

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 237.

*Vernacular names* — Buno putih (D), kanculi (D), tubulo (D).

Trees up to 30(–45) m tall, 30–65 cm in diameter. Buttresses variable, tall or small and spreading. Bark smooth or rough, slightly scaly, finely lenticellate. Inner bark orange white, mottled, oozing clear to whitish resin. Sapwood light yellow to cream. Twigs glabrous. Leaflets 1–5 pairs, elliptic or ovate to lanceolate-oblong, 3–11 cm long, 1–5 cm wide, glabrous, base more or less broadly wedge-shaped, unequal, apex acuminate, secondary veins 9–15 pairs, very slender, nearly straight, forking near the margin or less distinctly arching. Inflorescences axillary, 4–17 cm long. Flowers 2–3 mm long, greenish, slightly pubescent or glabrous. Fruits oblique, irregularly globular or ellipsoid, ripening through yellow to red mauve-blue to black.

*Habitat & Ecology* — Usually in lowland primary forest, but also found at high altitudes.

*Distribution* — Malay Peninsula, Sumatra, Borneo, New Guinea.

*Notes* — Sterile specimens can sometime hardly be distinguished from *S. griffithii*.

Usually *S. rubiginosa* has unequal leaflet bases.

*Material* — W 393, W 556, S 413.

**TRIOMMA** Hook. f., Trans. Linn. Soc. Lond. 23 (1860) 171.

*Triomma malaccensis* Hook. f., Trans. Linn. Soc. Lond. 23 (1860) 171. — Fig. 28

*Literature* — Leenhouts in Flora Malesiana I, 5 (1956) 218.

*Vernacular names* — Meraban (M), kayu batu (M), bijai (M), merlilin (M), rangasai (M), uma (M).

Trees up to 60 m tall, 1 m in diameter. Bark smooth to slightly scaly or dippled, lenticels few. Inner bark pink or reddish brown, oozing little colourless resin. Sapwood pale yellow. Twigs glabrous. Stipules absent. Leaflets 2–5 pairs, 4–15.5 cm long, 2–5.5 cm wide, papery, hairy, margin entire, base strongly unequal, decurrent, apex shortly acuminate, secondary veins 7–12 pairs, usually slightly curved, arching near apex. Inflorescences axillary, repeatedly branched from the base, up to 30 cm long. Flowers 5-merous, up to 3 mm long, tomentose. Fruits 3-winged woody capsules, 5.5–7.5 cm long, wings 2–2.5 cm broad, seeds 3, with broad papery wings, rounded at base, acuminate at apex.

*Habitat & Ecology* — Mainly in lowland Dipterocarp forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The soft timber is used for indoor construction.

*Material* — W 521, W 932, S 682, v.B. 6104.

11 CAESALPINIACEAE

Medium to large trees. Buttresses often present. Exudate present or absent. Stipules present. Leaves usually pinnate, spiral, leaflets entire. Petioles thickened at base. Flowers nearly actinomorphic, bisexual, sepals 5, fused at base, petals 5, the upper one innermost in bud, stamens 10, free, ovary superior, stipitate, ovules parietal. — About twelve genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Buttresses steep, bole hooped (with rings), leaves paripinnate (without leaflet at top), leaflets opposite, margin thickened, fruit often spiny, dehiscent, seeds with basal aril . . . . . *Sindora*
- b. Buttresses somewhat spreading, very thin, cut bark producing red sap, leaves imparipinnate (with leaflet at top), leaflets alternate or almost opposite, fruit not flattened, wingless. . . . . *Dialium*
- c. Buttresses widely spreading, leaves imparipinnate (with leaflet at top), leaflets alternate, fruit flattened, surrounded by a broad, papery wing . . . . . *Koompassia*

DIALIUM L., Mant. Pl. 1 (1767) 3.

Literature — Rojo, Studies in the genus Dialium (Cassieae–Caesalpinioideae), unpublished Thesis, Oxford University (1982) 1–282.

Trees up to 40 m, up to 100 cm in diameter. Bole columnar, often slightly twisted. Buttresses equal to steep, branching. Bark smooth, pale brown. Inner bark hard, finely mottled, exudate first clear, sticky, free flowing but not copious, watery, very soon turning red. Wood hard, yellowish brown. Leaves with a terminal leaflet, leaflets alternate to almost opposite, more or less equal at base, glabrous or velvety beneath. Flowers small, white, fragrant, in axillary or terminal, dense, many-flowered panicles. Sepals 3 or 5, petals absent, stamens 2 or 6. Pods oblong, ovoid, not flattened, thinly woody, not splitting open, black or dark brown velvety, seed 1, surrounded by sweet edible pulp. — About seven species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves 3-foliolate . . . . . *D. kunstleri* var. *trifoliolatum*
- b. Leaves with 5–11 pairs of leaflets . . . . . 2
- 2a. Leaflets almost leathery, glabrescent beneath . . . . . *D. indum* var. *bursa*
- b. Leaflets leathery, velvety beneath . . . . . *D. platysepalum*

*Dialium indum* L. var. *bursa* (De Wit) Rojo, Studies in the genus Dialium (Cassieae–Caesalpinioideae), unpublished Thesis, Oxford University (1982) 226. — Fig. 29

Synonyms — *Dialium laurinum* Baker, Fl. Brit. India 2 (1878) 269; *Dialium laurinum* Baker var. *bursa* De Wit, Blumea 7 (1953) 320.

Vernacular name — Keranji (M).

(Caesalpinaceae)

Trees up to 40 m tall, 50–100 cm in diameter. Leaves with 7–9 leaflets, broadly elliptic, 6–11 cm long, 3–7 cm wide, glabrescent, almost leathery, base rounded or wedge-shaped, apex obtuse to sometimes roundish or broadly acuminate, secondary veins 8–10 pairs, distinct. Panicles terminal. Flowers: sepals 5, petals absent, stamens 2. Fruits circular or ovoid, 1.5–2.5 cm long, outer layer of fruit wall brittle, hairy but not velvety.

*Habitat & Ecology* — Common in lowland forests.

*Distribution* — Thailand, West Malesia.

*Uses* — The fruits are edible. Burkill reports a considerable trade in the fruits from Sumatra to Java and Singapore.

*Material* — W 571.

*Dialium kunstleri* Prain var. *trifoliolatum* (De Wit) Rojo, Studies in the genus *Dialium* (Cassieae–Caesalpinioideae), unpublished Thesis, Oxford University (1982) 242.

*Vernacular name* — Keranji daun tiga (M).

Trees up to 40 m tall, c. 90 cm in diameter. Leaves 3-foliolate, elliptic, elliptic-oblong or ovate to lanceolate, 6–15 cm long, 3–6 cm wide, glabrescent, leathery, base wedge-shaped or rounded, apex long acuminate, secondary veins 6–8 pairs, distinctly raised beneath. Panicles axillary. Flowers: sepals 3, petals absent, stamens 6. Fruits broadly ellipsoid to ovoid, 3–4 cm long, 2.5–3 cm in diameter, sometimes mucro persistent, fruit wall rather thick and firm, glabrescent with age.

*Habitat & Ecology* — in primary forest in the lowland.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 417, S 422.

*Dialium platysepalum* Baker, Fl. Brit. India 2 (1878) 270.

*Literature* — Rojo, Studies in the genus *Dialium* (Cassieae–Caesalpinioideae), unpublished Thesis, Oxford University (1982) 212.

*Vernacular name* — Keranji kuning besar (M).

Trees up to 45 m tall, 90–120 cm in diameter. Leaflets 5–11 pairs, oblong elliptic to oblong lanceolate, 6–8 cm long, 2–4 cm wide, velvety, leathery, base rounded to wedge-shaped, apex rather abruptly tipped, secondary veins 10–12 pairs, distinct. Flowers: sepals 5, petals absent, stamens 2. Fruits ovoid to almost globular, 2–2.5 cm long, sometimes mucro persistent, fruit wall firm, densely brown velvety, persistent.

*Habitat & Ecology* — On dryland and freshwater swamp forests up to 500 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 895, S 477, S 724.



**KOOMPASSIA** Maingay ex Benth. in Hook., Ic. Pl. (1873) 58.

*Literature* — De Wit, Bull. Jard. Bot. Buitenzorg III, 17 (1947) 309–322.

Huge forest trees. Bole columnar with large steep, thick buttresses. Bark smooth. Inner bark hard, firm, finely granular, coarsely mottled orange-brown, sap absent. Wood ripple-marked, often with included phloem. Leaves imparipinnate, leaflets alternate with a terminal one, thinly leathery. Flowers very small in terminal panicles. Sepals 5, regular, petals 5, stamens 5. Pod flat, oblong, apex broadly rounded, with a broad, veined, papery wing all round a single flat seed, not splitting open until the seeds germinate.

KEY TO THE SPECIES

- 1 a. Leaflets 3–4 cm long, apex acuminate . . . . . *K. excelsa*
- b. Leaflets 5–7.5(–12.5) cm long, apex notched . . . . . *K. malaccensis*

*Koompassia excelsa* (Becc.) Taub. in Engler & Prantl, Pflanzenfam. 3, 3 (1891) 156.

*Literature* — De Wit, Bull. Jard. Bot. Buitenzorg III, 17 (1947) 311.

*Vernacular names* — Kempas madu (M), menggeris (M), tanjid (D), puti (B).

Trees up to 50–85 m tall, up to 270 cm in diameter. Bark shiny purplish grey, hooped. Sapwood hard, orange-fawn, vessels joined by paler wavy tangential bands. Leaflets 7–13, elliptic 3–4 cm long, 1–1.7 cm wide, finely velvety beneath, base wedge-shaped, apex acuminate, secondary veins indistinct. Pod 8–12.5 cm long, 2–3.5 cm wide.

*Habitat & Ecology* — Usually along rivers, in valleys and lower slopes of hills, locally abundant.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The wood is very strong and moderately durable, very attractive for table tops, furniture etc.

*Notes* — One of the tallest rain forest trees reported in the world. The branches often bear large combs of wild bees and the trees are therefore protected from cutting.

*Material* — W 517, W 539, AA 63.

*Koompassia malaccensis* Maing. ex Benth. in Hook., Ic. Pl. (1873) 58, t. 1164.  
— Fig. 30

*Literature* — De Wit, Bull. Jard. Bot. Buitenzorg III, 17 (1947) 317.

*Vernacular names* — Kempas merah (M), berniung (M), meryang (D).

Trees 40–60(–80) m tall, up to 120 cm in diameter. Bark dark grey, sometimes even black, very finely fissured. Sapwood hard, ripple-marked. Leaflets 5–9(–14), ovate to oblong-elliptic, 5–7.5(–12.5) cm long, 2–4 cm wide, base rounded, apex notched, secondary veins indistinct. Pods oblong to elliptic-obovate, flattened, surrounded by a broad papery wing, 9.5–13 cm long, 2.5–3.5 cm wide (including the wing).

(Caesalpinaceae)

*Habitat & Ecology* — In peat and freshwater swamps but also on dry land in lowland forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Suitable for heavy construction, for railway sleepers, fence posts, flooring etc.

*Material* — W 525, S 235.

**SINDORA** Miq., Fl. Ind. Bat., Suppl. 1 (1861) 287.

*Literature* — De Wit, Bull. Bot. Gard. Buitenzorg III, 18 (1949) 5–82.

Trees up to 35–45 m tall, up to 90 cm in diameter. Bole massive columnar. Buttresses absent. Bark smooth, prominently hooped. Inner bark very firm, fibrous near cambium. Wood hard, cream to white. Exudate absent. Leaves paripinnate, leaflets 2–6 pairs, opposite, margin thickened by a vein, prominent at least in lower half. Inflorescences in axillary or terminal panicles. Sepals 4, petal 1, stamens 10, 9 united, 1 free. Pod flat, roundish with or without spines, splitting open. Seeds few, flat hard, stony, seated on a hard red or yellow aril as big as themselves. — Eight species reported for Kalimantan.

*Uses* — The timber is very attractive and is used for high class furniture, especially cabinets.

KEY TO THE SPECIES

- 1a. Lower surface of leaflets minutely more or less densely pubescent; pods armed  
*S. wallichii*
- b. Lower surface of leaflets glabrous, except midrib; pods unarmed . *S. leiocarpa*

***Sindora leiocarpa*** Backer ex De Wit, Bull. Bot. Gard. Buitenzorg III, 18 (1949) 58.

*Vernacular names* — Sindur (M), tampar hantu (M), marijang (B).

Trees up to 40 m tall, 60–80 cm in diameter. Bark dark, even black. Leaflets obovate to elliptic-ovate, glabrous, base acute to rounded, often slightly unequal, apex broadly rounded, secondary veins 24–28 pairs, not very distinct. Pod unarmed.

*Habitat & Ecology* — Lowland Dipterocarp forest.

*Distribution* — Sumatra, Borneo.

*Material* — W 447, W 463, AA 13, S 230.

***Sindora wallichii*** Graham ex Benth. in Hook., Ic. Pl. (1873) t. 1018. — Fig. 31

*Literature* — De Wit, Revision of the genus *Sindora* Miquel (Legum.), Bull. Bot. Gard. Buitenzorg III, 18 (1949) 76.

*Vernacular names* — Sindur (M), simapar (M), anggi (M), marijang (B).

(**Caesalpinaceae / Casuarinaceae / Celastraceae**)

Trees up to 45 m tall, up to 90 cm in diameter. Bark brightly speckled. Leaflets elliptic, ovate, or obovate, pubescent, base acute, more or less unequal, apex acute, more or less acuminate, secondary veins more than 20, faintly visible. Pod armed.

*Habitat & Ecology* — In lowland Dipterocarp forest, on flat land, or less often on slopes.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 427, W 609.

**12 CASUARINACEAE**

CASUARINA Adans., Fam. 2 (1763) 481.

*Casuarina equisetifolia* J.R. & G. Forst., Char. Gen. (1776) 103. — Fig. 32

*Vernacular name* — Camara laut (M).

Trees 10–25(–50) m tall, up to 100 cm in diameter. Bark brown, ridged, fissured, and flaky in oblong pieces. Superficially resembling pines because of the absence of broad leaves. Twigs needle-like, mostly unbranched, bearing whorls of tiny scales (6–10) at the nodes, flowers minute, in unisexual spikes (male and female flowers on different plants), the male flowers consisting of a pair of bracts and one tiny stamen, the female flowers consisting of a pair of bracts and a tiny ovary with 2 styles. Fruits winged, in a woody, cone-like structure, 1.5–2 cm long, c. 1.5 cm in diameter.

*Habitat & Ecology* — Common on sandy sea-shores, widely cultivated.

*Distribution* — Burma to the Pacific.

*Uses* — In high esteem for making charcoal and firewood.

*Material* — P.K. 579.

**13 CELASTRACEAE**

Medium to large trees. Stipules small or absent. Leaves simple, spiral or opposite, entire or dentate. Flowers actinomorphic, uni- or bisexual, 4- or 5-merous, petals free, overlapping, disc present, stamens 4 or 5, on the disc, ovary superior, immersed in the disc. Fruit a capsule. — Five genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Leaves spiral, petioles thickened at both ends, tertiary venation ladder-like *Bhesa*
- b. Leaves opposite, petioles not thickened; middle bark often yellow . . . . . 2
- 2a. Seeds winged at one end . . . . . *Kokoona*
- b. Seeds winged all round (trees often with pneumatophores) . . *Lophopetalum*

(Celastraceae)

**BHESA** Ham. ex Arn., Edinb. New Phil. J. 16 (1834) 315.

*Literature* — Ding Hou in Flora Malesiana I, 6 (1963) 280.

KEY TO THE SPECIES

- 1a. Twigs flattened and angled, dark grey, stipule scars usually oblique, leaves usually dull below, inflorescences or infrutescences racemose, fruits not lobed  
*B. robusta* (Roxb.) Ding Hou\*
- b. Twigs rounded, reddish brown, stipule scars horizontal, leaves shiny below, inflorescences or infrutescences paniculate, fruits 2-lobed . . . . *B. paniculata*

*Bhesa paniculata* Arn., Edinb. New Phil. J. 16 (1834) 315. — Fig. 33

*Literature* — Ding Hou in Flora Malesiana I, 6 (1962) 282.

*Vernacular names* — Ruwas (M), geneirak (B).

Trees up to 40 m tall, up to 90 cm in diameter. Bole cylindrical, or fluted at base and sometimes with a few small buttresses up to 2 m long. Bark smooth, light brown, becoming cracked or scaly. Twigs terete, reddish brown, with pale horizontal stipule scar. Stipules lanceolate 1.75–3 cm long. Leaves spiral, entire, elliptic-oblong to elliptic-lanceolate, 6–40 cm long, 2–15 cm wide, glabrous, shiny below, base obtuse or wedge-shaped, apex shortly acuminate or obtuse, secondary veins 11–20 pairs. Petioles 1–10 cm long, thickened at both ends. Panicles crowded at the ends of the twigs. Flowers greenish white, stamens arising between the lobes, anthers extrorse. Fruits 2-lobed, ripening dark red. Seeds 2–4, usually largely covered by the bright pink aril.

*Habitat & Ecology* — Well drained soils or swampy and riverine areas.

*Distribution* — India, Thailand, Malay Peninsula, Sumatra, Borneo, Philippines.

*Note* — Common in primary and secondary forests.

*Material* — W 41, W 797, W 820.

**KOKOONA** Thwaites in Hook., J. Bot. Kew Misc. 5 (1853) 379.

*Literature* — Ding Hou in Flora Malesiana I, 6 (1962) 258–262.

Small to large trees. Bole columnar, sometimes fluted and buttressed. Bark grey to chocolate brown, hooped, fissured, with large lenticels. Inner bark pinkish or yellowish, fibrous. Sapwood white to yellow-brown, with conspicuous pale bands, soft to hard. Twigs flattened at nodes. Stipules very small. Leaves opposite, margin finely toothed. Flowers in axillary panicles, bisexual, sepals 5, petals 5, contorted, stamens 5, ovary 3-celled, ovules 4–18 in each cell, in two series, attached to the axis. Capsule oblong, bluntly 3-angular, 3-celled. Seeds 10, overlapping, flat, attached at base, with a prominent apical wing. — Four species reported for Kalimantan.

*Uses* — The bark of the two species mentioned contains oil which seems easy to burn and is therefore sometimes used for tinder. A medium hardwood.

KEY TO THE SPECIES

- 1a. Leaves thinly leathery, secondary veins distinctly raised below . . . *K. ochracea*
- b. Leaves papery, secondary veins scarcely raised below . . . . . *K. reflexa*

*Kokoona ochracea* (Elmer) Merr., Enum. Philipp. Flow. Plants 2 (1923) 484. — Fig. 34

*Literature* — Ding Hou in Flora Malesiana I, 6 (1963) 260.

*Vernacular names* — Kelapa tiung (M), batubagalang (M).

Trees 25–45 m tall, 20–40 cm in diameter, rarely with steep, thick buttresses up to 3 m tall. Leaves elliptic- or ovate-oblong, oblong-lanceolate, or lanceolate, 7.5–13.5 cm long, 3.5–6 cm wide, thinly leathery, base gradually narrowing to rounded, apex acute to acuminate, secondary veins 5–8 pairs. Petioles c. 1 cm long. Flowers yellowish to pale brown-orange.

*Habitat & Ecology* — Lowland forest, sometimes up to 1000 m altitude.

*Distribution* — Malay Peninsula, Borneo, Philippines.

*Material* — W 668, S 508.

*Kokoona reflexa* (Laws.) Ding Hou in Flora Malesiana I, 6 (1963) 262.

*Vernacular names* — Kayu minyak (M), bengkeleng (D, M).

Trees up to 50 m tall, up to 90 cm in diameter, rarely with up to 1.5 m tall buttresses. Leaves elliptic-oblong, 5.5–11 cm long, 2.5–4 cm wide, papery, base wedge-shaped, apex acuminate, secondary veins c. 5 pairs. Petioles up to 1.5 cm long. Flowers light green or dirty yellowish white.

*Habitat & Ecology* — Especially on ridges in lowland forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 144, W 667, v.B. 5948A, v.B. 5953, P.K. 609.

**LOPHOPETALUM** Wight ex Arn., Ann. Mag. Nat. Hist. I, 3 (1839) 150.

*Literature* — Ding Hou in Flora Malesiana I, 6 (1962) 262–272.

*Vernacular name* — Perupuk (M).

Small to tall trees. Bole straight. Buttresses present or absent, often pneumatophores present. Twigs terete, usually flattened at nodes. Stipules a tuft of hair-like processes, falling off early. Leaves opposite, margin entire. Petioles distinct. Thyrses axillary. Flowers bisexual, 5-merous. Calyx dish-shaped. Petals overlapping, inner surface partly covered with cristate, lamellate, or fimbriate appendages, rarely bearing a tuft of fleshy papillae at the central part (*L. beccarianum*). Ovary usually partly immers-

(Celastraceae)

ed in the disc. Ovules 4–18 in each cell, arranged in two series. Capsule oblong, 3-lobed, 3-winged, or 3-angular. Seeds oblong, flat, attached in the middle, the wing surrounding the seed. — Nine species reported for Kalimantan.

*Uses* — The light hardwood is an important timber sold under the name ‘Perupuk’.

*Note* — In sterile condition indistinguishable in the forest from *Kokoona*.

KEY TO THE SPECIES

- 1a. Bark rough, fissured, leaves almost obovate . . . . . *L. subbobovatum*
- b. Bark smooth, leaves different shaped . . . . . 2
- 2a. Leaves often olivaceous above, rather yellowish green beneath when dry, petioles up to 1.5 cm long . . . . . *L. beccarianum*
- b. Leaves often brown on both surfaces when dry, petioles 1.5–2 cm long  
*L. javanicum*

*Lophopetalum beccarianum* Pierre, Fl. For. Cochinch. 4 (1894) sub t. 307. — Fig. 35

*Literature* — Ding Hou in Flora Malesiana I, 6 (1963) 266.

*Vernacular names* — Perupuk tangkai pipih (M), belabak (M).

Trees up to 40 m tall, up to 60 cm in diameter. Bole straight or sinuous, buttresses absent. Bark grey-brown, hooped, smooth. Inner bark pale brown. Leaves parchment-like to thinly leathery, elliptic to narrowly ovate to obovate, 11–15 cm long, 3.5–7 cm wide, base wedge-shaped, apex usually obtuse, acute, sometimes short acuminate, secondary veins 5–8 pairs, ascending, arching, slightly raised below, frequently depressed above. Petioles 0.75–1.5 cm long. Flowers yellowish. Fruits c. 11 cm long, fruit wall leathery. Seeds (including the wing) 4.5 cm long, 1.25 cm wide.

*Habitat & Ecology* — In lowland Dipterocarp forest, up to 400 m altitude.

*Distribution* — Malay Peninsula, Borneo.

*Material* — AA 97, S 711.

*Lophopetalum javanicum* (Zoll.) Turcz., Bull. Soc. Nat. Hist. Mosc. 36 (1863) 598 (as *javanum*).

*Literature* — Ding Hou in Flora Malesiana I, 6 (1963) 269.

*Vernacular names* — Perupuk gunung (M), medang bora (M), kay sang (D), takorang (M).

Trees up to 45 m tall, up to 1 m in diameter. Bole with big steep buttresses. Bark grey or greenish, smooth. Inner bark pink. Sapwood white. Leaves thinly to thickly leathery, elliptic to elliptic-lanceolate, 5.5–18 cm long, 2.5–10 cm wide, base acute to wedge-shaped, apex acute to short acuminate, secondary veins 5–8. Petioles 1.5–2 cm long. Flowers white, light green or yellowish green. Fruits 6.5–11 cm long, fruit wall leathery, rather thin. Seeds (including the wing) 6.5 cm long, 1.5 cm wide.

(Celastraceae / Chrysobalanaceae)

*Habitat & Ecology* — Sometimes found in swamp or peat swamps, usually lowland, also up to 1500 m altitude.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi, Maluku, New Guinea.

*Material* — W 146, AA 189, v.B. 5891.

*Lophopetalum subobovatum* King, J. As. Soc. Beng. 65, ii (1896) 349 (as sub-obovatum).

*Literature* — Ding Hou in Flora Malesiana I, 6 (1963) 272.

*Vernacular name* — Perupuk kajo (D).

Trees up to 40 m tall, c. 70 cm in diameter. Bole with low thick buttresses. Bark pale to dark brown, rough, fissured. Inner bark pink-brown. Sapwood pale yellow. Leaves leathery, almost obovate, sometimes elliptic, 4.5–13 cm long, 2.5–7 cm wide, base wedge-shaped, apex obtuse and apiculate, the pointed part usually folded and sac-like, secondary veins 4–6 pairs. Petioles 0.5–1.5 cm long. Flowers white. Fruits up to 7 cm long. Seeds (including wing) 4.75–6 cm long.

*Habitat & Ecology* — Lowland forest up to 400 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 163, v.B. 5926.

**14 CHRYSOBALANACEAE**

Medium to large trees. Stipules present. Leaves simple, spiral, entire. Flowers somewhat zygomorphic, torus hollow, calyx 5-lobed, petals 5, overlapping, stamens many, in an open ring, ovary on the wall of the torus tube, style basal. Fruit a drupe. — Five genera reported for Borneo.

KEY TO THE GENERA

1 a. Leaves white hairy below, venation very prominent below . . . . . *Parinari*

b. Leaves glabrous below . . . . . 2

2 a. Leaves with 2 distinct glands at junction of lamina and stalk on upper side

*Maranthes*

b. Leaves without such glands . . . . . 3

3 a. Nervation of lower leaf surface not papillose, fruit a small, dry, smooth drupe

*Licania*

b. Nervation of lower leaf surface papillose, fruit a large, dry drupe, with a crustaceous warty surface . . . . . *Atuna*

(Chrysobalanaceae)

ATUNA Raf., Sylva Tell. (1838) 153.

*Atuna racemosa* Raf. subsp. *excelsa* (Jack) Prance in Flora Malesiana I, 10 (1989) 670.

*Synonym* — *Atuna excelsa* (Jack) Kosterm., Reinwardtia 7 (1969) 422.

Trees up to 45 m tall, up to 60 cm in diameter. Bole columnar, buttressed up to 2 m, not fluted. Bark grey, smooth, often lenticellate, becoming scaly. Inner bark red-brown, often purplish, fibrous, hard, gritty, lamellate. Wood hard. Stipules large, lanceolate, 8–15 mm long, almost persistent. Leaves glabrous, thinly leathery, ovate to oblong-ovate, 4.5–12 cm long, 2–5 cm wide, base more or less heart-shaped, rounded or slightly wedge-shaped, apex acuminate, 3–10 mm long, secondary veins 9–13 pairs, venation papillose, giving a bearded appearance, with a pair of glands on midrib at or near base of lower surface. Petioles without glands, 3–6 mm long. Inflorescence a raceme, axillary. Flowers: petals white to bluish white, to 5 mm long, falling off early, stamens 13–18, staminodes present, carpel 2-celled, with 1 ovule in each cell. Fruits large, almost globular to slightly pear-shaped, 5–7 cm in diameter, outer layer of fruit wall glabrous, crustaceous, warty, middle layer fibrous, 5–8 mm thick, inner layer thin, densely pilose within.

*Habitat & Ecology* — In lowland tropical forests on well drained soils.

*Distribution* — Malay Peninsula, Sumatra, W. Java, Borneo.

*Note* — A second species, *A. nannodes* (Kosterm.) Kosterm. is reported for Kalimantan.

*Material* — W 599.

LICANIA Aublet, Hist. Pl. Guiane (1775) 119.

*Licania splendens* (Korth.) Prance in Fl. Neotrop. (1972) 172. — Fig. 37

*Synonym* — *Angelesia splendens* Korth., Ned. Kruidk. Arch. 3 (1854) 384.

*Literature* — Prance in Flora Malesiana I, 10 (1989) 645.

Trees up to 25 m tall, c. 35 cm in diameter. Bark grey-brown, smooth, becoming cracked and flaky. Stipules linear-lanceolate, up to 3 mm long, falling off early. Leaves glabrous, parchment-like, oblong, 4–10 cm long, 1.8–4.2 cm wide, base wedge-shaped, apex acuminate, secondary veins 6–8, venation not papillose. Petioles without glands, 2–5 mm long. Inflorescence terminal and axillary panicles. Flowers: petals to 3 mm long, stamens 7–10, all fertile, ovary 1-celled, with 2 ovules. Fruits small, ellipsoid, 1–1.3 cm long, outer layer of fruit wall smooth, glabrous, not lenticellate, middle layer thin, fleshy, inner layer hard, thin, bony, tomentose within.

*Habitat & Ecology* — Very common in primary and secondary forest.

*Distribution* — Thailand, Malay Peninsula, Sumatra, W. Java, Borneo, Philippines.

*Uses* — The timber is strong and durable, resistant to marine borers, but it is extremely hard to work and requires special tools because of silica. The fruit is edible.

*Material* — W 411, W 576, W 588, W 968, S 282, S 635.



**MARANTHES** Blume, Bijdr. (1825) 89.

*Maranthes corymbosa* Blume, Bijdr. (1825) 89. — Fig. 38

*Literature* — Prance in Flora Malesiana I, 10 (1989) 671.

*Vernacular names* — Parada (M), undo (D), sibom (D).

Trees up to 40 m tall, up to 70 cm in diameter. Bole columnar, not buttressed. Bark and wood as *Parinari*. Stipules connate over the petioles, lanceolate, 5–10 mm long, falling off early. Leaves glabrous, leathery, oblong-lanceolate to oblong-elliptic, 6.5–14 cm long, 2.5–8 cm wide, base wedge-shaped, apex acuminate, secondary veins 7–10 pairs, venation not papillose, with paired glands at junction of lamina and petiole. Petioles without glands, 4–9 mm long. Inflorescence flattened, many-flowered corymbose, terminal panicles. Flowers: petals white, 3–6 mm long, falling off early, stamens 25–35, staminodes present, ovary 2-celled, with 1 ovule in each cell. Fruits large, ellipsoid, 3–4 cm long, outer layer of fruit wall thin, glabrous, inner layer hard, 5 mm thick, densely lanate within.

*Habitat & Ecology* — Usually on sandy soils, often coastal areas, sometimes on undulating country.

*Distribution* — Thailand, Malasia, Carolines, Solomons, Australia.

*Uses* — Fruit edible.

*Material* — W 883, AA 154, S 495, S 808.

**PARINARI** Aublet, Hist. Pl. Guiane (1775) 514.

*Parinari oblongifolia* Hook. f., Fl. Brit. India 2 (1878) 309. — Fig. 39

*Literature* — Prance in Flora Malesiana I, 10 (1989) 659.

*Vernacular name* — Melalin (B).

Trees up to 40 m tall, up to 60 cm in diameter. Bole columnar with steep 2 m tall buttresses. Bark grey, smooth, lenticellate. Inner bark brown, fibrous, hard, gritty, lamellate. Wood hard, red-brown. Stipules ovate to lanceolate, 3–5 mm long, falling off early. Leaves glabrous except stomatal cavities, leathery, elliptic to oblong, 14–23 cm long, 4–9 cm wide, base rounded or more or less heart-shaped, apex shortly acuminate, secondary veins 20–35 pairs, venation not papillose. Petioles with 2 glands at the middle (sometimes absent), 9–17 mm long. Inflorescence large terminal panicles. Flowers: petals c. 2 mm long, white, falling off early, stamens 8–10, staminodes present, ovary 2-celled, with 1 ovule in each cell. Fruits large, ellipsoid, 5–9 cm long, outer layer of fruit wall densely lenticellate, inner layer hard, 7–13 mm thick, fibrous, densely lanate within.

*Habitat & Ecology* — Usually in lowland Dipterocarp forest, sometimes along rivers, occasionally in seasonal swamps.

*Distribution* — Malay Peninsula, Sumatra, Borneo. Of the genus *Parinari* eight other species are reported for Kalimantan.

*Material* — S 624.

(Combretaceae/Compositae)

## 15 COMBRETACEAE

**TERMINALIA** L., Syst. Nat. ed. 12, 2 (1767) 674.

*Terminalia catappa* L., Syst. Nat. ed. 12, 2 (1767) 674. — Fig. 40

*Literature* — Exell in Flora Malesiana I, 4 (1954) 566.

*Vernacular name* — Ketapang pantai (M).

Trees up to 35 m tall, up to 40 cm in diameter, deciduous. Bole usually leaning, of poor form. Buttresses small. Bark grey, fissured, slightly flaky, inner bark pinkish brown. Wood brown or reddish. Branches whorled, horizontally spreading (pagoda trees), with large leaf-scars. Stipules absent. Leaves crowded, simple, entire, ovate, 8–38 cm long, 5–19 cm wide, base narrow, slightly heart-shaped, often with a pair of glands, apex slightly tipped or blunt, secondary veins 6–9 pairs, pocket domatia often present, scattered. Petioles thick, 5–15(–20) mm long. Flowers greenish white, uni- or bisexual, in 8–16 cm long, axillary spikes, 5-merous, petals absent, stamens 10, disc present, ovary inferior. Fruit a winged or ridged drupe, very variable in size, 3.5–7 cm long, 2–5.5 cm in diameter. Inner layer of fruit wall corky with air spaces.

*Habitat & Ecology* — Common tree, either wild or planted as shade tree in villages and on roadsides. Often found on sandy sea-shores.

*Distribution* — India, Malesia to Polynesia. Nine species of the genus *Terminalia* are reported for Kalimantan.

*Notes* — There is a marked tendency in Malesian *Terminalia* species towards a crown habit, described and figured by Corner as pagoda tree, a result of the peculiar branching (the so-called *Terminalia*-branching pattern). The leaves are crowded at the ends of the branches in whorls. This is caused by sympodial growth.

*Material* — P. K. 581.

## 16 COMPOSITAE

**VERNONIA** Schreber, Gen. 2 (1791) 541.

*Vernonia arborea* Buch.-Ham., Trans. Linn. Soc. 14 (1935) 218. — Fig. 41

*Literature* — Koster, Blumea 1 (1935) 382.

*Vernacular names* — Merembung (B), merambung (B), mung balug (B), tepung-tepung (M).

Trees up to 20(–35) m tall, 35 cm in diameter. Buttresses short if present. Bark grey-brown, smooth, scaly or fissured, inner bark soft, cream brown or orange-brown, turning dark on exposure. Sapwood white. Leaves simple, entire, spiral,

thin leathery, elliptic or ovate, 10–20 cm long, 3–8 cm wide, base pointed to rounded, slightly unequal-sided, apex acuminate, glabrous or hairy, secondary veins 8–14 pairs, arching. Stipules absent. Petioles 2.5–5 cm long. Inflorescences 1 large, terminal and in upper axils, paniculate, up to 25 cm in diameter. Axes and branches tomentose. Heads oblong, short-stalked, 5 or 6 flowers together, yellowish brown with violet tip, bracts in 5 or 6 rows (involucre), tomentose. Calyx reduced to a hair-like pappus. Fruits (achenes) oblong, 2–3 mm long, 3-angled, flattened at two sides and rounded at the third side, ribbed.

*Habitat & Ecology* — A common, widely distributed and polymorphic species, especially in secondary forest.

*Distribution* — India to South China, Indochina, Malesia.

*Notes* — If we follow the revision of Koster (1935) most of our specimens would belong to var. *obovata* Moore. However, there are transitions to other varieties and we feel we should not use varietal rank here. *Vernonia fimbrillata* Koster is reported for lower montane forest of Kalimantan.

*Uses* — The wood is soft and is sometimes used for indoor construction.

*Material* — W 85, S 278, S 637.

## 17 CONNARACEAE

*ELLIPANTHUS* Hook. f. in Benth & Hook. f., Gen. Pl. 1 (1862) 434.

*Ellipanthus tomentosus* Kurz var. *gibbosus* Leenhouts in Flora Malesiana I, 5 (1958) 523. — Fig. 42

Trees up to 15 m tall, c. 15 cm in diameter. Twigs 2–4 mm in diameter, soon glabrescent. Stipules absent. Petioles 0.75–1.5 cm long, soon glabrescent. Leaves simple, spiral, entire, oblong, 9–22 cm long, 4–8 cm wide, paperlike, almost glabrous, base almost peltate, apex acuminate, secondary veins 5–10 pairs. Inflorescences axillary, glomerulous, few-flowered. Flowers predominantly 5-merous, probably sometimes unisexual, sepals valvate, petals free, overlapping, stamens 10, fused at base, episepalous ones well developed, epipetalous ones staminodal, pistil 1, pilose, style slender, stigma 2-lobed. Fruits 0.5–3 cm stipitate, about 45 degree kneed, fertile part flattened, 2.5–3 cm long, c. 1 cm in diameter, fertile part opening lengthwise by a slit, fruit wall woody, calyx persistent. Seed 1, 12–20 mm long, aril minute, cupular, 3–5 mm high.

*Habitat & Ecology* — Lowland forest, up to 700 m altitude.

*Distribution* — India to Indochina, Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi.

*Uses* — The wood is hard and durable.

*Material* — S 816.

(Cornaceae/Datisceae/Dilleniaceae)

## 18 CORNACEAE

**MASTIXIA** Blume, Bijdr. (1826) 654.

*Vernacular name* — Nyaling (K).

Medium to large trees. Exudate clear, smelling of sugarcane. Stipules absent. Leaves simple, entire, opposite or alternate. Flowers actinomorphic, bisexual, 4- or 5-merous, stamens 7 or 8, disc present, ovary (semi)inferior. Fruit a one-seeded drupe. — Seven species are reported for Kalimantan.

## 19 DATISCEAE

**OCTOMELES** Miq., Fl. Ind. Bat., Suppl. (1861) 133, 336.

*Octomeles sumatrana* Miq., Fl. Ind. Bat., Suppl. (1861) 133, 336. — Fig. 43

*Literature* — Steenis in Flora Malesiana I, 4 (1953) 383.

*Vernacular names* — Binuang bini (M), benuang (B).

Trees up to 60(–80) m tall, 1.5–2.5(–4) m in diameter. Buttresses spreading, up to 10 m tall. Crown at first degree oblong with radial limbs. Bark grey, smooth. Wood soft. Stipules absent. Leaves simple, spiral, entire, roundish heart-shaped, 12–30 cm long, 6–23 wide, venation palmate, 5–7(–9) veins, with groups of large pitted domatial glands in the axils of the veins. Petioles long, 5-angled. Inflorescence a pendent spike. Flowers sessile, actinomorphic, bisexual, sepals 4–9, petals 4–9, free, ovary inferior, placentation parietal, fruit a capsule, seeds minute, numerous.

*Habitat & Ecology* — Usually along rivers, common in secondary forest.

*Distribution* — Malesia except Malay Peninsula, Java and Nusa Tenggara.

*Uses* — The wood is soft, used in the ply- and pulpwood industry.

*Material* — AA 680.

## 20 DILLENACEAE

**DILLENIA** L., Sp. Pl. (1753) 535.

Medium-sized trees. Bark reddish, thin flaky or scaly, bark producing watery exudate and a hissing sound when cut. Stipules absent. Leaves simple, spiral, dentate, sometimes entire. Petioles often with broad wings, resembling stipules. Inflorescence a raceme. Flowers large (5 cm or more across), actinomorphic, bisexual, sepals 5, petals 5 or absent, free, white or yellow, stamens numerous. Fruit consisting of up to 20 carpels joined at base, fleshy, in some species dehiscent and displaying arillate seeds. — Nine species reported for Kalimantan.

*Note* — The genus is easy to recognize by its stiltroots and the characteristic leaves.

KEY TO THE SPECIES

- 1a. Leaf stalk winged . . . . . *D. suffruticosa*
- b. Leaf stalk not winged . . . . . 2
- 2a. Mature leaves densely hairy, tertiary veins raised below, base of leaf rounded or heart-shaped . . . . . *D. reticulata*
- b. Mature leaves sparsely hairy, tertiary veins not raised below, base of leaf tapered . . . . . *D. grandifolia*

*Dillenia grandifolia* Hook. f. & Thomson, Fl. Ind. 1 (1855) 71. — Fig. 44a & b

*Synonym* — *Dillenia eximia* Miq., Fl. Ind. Bat., Suppl. (1861) 620.

*Literature* — Kochummen & Whitmore, Gard. Bull. Sing. 24 (1969) 3.

*Vernacular name* — Simpura (M).

Trees up to 40 m tall, up to 70 cm in diameter. Bole columnar, buttresses to 3 m tall, merging into stiltroots. Bark grey-brown or red-brown, smooth finely lenticellate. Inner bark dark purplish with radial rows of fibres. Sapwood pale brown. Leaves elliptic to obovate, 15–25 cm long, 9–15 cm wide, sparsely hairy below, base tapered, apex rounded to obtuse, secondary veins 18–28 pairs, tertiary veins not raised below. Petioles 3–7 cm long. Flowers without petals, c. 2.5 cm in diameter. Fruit indehiscent, dull yellow, c. 4.5 cm high, c. 6 cm in diameter. Seeds black, with rudimentary aril.

*Habitat & Ecology* — Usually in swamp forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 486, AA 36.

*Dillenia reticulata* King, J. As. Soc. Beng. 58, ii (1889) 367.

*Literature* — Hoogland in Flora Malesiana I, 4 (1951) 168.

*Vernacular names* — Simpura rawa (M), tempuran (M).

Trees up to 40 cm tall, up to 90 cm in diameter. Bole columnar, buttresses, if present, tall, almost always with conspicuous stiltroots. Bark grey-brown or red-brown, with brown lenticels. Inner bark thick, soft, pinkish cream. Sapwood pale brown. Leaves elliptic or elliptic-oblong to obovate, 15–30 cm long, 10–20 cm wide, velvety below, base rounded to heart-shaped, apex rounded or slightly emarginate, secondary veins 25–35 pairs, tertiary veins raised below. Petioles 4–10 cm long. Flowers with 5 yellow petals, c. 8 cm in diameter. Fruit indehiscent, greenish yellow, c. 3 cm high, 3.5 cm in diameter. Seeds glossy black, with rudimentary aril.

*Habitat & Ecology* — Usually in lowland swamps up to 200 m altitude, sometimes also on dryland.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Note* — Leaves of sapling are up to 1.25 m long.

*Material* — S 455.

(Dilleniaceae/Dipterocarpaceae)

*Dillenia suffruticosa* (Griff.) Martelli in Becc., Malesia 3 (1886) 163.

*Literature* — Hoogland in Flora Malesiana I, 4 (1951) 162.

*Vernacular name* — Simpuri bini (M).

Large shrub or small trees up to 10 m tall, often rooting down from lower twigs and forming thickets. Leaves elliptic to ovate, 15–25 cm long, 8–12 cm wide, woolly on the veins below, base obtuse, apex obtuse, secondary veins 12–20 pairs. Petioles 2–6 cm long, with up to 1.5 cm broad, persistent wings. Flowers with 5 bright yellow petals, 8–11 cm in diameter. Fruit dehiscent, carpels red, seeds brown or black, with a papery, scarlet aril.

*Habitat & Ecology* — Common in secondary forest and swampy areas.

*Distribution* — W. Malesia.

*Material* — W 224.

**21 DIPTEROCARPACEAE**

Medium to large, buttressed trees. Bole usually columnar, with resinous exudate (damar). Stipules present, often falling off early. Leaves simple, alternate, entire. Petioles thickened or not at apex. Inflorescence paniculate. Flowers bisexual, 5-merous, actinomorphic, calyx persistent, petals more or less free, contorted in bud, stamens usually numerous. Fruit nearly always winged (enlarged calyx lobes). Nut enclosed between the grown calyx lobes (ovary superior) or nut under the calyx lobes (ovary inferior). — Nine genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Trunk with thick round buttresses, bark scaly, stipules large, clasping the stem, leaves with wavy margin, folded in bud (visible in adult leaves as a thin line between the veins), petioles thickened at apex, flowers large (up to 5 cm across), fragrant, fruit with two large wings (rarely poorly developed) and 3 short ones, nut under the calyx lobes (ovary inferior) . . . . . *Dipterocarpus*
- b. Not this combination of characters . . . . . 2
- 2a. Trunk with low buttresses, bark flaky, lamina 9–17 cm long, 4–9.5 cm wide, base heart-shaped, white tomentose below, petioles thickened at apex, young parts often with multicellular glands, fruit with two large and 3 small wings, nut visible (ovary superior) . . . . . *Upuna*\*
- b. Not this combination of characters . . . . . 3
- 3a. Trunk with tall concave buttresses, bark flaky or scaly, petioles never thickened, leaves with numerous closely parallel veins reaching the margin, crushed leaves weakly or strongly fragrant, fruits with 5 more or less equal wings  
*Dryobalanops*
- b. Not this combination of characters . . . . . 4

(Dipterocarpaceae)

- 4a. Trunk with large round buttresses, bark purplish, shallowly fissured with stellate lenticels, leaves with oblique veins (at a sharp angle to the midrib), tertiary venation ladder-like (some species with folded leaves, in some species stipules clasping the twig), fruit with 2 short and 3 long wings (ovary superior)

*Parashorea*\*

- b. Not this combination of characters . . . . . 5

- 5a. Trunk with thick, tall, round buttresses, bark fissured and scaly, inner bark lamellate, wood with silica, leaves with looping veins, petioles thickened at apex, fruit with 3 short and 2 long, 3-veined wings, nut invisible (ovary inferior)

*Anisoptera*

- b. Not this combination of characters . . . . . 6

- 6a. Trunk with low round buttresses, bole somewhat twisted, bark smooth or somewhat flaky, inner bark not lamellate, petioles never thickened, leaves with looping veins, fruits with 3 short and 2 long wings, nut visible (ovary superior)

*Cotylelobium*

- b. Not this combination of characters . . . . . 7

- 7a. Trunk with small concave buttresses, bole often sinuate, bark smooth or somewhat flaky, with rings (hooped), petioles never thickened at apex, veins bending near margin, with glands near top of the veins, tertiary venation net-like or a combination of net- and ladder-like venation, (ovary superior or semi-inferior) fruit with 5 small more or less equal wings (sect. *Vatica*) or with 3 small and 2 large wings (sect. *Sunaptea*) . . . . . *Vatica*

- b. Not this combination of characters . . . . . 8

- 8a. Trunk often with stiltroots or thin buttresses, bole often tapering, bark smooth, flaky or fissured, petioles never thickened at apex, venation dryobalanoid, sub-dryobalanoid (veins closely parallel, but partly not reaching the margin as in *Dryobalanops*), or ladder-like, fruit with 3 short and 2 long wings, or all 5 wings short, nut visible (ovary superior) . . . . . *Hopea*

- b. Trunk with steep round buttresses, venation usually ladder-like, fruit with 2 short and 3 large wings, rarely all lobes equal, nut visible (ovary superior) (*Shorea*) . . . . . 9

- 9a. Bark irregularly fissured or smooth, inner bark lamellate, cream, rays shining, sapwood pale yellow, venation net- and ladder-like

*Shorea* (sect. *Anthoshorea*), White Meranti group

- b. Bark scaly or irregularly fissured, inner bark greenish yellow, fibrous, rays shining, sapwood yellow, resin turning black, venation ladder-like

*Shorea* (sect. *Richetioides*), Yellow Meranti group

- c. Bark irregularly cracked, scaly or fissured, inner bark brown or yellow, fibrous, rays not shining, sapwood yellow, venation ladder-like

*Shorea* (sect. *Shorea*, *Pentacme*, *Neohopea*), Balau group

- d. Bark regularly fissured, inner bark red, fibrous, rays shining, sapwood pinkish or brown, venation ladder-like

*Shorea* (sect. *Rubella*, *Brachypterae*, *Pachycarpae*, *Mutica*, *Ovalis*)  
Red Meranti group

**(Dipterocarpaceae)**

SYNOPTICAL KEY TO THE GENERA

(If more conditions of one character are found in one genus the number is marked with an asterisk)

- |                         |                                       |
|-------------------------|---------------------------------------|
| 1. <i>Anisoptera</i>    | 6. <i>Shorea</i> Balau group          |
| 2. <i>Cotylelobium</i>  | 7. <i>Shorea</i> White Meranti group  |
| 3. <i>Dipterocarpus</i> | 8. <i>Shorea</i> Yellow Meranti group |
| 4. <i>Dryobalanops</i>  | 9. <i>Shorea</i> Red Meranti group    |
| 5. <i>Hopea</i>         | 10. <i>Vatica</i>                     |

1. *Bark*

- a. Bark smooth: 2\*, 5\*, 7\*, 9\*, 10\*
- b. Bark flaky: 2\*, 4\*, 5\*, 10\*
- c. Bark scaly: 1\*, 3, 4\*, 6\*, 8\*,
- d. Bark fissured: 1\*, 5\*, 6\*, 7\*, 8\*, 9\*

2. *Markings on bark*

- a. Bark hooped: 9\*, 10
- (b. Bark not hooped)

3. *Inner bark*

- a. Inner bark lamellate: 1, 7
- (b. inner bark not lamellate)

4. *Wood*

- a. Wood with silica: 1
- (b. Wood without silica)

5. *Stipules*

- a. Stipules large, clasping the twig: 3, 9\*
- (b. Stipules small, often falling off early)

6. *Bud aestivation*

- a. Leaves folded in bud: 3
- (b. Leaves not folded in bud)

7. *Margin of leaves*

- a. Leaves with wavy margin: 3
- (b. Leaves with smooth margin)

8. *Venation of secondary veins*

- a. Leaves with numerous closely parallel secondary veins reaching the margin (dryobalanoid venation): 4, 5\*
- (b. Leaves with well spaced secondary veins)

9. *Looping of secondary veins*

- a. Leaves with looping secondary veins: 1, 2, 10
- (b. Leaves without looping secondary veins)



(Dipterocarpaceae)

10. *Venation of tertiary veins*
  - a. Tertiary venation ladder-like: 5, 6, 7\*, 8\*, 9\*
  - b. Tertiary venation net-like: 2, 7\*, 8\*, 9\*, 10\*
  - c. Tertiary venation net- and ladder-like: 1, 3, 7\*, 8\*, 10\*
  - d. Tertiary venation more or less invisible: 4
11. *Glands or domatia on lower leaf surface*
  - a. Leaves with glands or domatia on lower leaf surface: 5\*, 9\*, 10
  - b. Leaves without any glands or domatia)
12. *Fragrance of crushed leaves*
  - a. Crushed leaves weakly or strongly fragrant: 4
  - b. crushed leaves not fragrant)
13. *Petioles*
  - a. Petioles thickened at apex: 1, 3, 7\*
  - b. Petioles not thickened at apex)
14. *Flowers*
  - a. Flowers large (up to 5 cm across): 3
  - b. Flowers small)
15. *Fruits*
  - a. Fruits with 2 long wings and 3 short ones: 1, 2, 3\*, 5, 10\*
  - b. Fruits with 3 long wings and 2 short ones: 6\*, 7, 8\*, 9
  - c. Fruits with 5 more or less equal, long wings: 4, 10\*
  - d. Fruits with 5 more or less equal, short wings: 6\*
  - e. Fruits with undeveloped wings: 3\*, 8\*
16. *Wings of fruits*
  - a. Wings 3-veined: 1
  - b. Wings usually 5-veined)
17. *Nut*
  - a. Nut invisible (nut fused with basal part of wings): 1, 3
  - b. Nut visible, nut free from the basal parts of wings)

ANISOPTERA Korth., Kruidk. (1841) 65.

*Anisoptera costata* Korth., Kruidk. (1841) 67 — Fig. 45

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 330.

*Vernacular names* — Mersawa daun besar (M), laripung (D), damar tingkis (D).

Trees up to 65 m tall, up to 1.7 m in diameter, bole straight, cylindrical, buttresses few, up to 4 m tall, up to 2.5 m long, thick, rounded, straight, continuing up the bole as ribs up to 10 m. Bark greyish brown, shallowly fissured, fissures up to 1.5 m long, lenticellate, outer bark thick, inner bark up to 3 cm thick, thickly lamellate cream

**(Dipterocarpaceae)**

and yellow, sapwood creamy-white, heartwood pale yellow with silica. Damar grey-green. Twigs at first frequently angular, becoming minutely striated or smooth, terete. Stipules c. 8 mm long, c. 3 mm wide, hastate, acute, falling off early. Petioles 2–4 cm long, thickened at apex. Leaves oblong to obovate, 6–20 cm long, 7–11 cm wide, thinly leathery, frequently slightly raised between veins, glabrescent beneath, grey-green stellate hairs present, base obtuse or broadly wedge-shaped, often heart-shaped, acumen to 5 mm long, secondary veins 15–22 pairs. Calyx not cupped at base, lobes triangular, corolla cream, petals broadly hastate, acute, stamens c. 25, ovary cylindrical, style short, pubescent at base. Fruit calyx shortly pubescent, tube 1–1.3 cm in diameter, globular, tapering gradually to the pedicel, 2 longer calyx lobes c. 1.6 cm long, 1.5–2 cm wide, spatula-shaped, obtuse, 3 shorter lobes c. 20 mm long, c. 4 mm wide, variable, hastate, base slightly constricted, apex of nut broadly conical.

*Habitat & Ecology* — Common, often gregarious, in Semi-evergreen Dipterocarp forest and evergreen forest in seasonal areas, rare but widespread in lowland forest in everwet areas, up to 700 m altitude.

*Distribution* — Of the genus *Anisoptera* five species are reported for Kalimantan.

*Uses* — Only limited value as the wood is susceptible to insect attack and it has an uninteresting dull yellow colour on drying; more in demand as a peeler for plywood.

*Material* — W 783.

**COTYLELOBIUM** Pierre, Fl. For. Coch. 3 (1889) sub t. 235.

*Cotylelobium melanoxylo*n (Hook. f.) Pierre, Fl. For. Coch. 3 (1889) t. 235 — Fig. 46

*Synonym* — *Sunaptea melanoxylo*n (Hook. f.) Kosterm. in Kosterm., Proc. Third Round Table Conf. Dipterocarps (1987) 617.

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 341.

*Vernacular names* — Giam (M), resak tembaga (M), resak bunga (M), resak padi (M), tebung (B).

Trees 30–45 m tall, c. 60 cm in diameter, bole often twisted, buttresses low, rounded. Bark grey, at first smooth but prominently hooped, becoming irregularly, flaky, leaving a distinct scroll-marked surface below, outer bark thin, c. 0.5 mm thick, brittle, inner bark 1 cm thick, outer layer pale brown-red, inner layer dirty white, sapwood pale brown, heartwood light brown. Damar whitish or pale yellow. Twigs terete, slender, minutely striated with fine cracks. Stipules linear, small, up to 3 mm long, falling off early. Petioles up to 1.5 cm long. Leaves ovate to obovate, 8–12 cm long, 4–7 cm wide, base rounded to broadly wedge-shaped, apex acuminate, up to 8 mm long, densely brownish peltate beneath, secondary veins 10–13 pairs, curved, with more slender, shorter intermediates, intramarginal veins strongly looped. Calyx lobes almost equal, corolla narrowly ovate, stamens 15, ovary ovoid, style needle-

(Dipterocarpaceae)

like, pubescent towards the base. Calyx persistently pubescent towards the base, glabrescent elsewhere, 2 longer calyx lobes up to 4.5 cm long, 1.2 cm wide, oblong, obtuse, 3 shorter lobes up to 1.5 cm long, 3 mm wide, hastate, acute, lobes united at base into a shallow cup, c. 8 mm in diameter.

*Habitat & Ecology* — Local, on dry, often sandy soils on coastal hills and terraces, sometimes in secondary forest.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo. Of the genus *Cotylelobium* three species are reported for Kalimantan.

*Uses* — A hard durable timber similar to that of *Vatica*.

*Note* — If one tries to identify our material with the key in Flora Malesiana one will end up either with *C. burckii* or *C. lanceolatum* due to the indument of the leaves in our specimens. Ashton (1991, pers. comm.) prefers to include our material in *C. melanoxylon*, which has usually glabrous leaves according to Flora Malesiana.

*Material* — W 145, W 699, W 857, S 583, v.B. 5987.

**DIPTEROCARPUS** Gaertn. f., Fruct. 3 (1805) 50.

*Vernacular names* — Keruing (M), tempudao (D).

Medium-sized to large trees with thick, rounded, usually small and concave, sometimes tall and straight buttresses. Bark more or less prominently densely warty lenticellate. Twigs variable, stout or slender, terete or compressed, glabrous or tomentose, with distinct stipule scars. Stipules large, clasping the twig, falling off early. Petioles distinctly kneed, stout. Leaves leathery, rarely thin, veins prominent beneath, with traces of the folded venation remaining persistently between them, tertiary venation ladder-like. Inflorescences racemose, short, stout, zigzag, few-flowered. Flowers large, calyx united round the fruit into a tube, but not united with it, lobes valvate, 2 long, 3 short, or 5 vestigial, almost equal (*D. tempehes*), petals large, strongly twisted, cream with a prominent pink stripe down the centre, stamens 15–40, ovary enclosed in the calyx tube, shortly tomentose. Fruits large, lobes as in flower, but greatly expanded. — Forty-one species reported for Kalimantan.

*Uses* — Medium hardwood, easily to preserve, used for railway sleepers and heavy construction.

KEY TO THE SPECIES

A: *Sterile specimens*

- 1a. Petioles up to 2.5 cm long ..... 2
- b. Petioles at least 5 cm long ..... 4
- 2a. Leaves, petioles and young shoots softly hairy ..... *D. gracilis*
- b. Leaves, petioles and young shoots glabrous ..... 3
- 3a. Leaf bud densely persistent velvety ..... *D. fusiformis*
- b. Leaf bud very shortly pubescent ..... *D. tempehes*

(Dipterocarpaceae)

- 4a. Leaves strongly concave, almost peltate, secondary veins 12–14(–16) pairs  
*D. confertus*
- b. Leaves not concave, never peltate, secondary veins 18–25 pairs . . . . . 5
- 5a. Leaves glabrescent, stipules c. 10 cm long, c. 2 cm wide . . . . . *D. humeratus*
- b. Leaves densely cream scaly, stipules c. 20 cm long, c. 4 cm wide *D. cornutus*

B : *Fruiting specimens*

- 1a. Mature fruit calyx tube spherical, not angled, ribbed, tuberculate or winged . 2
- b. Mature fruit calyx tube angled, ribbed, tuberculate or winged . . . . . 3
- 2a. Fruit calyx lobes vestigial, almost equal or even absent . . . . . *D. tempehes*
- b. Fruit calyx lobes unequal with 2 long and 3 short ones . . . . . *D. gracilis*
- 3a. Fruit calyx angled or winged in its whole length . . . . . 4
- b. Fruit calyx with 5 prominent apical protuberances below the neck only . . . . . 5
- 4a. Fruit calyx angled rather than winged . . . . . *D. confertus*
- b. Fruit calyx distinctly winged . . . . . *D. fusiformis*
- 5a. Protuberances knob-like not exceeding one third of the length of the calyx  
*D. cornutus*
- b. Protuberances wing-like, covering the upper half of the calyx . . *D. humeratus*

*Dipterocarpus confertus* Sloot., Bull. Jard. Bot. Buitenzorg III, 8 (1927) 322  
— Fig. 47a & b

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 315.

*Vernacular name* — Keruing tempudau (M).

Trees up to 35 m high, up to 1.2 m in diameter, bole cylindrical, buttresses low, 1–2 m, sometimes up to 4 m high, older trees often strongly fluted. Bark grey to pale brown, scaling evenly in old trees, scales vertically elongated, outer bark thin, inner bark brownish, brittle, sapwood pale yellow, hard, 2–10 cm thick, heartwood red-brown, brown-grey or grey-brown-red. Twigs 0.8–1 cm in diameter, somewhat flattened. Stipules up to 5 cm long and broad, broadly ovate, obtuse, soon falling. Petioles 5–6 cm long, persistently tufted hairy. Leaves broadly obovate to circular, (18–)22–35 cm long, (14–)16–22 cm wide, parchment-like, concave, base usually almost peltate, apex obtuse or shortly acuminate, veins 12–14(–16) pairs. Calyx and corolla typical, stamens c. 25, ovary ovoid-conical, style slender, tomentose except apex. Fruits almost sessile, calyx tube densely pale rusty brown hairy, narrowly obovoid, with 5 ridges on the whole length, 2 longer calyx lobes up to 14 cm long, 3 cm wide, glabrous within, prominently 3-veined, 3 shorter lobes up to 1.7 cm long, c. 0.7 cm wide, oblong, recurved at apex.

*Habitat & Ecology* — Usually common on low hills and undulating land below 800 m altitude.

*Distribution* — Endemic in Borneo.

*Uses* — See genus description.

(Dipterocarpaceae)

*Note* — This species is easily recognized by its characteristic large, softly tomentose, concave, almost peltate leaves.

*Material* — W 178, v.B. 5949, S 179.

*Dipterocarpus cornutus* Dyer, Fl. Br. India 1 (1874) 296 — Fig. 48

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 312.

*Vernacular name* — Keruing tembaga (M).

Trees up to 40 m tall, c. 50 cm in diameter. Bark pale greyish. Twigs c. 1 cm in diameter, somewhat compressed, stout, densely persistently puberulent. Stipules up to 20 cm long, up to 4 cm wide, strap-shaped, long tufted tomentose. Petioles 5–8.5 cm long, c. 4 mm in diameter, stout. Leaves broadly elliptic to oblong-ovate, 15–30 cm long, 7.5–18 cm wide, thickly leathery, cream beneath, base obtuse, acumens obtuse, secondary veins 18–21 pairs. Calyx and corolla typical, stamens 30, ovary ovoid, style stoutly columnar, densely hirsute at base. Fruits almost sessile, calyx tube to 2.5 cm long, up to 3.7 cm in diameter, densely warty lenticellate, 5 prominent apical tubercles present, 2 longer calyx lobes up to 21 cm long, up to 5 cm wide, oblong, revolute at base, 3 shorter lobes up to 1.5 cm long, up to 1.5 cm wide, more or less circular, revolute.

*Habitat & Ecology* — Lowland forest up to 1000 m altitude, on well drained usually undulating land, common.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — See genus description.

*Material* — W 580, S 733.

*Dipterocarpus fusiformis* Ashton, Gard. Bull. Sing. 31 (1978) 12 — Fig. 49

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 319.

Trees up to 45 m tall, c. 50 cm in diameter. Bark grey, flaky, hooped, inner bark brown, granular. Twigs slender, terete. Stipules up to 3 cm long, 6 mm wide, lanceolate, acute. Petioles 2–3 cm long, slender. Leaves elliptic or narrowly ovate, 7–17 cm long, 3–7 cm wide, leathery, base wedge-shaped or obtuse, apex acuminate, c. 12 mm long, secondary veins 13–17 pairs. Calyx and corolla typical, stamens 15, ovary ovoid, style slender, densely hirsute at base. Fruits almost sessile, calyx tube to 3 cm long, up to 2 cm in diameter, ellipsoid, with 5, 5–6 mm broad wings, 2 longer lobes up to 10 cm long, up to 2.5 cm wide, broadly spatula-shaped, 3 shorter lobes up to 5 mm long, up to 5 mm wide, more or less circular, more or less revolute.

*Habitat & Ecology* — On well-drained, fertile soils, in Mixed Dipterocarp Forest.

*Distribution* — Endemic in East Kalimantan and Sabah.

*Note* — Up to date only known from a few collections from the Tawau area (NE Borneo).

*Material* — S 462.

(Dipterocarpaceae)

*Dipterocarpus gracilis* Blume, Bijdr. (1826) 224 — Fig. 50

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 301.

*Vernacular name* — Keruing wuluk bulan (M).

Trees up to 50 m tall, up to 1 m in diameter. Bole cylindrical, buttresses rather small to large, rounded. Bark grey with large reddish brown patches from which the scales have recently fallen, finely lenticellate, inner bark reddish brown, brittle, sapwood ochre, heartwood red-brown, brown-grey or grey-brown-red. Stipules up to 5 cm long, narrowly lanceolate. Twigs c. 3 mm in diameter, terete. Petioles 2–2.5 cm long. Leaves elliptic to ovate, 8–15 cm long, 4–10 cm wide, parchment-like, base rounded to obtuse, apex shortly acuminate, secondary veins 12–20 pairs. Calyx and corolla typical, stamens c. 30, ovoid-conical, style hair-like, tomentose at the basal half. Fruits almost sessile, calyx tube glabrous, globular, smooth, 2 longer calyx lobes up to 14 cm long, c. 2.5 cm wide, 3-veined but in the upper half with the central vein more prominent than the others, 3 shorter lobes up to 2.2 cm long, c. 1 cm wide, ovate, revolute.

*Habitat & Ecology* — This species is widespread in seasonal semi-evergreen forest, becoming scattered and confined to fertile soil in everwet areas.

*Distribution* — Andamans, Burma, Thailand, Malay Peninsula, Sumatra, Java, Borneo, Philippines.

*Uses* — See genus description.

*Material* — W 436, W 559.

*Dipterocarpus humeratus* Sloot., Bull. Jard. Bot. Buitenzorg III, 8 (1927) 308 — Fig. 51

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 311.

*Vernacular name* — Keruing kerukup (M).

Trees up to 50 m tall, up to 80 cm in diameter. Bole columnar, buttresses several, steep, rather small to pronounced. Bark grey, locally with large reddish brown patches from which the scales have recently fallen, with star-like lenticels, outer bark thin, inner bark dull pale pinkish brown, thick, fibrous, sapwood pale ochre, heartwood red-brown, brown-grey or grey-brown-red. Damar white. Twigs 1–1.2 cm in diameter, terete, becoming thinly flaky. Stipules up to 10 cm long, c. 2 cm wide, narrowly lanceolate. Petioles more than 5 cm long. Leaves broadly ovate, 20–28 cm long, 12–23 cm wide, parchment-like, base rounded to obtuse, apex obtuse to shortly acuminate, veins c. 20 pairs. Calyx and corolla typical, stamens c. 40, ovary ovoid, conical, style short, pubescent except apex. Fruits sessile, calyx tube c. 4 cm in diameter, glabrous, globular, smooth, with 5 obtuse tubercles in the apical half, 2 longer calyx lobes up to 18 cm long, c. 5 cm wide, 3 shorter lobes up to 1.5 cm long, c. 1.5 cm wide, broadly ovate, base more or less heart-shaped, revolute.

*Habitat & Ecology* — This species is confined to well-drained flat or undulating land or hills, frequently common.

*Distribution* — Sumatra, Borneo.

*Uses* — See genus description.

*Note* — Closely allied to *D. cornutus*, from which it differs principally in the tomentum and the fruit calyx.

*Material* — W 437, W 438, W 466, W 583, S 736.

*Dipterocarpus tempehes* Sloot., Reinwardtia 5 (1961) 468 — Fig. 52

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 297.

*Vernacular names* — Tempehes (D), keruing asam (M).

Trees up to 35 m tall, up to 90 cm in diameter, buttresses symmetrical, rather flat to rounded. Bark pale greyish to pale brown, flaky, with whitish star-like lenticels, outer bark thin, pale greyish brownish, inner bark reddish-brown, rather fibrous, sapwood pale ochre, heartwood red-brown, brown-grey or grey-brown-red. Twigs 2–4 mm in diameter, compressed. Stipules up to 8 cm long, c. 1.2 cm broad, strap-shaped, acute. Petioles 1–2 cm long. Leaves broadly elliptic to obovate, 6–12 cm long, 3.5–8 cm wide, thickly leathery, base broadly wedge-shaped, apex acute or shortly acuminate, veins 9–12 pairs. Calyx and corolla typical, stamens c. 30, ovary ovoid, style hair-like, pubescent except apex. Fruits almost sessile, calyx tube glabrous, turbinate, with prominent but unraised pale lenticels, c. 10 cm long, c. 5 cm in diameter, calyx lobes vestigial, almost equal.

*Habitat & Ecology* — Locally abundant in freshwater swamps and stream banks.

*Distribution* — Endemic in Borneo.

*Uses* — See genus description.

*Note* — This species is easily recognized by its characteristic large fruits without wings.

*Material* — W 403, W 451, S 699, AA 1.

**DRYOBALANOPS** Gaertn. f., Fruct. 3 (1805) 49.

*Dryobalanops beccarii* Dyer, J. Bot. 12 (1874) 100 — Fig. 53

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 375.

*Vernacular name* — Kapur merah (M).

Trees up to 45 m tall, c. 1.5 m in diameter, bole slender, tapering, often hollow, buttresses usually present, sometimes large, some damar exudates on lower bole. Bark surface with large 70 cm long and 10 cm wide irregular or more or less rectangular pieces, outer bark 3 mm thick, pale brown, closely lamellate, sapwood pale yellow brown, heartwood brown red. Twigs terete but with two ridges descending from leaf base. Stipules linear, 5–8 cm long, falling off early. Petioles 0.7–1 cm long, very slender. Leaves ovate to lanceolate, 5–8 cm long, 1–3 cm wide, thin, margin often undulate, base wedge-shaped, apex acuminate, to 17 mm long, narrow, secondary veins numerous, very close. Sepals glabrous, equal, corolla white, petals

**(Dipterocarpaceae)**

large, broadly elliptic, stamens c. 30, almost equal, almost two-third of the style, filaments united in a tube, almost half as long as anthers, anthers narrowly oblong, sterile tissue between the anthers short, erect, slightly exceeding anther, ovary ovoid, glabrous, style 2 to 3 times as long as ovary, filiform, glabrous. Calyx glabrous, base with a shallow cup, c. 8 mm in diameter, lobes 5, almost equal in length, up to 6.5 cm long, 0.8 cm wide, glabrous, nut c. 1.4 cm in diameter, ovoid to globular, glabrous.

*Habitat & Ecology* — Locally abundant, on rather acid, sandy soils, on coastal ridges and inland ridges below 700 m.

*Distribution* — Endemic in Borneo. Of the genus *Dryobalanops* seven species are reported for Borneo.

*Uses* — The timber is strong and durable and is regarded as an all-purpose timber (boats, beams, columns, trusses, furniture, boxes). It contains, however, silica and is therefore difficult to saw.

*Material* — W 470, W 637, AA 20.

**HOPEA** Roxb., Pl. Corom. 3 (1811) 7; nom. gen. cons.

Small to large trees. Bole usually tapering, hooped. Buttresses thin, stiltroots and flying buttresses sometimes present. Bark first smooth becoming cracked, flaky or fissured. Twigs slender. Stipules linear, falling off early, scars small, inconspicuous. Petioles never thickened at apex. Leaves with ladder-like, dryobalanoid or subdryobalanoid venation. Inflorescences paniculate, slender, terminal or axillary. Flower buds small, ovoid or rarely globular. Sepals overlapping, petals fused at base, stamens 15–18, in 3 whorls, filaments broad at base, tapering, anthers almost globular, sterile tissue above the anthers usually at least twice as long as anther, slender, glabrous or minutely glandular warty, ovary glabrous or tomentose, stylopodium absent or present, style long or short, glabrous, stigma minute. Fruit relatively small, 2 outer fruit calyx lobes prolonged, spatula-shaped, 3 inner lobes short, thickened and saccate at base, nut ovoid, usually glabrous. Fruit wall irregularly splitting at germination. — Forty-three species reported for Kalimantan.

KEY TO THE SPECIES

A :

- 1a. Tertiary veins ladder-like ..... *H. rudiformis*
- b. Tertiary veins dryobalanoid or subdryobalanoid. .... 2
- 2a. Secondary veins many (more than 20) ..... *H. mengerawan*
- b. Secondary veins few (8–12). .... 3
- 3a. Lamina silvery scaly beneath, domatia usually present ..... *H. cernua*
- b. Lamina glabrous beneath, domatia usually absent ..... 4
- 4a. Petioles glabrous, drying black, sometimes domatia present  
*H. dryobalanoides*
- b. Petioles hairy, drying greyish-silvery, domatia absent ..... *H. pedicellata*



B :

- 1a. Domatia present . . . . . 2
- b. Domatia absent . . . . . 3
- 2a. Petioles hairy, drying silvery, lamina silvery scaly beneath . . . . . *H. cernua*
- b. Petioles glabrous, drying black, lamina glabrous beneath . . . . . *H. dryobalanoides*
- 3a. Tertiary veins ladder-like . . . . . *H. rudiformis*
- b. Tertiary veins dryobalanoid . . . . . 4
- 4a. Secondary veins many (more than 20) . . . . . *H. mengerawan*
- b. Secondary veins few (7–12) . . . . . *H. pedicellata*

*Hopea cernua* Teijsm. & Binn., Nat. Tijd. Ned. Indië 29 (1867) 252. — Fig. 54

*Literature* — Ashton, Flora Malesiana I, 9 (1982) 398.

*Vernacular name* — Damar putih (M).

Trees up to 30 m tall, 60–90 cm in diameter. Bole straight, flying buttresses 1–3 m high. Bark becoming thickly flaky, brown-grey to black, outer bark corky, thick, lamellate with black and brown layers, fibrous, inner bark pale brown, finely lamellate, sapwood white or light yellow, distinct from the heartwood, 3–4(–10) cm thick, heartwood brownish light yellow, sometimes with light red lines. Damar white. Twigs terete, smooth. Stipules 4 mm long, 2 mm wide, strap-shaped, elliptic, falling off early. Petioles 7–9 mm long, slender. Leaves elliptic to ovate, 5–15 cm long, 2–5 cm wide, thinly leathery, silvery scaly beneath, domatia present, base wedge-shaped, apex acuminate, up to 6 mm long, venation dryobalanoid, secondary veins 10–12, prominent beneath. Calyx patent, sepals almost equal, narrowly ovate, glabrous, petals lanceolate, pubescent on parts exposed in bud, stamens 15–18, ovary ovoid, style short, base villous. Fruit pedicel to 2 mm long, 2 longer calyx lobes up to 6 cm long, c. 1 cm wide, 3 shorter ones to 1.5 cm long, nut glabrous, ovoid, apiculate.

*Habitat & Ecology* — Usually on fertile soils in mixed lowland Dipterocarp forest.

*Distribution* — Sumatra, Borneo.

*Uses* — Used for beams, columns and boards in house construction.

*Material* — S 439, S 539.

*Hopea dryobalanoides* Miq., Fl. Ind. Bat., Suppl. (1861) 492. — Fig. 55

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 402.

*Vernacular names* — Merawan berjangkang (M), mensega (D).

Trees up to 50 m tall, c. 70 cm in diameter. Bole cylindrical. Buttresses thin, steep, stiltroots present. Bark flaky or slightly fissured, inner bark pale brown, tinged pink, slightly lamellate, sapwood pale yellow. Damar often in tear-like stalactitic exudations, pale yellow. Twigs terete, glabrous. Stipules up to 2 mm long, falling off early. Petioles 5–10 mm long. Leaves ovate-lanceolate, 5–12 cm long, 1.5–4.5 cm wide, thinly leathery, base wedge-shaped, almost equal, apex long pointed, up to 2 cm long, secondary veins 8–12 pairs, usually with scattered domatia. Flowers:

**(Dipterocarpaceae)**

2 outer calyx lobes ovate, 3 inner lobes more or less circular, petals narrowly lanceolate, stamens 15, ovary ovoid, glabrous, style short, base setose. Fruit calyx glabrous, 2 longer lobes up to 6.5 cm long, c. 1.5 cm wide, spatula-shaped, pronouncedly twisted, 3 shorter lobes up to 8 mm long, c. 6 mm wide, base saccate, nut broadly ovoid, up to 10 mm long, c. 8 mm in diameter, glabrous.

*Habitat & Ecology* — Widespread, locally frequent.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Formerly an important producer of damar mata kucing.

*Material* — S 707.

***Hopea mengerawan*** Miq., Fl. Ind. Bat., Suppl. (1861) 492. — Fig. 56

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 400.

*Vernacular names* — Mengerawan (M), merawan (K).

Trees up to 50 m, up to 75 cm in diameter. Bole straight, flying buttresses 1–3 m high. Bark fissured, dark brown to black, outer bark thick, lamellate, inner bark light brown, tinged pink, sapwood pale. Damar yellow. Twigs terete, smooth. Stipules falling off early, becoming markedly recurved before falling. Petioles 9–20 mm long. Leaves elliptic to ovate, 10–15 cm long, 5–7 cm wide, leathery, drying yellowish brown, base broadly wedge-shaped, acumen up to 1.5 cm long, venation dryobalanoid, secondary veins many (more than 20). Calyx patent, petals sericeous on parts exposed in bud, stamens 15, ovary ovoid, glabrous, style long, villous at base. Fruits: pedicel to 2 mm long, 2 longer calyx lobes up to 7 cm long, c. 12 mm wide, 3 shorter ones to 6 mm long, nut glabrous, narrowly ovoid, apiculate.

*Habitat & Ecology* — In lowland Dipterocarp forest, on flat land and base of hills.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Usually used for beams, columns and boards in house construction.

*Material* — W 142, W 261, S 605.

***Hopea pedicellata*** (Brand.) Sym., Gard. Bull. Sing. 9 (1938) 327. — Fig. 57

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 408.

Trees up to 35 m tall, c. 50 cm in diameter. Bole twisted, buttresses usually present, sharp and more or less stilted. Bark blackish, smooth, finely lenticellate, outer bark dark brown, thin, inner bark thick, pink, sapwood pale yellow, hard, heartwood brown-pink. Damar clear. Twigs terete, minutely puberulous. Stipule small, linear, falling off early. Petioles 6–8 mm long. Leaves ovate-lanceolate, 4–9 cm long, 1–3.5 cm wide, base wedge-shaped, apex more or less long pointed, c. 1.5 cm long, venation dryobalanoid, secondary veins 8–12 pairs. Calyx glabrous, petals sericeous on parts exposed in bud, pale yellow, stamens 15, ovary cylindrical-conical, style short, glabrous. Fruit glabrous, 2 longer calyx lobes 3 cm long, 5 mm wide, spatula-shaped, base saccate, 3 shorter lobes c. 3 mm long, 3 mm wide, ovate, saccate, nut up to 6 mm long, c. 4 mm in diameter, ovoid.

*Habitat & Ecology* — Usually in hill forests up to 750 m altitude.

*Distribution* — Malay Peninsula, Borneo.

*Uses* — In Malaysia a minor source of damar mata kucing.

*Material* — W 514, W 596, AA 86.

*Hopea rudiformis* Ashton, Gard. Bull. Sing. 31 (1978) 30. — Fig. 58

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 409.

*Vernacular names* — Damar jankar (M), emang bahau (D).

Trees up to 35 m tall, c. 50 cm in diameter. Bark flaky, buttresses thin, sometimes stiltroots present. Twigs terete, pale tawny puberulent. Stipules falling off early, unknown. Petioles 8–13 mm long. Leaves ovate to broadly lanceolate, 6.5–14 cm long, 3.5–7.5 cm wide, thinly leathery, glabrescent, base broadly wedge-shaped, apex acuminate, acumen c. 1.5 cm long, venation ladder-like, veins 11–13 pairs. Flowers: stamens 15, ovary ovoid, style short, base ciliate. Fruit glabrous, 2 longer calyx lobes up to 9 cm long, 2 cm wide, broadly spatula-shaped, base saccate, 3 shorter lobes up to 8 mm long, up to 8 mm wide, ovate, reaching apex of nut and appressed to it, nut up to 8 mm long, up to 8 mm in diameter, ovoid.

*Habitat & Ecology* — Undulating land on deep well drained soil in lowlands, sometimes in freshwater swamps.

*Distribution* — Endemic in Sabah and Kalimantan.

*Material* — AA 114.

**SHOREA** Roxb. ex Gaertn. f., Fruct. 3 (1805) 48.

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 436.

Medium to large trees. Buttresses present, stiltroots absent. Inflorescence paniculate. Calyx lobes free, 3 outer lobes thicker, somewhat longer than inner lobes in flower, petals usually fused at base, sometimes free. Stamens 10 to numerous, filaments variable, strap- to needle-shaped, anthers almost globular to narrowly oblong, sterile tissue above the anthers vestigial to prominent, ovary tomentose, rarely glabrous, style with or without stylopodium. Fruits: 3 outer fruit calyx lobes usually much longer than inner two lobes, thin, spatula-shaped, or all lobes almost equal, base of lobes more or less thickened, expanded saccate. Nut free from calyx, pericarp splitting irregularly at germination. — Hundred and thirty-five species reported for Kalimantan.

*Uses* — The most important timber genus in the Asian humid tropics. Some species provide 'illipe' (tengkawang) nuts which contain fats used in the chocolate industry.

*Note* — We follow the subdivision of the genus according to Ashton; for practical reasons we use the groups distinguished in the sawmills and the timber market, which in most cases correspond to the sections of Ashton.

(Dipterocarpaceae)

KEY TO THE SECTIONS

- 1 a. Inner bark lamellate, heartwood white . . . sect. *Anthoshorea* (White meranti)  
*S. lamellata*
- b. Inner bark not lamellate, or if so, heartwood reddish . . . . . 2
- 2a. Sap- and heartwood very hard, bark scaly or flaky, never fissured  
sect. *Shorea* (Balau group)  
*S. seminis*, *S. laevis*
- b. Sap- and heartwood lighter, bark smooth or fissured . . . . . 3
- 3a. Inner bark greenish or bright yellow, damar blackish, heartwood yellowish  
sect. *Richetioides* (Yellow meranti)  
*S. gibbosa*, *S. macrobalanos*, *S. patoiensis*, *S. mujongensis*
- b. Inner bark reddish to yellowish brown, heartwood light to dark red  
sect. *Brachypterae* (Red meranti)  
*S. smithiana*, *S. parvistipulata*, *S. balangeran*,  
*S. coriacea*, *S. johorensis*, *S. pauciflora*  
sect. *Pachycarpae* (Red meranti)  
*S. pinanga*  
sect. *Mutica* (Red meranti)  
*S. leprosula*, *S. parvifolia*  
sect. *Ovalis* (Red meranti)  
*S. ovalis*

KEY TO THE SPECIES OF THE BALAU GROUP

- 1a. Lower leaf surface cream scaly or glabrous, leaves ovate to narrowly ovate-lanceolate, 5–10 cm long, 2.5–4 cm wide . . . . . *S. laevis*
- b. Lower leaf surface greyish scaly, leaves oblong-ovate to lanceolate, 9–18 cm long, 2.5–8 cm wide . . . . . *S. seminis*

KEY TO THE SPECIES OF THE YELLOW MERANTI GROUP

- 1a. Petioles stout (c. 4 mm thick), leaves 19–37 cm long, base heart-shaped, margin revolute . . . . . *S. macrobalanos*
- b. Petioles slender (1–2 mm thick), leaves up to 14 cm long, base never heart-shaped, margin revolute or not . . . . . 2
- 2a. Lower leaf surface tomentose . . . . . *S. gibbosa*
- b. Lower leaf surface glabrous . . . . . 3
- 3a. Margin revolute . . . . . *S. mujongensis*
- b. Margin not revolute . . . . . *S. patoiensis*



(Dipterocarpaceae)

Trees up to 30 m tall, in diameter. Buttresses up to 1.2 m high. Crown thin, open. Damar whitish-yellowish. Bark reddish white to reddish black, deeply fissured. Outer bark light or rusty red, sapwood reddish- or rusty-brown, heartwood dark red. Twigs slender, terete. Stipules 10–15 mm long, 3.5–7 mm wide, ovate, falling off early. Petioles 2–3 cm long. Leaves oblong-elliptic to lanceolate, 7–18 cm long, 3–8 cm wide, drying yellowish beneath, scaly, leathery, base wedge-shaped to obtuse, apex acuminate, up to 1.5 cm long, secondary veins 13–18 pairs, tertiary veins densely ladder-like. Petals narrowly oblong, stamens 15, ovary, ovoid, style columnar, pubescent at base. Fruit pedicel to 2 mm long, calyx sparsely pubescent, 3 longer lobes up to 5 cm long, c. 7 mm wide, spatula-shaped, two shorter lobes up to 1.5 cm long, c. 0.2 cm wide. Nut c. 6 mm long, c. 4 mm in diameter, ovoid, apiculate.

*Habitat & Ecology* — Locally common, often gregarious, in peat swamp and kerangas forests.

*Distribution* — Sumatra, Borneo.

*Uses* — In former times a major timber in Indonesian Borneo, now due to over-exploitation tall trees are almost extinct.

*Notes* — In many ways resembling *Shorea albida*, which is not found in the region.

Already very small trees flower and fruit abundantly, as do coppiced trees.

*Material* — AA 142, AA 149, v.B. 6061, P.K. 574.

*Shorea coriacea* Burck, Ann. Jard. Bot. Buitenzorg 6 (1887) 214. — Fig. 60

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 509 (Sect. *Brachypterae*).

*Trade names* — Red meranti, meranti merah.

*Vernacular name* — Lempung merkabang (M).

Trees up to 45 m tall, c. 1.5 m in diameter. Buttresses small, c. 1.5 tall and long. Damar bright yellow. Bark greyish brown, shallowly fissured, flaky. Outer bark dark brown, inner bark yellowish brown, sapwood pale yellow, heartwood dark red. Twigs stout, terete or slightly compressed, smooth or somewhat wrinkled. Stipules c. 20 mm long, c. 5 mm wide, narrowly oblong, falling off early. Petioles 2.5–4 cm long. Leaves ovate, 10–15 cm long, 5–8 cm wide, glabrous, leathery, lustrous, base almost peltate, apex acuminate, up to 1 cm long, margin revolute, secondary veins 16–20 pairs, tertiary veins densely ladder-like. Calyx densely grey pubescent outside, petals linear, stamens 15, ovary ovoid, style filiform, glabrous except setose base. Fruit pedicel to 2 mm long, calyx sparsely pubescent, 3 longer lobes up to 9 cm long, c. 1.5 cm wide, spatulate, two shorter lobes up to 3.5 cm long, 3–4 mm wide. Nut c. 18 mm long, c. 9 mm in diameter, ovoid, style remnant acute.

*Habitat & Ecology* — Usually found in heath forests on podsol, reported for East Borneo on ultrabasic.

*Distribution* — Endemic in Borneo.

*Uses* — A dark red meranti.

*Material* — W 491, AA 41.

*Shorea gibbosa* Brandis, J. Linn. Soc. Bot. 31 (1895) 99. — Fig. 61

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 482 (Sect. *Richetioides*).

*Trade names* — Yellow meranti, meranti kuning.

Trees usually more than 75 m tall when mature, up to 1.8 m in diameter. Buttresses numerous, large, up to 5 m tall, c. 4 m long. Crown conical. Damar black. Bark grey, fissured. Outer bark thin, brown, inner bark dull brown grading to lemon-yellow, sapwood dull greenish yellow. Twigs slender, rugulose. Stipules c. 3 mm long and c. 1 mm wide, narrowly elliptic, falling off early. Petioles 0.8–1.2(–1.5) cm long. Leaves ovate to lanceolate, 5–13 cm long, 2–6 cm wide, margin undulate, drying pale grey-green, glabrous, parchment-like, base almost equal, wedge-shaped, apex acuminate, up to 1.5 cm long, secondary veins 7–9 pairs, tertiary veins more or less net-like. Petals narrowly oblong, strongly twisted, stamens 15, ovary ovoid, style columnar, pubescent at base. Fruit pedicel to 2 mm long, calyx sparsely pubescent, 3 longer lobes up to 9 cm long, 2 cm wide, spatula-like, two shorter lobes up to 6 cm long, 0.5 cm wide. Nut c. 1.8 cm long, c. 1.2 cm in diameter, ellipsoid, densely buff pubescent, style remnant almost acute.

*Habitat & Ecology* — Locally common on deep fertile clay-rich soils.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Note* — A very variable species.

*Material* — S 437, S 546, S 551, S 552.

*Shorea johorensis* Foxw., Mal. For. Rec. 10 (1932) 236. — Fig. 62

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 513 (Sect. *Brachypterae*).

*Trade names* — Red meranti, meranti merah.

*Vernacular names* — Meranti kenuar (M), langko (D), pelepak (D), mentewohok (B).

Trees up to 75 m tall, up to 1.5 m in diameter. Bole straight. Buttresses steep, up to 2 m tall. Bark covered with thin papery scales, grey to dull-brown, old bark almost white due to decay, inner bark pink, fibrous, sapwood white, soft. Twigs slightly ribbed and compressed, pubescent. Stipules up to 3.5 mm long, lanceolate, falling off early. Petioles 1.5–2 cm long. Leaves ovate, 9–14 cm long, 4.2–7.5 cm wide, glabrous, parchment-like to thinly leathery, base more or less heart-shaped, apex shortly acuminate, up to 7 mm long, secondary veins 10–12 pairs, first 3–6 pairs usually with prominent scale-like domatia, the basal two pairs of which fused along the midrib on each side. Calyx lobes almost equal, slightly revolute towards the apex, petals narrowly lanceolate, stamens 15, ovary globular, style filiform, glabrous but for the base. Fruits: 3 longer calyx lobes up to 12 cm long, c. 2.3 cm wide, spatula-shaped, 2 shorter lobes up to 6.5 cm long, c. 0.6 cm wide, linear, saccate at base, nut broadly ovoid, up to 2 cm long, c. 1.5 cm in diameter, buff tomentose.

*Habitat & Ecology* — Common in East Borneo, on fertile soils on hillsides.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

(Dipterocarpaceae)

*Uses* — One of the best light red merantis, used for light constructional work.

*Note* — If sterile, *S. johorensis* can easily be confused with *S. pauciflora*, but the bark is different.

*Material* — W 454, AA 4, S 630, S 697.

*Shorea laevis* Ridley, Fl. Mal. Pen. 1 (1922) 232. — Fig. 63

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 461 (Sect. *Shorea*).

*Trade name* — Balau group.

*Vernacular names* — Bangkirai tanduk (M), bangkirai tembaga (M), jengan (B).

Trees up to 75 m high, up to 2.3 m in diameter. Buttresses distinct, short up to 1.8 m tall, 50–60 cm long. Crown rounded, with a few irregularly placed spreading main axes. Damar pale yellow. Bark surface dark brown, scaly. Outer bark usually thin, inner bark dull yellow, sapwood ochre, hard. Twigs slender, terete, glabrous. Stipules c. 8 mm long, c. 2 mm wide, narrowly lanceolate, falling off early. Petioles 1–1.5 cm long. Leaves ovate to narrowly ovate-lanceolate, 5–10 cm long, 2.5–4 cm wide, cream scaly or glabrous beneath, thinly leathery, base almost equal, broadly wedge-shaped, acumen up to 2 cm long, slender, secondary veins 11–14 pairs, very dense, tertiary veins densely ladder-like. Petals adhering together when falling, stamens c. 50, adhering to the base of petals, ovary conical, style short, glabrous. Fruit calyx greyish buff pubescent, 3 longer lobes up to 6.5 cm long, 1 cm wide, oblong, two shorter lobes up to 4 cm long, 0.5 cm wide. Nut c. 1.5 cm long, c. 0.9 cm in diameter, ovoid, style remnant to 4 mm long.

*Habitat & Ecology* — Gregarious on dry soils on ridges, almost always growing together with Ulin (*Eusideroxylon zwageri*, Lauraceae).

*Distribution* — Burma, Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is very hard and is used for heavy construction.

*Material* — W 550, W 627, W 654, W 693, S 174, S 175.

*Shorea lamellata* Foxw., Mal. For. Rec. 10 (1932) 278. — Fig. 64

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 492 (Sect. *Anthoshorea*).

*Trade names* — White meranti, meranti putih.

*Vernacular names* — Bangkirai lempung (M), anggelan tikus (M), awang batu (M, D), bunjau (D).

Trees up to 45 m tall, up to 1.8 m in diameter. Buttresses short, stout, up to 3 m tall, c. 2 m long. Damar clear. Bark grey, fissured. Outer bark thin, brown, inner bark dull brown grading to lemon-yellow, lamellate, sapwood dull greenish yellow without distinct heart. Twigs slender, rugulose. Stipules c. 3 mm long, c. 1 mm wide, narrowly elliptic, falling off early. Petioles 0.8–1.2(–1.5) cm long. Leaves ovate to lanceolate, 5–13 cm long, 2–6 cm wide, margin wavy, drying pale grey-green, glabrous, parchment-like, base almost equal, wedge-shaped, acumen up to 1.5 cm long, secondary veins 7–9 pairs, tertiary veins more or less net-like. Petals narrowly



(Dipterocarpaceae)

oblong, strongly twisted, stamens 15, ovary ovoid, style columnar, pubescent at base. Fruit pedicel to 2 mm long, calyx sparsely pubescent, 3 longer lobes up to 9 cm long, c. 2 cm wide, spatula-shaped, two shorter lobes up to 6 cm long, c. 0.5 cm wide. Nut c. 1.8 cm long, c. 1.2 cm in diameter, ellipsoid, densely buff pubescent, style remnant tapering.

*Habitat & Ecology* — Locally common on deep fertile clay-rich soils.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Suitable for indoor construction and plywood.

*Note* — A very variable species, easy to recognize from the lamellate inner bark.

*Material* — W 25, W 248, W 310.

***Shorea leprosula*** Miq., Fl. Ind. Bat., Suppl. (1861) 191, 487. — Fig. 65

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 540 (Sect. *Mutica*).

*Trade names* — Red meranti, meranti merah.

*Vernacular name* — Mengkorau (B).

Trees up to 60 m tall. c. 1 m in diameter. Buttresses prominent, but usually not very large, c. 1.5 m tall and long. Crown wide, umbrella-shaped. Damar yellow. Bark greyish brown, shallowly fissured, V-shaped. Outer bark dull purple brown, rather hard, brittle, inner bark fibrous, yellowish brown, sapwood pale, heartwood dark red. Twigs slender, terete, ridged when young, smooth. Stipules c. 10 mm long, c. 3.5 mm wide, oblong, falling off early. Petioles 1–1.5 cm long. Leaves elliptic to ovate, 8–14 cm long, 3.5–5.5 cm wide, cream scaly, thinly leathery, base obtuse, apex acuminate, up to 8 mm long, secondary veins 12–15 pairs, tertiary veins densely ladder-like, domatia confluent, at least in young trees present. Calyx densely pale brown pubescent outside. Petals narrowly oblong, stamens 15, ovary ovoid, style filiform, glabrous. Fruit pedicel to 2 mm long, calyx sparsely pubescent, 3 longer lobes up to 10 cm long, c. 2 cm wide, spatula-like, two shorter lobes up to 5.5 cm long, c. 0.3 cm wide. Nut c. 2 cm long, c. 1.3 cm in diameter, ovoid, pale buff pubescent, style remnant acute.

*Habitat & Ecology* — Common, sometimes abundant, on deep clay soils in mixed Dipterocarp forest below 700 m.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — A light red meranti which is quite important.

*Note* — It is the fastest growing red meranti up to about the twentieth year, but later surpassed by most species.

*Material* — W 453, W 554, AA 3, S 178, S 799.

***Shorea macrobalanos*** Ashton, Gard. Bull. Sing. 22 (1967) 202. — Fig. 66

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 473 (Sect. *Richetioides*).

*Trade names* — Yellow meranti, meranti kuning.

*Vernacular name* — Meranti engkabang (M).

(Dipterocarpaceae)

Medium to tall trees. Buttresses present. Twigs terete, becoming prominently warty. Stipules falling off early. Petioles 1.8–3.8 cm long. Leaves oblong, 19–37 cm long, 9–25 cm wide, leathery, base heart-shaped, apex shortly broadly acuminate, margin revolute, secondary veins 12–16 pairs. Calyx glabrous, inner 2 lobes smaller than outer 3, petals linear, stamens 10, ovary narrowly ovoid, style slender, glabrous. Fruit sessile, entirely glabrous, calyx lobes to 8 mm long, ovate, more or less wavy, not closely appressed to the nut, mounted on a to 1 cm in diameter, to 8 mm deep torus. Nut oblong, c. 5 cm long, c. 2.5 cm in diameter, shortly apiculate.

*Habitat & Ecology* — Rare, on clay-rich soils on undulating land and ridges.

*Distribution* — Endemic in Sarawak and E. Kalimantan.

*Material* — AA 80.

*Shorea mujongensis* Ashton, Gard. Bull. Sing. 22 (1967) 292. — Fig. 67

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 484 (Sect. *Richetioides*).

*Trade names* — Yellow meranti, meranti kuning.

Trees up to 50 m tall, up to 1 m in diameter. Buttresses present. Twigs terete. Stipules unknown. Petioles 10–16 mm long. Leaves ovate or elliptic, 6–14 cm long, 2.5–5.5 cm wide, thinly leathery, base wedge-shaped, apex acuminate, c. 8 mm long, margin revolute, secondary veins 8–13 pairs. Sepals ovate, petals unknown, stamens 15, ovary pear-shaped, style glabrous. Calyx lobes glabrescent, 3 longer one spatula-shaped, up to 7 cm long, c. 1.5 cm wide, 2 shorter ones up to 4.5 cm long, c. 0.7 cm wide, base tuberculate, nut narrowly ovoid, up to 2.2 cm long, pale buff pubescent.

*Habitat & Ecology* — On fertile soils up to 1100 m altitude.

*Distribution* — Endemic in Borneo.

*Note* — Closely related to *S. gibbosa*.

*Material* — W 387, W 393, S 414.

*Shorea ovalis* (Korth.) Blume, Mus. Bot. Lugd.-Bat. 2 (1852) 33. — Fig. 68  
subsp. *ovalis*

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 548 (Sect. *Ovalis*).

*Trade names* — Red meranti, meranti merah.

*Vernacular name* — Meranti lonjong (M).

Trees up to 60 m tall, c. 1.2 m in diameter. Buttresses prominent, rather sharp, small, up to 1.5 m tall, c. 1 m long. Crown with many rather small, radiating and slender branches. Damar opaque, pale olive-brown with a yellow crust. Bark grey-brown, V-section fissured, bark falling in rather narrow scales. Outer bark grey brown or dull purple brown with black portions, rather hard, inner bark fibrous, yellowish brown, sapwood pale yellow, heartwood dark red. Twigs stout, terete, becoming smooth. Stipules c. 13 mm long, c. 7 mm wide, ovate, more or less persistent. Petioles 7–9 mm long. Leaves oblong or narrowly ovate, 8–18 cm long, 3–7 cm wide,

(Dipterocarpaceae)

scabrid, leathery, base obtuse, apex acuminate, up to 8 mm long, margin revolute, secondary veins (20–)22–24 pairs, tertiary veins ladder-like. Calyx densely golden brown pubescent outside, petals narrowly oblong, stamens 50–70, ovary narrowly conical, style short, glabrous. Fruit calyx sparsely pubescent, 3 longer lobes up to 11 cm long, c. 1.4 cm wide, spatulate, two shorter lobes up to 6 cm long, c. 0.4 cm wide, linear. Nut c. 2.2 cm long, c. 1.3 cm in diameter, ovoid, densely rufous pubescent, style remnant acute.

*Habitat & Ecology* — Scattered in mixed lowland Dipterocarp forest below 700 m.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — A light red meranti, suitable for indoor construction and plywood.

*Notes* — This is one of the fastest growing red merantis although a slow grower in the earliest stages. Other subspecies not reported in the region.

*Material* — W 538, W 579, AA 62, S 688, P.K. 626.

*Shorea parvifolia* Dyer, Fl. Brit. India 1 (1874) 305.

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 546 (Sect. *Mutica*).

*Trade names* — Red meranti, meranti merah.

KEY TO THE SUBSPECIES

- 1 a. Leaves more or less glabrous beneath, domatia usually absent subsp. *parvifolia*
- b. Leaves sparsely scabrid pubescent beneath, domatia present subsp. *velutinata*

subsp. *parvifolia* — Fig. 69

*Vernacular names* — Meranti fabut (M), sawang putih (M), awang belah (D).

Trees up to 65 m tall, up to 1 m in diameter. Bole cylindrical, tapering. Buttresses short. Bark coarsely fissured, dark brown to dark reddish, damar opaque, sticky, inner bark fibrous, deep red, sapwood pale yellow, tinged pink towards the heartwood. Twigs glabrescent, terete. Stipule to 12 mm long, oblong to ovate, more or less persistent. Petioles 1–1.5 cm long. Leaves broadly ovate, 5–9 cm long, 2.5–5 cm wide, leathery, base more or less heart-shaped, apex acuminate, c. 1 cm long, margin slightly revolute, secondary veins 10–13 pairs. Flowers: 3 outer calyx lobes triangular-ovate, 2 inner lobes smaller, ovate, petals oblong, stamens 15, ovary ovoid, style short, glabrous. Fruits: 3 longer calyx lobes up to 9 cm long, c. 1.5 cm wide, spatula-shaped, 2 shorter lobes up to 3.5 cm long, 0.2 cm wide, linear, saccate at base. Nut ovoid, up to 14 mm long, c. 7 mm in diameter, buff pubescent.

*Habitat & Ecology* — Perhaps the commonest Dipterocarp in the region, on clay soils on hills below 800 m altitude.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — A very important timber tree, the main source of light red meranti.

*Material* — W 431, W 473, AA 23, S 795.

(Dipterocarpaceae)

subsp. *velutinata* Ashton, Gard. Bull. Sing. 20 (1963) 278. — Fig. 70

Differs from subsp. *parvifolia* mainly in the sparse scabrid hairs on the lower leaf lamina. All our collections show a pair of large pale scale-like domatia in the axils of the first pair of secondary veins.

*Habitat & Ecology* — Mainly coastal.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 492, AA 42, S 593.

*Shorea parvistipulata* Heim, Bull. Mens. Soc. Linn. Paris 2 (1891) 974.

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 508 (Sect. *Brachypterae*).

*Trade names* — Red meranti, meranti merah.

KEY TO THE SUBSPECIES

- 1a. Leaves silvery scaly beneath . . . . . subsp. *albifolia*
- 1b. Leaves not scaly beneath . . . . . subsp. *parvistipulata*

subsp. *parvistipulata* — Fig. 72

*Vernacular name* — Kenuar (M).

Trees up to 60 m tall, up to 2 m in diameter. Buttresses symmetrical, rounded, up to 5 m tall, up to 3 m long. Crown wide spreading. Damar cream. Bark surface blackish brown, thinly scaly flaky. Outer bark dark blackish brown, inner bark reddish brown, fibrous, sapwood pale yellow, heartwood red. Twigs slender, terete, smooth. Stipules c. 14 mm long, c. 7 mm wide, ovate, falling off early. Petioles 12–15 mm long. Leaves very variable in size and shape, more or less oblong, 6–20 cm long, 3–9 cm wide, scabrid, parchment-like, base heart-shaped, apex acuminate, up to 1 cm long, secondary veins 13–21 pairs, tertiary venation densely ladder-like. Petals lanceolate, stamens 15, ovary ovoid, style filiform, glabrous but for a pubescent ring at base. Fruit pedicel to 2 mm long, calyx glabrescent, 3 longer lobes up to 20 cm long, c. 2.5 mm wide, strap- to spatula-shaped, two shorter lobes up to 8 cm long, c. 0.4 cm wide. Nut c. 2.5 cm long, c. 2 cm in diameter, ovoid, style remnant filiform.

*Habitat & Ecology* — Widespread on clay rich soils and on alluvium, on hillsides and low ridges.

*Distribution* — Endemic in Borneo.

*Material* — W 499, AA 49, S 435, S 471, S 540.

subsp. *albifolia* Ashton, Gard. Bull. Sing. 31 (1978) 46. — Fig. 71

Differs from subsp. *parvistipulata* in the silvery scaly lamina undersurface.

*Habitat & Ecology* — Fertile soils on undulating land and periodically inundated alluvium.

*Distribution* — Endemic.

*Note* — Resembles *S. fallax*, which has not been found within our region!

*Material* — W 640, W 642, S 603, S 696.

*Shorea patoiensis* Ashton, Gard. Bull. Sing. 19 (1962) 302. — Fig. 73

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 476 (Sect. *Richetioides*).

*Trade names* — Yellow meranti, meranti kuning.

*Vernacular name* — Nyerakat (Berau).

Trees up to 40 m tall, up to 90 cm in diameter. Buttresses steep. Bark tawny brown, flaky, inner bark yellowish brown, sapwood pale yellow, heartwood brownish. Twigs slender, terete, glabrous. Stipule c. 8 mm long, oblong, glabrous but for the margin. Petioles 7–10 mm long. Leaves ovate, 5–8 cm long, 2–3.5 cm wide, parchment-like, frequently sickle-shaped, base broadly wedge-shaped, apex acuminate, c. 1 cm long, secondary veins 7–9 pairs. Calyx lobes very small, more or less circular, the inner two something thinner, petals linear, overlapping, forming a cup at base, stamens 15, ovary ovoid, style short, glabrous. Fruit calyx shorter than nut, lobes broadly ovate, 3–5 mm long, almost equal, more or less appressed to the base of the nut and united at the base forming a cup, c. 5 mm in diameter. Nut oblong-ellipsoid, c. 15 mm long, striated, glabrescent, with a minute style remnant.

*Habitat & Ecology* — On fertile, clay rich soils, on hills below 500 m altitude.

*Distribution* — Endemic in Borneo.

*Material* — W 452, AA 2, S 691.

*Shorea pauciflora* King, J. As. Soc. Beng. 62, ii (1893) 116. — Fig. 74

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 511 (Sect. *Brachypterae*).

*Trade names* — Red meranti, meranti merah.

Trees up to 45 m tall, up to 1 m in diameter. Bole straight, cylindrical. Buttresses small. Bark deeply fissured, dark grey, inner bark red. Twigs terete, glabrescent. Stipules hastate, up to 13 mm long, falling off early. Petioles 1.3–1.8 cm long. Leaves ovate, 9–15 by 4–5.5 cm, glabrous, thinly leathery, base broadly wedge-shaped, apex acuminate, up to 1.2 cm long, secondary veins 8 or 9 pairs, tertiary venation ladder-like. Calyx densely pale yellowish buff pubescent, petals oblong, stamens 15, ovary ovoid to conical, style glabrous. Fruit almost sessile, 3 longer calyx lobes up to 9 by c. 1.5 cm, spatula-shaped, 2 shorter lobes up to 5 by c. 0.5 cm, linear, base thickened, saccate. Nut broadly ovoid, c. 1.4 cm in diameter.

*Habitat & Ecology* — Usually on undulating land and hills in fertile soils, sometimes common.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — A valuable, heavy red meranti.

*Material* — W 428, W 621, S 242, S 503, S 710.

*Shorea pinanga* Scheff., Nat. Tijd. Ned. Indië 31 (1870) 350. — Fig. 75

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 526 (Sect. *Pachycarpeae*).

*Trade names* — Red meranti, meranti merah.

*Vernacular names* — Tengawang buah (M), orai (B).

**(Dipterocarpaceae)**

Trees up to 45 m tall, up to 1 m in diameter. Bole straight, cylindrical. Buttresses small. Bark smooth, scaly to flaky, hooped, dark grey. Twigs glabrescent, compressed. Stipules hastate, up to 5 cm long, almost persistent. Petioles 1.5–2 cm long, slender. Leaves elliptic to narrowly ovate, 11–24 cm long, 4–9 cm wide, glabrous, thinly leathery, base wedge-shaped to more or less heart-shaped, apex acuminate, c. 1.5 cm long, secondary veins 10–20 pairs, tertiary venation ladder-like. Calyx glabrous or pubescent, lobes almost equal, linear, petals linear-lanceolate, stamens 15, ovary almost globular, style long, glabrous. Fruit calyx glabrescent, 3 longer lobes up to 28 cm long, c. 3.5 cm wide, spatula-shaped, 2 shorter lobes up to 17 cm long, c. 1.2 cm wide, base thickened, saccate. Nut broadly ovoid, c. 2.3 cm in diameter, buff pubescent.

*Habitat & Ecology* — Locally common on clay-rich soils, especially on ridges below 700 m altitude.

*Distribution* — Endemic in Borneo.

*Uses* — Important source of plywood timber and a good producer of illipe nuts.

*Material* — S 450.

***Shorea seminis*** (De Vriese) Sloot. in Merr., Pl. Elm. Born. (1929) 204. — Fig. 76

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 451 (Sect. *Shorea*).

*Trade name* — Balau group.

*Vernacular names* — Meranti pakik (M), utang keladen (D), kawang (B).

Trees up to 55 m high, up to 1.2 m in diameter. Bole usually short, often twisted. Buttresses distinct, short and sharp, or up to 3 m tall, 4.5 m long. Crown rounded, spreading widely, dense, damar never observed. Bark surface dark brown with lighter patches, rather smooth but closely lenticellate, or rough with scales, not fissured, older trees scaling in rather large flakes. Outer bark usually thin, inner bark dull brown, sapwood pale yellow, heartwood dark brown. Twigs slender, frequently ribbed when young. Stipules c. 7 mm long, c. 3.5 mm wide, oblong, falling off early. Petioles 1–1.5 cm long. Leaves oblong-ovate to lanceolate, 9–18 by 2.5–8 cm, glabrous or greyish scaly beneath, thinly leathery, base rounded or acute, sometimes unequal, apex acuminate, 0.8–2 cm long, narrow, secondary veins 9–15 pairs, rather straight, tertiary veins densely ladder-like. Calyx lobes almost equal, ovate, obtuse, the inner 2 somewhat narrower and thinner than the outer 3, corolla hardly twisted, stamens 30–40, ovary conical to hourglass-shaped, style short, glabrous. Fruit calyx greyish buff pubescent, lobes almost equal, up to 2 by 1.8 cm, circular. Nut c. 1 cm in diameter, ovoid or globular, style remnant to 12 mm long, stout.

*Habitat & Ecology* — Alluvium banks of sluggish rivers, often gregarious.

*Distribution* — Borneo, Philippines.

*Uses* — The fruits are prepared as a source of illipe butter. The timber is very hard and is used for all constructions where strength is required.

*Note* — The seeds are buoyant and are adapted to distribution by water.

*Material* — W 418, W 443, W 533, S 424.

*Shorea smithiana* Sym., Gard. Bull. Sing. 9 (1938) 345. — Fig. 77

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 503 (Sect. *Brachypterae*).

*Trade names* — Red meranti, meranti merah.

*Vernacular names* — Meranti lempung bulu (M), damar lahung (M, D), putang harputup (D), merembung (B).

Trees up to 55 m tall, c. 1.5 m in diameter. Buttresses large, relatively thin, up to 3.5 m tall, c. 2 m long. Crown very open. Damar clear to yellow. Bark yellowish brown, shallowly fissured. Outer bark dark brown, inner bark yellow, fibrous, sapwood pale yellow, heartwood bright pink. Twigs stout, ribbed, smooth, glabrous. Stipules c. 20 mm long, c. 6 mm wide, broadly hastate, falling off early. Petioles 2.2–2.8 cm long. Leaves broadly obovate to oblong or ovate, 12–20 cm long, 6.5–11.5 cm wide, drying grey beneath, scabrid, leathery, base more or less heart-shaped, apex acuminate, up to 1.5 cm long, secondary veins 14–17 pairs, tertiary veins ladder-like, well spaced. Petals narrowly oblong, stamens 22–26, ovary narrowly pear-shaped, style cylindrical, glabrous. Fruit calyx glabrescent, 3 longer lobes up to 20 cm long, c. 2.8 mm wide, narrowly spatula-shaped, two shorter lobes up to 13 cm long, c. 0.9 cm wide. Nut c. 2.7 cm long, c. 1.8 cm in diameter, ovoid, style remnant tapering.

*Habitat & Ecology* — Frequent on deep sandy clay soils on undulating land below 400 m altitude.

*Distribution* — Endemic in Borneo.

*Uses* — A light red meranti for many purposes.

*Material* — W 510, W 543, W 653, AA 49, S 176, S 435, S 451.

VATICA L., Mant. 2 (1771) 152.

Small to large trees, bole frequently bent. Buttresses thick, rounded, small. Bark usually grey-mottled, smooth, hooped, occasionally scroll-marked. Damar yellowish, translucent. Leaf venation more or less net-like, never truly ladder-like, glands present at the junction of two secondary veins. Petioles not thickened at apex. Inflorescences racemose, sometimes partially cymose. Calyx lobes valvate, almost equal, petals free at base, stamens 15, in 3 whorls, single stamens alternating with pairs, filaments short, dilated at base, sterile tissue above the anthers short, rarely as long as the anthers, ovary broadly ovoid, superior or semi-inferior, pubescent, the style short, stigma prominent, 3-lobed. Fruit calyx variable. Nut variable. Fruit wall splitting along three lines at germination. — Thirty-five species reported for Kalimantan.

*Uses* — A hard, semi-durable timber. As the trees are usually small, the wood is used locally for house posts and other construction work.

*Note* — The genus can easily be recognized by the presence of glands on the lower leaf surface.

(Dipterocarpaceae)

KEY TO THE SPECIES

A: *Sterile specimens*

- 1a. Twigs compressed . . . . . 2
- b. Twigs terete . . . . . 3
- 2a. Leaves scabrid below, veins 22–25 pairs . . . . . *V. javanica* subsp. *scaphifolia*
- b. Leaves not scabrid below, veins 12–15 pairs . . . . . *V. oblongifolia*
- 3a. Petioles usually more than 2 cm long, 3–4 mm in diameter, veins 15–25 pairs  
*V. rassak*
- b. Petioles usually not more than 1.2 cm long, up to 2 mm in diameter, veins 5–12  
pairs . . . . . 4
- 4a. Petioles 2–4 mm long . . . . . *V. venulosa*
- b. Petioles c. 1 cm long . . . . . 5
- 5a. Young twigs and petioles scabrid, veins 8–12 pairs . . . . . *V. odorata*
- b. Young twigs and petioles not scabrid, veins 5–7 pairs  
*V. umbonata* / *V. pauciflora*

B: *Fruiting specimens*

- 1a. Fruit calyx lobes equal . . . . . 2
- b. Fruit calyx lobes unequal . . . . . 6
- 2a. Fruits calyx lobes corky, fused with each other and with the nut, forming a cup  
enclosing it . . . . . *V. umbonata*
- b. Calyx lobes not as above . . . . . 3
- 3a. Calyx lobes more or less heart-shaped, somewhat revolute at base, not reflexed,  
more or less concealing the nut . . . . . *V. venulosa*
- b. Calyx lobes not heart-shaped, nut completely exposed . . . . . 4
- 4a. Nut ovoid, generally coming to exceed 2.5 cm, pericarp thick, corky warty 5
- b. Nut smooth . . . . . *V. oblongifolia*
- 5a. Fruit sepals to 5 mm long, broadly ovate to almost circular, appressed to the  
base of the nut . . . . . *V. pauciflora*
- b. Fruit sepals up to 12 mm long, reflexed, recurved . . . . . *V. rassak*
- 6a. Twigs terete, fruit calyx lobes more or less patent . . . . . *V. odorata*
- b. Twigs compressed, ripe fruits unknown . . . . . *V. javanica* subsp. *scaphifolia*

*Vatica javanica* Sloot., Bull. Jard. Bot. Buitenzorg III, 16 (1940) 451.

var. *scaphifolia* (Kosterm.) Ashton, Gard. Bull. Sing. 31 (1978) 22. — Fig. 78

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 362.

Trees up to 40 m tall, up to 70 cm in diameter. Bole cylindrical. Bark scaly, grey-brown. Twigs compressed at first and ribbed, becoming terete, stout, scabrid. Petioles 2–3 cm long. Leaves more or less prominently boat-shaped with the lower surface concave, elliptic oblong or obovate, 13–25 cm long, 6–10 cm wide, thinly leathery, base more or less heart-shaped, apex acuminate, c. 1.5 cm long, secondary



(Dipterocarpaceae)

veins 22–25 pairs, distinctly raised between veins. Panicles up to 12 cm long, terminal or axillary, sepals narrowly lanceolate, unequal, flowers otherwise typical. Fruit pedicels to 8 mm long, calyx lobes unequal, free to base, 2 longer lobes up to 7.5 cm long, c. 1.7 cm wide, spatula-shaped, 3 shorter lobes up to 3 cm long, c. 0.7 cm wide, lanceolate. Nut globular, mature ones unknown.

*Habitat & Ecology* — Locally frequent in mixed lowland Dipterocarp forest.

*Distribution* — As yet only known from the Balikpapan-Samarinda area.

*Note* — *Vatica javanica* Sloot. var. *javanica* only known from West Java.

*Material* — W 784 (sterile!).

*Vatica oblongifolia* Hook. f., Trans. Linn. Soc. 23 (1860) 160. — Fig. 79

subsp. *oblongifolia*

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 355.

*Vernacular name* — Resak daun panjang (M).

Trees up to 35 m tall, up to 50 cm in diameter. Bark smooth, hooped, inner bark brownish or purple brownish with pale yellow streaks. Twigs compressed, vinous, cinereous. Stipules oblong, up to 4.5 cm long. Petioles 2.5–5 cm long. Leaves oblong to obovate, 10–31 cm long, 4.5–10 cm wide, base wedge-shaped, apex acuminate, c. 1 cm long, leathery, secondary veins 10–18 pairs. Panicle to 8 cm long, terminal. Flowers typical. Fruit pedicel up to 8 mm long, calyx lobes equal, triangular, c. 3 cm long, c. 2 cm wide, thickly leathery, apex reflexed. Nut globular, up to 2 cm in diameter, faintly 3-sulcate.

*Habitat & Ecology* — On dry ridges near the coast or along streams in lowland primary forest.

*Distribution* — Endemic in Borneo.

*Material* — S 692.

*Vatica odorata* (Griff.) Sym., J. Mal. Br. Roy. As. Soc. 19 (1941) 156.

subsp. *odorata* — Fig. 80

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 360.

*Vernacular name* — Resak biabas (M).

Trees up to 35 m tall, up to 40 cm in diameter. Bole often twisted. Twigs terete, glabrous rugose. Stipules oblong, up to 8 mm long. Petioles 8–12 mm long. Leaves narrowly elliptic to ovate, 8–16 cm long, 3–5.5 cm wide, thinly leathery, base wedge-shaped, apex acuminate, up to 8 mm long, secondary veins 11–15 pairs. Panicles up to 7 cm long, terminal or axillary. Flowers typical. Fruit pedicel c. 3 mm long, lobes united in an up to 5 mm deep, to 8 mm in diameter cup at base, 2 longer lobes up to 5.5 cm long, c. 1.5 cm wide, spatula-shaped, 3 shorter lobes up to 1.5 c long, c. 4 mm wide, hastate. Nut globular, c. 7 mm in diameter, tomentose, the basal half fused with the calyx cup.

(Dipterocarpaceae)

*Habitat & Ecology* — Coastal areas.

*Distribution* — Indochina, S. China, Thailand, Malay Peninsula, Borneo.

*Material* — W 549, W 1016, S 181, S 588.

*Vatica pauciflora* (Korth.) Blume, Mus. Bot. Lugd.-Bat. 2 (1852) 31. — Fig. 81

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 351.

*Vernacular name* — Resak rawa (M).

Trees, up to 30 m tall, up to 45 cm in diameter. Twigs terete, glabrescent, not scabrid. Stipules up to 8 mm long, linear, becoming reflexed. Petioles 10–18 mm long. Leaves elliptic lanceolate, 6.5–20 cm long, 2.2– 8 cm wide, thinly leathery, base wedge-shaped, apex acuminate, up to 1.5 cm long, secondary veins 5–7 pairs. Panicle up to 9 cm long, terminal or almost terminal. Flowers typical. Fruit pedicels up to 7 mm long, calyx lobes up to 5 mm in diameter, hemispherical, more or less fused with the impressed base of the nut. Nut ovoid, c. 3 cm long, almost acute, with 3 distinct furrows, pericarp thick, corky, warty.

*Habitat & Ecology* — Common in fresh water swamps and on banks along rivers.

*Distribution* — Thailand, Malay Peninsula, Sumatra, new record for E. Kalimantan.

*Note* — Indistinguishable from *V. umbonata* if sterile, it is nevertheless consistently distinguishable by the fruit calyx.

*Material* — AA 593, W 307.

*Vatica rassak* (Korth.) Blume, Mus. Bot. Lugd.-Bat. 2 (1852) 31. — Fig. 82

*Literature* — Ashton in Flora Malesiana. I, 9 (1982) 353.

*Vernacular name* — Resak irian (M).

Trees up to 40 m tall, up to 50 cm in diameter. Bole straight, base fluted and with short buttresses. Bark non-fissured, with horizontal hoops, light-coloured, outer bark brown, thin, inner bark light dull yellowish brown, very fibrous, white near cambium, sapwood white, soft. Twigs terete, stout, stipule scars prominent. Stipules c. 14 mm long, 4 mm wide, strap-shaped, almost acute, almost persistent. Petioles 2–2.5 cm long, stout. Leaves oblong to narrowly elliptic, 13–32 cm long, 5–11 cm wide, thickly leathery, base broadly wedge-shaped to more or less heart-shaped, apex acuminate, c. 1.5 cm long, secondary veins 16–20 pairs. Flowers typical. Fruit pedicel 3 mm long, calyx lobes up to 16 mm long, triangular, acute, reflexed, recurved. Nut up to 7 cm long, c. 4.5 cm in diameter, oblong with 3 superficial furrows, fruit wall thick, woody.

*Habitat & Ecology* — Usually on riverbanks, also on top of hills.

*Distribution* — Sulawesi, Borneo, Philippines, Maluku, New Guinea.

*Note* — A very variable species, the fruits from E. Kalimantan are usually bigger than those from other areas.

*Material* — W 340, W 441.

*Vatica umbonata* (Hook. f.) Burck, Ann. Jard. Bot. Buitenzorg 6 (1887) 232.

subsp. *umbonata* — Fig. 83

*Literature* — Ashton, in Flora Malesiana I, 9 (1982) 349.

*Vernacular name* — Resak gunung (M).

Trees up to 25 m high, up to 35 cm in diameter. Bole cylindrical, buttresses absent. Bark non-fissured, brown, inner bark dull yellow. Sapwood yellowish. Twigs terete, shortly sparsely pale grey-brown puberulent, persistent only on buds and stipules. Stipules up to 4 mm long, 2 mm wide, hastate, almost acute, early falling. Petioles 7–15 mm long. Leaves elliptic-ovate, 8–16 cm long, 3–6.5 cm wide, leathery, base broadly wedge-shaped, apex obtuse or shortly acuminate, secondary veins 7 or 8 pairs. Panicle up to 12 cm long, axillary or terminal, falling apart before maturity. Flowers typical. Fruit pedicel 2–5 mm long, nut ovoid up to 3 cm in diameter, warty, calyx united to basal half only and apices reflexed, fused to nut, nut 3-grooved, opening while germinating with 3 valves. — Saplings: Leaves with 10–12 pairs of secondary veins and more pronounced tertiary veins.

*Habitat & Ecology* — Apparently usually on or near riverbanks.

*Distribution* — Malay Peninsula, Borneo, Philippines.

*Material* — W 311, W 391, W 775, W 955, S 411

*Vatica venulosa* Blume, Mus. Bot. Lugd.-Bat. 2 (1852) 32. — Fig. 84

*Literature* — Ashton in Flora Malesiana I, 9 (1982) 350.

*Vernacular names* — Resak bangsa (M), resak putih (M), resak seluang (M).

Trees up to 35 m tall, up to 45 cm in diameter. Bole cylindrical, buttresses small. Twigs terete, more or less persistently densely shortly pale pink-brown puberulent. Stipules to 5 mm long, hastate, falling off early. Petioles 5–9 mm long. Leaves elliptic to ovate-lanceolate, 4–12 cm long, 1.5–5 cm wide, thinly leathery, base wedge-shaped, apex shortly acuminate, secondary veins 7–12 pairs. Panicle short, up to 3 cm long, terminal or axillary. Flowers typical. Fruit pedicel up to 2 mm long, hidden in the bases of the calyx, calyx lobes almost equal, c. 3 cm long, c. 1.3 cm wide, ovate-oblong, acute, revolute, bases heart-shaped, nut up to 1 cm in diameter, globular, completely hidden by, but free from, the calyx, style remnant up to 1.5 cm long, acute.

*Habitat & Ecology* — Occurs very locally, on alluvium riverbanks and fresh water swamp.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo.

*Note* — Difficult to distinguish from *V. umbonata* on leaf characters only, easy to recognize by its peculiar fruits.

*Material* — W 260, W 413, W 612, W 992, S 418, S 1025, P.K. 547.

(Ebenaceae/Elaeocarpaceae)

## 22 EBENACEAE

*Diospyros* L., Sp. Pl. (1753) 1057.

*Diospyros borneensis* Hiern, Trans. Cambridge Phil. Soc. 12 (1873). — Fig. 85

*Literature* — Ng, A taxonomic study of the Ebenaceae with a special reference to Malesia. Oxford PhD Thesis (1971).

*Vernacular name* — Kayu arang (M).

Trees up to 25 m tall, up to 40 cm in diameter. Bole straight, not buttressed, often slightly fluted, bark black to brown, hard, brittle, fissured, scaly. Inner bark without exudate. Stipules absent. Leaves simple, alternate, entire, broadly ovate to elliptic, 15–20 cm long, 7–10 cm wide, base wedge-shaped, apex acuminate, glabrous below, secondary veins 8–12 pairs, usually looping near margin, often with black glands below. Flowers in axillary clusters, actinomorphic, usually male or female, rarely bisexual, 5-merous, calyx enlarged in fruit, petals united at base, lobes overlapping in bud, stamens 18, ovary superior, 2 to many-celled, fruit a berry with 1 to many seeds.

*Habitat & Ecology* — Very common in primary and secondary forest, on hillsides or ridges.

*Distribution* — Hainan, Malay Peninsula, Sumatra, Borneo. Of the genus *Diospyros* c. 100 species are reported for Kalimantan.

*Note* — The genus can easily be recognized by its black bark.

*Material* — W 159, S 204, S 403, S 638, S 791, v.B. 5922.

## 23 ELAEOCARPACEAE

Small to very large trees. Stipules present, in young growth at least. Leaves simple, spiral or alternate, usually toothed, often with domatia. Petioles usually thickened at apex. Inflorescence a raceme or a cyme. Flowers usually bisexual, actinomorphic, 4- or 5-merous, sepals free, petals free, stamens many, basifixed, disc present, ovary superior, 2–5-celled. Fruit a drupe or capsule.

*Uses* — Presently the wood of the family is non-commercial.

### KEY TO THE GENERA

- 1a. Leaves pinnately veined, margin toothed in mature stage, flowers in racemes, stamens in 5 groups, fruit a drupe, usually blue at maturity, endocarp bony, sculptured (old leaves turning red) . . . . . *Elaeocarpus*
- b. Leaves palmately veined at base, margin entire in mature stage, flowers in cymes, stamens many, in a ring, fruit a big, woody, dehiscent capsule with arilate seeds . . . . . *Sloanea*

ELAEOCARPUS L., Sp. Pl. (1753) 515.

*Vernacular names* — Mendang (M), mentanahan (K).

Small to very large trees. Leaves toothed, withering red. Inflorescence a raceme, axillary, never terminal. Petals toothed or fimbriate. Fruits small to large drupes, with a hard stone containing 1–5 seeds, ripening usually blue-green, blue-grey or yellowish green, rarely red (*E. glaber*). — Sixty-five species reported for Kalimantan.

KEY TO THE SPECIES

- 1 a. Leaves velvety to the touch . . . . . 2
- b. Leaves glabrous or if hairs present confined to main veins . . . . . 3
- 2 a. Stipules leafy, palmately 3–5-lobed, falling off early, on vegetative shoots sometimes up to 5 cm long; petals with many linear divisions, more or less glabrous; fruits more than 1 cm long . . . . . *E. stipularis*\*
- b. Stipules linear; petals more or less undivided, densely short-hairy; fruits up to 1 cm long . . . . . *E. cupreus*
- 3 a. Petioles short (up to 1.2 cm long), not thickened, leaves dotted with scabby pustules or pimples . . . . . *E. angustifolius*\*
- b. Petioles long (at least 2.5 cm long), thickened or not, leaves not dotted . . . . . 4
- 4 a. Pneumatophores present, petioles not thickened, leaf-apex blunt, often notched, flowers large, c. 2 cm in diameter . . . . . *E. macrocerus*
- b. Pneumatophores absent, petioles thickened, leaf-apex pointed, flowers up to 1 cm in diameter . . . . . 5
- 5 a. Largest leaves on a twig not wider than 5.5 cm, petioles slender (c. 1 mm in diameter), small treelet usually not exceeding 7 m . . . . . *E. griffithii*\*
- b. Larger leaves exceeding 5.5 cm in width, petioles stout (c. 2–3 mm in diameter) . . . . . 6
- 6 a. Petioles up to 2.5 cm long, leaves 8–13 cm long, fruits ellipsoid, warty, red, edible . . . . . *E. glaber*
- b. Petioles 3.5–10 cm long, leaves 12–20 cm long, fruits globular, smooth, blue . . . . . *E. valetonii*

*Elaeocarpus cupreus* Merr., J. Str. Br. Roy. As. Soc. 17 (1917) 193.

*Vernacular name* — Mentanahan (K).

Trees up to 25 m tall, up to 20 cm in diameter. Buttresses steep. Bark light brown to greyish, smooth, inner bark pale orange, yellow or brown, granular, sapwood yellowish. Petioles 2.5–6 cm long, thickened at apex. Leaves elliptic, 9–17 cm long, 3–7.5 cm wide, base wedge-shaped, apex acuminate, velvety, margin vaguely toothed, secondary veins 9–12 pairs, tertiary veins transverse. Racemes 9–13 cm long. Flowers 5-merous, small, c. 7 mm in diameter, petals c. 7 mm long, hairy all over, not divided into segments, stamens more than 40, ovary hairy. Fruits ellipsoid, c. 1.2 cm long, c. 0.9 cm in diameter, smooth, glabrous.

(*Elaeocarpaceae*)

*Habitat & Ecology* — In primary lowland forest.

*Distribution* — Endemic in Borneo.

*Material* — W 103, W 323, W 695, W 834.

*Elaeocarpus glaber* Blume, Bijdr. (1825) 122. — Fig. 86

*Vernacular name* — Bengkinang (K).

Trees up to 25 m tall, up to 20 cm in diameter. Stiltroots present. Bark greyish, smooth, inner bark pale orange, yellow or brown, hard, sapwood yellowish. Petioles c. 2.5 cm long, thickened at apex. Leaves elliptic, 8–12 cm long, 4–7.5 cm wide, base wedge-shaped, apex acute, glabrous, margin toothed, secondary veins 5–7 pairs, tertiary venation net-like. Racemes 9–15 cm long. Flowers 5-merous, small, c. 7 mm in diameter, petals c. 7 mm long, scarcely hairy, much divided, stamens more than 40, ovary hairy. Fruits ellipsoid, 2–3.5 cm long, c. 1.5 cm in diameter, tuberculate, glabrous, red when ripe.

*Habitat & Ecology* — In primary and secondary lowland forest.

*Distribution* — Sumatra, Java, Borneo.

*Uses* — The yellow middle layer of the fruit wall is edible and the fruits are sold at local markets.

*Material* — AA 417, AA 556, v.B. 6205.

*Elaeocarpus macrocerus* (Turcz.) Merr., J. Arnold Arbor. 32 (1951) 183.

*Vernacular name* — Bengkinang rawa (K).

Trees up to 45 m tall, up to 70 cm in diameter. Buttresses, stiltroots and pneumatophores present. Bark light brown to greyish, smooth or cracked, inner bark pale orange, yellow or brown, granular, sapwood white. Petioles 2.5–3 cm long, not thickened. Leaves obovate, 5–16 cm long, 2.5–6.5 cm wide, base wedge-shaped, apex blunt, notched, glabrous, margin toothed, secondary veins 4–10 pairs, tertiary veins vaguely transverse. Racemes 1–5 cm long. Flowers 5-merous, large, c. 2 cm in diameter, petals 1–1.5 cm long, with some hairs, much divided, stamens more than 40, ovary hairy. Fruits ellipsoid, c. 3 cm long, c. 2.5 cm in diameter, smooth, glabrous.

*Habitat & Ecology* — Locally common in tidal swamps and on riverbanks near the coast.

*Distribution* — Malay Peninsula, Sumatra, Borneo, Philippines.

*Material* — AA 590, v.B. 6206.

*Elaeocarpus valetonii* Hochr., Pl. Bogor. Exsicc. (1905) 29.

var. *valetonii*

*Vernacular name* — Bengkinang gunung (K).

(Elaeocarpaceae/Euphorbiaceae)

Trees up to 30 m tall, up to 40 cm in diameter. Buttresses steep. Bark reddish brown, smooth, inner bark fibrous, brownish, hard, sapwood white. Petioles 5–10 cm long, thickened at apex. Leaves ovate to elliptic, 12–20 cm long, 5–11 cm wide, the base broadly wedge-shaped to slightly heart-shaped, apex acute, glabrous, margin toothed, secondary veins 8–10 pairs, tertiary venation net-like. Racemes 8–10 cm long. Flowers 5-merous, small, c. 1 cm in diameter, petals 0.8 cm long, hairy inside, much divided, stamens less than 25, ovary hairy. Fruits almost globular, c. 2 cm in diameter, smooth, glabrous.

*Habitat & Ecology* — In primary and secondary lowland forest.

*Distribution* — Sumatra, Borneo.

*Material* — W 216, W 325, W 558, W 731, AA 107, S 1048.

SLOANEA L., Sp. Pl. (1753) 512.

*Sloanea javanica* (Miq.) K. Schum. in Engl., Nat. Pflanzenfam. 2, 6 (1890) 5. — Fig. 87

*Literature* — Coode, Kew Bull. 38 (1983) 377.

*Vernacular name* — Sarang (M).

Trees up to 25 m tall, up to 55 cm in diameter. Bole columnar, often fluted, buttresses large, up to 5 m tall. Bark smooth to scaly, lenticellate. Inner bark pink to red-brown. Wood white. Leaves spiral, elliptic, 11–29 cm long, 7–16 cm wide, base rounded to more or less heart-shaped, apex rounded or shortly acuminate, secondary veins 6–9 pairs, palmately veined at base. Petioles 2–7.5 cm long. Flowers in cymes, usually 4-merous, stamens numerous, ovary 3- or 4-celled, seated on a disc. Fruits oblong, 4.5–7 cm long, smooth, woody, capsular, longitudinally dehiscent into 3 or 4 valves. Seeds 1–3 in each cell, pale yellow to dark brown, covered by a red aril.

*Habitat & Ecology* — Common on sandy to loamy soils, also on limestone.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi.

*Material* — W 589.

## 24 EUPHORBIACEAE

Small to medium-sized trees. Bark usually smooth, inner bark rarely with white or red latex. Stipules nearly always present. Leaves simple, entire or variously lobed or toothed, usually spiral, often with glands on petiole or at base of lamina and elsewhere. Petioles often thickened at apex. Flowers unisexual (male or female flowers on the same or on different plants), usually tiny, sepals 3–5, petals generally absent, stamens usually numerous, free or united, ovary superior, usually 3-celled, style usually 3-armed, fruit often capsular. — Thirty-two genera reported for Kalimantan.

*Note* — The family is hard to characterize; the key below is tentative.

(Euphorbiaceae)

KEY TO THE GENERA

- 1 a. Leaves alternate, on spreading branches, resembling compound leaves, fruit a many-celled capsule, crowned by the unbranched persistent style *Glochidion*\*
- b. Leaves spiral or opposite, fruit different . . . . . 2
- 2 a. Plants with white or yellowish milksap . . . . . 3
- b. Plants without milksap, sometimes red exudate . . . . . 4
- 3 a. Sap white, leaves round with basal veins, turning red when old, inflorescence an erect raceme with numerous male flowers and often a single female flower at base . . . . . *Homalanthus populneus*
- b. Sap yellowish, leaves oblong ovate, not turning red . . . . . *Pimelodendron*
- 4 a. Leaves opposite . . . . . 5
- b. Leaves spiral . . . . . 6
- 5 a. Stellate hairs or hairs in bundles . . . . . *Mallotus* p.p.
- b. No stellate hairs present . . . . . *Blumeodendron tokbrai*
- 6 a. Leaves densely or sparsely granular-glandular below . . . . . 7
- b. Leaves not granular-glandular . . . . . 8
- 7 a. Inner bark often with reddish sap, large glands at leaf base or along margin, stipules usually large, inflorescence usually axillary, anthers 3–4-celled *Macaranga*
- b. Inner bark without red sap, large glands absent, stipules usually small, inflorescence usually terminal, anthers 2-celled . . . . . *Mallotus* p.p.
- 8 a. Stellate hairs or scales present . . . . . 9
- b. Stellate hairs or scales absent . . . . . 12
- 9 a. Leaves with 2 conspicuous glands at the base of the leaf . . . . . 10
- b. Leaf base without glands . . . . . 11
- 10 a. Indument of stellate hairs only . . . . . *Fahrenheitia pendula*
- b. Indument of stellate hairs and scales . . . . . *Croton*\*
- 11 a. Branching not *Terminalia*-like, petioles distinctly thickened at both ends  
*Koilodepas pectinatus*
- b. Branching often *Terminalia*-like, petioles thickened at apex only *Baccaurea*
- 12 a. Leaf base distinctly unequal . . . . . *Drypetes*
- b. Leaf base symmetrical . . . . . 13
- 13 a. Leaves when dry often with minute black pits above . . . . . *Aporusa*\*
- b. Leaves without black pits above . . . . . 14
- 14 a. Leaf margin toothed . . . . . 15
- b. Leaf margin entire . . . . . 16
- 15 a. Petioles up to 3 cm long, thickened at apex only . . . *Neoscortechinia ringii*
- b. Petioles 5–8 cm long, thickened at both ends . . . . . *Dimorphocalyx*\*
- 16 a. Leaves glaucous beneath . . . . . *Sebastiania borneensis*
- b. Leaves not glaucous beneath . . . . . 17
- 17 a. Leaves 3-veined at base . . . . . *Trigonostemon*
- b. Leaves not 3-veined at base . . . . . 18
- 18 a. Fruits red, laterally compressed, fleshy drupes, borne on racemes, the inner layer of fruit wall pitted . . . . . *Antidesma*\*
- b. Plants different . . . . . 19



(Euphorbiaceae)

- 19a. Flowers in axillary fascicles, often subtended by reduced leaves, petioles in dry state often transversely wrinkled, fruit a smooth capsule . *Cleistanthus*\*
- b. Flowers in axillary clusters, petioles not wrinkled, fruit a densely bristly capsule . . . . . *Chaetocarpus castanocarpus*

**ANTIDESMA** L., Sp. Pl. (1753) 1027.

*Vernacular names* — Buni (M), buni hutan (M).

Shrubs or trees up to 21 m tall. Leaves spiral, entire, petioles short, not thickened, stipules persistent, sometimes leafy. Flowers unisexual (male and female flowers on different plants), in spikes, terminal or axillary, calyx cup-like, petals absent. Male flowers: stamens 3–5, disc present, pistil reduced or absent. Female flowers: ovary 1-celled, protruding styles 3, short, forked. Fruits a small roundish to ovate, flattened, juicy, red or black drupe, with a thin pitted stone. Seed 1, stigmas persistent, usually off-centre. — Twenty-two species reported for Kalimantan.

*Uses* — The wood is very hard and is used only as fuel wood, as the size of the trees is too small for other purposes.

KEY TO THE SPECIES

- 1a. Trees up to 21 m tall, bark brownish, leaves elliptic, 7–15 cm long, 2.5–5 cm wide, drying dark reddish brown, stipules leafy, c. 7 mm long, c. 3 mm wide, long persistent, spikes in leaf axils. Fruits roundish, c. 5 mm in diameter, slightly flattened, stigma just off-centre, surface with big shallow round dimples, stalk 3–5 mm long . . . . . *A. neurocarpum*\*
- b. Trees up to 18 m tall, bark whitish, leaves drying olivaceous-green, stipules small, persistent, spikes extensively on the branches and on the trunk. Fruits lens-shaped, up to 4 mm long, flattened, stigma terminal . . . . *A. leucopodum*\*

**APORUSA** Blume, Bijdr. (1825) 581.

Trees up to 25 m tall. Bark smooth, finely fissured or scaly, often powdery, inner bark thin, dark red-brown, fibrous. Wood hard, yellow-brown, radially striate. Leaves spiral, entire, petioles short, thickened at apex, sometimes also at base, lamina often with tiny, coloured (often black) dots below, margin often wavy or toothed. Flowers unisexual (male and female flowers on different plants), in axillary clusters of short catkins, tiny, sepals 4, petals absent, disc absent. Male flowers: stamens 2, occasionally with tiny reduced pistil. Female flowers: ovary usually 2-celled, styles short, shortly forked. Fruits small, round to oval or bottle-shaped, topped by the persistent styles, yellow or reddish when fresh, drying brownish to black, wall leathery-fleshy, thin to very thick, splitting regularly into 3 parts, or bursting open irregularly, or closed. Seeds few, on a central stalk, with brightly coloured arils. — Thirty species reported for Kalimantan.

*Uses* — The genus does not provide important timber, except for local construction work. It provides suitable firewood.

(Euphorbiaceae)

KEY TO THE SPECIES

- 1a. Trees up to 25 m tall. Leaves big, up to 30(–37) cm long, glabrous, stipules large, persistent, sickle-shaped to half circular, male inflorescences interrupted throughout, bearing distinct glomerules of flowers, female inflorescence with an elongate rhachis, ovary and capsule 3-celled, densely or sparsely pubescent, large . . . . . *A. grandistipula*\*
- b. Leaves to 25 cm long, stipules usually small, usually falling off early . . . . . 2
- 2a. Trees up to 20 m tall. Leaves elliptic, up to 10 cm long, papery, finely hairy, male flowers in clustered short, finger-like spikes, fruits depressed globular, c. 7 mm in diameter, wall thin, drying cream-brown . . . . . *A. frutescens*\*
- b. Leaves up to 25 cm long, thickly leathery, very smooth, glabrous, slightly shiny on both surfaces, often drying bright yellowish-green, fruits round, regularly dehiscent . . . . . 3
- 3a. Trees to 15 m tall, c. 10 cm in diam., ovary 2-celled, fruits c. 13 mm in diam., wall thin, surface smooth, drying reddish to dark brown *A. lucida*\* — Fig. 88
- b. Trees up to 18 m tall, c. 15 cm in diameter, ovary (4- or) 5-celled, fruits 2.5–3 cm in diameter, wall thick, surface uneven, orange, drying reddish brown, aril edible . . . . . *A. nitida*\* — Fig. 89

**BACCAUREA** Lour., Fl. Cochinch. (1790) 651.

Trees up to 35 m tall. Crown sometimes with *Terminalia*-branching. Bark red to orange-brown, usually finely dipped or papery scaly, inner bark soft, thin, fibrous, often deep red-brown. Sapwood pink to whitish, heartwood hard, yellow to red-brown. Leaves spirally arranged, entire, often stellate. Petioles long, distinctly thickened at apex. Flowers unisexual (male and female flowers on different plants) in catkins or narrow racemes, small, sepals 4–6, overlapping, petals absent, disc small or absent. Male flowers: stamens 4–10, pistil reduced. Female flowers: often from branches or from trunk, ovary 2–5-celled, the styles very short, stigmas branched. Fruits with a firm fleshy rind, dehiscent or not. Seeds 1–6, large, each with a thick, juicy aril. — Twenty-five species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves clustered at tips, *Terminalia*-like branching pattern, twigs often whitish *B. stipulata*
- b. Leaves spirally arranged along the twigs . . . . . 2
- 2a. Lower leaf surface with fuscous dots . . . . . *B. bracteata*
- b. Lower leaf surface without fuscous dots . . . . . 3
- 3a. Lower leaf surface glabrous, base wedge-shaped . . . . . *B. macrocarpa*
- b. Lower leaf surface hairy, base wedge-shaped or heart-shaped . . . . . 4
- 4a. Lower leaf surface velvety, base heart-shaped, pedicels recurved *B. motleyana*
- b. Lower leaf surface fuscous tomentellous, base wedge-shaped, leaves bearing a series of minute tooth-like tufts of hairs on the margins, pedicels straight *B. pyriformis*

*Baccaurea bracteata* Muell. Arg. in DC., Prod. 15 (1866) 466.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 46.

Trees up to 25 m tall, c. 25 cm in diameter. Bark brown, smooth. Inner bark granular, reddish brown. Leaves spirally arranged, ovate-elliptic, 10–14 cm long, 6–9 cm wide, base wedge-shaped, apex acute, lower surface with fuscous dots, secondary veins 5–6 pairs. Petioles 1.5–3 cm long. Inflorescences ferruginous-tomentellous, usually borne on twigs and small branches, bracts relatively large, boat-shaped. Capsule 3-celled, globular, 1.5–2 cm in diameter.

*Habitat & Ecology* — Common in kerangas forest and along rivers in swampy areas, also from secondary forest, on poor sandy soils, up to 240 m altitude.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Material* — S 780, S 1038.

*Baccaurea macrocarpa* (Miq.) Muell. Arg. in DC., Prod. 15 (1866) 459. — Fig. 90

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 50.

*Vernacular name* — Kapul (M).

Trees 10–15(–25) m tall, c. 35 cm in diameter. Buttresses steep. Bark brown, smooth to flaky, inner bark fibrous, reddish brown, sapwood white. Leaves spirally arranged, ovate, 15–30 cm long, 6–11 cm wide, base broadly wedge-shaped, apex acute to rounded, lower surface glabrous, secondary veins 7 or 8 pairs. Petioles 3–6(–10) cm long. Inflorescences ochreous-grey, usually borne on trunk and branches, bracts small. Capsule 3-celled, globular, c. 6 cm in diameter.

*Habitat & Ecology* — In primary and secondary mixed Dipterocarp forest, on sandy acid soils, usually in the lowland.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The white aril is sweet and is sold in large quantities under the name ‘kapul’ in the markets.

*Material* — W 471, W 663, W 708, AA 21, AA 76.

*Baccaurea motleyana* (Muell. Arg.) Muell. Arg. in DC., Prod. 15 (1866) 461.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 52.

*Vernacular name* — Rambai (M).

Trees 15–20(–25) m tall, c. 20 cm in diameter. Buttresses steep. Bark brown, scaly, inner bark fibrous, hard. Leaves spirally arranged, ovate, 15–25 cm long, 6–12 cm wide, base almost heart-shaped, apex acute to rounded, lower surface velvety, secondary veins 10–12 pairs. Petioles 4–5.5 cm long. Inflorescences ochreous-brown, usually borne on small and big branches, bracts small. Capsule 2-celled, globular, c. 2.5 cm in diameter. Pedicels recurved.

(Euphorbiaceae)

*Habitat & Ecology* — On sandy soils, probably only known in cultivation or as a relic of cultivation.

*Distribution* — Sumatra, Java, Borneo.

*Uses* — The fruits are sold under the name 'Rambai' in the markets, as the arils are edible.

*Baccaurea pyriformis* Gage, Rec. Bot. Surv. India 9 (1922) 233.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 53.

*Vernacular names* — Jentikan (M), mata kucing (K).

Trees up to 21 m tall, c. 20 cm in diameter. Bark brownish, finely fissured. Leaves spirally arranged, ovate to lanceolate, 9–20 cm long, 3–7 cm wide, base wedge-shaped, apex acute to rounded, lower surface more or less rusty brown hairy, margin bearing a series of minute tooth-like tufts of hairs, secondary veins 6–9 pairs. Petioles 2.5–4.5 cm long. Inflorescences brownish, borne on small branches directly behind the leaves, bracts small. Capsule 3-celled, pear-shaped, c. 2.5 cm in diameter.

*Habitat & Ecology* — In primary and secondary lowland Dipterocarp forest, on sandy soils.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — As the aril is edible the fruits are sold in local markets.

*Material* — W 86, W 212, S 509.

*Baccaurea stipulata* J.J. Smith, Ic. Bogor. 4 (1910) 33, t. 311.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 55.

*Vernacular names* — Rambai burung (M), mata pelanduk (M).

Trees up to 15 m tall, usually smaller. Twigs whitish, branching *Terminalia*-like. Stipules or bud scales conspicuous, many. Leaves crowded at the end of the branches, with a faint dusty whitish suffusion when dry. Inflorescences on the old branches or on the trunk. Fruits ellipsoid, c. 1 cm long.

*Habitat & Ecology* — Very common in primary lowland forest, sometimes also in secondary forest, on sandy soils.

*Distribution* — Endemic in Borneo.

*Material* — W 109, W 116, W 909, AA 156, AA 271, S 523, v.B. 5886, v.B. 5898, P.K. 546.

**BLUMEODENDRON** Kurz, J. As. Soc. Beng. 42 (1873) 245.

*Blumeodendron tokbrai* (Blume) J.J. Smith in Koord. & Valetton, Bijdr. No. 12, Booms. Java (1910) 463. — Fig. 91

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 59.

(Euphorbiaceae)

Trees up to 25(–36) m tall, 30(–60) cm in diameter. Bole fluted, sometimes with small buttresses, in peat swamps with numerous stiltroots. Bark orange-brown, smooth, very finely rugulose, the inner bark granular, soft. Wood hard, yellow-brown. Petioles thickened at the base and more or less at the top, 2.5–5 cm long. Leaves opposite, elliptic, 7.5–17 cm long, 3.7–11.3 cm wide, base wedge-shaped, apex acuminate, margin often whitish when fresh and dry, secondary veins c. 6 pairs, tertiary venation ladder-like, raised and prominent below. Flowers unisexual (male and female flowers on different plants), on 5–7 cm long racemes, sepals 3–5, valvate. Male flowers: the stamens 14–35, with numerous little glands between their bases, pistil absent. Female flowers: the disc present, ovary 2- or 3-celled, styles joined at base, spreading and recurving. Fruits globular, very slightly flattened, c. 3.5 cm in diameter, faintly 3-shouldered, ripening orange. Seeds black, aril present.

*Habitat & Ecology* — In lowland Dipterocarp forest.

*Distribution* — Sumatra, Borneo.

*Uses* — Suitable as a substitute for red meranti, used for indoor construction. It is stated that the aril is edible.

*Material* — W 807.

**CHAETOCARPUS** Thwaites in Hook., Kew J. 6 (1854) 300, t. 10.

*Chaetocarpus castanocarpus* (Roxb.) Thwaites, Enum. Pl. Zeyl. (1861) 275.  
— Fig. 92

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 67.

*Vernacular names* — Kayu batu (M), dengin bobo (D), lawang (B).

Trees up to 33 m tall, 30 cm in diameter. Petioles c. 5 mm long, not thickened. Leaves spiral, elliptic, 9–11 cm long, 3–4 cm wide, base wedge-shaped, apex pointed, leathery, glabrous, shiny. Flowers unisexual (male and female flowers on different plants), small, in dense axillary clusters, c. 5 mm in diameter, green, sepals 4, overlapping, petals absent, glands on sepal bases. Male flowers: stamens 8, fused in a short column, pistil reduced, hairy, 3-lobed. Female flowers: ovary 3-celled, styles free, deeply divided. Fruit a globular, densely shortly bristly capsule, c. 13 mm in diameter, splitting in 3 bivalved parts. Seeds black, shiny, aril present.

*Habitat & Ecology* — Lowland forest, on slopes of undulating land.

*Distribution* — Sri Lanka, Assam, Thailand, Malay Peninsula, Sumatra, Borneo.

*Material* — W 80, W 162, W 557, W 901, W 942, v.B. 5813, v.B. 5925, v.B. 6073, v.B. 6140.

**CLEISTANTHUS** Hook.f. ex Planch. in Hook., Icon. Pl. (1848) t. 779.

*Vernacular names* — Asam gunung (M), bajar buhu (K).

(Euphorbiaceae)

KEY TO THE SPECIES

- 1a. Trees up to 16 m tall, stipules tiny, up to 1 mm across, falling off early, leaves 10–20(–30) cm long, 4–5(–8) cm wide, base rounded to heart-shaped, hairy beneath, secondary veins, capsule stipitate (i.e. with a gynophore) *C. myrianthus\**
- b. Leaves glabrous, except the midrib beneath, capsule not stipitate . . . . . 2
- 2a. Trees up to 9 m tall, branchlets rufous-tomentellous, stipules awl-shaped, leaves 13–20 cm long, thinly papery or parchment-like, base rounded or heart-shaped, slightly glaucous, secondary veins 10–13 pairs . . . . . *C. beccarianus\**
- b. Trees up to 12 m tall, branchlets shortly tomentellous, stipules tiny, leaves lanceolate to elliptic, 3–7(–12) cm long, 1–2(–4) cm wide, parchment-like, base rounded or very shortly heart-shaped at the base, apex distinctly long pointed, secondary veins 7 or 8 pairs . . . . . *C. brideliifolius\**

**CROTON** L., Sp. Pl. 1 (1753) 1004.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 67.

*Vernacular names* — Bekakalap (M), jingah (K).

Trees up to 25 m tall, 30–40 cm in diameter, usually much smaller. Leaves spiral, margin toothed, with two conspicuous glands at leaf base, petioles up to 6 cm long. Flowers unisexual (male and female flowers on the same plant), in terminal spikes, sepals 5, overlapping, petals 5, densely hairy within, disc present. Male flowers: stamens numerous, filaments free, pistil absent. Female flowers: ovary 3-celled, styles long, forked. Fruit an oblong capsule, splitting into 3–6 parts. — Fifteen species reported for Kalimantan.

*Uses* — Usually only small trees, timber of no economic importance.

KEY TO THE SPECIES

- 1a. Leaves densely coppery scaly beneath . . . . . *C. argyratus\**
- b. Leaves glabrous or almost glabrous beneath . . . . . *C. griffithii\**

**DIMORPHOCALYX** Thwaites, Enum. Pl. Zeyl. (1861) 278.

Trees up to 15 m tall, up to 15 cm in diameter. Leaves spiral, oblong-elliptic, 10–30 cm long, 3.5–10 cm wide, margin distantly strongly toothed, petioles up to 8 cm long, stout, usually thickened at both ends. Flowers white, in axillary, few-flowered racemes, sepals 5, overlapping, petals 5. Male flowers: stamens 10–20, the inner fused into a column, pistil absent. Female flowers: ovary 3-celled, styles joined at base, erect, forked. Fruits sitting on greatly enlarged calyx, 3-lobed, woody capsule splitting into bivalved parts, leaving a central column.

KEY TO THE SPECIES

- 1a. Petioles more than 1.5 cm long, calyx not enlarged, capsule lamellate-tuberculate, glabrous . . . . . *D. muricatus*\*
- b. Petioles less than 1 cm long, calyx enlarged, capsule smooth . . . . . *D. murinus*\*

**DRYPETES** Vahl, *Eclog. amer.* 3 (1810) 49.

Trees up to 35 m tall. Petioles not thickened. Leaves spiral, entire, leathery, base unequal. Stipules persistent or not. Flowers unisexual (male and female flowers on different plants), in clusters in leaf-axils, often on branches behind the leaves. Flowers small, sepals 4, overlapping, petals absent. Male flowers: stamens few to many, disc present, pistil absent or minute. Female flowers: ovary 1–3-celled, styles very short, stigmas broad, flat, fan- to almost kidney-shaped. Fruits a leathery, fleshy drupe. Stones 1–3, large. — Twenty-seven species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves 8–17 cm long, with numerous (10–15) pairs of secondary veins, margin toothed . . . . . *D. polyneura*
- b. Leaves with up to 7 pairs of secondary veins, margin entire . . . . . 2
- 2a. Leaves 2–12(–19) cm long, fruits olive-like . . . . . *D. kikir*
- b. Leaves 15–60 cm long, fruits globular . . . . . *D. longifolia*

*Drypetes kikir* Airy-Shaw, *Kew Bull.* 23 (1969) 60. — Fig. 93

*Vernacular name* — Kayukikir (M).

Trees 15–25(–30) m tall, up to 60 cm in diameter. Bole fluted, tapering. Bark smooth, lenticellate, grey, inner bark orange brown, fibrous to granular, firm. Leaves ovate, 2–12(–19) cm long, 1–4(–7) cm wide, base strongly unequal, apex acuminate, margin entire, thinly leathery, glabrous, rather shiny above, secondary veins 5–7 pairs, faint. Fruits oblong, olive-like, c. 1.5 cm long, in axillary clusters.

*Habitat & Ecology* — Frequent, on low undulating land.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 62, W 551, W 624, S 189, S 587.

*Drypetes longifolia* (Blume) Pax & Hoffm. in *Engl., Pflanzenr.* IV, 147, XV (1922) 245.

*Vernacular name* — Kikir daun besar (M).

Trees up to 20 m tall, up to 40 cm in diameter. Bark smooth, grey, inner bark hard, firm, orange, fibrous. Leaves oblong-elliptic, 15–60 cm long, 5–15 cm wide, base wedge-shaped, apex acute, margin entire, leathery, glabrous, secondary veins 5–7 pairs, prominent. Fruits oblong, c. 3.5 cm long, behind the leaves, scurfy, orange.

(Euphorbiaceae)

*Habitat & Ecology* — Hillsides and ridges up to 350 m altitude.

*Distribution* — Andamans, Thailand, Malesia.

*Uses* — The orange pulp of the fruits is sweet, but slightly irritant.

*Material* — W 222.

*Drypetes polyneura* Airy Shaw, Kew Bull. 20 (1966) 388. — Fig. 94

*Vernacular names* — Kikir putih (M), penjalin (K).

Trees 10–20(–35) m tall, up to 40 cm in diameter. Bark smooth, grey. Wood hard white. Leaves 8–17 cm long, 3.5–6.5 cm wide, base slightly unequal, apex acuminate, c. 1 cm long, margin shallowly toothed, thinly leathery, glabrous, secondary veins 10–15 pairs, prominent. Fruits oblong, sometimes globular, up to 2.5 cm long, up to 2.2 cm in diameter, yellow.

*Habitat & Ecology* — Hillsides and ridges on low undulating land.

*Distribution* — Sumatra, Borneo.

*Material* — W 112, W 203, W 568, S 231, S 538, v.B. 5877, v.B. 5990.

**FAHRENHEITIA** Reichb. f. & Zoll., Linnaea 28 (1856) 600.

*Fahrenheitia pendula* (Hassk.) Airy Shaw, Kew Bull. 20 (1966) 410. — Fig. 95

Trees 8–15(–21) m tall, up to 20 cm in diameter. Cut branches with red sap. Leaves clustered at top, narrowly obovate, 17–30 cm long, 5–13 cm wide, parchment-like, margin strongly, distantly toothed, base wedge-shaped, with 2 glands near petiole, apex acute, secondary veins with stellate hairs. Inflorescences in terminal, up to 50 cm long pendent panicles. Fruits globular, slightly 3-lobed, c. 2.5 cm in diameter, ripening red, finely velvety. Seeds with a white aril.

*Habitat & Ecology* — Often along streams in primary or secondary lowland forest.

*Distribution* — Thailand, West Malesia.

*Uses* — No information available.

*Note* — The sap is irritating and painful.

*Material* — W 4, W 60, W 355, W 776, S 653, S 758.

**GLOCHIDION** J.R. & G. Forst., Char. Gen. (1776) 145, t. 73.

*Vernacular names* — Paradian (M), uwar (K).

Small to rarely medium-sized trees. Leaves alternate, on spreading branches, resembling compound leaves, unequal at base. Petioles very short. Flowers minute, unisexual (male and female flowers on the same plant), in dense clusters, axillary, sepals 6, petals absent, disc absent. Male flowers: stamens 3–8, fused in a column, pistil absent or tiny. Female flowers: ovary 3–25-chambered, styles joined into a knob or a column. Fruit stalked, thinly to firmly woody capsule, lobed or ribbed, crowned



by the unbranched persistent style. Seeds orange or red, smooth, often with a thin aril. — Forty species reported for Kalimantan.

*Habitat & Ecology* — Very common in secondary forest, usually along rivers.

*Uses* — Trees of this genus are promoted as firewood-providing by the Indonesian government.

KEY TO THE SPECIES

- 1a. Treelet up to 4 m tall, leaves large, 25–30 cm long, 7–9 cm wide, capsule up to 1.5 cm in diameter, densely hirsute, reddish, seeds 5 mm long, orange red  
*G. calospermum\**
- b. Trees up to 11 m tall, leaves small, not more than 12 cm long, capsule 5–7 mm in diameter, woolly white tomentose . . . . . *G. sericeum\**

**HOMALANTHUS** Juss., Euphorb. gen. (1824) 50, t. 16.

*Homalanthus populneus* (Geisel.) Pax in Engl. & Prantl, Nat. Pflanzenfam. 3, 5 (1890) 96. — Fig. 96

*Vernacular name* — Kelebutag (B).

Trees 8–10(–15) m tall. Inner bark with watery, white latex. Wood white, soft. Leaves spiral, almost as broad as long, broadly triangular to ovate, 6–9 cm long, 6–8 cm wide, base straight, glaucous below, papery. Petioles 4–10 cm long, red, with a pair of tiny glands at the junction with the lamina. Stipules large, leaving conspicuous scars. Flowers unisexual (male and female flowers on the same plant), in terminal 10–25 cm long spikes, 2–8 long-stalked female flowers near the base, the rest male ones, petals absent, disc absent. Male flowers: calyx flattened, sepals 2, stamens 6–10, pistil absent. Female flowers: calyx 2- or 3-lobed, ovary 2-celled, style not divided. Fruits bilobed, 7 mm in diameter, rather fleshy, tardily dehiscent, grey-green, on very slender 2.5–5 cm long stalks.

*Habitat & Ecology* — In primary forest only on open places, frequent in secondary forest on limestone, from lowland to mountains.

*Distribution* — Malesia, except New Guinea.

*Material* — W 209, S 199, v.B. 5903A.

**KOILODEPAS** Hassk., Versl. Meded. Akad. Wet. Amsterdam 4 (1855) 139.

*Koilodepas pectinatus* Airy Shaw, Kew Bull. 23 (1969) 82. — Fig. 97

*Vernacular name* — Gading (B).

Trees up to 10 m tall, up to 25 cm in diameter. Bark smooth, greyish black, inner bark red, wood hard. Leaves spiral, oblong-oblongate, 8–18 cm long, 2–5.5 cm wide, base wedge-shaped or rounded, apex acuminate to long pointed, margin shallowly toothed, parchment-like, secondary veins c. 14 pairs, with stellate hairs below.

(Euphorbiaceae)

Stipules elongate, 9–12 mm long, deeply and finely pectinate. Flowers unisexual (male and female flowers on the same plant), in axillary, pendulous, racemes, petals absent. Male flowers: sepals 4, valvate, stamens 4, shortly fused, pistil reduced, minute. Female flowers: 1 or 2 at base of raceme, calyx big, cup-like with 8 or 9 lobes, ovary 3-celled, styles joined, erect, much-branched. Fruit a capsule, c. 2 cm in diameter, splitting into three parts, seated on a papery, broadly enlarged calyx.

*Habitat & Ecology* — Primary and secondary lowland forest.

*Distribution* — Endemic in Borneo.

*Material* — W 482, S 199, v.B. 5903A.

**MACARANGA** Thou., Gen. Nov. Madagasc. (1806) 26.

*Vernacular name* — Most of the species occurring in secondary forest are called mahang (M).

Trees up to 30 m tall, usually smaller. Bark smooth, grey, often prominently hooped, inner bark often with red sap, especially in the twigs. Wood soft, white. Twigs sometimes hollow and ant-inhabited. Petioles often long, thickened at apex. Leaves spiral, often large, lamina pinnately- or palmately-veined, often gland-dotted, sometimes peltate, sometimes lobed, margin toothed. Stipules often large and persistent. Flowers unisexual (male and female flowers on different plants), axillary, amongst or behind the leaves, on short racemes, often subtended by glandular bracts, petals absent, disc absent. Male flowers: sepals 2–4, stamens 1–20, anthers 3- or 4-celled, pistil absent. Female flowers: calyx very shortly or not toothed, sometimes splitting, ovary 2- or 3-celled, styles long or short, usually free and unbranched. Fruit a leathery capsule, smooth, horned or long spiny, often yellowish waxy, ultimately dehiscent into bivalved parts on a central column. Seeds black, sometimes with a red jacket. — Forty-seven species reported for Kalimantan.

*Habitat & Ecology* — Most *Macaranga* species are confined to secondary forest, where they can form pure stands.

*Uses* — The timber is generally soft and non-durable, and may be used for pulp.

*Note* — As most of the species are dominant in certain types of secondary forest, we provide a key to most of the species but treat in detail only those which are confined to primary forest.

KEY TO THE SPECIES

- 1a. Stems solid, leaves pinnately veined, not peltate, with large superficial glands near insertion of petiole, small trees of primary forest . . . . . 2
- b. Stems solid or hollow, leaves palmately veined or 3-veined, peltate or not, without such glands, trees of primary or usually secondary forest . . . . . 4
- 2a. Leaves 15–36 cm long, stipules narrowly triangular . . . . . *M. anceps*\*
- b. Leaves up to 13 cm long, stipules crowded, usually linear . . . . . 3
- 3a. Leaves finely pubescent on nerves below, dull . . . . . *M. lowii*
- b. Leaves entirely glabrous, shiny . . . . . *M. lowii* var. *kostermansii*

(Euphorbiaceae)

- 4a. Stems hollow . . . . . 5
  - b. Stems solid . . . . . 12
- 5a. Leaves with 3 or more lobes . . . . . 6
  - b. Leaves not lobed . . . . . 11
- 6a. Leaves with broadly truncate base which is bearing volcano-like glands  
*M. aetheadenia*\*
- b. Not so . . . . . 7
- 7a. Leaves with an intensely white paint-like substance on the lower surface  
*M. hypoleuca*\*
- b. Not so . . . . . 8
- 8a. Twigs very pale in colour, leaf surface below with yellow granular glands plus hairs on the veins, lobes shallow . . . . . *M. indistincta*\*
- b. Not so . . . . . 9
- 9a. Stipules to 2 cm long, stiff, recurved like a pair of horns, the leaves 5–7-lobed  
*M. kingii*\*
- b. Stipules smaller, leaves 3-lobed . . . . . 10
- 10a. Bracteoles of inflorescence long pointed . . . . . *M. motleyana*\*
- b. Bracteoles of inflorescence acuminate . . . . . *M. triloba*\*
- 11a. Stipules much longer than broad, c. 2 cm long, fruits tiny, not greater than 2 mm in diameter, bilobed . . . . . *M. winkleri*\*
- b. Stipules broadly triangular, fruits 5 mm or more . . . . . *M. petanostyla*\*
- 12a. Leaves not peltate or rarely up to 0.7 cm peltate . . . . . 13
  - b. Leaves peltate, usually at least 2.5 cm peltate . . . . . 15
- 13a. Leaves 3-lobed . . . . . *M. pearsonii*\*
- b. Leaves not lobed . . . . . 14
- 14a. Leaves ovate, with a long tip, margins toothed, velvety all over beneath  
*M. trichocarpa*\*
- b. Leaves ovate to elliptic, not long-tipped, margins entire, glabrous and glaucous beneath . . . . . *M. conifera*
- 15a. Leaves not lobed . . . . . 16
  - b. Leaves lobed . . . . . 17
- 16a. Leaves velvety below . . . . . *M. tanarius*\*
- b. Leaves glabrous below, or occasionally with sparse hairs on the veins  
*M. curtisii* var. *glabra*\*
- 17a. Leaves 5-lobed . . . . . *M. depressa*\* (rarely)
  - b. Not so . . . . . 18
- 18a. Leaves shallowly lobed, 30 cm or more across, stipules large, up to 4 cm long, c. 1.5 cm across . . . . . *M. gigantea*\*
- b. Leaves lobed to halfway or more, not exceeding 15 cm across, stipules much smaller, 1 cm or less across . . . . . 19
- 19a. Stipules pointed, as long or longer than broad, fruits horned, in heads  
*M. depressa*\* (usually)
  - b. Stipules rounded, broader than long, fruits unarmed, not clustered into heads  
*M. pruinosa*\*

(Euphorbiaceae)

*Macaranga conifera* (Zoll.) Muell. Arg. in DC., Prod. 15 (1866) 1005. — Fig. 98

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 157.

*Vernacular names* — Sange-sange (D), sepu (D).

Trees 8–15(–30) m tall, up 40 cm in diameter. Bark whitish grey, smooth. Stems solid. Leaves ovate to elliptic, not lobed, 8–12 cm long, 4–5.5 cm wide, base wedge-shaped, apex acuminate, margin entire, 3-veined, 7 or 8 pairs of veins, glabrous and glaucous beneath, gland dotted. Stipules c. 1.3 cm long, c. 0.5 cm wide. Petioles 5–6.5 cm long, 1.5 mm in diameter. Inflorescence axillary.

*Habitat & Ecology* — Locally common in secondary forest, sometimes also in primary forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 72, W 984, S 632, S 832.

*Macaranga lowii* King ex Hook. f. in Hook. f., Fl. Brit. India 5 (1887) 453.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 154.

KEY TO THE VARIETIES

- 1a. Leaves finely pubescent on veins below, dull ..... var. *lowii*
- b. Leaves entirely glabrous, shiny ..... var. *kostermansii*

var. *lowii* — Fig. 99

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 154.

*Vernacular name* — Mahang jarum (M).

Trees up to 25 m tall, c. 60 cm in diameter. Stipules linear. Leaves elliptic to oblong, 6–9(–13) cm long, 3–4(–5.5) cm wide, base auricled, with 2 glands, apex acute, finely pubescent on veins below, dull, pinnately veined, secondary veins 9 or 10 pairs. Petioles 2–2.5 cm long. Fruits densely echinate.

*Habitat & Ecology* — Very common only in primary forest, on hillsides, ridges of lowland Dipterocarp forest.

*Distribution* — Indochina, Hainan, Thailand, Malay Peninsula, Borneo, Philippines.

*Uses* — Living wood dry, used as firewood.

*Material* — W 57, S 226, S 476, S 762.

var. *kostermansii* Airy Shaw, Kew Bull. 23 (1969) 107.

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 155.

Trees up to 20 m tall, usually smaller. Leaves entirely glabrous, shiny.

*Habitat & Ecology* — In lowland primary forest, on sandy loam.

*Distribution* — Endemic in Kalimantan.

*Uses* — Living wood dry, used as firewood.

*Material* — S 754, S 756.

**MALLOTUS** Lour., Fl. Cochinch. (1790) 635.

Trees up to 20 m tall, usually smaller. Wood usually hard, yellow-brown. Leaves spiral or opposite, then one often reduced in dimension, pinnately veined, palmately veined, or 3-veined. Stipules small. Petioles long or short. Flowers unisexual (male and female flowers on different plants), usually in axillary racemes or spikes, petals absent. Male flowers: calyx with 3 or 4 lobes, valvate, stamens 16 to many, anthers 2-celled, pistil absent, sometimes disc present. Female flowers: the ovary 3-celled, styles long, simple, free, or joined at base. Fruit a 3-lobed woody spiny capsule, splitting into bivalved parts, leaving a central column. — Twenty-five species reported for Kalimantan.

#### KEY TO THE SPECIES

- 1a. Leaves pinnately veined . . . . . 2
- b. Leaves palmately veined or 3-veined . . . . . 3
- 2a. Reduced leaf of each opposite pair circular or ovate . . . . . *M. miquelianus*\*
- b. Reduced leaf of each opposite pair awl-shaped, stipule-like . . . . . *M. penangensis*
- 3a. Leaves opposite, of each pair one is small . . . . . *M. dispar*\*
- b. Leaves alternate, or if opposite than more or less of the same size . . . . . 4
- 4a. Leaves peltate . . . . . 5
- b. Leaves not peltate . . . . . 6
- 5a. Dried plant smelling of fenugreek . . . . . *M. lackeyi*\*
- b. Dried plant not smelling of fenugreek . . . . . *M. macrostachyus*\*
- 6a. Dried plant smelling of fenugreek . . . . . *M. oblongifolius*\*
- b. Dried plant not smelling of fenugreek . . . . . *M. paniculatus*\*

*Mallotus penangensis* Muell. Arg., Linnaea 34 (1865) 186. — Fig. 100

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 164.

*Vernacular name* — Balik angin (M).

Trees 8–15(–20) m tall, 25 cm in diameter. Wood hard, yellow-brown. Twigs with thickened nodes. Leaves opposite, reduced leaf of each opposite pair awl-shaped, stipule-like, normal ones elliptic, 10–13 cm long, 4–7 cm wide, parchment-like to leathery, glabrous, with hairs on midrib only, pinnately veined, secondary veins 5–7 pairs, petioles up to 2.5 cm long, thickened at both ends. Inflorescence solitary, up to 5 cm long. Flowers in axillary spikes, petals absent. Male flowers: calyx 3- or 4-lobed, valvate, stamens 16–250; anthers 2-celled, pistil absent. Female flowers: calyx strongly or weakly 3–5-lobed, ovary 3-celled, styles long, simple, free. Fruits a strongly 3-lobed woody capsule, with scattered, short, stiff spines.

(Euphorbiaceae)

*Habitat & Ecology* — Frequent in primary lowland forest, along rivers or on undulating land.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 2, W 83, W 99, W 187, W 333, W 335, AA 319A, S 232, S 557, v.B. 5965.

**NEOSCORTECHINIA** Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam., Nachträge (1897) 213.

*Neoscortechinia kingii* (Hook. f.) Pax & Hoffm. in Engl., Pflanzenr. IV, 147, XIV (Euph.-Addit. VI) (1919) 52. — Fig. 101

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 177.

*Vernacular names* — Baniran (M), perupuk batu (M), uwun (M).

Trees 10–15(–30) m tall, 30–50 cm in diameter. Bole often fluted at base. Bark red brown, smooth, dipped when old, inner bark red to pink, fibrous. Wood cream. Leaves spiral, elliptic to obovate, 3–17 cm long, 1.5–7 cm wide, base wedge-shaped, apex acute, margin usually toothed, leathery, glabrous. Petioles 5–30 mm long, thickened at apex, without glands at top. Flowers unisexual (male and female flowers on different plants), in terminal and axillary c. 5(–17.5) cm long panicles, small, sepals 4, free, overlapping, petals absent. Male flowers: stamens 5–7, pistil reduced, tiny. Female flowers: ovary 2-celled. Fruit a capsule, thin-walled, woody, densely pilose, up to 34 mm long, 14–17 mm in diameter. Seed usually 1, large.

*Habitat & Ecology* — Rare, on ridges in primary lowland Dipterocarp forest, up to 300 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo. Of the genus *Neoscortechinia* four species are reported for Kalimantan.

*Material* — W 389, S 409.

**PIMELODENDRON** Hassk., Versl. Meded. Akad. Wet. Amsterdam 4 (1855) 140.

*Pimelodendron griffithianum* (Muell. Arg.) Benth. in Benth. & Hook. f., Gen. Pl. 3 (1880) 332. — Fig. 102

*Literature* — Airy Shaw, Kew Bull. Add. Ser. IV (1975) 186.

*Vernacular name* — Murung (K).

Trees up to 30 m tall, 40–50 cm in diameter. Bole often fluted. Bark dull reddish brown, smooth, the inner bark granular, with little thick, white latex. Wood white. Leaves crowded at end of twigs, oblong-ovate, 6–15 cm long, 2.5–5 cm wide, base wedge-shaped, apex acuminate, margin slightly wavy, distantly toothed, thinly leathery, glabrous. Petioles slender, 1.3–3.7 cm long, short and long ones on each twig, thickened at both ends. Flowers unisexual (male and female flowers on different

plants), on short, up to 2.5 cm long axillary racemes, crowded on twigs behind the leaves, calyx flattened with 2 short, broad lobes, overlapping, petals absent, disc absent. Male flowers: yellow, c. 2 mm in diameter, stamens 12–16, often joined at base, pistil absent. Female flowers: ovary 2–many-celled, compressed, style short. Fruit a big leathery berry, globular, 3.7–5 cm in diameter, shiny green, ripening yellow, at first tipped by the persistent style.

*Habitat & Ecology* — On hillsides, in swamps or peat swamp, up to 300 m altitude.

*Distribution* — Malay Peninsula, Borneo. Of the genus *Pimelodendron* three species are reported for Kalimantan.

*Uses* — A soft to moderately hard timber; the wood is apparently not very durable.

*Material* — W 5, W 53, AA 188, AA 261, S 217, v.B. 5918A.

**SEBASTIANIA** Sprengel, *Neue Entdeck.* 2 (1821) 118, t. 3.

*Sebastiania borneensis* Pax in Pax & Hoffm. in Engl., *Pflanzenr.* IV, 147, V (1912) 122. — Fig. 103

*Literature* — Airy Shaw, *Kew Bull. Add. Ser.* IV (1975) 195.

Trees up to 14 m tall. Leaves spiral, elliptic, 10–20 cm long, 4–9 cm wide, entire or vaguely lobed, parchment-like, glabrous, glaucous. Petioles c. 1 cm long, not thickened. Flowers unisexual (male and female flowers on different plants). Male inflorescences spicate, in axillary fascicles, up to 2.5 cm long, with numerous minute yellow flowers subtended by small red bracts. Female inflorescences 1–3-flowered, the flowers and fruits borne on greatly elongate, finally more or less rigid, up to 17 cm long stalks.

*Habitat & Ecology* — In primary forest, on sandy soils, up to 1200 m altitude.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 122, W 495, W 791, AA 45.

**TRIGONOSTEMON** Blume, *Bijdr.* (1825) 600.

*Trigonostemon laevigatus* Muell. Arg., *Flora* 47 (1864) 538. — Fig. 104

*Vernacular name* — Jingah tulang tiga (M).

Trees up to 11 m tall. Leaves spiral, glabrous, extremely variable in size and shape, broadly ovate with rounded base to narrowly oblong-elliptic with wedge-shaped base, usually more or less 3-veined at base. Petioles 1–3 cm long, thickened at both ends. Inflorescences small, up to 3.3 cm long, cymose. Flowers red or carmine, rarely yellow, unisexual (male and female flowers on same plant), sepals 5, overlapping, petals 5 (or absent in female), disc present. Male flowers: stamens 3–5, joined in a column, pistil absent. Female flowers: ovary 3-celled, styles forked. Fruit a 3-lobed smooth capsule, splitting into 3 bivalved parts, seated on the persistent, sometimes enlarged calyx.

(Euphorbiaceae / Fagaceae)

*Habitat & Ecology* — A very variable species from primary or secondary forest on sandy clay or loam, brown soils, up to 300 m altitude.

*Distribution* — Andamans, Indochina, Thailand, Malay Peninsula, Borneo, Philippines.

*Material* — W 28, W 467, W 714, AA 268, v.B. 5736, v.B. 5822.

**25 FAGACEAE**

Medium to large trees. Sapwood with ridges, caused by ingrowth of bark (except *Castanopsis*). Stipules small, falling off early. Leaves simple, spiral, sometimes stellate hairs present. Petioles thickened at base or not. Flowers tiny in catkins, unisexual and/or bisexual (male and female flowers on same plant), petals absent, the ovary inferior. Fruit a 1-seeded nut, partly or completely covered by a cupule, 1–4 nuts grouped within one cupule. — Four genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Boundary between bark and wood wavy, leaves spiral, entire, petioles thickened at base, fruit consisting of 1–3 nuts, entirely covered by a spiny cupule  
*Castanopsis*
- b. Wood distinctly ridged by ingrowth of bark, nut single, partly covered by a cupule . . . . . 2
- 2a. Leaves more or less crowded towards the ends of the twigs, margin toothed, at least at apex, petioles thickened at base, male catkins pendent, fruits usually single . . . . . *Quercus*
- b. Leaves spiral, entire, petioles not thickened at base, inflorescences erect, fruits usually in clusters . . . . . *Lithocarpus*

**CASTANOPSIS** Spach, Hist. Veg. Phan. 2 (1842) 185.

*Vernacular name* — The whole genus is usually called pasang (M).

Trees, sometimes with buttresses. Inner bark without broad hard rays penetrating the young wood. Stipules falling off early. Leaves spiral, margins entire. Petioles thickened at base. Inflorescences male, female, bisexual, always erect. Male flowers solitary or in groups of 3–7, at top only of bisexual spikes, perianth 6-lobed, stamens usually 12, filaments slender, anthers small, 0.25–0.35 mm long, pistil rudimentary. Female flowers solitary or in groups of 3–7, at base only of bisexual spikes, perianth 6-lobed, staminodes 10–12, rudimentary, styles 3–5, stigmas terete, slender. Cupules cup-shaped or completely enclosing the 1–7 fruits, spiny or warty, dehiscent or not. — Twenty-one species are reported for Kalimantan.

*Uses* — The timber is difficult to prepare and to work, not very resistant to rot or insect attack.



## KEY TO THE SPECIES

A: *Sterile specimens*

- 1a. Upper side of leaves drying yellowish green . . . . . 2
- b. Upper side of leaves drying light brown . . . . . 3
- 2a. Petioles 2–2.5 cm long, lower side of leaves drying greenish, more or less glabrous . . . . . *C. evansii*
- b. Petioles up to 1.5 cm long, lower side of leaves drying silvery-brown, densely set with silvery, glaucous, adpressed hairs or scales . . . . . *C. argentea*
- 3a. Lower side of leaves velvety to touch . . . . . *C. motleyana*
- b. Lower side of leaves smooth to touch . . . . . 4
- 4a. Leaves beneath with densely adpressed hairs ( $\times 60$ ) . . . . . *C. paucispina*
- b. Leaves almost glabrous ( $\times 60$ ) . . . . . *C. oviformis*

B: *Fruiting specimens*

- 1a. Cupule enclosing 1 fruit only . . . . . 2
- b. Cupule enclosing usually 3 fruits . . . . . 4
- 2a. Spines much branched, needle-shaped, 1–2.5 cm long, occurring all over the cupule . . . . . *C. evansii*
- b. Spines simple, sturdy, flat, 0.5–1 cm long, arranged in regular arching rows with gaps in between . . . . . 3
- 3a. Leaves beneath with densely adpressed hairs ( $\times 60$ ) . . . . . *C. paucispina*
- b. Leaves almost glabrous ( $\times 60$ ) . . . . . *C. oviformis*
- 4a. Leaves densely set with silvery, glaucous, adpressed hairs or scales *C. argentea*
- b. Leaves densely set with yellowish to brown, adpressed stellate hairs and simple or stellate erect hairs . . . . . *C. motleyana*

*Castanopsis argentea* (Blume) A.DC., J. Bot. 1 (1863) 182. — Fig. 105

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 311.

Trees up to 30 m tall, up to 1 m in diameter. Bark fissured, lenticellate, dark grey. Branchlets rusty brown hairy, lenticellate. Stipules linear, 10–15 mm long, 2–3 mm wide. Petioles up to 1.5 cm long, c. 2 mm in diameter. Leaves elliptic to ovate, 10–18 cm long, 5–8 cm wide, thinly leathery, base rounded, apex acute, drying greenish above, silvery brown beneath, densely set with silvery, glaucous adpressed hairs or scales, secondary veins 11–13, arching near the margin. Mature cupules c. 5 mm stalked, 3–4 cm in diameter, spines 1–1.5 cm long, dehiscence into 4 segments or irregular. Fruits 3, 2–2.5 cm in diameter.

*Habitat & Ecology* — In primary forest up to 1400 m altitude.

*Distribution* — Sumatra, Java, Borneo.

*Uses* — The fruits are edible.

*Material* — W 553.

(Fagaceae)

*Castanopsis evansii* Elmer, Leafl. Philipp. Bot. 5 (1913) 1778. — Fig. 106

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 305.

Trees up to 25 m tall, up to 40 cm in diameter. Bole somewhat fluted. Bark smooth, greyish, sometimes hooped. Inner bark c. 0.8 cm thick, fibrous, hard. Branchlets glabrous. Stipules triangular, 5–6 mm long, 1.5–2 mm wide. Petioles 2–2.5 cm long, c. 2 mm in diameter. Leaves elliptic, 10–18 cm long, 4–6.5 cm wide, papery, base acute to rounded, apex acute to acuminate, c. 1 cm long, drying greenish on both sides, glabrous, secondary veins 9–11, arching near the margin. Mature cupules c. 5 mm stalked, 4–4.5 cm in diameter, red, spines 1–2 cm long. Fruit solitary, 3–3.5 cm in diameter.

*Habitat & Ecology* — Inland Dipterocarp forest.

*Distribution* — Borneo, Philippines.

*Material* — W 564, W 938, W 991, v.B. 6120

*Castanopsis motleyana* King, Ann. Roy. Bot. Gard. Calc. 2 (1889) 96, t. 86, as 'mottleyana'.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 314.

Trees up to 40 m tall, up to 70 cm in diameter. Buttresses spreading, 3–4 m tall. Bark fissured or flaky, chocolate- or reddish brown. Branchlets dense rusty brown hairy. Stipules ovate, 7–10 mm long, 2.5–3 mm wide. Petioles 1.5–2 cm long, c. 2 mm in diameter. Leaves elliptic to ovate, 13–25 cm long, 5–10 cm wide, leathery, base acute, apex acute with a small sharp acumen, drying rusty brown on both sides, velvety, secondary veins 12–15, arching near the margin. Mature cupules 3–4 cm in diameter, spines 1–1.5 cm long, dehiscence into 4 segments or irregular. Fruit solitary, 2–2.5 cm in diameter.

*Habitat & Ecology* — In lowland forest, on brown, clay or loam soils.

*Distribution* — Borneo, Philippines.

*Material* — W 406.

*Castanopsis oviformis* Soepadmo, Reinwardtia 7 (1968) 397.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 302.

Trees up to 30 m tall, up to 45 cm in diameter. Buttresses small, sometimes branched. Bark smooth or fissured, greyish brown. Branchlets glabrescent. Stipules ovate, 3–5 mm long, 2–3 mm wide. Petioles 1–1.5 cm long, c. 2 mm in diameter. Leaves elliptic to lanceolate, 10–16 cm long, 3.5–7 cm wide, thinly leathery, base acute, apex acute to acuminate, 0.5–1 cm long, drying light brownish on both sides, almost glabrous ( $\times 60$ ), secondary veins 7–11, arching near margin. Mature cupules 0.5–1 cm stalked, 2.5–5 cm long, 1.5–3 cm in diameter, spines 2–3 mm long, arranged in arching lines on both sides of the cupules except some sectors, dehiscence irregular or in two equal halves. Fruit solitary, 2–3.5 cm long, 1.5–2 cm in diameter.

*Habitat & Ecology* — In primary lowland forest, sometimes in kerangas, on sandy loamy soils.

*Distribution* — Endemic in Borneo.

*Material* — W 555, W 590.

*Castanopsis paucispina* Soepadmo, Reinwardtia 7 (1968) 398.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 301.

Trees up to 30 m tall, up to 60 cm in diameter. Bark smooth or fissured, dark grey, sometimes hooped. Inner bark thick, hard, fibrous. Branchlets glabrescent. Stipules ovate, c. 2 mm long, c. 1 mm wide. Petioles 1–1.5 cm long, c. 2 mm in diameter. Leaves elliptic to lanceolate, 8–14 cm long, 3–5.5 cm wide, thinly leathery, base acute, apex acute to acuminate, 0.5–1 cm long, drying light brownish on both sides, with adpressed scales ( $\times 60$ ), secondary veins 9–10, arching near the margin. Mature cupules 0.5–1 cm stalked, 4–5 cm long, 1.5–3 cm in diameter, spines 2–3 mm long, arranged in 3–4 arching lines on both sides of the cupules except on some sectors, dehiscence irregular or in two equal halves. Fruit solitary, 2–3.5 cm long, 1.5–2 cm in diameter.

*Habitat & Ecology* — Mixed Dipterocarp forest, on basalt-derived soils.

*Distribution* — Endemic in Borneo.

*Material* — W 649.

**LITHOCARPUS** Blume, Bijdr. (1826) 526.

*Vernacular names* — Common names for the whole genus are paning-paning (M), palele (M), and beleleg (B).

Trees sometimes with buttresses or stiltroots. Inner bark with broad hard rays penetrating the young wood. Stipules falling off early. Leaves spiral, margins entire. Petioles not thickened at base. Inflorescences male, female, bisexual, always erect. Male flowers solitary or in groups of 3–7, at top only of bisexual spikes, perianth 6-lobed, stamens usually 12, filaments slender, anthers small, 0.2–0.3 mm long, pistil reduced. Female flowers solitary or in groups of 3–7, at base only of bisexual spikes, perianth 6-lobed, staminodes 10–12, styles 3–6, stigmas tiny. Cupules cup-shaped or completely enclosing the single fruit, lamellate, squamose, tuberculate, or muricate, never truly spiny, never splitting. — Fifty-two species reported for Kalimantan.

*Uses* — Moderate to very hard timber. The wood is not used much as it is difficult to prepare. It is locally used for housing construction but mainly serves as firewood.

(Fagaceae)

KEY TO THE SPECIES

A: *Sterile specimens*

- 1a. Leaves glabrous, petioles thick (c. 4 mm in diameter) . . . . . *L. gracilis*
- b. Leaves hairy, petioles thin (c. 1–2.5 mm in diameter) . . . . . 2
- 2a. Leaves with long rufous hairs beneath . . . . . *L. conocarpus*
- b. Leaves with appressed greyish hairs . . . . . 3
- 3a. Branchlets glabrous, more or less smooth . . . . . *L. sericobalanus*
- b. Branchlets densely tomentose, ridged, lenticellate . . . *L. coopertus*/*L. leptogyne*

B: *Fruiting specimens*

- 1a. Cupule densely set with spine-like appendages . . . . . *L. coopertus*
- b. Cupule lamellate, muricate, scaly to almost smooth . . . . . 2
- 2a. Cupule more than 3.5 cm in diameter . . . . . *L. sericobalanus*
- b. Cupule up to 2 cm in diameter . . . . . 3
- 3a. Leaves glabrous beneath, petioles thick (c. 4 mm in diameter) . . . . . *L. gracilis*
- b. Leaves tomentose beneath, petioles thin (1–2.5 mm in diameter) . . . . . 4
- 4a. Leaves more or less greyish beneath, cupule scaly . . . . . *L. leptogyne*
- b. Leaves yellowish-brown to rufous beneath, cupule lamellate . . . *L. conocarpus*

*Lithocarpus conocarpus* (Oudem.) Rehd., J. Arnold Arbor. 1 (1919) 123.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 349.

Trees up to 40 m tall, up to 90 cm in diameter. Buttresses absent. Bark smooth, lenticellate, greyish, sometimes hooped. Inner bark c. 2 cm thick, hard. Branchlets densely yellowish brown hairy. Stipules ovate, 2–3 mm long, c. 1–1.5 mm wide. Petioles up to 1 cm long, 1–2 mm in diameter. Leaves elliptic, 5–12 cm long, 2–3 cm wide, thinly leathery, base acute, apex acute to acuminate, c. 1 cm long, yellowish brown to rufous beneath, greenish grey above, secondary veins 9–12, joining near the margin. Mature cupules 3–8 mm stalked, 4–8 mm high, up to 2 cm in diameter, lamellae 6 or 7, free, denticulate at rim. Fruits up to 2 cm high, up to 1.8 cm in diameter, hairy.

*Habitat & Ecology* — From sea-level up to 1800 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo, Philippines.

*Material* — S 586.

*Lithocarpus coopertus* (Blanco) Rehd., J. Arnold Arbor 1 (1919) 124. — Fig. 107

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 335.

Trees up to 40 m tall, up to 70 cm in diameter. Buttresses absent or up to 2 m tall. Bark smooth to scaly, lenticellate, greyish brown. Inner bark c. 2 cm thick, hard. Branchlets densely yellowish brown hairy. Stipules triangular, 4–8 mm long, c. 1–3

mm wide. Petioles up to 0.6 cm long, 1–2 mm in diameter. Leaves elliptic, 7–15 cm long, 3–5 cm wide, thinly leathery, base rounded-acute, apex acute to acuminate, c. 1 cm long, greyish brown beneath and above, secondary veins 10–13. Mature cupules almost sessile, up to 2 cm high and 2 cm in diameter, covered by reflexed spines. Fruit completely covered by the cupule.

*Habitat & Ecology* — Usually in lowland forest on yellowish sandy soils, occasionally in peat swamps or heath forest.

*Distribution* — Malay Peninsula, Borneo, Philippines.

*Material* — AA 85, S 595, S 622.

*Lithocarpus gracilis* (Korth.) Soepadmo, Reinwardtia 8 (1970) 243.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 362.

Trees up to 40 m tall, up to 90 cm in diameter. Buttresses spreading to steep, up to 1.5 m tall. Bark smooth to finely fissured, greyish brown. Inner bark c. 2 cm thick, soft. Branchlets more or less glabrous. Stipules ovate to linear acute, 1.5–4 mm long, c. 0.7–1 mm wide. Petioles 1.5–2 cm long, 4 mm in diameter. Leaves broadly elliptic, 15–25 cm long, 7–10 cm wide, leathery, base acute, apex bluntly acute to acuminate, c. 1 cm long, brownish on both sides, secondary veins 10–12. Mature cupules almost sessile or up to 5 mm stalked, up to 1 cm high, 2–2.5 cm in diameter, lamellae 6–8, thin. Fruit 1.5–1.8 cm high, 1.5–2.3 cm in diameter, glabrous.

*Habitat & Ecology* — Usually in primary forest, occasionally in secondary or heath forest, on ridges, swampy areas, often on riverbanks, rarely on limestone-derived soils.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 287, P.K. 526.

*Lithocarpus leptogyne* (Korth.) Soepadmo, Reinwardtia 8 (1970) 254.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 379.

Trees up to 40 m tall, up to 90 cm in diameter. Buttresses spreading, up to 1.5 m tall. Bark smooth to finely fissured, lenticellate, hooped, greyish brown. Inner bark thick. Branchlets densely greyish hairy. Stipules linear acute, 4–5 mm long, c. 0.7–1 mm wide. Petioles up to 6 mm long, c. 2 mm in diameter. Leaves elliptic, 8–13 cm long, 3–5 cm wide, thinly leathery, base acute to rounded, apex acuminate, 1–1.5 cm long, greyish on both sides, secondary veins 10–13. Mature cupules almost sessile or up to 3 mm stalked, up to 4 mm high, up to 1.5 cm in diameter, scales adpressed in 6–10 concentric rows. Fruit 1.8–2 cm high, 1–1.3 cm in diameter, tomentose.

*Habitat & Ecology* — A rare species, from sea-level up to 1500 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 220, W 294, P.K. 538.

(Fagaceae)

*Lithocarpus sericobalanus* E.F. Warb., Kew Bull. (1936) 20.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 340.

Trees up to 50 m tall, up to 1 m in diameter. Buttresses steep, up to 1.8 m tall. Bark deeply fissured to scaly, pale to dark-brown. Inner bark thick. Branchlets glabrous, more or less smooth. Stipules triangular, 3–4 mm long, 0.7–1 mm wide. Petioles up to 1 cm long, c. 2 mm in diameter. Leaves elliptic, 10–13 cm long, 3–5 cm wide, leathery, base acute to rounded, apex acuminate, 0.5–1 cm long, greyish on both sides, secondary veins 10–12. Mature cupules 0.5–1 cm stalked, up to 1.5 cm high, 3–4.5 cm in diameter, lamellae thick, 6–8 concentric or spiral rows. Fruit 1.8–2 cm high, 2.4–4 cm in diameter, greyish tomentose.

*Habitat & Ecology* — Usually in primary forest, sometimes in secondary or heath forest, on hills and low ridges up to 1200 m altitude.

*Distribution* — Endemic in Borneo (except Brunei).

*Material* — W 359.

QUERCUS L., Gen. Pl. ed. 5 (1754) 431.

Medium to large trees, often with thick, equal buttresses, or small stiltroots. Inner bark with broad hard rays penetrating the young wood. Stipules falling off early. Leaves more or less crowded at the end of twigs, margins toothed at least at the apex. Petioles thickened at the base. Inflorescences male or female, male pendent, branched or not, female erect, unbranched. Male flowers in groups of 3 or 4, the perianth 6-lobed, stamens usually 6, filaments slender, anthers large 0.5–1 mm long, pistil usually absent. Female flowers solitary, sessile, the perianth 6-lobed, staminodes usually absent, styles 3 or 4, stigmas broadly capitate. Cupules saucer- or cup-shaped, lamellate. Fruits only 1 per cupule. — Seventeen species reported for Kalimantan.

*Uses* — The wood quality is similar to that of *Lithocarpus*.

KEY TO THE SPECIES

- 1a. Leaves glaucous to silvery beneath ..... *Q. argentata*
- b. Leaves neither glaucous nor silvery ..... 2
- 2a. Mature leaves glabrous beneath ..... *Q. gaharuensis*
- b. Mature leaves sparsely hairy beneath ..... *Q. oidocarpa*

*Quercus argentata* Korth., Ned. Kruidk. Arch. (1844) 215. — Fig. 108

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 389.

Trees up to 40 m tall, up to 1 m in diameter. Buttresses spreading, up to 1.2 m tall. Bark smooth, lenticellate, pale grey, sometimes hooped. Inner bark c. 2 cm thick, brittle. Branchlets more or less glabrous, lenticellate. Stipules linear-acute, 3–5 mm

long, c. 1–1.5 mm wide. Petioles up to 1.5 cm long, c. 1.5 mm in diameter. Leaves elliptic- or lanceolate-oblong, 8–22 cm long, 3–7 cm in diameter, thinly leathery, base acute, slightly unequal, apex acuminate, c. 1 cm long, glaucous to silvery beneath, greenish above, secondary veins 9–12, brownish. Margin wavy, minutely toothed at apical half. Mature cupules up to 1.3 cm high, up to 3 cm in diameter, lamellae 6–8, free, denticulate at rim. Fruits up to 2 cm high, up to 2.5 cm in diameter.

*Habitat & Ecology* — Lowland to montane forest, up to 2700 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo.

*Material* — W 566, W 606.

*Quercus gaharuensis* Soepadmo, Gard. Bull. Sing. 21 (1966) 384. — Fig. 109

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 391.

Trees up to 35 m tall, up to 1 m in diameter. Buttresses spreading, up to 70 cm tall. Bark smooth, lenticellate, grey brown, hooped. Inner bark thick, fibrous. Branchlets glabrescent, lenticellate. Stipules linear-acute, c. 5 mm long, c. 1 mm wide. Petioles 1–2 cm long, 1.5–2 mm in diameter. Leaves oblong-elliptic to obovate, 5–20 cm long, 3.5–9 cm wide, thinly leathery, base acute, slightly unequal, apex rounded, blunt, glabrous beneath, secondary veins 8–10 pairs. Margin wavy, remotely toothed at the apical half. Mature cupules up to 2.5 cm high, c. 2 cm in diameter, lamellae 6–8, free, denticulate at rim. Fruits up to 3.5 cm long, c. 1.8 cm in diameter.

*Habitat & Ecology* — From sea-level up to 1400 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — AA 68, S 684.

*Quercus oidocarpa* Korth., Ned. Kruidk. Arch. (1844) 216.

*Literature* — Soepadmo in Flora Malesiana I, 7 (1972) 392.

Trees up to 30 m tall, up to 50 cm in diameter. Buttresses often absent. Bark cracked, often peeling off into rectangular pieces, greyish green. Inner bark thick, fibrous, Branchlets with stiff pubescence, lenticellate. Stipules linear-acute, 3–4 mm long, 0.5–1 mm wide. Petioles 1–2.5 cm long, c. 2 mm in diameter. Leaves elliptic-oblong, 10–17 cm long, 5–7 cm wide, thinly leathery, base acute to rounded, apex acute, sparsely hairy beneath, secondary veins 10–13 pairs. Margin wavy, toothed at the apical half. Mature cupules c. 1.8 cm high, c. 3 cm in diameter, lamellae 9–11, lower ones denticulate at rim, upper ones entire. Fruits up to 3.5 cm long, c. 2.5 cm in diameter.

*Habitat & Ecology* — In primary forest, up to 1500 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo.

*Material* — W 464, AA 14.

(Flacourtiaceae)

## 26 FLACOURTIACEAE

Small to large trees. Stipules small or absent. Leaves simple, spiral, entire or toothed. Flowers bisexual or unisexual (male and female flowers on different plants), actinomorphic, sepals 3–10, free, petals 3–12, often soon falling or absent, often with appendages or staminodes, stamens 5 to many, disc present, ovary superior, rarely inferior, stigma sessile. — Seven genera reported for Kalimantan.

### KEY TO THE GENERA

- 1a. Cut bark smelling of cyanide, petioles strongly thickened at apex, leaves with T-shaped hairs, inflorescence often on the trunk . . . . . *Ryparosa*\*
- b. Cut bark without smell, petioles thickened or not, leaves without T-hairs . . . . . 2
- 2a. Petioles not thickened, two glands at top, leaf base equal, flowers in a raceme, ovary inferior . . . . . *Homalium*\*
- b. Petioles without glands, leaf base usually unequal, flowers in axillary clusters 3
- 3a. Petioles not thickened, leaves usually with translucent dots and dashes, fruits leathery, fleshy, dehiscent . . . . . *Casearia*\*
- b. Petioles usually thickened at apex, leaves without dots, fruits woody with scattered seeds embedded in fleshy pulp . . . . . *Hydnocarpus*

**HYDNOCARPUS** Gaertn., Fruct. 1 (1788) 288, t. 60, f. 3.

*Hydnocarpus polypetala* (Sloot.) Sleumer, Bot. Jahrb. 69 (1938) 62. — Fig. 110

*Literature* — Sleumer in Flora Malesiana I, 5 (1954) 31.

*Vernacular name* — Merore (K).

Trees up to 20 m tall. Bark pale brown, cracked. Branchlets densely ferruginous-pubescent. Stipules oblong-lanceolate, almost persistent, 6–11 mm long, c. 3 mm wide. Petioles 5–9 mm long, c. 3 mm thick, thickened at apex. Leaves oblong to elliptic-oblong, 16–35 cm long, 6.5–11 cm wide, base rounded, slightly unequal, apex abruptly acuminate, 1–2 cm long, thinly leathery, margin entire, veins 9–12 pairs, curved-anastomosing, densely ferruginous pubescent. Male flower: sepals 8–10, yellow-green, circular, very unequal, inner gradually smaller, petals 8–12, white or greenish, unequal, inner gradually smaller, all fimbriate, scales thick, sulcate, stamens c. 45, filaments slender, glabrous, 1 cm long, anthers elliptic, 3–4 mm long, rudiment of ovary hairy, 2 mm long. Female flowers: as the male ones, but staminodes numerous, anthers sterile, slightly smaller in size, ovary ovoid, velvety, stigmas 5, radiate, blackish. Fruit globular, c. 10 cm in diameter, densely covered with numerous, irregular appendages, forming longitudinal crests. Seeds c. 20, c. 2 cm long, 1 cm in diameter.

*Habitat & Ecology* — Frequently found on ridges or hill sides up to 600 m altitude.

*Distribution* — Sumatra, Borneo. Of the genus *Hydnocarpus* seventeen species are reported for Kalimantan.



*Uses* — Oil is extracted from the seeds and is used for curing wounds and eczema (a kind of ‘chaulmoogra-oil’).

*Material* — W 125, W 578, AA 225, v.B. 5871.

## 27 GUTTIFERAE

Small to large trees. Exudate usually yellow, also white, red or clear. Stipules absent (sometimes with small hypsophylls resembling stipules). Leaves simple, opposite, entire, often with gland dots or lines. Flowers actinomorphic, often unisexual, stamens numerous, often in bundles, ovary superior. — Four genera reported for Kalimantan.

*Note* — This family can easily be recognized by the opposite leaves and the usually yellow latex oozing from the inner bark.

### KEY TO THE GENERA

- 1a. Secondary veins very numerous, running closely parallel from midrib to margin, flowers bisexual, fruit a drupe . . . . . *Calophyllum*
- b. Venation different, flowers bisexual or unisexual, fruit a nut or a berry . . . . . 2
- 2a. Usually copious yellow sap, petiole base clasping the twig, leaves often with dark sinuous lines or dots, male and female flowers on different plants, fruit a leathery berry, crowned by a sessile stigma, seeds with juicy aril . . . . . *Garcinia*
- b. Exudate sparse, yellow to pink, petiole base not clasping the twig, flowers bisexual, fruit a nut, enclosed by the 2 woody sepals . . . . . *Mesua*

**CALOPHYLLUM** L., Sp. Pl. 1 (1753) 513.

*Literature* — Stevens, J. Arnold Arbot. 61 (1980) 117–691.

*Vernacular name* — Bintangur (M).

Shrubs or trees. Buttresses absent or present, sometimes also stiltroots. Bole usually cylindrical. Bark often fissured. Latex usually yellow. Twigs more or less flattened, angled. Terminal buds usually prominent, tomentose or glabrous. Leaves opposite, entire, more or less leathery, with close parallel venation alternating with and usually more prominent than latex canals. Inflorescences axillary and/or terminal. Flowers stalked, usually bisexual, tepals 4–16, stamens numerous, at most obscurely in bundles, filaments long, anthers small, dehiscing by long, lateral slits, ovary 1-celled, ovule 1, basal, style present, stigma more or less expanded, often peltate. Fruit drupe-like, outer layer thin, papery, middle layer fleshy to fibrous. Seed 1, cotyledons large. — Sixty species reported for Kalimantan.

### KEY TO THE SPECIES

- 1a. Leaves more than 10 cm long, trees from sea-shore or kerangas . *C. inophyllum*
- b. Leaves up to 8 cm long, trees from inland . . . . . 2
- 2a. Terminal bud up to 4.5 mm long . . . . . *C. pisiferum*
- b. Terminal bud c. 8–13 mm long . . . . . *C. venulosum*

(Guttiferae)

*Calophyllum inophyllum* L., Sp. Pl. 1 (1753) 513.

*Literature* — Stevens, J. Arnold Arbor. 61 (1980) 324.

Trees 10–25(–35) m tall, up to 1.5 m diameter. Buttresses absent, bole often twisted, not erect. Bark brown to grey, fissured. Inner bark reddish, latex yellow, very sticky. Twigs glabrous. Internodes 1–3 cm long. Terminal buds 4–9 mm long, plump, brown hairy. Petioles 1–2.5 cm long, glabrous. Leaves elliptic to ovate, obovate, or oblong, 8–20 cm long, 4.5–11.5 cm wide, glabrous beneath, base wedge-shaped to rounded, finally decurrent, apex rounded to notched or almost acute. Inflorescence from foliate axils, with 5–15 flowers. Flowers bisexual, tepals 8, stamens 210–360, filaments 5–7 mm long, fused for c. 2 mm, anthers oblong, 1–2 mm, rounded to notched at apex, ovary 1.5–3.5 mm long, style 4.5–9 mm long, stigma peltate. Fruits globular to obovoid, 2.5–5 cm long, 2–4 cm in diameter, apiculate to rounded at apex, sharply wrinkled.

*Habitat & Ecology* — Often common at sea-shore, on sandy soils, up to 200 m altitude.

*Distribution* — From India to Pacific islands.

*Uses* — The wood is moderately heavy, fairly strong, and especially durable under water.

*Material* — AA 141.

*Calophyllum pisiferum* Planchon & Triana, Ann. Sci. Nat. Bot. IV, 15 (1862) 294.

*Literature* — Stevens, J. Arnold Arbor. 61 (1980) 518.

Shrubs or trees up to 30 m tall, up to 60 cm diameter. Buttresses absent, bole erect. Bark yellowish brown, sometimes lenticellate. Inner bark dark red, latex yellow, sticky. Twigs tomentose. Internodes 0.3–3 cm long. Terminal buds 2–4.5 mm long, plump, indument brown. Petioles 2.5–5 mm long, tomentose. Leaves ovate to oblong or elliptic, 3–7.5 cm long, 1.5–3.5 cm wide, almost glabrous beneath, base wedge-shaped to rounded, apex rounded to acute. Inflorescence from (de)foliate axils, with 5–15 flowers. Flowers bisexual, tepals 4, stamens 30–70, filaments 3–3.5 mm long, free, anthers elliptic, 0.4–0.6 mm long, more or less notched at apex, ovary 1.2–1.3 mm long, style 2.5–3.5 mm long, stigma expanded. Fruits globular to ellipsoid, 6–9 mm long, 5.5–7 mm in diameter, sharply apiculate, sharply wrinkled.

*Habitat & Ecology* — Usually in peat swamps or riverine forest below 700 m altitude.

*Distribution* — S. Vietnam to Borneo, excluding Java.

*Material* — W 70, S 744, v.B. 5760.

*Calophyllum venulosum* Zoll., Syst. Verz. 2 (1854) 149. — Fig. 111

*Literature* — Stevens, J. Arnold Arbor. 61 (1980) 479.

(Guttiferae)

Trees 10–45 m tall, up to 80 cm diameter. Buttresses absent, bole straight. Bark brown to grey, flaky. Inner bark dark red or pale brown, latex yellow, sticky. Twigs tomentose. Internodes 1–10 cm long. Terminal buds to 8–13 mm long, plump, indument greyish brown. Petioles 1–6 mm long, almost glabrous. Leaves elliptic, ovate, or almost obovate, 3.5–20 cm long, 1.5–11.5 cm wide, almost glabrous beneath, base heart-shaped or ear-shaped, apex rounded to acute. Inflorescence from foliate axils, rarely terminal, with 5(–11) flowers. Flowers bisexual, tepals 4, stamens 85–215, filaments 5–7 mm long, fused for c. 0.7 mm, anthers oblong, 1–1.5 mm, rounded to more or less notched at apex, ovary 1.5–3 mm long, style 3–5 mm long, stigma peltate. Fruits almost globular, 1.2–2 cm in diameter, minutely apiculate, smooth.

*Habitat & Ecology* — Usually in mixed Dipterocarp forest, often along streams.

*Distribution* — Endemic in Borneo.

*Material* — W 478, AA 28.

**GARCINIA** L., Sp. Pl. 1 (1753) 443.

*Garcinia parvifolia* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 208. — Fig. 112

*Vernacular name* — Manggis (M).

Trees 15–30 m tall, 20–60 cm in diameter. Twigs slender, c. 3 mm in diameter, glabrous. Petioles up to 1 cm long, c. 1.5 mm in diameter. Leaves elliptic, 7–1 cm long, 2.5–3.5 cm wide, base wedge-shaped, apex acuminate, c. 1 cm long, papery, secondary veins faint. Flowers with 4 sepals and 4 petals. Fruits solitary, terminal, globular to elongate, c. 2 cm in diameter, sepals and petals persistent.

*Habitat & Ecology* — Common in primary and secondary forest at low altitudes.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Timber of little value. Several species with edible fruits (*G. mangostana*, ‘manggis’, a common fruit tree).

*Note* — Many species, usually small trees.

*Material* — W 52, W 610, S 263, S 296, S 363.

**MESUA** L., Sp. Pl. 1 (1753) 515.

*Mesua macrantha* (Baillon) Kosterm., Reinwardtia 7 (1969) 426. — Fig. 113

*Vernacular name* — Mengalin (K).

Tree 20–25(–30) m tall, 40–50 cm in diameter. Bole fluted or with small up to 50 cm tall buttresses. Bark flaky, greyish yellow, inner bark firmly fibrous, pink to red, exudate yellow to pink, oozing slowly. Wood hard. Branchlets glabrous, pale grey. Hypsophylles present? Petioles c. 1.5 cm long, c. 2.5 mm in diameter. Leaves oppo-

(Guttiferae/Hypericaceae)

site, lanceolate, 10–23 cm long, 3–7 cm wide, base and apex acute, glabrous on both sides, more or less glaucous beneath, secondary veins c. 20, looping at the margin, with the same number of somewhat shorter intercostals. Flowers bisexual, axillary, sepals 2 + 2, opposite, petals 4, stamens numerous, free, ovary 1- or 2-celled, ovules 1 or 2, stigma capitate. Fruit thinly woody, splitting open, enveloped by the enlarged woody sepals, 3–5 cm in diameter.

*Habitat & Ecology* — Usually on hills or along streams in primary forest.

*Distribution* — Endemic in Borneo. Of the genus *Mesua* twenty-two species are reported for Kalimantan.

*Material* — W 168, W 293, S 478, v.B. 5936, P.K. 537.

**28 HYPERICACEAE**

**CRATOXYLUM** Blume, Mus. Bot. Lugd. Bat. 2 (1852) 16.

*Literature* — Gogelein, Blumea 15 (1967) 453–475

Small to medium-sized trees. Exudate pinkish to red. Stipules absent. Leaves simple, opposite, entire, with gland dots. Flowers in terminal panicles, actinomorphic, bisexual, sepals 5, persistent in fruit, petals 5, obovate, stamens numerous, in 3 bundles, with 3 alternating scales, ovary superior, 3-celled, styles free, ovules many, attached to the basal half. Fruit a capsule with numerous (10–60) small, winged seeds. — Six species reported for Kalimantan.

*Uses* — The genus produces a light to medium hardwood. It is not durable if exposed to weather or in contact with ground.

KEY TO THE SPECIES

- 1a. Leaves thickly leathery, veins very inconspicuous below, midrib sharply keeled below ..... *C. arborescens*
- 1b. Leaves papery to thinly leathery, venation conspicuous on both sides, midrib blunt below ..... *C. sumatranum*

*Cratoxylum arborescens* (Vahl) Blume, Mus. Bot. Lugd. Bat. 2 (1852) 17.

*Vernacular names* — Gerunggang (M), irat (D).

Trees up to 40 m tall, up to 70 cm in diameter. Bole without buttresses. Bark brown, fissured, often scaly or flaky. Inner bark lamellate, pink, rubber-like, exudate red-brown on exposure. Twigs prominently flattened or angled, scaly. Stipular scars prominent, forming a convex or pyramidal line. Petioles 3–12 mm long, thickened at base. Leaves obovate-oblong to obovate-lanceolate, 5–14 cm long, 2–6 cm long, base wedge-shaped, apex acute to cuspidate, rarely rounded or notched, thickly leathery, midrib sharply keeled, secondary veins numerous, very inconspicuous below. Flowers in terminal, leafless panicles, calyx bell-shaped, sepals 3–6 mm long, petals 4–7 mm long, deep red, soon falling off. Capsules dark brown to purplish, 7–9 mm long.

(Hypericaceae / Icacinaceae)

*Habitat & Ecology* — In primary and secondary forest up to 1700 m altitude, gregarious in old shifting cultivation area, often in peat swamps.

*Distribution* — Burma, Malay Peninsula, Sumatra, Borneo.

*Uses* — Important timber trees for indoor construction.

*Material* — W 137, W 285, S 275, S 753, P.K. 524.

*Cratoxylum sumatranum* (Jack) Blume, Mus. Bot. Lugd. Bat. 2 (1852) 16. — Fig. 114

*Vernacular names* — Irat (D), mentaling (B).

Trees 8–12(–30) m tall, up to 30 cm in diameter. Bole sometimes fluted at base. Bark brown to reddish brown, smooth or slightly fissured, scaly or flaky. Inner bark orange brown, exudate yellow to orange-red. Branchlets slightly flattened, thickened at nodes. Stipular scars prominent, forming a convex line. Petioles 0–3 mm long. Leaves oblong-lanceolate, 4–18 cm long, 2–5 cm wide, the base wedge-shaped, the apex long pointed, papery, the midrib blunt below, secondary veins 10–12, prominent below. Flowers in terminal, leafy panicles, the sepals 3–7 mm long, petals 4–9 mm long, pink or red. Capsules 7–10 mm long, covered to 3/4 of its length by the sepals.

*Habitat & Ecology* — In primary and secondary forest up to 500 m altitude.

*Distribution* — Burma, Indochina, Thailand, Malesia except Philippines and New Guinea.

*Uses* — Used for local housing construction only, or for firewood.

*Material* — W 71, W 137A, S 404, S 634.

**29 ICACINACEAE**

Medium-sized trees. Stipules absent. Leaves simple, spiral, entire, glaucous or not below. Flowers actinomorphic, uni- or bisexual, 4–6-merous, petals valvate, ovary superior, 1-celled, stigma sessile. Fruit a 1-seeded drupe. — Seven genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Leaves with stellate hairs and scales, somewhat glaucous, flowers unisexual (male and female flowers on different plants) . . . . . *Platea*
- b. Leaves glabrous, thickly leathery, flowers bisexual . . . . . *Stemonurus*

**PLATEA** Blume, Bijdr. (1826) 646.

*Literature* — Sleumer in Flora Malesiana I, 7 (1971) 9.

(Icacinaceae)

*Platea excelsa* Blume var. *borneensis* (Heine) Sleumer, Blumea 17 (1969) 246.  
— Fig. 115

*Vernacular name* — Geruntung (K).

Trees 15–25(–35) m tall, 30–60 cm in diameter. Bole more or less angular. Buttresses up to 1.5 m tall. Bark dark grey to brown, smooth, fissured, thin, with a certain aromatic smell and bitter taste. Petioles 1.5–2 cm long, c. 2 mm in diameter. Leaves elliptic or ovate-elliptic, rarely ovate, 12–17 cm long, 6–9 cm wide, base broadly wedge-shaped, apex shortly acuminate, densely scaly beneath, somewhat glaucous, secondary veins 10–12 pairs, rather straight. Male inflorescence in simple spikes, flowers glomerulose, 3–5 mm, calyx lobes 5, petals 5, greenish yellowish, glabrous, stamens 5, c. 2 mm long. Female inflorescence in 2–6-flowered cymes, ovary glabrous. Drupe ovoid-oblongoid, distinctly narrowing towards the apex, 3–3.5 cm long, 1.5–2 cm in diameter, crowned by a large stigma, outer layer of fruit wall thin-fleshy, inner layer of fruit wall woody.

*Habitat & Ecology* — Primary forest up to 2000 m altitude, scattered, often along rivers.

*Distribution* — Malesia. Of the genus *Platea* four species are reported for Kalimantan.

*Uses* — The wood is hardly in use for indoor construction.

*Material* — S 594.

**STEMONURUS** Blume, Bijdr. (1826) 648.

*Stemonurus scorpioides* Becc., Malesia 1 (1877) 113. — Fig. 116

*Literature* — Sleumer in Flora Malesiana I, 7 (1971) 58.

Trees up to 30 m tall, 15–30 cm in diameter. Bark grey-brown, smooth. Branchlets and buds varnished. Petioles 1.5–2 cm long, c. 3 mm in diameter. Leaves elliptic-oblong, 11–23 cm long, 6–9 cm wide, leathery, glossy, drying greenish, base broadly wedge-shaped, apex abruptly acuminate, secondary veins 15–20 pairs, looping. Flowers bisexual, sessile, fragrant, calyx cup-shaped, 5-lobed, petals 5, white to cream to greenish, c. 5 mm long, c. 1.5 mm wide, falling off early. Stamens 5, filaments fleshy, flat, disc present, ovary 1-celled, style slender, stigma dot-like, ovules 2, pendent. Drupe ovoid-ellipsoid, obliquely narrowing towards the apex, 4.5–5.5 cm long, 2–2.5 cm in diameter, whitish above, dark green-purplish in the lower third, with numerous slight vertical grooves, inner layer of fruit wall firm, leathery to woody, its outer part fibrous. Seed 1.

*Habitat & Ecology* — Often in peat swamp forest, but also in secondary vegetation, locally frequent.

*Distribution* — Malay Peninsula, Sumatra, Borneo. Of the genus *Stemonurus* five species reported for Kalimantan.

*Uses* — Timber soft, not durable, locally used for planks and household utensils.

*Material* — W 363, S 356, v.B. 6067.

### 30 JUGLANDACEAE

*ENGELHARDIA* Leschen. ex Blume, Bijdr. (1826) 528.

*Engelhardia serrata* Blume, Fl. Jav., Jugl. (1829) 14. — Fig. 117

*Literature* — Jacobs in Flora Malesiana I, 6 (1960) 150.

*Vernacular name* — Tambun rangas (K).

Trees 20–25(–40) m tall, c. 50 cm in diameter. Buttresses small, steep. Bark smooth, grey, lenticellate, inner bark fibrous, pink to red brown, mottled, smelling of young coconut. Sapwood pale yellow. Stipules absent. Leaves spiral, paripinnate, leaflets almost opposite, almost sessile, 3–7(–9) pairs, obovate to elliptic, base narrowed, apex acute to acuminate, margin toothed (at least upper half), glandular scales yellow golden, rhachis tip free. Catkins lateral. Flowers unisexual (male and female flowers on different plants), perianth almost reduced. Male flowers: stamens 3–7, sessile. Female flower: ovary inferior, 1-celled, ovule 1. Fruit a small nut, globular, c. 3 mm in diameter, attached to a 3-lobed bract.

*Uses* — The wood is locally applied for timber but is considered to be of inferior quality.

*Habitat & Ecology* — On lower slopes in primary forest, on clayey to loamy soils, up to 2200 m altitude.

*Distribution* — Burma, Thailand, Indochina, Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi, Maluku. Of the genus *Engelhardia* five species are reported for Kalimantan.

*Note* — Sterile trees may be mistaken for Sapindaceae, due to their pinnate leaves and the free rhachis tip.

*Material* — S 1060.

### 31 LAURACEAE

*Vernacular name* — Most of the species of this family are called medang (M), except *Eusideroxylon zwageri* (= ulin).

Small to large trees. All parts more or less aromatic. Stipules absent. Leaves simple, spiral or opposite, entire, often glaucous below, with tiny translucent dots, young leaves usually red. Flowers actinomorphic, bisexual, 3-merous, anthers opening by valves, ovary 1-celled. Fruit a 1-seeded, often hard fleshy, berry. — Seventeen genera reported for Kalimantan.

(Lauraceae)

KEY TO THE GENERA

A: *Flower and fruit characters*

- 1a. Young inflorescence enclosed by bracts, anthers 4-celled . . . . . 2
- b. Young inflorescence without bracts, anthers 2- or 4-celled . . . . . 3
- 2a. Leaves densely crowded, almost whorled, fruit supported by a persistent calyx, not forming a cupule . . . . . *Actinodaphne*
- b. Leaves spiral or opposite, fruit at base enclosed by a fleshy cupule . . . . . *Litsea*
- 3a. Ovary inferior . . . . . 4
- b. Ovary superior . . . . . 5
- 4a. Ultimate branches pendent, leaves penniveined, anthers 4-celled, fruit large (up to 15 cm long). . . . . *Eusideroxylon zwageri*
- b. Branches spreading, leaves penniveined or 3-veined, anthers 2-celled, fruit much smaller . . . . . *Cryptocarya*
- 5a. Pedicel in fruit strongly swollen, fleshy, often coloured . . . . . 6
- b. Pedicel not fleshy . . . . . 7
- 6a. Leaves often black upon drying, anthers 2-celled . . . . . *Dehaasia*
- b. Leaves usually brown upon drying, anthers 4-celled . . . . . *Alseodaphne*
- 7a. Pedicel thickened below fruit, anthers 4-celled . . . . . 8
- b. Pedicel not thickened . . . . . 9
- 8a. Leaves spiral, more or less crowded, penniveined, calyx lobes woody, persistent in fruit . . . . . *Phoebe*
- b. Leaves opposite, rarely alternate, usually 3-nerved, fruit without woody calyx  
*Cinnamomum*
- 9a. Leaves spiral, anthers 4-celled . . . . . *Nothaphoebe*
- b. Leaves spiral or opposite, anthers 2-celled . . . . . 10
- 10a. Leaves spiral with very fine raised, net-like venation, stamens usually 3  
*Endiandra*
- b. Leaves spiral or opposite, venation rarely fine, stamens in 2 or 3 rows of 3  
*Beilschmiedia*

B: *Mainly vegetative characters*

- 1a. Leaves in pseudowhorls, leaf buds enclosed by large bud scales (cataphylls) which leave circular markings on twigs, fruits on a shallow or deep cup  
*Actinodaphne glabra*
- b. Leaves spiral, opposite or almost opposite . . . . . 2
- 2a. Leaves opposite or almost opposite . . . . . 3
- b. Leaves spiral . . . . . 5
- 3a. Leaves 3-veined, fruit base embedded in a cupule *Cinnamomum cuspidatum*
- b. Leaves penniveined . . . . . 4
- 4a. Petioles c. 1 cm long, c. 3 mm in diameter, leaves hairy beneath  
*Litsea oppositifolia*
- b. Petioles c. 2 cm long, leaves glabrous beneath *Beilschmiedia dictyoneura*
- 5a. Leaves crowded at the end of twigs . . . . . 6
- b. Leaves not crowded . . . . . 7



(Lauraceae)

- 6a. Fruits seated on an enlarged, fleshy, warty stalk . . . . . *Alseodaphne*
- b. Fruits seated on a cup formed by the enlarged and thickened erect persistent perianth lobes . . . . . *Phoebe grandis*
- 7a. Leaves with very fine, raised, distinct net-like venation, fruit without perianth  
*Endiandra*
- b. Leaves with different venation . . . . . 8
- 8a. Ultimate branches pendent, fruits large, up to 15 cm long  
*Eusideroxylon zwageri*
- b. Ultimate branches spreading, fruits much smaller . . . . . 9
- 9a. Young branches usually whitish, leaves drying black, fruit pedicel strongly enlarged, fleshy, brightly coloured . . . . . *Dehaasia*
- b. Young branches not whitish, leaves drying brownish or greenish . . . . . 10
- 10a. Twigs and leaves reddish brown velvety hairy, fruit entirely included in the enlarged perianth tube, leaving only a minute opening at apex  
*Cryptocarya crassinervia*
- b. Twigs and leaves glabrous or hairy, but never reddish brown velvety, fruit seated on the enlarged perianth tube, never totally enclosed . . . . . 11
- 11a. Inner bark with distinct short fibres, leaves usually glaucous beneath, flowers in pseudo-umbels, surrounded by bracts . . . . . *Litsea*
- b. Inner bark without distinct short fibres, leaves not glaucous beneath, flowers in panicles, not surrounded by bracts . . . . . *Nothaphoebe umbelliflora*

ACTINODAPHNE Nees in Wall., Pl. Asiat. Rar. 2 (1831) 61.

*Actinodaphne glabra* Blume, Ann. Mus. Bot. Lugd.-Bat. 1 (1851) 345. — Fig. 118

Trees c. 10 m tall, c. 10 cm in diameter. Bark smooth. Leaves in pseudowhorls, bud scales leaf-like (cataphylls), c. 1.5 cm long, leaving distinct scars on the twigs. Inflorescences in shortened racemes appearing as pseudo-umbels, bracts falling off early. Flowers dioecious (male and female flowers on different plants), perianth vil- lous outside, with 6 lobes, almost equal, stamens in male flowers and staminodes in female flowers 9 in 3 rows, third row with two glands each, anthers introrse, 4- celled, ovary ovoid. Berry seated on the enlarged cup-shaped perianth tube.

*Distribution* — Endemic in Borneo.  
*Material* — v.B. 6125.

ALSEODAPHNE Nees in Wall., Pl. Asiat. Rar. 2 (1831) 61.

Trees or shrubs. Twigs sometimes white. Leaves spiral. Terminal bud naked or with stiff narrow scales. Flowers in axillary panicles, bisexual, perianth lobes 6, outer 3 usually smaller than inner 3, stamens 9, in 3 rows, anthers 4-celled, staminodes pres- ent. Fruits ellipsoid, black, glossy, stalk swollen, warty, bright red.

(Lauraceae)

KEY TO THE SPECIES

- 1a. Petioles up to 1 cm long, leaves 3–7 cm wide . . . . . *A. peduncularis*  
b. Petioles 1.5–2.5 cm long, leaves 7–12 cm wide . . . . . *A. elmeri*

*Alseodaphne elmeri* Merr., Univ. Calif. Publ. Bot. 15 (1929) 82.

Trees up to 20 m tall, c. 30 cm in diameter. Bark pale, more or less smooth. Twigs whitish. Petioles 1.5–2.5 cm long. Leaves elliptic, 20–30 cm long, 7–12 cm wide, base wedge-shaped, apex acute, secondary veins 7–12 pairs. Fruit ellipsoid, stalk red.

*Habitat & Ecology* — Common in primary and secondary lowland Dipterocarp forest.

*Distribution* — Endemic in Borneo.

*Material* — W 200, v.B. 5984.

*Alseodaphne peduncularis* (Wall. ex Nees) Meissn., Gen. 2 (1841) 238. — Fig. 119

Trees up to 20 m tall, c. 30 cm in diameter. Bark pale, more or less smooth. Twigs whitish. Petioles up to 1 cm long. Leaves elliptic to lanceolate, 10–20 cm long, 3–7 cm wide, base wedge-shaped, apex acute, secondary veins 6–10 pairs. Fruits ellipsoid or globular, purple, stalk red.

*Habitat & Ecology* — Common in lowland and hill primary forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 422, S 272.

**BEILSCHMIEDIA** Nees in Wall., Pl. Asiat. Rar. 2 (1831) 61.

*Beilschmiedia dictyoneura* Kosterm., Reinwardtia 7 (1965) 24. — Fig. 120

Trees up to 35 m tall, c. 50 cm in diameter. Bark grey brown, smooth to scaly, inner bark reddish brown, granular, sapwood yellowish. Petioles 0.8–1.5 cm long. Leaves opposite or almost opposite, elliptic to oblong, 8–16 cm long, 3–5.5 cm wide, base wedge-shaped, apex acute, leathery, secondary veins 7–9 pairs, curving, joining near margin, tertiary veins laxly net-like. Flowers unknown. Fruits in leaf axils, oblong, c. 1.5 cm long, c. 1 cm in diameter, smooth to warty, on an up to 5 mm long not thickened stalk.

*Habitat & Ecology* — From lowland to mountain forest, up to 1000 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is exploited.

*Material* — W 688, W 698.

**CINNAMOMUM** Boehmer in Ludwig, *Defin.* (1760) 63.

*Vernacular name* — The whole genus is usually called kayu manis (M).

*Cinnamomum cuspidatum* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 1 (1864). 262. —  
Fig. 121

Trees up to 15 m tall, c. 20 cm in diameter. Bark brown. Leaves opposite or almost opposite, elliptic-ovate or lanceolate, 7–18 by 3–6 cm, the base wedge-shaped to rounded, the apex acuminate to long pointed, leathery, glabrous, slightly glaucous below, 3-veined, reticulation visible on both sides. Flowers in axillary racemes, bisexual, rarely unisexual, perianth tube short, funnel-shaped, enlarged, becoming hard in fruit, lobes 6, almost equal, stamens 9, in 3 rows, 3rd row with a pair of stalked or sessile glands on the filaments, staminodes stalked, ovary sessile, style slender. Fruit ovoid, c. 1 cm long, c. 8 mm in diameter, seated on the lobed perianth cup.

*Habitat & Ecology* — In lowland Dipterocarp forest.

*Distribution* — Endemic in Borneo.

*Material* — AA 224.

**CRYPTOCARYA** R. Br., *Prod. Fl. Nov. Holland.* (1810) 402.

*Cryptocarya crassinervia* Miq., *Fl. Ind. Bat.* 1 (1858) 924. — Fig. 122

Trees up to 30 m tall, c. 30 cm in diameter. Bark scaly, brown, inner bark reddish brown, granular, sapwood pale yellow. Twigs stout, covered with reddish brown velvety hairs. Petioles 0.7–2.5 cm long, c. 0.5 cm in diameter. Leaves spiral, elliptic to oblong or almost rounded, 12–32 cm long, 8–15 cm wide, base unequal, wedge-shaped to rounded, apex acute to acuminate, sometimes notched, lower surface glaucous, densely velvety hairy, midrib distinctly channelled below, secondary veins 5–8 pairs, prominently raised below, clearly sunken above. Flowers in terminal and axillary reddish hairy panicles, bisexual, perianth tube ovoid, lobes 6, almost equal, stamens 9, anthers 2-celled, staminodes prominently stalked, ovary sessile. Fruit entirely included in the enlarged perianth tube leaving only a minute opening at apex, oblong to ovate, c. 2.5 cm long, c. 1.5 cm in diameter, with faint ridges.

*Habitat & Ecology* — Scattered from lowland up to 1000 m altitude.

*Distribution* — Malay Peninsula, Java, Borneo.

*Material* — W 662, S 481.

**DEHAASIA** Blume, *Rumphia* 1 (1835) 161.

*Dehaasia cuneata* (Blume) Blume, *Rumphia* 8 (1836) 164. — Fig. 123

Trees up to 35 m tall, up to 45 cm in diameter. Bark more or less smooth, pale brown to whitish, inner bark dark brown, sapwood yellowish brown. Twigs greyish white,

(Lauraceae)

lenticellate, leaf scars prominent. Petioles 1–3 cm long, drying black. Leaves spiral, obovate, 11–19 cm long, 5–9.5 cm wide, base wedge-shaped, apex acute, glaucous below, secondary veins 7–11 pairs, joining near margin. Flowers in axillary panicles, bisexual, perianth lobes 6, outer 3 smaller than inner 3, stamens 9, in 3 rows, anthers 2-celled, staminodes minute. Fruits oblong, up to 2.5 cm long, c. 1.5 cm in diameter, purple to black, stalk swollen, warty, bright red, c. 1.5 cm long.

*Habitat & Ecology* — Scattered in lowland Dipterocarp forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 773, W 927, v.B. 6098.

ENDIANDRA R. Br., Prod. Fl. Nov. Holland. (1810) 402.

*Endiandra kingiana* Gamble, Kew Bull. (1910) 151. — Fig. 124

Trees up to 35 m tall, c. 50 cm in diameter. Buttresses up to 4 m tall. Bark ochre grey or white, smooth, inner bark red, sapwood pale yellow. Young twigs rusty hairy, soon becoming glabrous and whitish. Petioles 1–2 cm long. Leaves spiral, elliptic to oblong, 12–25 cm long, 5–10 cm wide, base wedge-shaped, apex acute to acuminate, hairy below when young, secondary veins 7–9 pairs, tertiary veins very fine, raised, distinct net-like. Flowers in axillary panicles, bisexual, perianth tube short, with 6 lobes, almost equal, stamens 3, staminodes absent, ovary globular. Fruit oblong, c. 3 cm long, c. 1.5 cm in diameter, shining green, drying brown, perianth absent.

*Habitat & Ecology* — Scattered in lowland Dipterocarp forest.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 763, W 867.

EUSIDEROXYLON Teijsm. & Binn., Nat. Tijd. Ned. Indië 25 (1863) 292.

*Eusideroxylon zwageri* Teijsm. & Binn., Nat. Tijd. Ned. Indië 25 (1863) 292.  
— Fig. 125

*Vernacular names* — Ulin (D), teluyan (B).

Trees up to 40 m tall, c. 80 cm in diameter. Bole cylindrical, sometimes shallowly fluted. Buttresses absent. Bark smooth, slightly flaky, reddish brown. Twigs terete, drooping. Petioles c. 1 cm long. Leaves spiral, ovate-oblong or elliptic, 20–30 cm long, 6–9(–15) cm wide, base rounded, apex acute to acuminate, secondary veins 8–12. Flowers in axillary panicles, bisexual, perianth tube short, with 6 lobes, almost equal, stamens 12, staminodes present, ovary globular. Fruit oblong, cylindrical, up to 15 cm long, up to 8 cm in diameter.

*Habitat & Ecology* — In lowland primary and secondary forest, up to 500 m altitude, on sandy well-drained soils. Often common along rivers and adjacent hills, sometimes forming pure stands.

*Distribution* — Sumatra, Borneo, Philippines (Palawan).

*Uses* — This species provides an extremely durable timber ('Bornean ironwood') which is used for heavy construction, posts and woody shingles. Due to over-exploitation the wood is only sold on the inland market.

*Material* — W 47, W 300, AA 153.

LITSEA Lamarck, Encycl. Méth. Bot. 3 (1791) 574.

Trees up to 45 m tall. Leaf buds with or without scales. Leaves spiral, almost opposite or opposite, often glaucous below. Flowers dioecious (male and female flowers on different plants), in pseudo-umbels, surrounded by 4–6 bracts, perianth lobes 6, equal or unequal, stamens in male flowers usually 9 or 12, anthers 4-celled, ovary rudimentary or absent, in the female flower an equal number of staminodes as stamens in male flowers is present, ovary globular or ovoid, style thick. Fruit globular, ovoid, ellipsoid or cylindrical, resting on the more or less enlarged perianth tube, sometimes partly enclosing it.

KEY TO THE SPECIES

- 1 a. Leaves opposite . . . . . *L. oppositifolia*\*
- b. Leaves spiral . . . . . 2
- 2 a. Twigs stout, young usually with hairy cataphylls, the petioles c. 5 mm in diameter . . . . . *L. garciae*
- b. Twigs slender, cataphylls absent, petioles c. 2 mm in diameter . . . . . *L. firma*

*Litsea firma* (Blume) Hook. f., Fl. Brit. India 5 (1886) 162. — Fig. 126

Trees up to 45 m tall, c. 45 cm in diameter. Buttresses sometimes present, up to 2.5 m tall. Bark smooth to scaly, yellowish grey, inner bark yellow, with distinct, white, short, itching fibres, sapwood yellow. Twigs reddish brown hairy. Petioles 1–2 cm long. Leaves spiral, elliptic, oblong, or narrowly obovate, 6–15 cm long, 2.5–6 cm wide, base wedge-shaped, apex rounded or blunt, slightly glaucous, softly hairy beneath, secondary veins 7–11 pairs. Inflorescences from clusters from leaf axils and leafless twigs. Fruits ovoid-oblong, c. 1.5 cm long, c. 1 cm in diameter, apex blunt, seated on a c. 0.5 cm deep perianth cup.

*Habitat & Ecology* — Common species in lowland forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo, Sulawesi.

*Material* — W 141, W 172, W 199, S 649, v.B. 5941, v.B. 5982.

*Litsea garciae* Vidal, Rev. Pl. Vasc. Filip. (1886) 228.

*Vernacular name* — Kangkala (M).

Trees up to 35 m tall, c. 50 cm in diameter. Bark smooth lenticellate, greyish white, inner bark hard, with distinct, short fibres, sapwood white. Twigs stout c. 5 mm in

(Lauraceae)

diameter. Petioles 1–2 cm long, c. 5 mm in diameter. Cataphylls large, up to 10 cm long, silky hairy. Leaves spiral, oblong-lanceolate, or oblong, 15–50 cm long, 5–12 cm wide, base wedge-shaped to almost heart-shaped, decurrent, secondary veins 15–20 pairs. Inflorescences usually in the axils of fallen leaves. Fruits depressed globular, c. 3 cm long, c. 4 cm in diameter, pink becoming purple-black, perianth tube fleshy, green.

*Habitat & Ecology* — Sometimes in secondary forest, or even planted.

*Distribution* — Endemic in Borneo.

*Uses* — The fruits are eaten after boiling in hot water.

*Material* — W 154, AA 391, v.B. 5913.

**NOTHAPHOEBE** Blume, Ann. Mus. Bot. Lugd.-Bat. 1 (1851) 328.

*Nothaphoebe umbelliflora* Blume, Ann. Mus. Bot. Lugd.-Bat. 1 (1851) 328 — Fig. 127.

Trees up to 35 m tall, c. 50 cm in diameter. Bark grey to grey-brown, lenticellate, smooth to scaly, inner bark pink, mottled, aromatic, sapwood yellow. Petioles 1–3 cm long. Leaves spiral, elliptic to oblong or obovate, very variable in size, 6–17 cm long, 2–6 cm wide, base wedge-shaped, apex acute to acuminate, secondary veins 5–9 pairs. Flowers axillary panicles, yellow, bisexual, perianth lobes 6, outer 3 much smaller than inner 3, stamens 9, in 3 whorls, anthers 4-celled, staminodes ovate or triangular, ovary ovoid, style slender. Fruits oblong, c. 3 cm long, c. 1 cm in diameter, reddish, stalk pink, not enlarged.

*Habitat & Ecology* — From lowland to mountain forest, up to 1200 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo.

*Material* — W 192, v.B. 5975, S 488.

**PHOEBE** Nees, Syst. (1836) 98.

*Phoebe grandis* (Nees) Merr., Contr. Arnold Arbor. 8 (1934) 61. — Fig. 128

Trees up to 27 m tall, c. 50 cm in diameter. Bark greyish, lenticellate, scaly, inner dark brown, sapwood deep yellow. Petioles 1.2–5 cm long. Leaves clustered at the end of the twigs, obovate to oblanceolate, 12–30 cm long, 3.5–12.5 cm wide, base wedge-shaped, apex acute to blunt, leathery, secondary veins 9–11 pairs. Flowers in 10–25 cm long panicles, yellowish brown, perianth lobes 6, almost equal, enlarged and erect in fruit, stamens 9, in 3 rows, staminodes stalked, heart-shaped, ovary ovoid, style slender. Fruits ellipsoid, c. 1.5 cm long, c. 0.75 cm in diameter, blue-green, seated on the enlarged lobed perianth cup, stalk red.

*Habitat & Ecology* — Common species from lowland to mountain forest.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo.

*Material* — S 558.

**32 LECYTHIDACEAE**

Medium to large trees. Stipules small falling off early. Leaves simple, obovate, often toothed, spiral, often crowded, without dots. Petioles thickened or not at base. Flowers actinomorphic, 4–6-merous, stamens numerous, disc between stamens and ovary, ovary inferior. Fruit a drupe with hard fleshy and fibrous middle layer of fruit wall, crowned by persistent calyx. — Three genera reported for Kalimantan.

## KEY TO THE GENERA

- 1a. Petioles thickened at base, flowers on long terminal or axillary, usually pendulous spikes, fruits elongate, often ridged . . . . . *Barringtonia*
- b. Petioles not thickened at base, flowers on short (less than 10 cm) few-flowered spikes, fruit ovoid to ellipsoid . . . . . *Planchonia*

**BARRINGTONIA** J.R. & G. Forst., Char. Gen. (1776) 75.

*Literature* — Payens, Blumea 15 (1967) 157–263.

Shrubs or trees. Growth flushwise, with an open terminal bud, each flush provided with reduced leaves (cataphylls) in the basal part. Leaves tufted at the end of the twigs, margin entire or more or less toothed. Petioles thickened at base. Racemes terminal or lateral, or on older twigs, pendent. Flower bud globular, calyx tube terete or quadrangular. Petals 4, free, fused to the staminal tube, papery, stamens fused at base, in 3–6 whorls, style 1, long, terete, needle-shaped, persistent, ovary 4-celled, ovules 2–6 in each cell, pendent. Seed 1, large. — Eighteen species reported for Kalimantan.

## KEY TO THE SPECIES

- 1a. Leaves thickly leathery, drying shiny, margin entire, inflorescences terminal, flowers sessile, fruits angled, red, 4–5 cm long, 1–2 cm in diameter, shrub or small treelet up to 8 m tall, kerangas and sandy shores . . . . . *B. reticulata*\*
- b. Leaves papery to almost leathery, margin distinctly toothed . . . . . 2
- 2a. Leafy twigs 1–1.8 cm in diameter, petioles stout, 5–7 mm in diameter, reduced leaves (cataphylls) up to 3 cm long, inflorescence terminal, rhachis rusty brown hairy . . . . . *B. curranii*
- b. Leafy twigs up to 4 mm in diameter, the petioles slender, up to 2.5 mm in diameter . . . . . 3
- 3a. Leaves toothed, inflorescences directly behind the leaves, slender, 2–4 mm in diameter, treelets up to 5 m tall . . . . . *B. macrostachya*\*
- b. Leaves wavy, inflorescences from older branches, stout, 7–12 mm in diameter, usually trees, more than 10 m tall . . . . . *B. pendula*

(Lecythydaceae)

*Barringtonia curranii* Merr., Philipp. J. Sc. 1 (1906) Suppl. 211. — Fig. 129

*Literature* — Payens, Blumea 15 (1967) 255.

*Vernacular name* — Melapisan (M).

Trees 10–25(–30) m tall, up to 50 cm in diameter. Bole straight. Bark grey to dark brown, pitted like *Agathis*. Leafy twigs 1–1.8 cm in diameter. Petioles stout, 5–7 mm in diameter, cataphylls up to 3 cm long. Leaves obovate-lanceolate, 24–70(–90) cm long, 9–13(–21) cm wide, almost leathery, margin toothed, base wedge-shaped, apex acuminate or obtuse, secondary veins (15–)18–26(–30) pairs. Inflorescences terminal, finely rusty brown hairy, 40–100 cm long. Flowers usually more than 50, sessile, calyx open in bud, petals 4, elliptic, 2.8–3.5 cm long, 1.2–2 cm wide, red, stamens in 5 (or 6) whorls, inner one staminodial, filaments 3–5 cm long, the staminodes 1.2–2.3 cm long. Fruits ovoid, almost quadrangular or more or less terete, tapering at both ends, ferruginous puberulent, pinkish, dark reddish, or light purple.

*Habitat & Ecology* — From sea-level up to 1700 m altitude, on heavy black loam soils or coral limestone.

*Distribution* — Endemic in Borneo.

*Material* — AA 115.

*Barringtonia pendula* (Griff.) Kurz, J. As. Soc. Beng. 46 (1877) 71.

*Literature* — Payens, Blumea 15 (1967) 248.

Trees up to 35(–47) m tall, up to 50(–90) cm in diameter. Bole straight. Bark red-brown, hooped. Leafy twigs 3–4 mm in diameter. Petioles slender, up to 2.5 mm in diameter, cataphylls up to 8 mm long. Leaves obovate-lanceolate or obovate-oblong, 13–22(–30) cm long, 5–7(–9) cm wide, almost leathery, margin wavy, base wedge-shaped, apex acuminate, secondary veins 8–15 pairs. Inflorescences on older branches, glabrous, 20–40 cm long. Flowers less than 50, sessile, calyx open in bud, petals 4, elliptic, 2–3.5 cm long, 1.5–2.5 cm wide, white to pinkish, stamens in 4(–6) whorls, inner one staminodial, filaments 3–4 cm long, staminodes 5–13 mm long. Fruits ovoid, fissured, warty, pinkish green or red.

*Habitat & Ecology* — Usually in mixed Dipterocarp forest, up to 800 m altitude.

*Distribution* — Burma, China, Thailand, Malay Peninsula, Sumatra, Borneo.

*Material* — W 256, W 467, AA 26, S 582.

**PLANCHONIA** Blume in Van Houtte, Fl. Serres 7 (1851) 24.

*Planchonia valida* (Blume) Blume in Van Houtte, Fl. Serres 7 (1851) 24. — Fig. 130

*Literature* — Kuswata, Bull. Surv. Ind. 7 (1965) 168.

*Vernacular name* — Putat (M).



(**Lecythidaceae/Linaceae/Loganiaceae**)

Trees up to 35(–50) m tall, up to 1 m in diameter. Bole slightly uneven. Buttresses low, up to 50 cm tall. Bark smooth, blackish, older one with loose, thin papery scales. Inner bark thick, soft, fibrous, pink. Sapwood white sharply marked from the heartwood. Leaves elliptic to obovate, (5–)10–25(–28) cm long, (3–)6–10 cm wide, base tapering into winged petiole, apex acute to acuminate, secondary veins 9–13, looping, margin finely toothed all round. Inflorescences terminal, up to 10 cm long, many-flowered. Sepals 4, fused, calyx tube bell-shaped, ribbed, petals 4, free, overlapping, papery, greenish, reflexed, obovate-oblong, 15–35 mm long, 7–10 mm wide, staminal tube c. 1 cm long, pink to red, free part 2.5–4.5 cm long, yellowish white, ovary 4-celled, ovules horizontal, numerous, style slender, 3–6 cm long. Fruits ovoid to ellipsoid, 3–4 cm long, 1.5–2.5 cm in diameter inner fruit wall hard, fibrous. Seeds 1–15.

*Habitat & Ecology* — In lowland forest, usually along rivers or on hillsides.

*Distribution* — Malay Peninsula, Sumatra, Java, Bali, Timor, Borneo, Sulawesi. Of the genus *Planchonia* three species are reported for Kalimantan.

*Uses* — The wood is easy to work, but not very durable and it provides a good to very good firewood. Young leaves are eaten as lalab (raw vegetables).

*Material* — W 978, S 555.

### 33 LINACEAE

*Vernacular name* — Ketinjak (K).

Medium trees. Stipules small, falling off early. Leaves simple, opposite or spiral, entire. Inflorescence a panicle, terminal or axillary. Flowers actinomorphic, 4- or 5-merous, bisexual, sepals persistent in fruit, disc present. Fruits thinly woody, ellipsoid, dehiscent. Seeds arillate. — Two genera reported for Kalimantan.

#### KEY TO THE GENERA

- 1a. Leaves opposite, inflorescence terminal, stamens 5 long, 5 short, fruit dehiscent on one side, containing one seed with a bristly aril . . . . . *Ctenolophon*
- b. Leaves spiral, inflorescence axillary, stamens 8–18, fruits dehiscent into 5 parts, containing a few seeds with a fleshy aril . . . . . *Ixonanthes*

### 34 LOGANIACEAE

**FAGRAEA** Thunb., Vet. Acad. Handl. Stockh. 3 (1782) 132, t. 4.

*Literature* — Leenhouts in *Flora Malesiana* I, 6 (1962) 299–336.

(Loganiaceae/Lythraceae)

KEY TO THE SPECIES

- 1a. Stipules fused in an ochrea, inflorescences peduncled, trees or shrubs *F. racemosa*
- b. Stipules fully split, inflorescences not distinctly stalked, 3--17-flowered, usually a shrub or epiphyte ..... *F. ceilanica\**

*Fagraea racemosa* Jack ex Wall. in Roxb., Fl. Ind. 2 (1824) 35. — Fig. 131

*Literature* — Leenhouts in Flora Malesiana I, 6 (1962) 311.

*Vernacular name* — Engkudug biang (B).

Trees 5–8(–15) m tall, up to 30 cm in diameter. Leaves simple, opposite, entire, broadly ovate to elliptic, obovate-oblong, 15–30 cm long, 8–15 cm wide, leathery, base wedge-shaped to rounded, often distinctly heart-shaped, apex acute or acuminate, secondary veins 4–12 pairs, sunken above. Petioles 0.25–5 cm, usually stout. Stipules fused into ring-like, up to 0.75 cm high ochrea, which clasps the twig. Inflorescences terminal, often drooping, 2–60 cm long (including the 1–30 cm long stalk). Flowers actinomorphic, bisexual, 5-merous, calyx bell-shaped to almost globular, corolla tube 2–4 cm long, creamy-white, funnel-shaped, lobes overlapping, stamens inserted on corolla tube, ovary superior. Fruit a many-seeded berry with sticky exudate in the outer skin, up to 2 cm long.

*Habitat & Ecology* — Light to rather dense, often secondary forest on swampy to dry soil.

*Distribution* — Indochina, Thailand, Malay Peninsula, Sumatra, Borneo, Maluku, New Guinea.

*Uses* — Wood soft to moderately hard, used for construction and firewood.

*Material* — W 73, W 846, S 201, S 787.

### 35 LYTHRACEAE

**LAGERSTROEMIA** L., Am. Acad. IV (1759) 137.

*Literature* — Furtado & Srisuko, Gard. Bull. Sing. 24 (1969) 185–335.

*Vernacular name* — Bungur (M).

Medium trees. Stipules absent. Leaves simple, opposite, entire. Inflorescence a terminal panicle. Flowers actinomorphic, bisexual, calyx ridged, 5–10-lobed, petals 6, free, wrinkled, stamens usually numerous, ovary superior or semi-inferior. Fruit a woody capsule with persistent calyx, seeds numerous, elongate, winged. — Five species reported for Kalimantan.

*Note* — *Lagerstroemia speciosa* (L.) Pers. is commonly planted as ornamental along the roads. It is also used to control erosion and planted for firewood.

**36 MAGNOLIACEAE**

Medium to large trees, wood and flowers often aromatic. Leaves simple, spiral, entire. Stipules large, leaving ring-like scars. Flowers single, actinomorphic, bisexual, tepals several, free, overlapping, hypanthium raised with free stamens below and many carpels above. — Four genera reported for Kalimantan.

## KEY TO THE GENERA

- 1 a. Flowers terminal, gynoecium sessile or very shortly stipitate, fruits formed of fleshy carpels, not splitting or partly to completely free, dehiscent, seeds pendent from white threads . . . . . *Magnolia* (*Aromadendron*, *Talauma*)
- b. Flowers axillary on short branches . . . . . 2
- 2 a. Leaves glaucous, gynoecium sessile, carpels united, primary forest tree, often swamps . . . . . *Elmerillia tsiampacca*
- b. Leaves not glaucous, gynoecium stipitate, carpels well-spaced, commonly cultivated, originally from India  
       *Michelia champaca* var. *champaca*\* (cempaka kuning)

*ELMERILLIA* Dandy, Kew Bull. (1927) 261.

*Elmerillia tsiampacca* (L.) Dandy in Praglowski, World Pollen & Spore Flora 3 (1974) 5. — Fig. 132

*Literature* — Nooteboom in Flora Malesiana I, 10 (1988) 596.

*Vernacular names* — Arau (K), minag (B).

Trees 20–35(–60) m tall, up to 1.50(–2) m in diameter. Bark pale brown, finely cracked. Twigs ferruginously pubescent. Stipules free from petioles, same indument as the twigs. Leaves elliptic, 20–30 cm long, 8–12 cm wide, base wedge-shaped to rounded, apex acuminate, 5–17 mm long, hairy beneath, glaucous, secondary veins 16–22 pairs. Petioles 7–35 mm long. Flowers solitary, on axillary shortshoots, white, tepals c. 15, glabrous, stamens numerous, 10–14 mm long, connective produced in a short appendage, gynoecium sessile, carpels many (c. 50), with the base sunken in the torus, fused, ovules 2–6. Fruits cylindrical, 4–9 cm long, 1.4–2 cm in diameter.

*Habitat & Ecology* — Very common in swamps and along streams.

*Distribution* — Sumatra, Borneo, Sulawesi, Maluku, New Guinea.

*Uses* — The timber is valuable for its colour (whitish yellow) and is suitable for making furniture, plywood and is used for construction purposes.

*Note* — Only this species reported for Kalimantan.

*Material* — W 926, v.B. 6096.

(Magnoliaceae)

MAGNOLIA L., Sp. Pl. (1753) 535.

*Synonyms* — *Talauma* Juss., Gen. Pl. (1789) 281; *Aromadendron* Blume, Bijdr. (1825) 10.

*Literature* — Nootboom in Flora Malesiana I, 10 (1988) 568–589.

Medium-sized trees. Stipules fused to or free from the petioles. Flowers terminal, solitary. Tepals c. 12, almost equal or the outer whorl forming a distinct calyx. Gynoecium sessile or stipitate, carpels many to few, usually free, sometimes fused (subg. *Talauma*). Fruiting carpels dehiscent longitudinally, often exposing the seeds hanging downwards from stalks. Ovules generally 2 in each carpel. — Fourteen species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves small, up to 15 cm long, petioles 12–17 mm long, stipules free from the petioles . . . . . *M. borneensis*\*
- b. Leaves large, 30–70 cm long, petioles 3–11 cm long, stipules fused to the petioles, leaving a scar on it . . . . . 2
- 2a. Young twigs, peduncle and carpels densely very long villous . . . . . *M. lasia*
- b. Young twigs, peduncle and carpels glabrescent *M. candollii* var. *singaporensis*

*Magnolia candollii* (Blume) H. Keng var. *singaporensis* (Ridley) Noot., Blumea 32 (1987) 376. — Fig. 133

*Literature* — Nootboom in Flora Malesiana I, 10 (1988) 586.

Trees up to 40 m tall, up to 60 cm in diameter. Bark smooth, brownish. Twigs glabrescent. Petioles 3–11 cm long, stipule scars from up to one third to up to two thirds of its length. Leaves elliptic to obovate, 30–70 cm long, 8–25 cm wide, glabrous, base wedge-shaped, apex slightly acuminate, secondary veins 17–29 pairs. Peduncle glabrescent, 5–12 cm long. Outer tepals glabrous, 5–8 cm long, inner ones c. 2 cm shorter, stamens 25–30 mm long, carpels glabrescent, 50–150. Fruits dark red, 10–15 cm long, 6–7 cm in diameter, stylar spine recurved, c. 1 cm long.

*Habitat & Ecology* — Lowland Dipterocarp forest, sometimes also in secondary forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — S 554, S 822, P.K. 622.

*Magnolia lasia* Noot., Blumea 32 (1987) 377. — Fig. 134a & b

*Literature* — Nootboom in Flora Malesiana I, 10 (1988) 587.

*Vernacular name* — Cempaka hutan (M).

Trees up to 25 m tall, up to 25 cm in diameter. Bark smooth, greyish, lenticellate. Young twigs densely very long villous. Petioles 4–10 cm long, stipule scars from halfway to up to the apex. Leaves elliptic to obovate, 25–60 cm long, 11–25 cm

(Magnoliaceae/Melastomataceae)

wide, glabrous, base wedge-shaped, apex hardly acuminate, secondary veins 16–22 pairs. Peduncle densely long villous, 4–15 cm long. Flowers fragrant, tepals glabrous, yellowish, 6–10 cm long, stamens 25–30 mm long, carpels densely long villous, with very long styles, more than 100. Fruits 10–15 cm long, 7–8 cm in diameter, stilar spine recurved, c. 0.5 cm long.

*Habitat & Ecology* — Lowland Dipterocarp forest, sometimes also in secondary forest.

*Distribution* — Endemic in Kalimantan.

*Material* — W 625, S 532, v.B. 5926A, v.B. 5967.

### 37 MELASTOMATACEAE

Small trees. Stipules absent. Leaves simple, opposite, entire. Flowers actinomorphic, bisexual, petals free, stamens up to 10, connective often with appendages, anthers opening by a vertical slit (in most other genera the anthers opening by apical pores), ovary inferior. Fruit a berry. — Three genera reported for Kalimantan.

#### KEY TO THE GENERA

- 1a. Leaves pinnately veined, venation indistinct, calyx smooth, fruit 1-celled, fruit with star-shaped ridges inside the calyx rim, seed 1 . . . . . *Memecylon*
- b. Leaves 3-veined, venation ladder-like, calyx ornamented, fruit 5-celled, seeds many . . . . . *Pternandra*

**MEMECYLON** L., Sp. Pl. (1753) 349.

*Memecylon borneense* Merr., Philipp. J. Sci. 8 (1913) Bot. 213. — Fig. 135

*Literature* — Bremer, Opera Bot. 69 (1983) 41.

*Vernacular name* — Nipis kulit (M).

Tree up to 20 m tall, c. 30 cm in diameter. Bark smooth, very finely fissured, brownish, inner bark thin. Twigs terete. Leaves elliptic, 3–9 cm long, 1–4 cm wide, base wedge-shaped, apex acuminate to long pointed, drying dark brown, venation obscure or invisible. Inflorescences condensed in the leaf axils and at the nodes on the branches just below the leaves. Calyx cup-shaped, 4-lobed, 1.5–2.5 mm in diameter, petals 4, almost circular to triangular, stamens 8, anthers 0.8–1.4 mm long, connective curved, with a gland, ovary 1-locular, ovules 2–20. Fruits globular, 6–9 mm in diameter, greenish white becoming blue, seed 1.

*Habitat & Ecology* — Common in kerangas forest in Sabah.

*Distribution* — Endemic in Borneo. Of the genus *Memecylon* thirteen species are reported for Kalimantan.

*Material* — W 488 = AA38.

(Melastomataceae / Meliaceae)

**PTERNANDRA** Jack, Malay Misc. 2 (1822) 60.

*Pternandra rostrata* (Cogn.) Nayar, Bull. Bot. Survey India 17 (1978) 53. — Fig. 136

*Literature* — Maxwell, Gard. Bull. Sing. 34 (1981) 62.

*Vernacular name* — Tiju (K).

Trees up to 20 m tall, up to 25 cm in diameter. Bark finely fissured, thinly scaly, grey to brown, inner bark fibrous, thin, light brown, sapwood cream-coloured to yellow, very hard. Branchlets terete, smooth. Leaves elliptic to ovate, 6.5–21 cm long, 3–10 cm wide, base wedge-shaped to rounded, apex acuminate, almost leathery, glabrous, prominently 3-veined from base. Petioles 2–8 mm long. Inflorescences of axillary or terminal cymes of 3 or solitary flowers. Calyx tube cup-shaped, with an external pattern of tubercles, petals 4, thick, stamens 8, filaments flattened, anthers almost kidney-shaped, glands absent, ovary 4-celled, each cell with many minute ovules. Fruits bell-shaped, truncate at top, external pattern as in calyx. Seeds numerous.

*Habitat & Ecology* — In primary forest, often along streams.

*Distribution* — Sumatra, Borneo, New Guinea. Of the genus *Pternandra* fourteen species are reported for Kalimantan.

*Material* — W 786.

### 38 MELIACEAE

Small to large trees. Stipules absent. Leaves compound, spiral, entire, without gland dots. Petioles thickened at base. Flowers actinomorphic, bisexual, 5-merous, petals free, filaments fused into a staminal tube, ovary superior, stigma broad, nearly sessile. Fruit a capsule, berry or drupe. Seeds usually arillate. — Fourteen genera reported for Kalimantan.

*Uses* — Most Meliaceae grown for timber are exotics, notably the neotropical *Swietenia mahagoni* (L.) Jacq. (mahogany). Although the timber of some other genera is very fine, few are exploited. Locally, some *Aglaia*, *Dysoxylum*, and *Walsura* species are used for construction work and furniture. The fruit trees *Lansium domesticum* Correa (langsats, duku, lisat) and *Sandoricum koetjape* (Burm. f.) Merr. (sentol, ketapi) are common in villages and widely grown.

#### KEY TO THE GENERA

- 1a. Leaves 3-foliolate, fruit a leathery 5-seeded berry, fruit trees . . . *Sandoricum*\*
- b. Leaves pinnate or 1-foliolate . . . . . 2
- 2a. Rhachis with continuously growing coiled tip . . . . . *Chisocheton*\*
- b. Rhachis without continuously growing tip . . . . . 3

(Meliaceae)

- 3a. Plants without milksap, leaves paripinnate or imparipinnate, opposite, inflorescence axillary, rarely flowers on the trunk, fruit dehiscent . . . . . **Dysoxylum**
- b. Plants with milksap (at least in young fruits) . . . . . 4
- 4a. Plants with scales or stellate hairs, especially on the young parts, inflorescence, axillary or terminal, fruit dehiscent or not . . . . . **Aglaia (Amoora)**
- b. Plants glabrous or hairy, without scales or stellate hairs . . . . . 5
- 5a. Inflorescence on the trunk, fruit non-dehiscent, common fruit trees in villages **Lansium\***
- b. Inflorescence axillary, fruit dehiscent . . . . . **Aphanamyxis\***

AGLAIA Lour., Fl. Cochin. (1790) 173.

*Synonym* — *Amoora* Roxb., Pl. Corom. 3 (1820) 54.

*Literature* — Pannell, Kew Bull. Add. Ser. XVI (1992) 1–379.

Trees or shrubs. Bark with large scattered lenticels, latex usually present, white. Young parts usually with stellate hairs or stellate or peltate scales. Leaves spiral, usually imparipinnate, rarely with a single leaflet (*A. simplicifolia*). Inflorescences axillary or above the axils, rarely on branches. Male inflorescences large, much branched, up to several thousand flowers, female ones similar, but usually smaller and less-branched. Calyx cup-shaped, 3–5(–6)-lobed, petals 3–5(–6), usually free, staminal tube obovoid with a minute pore or almost globular or cup-shaped with a wider aperture, anthers 5–8, in a single whorl. Infructescences with 1 to several fruits, fruits almost globular, obovoid or ellipsoid, dehiscent or indehiscent, containing 1–4 arilate seeds. — About 50 species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves ‘simple’ . . . . . *A. simplicifolia*
- b. Leaves compound of more than 5 leaflets . . . . . 2
- 2a. Leaflets with stellate reddish brown hairs . . . . . *A. tomentosa*
- b. Leaflets more or less glabrous . . . . . 3
- 3a. Leaflet surfaces dull and pitted, venation net-like, more or less prominent *A. spectabilis*
- b. Leaflet surfaces not pitted . . . . . *A. crassinervia\**

*Aglaia (Aglaia) simplicifolia* (Bedd.) Harms in Engl. & Prantl, Nat. Pflanzenfam. 3, 4 (1896) 300.

*Literature* — Pannell, Kew Bull. Add. Ser. XVI (1992) 306.

*Vernacular names* — Belayang (M), bunau (M).

Treelets 8–10(–20) m tall, up to 20 cm in diameter. Outer and inner bark greyish brown, sapwood yellow or red. Young twigs with dense reddish brown stellate hairs. Leaf consisting of a single leaflet, 15–32 cm long, 4.5–10 cm wide, upper surface minutely pitted, lower surface with occasional stellate hairs, secondary veins

(Meliaceae)

11–18 pairs, longitudinally wrinkled. Staminal tube nearly as long as the corolla, obovoid with a small aperture and the 5 anthers not protruding. Fruits obovoid to almost globular, c. 4 cm in diameter, indehiscent, 2-celled, each containing 0 or 1 seed.

*Habitat & Ecology* — Usually on ridges in undulating country.

*Distribution* — India, Laos, Thailand, Malay Peninsula, Sumatra, Borneo.

*Material* — v.B. 5829, P.K. 643.

*Aglaia (Amoora) spectabilis* (Miq.) Jain & Bennett, Indian J. For. 9 (1987) 271. — Fig. 137

*Synonym* — *Aglaia ridleyi* (King) Pannell, Malay. For. 45 (1982) 455.

*Literature* — Pannell, Kew Bull. Add. Ser. XVI (1992) 79.

Trees up to 40 m tall, up to 1.5 m in diameter. Buttresses up to 2 m tall, up to 3.7 m wide. Bark grey, white or brown, flaky, exposing a cream-coloured enamel-like surface beneath, inner bark reddish brown, sapwood pale brown or white, heartwood pale brown, latex white. Apical bud with dense reddish or pale brown stellate hairs. Leaves up to 80 cm long, leaflets (11–)15–21, 8–23 cm long, 2.5–6 cm wide, almost leathery, upper surface rugulose and pitted, secondary veins 9–19 pairs, venation net-like, more or less prominent. Petals 3, staminal tube cup-shaped, anthers 6. Fruit almost globular or ovoid, c. 9 cm long, c. 8 cm in diameter, dehiscent, fruit wall c. 1 cm thick, with white latex, 3-celled, each cell containing 0 or 1 seed, aril complete, white when unripe becoming red.

*Habitat & Ecology* — In mixed Dipterocarp lowland forest, but also in secondary and riverine forest, scattered to common on sandstone, loam, alluvial or coral, up to 650 m altitude.

*Distribution* — South and Southeast Asia, Malesia, Pacific islands, Australia.

*Material* — W 246.

*Aglaia (Aglaia) tomentosa* Teijsm. & Binn., Nat. Tijds. Ned. Indië 27 (1864) 43.

*Literature* — Pannell, Kew Bull. Add. Ser. XVI (1992) 331.

*Vernacular name* — Bunau (M).

Trees 8–10(–26) m tall, c. 20 cm in diameter. Bark grey with green patches, sometimes hooped, inner bark yellow, sapwood whitish to pale brown, latex white. Leaves up to 45 cm long, leaflets 5–11, 2.5–17 cm long, 1.5–6.5 cm wide, parchment-like, with dense reddish brown stellate hairs on midrib veins and scattered on the rest of the lower surface, secondary veins 5–20 pairs, tertiary venation invisible. Petals 5, staminal tube cup-shaped, anthers 5. Fruit almost globular to pear-shaped, c. 2.5 cm in diameter, 1- or 2-celled, each cell containing 1 seed.

*Habitat & Ecology* — A very widespread species, in primary forest from sea-level up to 2000 m altitude. Fruit eaten by monkeys.

*Distribution* — S. India, Vietnam, Laos, Thailand, Malesia, Australia.

*Material* — W 778, W 919, AA 106, AA 262, v.B. 5781.



**DYSOXYLUM** Blume, Bijdr. (1825) 172.

*Dysoxylum alliaceum* Blume, Bijdr. (1825) 172. — Fig. 138

*Vernacular name* — Longkang bawang (M).

Trees up to 38 m tall, up to 65 cm in diameter. Bole often of poor shape, fluted. Buttresses short. Bark thin, lenticellate to finely fissured, inner bark red brown, with strong smell of onion, heartwood red-brown. Apical bud leaves fist-shaped. Leaves spiral, pinnate, up to 60(–120) cm long, smelling of onion when crushed. Leaflets in c. 6 pairs, almost glabrous, secondary veins 8–12 pairs. Flowers in thyrses, calyx 3–5-lobed, petals 4 or 5, anthers 8–10, disc tubular, ovary 2–5-celled. Fruit a 3-celled capsule, each cell 1- or 2-seeded. Seeds 1–4, covered by a red aril.

*Habitat & Ecology* — In *Agathis* forest on peat with sandy underlayer.

*Distribution* — Andamans to Australia. Of the genus *Dysoxylum* seventeen species are reported for Kalimantan.

*Material* — AA 421, v.B. 5830.

### 39 MIMOSACEAE

Medium to large trees. Stipules rarely absent, usually falling off early. Leaves bipinnate, spiral, leaflets entire, often glands on rhachis. Flowers actinomorphic, bisexual, sepals 5, petals 5, both fused at base, stamens many, filaments fused at base, ovary superior, 1-celled. Fruit a pod, often coiled. — Thirteen genera are reported for Kalimantan.

#### KEY TO THE GENERA

- 1a. Flowers in small heads arranged in panicles, pods usually coiled, dehiscent  
*Archidendron*
- b. Flowers in a single large head, pendent from a long stalk, pods non-dehiscent  
*Parkia*

**ARCHIDENDRON** F. Muell., Fragm. 5 (1865) 59.

*Literature* — Nielsen in *Flora Malesiana* I, 11 (1992) 86–141.

*Vernacular name* — Jengkol hutan (M).

Shrubs or trees. Stipules present or not. Leaf rhachis and pinnae with extrafloral nectaries, leaflets opposite or alternate. Flowers bisexual, 5-merous, uniform. Calyx fused, valvate. Corolla fused, valvate, tube united with the staminal tube in the lower part. Stamens numerous, at base united into a tube. Ovary(ies) 1–15 per flower, sessile or stipitate. Pods parchment-like, leathery, fleshy or woody, straight, curved, or spirally twisted, flat or terete, dehiscent, often reddish outside, and orange-reddish within. Seeds transversely held, ellipsoid, flattened, with a black or bluish-black testa, wingless, aril absent, endosperm absent, cotyledons large. — Nineteen species reported for Kalimantan.

(Mimosaceae)

KEY TO THE SPECIES

- 1 a. Branchlets terete, leaflets alternate (at least proximal pair), large, 6–22 cm long, glands large, urn-like . . . . . *A. havilandii*
- b. Branchlets terete, leaflets opposite, smaller, up to 15 cm long, glands smaller, usually not urn-like . . . . . 2
- 2 a. Leaflets parchment-like, nearly sessile, lower leaflet surface puberulous or velvety, papillose, flowers grouped in corymbs or umbels, fruits spirally twisted, flattened . . . . . *A. clypearia*
- b. Leaflets leathery, petioles 2–5 mm long, lower leaflet surface not papillose . . . 3
- 3 a. Leaflets with 7–14 lateral pairs of veins, parallel, straight, lower surface almost glabrous, flowers grouped in umbels, fruits forming a circle or a rounded square, c. 3.5 cm in diameter, Kerangas forest . . . . . *A. borneense*\*
- b. Leaflets with 6–10 lateral pairs of veins, not parallel, arching, lower surface puberulous, flowers aggregated into glomerules, sessile or nearly sessile, fruits spirally twisted, 14–25 cm long . . . . . *A. cockburnii*

*Archidendron clypearia* (Jack) Nielsen, *Adansonia sér.* 2, 19 (1) (1979) 15.

*Literature* — Nielsen in *Flora Malesiana I*, 11 (1992) 97.

Trees 8–15(–22) m tall, up to 25 cm in diameter. Bark brown, cracked, inner bark reddish brown, sapwood white. Branchlets strongly angled or winged by decurrent leaf-scars. Leaflets 4–14 pairs per pinna, nearly sessile, opposite, parchment-like, unequal-sided, trapezoid to oblong, 0.35–4 cm long, 0.5–2.5 cm wide, base unequally wedge-shaped, apex acuminate, sometimes glabrous beneath, papillose. Inflorescences terminal. Flowers in stalked corymbs or umbels, calyx light green, cup-shaped, 1–3 mm long, corolla creamy white or yellow, bell-shaped, 3.5–11 mm long, stamens creamy white or yellow, ovary solitary, hairy. Pods orange-yellow outside, reddish inside, flattened, spirally twisted, parchment-like, up to 20 cm long, c. 1 cm in diameter, dehiscent. Seeds black, ovoid to ellipsoid, 6–10 mm long.

*Habitat & Ecology* — Primary and secondary rain forest, also from kerangas, swamp and peat-swamp forest, usually on sandy soils.

*Distribution* — India to New Guinea.

*Uses* — Leaves used for tanning and colouring of rattan.

*Material* — W 1A, S 647A.

*Archidendron cockburnii* Nielsen, *Opera Bot.* 76 (1984) 63.

*Literature* — Nielsen in *Flora Malesiana I*, 11 (1992) 99.

Trees up to 40 m tall, c. 50 cm in diameter. Bark brown, grey, hooped (transverse rows of lenticels), inner bark pale greenish yellow, sapwood white or pale yellow, heartwood yellowish. Branchlets angled by decurrent leaf-scars. Leaflets 2 or 3 pairs per pinna, opposite, leathery to parchment-like, unequal-sided, elliptic-lanceo-

(Mimosaceae)

late or lanceolate, 4–15 cm long, 2–7 cm wide, base unequally wedge-shaped, apex acuminate, lower surface puberulous. Inflorescences terminal. Flowers in stalked glomerules, calyx pale yellowish white, narrowly cup-shaped, 3.5–4.8 mm long, corolla creamy white, funnel-shaped, 7–11 mm long, stamens creamy whitish, ovary solitary, hairy. Pods ferruginous or chocolate-brown outside, apricot-red or orange inside, flattened, spirally twisted, leathery to parchment-like, 14–25 cm long, 1.5–2.2 cm in diameter, dehiscent. Seeds black, glossy, ellipsoid, c. 15 mm long.

*Habitat & Ecology* — Primary and secondary rain forest, often along rivers.

*Distribution* — Endemic in Borneo.

*Material* — W 838.

*Archidendron havilandii* (Ridley) Nielsen, Opera Bot. 76 (1984) 75. — Fig. 139

*Literature* — Nielsen in Flora Malesiana I, 11 (1992) 105.

Trees up to 40 m tall, c. 75 cm in diameter. Bark grey, smooth, hooped (transverse rows of lenticels), inner bark dark red or white, sapwood white, heartwood bright yellow. Branchlets terete. Leaflets 1.5 or 2 pairs per pinna, basal pair alternate, apical one opposite, parchment-like, equal-sided, ovate-elliptic, elliptic, or obovate-elliptic, 5.5–22 cm long, 3–12 cm wide, base wedge-shaped, apex acuminate, lower surface with scattered hairs. Inflorescences terminal. Flowers in stalked glomerules, calyx green, funnel-shaped, 3.1–4 mm long, corolla green or white, narrowly funnel-shaped, 6.5–8 mm long, stamens white, ovary solitary, glabrous. Pods brown outside, light brown inside, terete, straight, woody-rigidly leathery, up to 16 cm long, c. 4 cm in diameter, dehiscent. Seeds brown, truncate at both ends, almost cylindrical, 12–35 mm in diameter.

*Habitat & Ecology* — Primary and secondary rain forest, up to 1500 m altitude.

*Distribution* — Endemic in Borneo.

*Material* — W 765, AA 396.

**PARKIA** R. Br. in Denham & Clapp., Narr. Travels Africa, Bot. App. (1826) 289.

*Literature* — Hopkins in Flora Malesiana I, 11 (1992) 193–205.

Trees up to 50 m tall. Petioles and rachis usually with extrafloral nectaries. Flowers in small heads, arranged in panicles, stamens 10, all fertile, ovary shortly stalked, stigma terminal. Infructescence pendent, receptacle swollen, bearing one to several pods. Pods stipitate, woody or leathery, glabrous, usually twisted. Seeds many, in one row, ellipsoid, flattened. — Four species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaflets sigmoid, apex acute . . . . . *P. timoriana*
- 1b. Leaflets narrowly oblong, apex rounded . . . . . *P. speciosa*

(Mimosaceae / Moraceae)

*Parkia speciosa* Hassk., Flora 25 (1842) 55.

*Literature* — Hopkins in Flora Malesiana I, 11 (1992) 198.

*Vernacular name* — Petai (M).

Trees up to 40 m tall, up to 1 m in diameter. Buttresses up to 1.5 m tall or absent. Bark smooth or dippled, light brown to grey, or reddish. Inner bark pink to deep red, fibrous. Leaves 21–35 cm long. Gland on petioles single, elliptical, midway between base and first pair of pinnae. Pinnae 11–20 pairs, opposite, leaflets 29–42 pairs, narrowly oblong, (3–)5–10(–12) mm long, glabrous, base strongly ear-shaped on proximal side, apex rounded. Pods strap-shaped, usually twisted, leathery, swollen over the seeds, veins prominent, stalk 3–13.5 cm long. Seeds c. 18 per pod, testa green, soft.

*Habitat & Ecology* — Lowland rain forest, common but scattered. Often cultivated.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo.

*Uses* — The mature green seeds are eaten as vegetable; they are also used medicinally against liver disease, diabetes, and worms.

*Material* — W 869, v.B. 6072.

*Parkia timoriana* (DC.) Merr., Philipp. J. Sci. 5 (1910) Bot. 33. — Fig. 140

*Synonym* — *Parkia javanica* auct. vix (Lam.) Merr., Sp. Blanc. (1918) 168.

*Literature* — Hopkins in Flora Malesiana I, 11 (1992) 201.

*Vernacular name* — Petai hutan (M).

Trees up to 50 m tall, c. 2.5 m in diameter. Buttresses 1–4 m tall, sometimes absent. Bark smooth, brownish. Inner bark outwards red and inwards yellowish, fibrous. Leaves 18–42 cm long. Gland on petioles 1 or sometimes 2, 1.5–4 cm from base. Pinnae 14–31 pairs, opposite or almost opposite, leaflets 52–72 pairs, somewhat sigmoid, 6–10.5 mm long, margin with stiff white hairs, base ear-shaped at proximal side, apex acute. Pods strap-like, flat, woody, veins prominent, stalks 6–15.5 cm long. Seeds 12–19 per pod, testa dark brown, hard.

*Habitat & Ecology* — Lowland rain forest, sometimes common.

*Distribution* — NE. India, Bangladesh, Burma, Thailand, Malesia.

*Uses* — The seeds are sometimes eaten as a substitute for *P. speciosa* after roasting, but they have a bitter flavour.

*Material* — S 712.

#### 40 MORACEAE

Trees, shrubs, or climbers. Inner bark with white latex. Stipules small to large, often forming a cap over the buds. Leaves alternate, spiral or rarely opposite (some *Ficus*), simple, pinnate, or pinnatifid. Inflorescences axillary, unisexual or bisexual, male and female flowers on different plants or not. Fruits united into large fleshy compound structures (heads) or enclosed in figs. — Five genera reported for Kalimantan.

## KEY TO THE GENERA

- 1a. Leaf base 3-veined ..... *Ficus*\*
- b. Leaf base not 3-veined ..... 2
- 2a. Bole with large lenticels, fruits with persistent bracts on stalk  
*Parartocarpus bracteatus*
- b. Bole without large lenticels, fruits without bracts ..... 3
- 3a. Stipules stem-clasping, leaving ring-like scars on the twigs, leaves spirally arranged ..... *Artocarpus* subg. *Artocarpus*
- b. Stipules not stem-clasping, leaves alternate ..... 4
- 4a. Leaves abruptly and distinctly acuminate, glabrous, gland hairs sunken  
*Prainea*\*
- b. Leaves usually not abruptly acuminate, often pubescent, gland hairs not sunken  
*Artocarpus* subg. *Pseudojaca*

**ARTOCARPUS** J.R. & J.G.A. Forster, Charact. Gen. (1776) 101.

Small to tall trees. Leaves spiral or alternate, simple and entire, or pinnate (*A. anisophyllus*); juvenile leaves often shallowly to deeply lobed to pinnatifid. Stipules generally large and conical, covering the bud, leaving ring-like scars on the twigs. Petioles sometimes thickened at base. Flowers unisexual, in heads, male and female heads on the same tree, male ones smaller than female ones. Fruit a fleshy, smooth, prickly, scaly or chequered head, small to gigantic. Seeds large, embedded in the fruit head and surrounded by a waxy or pulpy succulent layer (= enlarged perianth tube), the strap-shaped parts between them being the undeveloped female flowers. — Twenty-five species reported for Kalimantan.

*Uses* — Well known for its edible fruits as Jack-fruit (nangka), Bread-fruit (kluwih/sukun) and cempedak. The light hardwood (terap) and the medium hardwood (keledang) constitute a valuable timber resource.

## KEY TO THE SPECIES

- 1a. Cultivated trees ..... 2
- b. Wild trees ..... 4
- 2a. Mature leaves always lobed ..... *A. altilis* (syn. *A. communis*)\*  
(Bread-fruit, kluwih: seeded form; sukun: seedless form)
- b. Mature leaves entire ..... 3
- 3a. Leaves glabrous ..... *A. heterophyllus*\* (Jack-fruit, nangka)
- b. Leaves with long hairs on petioles and midrib below ..... *A. integer*\* (cempedak)
- 4a. Mature leaves compound, a small pair of leaflets alternating with a large pair  
*A. anisophyllus*
- b. Mature leaves simple, sometimes deeply lobed ..... 5
- 5a. Leaves glabrous ..... *A. nitidus* subsp. *griffithii*
- b. Leaves sparsely to densely hairy ..... 6
- 6a. Leaf undersurface soft to touch ..... *A. dadah*
- b. Leaf undersurface rough to touch ..... *A. rigidus*

(Moraceae)

*Artocarpus* (subg. *Artocarpus*) *anisophyllus* Miq., Fl. Ind. Bat., Suppl. (1861) 422. — Fig. 141

*Vernacular names* — Bintawa (M), puan (K), pepuan (B).

Trees up to 30 m tall, c. 60 cm in diameter. Buttresses spreading, up to 2.5 m tall. Bark dark grey, smooth to diphled. Inner bark yellow-brown. Sapwood pale yellow. Twigs stout, 1–1.5 cm in diameter. Buds 2.5–10 cm long, hairy. Leaves compound, a small pair of leaflets alternating with a large pair, terminal leaflet present, the whole leaf falling off in one piece, leaflets leathery, oblong, small ones up to 3.5 cm long, up to 2 cm wide, large ones 20–30 cm long, 7.5–11.5 cm wide, base unequal, apex acute, secondary veins 7–20 pairs. Flower heads on leafy twigs, male and female heads usually paired in the same axil, male head finger-like, 5–7.5 cm long, c. 2 cm in diameter, stalk 5–6 cm long, female heads almost globular, 10–12.5 cm long, 7.5–10 cm in diameter, set with blunt thick c. 1.5 cm long spines. Seeds covered with thick orange pulp.

*Habitat & Ecology* — In primary and secondary lowland forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Pulp and seeds are edible.

*Material* — W 544.

*Artocarpus* (subg. *Pseudojaca*) *dadah* Miq., Fl. Ind. Bat., Suppl. (1861) 420.

*Literature* — Jarrett, J. Arnold Arbor. 41 (1960) 91.

*Vernacular names* — Tampang (M), darak (B).

Trees 15–25(–35) m tall, c. 60 cm in diameter. Buttresses absent. Bark grey, fissured. Twigs slender, up to 5 mm in diameter. Buds up to 1 cm long. Leaves simple, oblong, 10–30 cm long, 5–14.5 cm wide, base often unequal, rounded, broadly wedge-shaped or shallowly heart-shaped, apex acute, margin entire (juvenile leaves deeply lobed), secondary veins 10–20 pairs, undersurface soft to touch. Flower heads on leafy twigs, male heads globular, 0.8–2 cm in diameter, stalk 0.8–2 cm long, female heads globular, 1.25–2 cm in diameter, finally velvety or appearing smooth, never spiny or chequered, stalk 2.5–3.25 cm long. Seeds covered with deep pinkish flesh.

*Habitat & Ecology* — Usually in primary, but sometimes also in secondary forest.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The wood is used as construction timber.

*Note* — The only species within our area with which *A. dadah* might be confused is *A. fretessii*. The latter differs in the more prominent, straw-coloured reticulum of the leaves, the paler indumentum, the smaller male flower heads and the lobed fruits.

*Material* — W 42, v.B 5788.

*Artocarpus* (subg. *Pseudojaca*) *nitidus* Tréc. subsp. *griffithii* (King) Jarrett, J. Arnold Arbor. 41 (1960) 128.

Trees up to 30 m tall, c. 65 cm in diameter. Buttresses short, up to 1 m tall. Bark grey to grey-brown, smooth to shallowly fissured. Inner bark pinkish to reddish. Sapwood white. Twigs slender, up to 5 mm in diameter. Buds small, up to 0.5 cm long. Leaves simple, elliptic oblong to obovate oblong, 6–22 cm long, 2.5–10 cm wide, base wedge-shaped to rounded, apex acute, margins entire, secondary veins 8–14 pairs, undersurface glabrous. Flower heads solitary or paired on leafy twigs, male heads obovoid, 3.5–10 cm long, stalk 1.5–3 mm long, female heads flattened to globular, 3–5 cm long, shiny, smooth. Seeds covered with bright pink flesh.

*Habitat & Ecology* — Relatively common near streams and on hillsides in primary and secondary forest.

*Distribution* — Indochina, Thailand, Malay Peninsula, Sumatra, Borneo.

*Material* — W 3, S 228, v.B. 5920.

*Artocarpus* (subg. *Artocarpus*) *rigidus* Blume, Bijdr. (1825) 482.

*Literature* — Jarrett, J. Arnold Arbor. 40 (1959) 150.

Trees up to 30 m tall, c. 40 cm in diameter. Buttresses short, sometimes up to 3 m tall. Bark dark greenish grey, smooth to scaly. Inner bark dull yellow-brown. Sapwood pale yellow. Twigs slender up to 6 mm in diameter. Buds 0.5–3 cm long, hairy. Leaves simple, elliptic to obovate, 6.5–26 cm long, 3.5–15 cm wide, base wedge-shaped to rounded, apex acute to short acuminate, margins entire or toothed at apical half, secondary veins 10–18 pairs, undersurface rough to touch. Flower heads solitary on leafy twigs, male heads obovoid to globular, 1.25–2.5 cm in diameter, stalk 2–6 mm long, female head globular, up to 15 cm in diameter, thickly set with stiff conical spines, stalk 8–25 mm long. Seeds covered with orange waxy flesh.

*Habitat & Ecology* — Lowland and hill forest.

*Distribution* — Burma, Indochina, Thailand, Malay Peninsula, Sumatra, Java, Borneo.

*Uses* — Tree sometimes cultivated for its edible fruits; also the timber is used.

*Note* — A very variable species, especially in leaf size and indumentum.

*Material* — W 502, AA 52, S 442.

**FICUS** L., Sp. Pl. (1753) 1059.

*Vernacular name* — The genus is usually called ara (M).

Trees, shrubs, woody epiphytic climbers and stranglers or woody creepers. Bark generally pale grey, smooth. Twigs with a ring-like stipule scar. Leaves simple, distichous or opposite, margin entire, toothed or lobed, 3-veined at the base. Flowers small, inside of fleshy figs, usually of three kinds, sepals tiny, 3–5, often wine-red

(Moraceae / Myristicaceae)

or calyx cup-shaped. Figs at first green, ripening to various colours, from the leaf-axils, branches, trunks or base of trunk. — About two-hundred species reported for Kalimantan.

*Uses* — The timber is of no commercial use; *F. elastica* (India rubber tree) has formerly been used for its latex; several species produce edible figs.

**PARARTOCARPUS** Baillon, *Adansonia* 11 (1875) 294.

*Literature* — Jarrett, *J. Arnold Arbor.* 41 (1960) 320–334.

*Parartocarpus bracteatus* (King) Becc., *For. Borneo* (1902) 632. — Fig. 142

*Vernacular name* — Tampang (M).

Medium-sized to large trees up to 45 m tall, c. 60 cm in diameter. Bole fluted or slightly buttressed. Bark grey-brown, smooth to slightly scaly, prominently lenticellate. Inner bark orange and white mottled, with copious milksap. Twigs 5–8 mm thick, reddish hairy, with prominent petiolar scars. Leaves simple, entire, obovate-oblong, 10–30 cm long, 6–14 cm wide, base broadly wedge-shaped to rounded, apex blunt or shortly acuminate, lamina densely reddish hairy below, secondary veins 11–15 pairs, sunken above, raised below. Petioles 2–3.5 cm long. Stipules not forming a cup over the bud, 5–10 mm long. Inflorescences solitary in leaf axils, male head globular, slightly spiny, with 3 basal bracts on 2–3.5 cm long stalk. Female inflorescences almost globular, c. 9 cm in diameter, shallowly lobed, spiny, on 4–5.5 cm long stalk, with persistent bracts.

*Habitat & Ecology* — In lowland and hills, up to 600 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo. Of the genus *Parartocarpus* three species are reported for Kalimantan.

*Uses* — A light hardwood known under the name terap, of only minor economic importance.

*Material* — W 149, W 928, v.B. 5897, v.B. 6099.

## 41 MYRISTICACEAE

*Vernacular names* — For the whole family the names darah-darah (M), mendaharan (M), kumpang (B) or deraya (B).

Small to medium trees, with usually blackish bark and red exudate, sometimes slow to appear. Stipules absent. Leaves simple, alternate or sometimes spiral, margin entire. Flowers actinomorphic, unisexual (male and female flowers on different plants), perianth usually 3-lobed, stamens united in a column, ovary superior. Fruit a fleshy to leathery capsule, splitting in two parts. Seed single, with aril, mostly completely covering the seed, endosperm ruminant. — Five genera reported for Kalimantan.



KEY TO THE GENERA

- 1 a. Leaves not brittle when dry, aril dissected ..... *Gymnacranthera*
- b. Not this combination of characters ..... 2
- 2 a. Male panicles strongly branched, leaves not glaucous beneath, very brittle when dry, aril entire ..... *Horsfieldia*
- b. Inflorescence little branched or in bundles, leaves usually glaucous beneath . 3
- 3 a. Venation sunken above, leaves glaucous or not, brittle when dry, aril dissected  
*Myristica*
- b. Venation raised or flat, leaves glaucous, not brittle when dry, aril entire *Knema*

**GYMNACRANTHERA** (A. DC.) Warb., Ber. Pharm. Ges. 2 (1892) 227.

*Literature* — Schouten, Blumea 31 (1986) 451–486.

Trees up to 30 m tall. Twigs inconspicuously or conspicuously lenticellate. Leaves parchment-like to leathery, tough, not brittle when dry, secondary veins looping. Inflorescences paniculate. Flowers stalked, pubescent, perianth 2–4-valved. Infructescences with 4–10 fruits. Fruits ovoid-ellipsoid to ellipsoid-oblong, pericarp hard-fleshy, drying brownish, seeds ellipsoid, aril deeply incised to near the base (as in *Myristica*), endosperm ruminant, containing oil but no starch. — Five species reported for Kalimantan.

KEY TO THE SPECIES

- 1 a. Young twigs with few lenticels only, leaves elliptic to lanceolate, 5–17 cm long, 1.5–5.5 cm wide ..... *G. farquhariana* var. *zippeliana*
- b. Young twigs conspicuously densely set with distinct lenticels, leaves ovate-elliptic, 10–25 cm long, 4–10 cm wide ..... *G. ocellata*

*Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *zippeliana* (Miq.) Schouten, Blumea 31 (1986) 482. — Fig. 143

Tree 5–30 m tall, c. 40 cm in diameter. Bark smooth or slightly fissured, red-brown or grey. Inner bark red-brown, heartwood yellow to brown, hard. Twigs slender, set with few lenticels only. Leaves thinly parchment-like to leathery, elliptic to lanceolate, 5–17 cm long, 1.5–5.5 cm wide, glabrescent below, base wedge-shaped, apex acute to acuminate, secondary veins 7–11 pairs. Petioles 5–20 mm long, 1–2 mm in diameter. Inflorescences paniculate, in male 2.5–12 cm long, many-flowered, female ones up to 4 cm long, fewer flowered. Flowers yellow, with sweet smell, male ones up to 4 mm long, valves 3 or 4. Female flowers up to 3 mm long, valves 3 or 4. Fruits up to 10 per infructescence, ellipsoid-oblong, 1.5–2 cm long, c. 1 cm in diameter, glabrous, reddish orange, stalk c. 4 mm long.

*Habitat & Ecology* — Abundant in freshwater and peat swamp forest, in dry forest often along small streams.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 249, W 269, W 401, W 516, S 237, S 423, S 631, P.K. 600.

(Myristicaceae)

*Gymnacranthera ocellata* Schouten, Blumea 31 (1986) 469.

Trees 20–25 m tall, c. 20 cm in diameter. Bark smooth, red-brown. Inner bark red-brown, heartwood light to dark brown. Twigs stout, densely set with conspicuous lenticels. Leaves thinly parchment-like to leathery, ovate-elliptic, 10–24 cm long, 4–10 cm wide, glabrescent below, base broadly rounded, apex acute, secondary veins 11–18 pairs. Petioles 9–20 mm long, 2–3 mm in diameter. Inflorescences paniculate, in male 3–8.5 cm long, many-flowered, female ones up to 2 cm long, few-flowered. Flowers yellowish brown, male ones up to 5 mm long, valves 3 or 4. Female flowers up to 3 mm long, valves (2 or) 3. Fruits 4–10 per infructescence, ovoid-ellipsoid with truncate base, 1.8–2.2 cm long, 1.1–1.3 cm in diameter, short pubescent, reddish orange, stalk 3–7 mm long.

*Habitat & Ecology* — Usually in lowland Dipterocarp forest, but also from kerangas.

*Distribution* — Endemic in Borneo.

*Material* — W 320, W 420, S 288, S 426.

**HORSFIELDIA** Willd., Sp. Pl. 4 (1806) 872.

*Literature* — De Wilde, Gard. Bull. Sing. 37 (1984) 115–179; *ibid.* 38 (1985) 55–144, 185–225; *ibid.* 39 (1986) 1–65.

Small to tall trees. Twigs usually early glabrescent, terete or sometimes drying flattened. Leaves alternate or sometimes spiral, lamina papery to leathery, brittle when dry, lower surface not glaucous. Inflorescences axillary, sometimes on leafless twigs, branched several times, female usually smaller than male ones. Flowers stalked, solitary or in clusters, perianth thin-leathery to succulent, either 2- (or 3-)lobed or (2-), 3- or 4-lobed, inside glabrous, greenish to yellowish, never red, the lobes splitting to varying depths, androecium very diverse in shape, sessile or with short stalk, the anthers usually fused, 2–25, extrorse, ovary globular or ovoid, glabrous or pubescent, stigma 2-lobed or 2-lipped. Fruits usually ellipsoid, sometimes globular, pericarp somewhat fleshy, often with lenticel-like tubercles, glabrous or pubescent, perianth sometimes persistent under the fruit. Seed ellipsoid, aril completely covering the seed, entire or at apex shallowly lobed, endosperm with fatty oil but no starch. — Forty-two species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves when dry with irregularly shaped white blotches, plants usually growing not too far from the coast . . . . . *H. irya*
- b. Leaves various, not white-blotched . . . . . 2
- 2a. Twigs pale, whitish or greyish brown, contrasting with the blackish colour of the dry petioles . . . . . *H. sucosa* subsp. *bifissa*
- b. Twigs usually brownish . . . . . 3
- 3a. Leaves, especially upper side, with rough hairs . . . . . *H. grandis*
- b. Leaves not with rough hairs . . . . . 4

(Myristicaceae)

- 4a. Leaves raised between the deep-laying veins, leaf-margin more or less revolute  
*H. reticulata*
- b. Leaves not raised between the veins . . . . . 5
- 5a. Leaves hirsute beneath . . . . . *H. motleyi*\*
- b. Leaves more or less glabrous . . . . . 6
- 6a. Twigs conspicuously hollow . . . . . *H. wallichii*\*
- b. Twigs not hollow . . . . . *H. polyspherula* var. *sumatrana*\*

*Horsfieldia grandis* (Hook. f.) Warb., Mon. Myrist. (1897) 301. — Fig. 144

*Literature* — De Wilde, Gard. Bull. Sing. 38 (1985) 203.

Trees 6–25 m tall, up to 25 cm in diameter. Bole without buttresses. Bark smooth, fissured or cracked, inner bark red brown, sapwood whitish to yellowish pink. Twigs terete, stout, densely yellow-rusty tomentose. Petioles 6–15 mm long. Leaves alternate, elliptic-oblong to oblong-oblongate, 12–40 cm long, 5–20 cm wide, base wedge-shaped to almost heart-shaped, apex acute or acute-acuminate, upper surface with harsh, rough persistent hairs, lower surface persistent woolly tomentose, without dark dots, secondary veins (8–)10–16(–19) pairs. Inflorescences densely yellow rusty tomentose, many-flowered. Male flowers in clusters of 3–10, female flowers solitary or a few together, perianth 3- or 4-valved, anthers 8–10, almost completely sessile, androphore narrow, ovary globular to broadly ellipsoid, glabrous, stigma faintly 2-lobed. Fruits 2–10 per infructescence, clustered, obovoid-ellipsoid, 1–1.4 cm long, 0.8–1.1 cm in diameter, glabrous, surface smooth, dry pericarp c. 1.5 mm thick, stalk 1 mm long, perianth persisting.

*Habitat & Ecology* — In primary and secondary forest, also in kerangas, on hill-sides, ridges or along streams.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 67, W 444, W 671, S 579.

*Horsfieldia irya* (Gaertn.) Warb., Fruct. 1 (1788) 195.

*Literature* — De Wilde, Gard. Bull. Sing. 38 (1985) 55.

Trees 10–25(–40) m tall, c. 30 cm in diameter. Bole often fluted or with up to 3 m tall buttresses. Bark smooth greyish with brown spots, inner bark cream or whitish, fibrous, thick, sapwood cream to whitish. Twigs terete, often drying flattened towards the apex, glabrescent. Petioles 7–16 mm long. Leaves in two rows, elliptic-oblong to lanceolate, 10–30(–35) cm long, 3–7(–9) cm wide, base rounded to wedge-shaped, apex acute-acuminate, upper surface usually finely pustulate with paler stipples and almost always with larger irregular whitish marks of unknown origin, lower surface glabrous, without dark dots, secondary veins 10–20 pairs. Inflorescences densely tomentose, many-flowered. Male flowers in clusters of 3–10, female flowers solitary or a few together, perianth 3-valved, anthers 6–9, not closely touching, androphore saucer- or cup-shaped, ovary broadly obovoid, glabrous, stig-

(Myristicaceae)

ma minute. Fruits 2–8 per infructescence, globular, 1.5–2.2 cm in diameter, glabrous, surface granular, without larger tubercles or lenticels, dry pericarp 1–2 mm thick, stalk 5–10 mm long, perianth not persisting.

*Habitat & Ecology* — In primary and old secondary forest, usually on coastal or riverine alluvial soils.

*Distribution* — Sri Lanka to Solomons.

*Material* — W 985, P.K. 653.

*Horsfieldia reticulata* Warb., Mon. Myrist. (1897) 304.

*Synonym* — *Horsfieldia affinis* De Wilde, Gard. Bull. Sing. 38 (1985) 000.

*Literature* — De Wilde, Gard. Bull. Sing. 38 (1985) 218.

Trees up to 20 m tall, up to 20 cm in diameter. Bole without buttresses. Bark black. Twigs terete, densely rusty tomentose. Petioles 7–15 mm long. Leaves in two rows, elliptic to oblong-oblancoolate, 8–24 cm long, 4–6.5 cm wide, base rounded, apex acute-acuminate, upper surface glabrous, lower surface persistent tomentose, without dark dots, secondary veins 9–19 pairs. Inflorescences densely yellow rusty tomentose, many-flowered. Male flowers on the older wood, in clusters of 3–10, female flowers solitary or a few together, perianth 3(–5)-valved, anthers 10–12, almost completely sessile, androphore slender, ovary globular to broadly ellipsoid, glabrous, stigma faintly 2-lobed. Fruits 2–10 per infructescence, clustered, obovoid-ellipsoid, 1–1.4 cm long, 0.8–1.1 cm in diameter, glabrous, surface smooth, dry pericarp c. 1.5 mm thick, stalk 1 mm long, perianth persisting.

*Habitat & Ecology* — Usually on hillsides in primary and secondary forest.

*Distribution* — Endemic in Borneo.

*Material* — W 48, W 301, v.B. 6101.

*Horsfieldia sucosa* (King) Warb., Mon. Myrist. (1897) 322.

subsp. *bifissa* De Wilde, Gard. Bull. Sing. 38 (1985) 190.

Trees up to 25 m tall, c. 45 cm in diameter. Bole fluted at base. Bark scaly to flaky, reddish brown, inner bark lamellate, reddish, exudate red becoming darker upon exposure. Twigs terete, pale grey to almost white, contrasting with the black colour of the dried petioles, glabrescent, lenticels very conspicuous only on the very young parts. Petioles 10–20 mm long. Leaves in 2 or 3 rows, elliptic-oblong to oblong-(ob)lanceolate, 14–28 cm long, 4.5–8.5 cm wide, base wedge-shaped, apex acute-acuminate, upper surface glabrous, lower surface without blackish dots, secondary veins 13–17 pairs. Inflorescences behind the leaves, many-flowered. Male flowers in clusters of 3–7, female flowers few together, perianth 2-valved, anthers 7, completely sessile, androphore saucer-shaped, ovary broadly ellipsoid, glabrous, stigma shallowly 2-lobed. Fruits 1–4 per infructescence, broadly ovoid-ellipsoid, 2–2.5 cm long c. 2 cm in diameter, glabrous, surface granular, often with larger tubercles, dry pericarp c. 4 mm thick, stalk 1–2 mm long, perianth not persisting.

*Habitat & Ecology* — In mixed Dipterocarp lowland forest, dominated by *Shorea laevis*.

*Distribution* — Endemic in Sabah and Kalimantan.

*Material* — W 8, W 960, W 897, v.B. 6081.

**KNEMA** Lour., Fl. Cochinch. (1790) 604.

*Literature* — Sinclair, Gard. Bull. Sing. 18 (1961) 102–327; De Wilde, Blumea 25 (1979) 321–478.

Small to tall trees. Twigs hairy or glabrescent, terete. Leaves alternate, lamina almost leathery, lower surface usually glaucous. Flowers clustered on short woody, sometimes branched knobs, stalked, perianth thin-leathery to succulent, 3-lobed, inside glabrous, red, pink, yellow, cream or white, the lobes splitting to varying depths, androecium very diverse in shape, sessile or with short androphore, the anthers free, 2–25, ovary globular or ovoid, pubescent, stigma variously lobed. Fruits usually stalked, fruit wall thick, fleshy, pubescent. Seed ellipsoid, aril divided slightly into many lobes at apex only, endosperm with starch. — Forty-three species reported from Kalimantan.

#### KEY TO THE SPECIES

- 1a. Lower leaf surface silky to touch . . . . . *K. elmeri*\*
- b. Lower leaf surface glabrous or with various tomentum not silky . . . . . 2
- 2a. Bark of twigs longitudinally cracking, when older flaking . . . . . 3
- b. Bark of twigs neither cracking nor flaking . . . . . 7
- 3a. Twigs at apex up to 3 mm in diameter . . . . . 4
- b. Twigs at apex 4–10 mm in diameter . . . . . 5
- 4a. Petioles up to 1 cm long . . . . . *K. latericia* subsp. *albifolia*
- b. Petioles 1.5–2.5 cm long . . . . . *K. membranifolia*\*
- 5a. Midrib flattish above, 1–2 mm wide at base . . . . . *K. percoriacea*\*
- b. Midrib raised above, c. 3 mm wide at base . . . . . 6
- 6a. Young twigs shortly rusty hairy . . . . . *K. galeata*\*
- b. Young twigs with up to 1 mm long hairs . . . . . *K. pallens*
- 7a. Petioles more than 2 cm long . . . . . *K. latifolia*
- b. Petioles up to 1.3 cm long . . . . . 8
- 8a. Leaf base heart-shaped . . . . . *K. pulchra*\*
- b. Leaf base wedge-shaped to rounded . . . . . 9
- 9a. Lower leaf surface hairy to touch . . . . . *K. laurina*
- b. Lower leaf surface seemingly glabrous . . . . . 10
- 10a. Secondary veins c. 13 pairs . . . . . *K. glauca*\*
- b. Secondary veins 15–20 . . . . . *K. glaucescens*\*/*K. hirtella*\*

(Myristicaceae)

*Knema latericia* Elmer, Leafl. Philipp. Bot. 5 (1913) 1815.

subsp. *albifolia* (Sinclair) De Wilde, Blumea 25 (1979) 397. — Fig. 145

Trees up to 20 m tall, c. 15 cm in diameter. Bark brownish, flaky. Twigs furfuraceous tomentose. Petioles 0.7–1 cm long. Leaves lanceolate, 11–17(–22) cm long, 2–3(–5) cm wide, base wedge-shaped, apex acute, glabrous, upper surface drying yellowish green, lower surface whitish, glaucous, secondary veins 9–21 pairs. Male flowers 3–5, arising from woody, axillary tubercles, 3–4 mm in diameter, anthers 9–12, very shortly stalked, staminal disc triangular or peltate. Female flowers 4–5 mm long, ovary rusty tomentose, stigma multi-lobed. Fruits pear-shaped, c. 1.7 cm long, c. 1.5 cm in diameter, pale reddish tomentose, stalk 1–3 mm long.

*Habitat & Ecology* — Common in lowland Dipterocarp forest.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo, Philippines.

*Material* — W 39, W 49, S 590, v.B. 5714.

*Knema latifolia* Warb., Mon. Myrist. (1897) 610.

Trees up to 20 m tall, c. 15 cm in diameter. Bark grey, brittle, smooth, peeling in thin narrow strips. Twigs glabrous, smooth with some lenticels. Petioles more than 2 cm long. Leaves oblong or elliptic-oblong, 10–28 cm long, 4–12 cm wide, base wedge-shaped or rounded, apex acute, glabrous, upper surface glossy, lower surface pale brown, glaucous, secondary veins 12–20 pairs. Male flowers in umbels, 5–8 mm in diameter, anthers 3, sessile, staminal disc triangular. Female flowers 7–8 mm long, ovary rusty tomentose, stigma half-way divided. Fruits oblong, c. 3 cm long, c. 2.5 cm in diameter, rusty tomentose, glabrescent, strongly ridged to almost winged along the longest axis, stalk 1–2 cm long.

*Habitat & Ecology* — A very common species, usually growing on ridges in lowland Dipterocarp forest.

*Distribution* — Endemic in Borneo.

*Material* — W 32, W 35, W 43, W 64, W 130, W 148, W 600, S 251, v.B. 5893, v.B. 5896, v.B. 5908, v.B. 5934.

*Knema laurina* (Blume) Warb., Mon. Myrist. (1897) 606.

var. *laurina*

*Literature* — De Wilde, Blumea 25 (1979) 379.

Trees up to 20 m tall, c. 15 cm in diameter. Bark reddish brown, nearly smooth. Twigs 3–4 mm in diameter, rusty tomentose. Petioles c. 1 cm long. Leaves variable, oblong, oblong-obovate or oblanceolate, 9–28 cm long, 3–8 cm wide, base acute, rounded or almost heart-shaped, apex acute, rusty tomentose beneath, harsh to the touch, glaucous, secondary veins 12–24 pairs. Inflorescences on woody tubercles. Male flower stalk 3–5 mm long, perianth 3–5 mm long, anthers 6, sessile, staminal disc narrow. Female flowers sessile, stigma 2-lobed. Fruits ovoid or ellipsoid, 25–30 mm long, 15–20 mm in diameter, stalk 2–3 mm long.

*Habitat & Ecology* — Mainly on ridges of primary forest.

*Distribution* — Thailand, Malay Peninsula, Java, Borneo.

*Material* — W 29, S 407, S 774, v.B. 5872.

*Knema pallens* De Wilde, Blumea 25 (1979) 391.

Trees up to 30 m tall, c. 20 cm in diameter. Bark flaky. Twigs 4–10 mm in diameter, with c. 1 mm long hairs. Leaves broad oblong, 30–60 cm long, 12–20 cm wide, base rounded to almost heart-shaped, apex rounded, glabrous beneath, glaucous. Male inflorescences sessile. Male flower stalks 12–20 mm long, perianth 6–10 mm long, anthers 15–23, sessile, staminal disc flattish. Female flower stalks 10–20 mm long, stigma 10–14-lobulate. Fruits ellipsoid, 35–55 mm long, 25–35 mm in diameter, with c. 1.5 mm long hairs, stalk 14–30 mm long.

*Habitat & Ecology* — Frequent on ridges and along streams in primary forest.

*Distribution* — Endemic in Borneo.

*Material* — W 194, W 255, v.B. 5971.

**MYRISTICA** Grovonijs, Fl. Or. (1755) 141.

*Vernacular name* — Pala hutan (M).

Trees up to 40 m tall. Bark slightly rough, greyish brown to black. Twigs glabrous to villous. Leaves sometimes glaucous below, brittle when dry, papery, parchment-like to leathery, secondary veins arching near the margin. Inflorescence a sessile woody knob (as in *Knema*) or a branched panicle. Flowers urn-like or bell-shaped, often fragrant, glabrous inside, 3-toothed, androecium a stalked column, anthers linear, 8–30, ovary more or less globular, stigma sessile, minutely bilobed. Fruits usually large, fruit wall thick, leathery, fleshy, but firm, aril divided up to the base, seeds shining, testa hard, endosperm ruminant, with oil and starch. — Twelve species reported for Kalimantan.

KEY TO THE SPECIES

- 1 a. Leaves and young twigs villous ..... *M. villosa*
- b. Leaves and young twigs almost glabrous or with minute hairs only ..... 2
- 2 a. Twigs pale, whitish or greyish brown, contrasting with the brownish colour of the dry petioles ..... *M. simiarum* subsp. *calcare\**
- b. Twigs brown to red-brown ..... 3
- 3 a. Twigs up to 3 mm in diameter, petioles up to 2 cm long, c. 2 mm in diameter, leaves up to 20 cm long ..... *M. iners*
- b. Twigs 8–10 mm in diameter, petioles 2.5–3.5 cm long, 4–5 mm in diameter, leaves 25–40 cm long ..... *M. maxima*

*Myristica iners* Blume, Bijdr. (1828) 575.

*Literature* — Sinclair, Gard. Bull. Sing. 23 (1968) 177.

(Myristicaceae)

Trees up to 35 m tall, c. 25 cm in diameter. Stiltroots sometimes present. Bark greyish black, brittle, scaly. Twigs glabrous, up to 3 mm in diameter. Petioles 1.5–2.5 cm long, c. 2 mm in diameter. Leaves extremely variable in size, usually lanceolate, 12–20 cm long, 3–6 cm wide, base acute, sometimes rounded, apex acute, secondary veins 12–15 pairs. Male inflorescences axillary panicles. Male flowers 7–8 mm long, perianth 3-lobed, anthers 9–10. Female inflorescences much shorter, contracted. Female flowers c. 5 mm long, ovary almost globular, rusty pubescent. Fruits oblong to oblong-ovoid, 5–9(–10) cm long, 4–4.5 cm in diameter, minutely rusty scaly.

*Habitat & Ecology* — Usually found in lowland primary forest, sometimes also in secondary forest.

*Distribution* — Indochina, Thailand, Malay Peninsula, Sumatra, Java, Borneo.

*Material* — W 37, W 545, W 581, W 661, W 701, v.B. 5708.

*Myristica maxima* Warb., Mon. Myrist. (1897) 385. — Fig. 146

*Literature* — Sinclair, Gard. Bull. Sing. 23 (1968) 131.

Trees up to 35 m tall, c. 55 cm in diameter. Bark brown, more or less flaky. Twigs glabrous, 8–10 mm in diameter. Petioles 2.5–3.5 cm long, 4–5 mm in diameter. Leaves oblong to obovate, 25–40 cm long, 10–16 cm wide, base rounded, apex rounded, secondary veins 23–30 pairs. Male inflorescences axillary panicles. Male flowers 5–8 mm long, perianth 3-lobed, anthers 12–20. Female inflorescences much shorter, contracted. Female flowers 8–9 mm long, ovary almost globular, rusty pubescent. Fruit oblong, 7–9 cm long, 3.5–5 cm in diameter, much wrinkled when dry.

*Habitat & Ecology* — Common in lowland mixed Dipterocarp forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 7, AA 105, v.B. 5789, v.B. 5918.

*Myristica villosa* Warb., Mon. Myrist. (1897) 419.

*Literature* — Sinclair, Gard. Bull. Sing. 23 (1968) 311.

Trees up to 30 m tall, c. 30 cm in diameter. Buttresses sometimes present. Bark reddish brown to black, flaky. Twigs villous, 8–10 mm in diameter. Petioles 1.5–2.5 cm long, 5–6 mm in diameter. Leaves oblong-elliptic, 20–35 cm long, 7–11 cm wide, base acute, apex acute, secondary veins 20–25(–30) pairs. Male inflorescences 1–2 cm long, woody tubercles, few-flowered. Male flowers 7–10 mm long, perianth 3-lobed, anthers 10–12. Female inflorescences more contracted. Flowers half hidden among the hairs, c. 1 cm long, ovary ovoid, densely villose. Fruits ovoid, often slightly oblique or even recurved at apex, 4.5–6 cm long, 3–3.5 cm in diameter, velvety-tomentose.

*Habitat & Ecology* — Common along streams and in swamps of undulating land.

*Distribution* — Endemic in Borneo.

*Material* — W 38, W 189, W 598, W 887, S 234, v.B. 5969.



## 42 MYRTACEAE

Small to large trees, bark often flaky. Stipules absent. Leaves simple, opposite or spiral, entire, with intramarginal veins and translucent dots. Flowers actinomorphic, bisexual, 4- or 5-merous, sepals and petals free, sepals persistent in fruit, stamens numerous, ovary inferior. Fruit a berry or a capsule. — Five genera reported for Kalimantan.

## KEY TO THE GENERA

- 1a. Leaves spiral, bark peeling off in long scrolls, fruit a capsule with many winged seeds . . . . . *Tristaniopsis*
- b. Leaves opposite, fruit a berry . . . . . 2
- 2a. Leaves penniveined, usually glabrous, berry with 1 or 2 seed(s)
  - Eugenia* (*Acmena*, *Syzygium*, *Cleistocalyx*)
  - b. Leaves 3-veined, with grey silky hairs below . . . . . 3
- 3a. Leaf apex always pointed, flowers white, berry with 3–8 seeds . *Rhodamnia*
- b. Leaf apex usually blunt, flowers pink, berry with many seeds *Rhodomyrtus*\*

**EUGENIA** L., Sp. Pl. (1753) 470.

*Vernacular name* — Jambu (hutan) (M).

Shrubs to tall trees. Buttresses and/or stiltroots present. Bark grey-brown to red-brown, smooth, cracked, fissured, scaly or flaky, sometimes even papery-flaky, inner bark reddish, sapwood reddish brown, deep red, or yellowish to white. Twigs terete or angled, glabrous or hairy. Leaves opposite, simple, usually with a distinct intramarginal vein, gland dotted, glabrous, sometime tomentose, secondary veins distantly to closely arranged. Flowers solitary or in few- to many-flowered cymes, panicles or racemes, usually terminal and axillary, calyx tube globular to narrowly elongate turbinate, base often contracted into a pseudostalk, lobes 4 or 5, or absent, petals 4 or 5, free, stamens numerous, in several whorls, free or obscurely collected into 4 bundles, connective glands usually present, ovary 2-celled, rarely 3- or 4-celled, with few to several ovules per cell, style short or long, usually needle-shaped. Fruit a berry, the rind pulpy or leathery or dry and pithy, apex crowned by the remains of the calyx tube or the enlarged calyx lobes, seed(s) 1 or 2, rarely more, usually large.

*Habitat & Ecology* — Very common in primary, secondary and kerangas forest in all habitats from dry to swampy areas.

*Uses* — The wood is generally hard and good for fuel; many fruits of this genus are edible, some planted on a large scale [*Eugenia aquea*, *E. aromatica* (Clove), etc.].

*Notes* — *Eugenia* is a very large genus: on the Malay Peninsula alone more than 190 species of *Eugenia* occur (Tree Flora of Malaya 3, 1978). We are not able to give proper names to our material because no revision of this large genus exists. We accept *Eugenia* in the broadest sense including *Syzygium*, *Acmena*, and *Cleistocalyx* as synonyms until a world monographic study has been finished.

(Myrtaceae)

**RHODAMNIA** Jack, Malay Misc. 2 (1822) 48.

*Rhodamnia cinerea* Jack, Malay Misc. 2 (1822) 48. — Fig. 147

Trees 10–15(–20) m tall, c. 20 cm in diameter. Bark finely fissured, slightly scaly. Leaves opposite, oblong, 5–15 cm long, 1.5–7 cm wide, base wedge-shaped, apex acuminate to long pointed, 3-veined, silvery or ashen white below. Flowers in clusters of 3–6 in the leaf axils, shortly stalked, white, reddish in the centre, fragrant, sepals 4, petals 4, stamens many, ovary 1-celled. Fruits globular, c. 0.75 cm in diameter, green turning red and finally black, crowned by the persistent sepals. Seeds 3–8, angular.

*Habitat & Ecology* — Frequent in primary forest.

*Distribution* — Burma, Thailand, Malay Peninsula, Sumatra, Java, Borneo.

*Uses* — The fruits are edible. The wood is very hard and used in house construction.

*Note* — A second species, *R. mulleri* (Korth.) Blume is reported for Sarawak and South Kalimantan.

*Material* — W 87, W 755, v.B. 5814, v.B. 6064.

**TRISTANIOPSIS** Brongn. & Gris., Bull. Soc. Bot. France 10 (1863) 371.

*Tristaniopsis whiteana* (Griff.) Wilson & Waterhouse, Austr. J. Bot. 30 (1982) 440. — Fig. 148

*Synonym* — *Tristania whiteana* Griff., Pl. Cantor. (1837) 18.

*Vernacular name* — Pelawan (M).

Trees up to 25 m tall, c. 30 cm in diameter. Bark orange brown to grey, peeling off in large spiral, scroll-like pieces, inner bark pale whitish or yellowish, sapwood yellowish brown. Leaves spirally arranged at end of the twigs. Leaves narrowly ovate, 7–20 cm long, 2.5–5.5 cm wide, base wedge-shaped, apex acute, secondary veins many, intramarginal vein present. Flowers in long stalked cymose panicles, yellowish white, axillary, calyx cup with tooth-like lobes, petals 5, stamens in 5 bundles of 3–5 stamens, ovary 3-celled, ovules many. Fruit a capsule with the calyx attached round the lower half, the upper half splitting into 3 parts. 25 mm in diameter. Seeds many, winged.

*Habitat & Ecology* — Common along riversides, hillsides and ridges, on sandy or stony soils in secondary forest.

*Distribution* — Malay Peninsula, Sumatra, Borneo, Maluku, New Guinea. Of the genus *Tristaniopsis* eleven species are reported for Kalimantan.

*Uses* — The timber is suitable for heavy construction work, even under exposed conditions.

*Material* — v.B. 5974.

## 43 OLACACEAE

Small to medium trees. Exudate present or absent. Stipules absent. Leaves simple, spiral or alternate, entire, leaf surface when dry often somewhat pustular. Flowers actinomorphic, bisexual, calyx with 4–6 small teeth, petals 4–6, more or less free, valvate, stamens as many as petals and opposite, or twice as many, disc present, ovary inferior or superior. Fruit a one-seeded drupe. — Five genera reported for Kalimantan.

## KEY TO THE GENERA

- 1a. Most of the tissue strongly smelling of garlic, even in dried state, petioles distinctly thickened at apex . . . . . *Scorodocarpus*
- b. Garlic smell absent, petioles hardly or not thickened at apex . . . . . 2
- 2a. Inner bark with white latex, leaves usually showing scattered black dots on both surfaces . . . . . *Ochanostachys*
- b. Leaves usually with numerous fine pellucid points visible against strong light  
*Strombosia*\*

*OCHANOSTACHYS* Mast., Fl. Brit. India 1 (1875) 576.

*Ochanostachys amentacea* Mast., Fl. Br. India 1 (1875) 577. — Fig. 149

*Literature* — Sleumer in Flora Malesiana I, 10 (1984) 14.

*Vernacular names* — Ampilung (D), petaling (M), oos (B).

Trees up to 30 m tall, 20–40 cm in diameter. Bole straight, fluted or shortly buttressed at base. Bark grey-brown to brown-red, flaky, the bole characteristically mottled. Inner bark finely fibrous, with droplets of white latex. Leaves ovate to elliptic or elliptic oblong, 6–13 cm long, 3–7 cm wide, base broadly wedge-shaped to rounded, sometimes slightly unequal, apex short acuminate, more or less leathery, usually glabrous, usually sparsely warty on both surfaces, in part blackish, secondary veins 5 or 6 pairs. Petioles 1.5–2 cm long, not thickened at top. Spikes simple or sometimes 1- or 2-branched, elongate, slender, erect, bisexual flowers solitary or in groups of 2–4, calyx 4- or 5-toothed, 1 mm long, petals 4, free to almost the base, c. 2.5 mm long, stamens 2, disc present, ovary superior, 3-celled, glabrous. Drupe almost globular, 2–2.5 cm in diameter, pericarp thin, often warty outside, endocarp woody. Seed 1, almost globular.

*Habitat & Ecology* — On hillsides and along streams in primary forest.

*Distribution* — Andamans, Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is hard and durable, used for house constructions. The seeds are said to be edible.

*Material* — W 589, AA 260, S 524, S 708.

(Olaceae / Oleaceae)

**SCORODOCARPUS** Becc., Nuov. Giorn. Bot. Ital. 9 (1877) 274.

*Scorodocarpus borneensis* (Baillon) Becc., Nuov. Giorn. Bot. Ital. 9 (1877) 274. — Fig. 150

*Literature* — Sleumer in Flora Malesiana I, 10 (1984) 15–17.

*Vernacular names* — Kayu bawang (M), mencorug (B).

Trees up to 15–40(–60) m tall, 20–60(–80) cm in diameter. Bole usually straight, sometimes with small buttresses. Bark grey to dark brown, fissured, thinly rectangular flaky. Inner bark purplish red with coarse orange flecks, strongly smelling of garlic. Wood hard, yellow brown. Leaves spiral, elliptic, rarely lanceolate-oblong, leathery, glabrous, base wedge-shaped to rounded, apex abruptly acuminate, 1–2 cm, margin entire, secondary veins 4–5(–7) pairs. Petioles thickened at top, 1–1.5 cm long. Flowers bisexual, in axillary racemes, calyx small, cup-shaped, 4- or 5-toothed, petals 4 or 5, coherent by their edges, stamens 8 or 10, fused to the lower half of each petal in pairs, ovary superior, imperfectly 3- or 4-celled, with 1 ovule, stigma minutely 3- or 4-lobed. Drupe almost globular to pear-shaped, with numerous vertical stripes or faint ribs in dry state, glabrous, green, (3–)4–5(–7) cm in diameter, peduncle c. 1 cm long, pericarp thin, fleshy, endocarp woody. Seed 1, almost globular.

*Habitat & Ecology* — In primary or often disturbed lowland Dipterocarp forest, scattered, but locally common.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — A medium hardwood timber, rather durable, used for indoor construction.

Seeds are said to be edible.

#### 44 OLEACEAE

**CHIONANTHUS** L., Sp. Pl. (1753) 8.

*Chionanthus pluriflorus* (Knohl.) Kiew, Malaysian For. 43 (1980) 384. — Fig. 151

*Vernacular name* — Ibum (K).

Trees up to 25 m tall, c. 30 cm in diameter. Stiltroots or short buttresses present. Bark brown, smooth, lenticellate. Twigs white, glabrous. Stipules absent. Leaves simple, opposite, entire, oblong-lanceolate, (13–)15–20(–30) cm long, 4–9 cm wide, base wedge-shaped, apex acuminate, rounded or acute, thinly leathery to parchment-like, lateral veins 7–14 pairs. Petioles 0.5–1 cm long, drying black. Inflorescence a racemose panicle with third order branching, axillary. Flowers actinomorphic, bisexual, 4-merous, small, calyx c. 1 mm long, persistent, corolla tubular, c. 3 mm long, stamens 2, ovary superior, stigma capitate. Fruit a 1-seeded

berry, ellipsoid, c. 2 cm long, c. 1 cm in diameter, prominently warted even when immature, endosperm copious.

*Habitat & Ecology* — Common in primary and secondary rain forest, often along rivers and in swamp forest.

*Distribution* — Endemic in Borneo. Of the genus *Chionanthus* nine species are reported for Kalimantan.

*Material* — AA 373, AA 505.

## 45 OXALIDACEAE

*SARCOTHECA* Blume, Mus. Bot. Lugd. Bat. 1 (1850) 241.

*Sarcotheca diversifolia* (Miq.) Hall. f., Meded. Rijksherb. Leiden 1 (1911) 2.  
— Fig. 152

*Literature* — Veldkamp, Blumea 15 (1967) 529; id. in Flora Malesiana I, 7 (1971) 170.

*Vernacular name* — Belimbing hutan (M).

Trees up to 30 m tall, up to 90 cm in diameter. Bole fluted. Buttresses up to 90 cm tall. Bark smooth, reddish brown, flaky. Inner bark fibrous, yellowish. Sapwood white to pale pink or yellow. Hardwood pink to light brown. Stipules absent. Leaves spiral, 3-foliolate, almost leathery, ovate- to elliptic-oblong, to -lanceolate, base acute to truncate, apex acute to long pointed, drying greenish, secondary veins 1–5 pairs, basal ones 3-veined, lateral leaflets 3–9.5 cm long, 1–4 cm wide, terminal leaflet 5.5–18 cm long, 2–7 cm wide, petioles 6–25 mm long, distinctly constrictedly jointed, the petiolule 4–7 cm long, cross-wrinkled. Panicle shorter than subtending leaf. Flowers heterodistylous. Sepals 5, unequal, shortly fused at base, petals 5, twisted, free at base, cohering above the claw and falling off jointly, filaments 5 + 5, fused at base. Ovary 5-celled. Ovules 2 per cell. Fruit fleshy, indehiscent. Seeds 0–7 per fruit.

*Habitat & Ecology* — Scattered on ridges and hillsides in primary forest.

*Distribution* — Sumatra, Borneo. Of the genus *Sarcotheca* five species are reported for Kalimantan.

*Uses* — The fruits are eaten as a vegetable. The light wood is sometimes used for indoor construction.

*Material* — W 965, W 973, W 994.

## 46 PALMAE

Unbranched trees. Wood without secondary growth. Leaves compound, crowded. Inflorescence covered by a bract (spathe). Flowers unisexual, 3-merous. Fruit a berry or a drupe.

(Palmae / Papilionaceae)

KEY TO THE GENERA

- 1 a. Clustering trees, trunk with long spines, leaves pinnate *Oncosperma*\* (Bayas)
- b. Trees single, trunk unarmed . . . . . 2
- 2 a. Rhachis with 2 yellow bands below, margin beset with thick sharp spines, leaves palmate, fruits round, warty, c. 4 cm in diameter . *Pholidocarpus*\* (Kepau)
- b. Rhachis without bands or spines . . . . . 3
- 3 a. Leaves palmate, the fruits ovoid, at least 10 cm long, inflorescence among the leaves . . . . . *Borassodendron*\* (Bindang)
- b. Leaves pinnate, fruits smaller, smooth, inflorescence on the trunk

*Arenga*\* (Aren)

**47 PAPILIONACEAE**

Trees up to 50 m tall. Inner bark sometimes with red sap (*Callerya*, *Pterocarpus*). Stipules present, falling off early. Leaves pinnately compound, spiral, margin of leaflets entire. Petioles thickened at base. Flowers zygomorphic, bisexual, sepals fused, a cup or a tube with 5 teeth, petals 5, upper one (standard) largest, covering the others in bud, 2 lower petals united (keel), stamens 10, 1 free, 9 united. Pod dehiscent or indehiscent. — Six genera reported for Kalimantan.

KEY TO THE GENERA

- 1 a. Leaflets alternate . . . . . *Pterocarpus*
- b. Leaflets opposite . . . . . 2
- 2 a. Inner bark with red sap . . . . . *Callerya*
- b. Inner bark without red sap . . . . . *Ormosia*

**CALLERYA** Endl., Gen. Suppl. 3 (1843) 104

*Literature* — Schot, Blumea 39 (1994) 1–40.

*Callerya atropurpurea* (Wall.) Schot, Blumea 39 (1994) 1–40. — Fig. 153

*Synonyms* — *Milletia atropurpurea* (Wall.) Benth. in Miq., Pl. Jungh. (1852) 249; *Whitfordiodendron atropurpureus* (Wall.) Dunn, Kew Bull. (1911) 197; *Padbruggea atropurpurea* (Wall.) Craib, Kew Bull (1927) 61.

*Vernacular name* — Dalok (K).

Trees 5–25 m tall, up to 55 cm in diameter. Buttresses steep, 1.5–3 m tall. Bole poor, twisted. Bark smooth, brown to grey white. Inner bark brown, yellow mottled, fibrous, sap red, resinous, sticky, slow to appear. Stipules falling off early. Stipellae falling off early. Leaflets 7–11, ovate to elliptic to obovate, 5–17 cm long, 2.5–6 cm wide, base rounded to acute, apex acute, leathery, glabrous, drying greyish green, secondary veins 5–8 pairs, venation distinct, net-like. Inflorescence a terminal panicle, 11–20 cm long. Flowers 17–20 mm long, foul-smelling. Pod elliptic to obovate, inflated, 7.5–15 cm long, 4.5–6 cm in diameter, glabrous, slightly rough, green, dehiscent. Seed(s) 1 or 2, lens-shaped, smooth.

*Habitat & Ecology* — In primary Dipterocarp forest at low altitudes, the first record for Borneo!

*Distribution* — Thailand, West Malesia.

*Material* — AA 99.

**ORMOSIA** Jackson, Trans. Linn. Soc. 10 (1810) 360.

*Ormosia macrodisca* Baker, Fl. Br. India 2 (1878) 253. — Fig. 154

*Vernacular name* — Ongo (B).

Trees 20–30(–40) m tall, c. 70 cm in diameter. Buttresses usually present. Bole straight. Bark smooth, greyish. Inner bark thick, striated. Stipellae falling off early. Leaflets 9, elliptic to oblong-elliptic, 3.5–9 cm long, 3.5–4.5 cm wide, base acute, apex acute, almost glabrous, drying pale yellow-brown, secondary veins 6–8 pairs, venation distinct, net-like. Inflorescence a terminal panicle. Flowers 6–12 mm long. Pod round, flat, tipped, c. 5 cm in diameter, woody, dehiscent, containing 1 red seed with a black spot.

*Habitat & Ecology* — In lowland primary and secondary forest, sometimes also found in kerangas.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo, Sulawesi, Philippines. Of the genus *Ormosia* six species are reported for Kalimantan.

*Uses* — The timber is hard, but of no commercial importance.

*Material* — W 1003.

**PTEROCARPUS** Jacq., Sel. Stirp. Amer. Hist. (1763) 283.

*Pterocarpus indicus* Willd., Sp. Pl. 3 (1800) 904. — Fig. 155

*Literature* — Rojo in Phanerogam. Monogr. 5 (1972) 41.

*Vernacular names* — Sonokembang (M), angsana (M).

Trees up to 30 m tall, c. 45 cm in diameter. Buttresses equal to steep. Bole deeply fluted and twisted. Leafy twigs drooping, sometimes almost to ground. Bark greyish brown, fissured, often flaky. Inner bark fibrous, sap red, sparse, sapwood cream, heartwood dark brown. Stipules linear, 7–15 mm long. Leaves imparipinnate, spiral, leaflets 5–9, alternate, ovate, 4–6(–9) cm long, 2.5–4 cm wide, base rounded, apex acuminate, secondary veins 7–9 pairs. Flowers in axillary panicles, 6–13 cm long, fragrant. Pod circular to semi-circular, 4–7 cm in diameter, winged, indehiscent, style lateral. Seed(s) 1–2(–3).

*Habitat & Ecology* — Often near the sea on white sand and along rivers. Commonly planted as ornamental along roads.

*Distribution* — Burma, Malesia, Pacific islands.

*Uses* — The timber is the finest figured one for furniture.

*Material* — AA 401.

(Podocarpaceae / Polygalaceae)

## 48 PODOCARPACEAE

Medium to large trees. Resin clear. Stipules absent. Leaves simple, spiral or opposite, plants dioecious (male and female flowers on different plants), male cones clustered, axillary, female cones single, consisting of 1 scale and 1 ovule. Seed fleshy on a fleshy, often coloured receptacle. — Seven genera reported for Kalimantan.

### KEY TO THE GENERA

- 1a. Leaves opposite, with many parallel longitudinal veins, terminal bud conical, fresh leaves do not break when bent (see *Agathis*, Araucariaceae) . . . *Nageia*
- b. Leaves spiral, with midrib . . . . . *Podocarpus*\*

*NAGEIA* Gaertn., De Fruct. & Sem. (1788) 191.

*Nageia wallichiana* (Presl) O. Kuntze, Rev. Gen. Pl. 2 (1891) 800. — Fig. 156

*Synonymy* — *Podocarpus wallichianus* Presl, Bot. Bemerk. (1844) 110.

*Literature* — De Laubenfels in Flora Malesiana I, 10 (1988) 389.

*Vernacular names* — Leman (K), toga (K).

Trees up to 50 m tall, up to 60 cm in diameter. Bark smooth, peeling in large thin irregularly shaped plates, dark brown to black. Terminal bud conical. Leaves variable both on juvenile and adult plant, opposite, distinctly narrowed to a decurrent base, 6–14(–23) cm long, 2–5(–9) cm wide. Petioles 5–10 mm long. Pollen cones cylindrical, in groups of at least 7 on a 2–10 mm stalk, 8–18 mm long, 3–4 mm in diameter. Seed-bearing structure solitary on a 8–20 mm long stalk, scales falling off early, or occasionally persisting reduced leaves. Receptacle with 4–7 sterile, deflexed, slightly enlarged bracts, dark purple or black when ripe. Seeds smooth, globular, slightly elongated, 15–18 mm in diameter.

*Habitat & Ecology* — Scattered in mixed Dipterocarp forest, usually on sandstone, along streams.

*Distribution* — E. India to New Guinea. Of the genus *Nageia* three species are reported for Kalimantan.

*Uses* — A good timber for house construction.

*Material* — W 1027, AA 93.

## 49 POLYGALACEAE

*XANTHOPHYLLUM* Roxb., Pl. Corom. 3 (1820) ('1819') 81.

*Literature* — Meijden, Leiden Bot. Series 7 (1982) 1–159; id. in Flora Malesiana I, 10 (1988) 493–539.

*Vernacular names* — Most of the species are called kayu batu (M) or penjalin (M).



(Polygalaceae)

Small to large trees, usually not buttressed, bole smooth, often hooped. Stipules absent. Leaves simple, entire, alternate, usually with scattered glands below, often drying yellowish. Flowers in simple or branched racemes, bisexual, zygomorphic, sepals 5, petals 5, one large, keel-shaped, or all petals equal, stamens 8, disc present, ovary superior, 1-celled, placentation parietal. Fruit woody, 1- to many-seeded. — Forty-six species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Tertiary veins nearly all ladder-like . . . . . *X. affine*  
b. Tertiary veins net-like or mostly so, or invisible . . . . . 2  
2a. Leaves drying yellowish glaucous below, axillary buds large (4–8 mm long)  
*X. griffithii*  
b. Leaves drying black or dark brown, axillary buds small (up to 4 mm long) . . . 3  
3a. Midrib prominent above . . . . . *X. obscurum*  
b. Midrib sunken above . . . . . 4  
4a. Fruits globular . . . . . *X. amoenum*  
b. Fruits beaked . . . . . *X. stipitatum*

*Xanthophyllum affine* Korth. ex Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 271.

*Literature* — Meijden in Flora Malesiana I, 10 (1988) 503.

Tree 10–15(–30) m tall, 40–95 cm in diameter. Twigs hairy. Axillary buds 2 (or 3), mm long. Petioles (5–)6–11(–17) mm long, glands absent. Lamina 6.5–18 by 3–8 cm, base wedge-shaped, apex cuspidate, midrib prominent above, secondary veins 5–16 pairs, forming a more or less distinct intramarginal vein, tertiary veins ladder-like, prominent, glands very variable in number and size, usually distinct. Inflorescences shorter than the leaves. Sepals sometimes with small glands, petals white, stamens and ovary glabrous, ovules 8–12. Fruits globular, up to 1.5 cm in diameter.

*Habitat & Ecology* — Often in freshwater swamp forest but also in mountain forest.  
*Distribution* — India, Indochina, Thailand, Malay Peninsula, Sumatra, Borneo, Philippines.

*Note* — A very variable species.

*Material* — W 349, S 270, S 294.

*Xanthophyllum amoenum* Chodat, Bull. Herb. Boiss. 4 (1896) 259.

*Literature* — Meijden in Flora Malesiana I, 10 (1988) 533.

Tree up to 35 m tall, c. 80 cm in diameter. Twigs glabrous. Axillary buds 2 (or 3), c. 2 mm long. Petioles 4.5–10.5 mm long, glands absent. Lamina 4–14 cm long, 2–7 cm wide, base acute, apex pointed, midrib sunken above, secondary veins 5–7 pairs, not forming an intramarginal vein, tertiary veins coarsely net-like, glands 6–10(–20), scattered. Inflorescences shorter or longer than leaves. Sepals without glands, petals white, stamens glabrous, ovary densely lanate, ovules 8–16. Fruits globular, up to 5 cm in diameter.

(Polygalaceae)

*Habitat & Ecology* — In lowland primary forest up to 500 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 402, W 622.

*Xanthophyllum griffithii* Hook. f. ex Benn., Fl. Br. India 1 (1874) 210.

*Literature* — Meijden in Flora Malesiana I, 10 (1988) 513.

Tree up to 30 m tall, 40 cm in diameter. Twigs glabrous to minutely scurfy. Axillary buds 2.4–8 mm long. Petioles 4–9 mm long, sometimes with 1 or 2 glands in apical part. Lamina 4–8(–10) cm long, 1–4(–5) cm wide, glaucous papillose beneath, base acute, apex acuminate, midrib prominent above, secondary veins 4–5(–6) pairs, usually forming an indistinct intramarginal vein, tertiary veins finely net-like, glands 4–20, scattered, but often near midrib. Inflorescences shorter or longer than leaves. Sepals with glands, petals white, stamens glabrous, ovary hairy, ovules 4. Fruit globular, c. 1.1 cm in diameter.

*Habitat & Ecology* — In mixed Dipterocarp forest, up to 800 m altitude.

*Distribution* — Malay Peninsula, Borneo, Philippines.

*Material* — W 259, S 561.

*Xanthophyllum obscurum* Bennett, Fl. Br. India 1 (1874) 211. — Fig. 157

*Literature* — Meijden in Flora Malesiana I, 10 (1988) 536.

Tree up to 50 m tall, c. 70 cm in diameter. Twigs glabrous. Axillary buds few, 3–4 mm long. Petioles 5–11(–15) mm long, glands absent. Lamina (4–)7.5–17 by (1.5–)3.5–9 cm, base acute, apex rounded or obtuse, midrib prominent above, secondary veins (3–)6–9 pairs, sometimes forming an intramarginal vein, tertiary veins coarsely net-like, glands 2–16, usually situated near or on the margin of the leaf. Inflorescences shorter than leaves. Sepals without glands, petals white or purple, stamens hairy, ovary glabrous, ovules 8–18. Fruits globular, up to 14 cm in diameter.

*Habitat & Ecology* — Common in lowland primary forest, on hillsides.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The fruits are edible.

*Material* — W 132, W 321, W 666, W 709, W 916, S 520, v.B. 6085.

*Xanthophyllum stipitatum* Benn., Fl. Br. India 1 (1874) 210.

*Literature* — Meijden in Flora Malesiana I, 10 (1988) 535.

Tree up to 50 m tall, c. 120 cm in diameter. Twigs glabrous. Axillary buds 2(–4), c. 2 mm long. Petioles 3–8 mm long, glands absent. Lamina (2.5–)4–13 cm long, (1–)2–7 cm wide, base acute, apex acuminate, midrib sunken above, secondary veins 5 or 6 pairs, not forming an intramarginal vein, tertiary veins net-like, faint or invisible, glands few, 0–2(–4), near the base and in the middle of the lamina. Inflorescences shorter or longer than the leaves. Sepals without glands, petals dark reddish, stamens hairy, ovary hairy, ovules 8–12. Fruits beaked, 2–6 cm in diameter.

(Polygalaceae / Proteaceae / Rhamnaceae)

*Habitat & Ecology* — Very common species in primary forest on undulating land.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The fruits are edible.

*Material* — W 40, W 626, S 183, S 757.

**50 PROTEACEAE**

**HELICIA** Lour., Fl. Cochinch. 1 (1790) 83.

*Literature* — Sleumer in Flora Malesiana, I, 5 (1955) 164–190.

Trees. Stipules absent. Leaves simple, spiral, entire to deeply indented, obovate. Inflorescence a raceme, axillary or ramiflorous. Flowers actinomorphic, bisexual, perianth tubular with 4 coiled lobes, stamens 4, nearly sessile, ovary superior, sessile, ovules 2, style slender, disc glands free or more or less fused into a cup. Fruit a 1- (or 2-)seeded drupe or nut. — Two genera with thirteen species reported for Kalimantan.

*Habitat & Ecology* — Rare, occasionally on hillsides and ridges.

**51 RHAMNACEAE**

Trees, treelets or shrubs; stems often spiny. Stipules present. Leaves simple, alternate, rarely opposite. Inflorescences cymose, axillary. Flowers small, actinomorphic, perigynous, bisexual, calyx 4- or 5-lobed, petals 4 or 5, stamens 4 or 5, anthers freely moving, ovary 2–4-celled, each cell with 1 ovule, style simple. Fruit a drupe, capsule or samara (winged fruit), 2–4-seeds or stones. — Three genera reported for Kalimantan.

KEY TO THE GENERA

- 1 a. Trees without spines, leaf undersurface white, apex of lamina mucronate *Alphitonia*
- b. Trees with spiny stems, leaf undersurface not white . . . . . *Ziziphus\**

**ALPHITONIA** Reissek ex Endlicher, Gen. (1840) 1098.

*Alphitonia incana* (Roxb.) Teijsm. & Binn. ex Kurz, J. Bot., Lond. 11 (1873) 208. — Fig. 158

*Vernacular name* — Kole (M).

Trees 10–15(–30) m tall. Bark whitish, smooth. Inner bark pinkish, paler inwards. Leaves alternate, elliptic, 8–16 cm long, 3–6 cm wide, margin toothed, base rounded, apex mucronate, mucro c. 1.5 mm long, secondary veins 9–15 pairs, white be-

(**Rhamnaceae/Rhizophoraceae**)

low. Petioles c. 1 cm long. Stipules small. Inflorescence cymose, pseudo-paniculate, axillary. Flowers small, actinomorphic, sepals 5, petals 5, smaller than sepals, stamens 5, ovary 2–4-celled. Fruit a drupe, almost globular, c. 1 cm in diameter, middle layer of fruit wall creamy, powdery, stones c. 3.

*Habitat & Ecology* — Usually in secondary forest.

*Distribution* — Borneo, Sulawesi, Maluku, New Guinea.

*Material* — W 618, S 651.

**52 RHIZOPHORACEAE**

Trees or shrubs, mangrove species with various root formations. Twigs swollen at nodes, solid or hollow in *Gynotroches* and *Pellacalyx*. Stipules connate over the petioles, falling off early, leaving ring-like scars. Leaves simple, opposite, margin entire or toothed, gland-like cork warts sometimes occurring as small black dots on lower surface (*Bruguiera*, *Rhizophora*, *Carallia*). Inflorescences axillary. Flowers usually bisexual, anthers 4-celled, many-celled in *Rhizophora*, disc fleshy, ring-like, ovary inferior, superior (*Gynotroches*). Fruit a berry, drupe, or capsule, crowned by the persistent apex. Mangrove species viviparous. — Eight genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Trees of mangrove forests . . . . . 2
- b. Trees of inland forests . . . . . 3
- 2a. Trees with conspicuous stilts, leaf tip mucronate by the extending midrib, lower surface with black dots, calyx 4-lobed, petals entire, without appendages, anthers with many locules . . . . . *Rhizophora*\*
- b. Trees with knee-like pneumatophores, leaves pointed, lower surface with scattered black dots, calyx 8–16-lobed, petals bilobed or notched, anthers with 4 locules . . . . . *Bruguiera*\*
- 3a. Twigs solid, leaf surface with black dots below . . . . . *Carallia*
- b. Twigs hollow, black dots absent . . . . . 4
- 4a. Stipules overlapping, one margin of each free, ovary superior . . . . . *Gynotroches*
- b. Stipules flat, without overlapping margins, ovary inferior . . . . . *Pellacalyx*

**CARALLIA** Roxb., Pl. Corom. 3 (1811) 8, t. 211.

*Carallia brachiata* (Lour.) Merr., Philipp. J. Sci. 15 (1919) 249. — Fig. 159

*Literature* — Ding Hou in Flora Malesiana I, 5 (1958) 485.

*Vernacular name* — Ampana (K).

Trees 25–40(–50) m tall, up to 70 cm in diameter. Bole with steep c. 1 m tall buttresses. Bark reddish brown, smooth, lenticellate, hooped. Inner bark yellowish, granular, striated. Sapwood yellowish white. Twigs prominently swollen at nodes. Leaves obovate to elliptic, 4–15 cm long, 2.5–6 cm wide, base wedge-shaped, apex

(Rhizophoraceae)

acute to acuminate, lower surface covered with numerous tiny black dots, margin entire or toothed, strongly curling inwards when dry, secondary veins 8–15, joined near margin to form double loops. Petioles c. 1 cm long. Stipules lanceolate 1–2.5 cm long. Flowers greenish white, axillary on 1–6 cm long stalked di- or trichotomously branched inflorescences, calyx 6–8-lobed, petals 5–8, with narrow stalk and fimbriate margins, free, stamens twice the number of petals, free, persistent, disc ring-like, fleshy, ovary inferior, 5–8-celled, with each 2 seeds. Fruit a berry, globular, c. 6 mm in diameter, pink to red when ripe.

*Habitat & Ecology* — From sea-level up to 1800 m altitude, often at edges of freshwater swamp forest.

*Distribution* — Madagascar to Australia and Solomons. Of the genus *Carallia* four species are reported for Kalimantan.

*Material* — W 719, W 1000.

**GYNOTROCHES** Blume, Bijdr. (1825) 218.

*Literature* — Ding Hou in Flora Malesiana I, 5 (1958) 488–490.

*Gynotroches axillaris* Blume, Bijdr. (1825) 219. — Fig. 160

Trees 15–30(–45) m tall, 30–50 cm in diameter. Buttresses steep, c. 1 m tall. Bark greyish, smooth or fissured. Inner bark reddish, fibrous. Sapwood yellow. Young twigs hollow, swollen at nodes. Leaves very variable in shape, ovate, ovate-oblong, elliptic-oblong, obovate-oblong or lanceolate, 4.5–20 cm long, 1.5–9 cm wide, base acute to rounded, apex pointed or blunt, margin entire, secondary veins 5–9 pairs, curved, looping near the margin. Petioles 0.5–1 cm long. Stipules lanceolate, c. 1.5 cm long, overlapping with 1 free margin. Flowers greenish white, bisexual, bundled in short condensed and warty clusters in the leaf axils, calyx 4- or 5-lobed, petals 4 or 5, obovate or elliptic, divided into hair-like appendages at the upper half, disc cup-shaped, stamens 8–10, free, ovary superior, 4–6-celled. Fruit a berry, globular or oblong 5–7 mm long, 3–5 mm in diameter, with persistent calyx lobes. Seeds few to many.

*Habitat & Ecology* — Widely distributed especially in secondary forest.

*Distribution* — Burma, Thailand, Malesia, Pacific islands.

*Uses* — The brownish white timber is of little value and not durable.

*Material* — W 363, S 357.

**PELLACALYX** Korth., Tijds. Nat. Gesch. Phys. 3 (1836) 20.

*Literature* — Ding Hou in Flora Malesiana I, 5 (1958) 490–493.

Trees. Young twigs hollow. Leaves entire or slightly toothed, hairy or glabrous. Stipules without overlapping margins. Flowers axillary, in fascicles, calyx tubular, 4- or 5-lobed, lower part hairy inside, petals 4 or 5, free, stamens twice the number of petals, often unequal, ovary inferior, 9- or 10-celled, each cell with 8–25 ovules.

(Rhizophoraceae)

Fruit a berry, almost globular, few to many-seeded, with persistent calyx lobes. Seeds black. Endosperm fleshy. — Four species reported for Kalimantan.

Uses — The timber is red, hard, and heavy and may be used for under-roof constructions. Unfortunately the trees reach no exploitable size and are of no commercial importance now.

KEY TO THE SPECIES

- 1a. Leaves obovate, 7–11 cm long, base wedge-shaped, the flowers 4-merous *P. lobbii*
- b. Leaves oblong, 10–20 cm long, base rounded to heart-shaped, the flowers 5-merous *P. axillaris*

*Pellacalyx axillaris* Korth., Tijd. Nat. Gesch. Phys. 3 (1836) 20.

Literature — Ding Hou in Flora Malesiana I, 5 (1958) 493.

Vernacular name — Kayu baru (B).

Trees up to 25 m tall, 25–60 cm in diameter. Bole straight, buttresses up to 1 m tall. Bark reddish brown, smooth to fissured. Inner bark brown with reddish streaks. Sapwood yellow. Branches horizontal. Leaves drooping, oblong, 10–20 cm long, 5–6 cm wide, base rounded to heart-shaped, apex acute to acuminate, margin entire or toothed, secondary veins 9–15 pairs. Petioles up to 6 mm long. Stipules 1–1.5 cm long. Calyx c. 10 mm long, 5-lobed, ovary 10-celled. Fruit ovoid or almost globular, c. 10 mm long, c. 8 mm in diameter.

Habitat & Ecology — In lowland primary and secondary forest, especially along streams.

Distribution — Malay Peninsula, Sumatra, Borneo, Philippines.

Uses — The timber is red, durable for under-roof house construction.

Material — S 830.

*Pellacalyx lobbii* (Hook. f.) Schimp. in Engl. & Prantl, Nat. Pflanzenfam. 3, 7 (1893) 54. — Fig. 161

Literature — Ding Hou in Flora Malesiana I, 5 (1958) 491.

Trees 25–35(–45) m tall, 20–40(–65) cm in diameter. Bark grey to brown, regularly polygonally fissured. Leaves obovate, 7–11 cm long, base wedge-shaped, apex abruptly acute, margin entire to toothed, secondary veins 5–7 pairs. Petioles up to 1 cm long. Stipules 3–5 mm long. Calyx 5.5–9 mm long, 4-lobed, ovary 9-celled. Fruit almost globular, c. 10 mm in diameter.

Habitat & Ecology — Hillsides and undulating land at low altitudes.

Distribution — Sumatra, Borneo.

Uses — The wood is fairly heavy, yellowish brown, occasionally used for rafters and fuel.

Material — W 314, W 750, W 780.

**53 ROSACEAE**

**PRUNUS L., Sp. Pl. (1753) 474 ('Laurocerasus').**

*Literature* — Kalkman, Blumea 13 (1965) 1–115; id in Flora Malesiana I, 11 (1993) 319–351.

*Prunus beccarii* (Ridley) Kalkman, Blumea 13 (1965) 104. — Fig. 162

*Vernacular names* — Melipas (K), merlepas (K).

Trees up to 27 m tall. Bark brown, smooth, inner bark smelling of bitter almonds. Leaves simple, entire, spiral, elliptic or elliptic-ovate, 8–12 by 5.5–8 cm, base acute to rounded or decurrent, apex rounded to obtuse or shortly and bluntly acuminate, drying reddish brown and brittle, veins 4–7 pairs, prominent beneath, basal glands absent, usually several flat glands along the margin. Stipules small, 5–6 by up to 5 mm wide, outer surface with one large, hollowed gland. Inflorescence an axillary raceme. Flowers actinomorphic, bisexual, perianth segments 6–8, densely hairy, stamens 15–40, ovary superior with apical style, glabrous except some hairs at the base. Fruits a drupe, transversely ellipsoid, c. 7 mm long, up to 10 mm in diameter.

*Habitat & Ecology* — Scattered in lowland dipterocarp forest, up to 600 m altitude.

*Distribution* — Endemic in Borneo. Of the genus *Prunus* eleven species are reported for Kalimantan.

*Material* — W 1036.

**54 RUBIACEAE**

Small to medium, rarely large trees. Stipules between the petioles. Leaves simple, opposite, entire. Flowers actinomorphic, bisexual or unisexual, 4- or 5- (up to 12-) merous, corolla tubular, stamens 4 or 5, inserted on the corolla tube, ovary inferior. Fruits free or fused into a compound fruit, dehiscent or indehiscent, dry or fleshy. Seeds 1 to many, variously shaped. — Twelve genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Stipules with many long (more than 1 cm) linear teeth . . . *Jackiopsis ornata*
- b. Stipules different . . . . . 2
- 2a. Leaves apparently in whorls of 3 . . . . . *Rothmannia* spec. nov.
- b. Leaves in pairs . . . . . 3
- 3a. Tips of stipules halfway divided, clasping the terminal bud  
*Pertusadina eurhyncha*
- b. Stipules with entire tips . . . . . 4
- 4a. Vegetative bud flattened, tightly adpressed into a single plane at shoot tips, the edges not overlapping . . . . . 5
- b. Vegetative bud more or less conical, either mutually overlapping around the bud or loosely surrounding it . . . . . 6

(Rubiaceae)

- 5a. Secondary veins depressed above, not looping near the margin, flower hypanthium fused . . . . . *Nauclea officinalis*
- b. Secondary veins flat above, looping near the margin, flower hypanthium free  
*Neonauclea\**
- 6a. Main branches rather straight, horizontal, leaf pairs along branches mostly in one plane, stipules with 1 or 2 prominent ridges *Anthocephalus chinensis*
- b. Main branches ascending, leaf pairs along branches mostly perpendicular to one another . . . . . 7
- 7a. Branches with pairs of leaves equal in size, stipules with 2 lateral ridges, twig bark varnished and flaky when dry . . . . . *Ochreinauclea maingayi*
- b. Branches with pairs of leaves unequal in size, stipules triangular  
*Porterandia anisophylla\**

ANTHOCEPHALUS A. Rich., Mem. Fam. Rub. (1830) 157.

*Anthocephalus chinensis* (Lam.) A. Rich. ex Walp., Repert. 2 (1843) 491. — Fig. 163

*Synonyms* — *Neolamarckia cadamba* (Roxb.) Bosser, Bull. Mus. Hist. Nat., sér. 4, Adansonia 3 (1984) 247; *Anthocephalus cadamba* (Roxb.) Miq., Corner, Wayside Trees (1940) 533.

*Vernacular names* — Jabon (M), kelempayan (M).

Trees up to 40 m tall, up to 60 cm in diameter. Bole straight. Buttresses, if present, steep, up to 2 m tall. Bark smooth to scaly, grey-brown to dark brown. Inner bark pale yellow. Sapwood pale yellow. Branches horizontal. Stipules narrowly triangular, 1–2 cm long, overlapping and clasping the terminal bud, with 1 or 2 prominent ridges, falling off early. Leaves elliptic to obovate, 12–30 cm long, 5–16 cm wide, base rounded to heart-shaped, apex acuminate, glabrous below, secondary veins 11–17 pairs, tertiary veins ladder-like. Petioles 1–4 cm long. Inflorescence terminal. a solitary head, globular, 2–4 cm in diameter, without interfloral bracteoles, flowers bisexual, 5-merous, almost sessile, corolla yellow, glabrous, up to 9 mm long, twisted in bud, ovary 2-celled, ovules many. Fruiting heads globular, orange, fruitlets up to 3 mm in diameter, indehiscent, capped by the persistent calyx. Seeds c. 0.2 mm across, not winged.

*Habitat & Ecology* — An important pioneer tree species in secondary forest, especially on alluvial soils.

*Distribution* — India to New Guinea.

*Uses* — The species was extensively planted in Indonesia in 1933. However, growth in plantations is now usually very patchy. The timber is soft and light and is suitable for plywood, packing cases, and disposable chopsticks.

*Material* — W 92, v.B. 5995.



**JACKIOPSIS** Ridsdale, *Blumea* 25 (1979) 295.

*Literature* — Ridsdale, *Blumea* 25 (1979) 295–296.

***Jackiopsis ornata*** (Wall.) Ridsdale, *Blumea* 25 (1979) 296. — Fig. 164

Trees up to 35 m tall, up to 40 cm in diameter. Bole straight. Buttresses steep, up to 1 m tall. Bark reddish brown, peeling off in thin flakes. Inner bark and sapwood pale brown. Stipules fused into a shallow cup, 5–15 mm long, with many linear, 5–30 mm long teeth. Leaves obovate, 9–40 cm long, 5–16 cm wide, base wedge-shaped, apex blunt, short-hairy below and sometimes on the midrib above, secondary veins 11–16 pairs, tertiary veins faint, net-like. Petioles 1.5–3 cm long. Inflorescences axillary, paniculate, 10–50 cm long, pendulous, main branches 3, subtended by reduced leaves. Flowers bisexual, fragrant, arranged alternately in 2 rows along the upper side of the ultimate branches, each subtended by a papery, ovate bract, calyx 3-lobed, corolla up to 12 mm long, valvate, ovary 2-celled, ovules 2–5 per cell. Fruit a dry 3-winged nutlet, persistent calyx lobes spreading. Seed(s) usually 1 per fruit, 2–3 mm long.

*Habitat & Ecology* — Frequent in lowland swamp forest and along rivers.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is hard, heavy, reddish brown, and fine textured.

*Material* — W 341, W 934, v.B. 6109.

**NAUCLEA** L., *Sp. Pl.* ed. 2 (1762) 243.

***Nauclea officinalis*** (Pierre ex Pitard) Merr. & Chun, *Sunyatsenia* 5 (1940) 188.  
— Fig. 165

*Vernacular name* — Bengkal (M).

Trees up 30 m tall, c. 70 cm in diameter. Bark smooth to cracking, greyish to reddish brown. Inner bark yellow turning brown to orange on exposure. Sapwood pale yellow. Vegetative bud flattened. Stipules ovate to elliptic, up to 25 mm long, plane. Leaves elliptic to obovate, 4–25 cm long, 2–14 cm wide, base wedge-shaped, apex shortly acuminate, glabrous below, secondary veins 4–10 pairs, sunken above. Petioles up to 2 cm long. Flowering heads in groups of 2–5, rarely solitary, globular, c. 15 mm in diameter, flowers bisexual, calyx cups fused, calyx up to 1 mm long, corolla 4- or 5-lobed, up to 4.5 mm long, twisted in bud, ovary 2-celled, ovules many per cell. Fruiting heads globular, composed of many fused fruits, becoming woody and shallowly pitted and knobbed, indehiscent. Seeds ovoid to ellipsoid, not winged.

*Habitat & Ecology* — In lowland Dipterocarp forest, usually along streams.

*Distribution* — China, Indochina, Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is moderately strong and suitable for veneer and plywood manufacture, for flooring, furniture and ornaments.

*Material* — W 170, v.B. 5938.

(Rubiaceae)

**OCHREINAUCLEA** Ridsdale & Bakh. f., *Blumea* 24 (1978) 331.

*Ochreinauclea maingayi* (Hook. f.) Ridsdale, *Blumea* 24 (1978) 332. — Fig. 166

Trees up to 40 cm tall, up to 1 m in diameter. Bark lenticellate, greyish brown. Inner bark thick, fibrous, brown. Sapwood pale yellow. Stipules narrowly triangular, overlapping around the terminal bud, each with two prominent lateral keels, up to 1.2 cm long. Leaves elliptic to obovate, 10–30 cm long, 5–10 cm wide, base wedge-shaped, apex shortly acuminate, almost glabrous, secondary veins 10–20 pairs. Petioles 1–2.5 cm long. Inflorescence a stalked solitary terminal head, globular, with some small basal bracts. Flowers bisexual, 5-merous, calyx cups fused at the apices, with velvety lobed, corolla up to 17 mm long, ovary 2-celled, ovules many per cell. Fruiting head globular, up to 6.5 cm in diameter, of many fruits first fused apically, later free, velvety. Seeds flattened, elliptic, shortly winged at each end.

*Habitat & Ecology* — A rare species, usually confined to swampy areas.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The same use as *Nauclea*.

*Material* — W 180, W 337, v.B. 5950.

**PERTUSADINA** Ridsdale, *Blumea* 24 (1978) 353.

*Pertusadina eurhyncha* Ridsdale, *Blumea* 24 (1978) 354. — Fig. 167

Trees up to 45 m tall, up to 1.1 m in diameter. Bole latticed. Buttresses steep. Bark finely fissured to slightly scaly, grey-brown. Inner bark pale yellow, fibrous. Sapwood pink fading to yellow. Stipules narrowly triangular, 2–8 mm long, apex divided halfway. Leaves elliptic to obovate, 4–15 cm long, 1.5–7 cm wide, base wedge-shaped, apex strongly acuminate, 1–2 cm long, hairy on veins below, secondary veins 8–15 pairs, tertiary veins fine. Petioles up to 12 mm long. Inflorescences 1.5–4.5 cm long, branched like a simple dichasium. Flowering heads 3 in inflorescence, globular, c. 8 mm in diameter. Flowers bisexual, 5-merous, calyx up to 0.5 mm long, corolla up to 2.5 mm long, twisted in bud, ovary 2-celled, ovules 4–10 per cell. Fruiting heads globular, 3.5–6 mm in diameter, fruitlets splitting. Seeds trigonal, with a thin short apical wing.

*Habitat & Ecology* — A very common tree in secondary forest along roads.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — AA 70.

**ROTHMANNIA** Thunb., *Kongl. Vetensk. Acad. Handl.* 37 (1776) 65.

*Rothmannia* spec. nov. — Fig. 168

*Vernacular name* — Bengkil (K).

Trees up to 30 m tall, up to 50 cm in diameter. Bole slightly fluted at base. Bark greyish brown, smooth to finely granular. Inner bark brown, gritty. Sapwood yellow.

lowish. Branches with pairs of nodes together, one developing only one leaf, so that the leaves occur in whorls of three. Leaves elliptic to obovate, 9–17 cm long, 2.5–7 cm wide, base wedge-shaped, apex acute, glabrous, secondary veins 7–10 pairs. Petioles 3–5 mm long. Inflorescences cymose, bearing 5–11 flowers. Flowers bisexual, pale yellow. Fruits globular, c. 6 cm in diameter, green.

*Habitat & Ecology* — Lowland primary forest, along streams.

*Distribution* — Endemic in East Kalimantan and Sabah.

*Notes* — Our specimen resembles *Kostermans 5536* from E. Kutai and *SAN 17248* from Tawau, Sabah. The new species will be described by Ridsdale, who is revising the genus.

*Material* — v.B. 6094.

## 55 RUTACEAE

Small trees, all parts fragrant. Stipules absent. Leaves simple or compound, opposite (or elsewhere spiral), entire, with translucent oildots. Flowers actinomorphic, uni- or bisexual, 4- or 5-merous, stamens as many or twice as many as petals, disc present, ovary superior, stigma often capitate. Fruit a drupe, a berry, or a capsule. — Eleven genera reported for Kalimantan.

### KEY TO THE GENERA

- 1a. Leaves simple, petioles thickened at apex, fruit a drupe . . . . . *Acronychia*\*
- b. Leaves 3-foliolate, fruit a follicle, seeds glossy . . . . . *Euodia* (*Melicope*)

*EUODIA* J.R. & G. Forster, Char. Gen. (1776) 13, t. 7.

*Euodia glabra* (Blume) Blume, Bijdr. (1825) 245. — Fig. 169

*Vernacular names* — Empah (K), empatung (B).

Trees up to 20 m tall, c. 25 cm in diameter. Bark pinkish grey to brown, smooth, inner bark pink, brittle. Petioles 4–13 cm long. Leaves opposite, 3-foliolate, leaflets obovate, 7–20 cm long, 4–10 cm wide, base wedge-shaped, apex acuminate, secondary veins 8–15 pairs. Flowers in dense cymose panicles, with opposed branches, unisexual, sepals 4 or 5, very small, petals 4 or 5, ovate, white, glabrous, stamens 4 or 5, ovary 4-celled, ovule 2 per cell. Fruits glabrous, follicles often 1 or 2, sometimes 3 or 4. Seeds black, shiny.

*Habitat & Ecology* — Common in secondary forest.

*Distribution* — Andamans, Malay Peninsula, Sumatra, Java, Borneo. Of the genus

*Euodia* five species are reported for Kalimantan.

*Note* — Most species now considered to belong to *Melicope*.

*Material* — W 712, P.K. 633.

(Sabiaceae / Sapindaceae)

## 56 SABIACEAE

**MELIOSMA** Blume, Cat. (1823) 32.

*Literature* — Van Beusekom & Van de Water in Flora Malesiana I, 10 (1989) 690–715.

*Meliosma sumatrana* (Jack) Walp., Ann. 1 (1848) 135. — Fig. 170

Trees 15–20(–25) m tall, c. 25 cm in diameter. Bark smooth, grey to brown, lenticellate, often shallowly fissured. Inner bark soft, fibrous, yellowish, soon turning reddish after exposure. Sapwood whitish. Twigs terete, glabrous, lenticellate, often with conspicuous leaf-scars. Stipules absent. Leaves spiral, imparipinnate, rhachis 8–50 cm long, including the petiole, leaflets 2–5 pairs, elliptic to lanceolate, (3–)5–35(–50) cm long, (1.5–)2.5–15(–20) cm wide, base acute to rounded, apex acuminate to cuspidate, margin entire or toothed, midrib prominent above, secondary veins 6–11 pairs, very prominent below, looping near margin. Petioles thickened at base, glabrous to slightly rusty hairy. Panicles terminal, erect, dense, 9–50(–75) cm long, bearing numerous flowers. Flowers bisexual, small, sepals 5 or 4, overlapping, petals 5, overlapping, disc small, stamens 5 or 4, opposite the petals, 2 fertile, 3 staminodal, ovary 2- or 3-celled, each cell with 2 ovules. Fruit a drupe, ovoid to globular, 1–3 cm in diameter, ripening red.

*Habitat & Ecology* — Primary and secondary forest up to 2200 m altitude, along streams.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo, Sulawesi, Philippines. Of the genus *Meliosma* seven species are reported for Kalimantan.

*Uses* — This species was proposed by Koorders & Valeton for reforestation purposes. The fruits are edible.

*Material* — W 278, W 364, W 742, W 853, S 358.

## 57 SAPINDACEAE

*Literature* — Various authors in Flora Malesiana I, 11 (3) (1994) 419–seq.

Small to large trees. Exudate sometimes present (*Pometia*). Pseudostipules sometimes present. Leaves spiral, 3-foliolate, imparipinnate or paripinnate with free rhachis tip, entire or toothed. Flowers regular, unisexual, 4- or 5-merous, petals often with appendages, stamens free, disc present, ovary superior, usually of two or three free carpels, often only one developing. Seeds arillate. — Twelve genera reported for Kalimantan.

## KEY TO THE GENERA

- 1 a. Leaves 3-foliolate . . . . . *Allophyllus cobbe*\*
- b. Leaves pinnate . . . . . 2
- 2 a. Leaves imparipinnate . . . . . *Lepisanthes* p.p.\*
- b. Leaves paripinnate . . . . . 3
- 3 a. Cut stem with abundant red sap . . . . . *Pometia pinnata*
- b. Cut stem without red sap . . . . . 4
- 4 a. Rhachis of leaves distinctly winged . . . . . *Guioa pterorhachis*\*
- b. Rhachis of leaves not winged . . . . . 5
- 5 a. Leaflets with tufted hairs . . . . . *Dimocarpus*
- b. Leaflets without tufted hairs . . . . . 6
- 6 a. Leaflets with round flat glands . . . . . *Xerospermum*
- b. Leaflets without flat glands . . . . . 7
- 7 a. Leaflets papillate beneath . . . . . *Nephelium*
- b. Leaflets not papillate . . . . . 8
- 8 a. Domatia present . . . . . *Mischocarpus pentapetalus*
- b. Domatia absent . . . . . *Lepisanthes* p.p.\*

**DIMOCARPUS** Lour., Fl. Coch. (1790) 233.

*Dimocarpus longan* Lour. subsp. *malesianus* Leenh., Blumea 19 (1971) 126.  
— Fig. 171

*Vernacular names* — Longan (M), ihau (B).

Trees up to 40 m tall, usually smaller (c. 20 m tall), up to 1 m in diameter. Buttresses sometimes present, spreading. Bark greyish, fissured, scaly. Inner bark brownish, granular. Sapwood yellowish. Twigs whitish, early glabrescent. Leaves paripinnate, pairs of leaflets 2–4(–6), leaflets very variable, 7–20 cm long, 3.5–6 cm wide, leathery, base wedge-shaped, apex often acuminate, domatia present in part of the secondary vein axils, midrib sunken above, hairs in tufts. Inflorescences terminal or axillary at the apex of the shoot, thyrsoïd. Flowers in cymules, unisexual, calyx 5-lobed, petals 5, well developed, exceeding calyx in length, densely woolly, inside of ten fur-like, stamens usually 8, disc completely hairy, ovary two-lobed, hairy, usually only one developing into fruit. Fruits indehiscent, smooth to warty, usually globular, calyx persistent, 1–2 cm in diameter. Seeds globular, aril translucent, white, enveloping the whole seed.

*Habitat & Ecology* — Primary and secondary forest, especially on hillsides.

*Distribution* — Southeast Asia. Of the genus *Dimocarpus* three species are reported for Kalimantan.

*Uses* — The fruits are edible, usually sold at local markets.

*Material* — W 660, S 487, S 542, S 629, S 656, S 681.

(Sapindaceae)

**LEPISANTHES** Blume, Bijdr. (1825) 229.

*Literature* — Leenhouts, Blumea 17 (1969) 33–91.

Small trees or shrubs. Pseudostipules present or absent. Leaves pari- to imparipinnate, leaflets opposite to alternate. Rhachis winged or not. Inflorescences terminal, axillary, on the branches or on the trunk. Flowers unisexual, sepals 4 or 5, free, petals 4 or 5. Fruits sessile or sometimes with short stalks, distinctly lobed or not. — Twelve species reported for Kalimantan.

*Note* — *Lepisanthes* species occur frequently in our area. Therefore they have been included here in the key to the species, although they are only small trees.

KEY TO THE SPECIES

- 1 a. Pseudostipules present, rhachis winged or not, leaves imparipinnate or paripinnate ..... 2
- b. Pseudostipules absent, rhachis not winged, leaves paripinnate ..... 5
- 2 a. Leaves paripinnate ..... *L. fruticosa*\*
  - b. Leaves imparipinnate ..... 3
- 3 a. Rhachis winged ..... *L. alata*\*
  - b. Rhachis not winged ..... 4
- 4 a. Leaflets 7–9 pairs, secondary veins distinctly looped and joined at some distance from the margin ..... *L. kinabaluensis*\*
  - b. Leaflets rarely less than 30 pairs, secondary veins vaguely looped and joined ..... *L. amoena*\*
- 5 a. Leaflets up to 13 cm long, 4–6 pairs, usually from coastal forests ..... *L. rubiginosa*\*
  - b. Leaflets 17–50 cm long, 2–5 pairs, usually from inland forests ..... *L. tetraphylla*\*

**MISCHOCARPUS** Blume, Bijdr. (1825) 238.

*Literature* — Van der Ham, Blumea 23 (1977) 251–288.

*Mischocarpus pentapetalus* (Roxb.) Radlk., Sapind. Holl.-Ind. (1879) 43. — Fig. 172

*Literature* — Van der Ham, Blumea 23 (1977) 271.

Treelets or trees up to 25 m tall, up to 25 cm in diameter. Bark greyish, smooth. Inner bark thin, with a strong mango smell. Twigs greyish, glabrescent. Leaves paripinnate, with 2–5 pairs of leaflets, leaflets alternate to almost opposite, lanceolate, 7–25 cm long, 3–6.5 cm wide, glabrous, margin entire, domatia usually present in axils of the midrib, base wedge-shaped to rounded, apex acuminate, secondary veins distinct on lower surface, 9–20 pairs. Petioles 3–15 cm long, petiolules 3–12 mm long. Inflorescences axillary and pseudoterminal, main axis up to 30 cm long. Flowers unisexual, calyx 5-lobed, hardly fused at base, triangular, leathery, hairy outside,

petals 0–5, falling off early, smaller than sepals, disc ring-like, stamens 7 or 8, filaments hairy, ovaries 3-celled, slightly hairy. Fruits stalked, pear-shaped, smooth or with ridges, 1–2 cm long, glabrous, seed-bearing parts globular to ellipsoid, dehiscent along the vertical ribs. Seed 1, globular.

*Habitat & Ecology* — Usually on hillsides and along streams in primary and secondary forest, up to 2000 m altitude.

*Distribution* — South and Southeast. Asia, Malaysia, Sumatra, Java, Borneo, Philippines. Of the genus *Mischocarpus* two species are reported for Kalimantan.

*Material* — AA 72, AA 467, P.K. 627.

**NEPHELIUM L., Mant. Pl. (1767) 18.**

*Literature* — Leenhouts, *Blumea* 31 (1986) 373–438.

Trees. Stipules absent. Leaves paripinnate. Neither petioles nor rachis winged. Leaflets alternate, usually distinctly glaucous beneath, domatia often present, margin entire. Flowers actinomorphic, calyx (4–)5(–6)-merous, sepals free to fused, valvate, outside and inside hairy, petals 5 or 4–1 reduced petal(s), often completely lacking, disc complete, stamen number rather unstable, varying from 4–10, ovary 2(–4)-celled, usually warty, style usually well developed, stigmas long, spreading, recurved. Ovule 1 per cell. Fruits 1, exceptionally 2-lobed, ellipsoid to almost globular, at first hairy, soon glabrescent, surface warty to spiny, pericarp thin to thick leathery, inside glabrous. Seed 1, aril (sarcotesta) covering the whole seed. — Five species reported for Kalimantan.

*Uses* — The sarcotesta of a few species is eaten, only *N. lappaceum* (rambutan) is of major economic importance as a widely cultivated fruit tree. The timber has no special use.

*Note* — Without mature fruits identification is hardly possible. The following key can only be used in our area!

KEY TO THE SPECIES

- 1 a. Domatia absent ..... 2
- b. Domatia present ..... 3
- 2 a. Venation net-like or hardly visible ..... *N. cuspidatum*
- b. Venation tending to ladder-like ..... *N. lappaceum* var. *xanthoides*
- 3 a. Leaves lanceolate to almost sickle-shaped, usually less than 3 cm wide, parchment-like, midrib raised above ..... *N. uncinatum*
- b. Leaves elliptic, ovate to obovate, usually more than 4.5 cm wide ..... 4
- 4 a. Leaflets in the herbarium often curled or rolled up, tertiary venation indistinct below ..... *N. ramboutan-ake*
- b. Leaflets mostly flat when dried, tertiary venation usually distinct below  
*N. lappaceum*

(Sapindaceae)

*Nephelium cuspidatum* Blume, Rumphia 3 (1847) 110.

*Literature* — Leenhouts, Blumea 31 (1986) 385.

KEY TO THE VARIETIES

- 1a. Venation laxly net-like, prominent on both sides of the leaflets, twigs very coarse, up to 1.5 cm in diameter . . . . . var. *robustum*
- b. Venation inconspicuous to hardly visible . . . . . 2
- 2a. Leaflets especially on the veins densely, more or less patently hairy, thus emphasizing the venation . . . . . var. *eriopetalum*\*
- b. Leaflets sericeous beneath, the indument blurring the venation  
var. *ophiodes* subvar. *beccarianum*\*

var. *robustum* (Radlk.) Leenh., Blumea 31 (1986) 391. — Fig. 173

*Vernacular name* — Rambutan (M).

Trees up to 40 m tall, c. 60 cm in diameter. Bark smooth, hooped, grey-brown. Inner bark thick, hard. Sapwood white. Twigs coarse, 5–15 mm in diameter, tomentellous. Leaflets 2–9 pairs, elliptic, 20–35 cm long, 5–10 cm wide, base wedge-shaped to rounded, apex rounded to acute, venation laxly net-like, prominent on both sides, domatia absent. Inflorescences terminal. Sepals 25–50% fused, petals absent. Fruit appendages dense, narrowly strap-shaped to needle-shaped, gradually thickened or broadened to the base, c. 1.5 cm long, curled.

*Habitat & Ecology* — Usually confined to primary forest, up to 800 m altitude, on ridges and slopes.

*Material* — W 449, AA 211.

*Nephelium lappaceum* L., Mant. Pl. 1 (1767) 125.

*Literature* — Leenhouts, Blumea 31 (1986) 398.

*Vernacular name* — Rambutan (M), kopeg (B).

KEY TO THE VARIETIES

- 1a. Leaflets broadest above the middle, apex obtuse to rounded, glabrous and hardly or not glaucous beneath . . . . . var. *lappaceum*\*
- b. Leaflets broadest about or below the middle, apex mostly acuminate, glabrous or hairy and usually distinctly glaucous beneath . . . . . 2
- 2a. Leaflets relatively narrow, up to 5 cm wide, domatia present, almost glabrous beneath . . . . . var. *pallens*\*
- b. Leaflets 4–10 cm wide, domatia absent, midrib and secondary veins densely hairy . . . . . var. *xanthioides*



*Nephelium lappaceum* var. *xanthioides* (Radlk.) Leenh., Blumea 31 (1986) 403.

Trees up to 30 m tall, up to 60 cm in diameter. Buttresses steep, up to 2.5 m tall. Bark smooth, greyish, hooped. Inner bark thin. Sapwood white to pale yellow, heartwood dark brown. Twigs 6–10 mm in diameter, tomentellous. Leaflets 2–5 pairs, 9–30 cm long, 4–10 cm wide, base rounded, apex shortly acuminate, glaucous beneath, midrib and secondary veins densely hairy, domatia absent. Sepals 4 or 5, fused up to half way, stamens 5 or 6. Fruits red, ellipsoid, 3 cm long, 2 cm in diameter, spines needle-shaped, curved, 0.5–2 cm long.

*Habitat & Ecology* — Primary and secondary forest with a wide range of habitats from dry lands to swamps, on clay, loam or limestone, up to 600 m altitude.

*Uses* — The edible aril is sweeter than that in var. *lappaceum*.

*Material* — W 657, W 692.

*Nephelium ramboutan-ake* (Labill.) Leenh., Blumea 31 (1986) 415.

Trees up to 30 m tall, up to 35 cm in diameter. Buttresses steep, up to 2.5 m tall. Bark smooth, scaly. Inner bark fibrous. Sapwood white, heartwood dark brown. Twigs 1.5–7 mm in diameter, puberulous, early glabrescent. Leaflets 1–7 pairs, 4–20 cm long, 2–11 cm wide, base acute, apex acuminate, glaucous beneath, densely minutely sericeous, tertiary venation indistinct, domatia present. Sepals 5, fused up to half way, stamens 5–8. Fruits dark red or black, ellipsoid to almost globular, 4–6 cm long, 2.5–5 cm in diameter, spines bulbous-based and confluent at the base, up to 1.5 cm long.

*Habitat & Ecology* — Usually in primary forest, sometimes in secondary, on slopes and ridges, rarely in swamps.

*Uses* — Sometimes cultivated as fruit tree.

*Material* — AA 118

*Nephelium uncinatum* Radlk. ex Leenh., Blumea 31 (1986) 421.

Trees up to 25 m tall, up to 40 cm in diameter. Bark smooth, greyish to brown. Inner bark red. Sapwood white, heartwood brown. Twigs 2.5–4.5 mm in diameter, puberulous. Leaflets 3–7 pairs, lanceolate to almost sickle-shaped, 4.5–11 cm long, 1.5–3.5 cm wide, base wedge-shaped, apex acuminate, glaucous beneath, sparsely minutely sericeous, tertiary venation indistinct, domatia present. Sepals 5, slightly fused, petals absent, stamens 5 or 6. Fruits red, ellipsoid to almost globular, 2.75–3 cm long, 2–2.5 cm in diameter, sparsely set with needle-shaped spines, curved at apex, up to 8 mm long.

*Habitat & Ecology* — In primary forest, mainly on hillsides and ridges on well-drained, sandy soils.

*Material* — AA 73, S 513, S 646.

(Sapindaceae)

**POMETIA** Forst., Char. Gen. (1776) 110.

*Literature* — Jacobs, Reinwardtia 6 (1962) 109–144.

*Pometia pinnata* Forst., Char. Gen. (1776) 110. — Fig. 174

*Literature* — Jacobs, Reinwardtia 6 (1962) 120.

*Vernacular names* — Kayu sapi (M), matoa (M), pitanah (K).

Trees up to 40 m tall, up to 70 cm in diameter. Buttresses spreading. Bark dipped, rusty red and green. Inner bark with red exudate. Leaves paripinnate, 3–8 pairs of leaflets, rachis up to 1 m long, lowest pair often much reduced (pseudo-stipules), midrib hairy or glabrous above, margin toothed. Inflorescences terminal, 10–55 cm long, often branched. Flowers unisexual, calyx 5-lobed, petals 5, disc ring-like, stamens 5, filaments needle-shaped, ovaries 2-celled, hairy. Fruits 1-lobed, indehiscent. Seeds globular to ovoid.

*Habitat & Ecology* — Primary and secondary forest up to 1700 m altitude.

*Distribution* — South and Southeast. Asia, Malesia to Fiji, Samoa and Tonga. Of the genus *Pometia* two species are reported for Kalimantan.

*Uses* — Kayu sapi is a medium hardwood, and an important timber in Maluku and Irian Jaya. It is used for construction work. The aril is white or transparent and can be eaten.

KEY TO THE FORMS (after Jacobs, 1962)

- 1a. Leaflets hairy on the midrib above ..... forma *alnifolia*\*
- b. Leaflets glabrous on the midrib above ..... 2
- 2a. Leaflets more than 7 cm wide, base heart-shaped to ear-shaped, inflorescences at base. Usually found along streams ..... forma *glabra*\*
- b. Leaflets up to 4.5 cm wide, base wedge-shaped, inflorescences not ear-shaped at base. New record for East Kalimantan ..... forma *macrocarpa*\*

**XEROSPERMUM** Blume, Rumphia 3 (1847) 99.

*Literature* — Leenhouts, Blumea 28 (1983) 389–401.

Trees up to 30 m tall. Leaves paripinnate, leaflets 1–2(–3) pairs, opposite, glabrous, margin entire, round flat glands present above axis of veins or scattered all over the leaf surfaces. Inflorescences axillary or terminal. Flowers 4- or 5-merous, male and functionally female ones on different trees, sepals more or less fused, petals the same length as sepals, woolly ciliate, stamens 8, ovaries 2-celled. Fruits 1- or 2-lobed, indehiscent. Fruit wall almost smooth to spiny. Seeds with thin yellow aril (sarcotesta). — Two species reported for Kalimantan.

*Uses* — The thin yellow aril is eaten, but is, as the timber, of no economic importance.

KEY TO THE SPECIES

- 1a. Flowers 5-merous, fruit stalk not much swollen, 1.5–2.5 mm in diameter  
*X. laevigatum*  
b. Flowers 4-merous, fruit stalk swollen, 5–7 mm in diameter . . . *X. noronhianum*

*Xerospermum laevigatum* Radlk. subsp. *acuminatum* (Radlk.) Leenh., Blumea 28 (1983) 393.

*Vernacular name* — Meritam (M).

Trees 15–25(–35) m tall, 50(–100) cm in diameter. Buttresses up to 2 m tall. Bark smooth to slightly rough, hooped, dark greyish. Inner bark brown, granular. Sapwood whitish. Leaflets usually broad-elliptic, 4.5–18 cm long, 2–10 cm wide, base acute, apex distinctly acuminate, acute. Inflorescences up to 20 cm long, up to 5 cm long when tufted. Flowers 5-merous, disc interrupted always in female flowers, in male flowers either complete or slightly interrupted. Fruits unknown.

*Habitat & Ecology* — Usually in lowland peat-swamp forest.

*Distribution* — Burma, Malay Peninsula, Sumatra, Borneo.

*Notes* — Up to date only known from the western part of Borneo. Our specimen has, in contrast to all other specimens seen in the herbaria L and BO, relatively small, elliptic to oblong leaflets and produces up to 2 m high buttresses.

*Material* — S 445.

*Xerospermum noronhianum* Blume, Rumphia 3 (1847) 100. — Fig. 175

*Literature* — Leenhouts, Blumea 28 (1983) 394.

*Vernacular name* — Semayap (B).

Trees up to 25 m tall, up to 50 cm in diameter. Leaflets elliptic to obovate, 6–10 cm long, 3–8 cm wide, vary variable even on the same twig, base acute to rounded, apex rounded, blunt. Inflorescences up to 20 cm long, shorter when tufted. Flowers 4-merous, disc complete. Fruits almost globular, 2–2.5 cm in diameter, wall smooth to spiny, stalks swollen, 5–7 mm in diameter, maturing from green over yellow to red or dark brown.

*Habitat & Ecology* — In primary and secondary forest, on plains as well as on slopes, sometimes along rivers, up to 300(–1500) m altitude.

*Distribution* — South and Southeast Asia, Malay Peninsula, Sumatra, Java, Borneo.

*Material* — W 601.

## 58 SAPOTACEAE

Small to large trees, often buttressed, with sticky, white milksap. Stipules usually present. Leaves simple, spiral or alternate, entire, secondary veins often looping, hairs of balance type (T-hairs). Flowers actinomorphic, usually bisexual, in axillary

(Sapotaceae)

clusters, sepals free, persistent in fruit, petals fused at base, 4–16 overlapping lobes, stamens 4 to many on corolla tube and soon falling as a whole at anthesis, ovary superior, with short to long style. Fruit a hard drupe, with 1 or more seeds, seeds glossy with a large lateral scar. — Twelve genera reported for Kalimantan.

KEY TO THE GENERA

Note: Linear stipulate leaves are juvenile forms of *Madhuca* (*Ganua*) *palembanica/pierrei*.

- 1a. Stipules or stipule scars absent, leaves spiral, sepals 5, in one whorl, corolla 5-lobed, stamens 5, staminodes 5 . . . . . *Planchonella*\*
- b. Stipules or stipule scars present, sometimes tiny, leaves spiral or alternate, sepals in two whorls of 2 or 3, staminodes absent . . . . . 2
- 2a. Midrib often sharp below, sepals 2 × 3 . . . . . *Palaquium*
- b. Midrib usually rounded, sepals 2 × 2 . . . . . 3
- 3a. Leaves alternate, tertiary veins descending (= branching from leaf margin towards midrib), embryo with much endosperm, cotyledons foliaceous *Payena*
- b. Leaves spiral, tertiary veins parallel to secondary ones (or indistinctly descending), net- or ladder-like, embryo without endosperm, cotyledons thick  
*Madhuca*

MADHUCA Gmelin, Syst. (1791) 799.

Literature — Van Royen, Blumea 10 (1960) 1–117; Van den Assem, Blumea 7 (1953) 364–400 (as *Ganua*); Pennington, The genera of Sapotaceae (1991) 1–295.

Trees. Terminal vegetative bud sometimes with conspicuous ‘bud scales’ (not developing leaves). Leaves spiral, scattered or crowded at apex. Stipules small or large, usually falling off early. Flowers with 4 sepals, in two pairs, corolla 6–16-lobed, stamens 16–24, staminodes absent. Seeds 1(–4), scar lateral, narrow to very broad, endosperm thin or absent, cotyledons thick. — Forty-four species reported for Kalimantan.

Note — *Ganua* and *Madhuca*, always hard to distinguish, have been united by Pennington (1991).

KEY TO THE SPECIES

- 1a. Leaves more or less sessile, petioles up to 5 mm long. . . . . *M. (Ganua) pallida*
- b. Petioles at least 1 cm long . . . . . 2
- 2a. Leaves hairy below . . . . . *M. sericea*
- b. Leaves glabrous below . . . . . 3
- 3a. Leaves up to twice as long as wide . . . . . *M. (Ganua) motleyana*
- b. Leaves three or more times longer than wide . . . . . 4
- 4a. Leaves up to 6.5 cm wide . . . . . *M. (Ganua) palembanica/pierrei*\*
- b. Leaves 7–15 cm wide . . . . . 5

- 5a. Stipules large, up to 1.5 cm long, pedicels 0.5–1.2 cm long, sepals glabrous inside, fruits glabrous . . . . . *M. spectabilis*
- b. Stipules rather small, up to 7 mm long, pedicels 1.5–4.5 cm long, sepals hairy inside on apical part, fruits hairy, becoming glabrous . . . *M. (Ganua) kingiana*

*Madhuca kingiana* (Brace) H.J. Lam, Bull. Jard. Bot. Buitenzorg III, 7 (1925) 159.

Trees up to 20 m tall, up to 20 cm in diameter. Bole columnar. Buttresses small or absent. Bark smooth, hooped, greyish. Bud scales triangular, large, up to 1.5 cm long. Stipules 6–7 mm long, 1.5–5 mm wide. Leaves crowded at apex, oblong, 20–30 cm long, 7–12 cm wide, base wedge-shaped, apex shortly acuminate, secondary veins 26–34 pairs, impressed above, very prominent below, distinctly joining 4–5 mm before the margin, tertiary veins widely transverse, but near midrib ascending. Petioles up to 5.5 cm long, base rough. Flowers 1–6 in the axils of leaf-scars, pedicel up to 1.2 cm long, finely woolly, sepals finely woolly, corolla 12–16-lobed, white, stamens 24–38, inserted in a ring of hairs, ovary hairy, style twice as long as corolla, glabrous. Fruits subglobose, up to 1.5 cm in diameter, hairy, soon glabrescent.

*Habitat & Ecology* — Usually in lowlands or on low-undulating land.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 484, AA 34.

*Madhuca motleyana* (De Vriese) Baehni, Boissiera 11 (1965) 37.

*Literature* — Van den Assem, Blumea 7 (1953) 382 (as *Ganua*).

Trees 15–30 m tall, up to 45 cm in diameter. Bole columnar. Buttresses small or absent, sometimes knee pneumatophores present. Bark scaly, greyish brown. Bud scales up to 4 mm long. Stipules up to 2 mm long, c. 1 mm wide. Leaves more or less scattered along twigs, ovate to obovate, 4.5–9.5 cm long, 3.5–6.5 cm wide, base broadly wedge-shaped, apex acuminate, secondary veins 9–20 pairs, not impressed above, prominent below, distinctly joining 1–2 mm before the margin, tertiary veins net-like, one strongly developed, running parallel to the secondary ones. Petioles up to 3 cm long, base dark, never distinctly rough. Flowers 3–17, in the axils or in leaf-scars, stalk up to 2 cm long, sepals with a tuft of hairs at apex, corolla 8–10-lobed, green, stamens 16–20, ovary glabrous, styles 2.5–3 times as long as corolla. Fruits ellipsoid, up to 2.5 cm long, c. 1 cm in diameter, glabrous.

*Habitat & Ecology* — A fairly common species in lowland areas up to 600 m altitude, growing in periodically inundated forests, swamps and peat forest, sometimes on dry land.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 935, W 983, v.B. 6110.

(Sapotaceae)

*Madhuca pallida* (Burck) Baehni, Boissiera 11 (1965) 36. — Fig. 176

*Literature* — Van den Assem, Blumea 7 (1953) 377 (as *Ganua*).

Trees 10–15(–25) m tall, up to 30 cm in diameter. Bud scales triangular, c. 1 cm long. Stipules triangular, up to 5 mm long. Leaves crowded at apex, thickly leathery, obovate or obovate-lanceolate, 10–30 cm long, 4–8.5 cm wide, base narrowly wedge-shaped or even almost heart-shaped, apex acute to acuminate, thickly leathery, secondary veins 9–18 pairs, not impressed above, prominent below, distinctly joining 1–2 mm before the margin, tertiary veins net-like, but more transverse towards margin. Petioles up to 3 mm long, base not distinctly rough. Flowers clustered in the leaf-scars, stalk up to 2 cm long, sepals with a tuft of hairs at apex, corolla 8-lobed, yellow-green, stamens 16, ovary pubescent, styles twice as long as corolla. Fruits ellipsoid, c. 2.5 cm long, c. 1 cm in diameter, minutely tomentose.

*Habitat & Ecology* — In primary forest up to 1200 m altitude.

*Distribution* — Sumatra, Borneo.

*Material* — W 88, W 328.

*Madhuca sericea* (Miq.) H.J. Lam, Bull. Jard. Bot. Buitenzorg III, 7 (1925) 163.

— Fig. 177

*Literature* — Van Royen, Blumea 10 (1960) 70.

*Vernacular name* — Nyatoh (M).

Trees up to 30 m tall, up to 30(–50) cm in diameter. Bole columnar. Bark vertically cracked. Inner bark with milksap. Twigs slender, terete or angular, 3–6 mm in diameter, tomentose. Stipules minute, up to 1.5 mm long, relatively long persistent. Leaves scattered, elliptic to elliptic-obovate, 7–18(–27) cm long, 3.5–10 cm wide, base wedge-shaped, apex bluntly acuminate, sericeously pubescent, secondary veins 12–17(–20) pairs, diminishing until inconspicuous at the margins, tertiary veins transverse. Petioles 1.3–4 cm long. Flowers in 3–10-flowered, axillary clusters, pedicels slender, 7–14 mm long. Sepals ovate-triangular, 3.5–4.5 mm long, outside and inside sericeous, corolla 8- or 9-lobed, 5–6.5 mm long, glabrous outside, stamens 18–24, in 2 or 3 whorls, ovary ovoid or disciform, 8–10-celled, hirsute, style needle-shaped, c. 8 mm long, villose at base or glabrous. Fruits ellipsoid, 2–3.5 cm long, 1–1.5 cm in diameter, tomentose when young, later glabrous.

*Habitat & Ecology* — In primary lowland forest, especially on slopes and ridges, or on riverbanks.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — W 9, W 372, S 628.

*Madhuca spectabilis* Van Royen, Blumea 10 (1960) 24. — Fig. 178

Trees up to 25 m tall, up to 30 cm in diameter. Bole slightly fluted at base. Bark shallowly cracked. Inner bark with watery milksap. Twigs coarse, terete, 6–10 mm in

diameter, soon glabrous. Stipules very large, c. 1.5 cm long, relatively long persistent. Leaves scattered, narrowly obovate, 25–50 cm long, 8–15 cm wide, base wedge-shaped, apex obtusely acuminate, glabrous, secondary veins 24–30 pairs, joined near margin, tertiary veins transverse. Petioles 3.5–6 cm long. Flowers in 8 or more axillary clusters, stalks slender, 1.5–4.5 cm long. Sepals almost circular, 5–7 mm long, sericeous outside, glabrous inside, corolla hardly exerted, 8- or 9-lobed, 7–8 mm long, glabrous except some streaks on the tube, stamens 18–21, in 2 whorls, ovary discoid, 8-celled, villose, style needle-shaped, c. 10 mm long, glabrous. Fruits glabrous.

*Habitat & Ecology* — Primary lowland forest.

*Distribution* — Endemic in Sabah and Kalimantan.

*Material* — W 164, v.B. 5927.

**PALAQIUM** Blanco, Fl. Filip. (1837) 403.

*Literature* — Van Royen, Blumea 10 (1960) 432–606.

*Vernacular names* — Nyatoh (M), natu (B).

Medium to very big trees. Inner bark soft, fibrous. Leaves spiral, closely to loosely clustered. Stipules falling off early or absent. Lamina usually obovate. Flowers with 3 + 3 sepals, corolla usually 6-lobed, stamens 12, staminodes absent. Seeds 1–3, scar lateral, almost as long as seed and broad, usually covering one third to half of the surface, endosperm absent, cotyledons thick. — Forty species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves glabrous below, tertiary veins parallel to the secondary ones  
*P. pseudorostratum\** / *P. rostratum\**
- b. Leaves hairy, at least on midrib below, secondary veins ladder-like . . . . . 2
- 2a. Stipules large, up to 2 cm long, up to 1 cm wide . . . . . *P. ottolanderi\**
- b. Stipules much smaller, up to 1 cm long, up to 0.2 cm wide . . . . . 3
- 3a. Petioles up to 1.2 cm long, leaf base broadly rounded to slightly heart-shaped, lower leaf surface entirely silky hairy . . . . . *P. sericeum*
- b. Petioles much longer, or leaf base wedge-shaped, or lower leaf surface (partly) puberulous to wooly . . . . . 4
- 4a. Secondary veins 20–35 pairs . . . . . *P. beccarianum*
- b. Secondary veins 7–16 pairs . . . . . 5
- 5a. Petioles 1–2 cm long, lower leaf surface puberulous mainly on midrib and veins . . . . . *P. stenophyllum\**
- b. Petioles 3–7 mm long, lower leaf surface very short silky hairy *P. quercifolium*

(Sapotaceae)

*Palaquium beccarianum* (Pierre) Van Royen, *Blumea* 8 (1957) 424. — Fig. 179

*Literature* — Van Royen, *Blumea* 10 (1960) 461.

Trees 15–20(–30) m tall, up to 30 cm in diameter. Twigs stout, c. 1.5 cm in diameter, densely reddish brown woolly. Stipules lanceolate-oblong, up to 2.5 mm long. Leaves oblanceolate, 15–30 cm long, 4–9 cm wide, base wedge-shaped, apex shortly acuminate, glabrous above, densely light brownish-ferruginous woolly below, secondary veins 20–35 pairs, strongly looping c. 3 mm before the margin, tertiary veins transverse, prominent. Petioles 1–4.5 cm long. Flowers in 5–8 axillary clusters. Sepals up to 5 mm long, corolla 8–10 mm long, stamens 12, glabrous, ovary 6-celled, glabrous, style 14–18 mm long, glabrous. Fruit ellipsoid, 2.5–3 cm long, 1.5–2 cm in diameter, glabrous. Seeds ellipsoid to almost globular, testa black, scar covering about the half of the seed.

*Habitat & Ecology* — In primary lowland forest, on riverbanks, ridges or slopes.

*Distribution* — Endemic in Borneo.

*Material* — W 338.

*Palaquium quercifolium* (De Vriese) Burck, *Ann. Jard. Bot. Buitenzorg* 5 (1886) 41. — Fig. 180

*Literature* — Van Royen, *Blumea* 10 (1960) 562.

Trees up to 40 m tall, up to 75 cm in diameter. Buttresses steep, c. 1 m tall. Bark dark brown, shallowly fissured, cracked. Inner bark red, soft. Twigs slender to stout, 4–8 mm in diameter, glabrescent. Stipules lanceolate, up to 11 mm long. Leaves obovate-oblong, 12–30 cm long, 5–10 cm wide, base wedge-shaped, apex shortly acuminate, glabrous above, slightly sericeous below, secondary veins 9–16 pairs, not looping before the margin, tertiary veins transverse, slender. Petioles 3–7 cm long. Flowers in 4–8-flowered axillary clusters. Sepals up to 6 mm long, corolla 10–16 mm long, stamens 12, ovary 5- or 6-celled, hairy at apex, style 15–22 mm long, glabrous. Fruits globular, c. 2 cm in diameter, glabrous. Seeds ellipsoid, testa yellowish brown, scar broadly elliptic or ovate.

*Habitat & Ecology* — In primary lowland forest, especially on ridges.

*Distribution* — Sumatra, Borneo, Sulawesi, Maluku.

*Material* — W 51, W 120, W 331, W 357, W 839, S 482.

*Palaquium sericeum* H.J. Lam, *Bull. Jard. Bot. Buitenzorg* 7 (1925) 53.

*Literature* — Van Royen, *Blumea* 10 (1960) 463.

Trees up to 10 m tall, c. 10 cm in diameter. Twigs slender, 1–3 mm in diameter, ferruginously tomentose. Stipules linear, up to 9 mm long. Leaves oblong to obovate, 6–24 cm long, 3–12 cm wide, base rounded to slightly heart-shaped, apex acute to acuminate, glabrescent above, sericeous below, secondary veins 8–24 pairs, not



looping before margin, tertiary veins transverse, hardly visible. Petioles 5–12 mm long. Flowers in 2–10 axillary clusters. Sepals up to 4.5 mm long, corolla 6–9 mm long, stamens 12, ovary hairy, style up to 8 mm long, glabrous. Fruits globular, c. 1.5 cm in diameter, hairy, finally glabrous. Seeds unknown.

*Habitat & Ecology* — Primary and secondary forest at low altitudes.

*Distribution* — Endemic in Borneo.

*Material* — W 95, v.B., 6213, P.K. 528.

PAYENA DC., Prod. 8 (1844) 196.

*Literature* — Van Bruggen, Blumea 9 (1958) 89–138.

Trees. Leaves alternate, tertiary veins descending (branching from leaf margin towards midrib). Stipules small, early falling. Flowers with 2 + 2 sepals, corolla 8-lobed, stamens 16, staminodes absent. Seeds 1 or 2, scar lateral, narrow, endosperm thick, cotyledons foliaceous. — Ten species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves golden to brownish silky hairy on lower leaf surface . . . *P. acuminata*\*
- b. Leaves glabrous on lower leaf surface . . . . . *P. lucida*

*Payena lucida* (G. Don) DC., Prod. 8 (1844) 197. — Fig. 181

*Literature* — Van Bruggen, Blumea 9 (1958) 111.

Trees up to 35 m tall, up to 1 m in diameter. Buttresses symmetrical, up to 1.2 m tall. Bark smooth, brown. Inner bark thick, hard, fibrous, sap white. Sapwood white. Twigs slender, c. 2 mm in diameter. Stipules falling off early. Leaves opposite, elliptic lanceolate to ovate, 8–20 cm long, 3–8 cm wide, base wedge-shaped, apex acuminate, glabrous, secondary veins 9–16 pairs, joined near the margin, tertiary veins descending. Petioles 1–2.2 cm long, not thickened. Flowers in small axillary clusters, sepals 4, in two pairs, triangular, up to 5 mm long, corolla 8 mm long, 8-lobed, glabrous, stamens 16, staminodes absent, ovary 8-celled, style 8–10 mm long. Fruits ovoid 1.5–3.5 cm long, 1–2 cm in diameter. Seed 1, scar lateral, narrow, as long as seed, endosperm thick, cotyledons flat, thin.

*Habitat & Ecology* — Very widely distributed, usually in lowland primary forest, up to 1300 m altitude.

*Distribution* — India, Burma, Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — An important source of ‘Nyatoh’ timber, used for house construction.

*Note* — As an exception *Payena* is easily recognized by the descending tertiary veins and the alternate leaf position. However, there are pairs of species which are difficult to tell apart, even when fertile. One of these pairs is *P. lowiana* and *P. lucida*.

*Material* — W 50, W 1008, v.B. 5783 (eventually *P. lowiana*!).

(Simaroubaceae)

## 59 SIMAROUBACEAE

Trees or shrubs usually with a bitter taste. Stipules absent or present (*Irvingia*). Leaves spiral, simple or compound. Inflorescences compound, axillary or terminal panicles. Flowers small, actinomorphic, uni- or bisexual, sepals partly fused. Fruits usually indehiscent, drupe-like. — Five genera reported for Kalimantan.

### KEY TO THE GENERA

- 1a. Leaves compound, imparipinnate, crowded at apex of twigs, leaflets many, opposite or nearly opposite, inflorescences in axillary panicles, flowers unisexual, fruit a nut, the root is very often sold at markets as a panacea for various ailments and as an aphrodisiac . . . . . *Eurycoma longifolia*\*  
(Pasah bumi, tongkat ali, sentanir ular)
- b. Leaves simple . . . . . *Irvingia*

IRVINGIA Hook. f., Trans. Linn. Soc. Lond. 23 (1860) 167.

*Irvingia malayana* Oliv. ex Bennett in Hook. f., Fl. Brit. India 1 (1875) 522. — Fig. 182

*Literature* — Noot. in Flora Malesiana I, 6 (1962) 225.

*Vernacular names* — Pauh kijang (M), asem pauh (K).

Trees up to 60 m tall, up to 1.5 m in diameter. Buttresses steep, thin, up to 6 m tall. Bark grey, sometimes peeling with distant loose scales. Inner bark mottled, cream yellow. Sapwood orange-brown. Twigs slender. Leaves simple, entire, elliptic-oblong to lanceolate, 8–20 cm long, 2.5–9 cm wide, base broad wedge-shaped to rounded, often unequal, apex slightly acuminate, glabrous, secondary veins 10–16 pairs, looping and joining at margin. Petioles 1–2 cm long. Stipules surrounding the buds as a sharp, narrow, conical cap, up to 3 cm long. Inflorescences in axillary and terminal panicles. Flowers 5-merous, bisexual, sepals fused at base, petals overlapping, stamens twice as many as petals inserted beneath the disc, disc large, cushion-shaped, between stamens and ovary, ovary 2-celled, style 1, ovules solitary. Drupe large, resembling a mango, c. 6 cm long, c. 4 cm in diameter, 1- or 2-seeded.

*Habitat & Ecology* — Scattered on dry land in primary forest, on ridges and upper slopes, up to 250 m altitude.

*Distribution* — Indochina, Thailand, Malay Peninsula, Sumatra, Borneo.

*Uses* — The timber is very hard and heavy, suitable for furniture and heavy constructional work, although not resistant against termite attack. The seeds are eaten, fat from the seeds (dika) is used for making soap, wax, and candles.

*Material* — W 711, W 730.

## 60 SONNERATIACEAE

DUABANGA Buch.-Ham., Trans. Linn. Soc. Lond. 17 (1835) 177–178.

*Duabanga moluccana* Blume, Mus. Bot. Lugd. Bat. 1 (1849) 109. — Fig. 183

*Literature* — Backer & Steenis in Flora Malesiana I, 4 (1951) 288.

*Vernacular names* — Binuang (M), binuang laki (M).

Trees 25–35(–45) m tall, 70–100 cm in diameter. Bole straight, buttresses absent. Bark greyish, smooth, hooped. Inner bark soft, fibrous. Sapwood fibrous, yellowish, soft. Young twigs obtusely quadrangular, becoming terete. Stipules absent. Leaves opposite, simple, entire, ovate, oblong, or lanceolate, 7–30 cm long, 4–12 cm wide, base shallowly heart-shaped, apex acuminate, secondary veins 10–15 pairs, looping near the margin forming a strong intramarginal vein. Petioles 4–8 mm long. Flowers in terminal, 5- to many-flowered corymbs, rather large, sepals fused in a 4-lobed cup, petals falling off early, stamens 12, in one whorl, ovary 4-celled, stigma thick. Capsule ovoid-oblong, 2.5–3 cm long, 4-valved. Seeds many, tailed at both ends.

*Habitat & Ecology* — Common in secondary forest, especially on slopes or riverbanks, on alluvial or sandy soils.

*Distribution* — Java, Borneo, Sulawesi, Philippines, Maluku, New Guinea.

*Uses* — The soft pale wood is not durable and is mainly used for boxes and firewood, in Maluku and Nusa Tenggara it is used for house building construction.

*Material* — W 756, S 494.

## 61 STERCULIACEAE

Medium to large, often buttressed trees, inner bark fibrous, radially streaked. Stipules present. Leaves spiral, simple or palmate, entire or lobed, venation often palmate. Petioles often long and thickened at apex, usually stellate hairs and scales especially on young parts. Flowers actinomorphic, bisexual or unisexual, monoecious (male and female flowers on the same plant), sepals 3–5, valvate, petals 5, valvate, or absent, stamens 5 or more, fused into a narrow tube, ovary superior with 2–5 more or less free carpels. Fruits usually capsular. — Eight genera reported for Kalimantan.

### KEY TO THE GENERA

- 1 a. Leaves alternate in two rows . . . . . 2
- b. Leaves spiral . . . . . 3
- 2 a. Leaf base wedge-shaped, equal, lower leaf surface glabrous or sparsely hairy, fruits small, globular, 1–3-celled, c. 1.5 cm in diam. *Leptonychia caudata*\*
- b. Leaf base heart-shaped, distinctly unequal, lower leaf surface thickly covered with short yellow-brown hairs, fruits large, 3–10 cm long . . . *Pterospermum*

(Sterculiaceae)

- 3a. Fruit a large, papery, boat-shaped follicle, splitting open with 1 large seed at the base . . . . . *Scaphium*
- b. Fruit usually woody or leathery, if papery than with more than 1 seed along margin . . . . . 4
- 4a. Fruit winged, woody, not splitting open when ripe . . . . . *Heritiera*
- b. Fruits with 1–5 red, leathery, pod-like follicles, radiating from a common stalk, splitting open when ripe . . . . . *Sterculia\**

**HERITIERA** Aiton, Hort. Kew., ed. 1, 3 (1789) 456.

*Literature* — Kosterm., Reinwardtia 4 (1950) 465–583.

Large trees. Bole tall straight with tall buttresses. Inner bark lamellate. Young parts and leaf undersurface densely scaly. Twigs slender, terete. Leaves spiral, simple, entire. Petioles thickened at both ends. Inflorescence an axillary panicle. Flowers unisexual, very small, calyx 4- or 5-lobed, petals absent; male flowers fused in a column bearing 8–10 sessile anthers round the minute sterile ovaries; female ones with 4 or 5 minute sessile ovaries. Fruits not splitting open, sometimes partially surrounded by a wing (samara). — Eleven species reported for Kalimantan.

*Uses* — The timber makes a very attractive veneer for decorative work like furniture and interior finish, for which it is in great demand. The wood is usually mixed with dark red meranti, as it is often insufficiently abundant to be marketed separately.

KEY TO THE SPECIES

- 1a. Petioles 2.5–6 cm long, apex of leaf truncate or notched, secondary veins 9–16 pairs . . . . . *H. simplicifolia*
- b. Petioles up to 2.5 cm long, apex of leaf acute, secondary veins 4–7 pairs  
*H. elata*

***Heritiera elata*** Ridley, J. Roy. As. Soc. Str. Br. 50 (1908) 112. — Fig. 184

*Literature* — Kosterm., Reinwardtia 4 (1950) 497.

*Vernacular name* — Dungun (M).

Trees up to 40 m tall, 50–60(–90) cm in diameter. Bole sometimes fluted, buttresses spreading, up to 7.5 m tall. Bark grey to grey-brown, flaky. Inner bark light brown. Sapwood white, heartwood dark red, very hard. Leaves elliptical to obovate-elliptical, 5–13 cm long, 3–7.5 cm wide, base rounded, apex acute, lower surface scaly, secondary veins 4–8 pairs, 3-veined at base. Fruits almond-shaped, glabrous, 3–5 cm long, 2.5–3 cm in diameter, equally broad.

*Habitat & Ecology* — Rare in primary lowland forest.

*Distribution* — Malay Peninsula, Borneo.

*Material* — W 262, W 318, W 729.

*Heritiera simplicifolia* (Mast.) Kosterm., Reinwardtia 4 (1950) 514.

*Vernacular name* — Mengkulang (M).

Trees up to 50 m tall, c. 1.2 m in diameter. Buttresses spreading, up to 3 m tall. Bark greyish to reddish brown, fissured, peeling off in strips. Inner bark pink to brown. Sapwood yellowish, heartwood light brown-red. Leaves broadly elliptical to obovate elliptical, 5.5–17 cm long, 3–10 cm wide, base almost acute, apex truncate or notched, lower surface scaly, secondary veins 9–16 pairs. Fruits ovoid, glabrous, up to 1.5 cm long, c. 1.2 cm in diameter, wing up to 9 cm long, 3 cm wide.

*Habitat & Ecology* — In primary lowland forest, on undulating land and low hills.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Note* — Seedling and sapling leaves are palmately compound.

*Material* — W 460, AA 10.

**PTEROSPERMUM** Schreber, Gen. (1791) 461.

*Pterospermum javanicum* Jungh. in Hoenen & De Vriese, Tijd. Nat. Geschied. 7 (1840) 306. — Fig. 185

*Vernacular name* — Bayur (M).

Trees up to 40 m tall, c. 1 m in diameter. Bole with short buttresses. Bark grey, smooth or shallowly fissured. Inner bark deep red with broad, white, radial streaks. Sapwood white. Leaves alternate, simple, entire, ovate, 4–22 cm long, 2.5–10 cm wide, base heart-shaped, distinctly unequal, apex acuminate, lower leaf surface thickly covered with short yellow-brown hairs, secondary veins 5–7 pairs, base 3-veined. Flowers in axillary racemes, large, up to 6 cm long, sepals 5, petals 5, stamens 15, staminodes 5, ovary 5-celled, ovules numerous. Fruit a capsule, cylindrical, bluntly 5-angular, tapering at each end, c. 14 cm long, c. 5 cm in diameter, glabrescent, woody. Seeds many, winged.

*Habitat & Ecology* — Mainly in secondary forest, on riverbanks, up to 1000 m altitude.

*Distribution* — Burma, Thailand, Malay Peninsula, Sumatra, Java, Borneo. Of the genus *Pterospermum* six species are reported for Kalimantan.

*Uses* — An important timber tree, used for house construction and furniture.

*Note* — Sapling leaves as the adults, but larger.

*Material* — AA 399.

**SCAPHIUM** Schott & Endl., Melet. Bot. (1832) 33.

*Scaphium macropodum* (Miq.) Beumée ex Heine, Nutt. Pl. Ned. Indië ed. 2 (1927) 1068. — Fig. 186

*Literature* — Kosterm., J. Sci. Res. Indon. 2 (1953) 1–11.

*Vernacular names* — Kembang semangkuk (M), berempayang (B).

(Sterculiaceae / Theaceae)

Trees up to 45 m tall, c. 80 cm in diameter. Buttresses steep to spreading, up to 2.7 m tall. Bark rust-brown, fissured, flaky. Inner bark red-brown, fibrous, with prominent net-like markings. Sapwood pale yellow, heartwood dark red. Leaves spiral, simple, entire, broadly ovate-oblong to ovate-lanceolate, vary variable, 15–25 cm long, 3–10 cm wide, base broadly wedge-shaped or rounded, apex acute to acuminate, secondary veins 6–11 pairs, with 1 or 2 basal pairs, giving it a more or less 3-veined appearance. Petioles 4–15 cm long, thickened at apex. Flowers small, pale green, calyx 4–6-lobed, petals absent, unisexual, male flowers: stamens 8, fused at base, female flowers: staminodes 8–10, fused in a column around the 2–5 carpels. Fruit a large, green to red, papery follicle, becoming boat-shaped, c. 20 cm long, glabrous. Seed 1, ellipsoid, c. 2.5 cm long, c. 1.5 cm in diameter, glabrous, red, basal.

*Habitat & Ecology* — A widespread species, on well-drained undulating land and ridges, up to 1200 m altitude.

*Distribution* — Cambodia, Thailand, Malay Peninsula, Sumatra, Borneo. Of the genus *Scaphium* five species are reported for Kalimantan.

*Uses* — The timber has a high content of silica and is therefore difficult to saw. Due to its fine veneer it is in demand for the furniture industry.

*Note* — Sapling leaves deeply 5- or more lobed, petioles up to 50 cm long.

*Material* — W 672, W 999.

STERCULIA L., Sp. Pl. (1753) 1007.

*Literature* — Tantra, Lembaga Penelitian Hutan Bogor Pengumuman 102 (1976) 1–194.

Trees or shrubs, often with *Terminalia*-like branching. Leaves spiral, simple or palmately compound, often palmately or 3-veined at base. Petioles thickened at apex. Flowers uni- or bisexual, calyx cup with 5 sepals, bell-shaped, petals absent, stamens joined into a long or short column, ovary of partly free carpels. Fruits 1–5, free, pink or scarlet, leathery, splitting open along the inner face, seeds large, brown or velvety black, hanging from the split edges. — Twenty-three species reported for Kalimantan.

62 THEACEAE

Small to large trees, bark fibrous. Stipules absent. Leaves simple, alternate or spiral, entire or toothed. Flowers actinomorphic, usually bisexual and single, mostly 5-merous, sepals round, overlapping, petals 5, fused at the base, stamens numerous on corolla, ovary superior, 2–5-celled. Fruit a capsule or a berry.

KEY TO THE GENERA

- 1a. Leaves alternate . . . . . *Adinandra*
- b. Leaves spiral . . . . . 2

(Theaceae)

- 2a. Leaf margin entire, petioles with narrow wings, flowers in terminal racemes or panicles with many flowers, fruit an indehiscent berry . . . . . *Tetramerista*
- b. Leaf margin toothed, flowers axillary, usually 1–3, fruits a capsule or a berry 3
- 3a. Leaves congested in false whorls, fruit a berry . . . . . *Ternstroemia*\*
- b. Leaves spread out, fruit a capsule . . . . . 4
- 4a. Petioles usually c. 3 cm long, the fruit almost globular, seeds winged around  
*Schima*
- b. Petioles up to 0.5 cm long, the fruit ellipsoid oblong, seeds terminally winged  
*Gordonia*\*

**ADINANDRA** Jack, Mal. Misc. 5, 2 (1822) 47.

*Adinandra dumosa* Jack, Mal. Misc. 5, 2 (1822) 48. — Fig. 187

*Literature* — Kobuski, J. Arnold Arbor. 28 (1947) 55.

*Vernacular names* — Layau (K), marinkau (B).

Trees up to 30 m tall, up to 40 cm in diameter, but often much smaller, even shrub-like. Buttresses round, if present. Bark greyish to dark brown. Inner bark red brown, soft. Twigs terete, glabrous. Leaves alternate, elliptic-oblong, 6–12 cm long, 3–5 cm wide, base tapering into a short petioles, apex obtuse or shortly acuminate, glabrous at both sides, margin entire or serrulate, secondary veins obscure. Petioles c. 5 mm long. Flowers axillary, solitary, rarely 2, pedicel up to 2 cm long, bracteoles 2, persistent, opposite, immediately below the calyx, 3–4 mm long, calyx-lobes 5, overlapping, 7–8 mm long, corolla-lobes 5, fused at base, white, up to 16 mm long, stamens c. 40, ovary 5-celled, glabrous, style elongate, entire, glabrous. Fruit a berry, globular, glabrous, subtended by the calyx and crowned by the persistent style. Seeds many, small.

*Habitat & Ecology* — In secondary forest along roads; in lowlands to mountains.

*Distribution* — Malay Peninsula, Sumatra, Java, Borneo. Of the genus *Adinandra* twenty species are reported for Kalimantan.

*Uses* — Usually a non-commercial timber, but intensively used as fuel wood.

*Material* — W 115, W 615, W 758, W 947, S 617, v.B. 5885.

**SCHIMA** Reinwardt ex Blume, Bijdr. (1825) 129.

*Schima wallichii* (DC.) Korth. in Temminck, Verh. Nat. Gesch. Bot. 3 (1840) 143.  
— Fig. 188

*Literature* — Bloemb., Reinwardtia 2 (1952) 136.

*Vernacular name* — Puspa (M).

Trees up to 45 m tall, up to 1.25 cm in diameter. Buttresses, if present, steep, up to 1.8 m tall. Bark dark grey, scaly. Inner bark red, with dark spots, the fibre ends appearing as golden silky hairs, more or less irritating. Sapwood white. Leaves spiral, oblong to broadly elliptic, 6–13 cm long, 3–5 cm wide, base wedge-shaped, apex

(Theaceae)

acute to acuminate, margin toothed, secondary veins 6–8 pairs. Petioles c. 3 m long. Flowers axillary, but crowded at the end of the twigs, 17–35 mm in diameter, stalks c. 2.5 cm long, bracteoles 2, sepals 5, petals 5, shortly fused at the base, obovate, white, up to 2 cm long, stamens numerous, ovary 5-celled, style simple. Fruit a woody capsule, almost globular, 2–3 cm in diameter, silky, opening by 5 valves. Seeds winged around.

*Habitat & Ecology* — Primary and secondary forest, on well-drained land, locally common.

*Distribution* — Burma, S. China, Thailand, Malay Peninsula, W. Java, Borneo, Philippines (Palawan).

*Uses* — According to Bloembergen (1952) the species was locally an important source as timber used for house construction, furniture, and boats. This species should also be tried for reforestation purposes, as it is not only found in primary but also frequent in belukar forest.

*Note* — A very variable species; our material usually can be identified as *S. wallichii* subsp. *crenata* (Korth.) Bloemb. var. *crenata*. However, due to many transitions within the characters we hesitate to give our plants a name below the species level.

*Material* — W 140, W 812, S 265, P. K. 629.

**TETRAMERISTA** Miq., Fl. Ind. Bat., Suppl. 1 (1860) 54.

*Tetramerista glabra* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 54. — Fig. 189

*Vernacular names* — Miyapok (M), putat dusun (K).

Trees up to 35 m tall, up to 1 m in diameter. Bole usually fluted. Buttresses small, steep. Pneumatophores sometimes present. Bark dark brown, fissured, flaky, corky. Inner bark soft, fibrous, red to pinkish. Wood yellow. Leaves spiral, often congested near the apex of twigs, oblanceolate or obovate, 7–30 by 3–9 cm, base running to the stalk forming narrow wings, apex rounded, often notched, or acute, mucronate, glabrous, leathery, margin entire, secondary veins 12–20 pairs. Petioles 2–4 cm long, often difficult to distinguish from the lamina. Flowers in almost terminal racemes or panicles with many flowers. Flowers 2–2.5 cm in diameter, bracteoles 2, sepals 4, oblong, persistent, petals 4, lanceolate, persistent, stamens 4. Fruit an indehiscent berry, globular or slightly ovoid, 2–3 cm in diameter. Seeds oblong.

*Habitat & Ecology* — Usually in peat swamp forest, but also in kerangas or on white sand.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Uses* — Hard, heavy, durable timber for construction.

*Notes* — Sterile specimens may be mistaken for species of *Dillenia*, *Camptosperma* or *Tristaniopsis*, with obovate leaves and winged petioles. *Tetramerista* lacks the toothed leaf margin of *Dillenia*, the black sap of *Camptosperma* and the intra-marginal vein of *Tristaniopsis*.

*Material* — W 296, S 825.



**63 THYMELAEACEAE**

Small to large trees. Stipules absent. Leaves simple, spiral in our genera (opposite in most genera), entire. Flowers actinomorphic, bisexual, calyx tubular, 3–7-lobed, petals 7–40, arising from the calyx tube, stamens as many as petals, ovary superior, 2–5-celled. Fruit a capsule, sitting on the persistent calyx tube. — Four genera reported for Kalimantan.

## KEY TO THE GENERA

- 1a. Leaves with translucent dots, brittle, inner bark laminate, with glistening silky fibres . . . . . *Gonystylus*  
 b. Leaves without translucent dots, fibrous, not brittle, inner bark homogeneous, without glistening fibres . . . . . *Aquilaria*

**AQUILARIA** Lam., Encycl. 1 (1783) 49.

*Literature* — Ding Hou in Flora Malesiana I, 6 (1960) 6–15.

*Aquilaria malaccensis* Lam., Encycl. 1 (1783) 49. — Fig. 190

*Literature* — Ding Hou in Flora Malesiana I, 6 (1960) 9.

*Vernacular names* — Kayu gaharu (M), alas (B).

Trees up to 40 m tall, c. 60 cm in diameter. Bole often fluted at base. Bark smooth, whitish. Inner bark creamy white, fibrous, homogeneous, tearing off in long, strong strips. Sapwood white. Twigs slender. Leaves spiral, elliptic-oblong to oblong-lanceolate, 7.5–12 cm long, 2.5–5.5 cm wide, base acute, apex acute to acuminate, parchment-like, fibrous, not brittle, without translucent dots, secondary veins 12–16 pairs, rather irregular, often branched, distinct beneath, obscure above. Petioles 3–6 mm long. Inflorescences terminal, axillary, or above the axils, branched with c. 10-flowered umbels. Flowers green or dirty yellow, bell-shaped, 5–6 mm long, calyx lobes (4–)5(–6), petaloid appendages twice as many as the lobes, free, stamens twice as many as lobes, ovary ovoid, 1–1.5 mm long, stigma sessile. Fruits capsules, obovoid or obovoid-oblong, 3–4 cm long, c. 2.5 cm in diameter, base wedge-shaped, apex rounded. Seed 1, ovoid, c. 10 mm long, c. 6 mm in diameter, densely covered with red hairs.

*Habitat & Ecology* — Scattered on ridges and slopes, on well-drained land.

*Distribution* — India, Burma, Malay Peninsula, Sumatra, Borneo, Philippines. Of the genus *Aquilaria* four species are reported for Kalimantan.

*Uses* — Well known and in high esteem due to its incense wood caused by fungus attack. The timber is used for furniture and the bast is highly prized for its strength and durability (ropes, cloth).

*Material* — W 45, S 218, S 459.

(Thymelaeaceae)

**GONYSTYLUS** Teijsm. & Binn., Bot. Zeit. 20 (1862) 265.

*Literature* — Airy Shaw in Flora Malesiana I, 4 (1953) 349–361.

*Vernacular name* — Ramin (M).

Trees up to 45 m tall. Bole sometimes fluted or with thick buttresses. Bark dark brown, usually fissured. Inner bark thick, lamellate, cut surface glistening with irritant, protruding silky fibres. Sapwood soft. Twigs striate. Leaves alternate, spiral, translucent gland-dotted, leathery, secondary veins numerous, close, tertiary veins parallel. Inflorescences terminal, panicles glabrous or hairy. Flowers bisexual, cupule 3–7-lobed, petals 7–40, often fused at base, stamens 8–40, anthers horse-shoe-shaped, ovary 3–5-celled, each with 1 ovule, style thread-like, bent, often associated with basal threads, stigma small. Fruit a capsule, the walls thickly woody, splitting in 2–5 parts, seated on a persisting calyx. Seeds large, completely or partly enclosed in a colourful aril. — Twenty-five species reported for Kalimantan.

*Uses* — Especially *G. bancanus* is sought for its light construction wood. It is used especially for door and window frames, furniture, plywood, toys and handles of non-impact tools.

KEY TO THE SPECIES

- 1a. Mature leaves hairy to touch beneath, drying greyish-green beneath . . . . . 2
- b. Mature leaves glabrous to touch beneath, drying chestnut brown beneath . . . . . 3
- 2a. Leaves up to 11(–13) cm long, 2.5–5 cm wide, capsule up to 5.5 cm in diameter . . . . . *G. velutinus*
- b. Leaves 10–25 cm long, 5–9 cm wide, capsule c. 12 cm in diameter  
*G. consanguineum*
- 3a. Inflorescences velvety . . . . . *G. affinis* var. *elegans*\*
- b. Inflorescences glabrous . . . . . *G. brunnescens*

*Gonystylus brunnescens* Airy Shaw, Kew Bull. (1950) 138. — Fig. 191

*Literature* — Airy Shaw in Flora Malesiana I, 4 (1953) 356.

Trees up to 36 m tall, up to 50 cm in diameter. Bark reddish brown, smooth to fissured and scaly. Leaves elliptic to oblong, 12–25 cm long, 4–10 cm wide, base wedge-shaped to rounded, apex acute to rounded, glabrous beneath, drying chestnut-brown, the secondary veins many. Petioles 12–15 mm long. Petals 25–30, awl- to needle-shaped, style glabrous. Fruit almost globular, 3–5(–9) cm in diameter, 3-celled, aril white, bitter.

*Habitat & Ecology* — Usually in lowland Dipterocarp forest, on Kong Kemul and Mt Kinabalu up to 1500 m altitude.

*Distribution* — Malay Peninsula, Borneo.

*Material* — S 511, S 694.

*Gonystylus consanguineum* Airy Shaw, Kew Bull. 17 (1964) 454.

Trees up to 40 m tall, up to 80 cm in diameter. Bole fluted or buttresses steep. Bark reddish brown, smooth to fissured and scaly. Leaves elliptic to oblong, 10–25 cm long, 5–10 cm wide, base broadly wedge-shaped to rounded, apex acuminate to abruptly long pointed, velvety beneath, drying greyish green, secondary veins 15–25. Petioles 7–12 mm long. Petals c. 30, awl- to needle-shaped, style glabrous. Fruit almost globular, c. 12 cm in diameter, 3-celled?, aril white.

*Habitat & Ecology* — In lowland Dipterocarp forest.

*Distribution* — Endemic in Borneo.

*Material* — W 673.

*Gonystylus velutinus* Airy Shaw, Kew Bull. (1950) 140.

*Literature* — Airy Shaw in Flora Malesiana I, 4 (1953) 359.

Trees 25–35 m tall, 40–70 cm in diameter. Bole fluted or buttresses steep. Bark brownish, fissured and scaly. Leaves elliptic to oblong, 8–11(–13) cm long, 3.5–5 cm wide, base broadly wedge-shaped, apex acuminate, velvety beneath, drying greyish green, secondary veins crowded. Petioles 7–11 mm long. Petals 7–8, triangular, style glabrous. Fruit lanceolate-oblong, up to 5.5 cm long, 3-celled, aril white.

*Habitat & Ecology* — In lowland Dipterocarp forest, mostly on non-inundated sandy soil.

*Distribution* — Sumatra, Borneo.

*Material* — W 528.

## 64 TILIACEAE

Small to large trees, bark fibrous. Stipules present. Leaves simple, alternate or spiral, entire, toothed or lobed, 3-veined at base, usually with scales or stellate hairs. Petioles often thickened at apex. Flowers actinomorphic, bisexual, 5-merous, sepals free or united, petals free or absent, stamens many, free or connected at base, sometimes in bundles, ovary superior, 2–10-celled. Fruits a samara, drupe or capsule. — Six genera reported for Kalimantan.

### KEY TO THE GENERA

- 1a. Petioles not thickened at apex . . . . . *Microcos* p. p.
- b. Petioles thickened at apex . . . . . 2
- 2a. Small to medium trees, bark smooth, stipules usually large, persistent, leaves peltate, petioles 10–15 cm long, flowers with 5 free carpels, fruit a capsule, not winged . . . . . *Brownlowia peltata*\*
- b. Stipules usually small, falling off early, leaves not peltate, base sometimes heart-shaped, fruits a winged samara or a drupe . . . . . 3

(Tiliaceae)

- 3a. Bole usually flaky, leaves spiral, leaf margin toothed or sometimes entire, fruits a winged samara . . . . . *Pentace*
- b. Bole usually smooth, leaves alternate, leaf margin always entire, fruits a drupe  
*Microcos* p.p.

**MICROCOS** L., Sp. Pl. (1753) 514.

Trees up to 25 m tall. Leaves alternate, entire, simple, base 3-veined. Flowers in panicles, sepals free, petals shorter than sepals, stamens many, ovary 1–5-celled, style slender. Fruit a drupe. — Twenty-four species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves ovate to ovate-oblong, up to 12 cm long, up to 6 cm wide, 3-veined, no secondary veins present, petioles up to 1.3 cm long, c. 1 mm in diameter  
*M. cinnamomifolia*
- b. Leaves elliptic-oblong to ovate-oblong, 15–30 cm long, 7–14 cm wide, 3-veined, secondary veins 6–10 (including basal pair), petioles 1.3–2.5 cm long, c. 3 mm in diameter . . . . . *M. crassifolia*

*Microcos cinnamomifolia* Burr., Notizbl. Bot. Gart. Berlin-Dahlem 9 (1926) 770. — Fig. 192

*Vernacular name* — Hapuak (M).

Trees 20–25(–60) m tall, c. 30 cm in diameter. Bark smooth. Inner bark reddish brown, fibrous. Twigs glabrous, slender, c. 2 mm in diameter. Leaves ovate to ovate-oblong, 6–12 cm long, 2–6 cm wide, base rounded to broad acute, apex acuminate, no secondary veins present, glabrous. Petioles 1.3 cm long, c. 1 mm in diameter. Inflorescences axillary or terminal, few-flowered. Sepals oblong, c. 5 mm long, petals elliptic c. 2 mm long, stamens many, on a raised torus, ovary globular, glabrous. Fruits unknown.

*Habitat & Ecology* — On riverbanks and in swamps.

*Distribution* — Endemic in Sarawak and Kalimantan.

*Material* — W 382, W 524, v.B. 6136.

*Microcos crassifolia* Burr., Notizbl. Bot. Gart. Berlin-Dahlem 9 (1926) 780.

Trees up to 25 m tall, c. 35 cm in diameter. Bark smooth. Twigs glabrous, stout, c. 5 mm in diameter. Leaves elliptic-oblong to ovate oblong, 15–30 cm long, 7–14 cm wide, base rounded to broad acute, apex rounded to acuminate, secondary veins 6–10 (including basal pair), glabrous. Petioles c. 1.3–2.5 cm long, c. 3 mm in diameter. Inflorescences axillary or terminal, few-flowered. Fruits ovoid to pear-shaped, c. 3 cm long, smooth, glabrous.

*Habitat & Ecology* — In lowland mixed Dipterocarp forest.

*Distribution* — Endemic in Sabah and Kalimantan.

*Material* — W 835, W 920, W 961, v.B. 6090.

**PENTACE** Hassk., Hort. Bog. Descr. (1858) 110.

*Literature* — Kosterm., For. Res. Inst. Indon. 87 (1964) 1–78.

Medium to large trees. Bole straight. Buttresses short or tall. Bark shallowly fissured to scaly or flaky. Inner bark pink to red, lamellate, fibrous. Young parts covered with a dense layer of stellate hairs and scales. Leaves spiral, margin entire or toothed, base usually 3-veined. Petioles slender, long, prominently thickened at both ends. Flowers in axillary or terminal panicles, bisexual, calyx 5-lobed, petals 5, free, stamens numerous, in 5 bundles, staminodes 5, ovary 3–10-ribbed, 3–10-celled, each with 2 ovules. Fruits a samara with 3–10 wings, dry, indehiscent, 1-celled, 1-seeded. — Fifteen species reported for Kalimantan.

KEY TO THE SPECIES

- 1 a. Leaves broadly ovate to almost circular, 10–20 cm long, 8–17 cm wide, base heart-shaped, margin prominently glandular toothed, petioles 4–8 cm long  
*P. adenophora*
- b. Leaves ovate to lanceolate, up to 11 cm long, up to 6 cm wide, base rounded or acute, never heart-shaped, petioles up to 2 cm long . . . . . 2
- 2 a. Petioles up to 5 mm long, leaf base unequal, margin entire . . . . . *P. laxiflora*
- b. Petioles 1–2 cm long, leaf base equal or unequal, apex vaguely toothed  
*P. erectinervia*

*Pentace adenophora* Kosterm., Reinwardtia 5 (1960) 238. — Fig. 193

*Literature* — Kosterm., For. Res. Inst. Indon. 87 (1964) 16.

*Vernacular name* — Ketinyak (K).

Trees 25–35(–45) m tall, c. 80 cm in diameter. Buttresses symmetrical, c. 3 m tall. Bark grey-brown, scaly, cracked. Inner bark red, lamellate, fibrous. Sapwood yellowish to light brown, merging into the red-brown heartwood. Twigs rusty pubescent, glabrescent. Leaves broadly ovate to almost circular, 10–20 cm long, 8–17 cm wide, base deeply heart-shaped, apex blunt, margin prominently glandular toothed, palmately veined, c. 8 veins, secondary veins up to 4 pairs, very prominent, rusty brown hairy. Petioles 4–8 cm long, pubescent especially the thickened end. Panicles up to 40 cm long, stamens in 5 bundles with 15 in each bundle, staminodes shorter than stamens, ovary densely pilose stellate. Fruits 5-winged, the nut with stiff long bristles, wings 3.5–6 cm long, 2–3 cm wide.

*Habitat & Ecology* — In lowland forest, especially in swamps on undulating land.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — S 689.

(Tiliaceae/Ulmaceae)

*Pentace erectinervia* Kosterm., For. Res. Inst. Indon. 87 (1964) 24.

Trees up to 40, tall, up to 100 cm in diameter. Buttresses symmetrical, up to 1.6 m tall. Bark brown to greyish, finely fissured, flaky. Sapwood bright yellow. Hardwood brown to red-yellow. Twigs glabrescent. Leaves obovate-elliptic to elliptic, 6–11 cm long, 3–6 cm wide, base rounded, equal or unequal, apex vaguely toothed, acuminate, 3- or 5-veined, secondary veins c. 5 pairs, prominent. Petioles 1–2 cm long. Panicles up to 15 cm long, stamens numerous, staminodes strap-shaped, ovary pilose stellate and scaly. Fruits unknown.

*Habitat & Ecology* — In lowland Dipterocarp forest.

*Distribution* — Endemic in Borneo.

*Uses* — According to Kostermans (1964) the timber is easy to work and in high esteem for construction purposes.

*Material* — S 627.

*Pentace laxiflora* Merr., Philipp. J. Sci. 30 (1926) 82.

*Literature* — Kosterm., For. Res. Inst. Indon. 87 (1964) 33.

Trees up to 40 m tall, up to 70 cm in diameter. Buttresses up to 3 m tall. Bark brownish. Sapwood soft, yellow. Hardwood brownish red. Twigs glabrous. Leaves lanceolate-ovate to lanceolate, 6–8(–10) cm long, 1.5–2.5 cm wide, base wedge-shaped to rounded, unequal, apex long acuminate, margin entire, 3-veined, secondary veins 4 (or 5) pairs, hardly visible beneath. Petioles up to 5 mm long. Panicles up to 15 cm long, stamens almost free, staminodes narrowly lanceolate, ovary densely tomentelous. Fruits 5-winged, up to 1.5 cm long.

*Habitat & Ecology* — In lowland primary forest, kerangas and swamps, up to 1000 m altitude.

*Distribution* — Endemic in Borneo.

*Uses* — According to Kostermans (1964) the rather light wood is used as a substitute for red meranti (*Shorea*, Dipterocarpaceae).

*Material* — W 900, S 833.

## 65 ULMACEAE

Small to medium trees, bark fibrous. Stipules present. Leaves simple, alternate, entire or toothed. Flowers actinomorphic, bisexual or unisexual, monoecious (male and female flowers on the same plant), tepals 5, stamens 5, opposite the tepals, ovary superior, styles 2. Fruit a drupe. — Four genera reported for Kalimantan.

KEY TO THE GENERA

- 1a. Leaves pinnately veined, stipules overlapping with one another, leaving a distinct circular scar around the nodes, fruits compressed ovoid, usually in primary forest . . . . . *Gironniera*
- b. Leaves 3-veined at base, stipules free from each other, fruit ovoid, usually in secondary forest . . . . . *Trema*

**GIRONNIERA** Gaudich., Voyage Bonite Bot. Atlas (1844) t. 85.

*Gironniera nervosa* Planch., Ann. Sci. Nat. 10 (1848) 388. — Fig. 194

*Literature* — Soepadmo in Flora Malesiana I, 8 (1977) 74.

*Vernacular name* — Mara keladi (K).

Trees 25–30(–40) m tall, 40(–60) cm in diameter. Buttresses sometimes present. Bark smooth, grey-brown, often hooped. Inner bark yellowish to pinkish, granular outwards, fibrous inwards. Sapwood yellowish, hard. Young parts covered with short, dense hairs. Terminal bud 15–25 mm long, 3–4 mm in diameter, enclosed by two overlapping stipules, leaving a distinct circular scar around the nodes. Leaves distichous, very variable in size, elliptic-oblong, (8–)10–18(–25) cm long, (4–)5–8 (–10) cm wide, base rounded to broadly wedge-shaped, equal to unequal, apex acute, margin entire or toothed, secondary veins (9–) 12–15(–17) pairs, distinct beneath. Petioles 5–10 mm. Flowers unisexual, in racemose inflorescences. Male flowers: perianth lobes 5, stamens 5, ovary absent, replaced by a cluster of erect hairs. Female flowers: perianth lobes 5, staminodes absent, ovary 1-celled, ovule 1, styles 2, up to 3 cm long, persistent. Fruit a drupe, compressed ovoid, subtended by the persistent perianth lobes, 2–4 cm long.

*Habitat & Ecology* — Widely spread in lowland forest below 500 m altitude.

*Distribution* — Thailand, Malay Peninsula, Sumatra, Borneo, Maluku, New Guinea.

Of the genus *Gironniera* five species are reported for Kalimantan.

*Uses* — A soft and light to moderate hard and heavy timber, used for house construction.

*Note* — Whether all our material belongs to *G. nervosa* or partly to *G. hirta* Ridley, J. Roy. As. Soc. Str. Br. 82 (1920) 194 is difficult to decide. Both species are very similar to each other and the differences reported in literature are only minor.

Therefore we treat all under *G. nervosa*.

*Material* — W 105, AA 248, S 267, S 773, v.B. 5966.

**TREMA** Lour., Fl. Cochinch. (1790) 539.

*Trema tomentosa* (Roxb.) Hara, Bull. Univ. Mus. Tokyo 2 (1971) 19. — Fig. 195

*Literature* — Soepadmo in Flora Malesiana I, 8 (1977) 53.

*Vernacular name* — Lenduhung (K).

(Ulmaceae/Verbenaceae)

Trees 5–15(–35) m tall, 5–30(–90) cm in diameter. Bark smooth, grey-brown. Inner bark thin, fibrous. Stipules linear-lanceolate, free, falling off early. Leaves alternate, ovate to ovate-lanceolate, 8–12 cm long, 4–7 cm wide, base heart-shaped, usually unequal, apex acuminate, margin toothed, lamina with simple, glaucous or silky hairs, base 3-veined, secondary veins 3–5 pairs. Petioles c. 1 cm long. Inflorescences axillary, condensed, racemose. Flowers unisexual (male and female flowers on the same plant). Male flowers: perianth lobes 5, valvate, stamens 5, reduced ovary present. Female flowers: perianth lobes 5, staminodes present, 5, or absent, ovary 1-celled, ovule 1. Fruit a drupe, ovoid, 4–6 mm long, 3–5 mm in diameter, ripening black.

*Habitat & Ecology* — Usually from forest edges and in secondary forest.

*Distribution* — Africa to Australia and Polynesia. Of the genus *Trema* four species are reported for Kalimantan.

*Note* — From *T. orientalis* (L.) Blume different in the simple hairs.

*Material* — W 74, S 200, S 731.

## 66 VERBENACEAE

Small to medium trees. Stipules absent. Leaves opposite, simple or compound, margin entire or toothed. Flowers slightly zygomorphic, bisexual, calyx cup-shaped, persistent in fruit, corolla tubular, more or less 2-lipped, stamens 2–5, inserted on corolla tube, ovary inferior, 2- or 4-celled. Fruit a drupe or a capsule with 1–4 seeds. — Seven genera reported for Kalimantan.

### KEY TO THE GENERA

- 1a. Leaves compound . . . . . 2  
b. Leaves simple . . . . . 4  
2a. Leaves pinnately compound . . . . . *Peronema*\*  
b. Leaves 3-foliolate or palmately compound . . . . . 3  
3a. Petioles and petiolules strongly thickened . . . . . *Teijsmanniodendron*  
b. Petioles and petiolules not thickened . . . . . *Vitex*  
4a. Leaves with 2 large glands at the base of the leaves . . . . . *Gmelina*\*  
b. Leaves without large glands . . . . . 5  
5a. Leaves when crushed, evil smelling . . . . . *Premna*\*  
b. Leaves not evil smelling . . . . . 6  
6a. Undersurface of leaves creamy tomentose at least when young  
*Callicarpa*\* / *Geunsia*\*  
b. Undersurface of leaves even when young not creamy tomentose  
*Clerodendron*\*



TEIJSMANNIODENDRON Koord., Ann. Jard. Bot. Buitenzorg 19 (1904) 20.

*Literature* — Kosterm., Reinwardtia 1 (1951) 75–106.

Trees up to 30 m tall. Petioles and petiolules thickened at base. Leaves opposite, 3-foliolate or 5–7-foliolate. Flowers in opposite cymes which are combined into panicles, calyx persistent, 5-toothed, corolla shortly tubular, stamens 4, anthers glandular on the back side, style slender, ovary 2-celled. Fruits capsular, indehiscent, dry, 1-celled, 1-seeded. — Nineteen species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves 3-foliolate . . . . . *T. coriaceum*
- 1b. Leaves 5–7-foliolate . . . . . *T. bogoriense*

*Teijsmanniodendron bogoriense* Koord., Ann. Jard. Bot. Buitenzorg 19 (1904) 20. — Fig. 196

*Literature* — Kosterm., Reinwardtia 1 (1951) 88.

*Vernacular name* — Mara beliung (K).

Trees 10–20(–30) m tall, 20–50(–80) cm in diameter. Bole usually fluted. Buttresses present or not. Bark greyish, smooth. Inner bark thin, creamy, soft. Sapwood yellowish white. Leaves 5–7-foliolate, leaflets oblong to elliptic or obovate, 10–35 cm long, 4.5–12 cm wide, base wedge-shaped, apex acute to acuminate, leathery, secondary veins 7–12 pairs. Flowers rose red. Fruits oblong, 4–5 cm long, 2–4 cm in diameter, yellowish-brown.

*Habitat & Ecology* — In primary lowland forest.

*Distribution* — Borneo, Philippines, Sulawesi, Maluku, New Guinea.

*Material* — S 725.

*Teijsmanniodendron coriaceum* (Clarke) Kosterm., Reinwardtia 1 (1951) 80.

Trees up to 25 m tall, up to 60 cm in diameter. Bole usually fluted. Bark greyish brown, papery scaly. Inner bark thin, yellowish, soft. Sapwood yellowish white. Leaves 3-foliolate, leaflets oblong to elliptic or lanceolate, 6–12 cm long, 2.5–4.5 cm wide, base wedge-shaped, usually unequal, apex acuminate, thickly leathery, secondary veins 5–7 pairs. Flowers violet. Fruits globular to oblong, c. 1.25 cm in diameter, greyish.

*Habitat & Ecology* — A widely distributed species, in lowland forest, up to 700 m altitude.

*Distribution* — Malay Peninsula, Sumatra, Borneo.

*Material* — AA 247.

(Verbenaceae)

VITEX L., Sp. Pl. (1753) 638.

*Literature* — H.J. Lam & Bakh., Bull. Jard. Bot. Buitenzorg III, 3 (1921) 47–64.

Trees up to 25 m tall. Leaves opposite, 3-foliolate or 5-foliolate. Flowers in terminal panicles, zygomorphic, calyx small, cup-shaped, corolla with a short tube, 2-lipped, upper lip with 2 lobes, lower lip with 3 much larger lobes, stamens 4. Fruit a drupe. Stones 1–4. — Five species reported for Kalimantan.

KEY TO THE SPECIES

- 1a. Leaves usually 5-foliolate ..... *V. pinnata*  
b. Leaves usually 3-foliolate ..... *V. vestita*

*Vitex pinnata* L., Sp. Pl. (1753) 638.

*Vernacular name* — Laban daun menjari (M).

Trees up to 25 m tall, up to 40 cm in diameter. Bark pale yellowish grey, fissured, flaky. Inner bark pale yellow becoming green on exposure. Sapwood pale yellow. Leaves 5-foliolate, leaflets almost sessile, outer two usually much smaller than the others, densely hairy beneath, middle leaflets elliptic 7.5–25 cm long, 3–10 cm wide, apex acuminate, secondary veins 10–15. Flowers in terminal panicles, corolla whitish blue. Fruit c. 0.8 cm in diameter, ripening black.

*Habitat & Ecology* — Usually in secondary forest, on riverbanks and along roads.

*Distribution* — Indochina, Malay Peninsula, Sumatra, Borneo, Philippines (Palawan).

*Material* — P.K. 557.

*Vitex vestita* Wall. in DC., Prod. 11 (1847) 692. — Fig. 197

*Vernacular name* — Laban (M).

Trees up to 15 m tall, c. 40 cm in diameter. Leaves 3-foliolate, leaflets distinctly stalked, densely hairy beneath, middle leaflet 7–15 cm long, 3–7.5 cm wide, apex acuminate, secondary veins 4–7 pairs. Flowers yellow. Fruits c. 1 cm in diameter, black.

*Habitat & Ecology* — Lowland primary and secondary forest.

*Distribution* — Burma, Malay Peninsula, Sumatra, Java, Borneo.

*Note* — This species much resembles *V. gamosepala*, but differs in the fine tomentum on almost all parts of the plant and the calyx with 5 minute teeth.

*Material* — W 537, AA 61, AA 515, S 491, S 747, v.B. 5823.

## INDEX TO SCIENTIFIC NAMES

This index gives the names of genera and species described. Names marked with an asterisk belong to taxa not treated extensively in the manual; in many cases they only have been mentioned in a key. Names printed in *italics* are synonyms.

- Acronychia\* 203  
 Actinodaphne 153  
     *glabra* 153  
 Adinandra 223  
     *dumosa* 223  
 Agathis 55  
     *borneensis* 55  
 Aglaia 167  
     *crassinervia*\* 167  
     *ridleyi* 168  
     *simplicifolia* 167  
     *spectabilis* 168  
     *tomentosa* 168  
 Alangium 35  
     *griffithii*\* 35  
     *havilandii*\* 35  
     *javanicum*\* 35  
     *longiflorum*\* 35  
     *ridleyi* 36  
 Allophyllus *cobbe*\* 205  
 Alphitonia 195  
     *incana* 195  
 Alseodaphne 153  
     *elmeri* 154  
     *peduncularis* 154  
 Alstonia 51  
     *angustifolia*  
         *var. latifolia* 51  
     *angustiloba* 52  
     *pneumatophora*  
         *var. petiolata* 52  
     *scholaris* 52  
 Amoora 167  
     *spectabilis* 168  
 Angelesia  
     *splendens* 80  
 Anisoptera 89  
     *costata* 89  
 Anthocephalus 200  
     *cadamba* 200  
     *chinensis* 200  
 Antidesma\* 120, 121  
     *leucopodum*\* 121  
     *neurocarpum*\* 121  
 Aphanamyxis\* 167  
 Aporusa\* 120, 121  
     *frutescens*\* 122  
     (Aporusa)  
         *grandistipula*\* 122  
         *lucida*\* 122  
         *nitida*\* 122  
 Aquilaria 225  
     *malaccensis* 225  
 Archidendron 169  
     *borneense*\* 170  
     *clypearia* 170  
     *cockburnii* 170  
     *havilandii* 171  
 Arenga\* 17, 190  
 Aromadendron 164  
 Artocarpus 173  
     *altilis*\* 173  
     *anisophyllus* 174  
     *communis*\* 173  
     *dadah* 174  
     *heterophyllus*\* 173  
     *integer*\* 173  
     *nitidus*  
         *subsp. griffithii* 175  
     *rigidus* 175  
 Atuna 80  
     *excelsa* 80  
     *racemosa*  
         *subsp. excelsa* 80  
 Baccaurea 122  
     *bracteata* 123  
     *macrocarpa* 123  
     *motleyana* 123  
     *pyriformis* 124  
     *stipulata* 124  
 Barringtonia 159  
     *curranii* 160  
     *macrostachya*\* 159  
     *pendula* 160  
     *reticulata*\* 159  
 Beilschmiedia 154  
     *dictyoneura* 154  
 Bhesa 76  
     *paniculata* 76  
 Blumeodendron 124  
     *tokbrai* 124  
 Borassodendron\* 17, 190  
 Bouea 37  
     *oppositifolia* 37  
     *Brownlowia peltata*\* 227  
 Bruguiera\* 196  
 Buchanania 38  
     *insignis* 38  
     *sessifolia* 39  
 Callerya 190  
     *atropurpurea* 190  
 Callicarpa\* 232  
 Calophyllum 145  
     *inophyllum* 146  
     *pisiferum* 146  
     *venulosum* 146  
 Camptosperma\* 37  
 Cananga 46  
     *odorata* 46  
 Canarium 64  
     *littorale* 65  
     *megalanthum* 65  
     *pilosum* 66  
         *subsp. pilosum* 66  
 Carallia 196  
     *brachiata* 196  
 Casearia\* 144  
 Castanopsis 136  
     *argentea* 137  
     *evansii* 138  
     *motleyana* 138  
     *oviformis* 138  
     *paucispina* 139  
 Casuarina 75  
     *equisetifolia* 75  
 Cerbera\* 50, 53  
     *manghas*\* 53  
     *odollam*\* 53  
 Chaetocarpus 125  
     *castanocarpus* 125  
 Chionanthus 188  
     *pluriflorus* 188  
 Cinnamomum 155  
     *cuspidatum* 155  
 Cleistanthus\* 121, 125  
     *beccarianus*\* 126  
     *brideliifolius*\* 126  
     *myrianthus*\* 126  
 Clerodendron\* 232  
 Cotylelobium 90  
     *melanoxyton* 90

- Cratoxylum 148  
   arborescens 148  
   sumatranum 149  
 Croton\* 120, 126  
   argyratus\* 126  
   griffithii\* 126  
 Cryptocarya 155  
   crassinervia 155  
 Ctenolophon\* 21  
 Cyathocalyx\* 46  
 Dacryodes 66  
   rostrata 67  
   rubiginosa 67  
   rugosa 67  
 Dehaasia 155  
   cuneata 155  
 Dialium 71  
   indum  
     var. bursa 71  
   kunstleri  
     var. trifoliolatum 72  
   laurinum 71  
     var. bursa 71  
   platysepalum 72  
 Dillenia 84  
   eximia 85  
   grandifolia 85  
   reticulata 85  
   suffruticosa 86  
 Dimocarpus 205  
   longan  
     subsp. malesianus 205  
 Dimorphocalyx\* 120, 126  
   muricatus\* 127  
   murinus\* 127  
 Diospyros 116  
   borneensis 116  
 Dipterocarpus 91  
   confertus 92  
   cornutus 93  
   fusiformis 93  
   gracilis 94  
   humeratus 94  
   tempehes 95  
 Dracontomelon 39  
   dao 39  
 Dryobalanops 95  
   beccarii 95  
 Drypetes 127  
   kikir 127  
   longifolia 127  
   polyneura 128  
 Duabanga 219  
   moluccana 219  
 Durio 56  
   acutifolius 57  
   dulcis 58  
   graveolens 59  
   griffithii 59  
   kutejensis 60  
   lanceolatus 60  
   oxleyanus 61  
   zibethinus 62  
 Dyera 53  
   costulata 53  
 Dysoxylum 169  
   alliaceum 169  
 Elaeocarpus 117  
   angustifolius\* 117  
   cupreus 117  
   glaber 118  
   griffithii\* 117  
   macrocerus 118  
   stipularis\* 117  
   valetonii 118  
     var. valetonii 118  
 Ellipanthus 83  
   tomentosus  
     var. gibbosus 83  
 Elmerillia 163  
   tsiampacca 163  
 Endiandra 156  
   kingiana 156  
 Engelhardia 151  
   serrata 151  
 Eugenia 185  
 Euodia 203  
   glabra 203  
 Eusideroxylon 156  
   zwageri 156  
 Fagraea 161  
   ceilanica\* 162  
   racemosa 162  
 Fahrenheitia 128  
   pendula 128  
 Ficus\* 173, 175  
   Ganua 212  
 Garcinia 147  
   parvifolia 147  
 Geunsia\* 232  
 Gironniera 231  
   nervosa 231  
 Glochidion\* 120, 128  
   calospermum\* 129  
   sericeum\* 129  
 Gluta 40  
   renghas 40  
   wallichii 41  
 Gmelina\* 232  
 Gonystylus 226  
   affinis  
     var. elegans\* 226  
   brunnescens 226  
   consanguineum 227  
   velutinus 227  
 Gordonia\* 223  
 Guioa pterorhachis\* 205  
 Gymnacranthera 177  
   farquhariana  
     var. zippeliana 177  
   ocellata 178  
 Gynotroches 197  
   axillaris 197  
 Helicia 195  
 Heritiera 220  
   elata 220  
   simplicifolia 221  
 Homalanthus 129  
   populneus 129  
 Homalium\* 144  
 Hopea 96  
   cernua 97  
   dryobalanoides 97  
   mengerawan 98  
   pedicellata 98  
   rudiformis 99  
 Horsfieldia 178  
   grandis 179  
   iryia 179  
   motleyi\* 179  
   polyspherula  
     var. sumatrana\* 179  
   reticulata 180  
   sucosa 180  
     subsp. bifissa 180  
   wallichii\* 179  
 Hydnocarpus 144  
   polypetala 144  
 Ilex 54  
   cymosa 54  
 Irvingia 218  
   malayana 218  
 Ixonanthes\* 28  
 Jackiopsis 201  
   ornata 201  
 Knema 181  
   elmeri\* 181  
   galeata\* 181

- (Knema)  
 glauca\* 181  
 glaucescens\* 181  
 hirtella\* 181  
 latericia 182  
   subsp. albifolia 182  
 latifolia 182  
 laurina 182  
 membranifolia\* 181  
 pallens 183  
 percoriacea\* 181  
 pulchra\* 181  
 Koilodepas 129  
 pectinatus 129  
 Kokoona 76  
 ochracea 77  
 reflexa 77  
 Koompatia 73  
 excelsa 73  
 malaccensis 73  
 Koordersiodendron\* 36  
 Lagerstroemia 162  
 Lansium\* 167  
 Lepisanthes\* 205, 206  
 alata\* 206  
 amoena\* 206  
 fruticosa\* 206  
 kinabaluensis\* 206  
 rubiginosa\* 206  
 tetraphylla\* 206  
 Leptonychia caudata\* 219  
 Licania 80  
 splendens 80  
 Lithocarpus 139  
 conocarpus 140  
 coopertus 140  
 gracilis 141  
 leptogyne 141  
 sericobalanus 142  
 Litsea 157  
 firma 157  
 garciae 157  
 oppositifolia\* 157  
 Lophopetalum 77  
 beccarianum 78  
 javanicum 78  
 subobovatum 79  
 Macaranga 130  
 aetheadenia\* 131  
 anceps\* 130  
 conifera 132  
 curtisii  
   var. glabra\* 131  
 (Macaranga)  
 depressa\* 131  
 gigantea\* 131  
 hypoleuca\* 131  
 indistincta\* 131  
 kingii\* 131  
 lowii 132  
   var. kostermansii 132  
   var. lowii 132  
 motleyana\* 131  
 pearsonii\* 131  
 petanostyla\* 131  
 pruinosa\* 131  
 tanarius\* 131  
 trichocarpa\* 131  
 triloba\* 131  
 winkleri\* 131  
 Madhuca 212  
 kingiana 213  
 motleyana 213  
 palembanica\* 212  
 pallida 214  
 pierreii\* 212  
 sericea 214  
 spectabilis 214  
 Magnolia 164  
 borneensis\* 164  
 candollii  
   var. singaporensis 164  
 lasia 164  
 Mallotus 133  
 dispar\* 133  
 lackeyi\* 133  
 macrostachyus\* 133  
 miquelianus\* 133  
 oblongifolius\* 133  
 paniculatus\* 133  
 penangensis 133  
 Mangifera 41  
 foetida 42  
 odorata 42  
 similis 43  
 torquenda 43  
 Maranthes 81  
 corymbosa 81  
 Mastixia 84  
 Melanochyla 43  
 auriculata 44  
 bullata 44  
 fulvinervis 44  
 Meliosma 204  
 sumatrana 204  
 Memecylon 165  
 borneense 165  
 Mesua 147  
 macrantha 147  
 Mezzettia 47  
 parviflora 47  
 Michelia champaca  
   var. champaca\* 163  
 Microcos 228  
 cinnamomifolia 228  
 crassifolia 228  
 Milletia atropurpurea 190  
 Mischocarpus 206  
 pentapetalus 206  
 Monocarpia 47  
 euneura 48  
 kalimantanensis 48  
 marginalis 48  
 Myristica 183  
 iners 183  
 maxima 184  
 simiarum  
   subsp. calcarea\* 183  
 villosa 184  
 Nageia 192  
 wallichiana 192  
 Nauclea 201  
 officinalis 201  
 Neesia 62  
 synandra 62  
 Neolamarckia cadamba 200  
 Neonauclea\* 200  
 Neoscortechinia 134  
 kingii 134  
 Nephelium 207  
 cuspidatum 208  
   var. eriopetalum\* 208  
   var. ophiodes 208  
     subvar. beccarianum\*  
       208  
   var. robustum 208  
 lappaceum 208  
   var. lappaceum\* 208  
   var. pallens\* 208  
   var. xanthioides 209  
 ramboutan-ake 209  
 uncinatum 209  
 Nothaphoebe 158  
 umbelliflora 158  
 Ochanostachys 187  
 amentacea 187  
 Ochreinauclea 202  
 maingayi 202

- Octomeles 84  
     sumatrana 84  
 Oncosperma\* 17, 190  
 Ormosia 191  
     macrodisca 191  
*Padbruggea*  
     *atropurpurea* 190  
 Palaquium 215  
     beccarianum 216  
     ottolanderi\* 215  
     pseudorostratum\*  
         215  
     quercifolium 216  
     rostratum\* 215  
     sericeum 216  
     stenophyllum\* 215  
 Parartocarpus 176  
     bracteatus 176  
 Parashorea\* 20, 87  
 Parinari 81  
     oblongifolia 81  
 Parishia 45  
     insignis 45  
 Parkia 171  
     *javanica* 172  
     speciosa 172  
     timoriana 172  
 Payena 217  
     acuminata\* 217  
     lucida 217  
 Pellacalyx 197  
     axillaris 198  
     lobbii 198  
 Pentace 229  
     adenophora 229  
     erectinervia 230  
     laxiflora 230  
 Peronema\* 232  
 Pertusadina 202  
     eurhyncha 202  
 Phoebe 158  
     grandis 158  
 Pholidocarpus\* 17, 190  
 Pimelodendron 134  
     griffithianum 134  
 Planchonella\* 21, 212  
 Planchonia 160  
     valida 160  
 Platea 149  
     excelsa  
         var. borneensis 150  
 Podocarpus\* 192  
     *wallichianus* 192  
 Polyalthia 48  
     glaucua 49  
     sumatrana 49  
 Pometia 210  
     pinnata 210  
         forma alnifolia\* 210  
         forma glabra\* 210  
         forma macrocarpa\* 210  
 Porterandia anisophylla\* 200  
 Prainea\* 173  
 Premna\* 232  
 Prunus 199  
     beccarii 199  
 Pteleocarpa 63  
     lamponga 63  
 Pternandra 166  
     rostrata 166  
 Pterocarpus 191  
     indicus 191  
 Pterospermum 221  
     javanicum 221  
 Quercus 142  
     argentata 142  
     gaharuensis 143  
     oidocarpa 143  
 Rhizophora\* 196  
 Rhodamnia 186  
     cinerea 186  
 Rhodomyrtus\* 185  
 Rothmannia 202  
     spec. nov. 202  
 Ryparosa\* 144  
 Sandoricum\* 166  
 Santiria 68  
     apiculata\* 69  
     griffithii 69  
     laevigata\* 68  
     oblongifolia 69  
     rubicinosa 70  
         var. rubiginosa 70  
     tomentosa\* 68  
 Sarcotheca 189  
     diversifolia 189  
 Saurauia 35  
 Scaphium 221  
     macropodium 221  
 Schima 223  
     wallichii 223  
 Scorodocarpus 188  
     borneensis 188  
 Scutinanthe brunnea\* 64  
 Sebastiania 135  
     borneensis 135  
 Semecarpus\* 37  
 Shorea 99  
     balangeran 101  
     coriacea 102  
     gibbosa 103  
     johorensis 103  
     laevis 104  
     lamellata 104  
     leprosula 105  
     macrobalanos 105  
     mujongensis 106  
     ovalis 106  
     parvifolia 107  
         subsp. parvifolia 107  
         subsp. velutinata 108  
     parvistipulata 108  
         subsp. albifolia 108  
         subsp. parvistipulata  
             108  
     patoiensis 109  
     pauciflora 109  
     pinanga 109  
     seminis 110  
     smithiana 111  
 Sindora 74  
     leiocarpa 74  
 Sloanea 119  
     javanica 119  
 Stemonurus 150  
     scorpioides 150  
 Sterculia\* 220, 222  
 Strombosia\* 187  
*Sunaptea*  
     *melanoxydon* 90  
 Swintonia\* 37  
 Tabernaemontana\* 50, 54  
     corymbosa\* 54  
     sphaerocarpa\* 54  
*Talauma* 164  
 Teijsmanniodendron 233  
     bogoriense 233  
     coriaceum 233  
 Terminalia 82  
     catappa 82  
 Ternstroemia\* 223  
 Tetramerista 224  
     glabra 224  
 Trema 231  
     tomentosa 231  
 Trigonostemon 135  
     laevigatus 135  
 Triomma 70  
     malaccensis 70

<i>Tristania</i>	( <i>Vatica</i> )	<i>Xanthophyllum</i> 192
<i>whiteana</i> 186	rassak 114	affine 193
<i>Tristaniopsis</i> 186	umbonata 115	amoenum 193
<i>whiteana</i> 186	subsp. <i>umbonata</i>	griffithii 194
<i>Upuna</i> * 19	115	obscurum 194
<i>Vatica</i> 111	<i>venulosa</i> 115	stipitatum 194
<i>javanica</i> 112	<i>Vernonia</i> 82	<i>Xerospermum</i> 210
var. <i>scaphifolia</i> 112	<i>arborea</i> 82	<i>laevigatum</i>
<i>oblongifolia</i> 113	<i>Vitex</i> 234	subsp. <i>acuminatum</i> 211
subsp. <i>oblongifolia</i> 113	<i>pinnata</i> 234	<i>noronhianum</i> 211
<i>odorata</i> 113	<i>vestita</i> 234	<i>Xylopia</i> 50
subsp. <i>odorata</i> 113	<i>Whitfordiodendron</i>	<i>ferruginea</i> 50
<i>pauciflora</i> 114	<i>atropurpureus</i> 190	<i>Ziziphus</i> * 195

#### INDEX OF VERNACULAR NAMES

(a)lae kuyu 59	belimbing hutan 189	damar tingkis 89
agatis 55	bengaya 67	darah-darah 176
alas 225	bengkal 201	darak 174
ampana 196	bengkeleng 77	dengin bobo 125
ampilung 187	bengkil 202	deraya 176
anggelan tikus 104	bengkinang 118	dian 62
anggi 74	bengkinang gunung 118	dungun 220
angsana 191	bengkinang rawa 118	durian 56, 62
ara 175	benuang 84	durian anggag 60
arau 163	berempayang 221	durian burung 57
asam bawang 42	berniung 73	durian daging merah 59
asam gunung 125	bijai 70	durian ha-ha 62
asam pipit 43	bintangur 145	durian pelanduk 60
asem garunggang 69	bintawa 174	emang bahau 99
asem pauh 218	bintihung 52	embacang 42
awang batu 104	binuang 219	empah 203
awang belah 107	binuang bini 84	empanyit 47
bajar buhu 125	binuang laki 219	empatung 203
balal 49	bumbang gunung 69	engkudug biang 162
balangeran 101	bunau 167, 168	gading 129
balik angin 133	bungur 162	geneirak 76
bangkirai lempung 104	buni 121	gerunggang 148
bangkirai tanduk 104	buni hutan 121	geruntung 150
bangkirai tembaga 104	bunjau 69, 104	giam 90
baniran 134	buno 55, 69	hapuak 228
banitan 49	buno putih 70	ibun 188
banitan merah 50	camara laut 75	ihau 205
banitan putih 49	cempaka hutan 164	irat 148, 149
batubagalang 77	da(h)u 39	jabon 200
bayur 221	dalok 190	jambu (hutan) 185
bekakalap 126	damar 55	jelutung gunung 53
bekatan 65	damar daging 55	jengan 104
belabak 78	damar jankar 99	jengkol hutan 169
belayang 167	damar lahung 111	jentikan 124
beleleg 139	damar putih 97	jingah 126

jingah tulang tiga 135  
 kahoi 101  
 kalang 62  
 kamasira putih 54  
 kamatoa 65  
 kanculi 70  
 kangkala 157  
 kapul 123  
 kapur merah 95  
 kasar 46  
 kawang 110  
 kay sang 78  
 kayu arang 116  
 kayu baru 198  
 kayu batu 70, 125, 192  
 kayu bawang 188  
 kayu gaharu 225  
 kayu kikir 127  
 kayu manis 155  
 kayu minyak 77  
 kayu sapi 210  
 kayu sepak 45  
 kelapa tiung 77  
 kelebutag 129  
 kelempayan 200  
 kembang semangkuk 221  
 kembayau 67  
 kembayau burung 68  
 kempas madu 73  
 kempas merah 73  
 kenanga 46  
 kenari batu 66  
 kenuar 108  
 keramu berparuh 67  
 keramu bulu 67  
 keranji 71  
 keranji daun tiga 72  
 keranji kuning besar 72  
 kerantungan 61  
 keruing 91  
 keruing asam 95  
 keruing kerukup 94  
 keruing tembaga 93  
 keruing tempudau 92  
 keruing wuluk bulan 94  
 ketapang pantai 82  
 ketinjak 161  
 ketinyak 229  
 ketungan 61  
 kikir daun besar 127  
 kikir putih 128  
 kole 195  
 kopeg 208  
 kumbi 67  
 kumpang 176  
 laban 234  
 laban daun menjari 234  
 lae 60  
 lae kuyu 59  
 lahung 58  
 lai 60  
 lajik kuning 36  
 langko 103  
 laripung 89  
 lawang 125  
 layau 223  
 layung 58  
 leman 192  
 lempung merkabang 102  
 lenduhung 231  
 longan 205  
 longkang bawang 169  
 mahang 130  
 mahang jarum 132  
 mahurong 38  
 mangga 42  
 manggis 147  
 mara beliung 233  
 mara keladi 231  
 maraputih 68  
 marijang 74  
 marinkau 223  
 marjajat 69  
 mata kucing 124  
 mata pelanduk 124  
 matoa 210  
 medang 151  
 medang bora 78  
 melalin 81  
 melapisan 160  
 melipas 199  
 mencorug 188  
 mendaharan 176  
 mendang 117  
 mengalin 147  
 mengerawan 98  
 menggeris 73  
 mengkorau 105  
 mengkulang 221  
 mensega 97  
 mentanahan 117  
 mentewohok 103  
 mentaling 149  
 mentugal 63  
 meraban 70  
 merading 67  
 merambung 82  
 meranti engkabang 105  
 meranti fabut 107  
 meranti kenuar 103  
 meranti lempung bulu 111  
 meranti lonjong 106  
 meranti pakik 110  
 merasam 38  
 merawan 98  
 merawan berjangkang 97  
 merembung 82, 111  
 meritam 211  
 m(e)ritus 65  
 merlepas 199  
 merlilin 70  
 merore 144  
 mersawa daun besar 89  
 meryang 73  
 minag 163  
 miyapok 224  
 mung balug 82  
 murung 134  
 natu 215  
 nipis kulit 165  
 nyaling 84  
 nyatoh 214, 215  
 nyerakat 109  
 ongo 191  
 oos 187  
 orai 109  
 pala hutan 183  
 palele 139  
 pani-pani 37  
 paning-paning 139  
 pantung 53  
 parada 81  
 paradian 128  
 pasang 136  
 pauh kijang 218  
 pelawan 186  
 pelepak 103  
 pengitan 47  
 penjalin 128, 192  
 pepuan 174  
 perupuk 77  
 perupuk batu 134  
 perupuk gunung 78  
 perupuk kajo 79  
 perupuk tangkai pipih 78  
 petai 172  
 petai hutan 172  
 petaling 187  
 pitanah 210



plantan 52  
 pleihari 42  
 puan 174  
 pulau 52  
 pulau akar napas 52  
 pulau gunung 52  
 pulau rawa 51  
 pulantan 52  
 pulu 53  
 puspa 223  
 putang harputup 111  
 putat 160  
 putat dusun 224  
 puti 73  
 rajang 68  
 rambai 123  
 rambai burung 124  
 rambutan 208  
 ramin 226  
 rangasai 70  
 rarawa damar 65  
 rengas berlukup 44  
 rengas bukit 39  
 rengas bulu 44  
 rengas burung 40  
 rengas daging 41  
 rengas lanyuh 44  
 rengas lisang 44  
 rengas manuk 41  
 rengas tembaga 40  
 rengas tulang jingah 40  
 resak bangka 115  
 resak biabas 113  
 resak bunga 90  
 resak daun panjang 113  
 resak gunung 115  
 resak irian 114  
 resak padi 90  
 resak putih 115  
 resak rawa 114  
 resak seluang 115  
 resak tembaga 90  
 rupai 65  
 ruwas 76  
 sam pamas 42  
 sange-sange 132  
 sarang 119  
 sauri 35  
 sawang putih 107  
 semayap 211  
 sengkuan 39  
 sepu 132  
 sibom 81  
 simapar 74  
 simpur 85  
 simpur bini 86  
 simpur rawa 85  
 sindur 74  
 sonokembang 191  
 takorang 78  
 tambun rangas 151  
 tampang 174, 176  
 tampar hantu 74  
 tanjid 73  
 tebung 90  
 teluyan 156  
 tempehes 95  
 tempudao 91  
 tempuran 85  
 tengkawang buah 109  
 tepung-tepung 82  
 tiju 166  
 tinjau 67  
 toga 192  
 tubulo 63, 70  
 tuola 59  
 tupaloh 57  
 ulin 151, 156  
 uma 70  
 undo 81  
 utang keladen 110  
 uwar 128  
 uwun 134  
 watuk 68



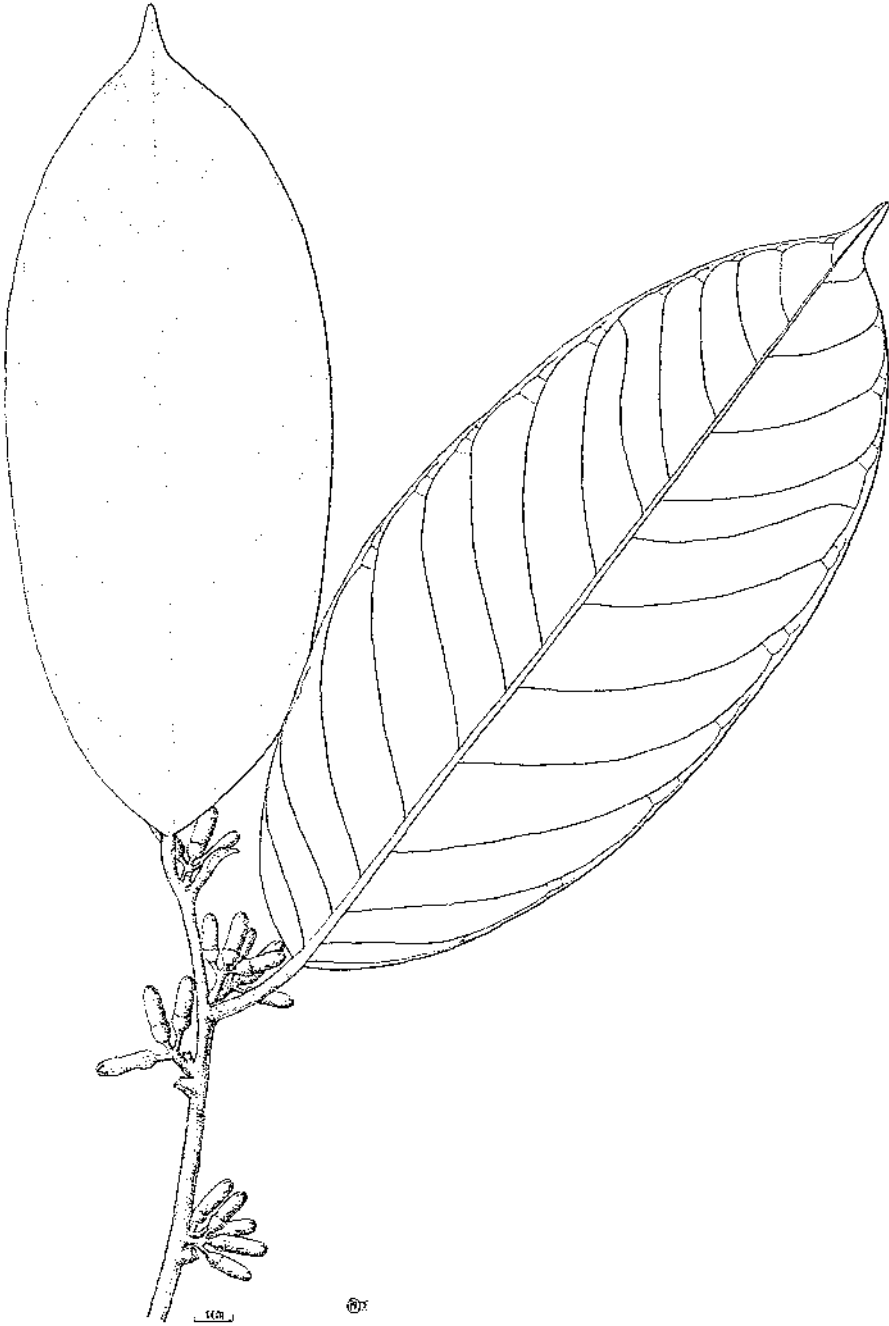
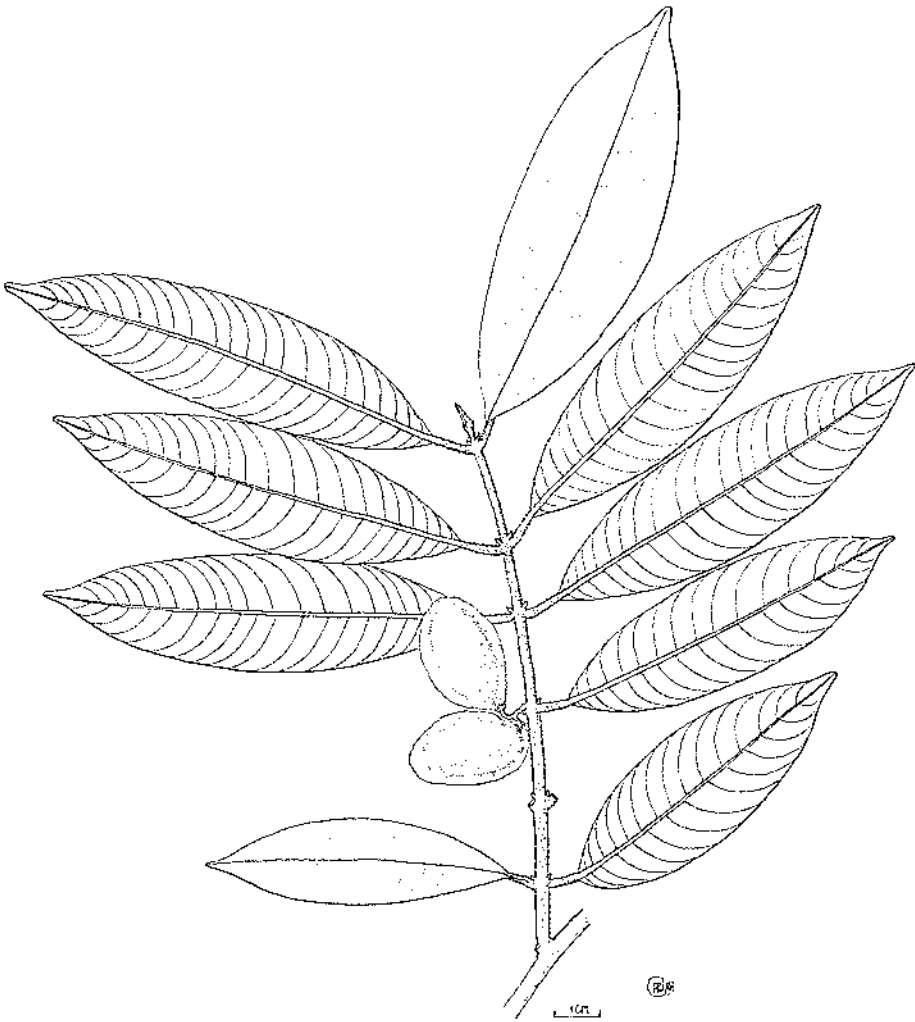


Fig. 1. *Alangium ridleyi* King

(Alangiaceae)



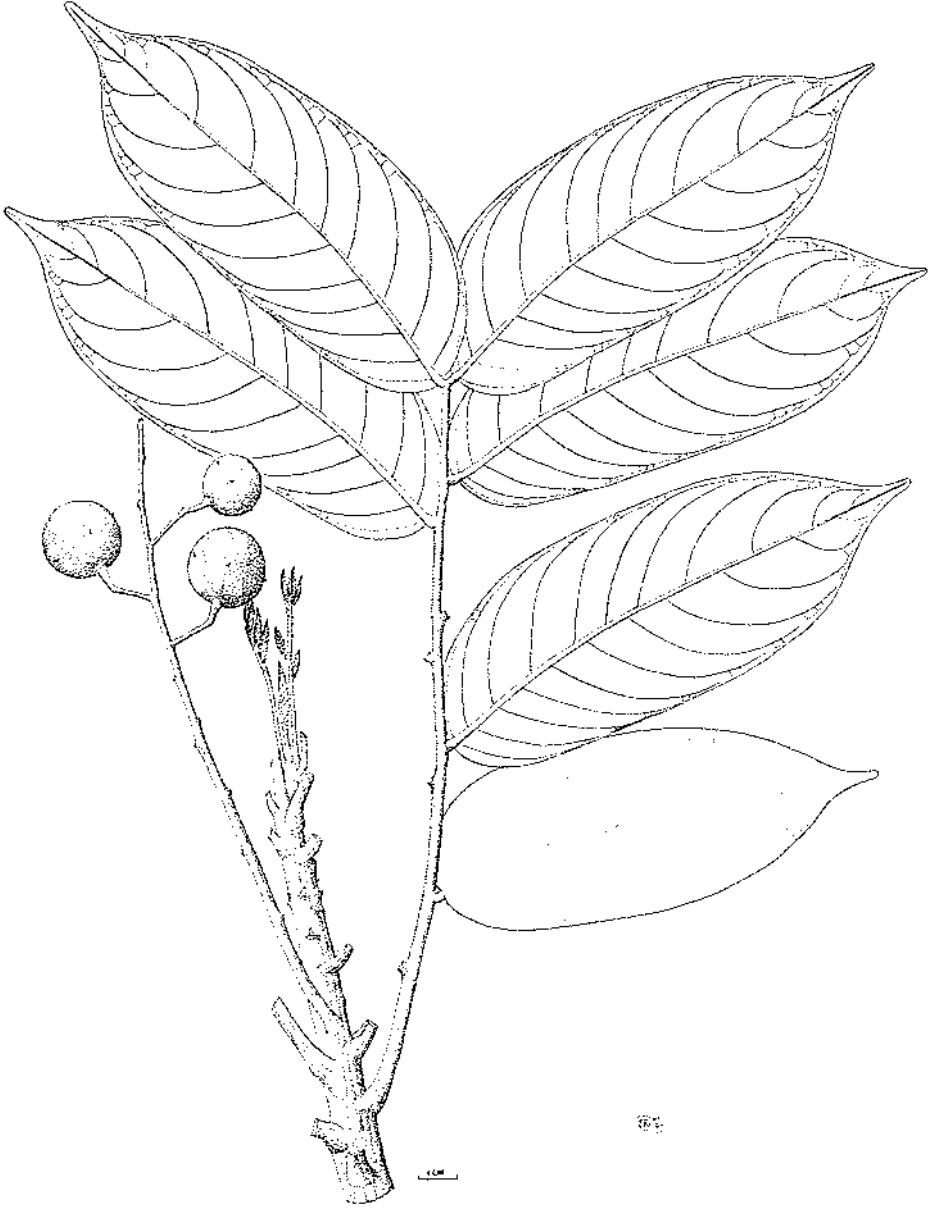
(Anacardiaceae)

Fig. 2. *Bouea oppositifolia* (Roxb.) Meisn.



Fig. 3. *Buchanania sessifolia* Blume

(Anacardiaceae)



(Anacardiaceae)

Fig. 4. *Dracontomelon dao* (Blanco) Merr. & Rolfe

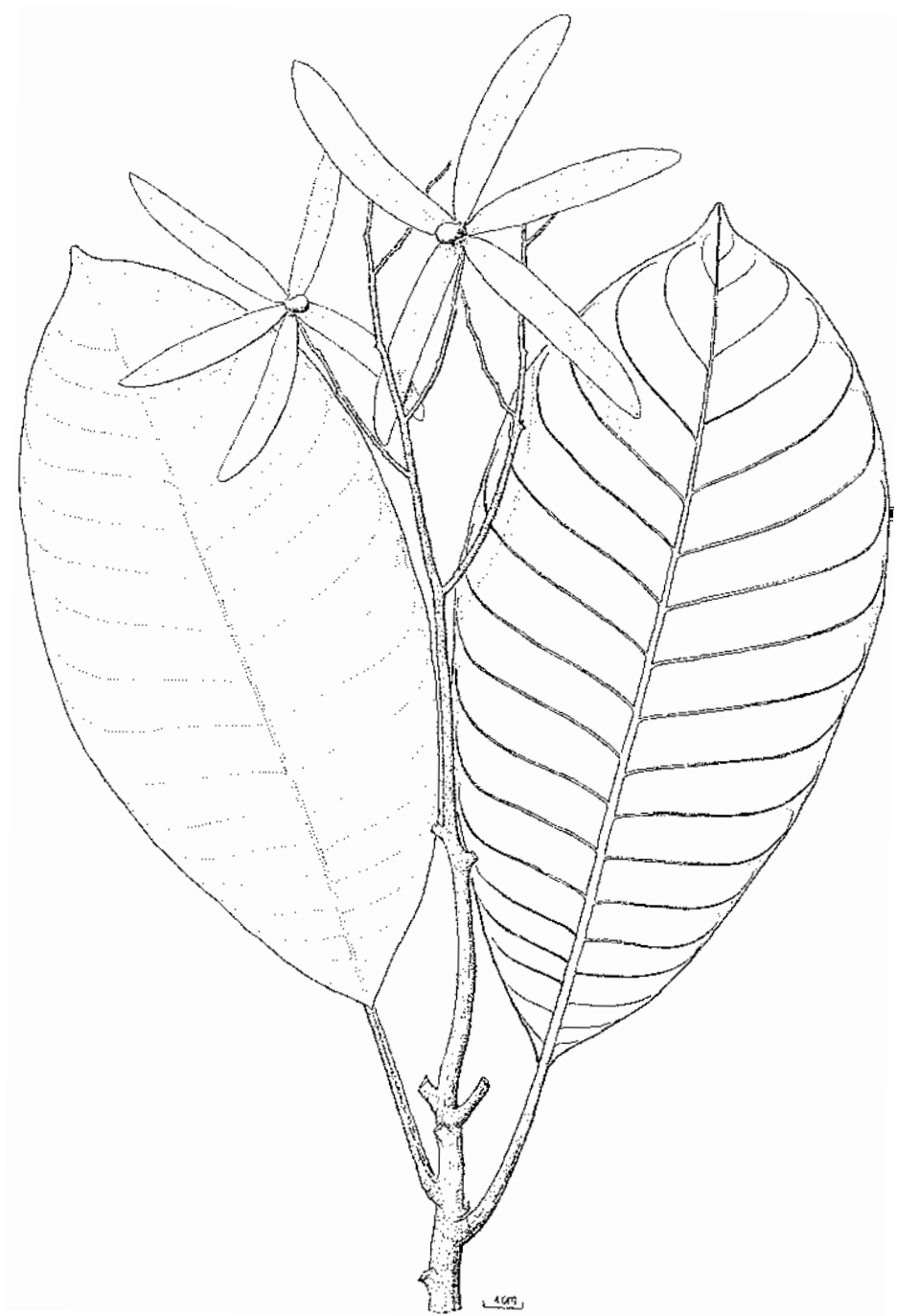
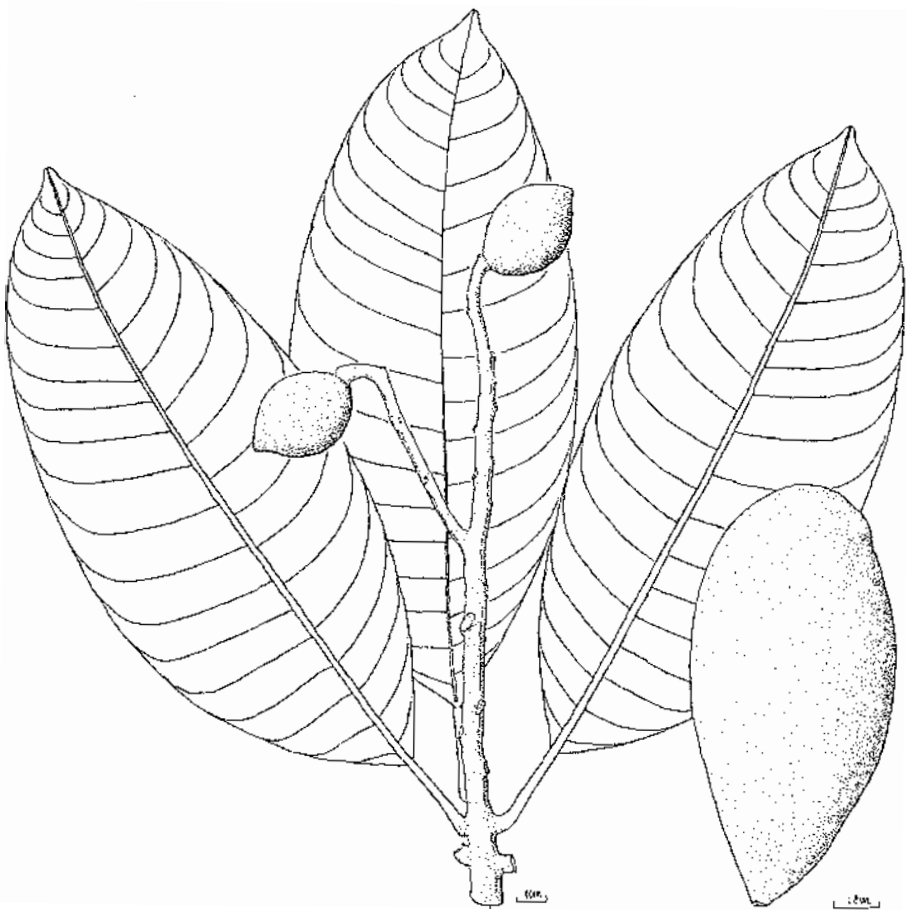


Fig. 5. *Gluta wallichii* (Hook. f.) Ding Hou

(Anacardiaceae)



(Anacardiaceae)

Fig. 6. *Mangifera foetida* Lour.



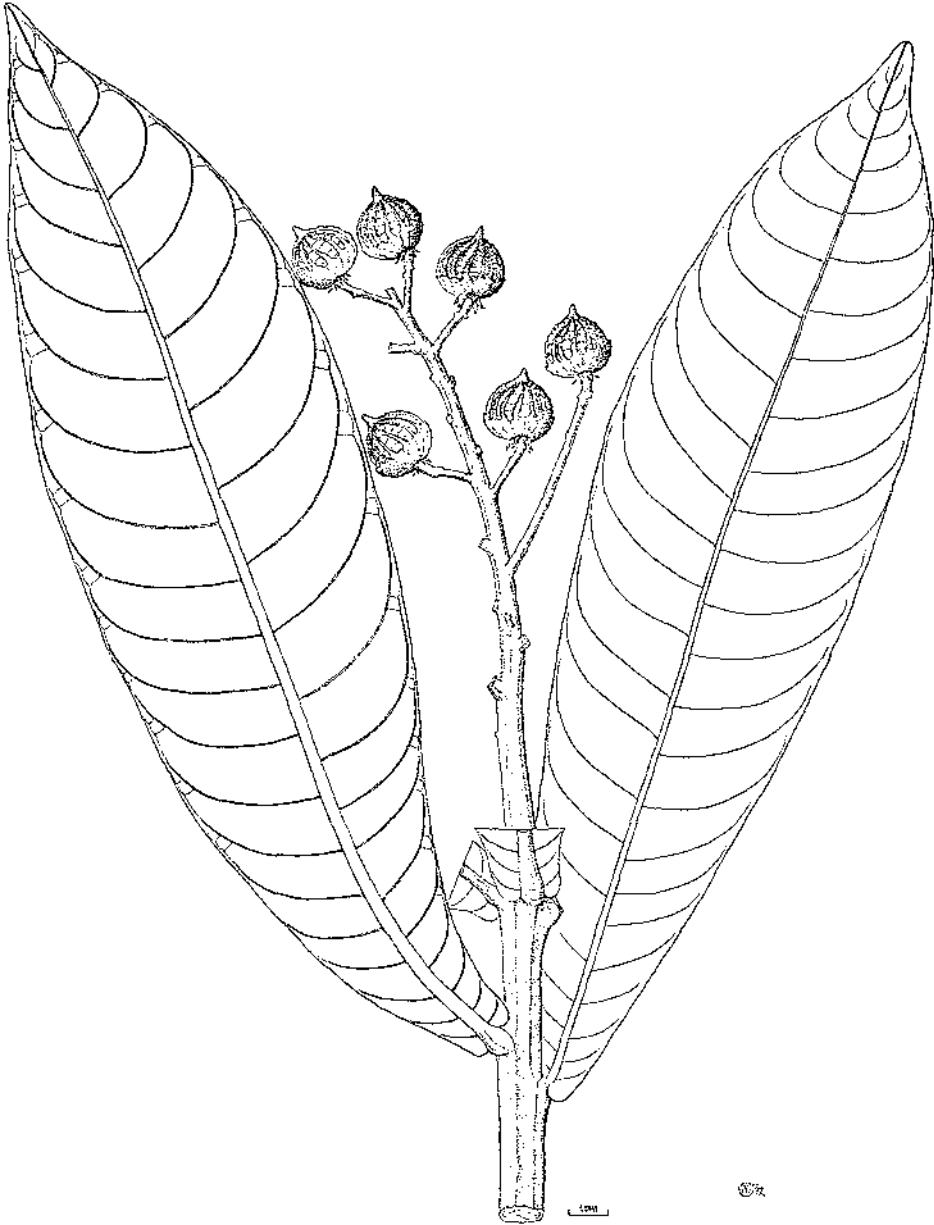
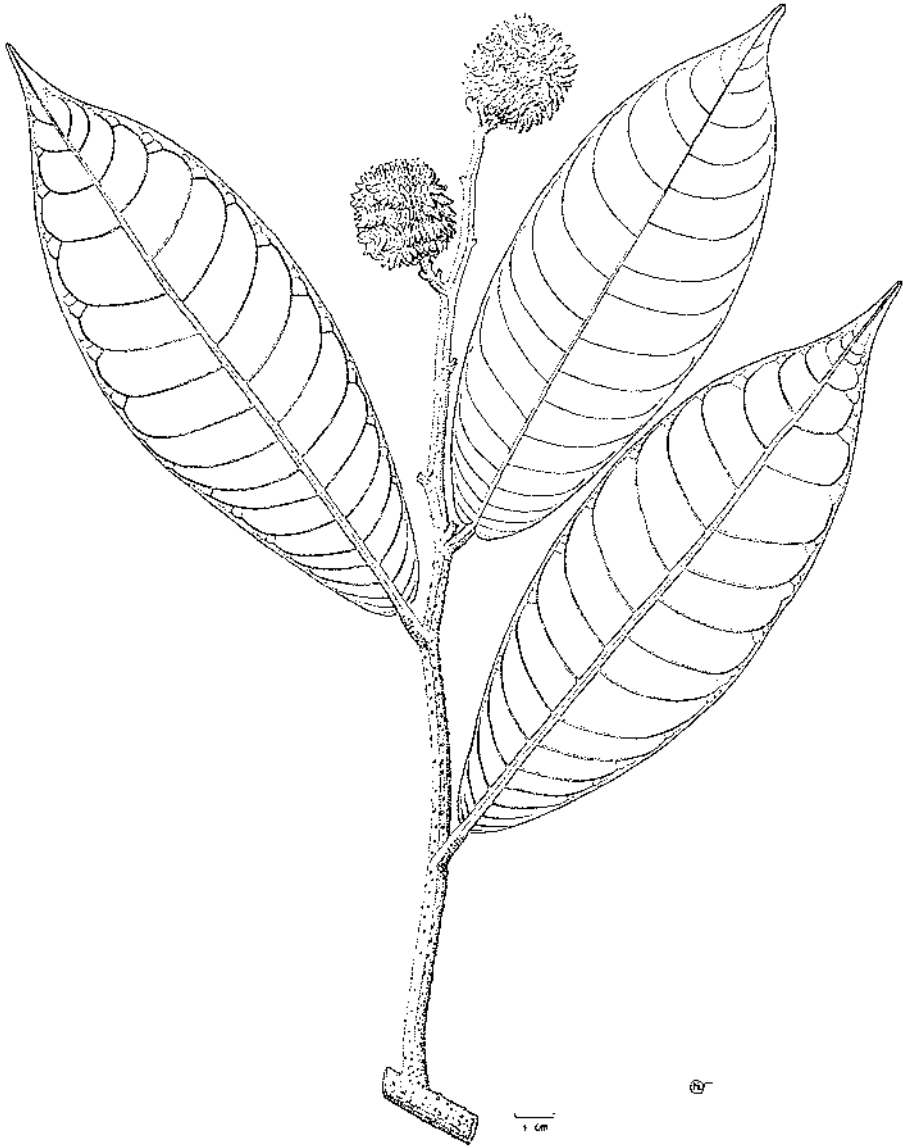


Fig. 7. *Melanochyla auriculata* Hook. f.

(Anacardiaceae)



(Anacardiaceae)

Fig. 8. *Melanochyla fulvinervis* (Blume) Ding Hou

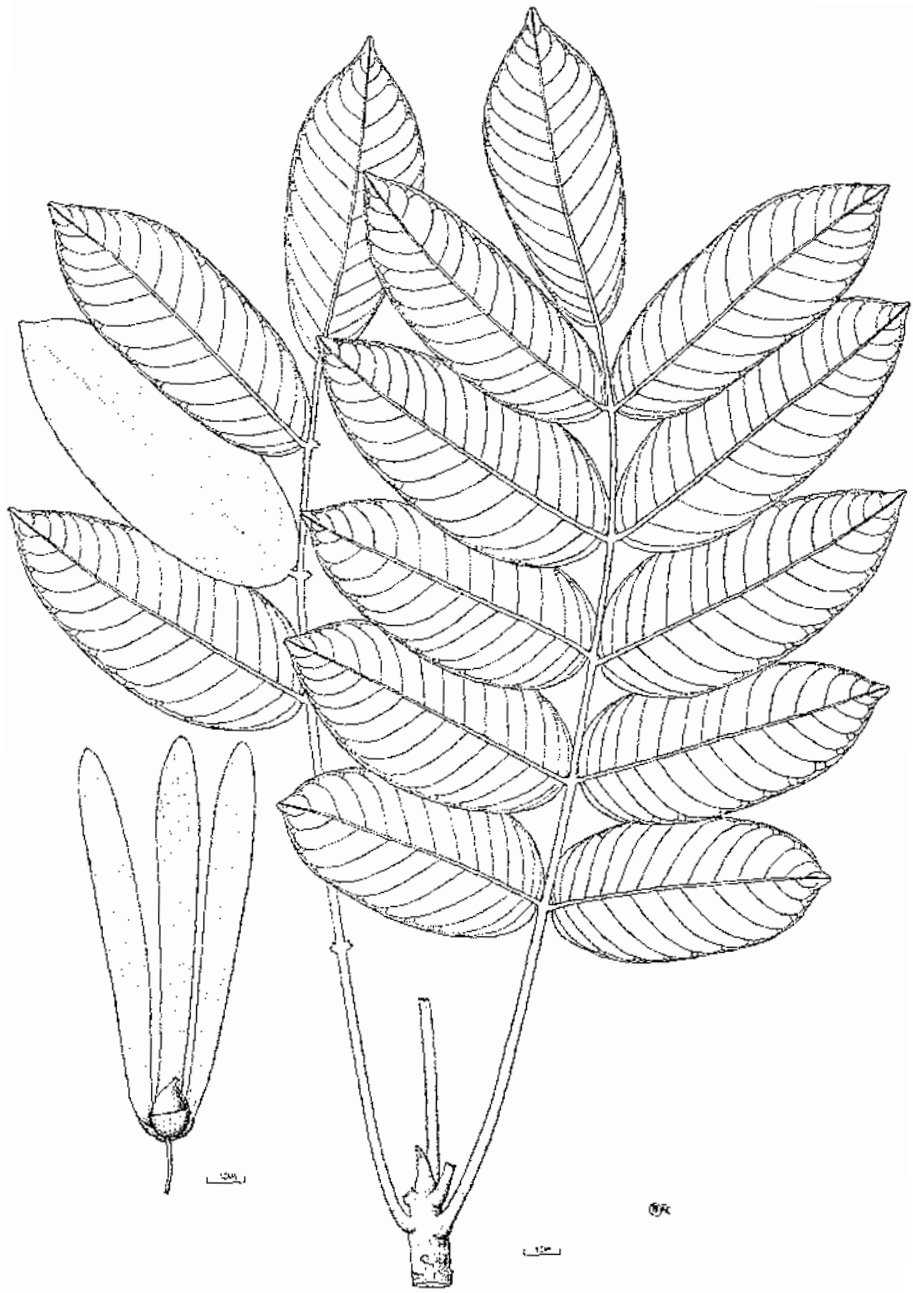


Fig. 9. *Parishia insignis* Hook. f.

(Anacardiaceae)



(Annonaceae)

Fig. 10. *Cananga odorata* (Lam.) Hook. f. & Thomson

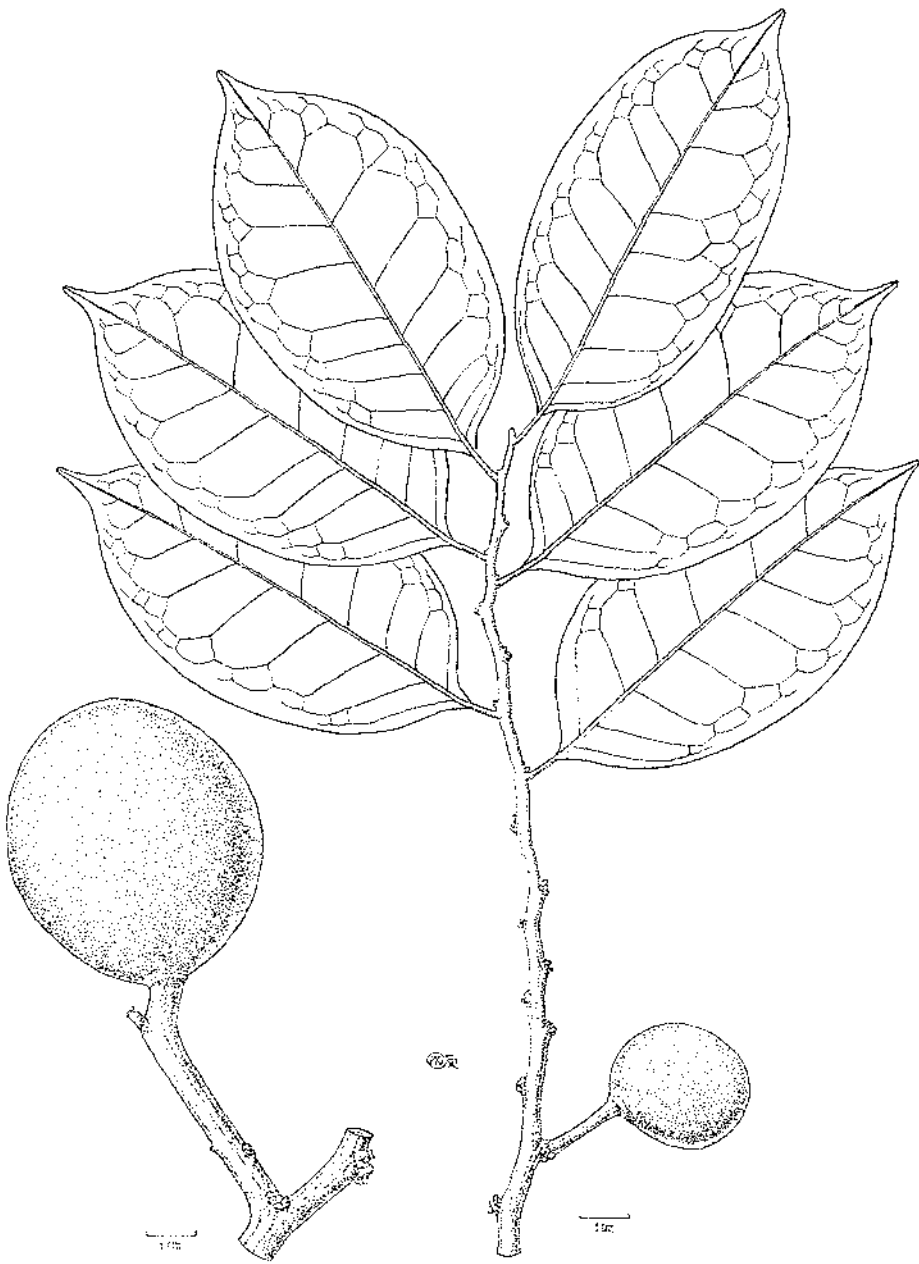


Fig. 11. *Mezzettia parviflora* Becc.

(Annonaceae)



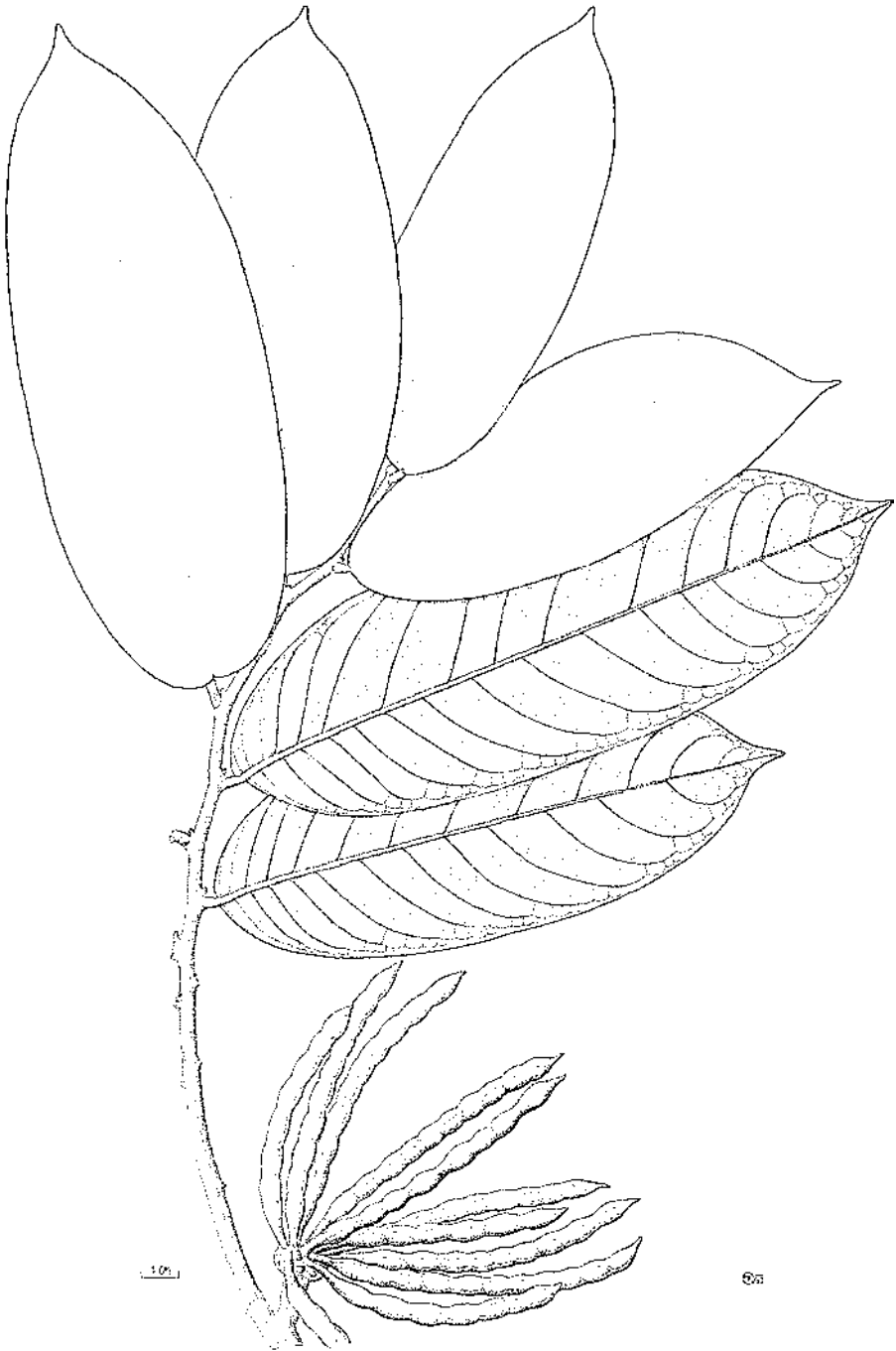
(Annonaceae)

Fig. 12. *Monocarpia kalimantanensis* Keßler



Fig. 13. *Polyalthia glauca* (Hassk.) F. Muell.

(Annonaceae)



(Annonaceae) Fig. 14. *Xylopiya ferruginea* (Hook. f. & Th.) Hook. f. & Th.



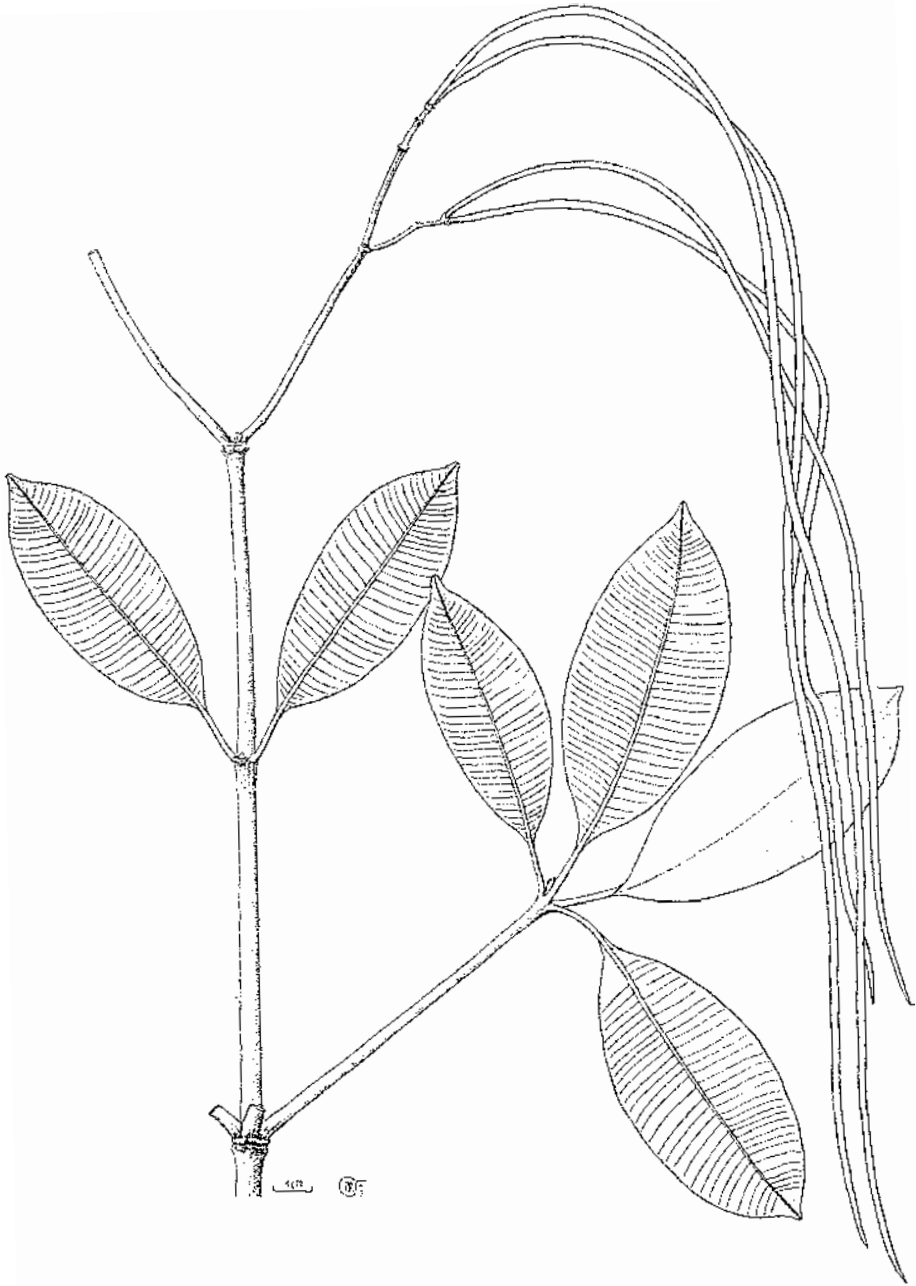
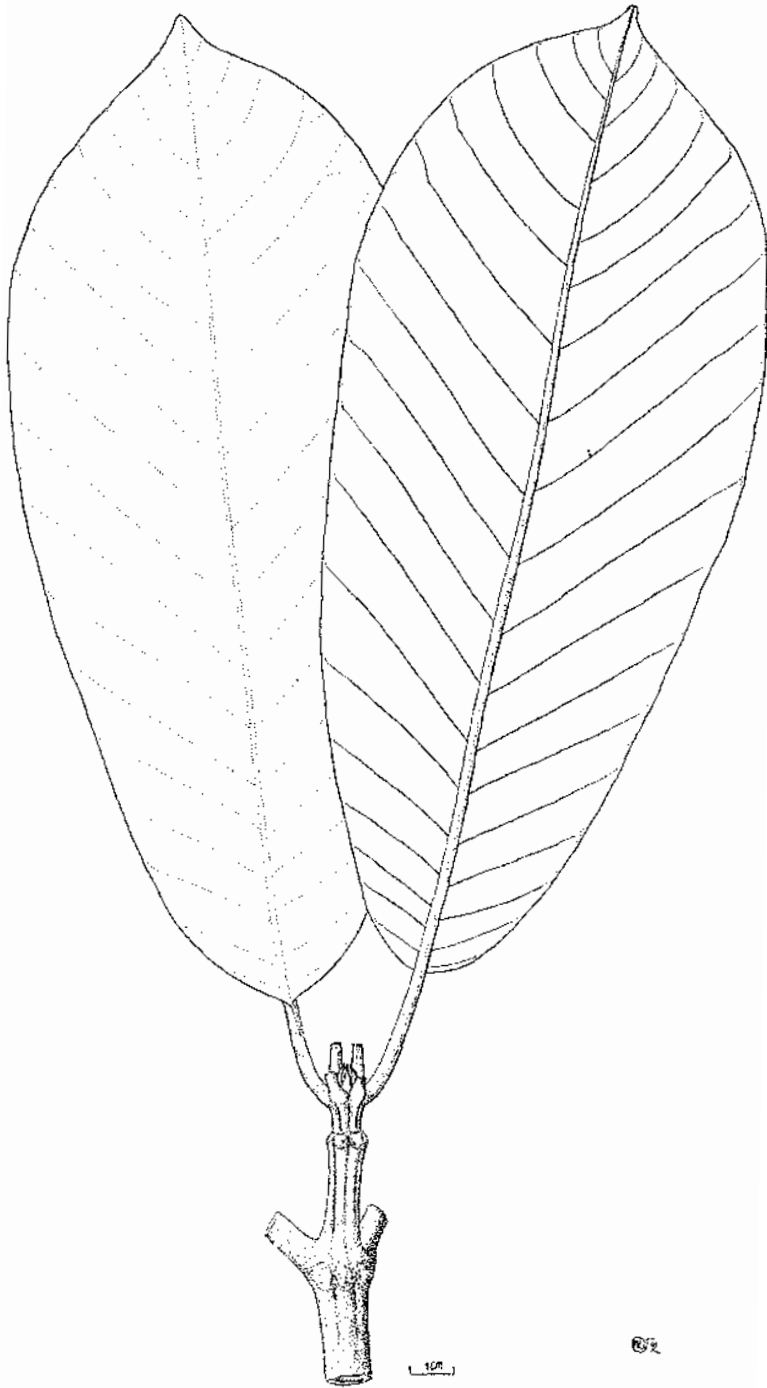


Fig. 15. *Alstonia scholaris* (L.) R. Br.

(Apocynaceae)



(Apocynaceae)

Fig. 16a. *Dyera costulata* (Miq.) Hook. f.

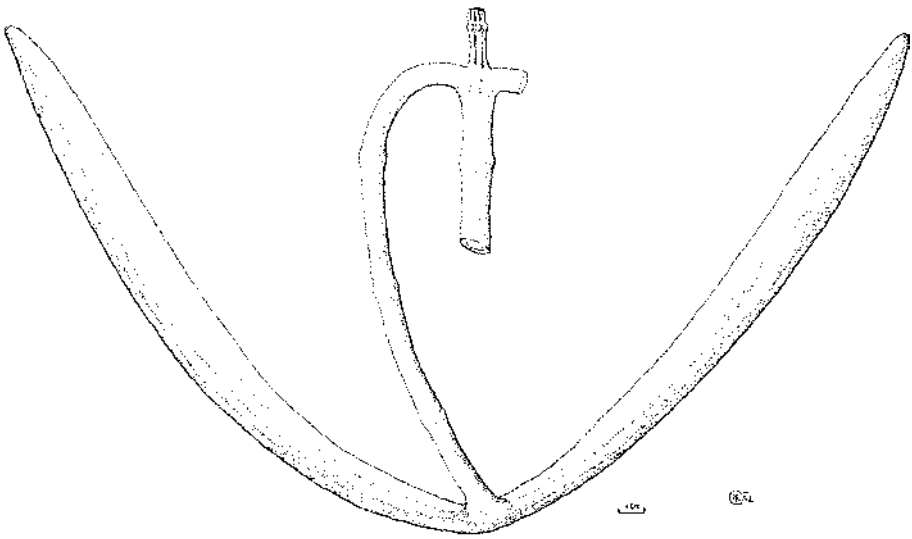


Fig. 16b. *Dyera costulata* (Miq.) Hook. f.

(Apocynaceae)



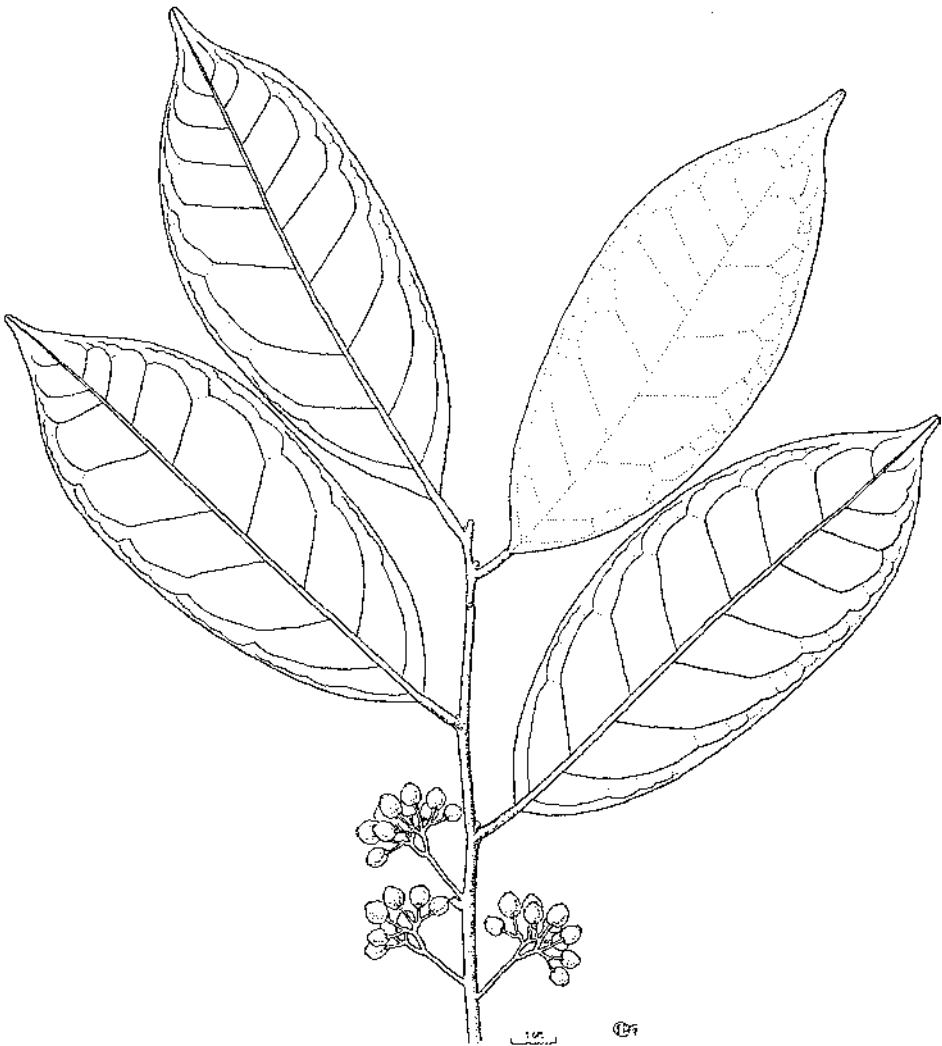
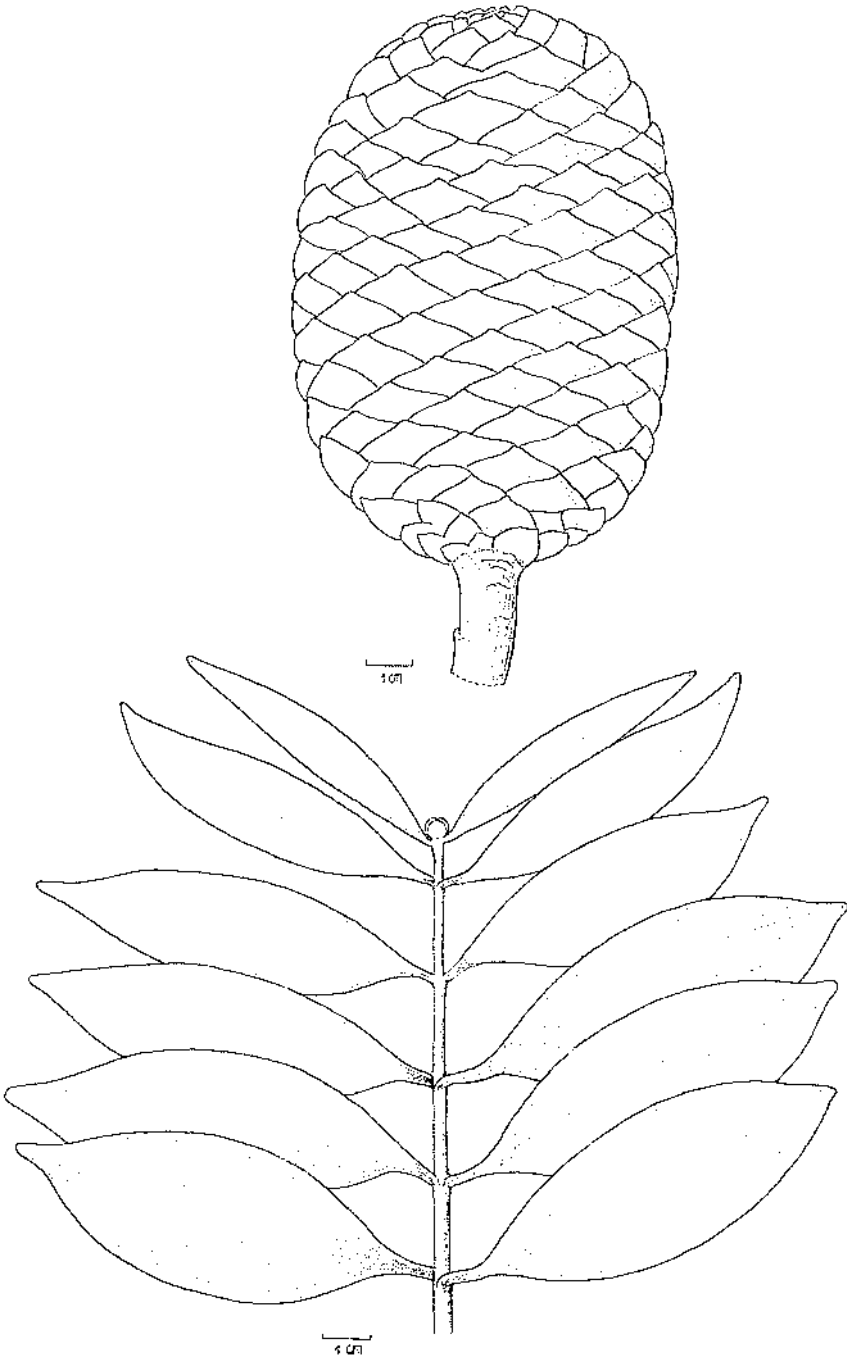


Fig. 17. *Ilex cymosa* Blume

(Aquifoliaceae)



(Araucariaceae)

Fig. 18. *Agathis borneensis* Warb.

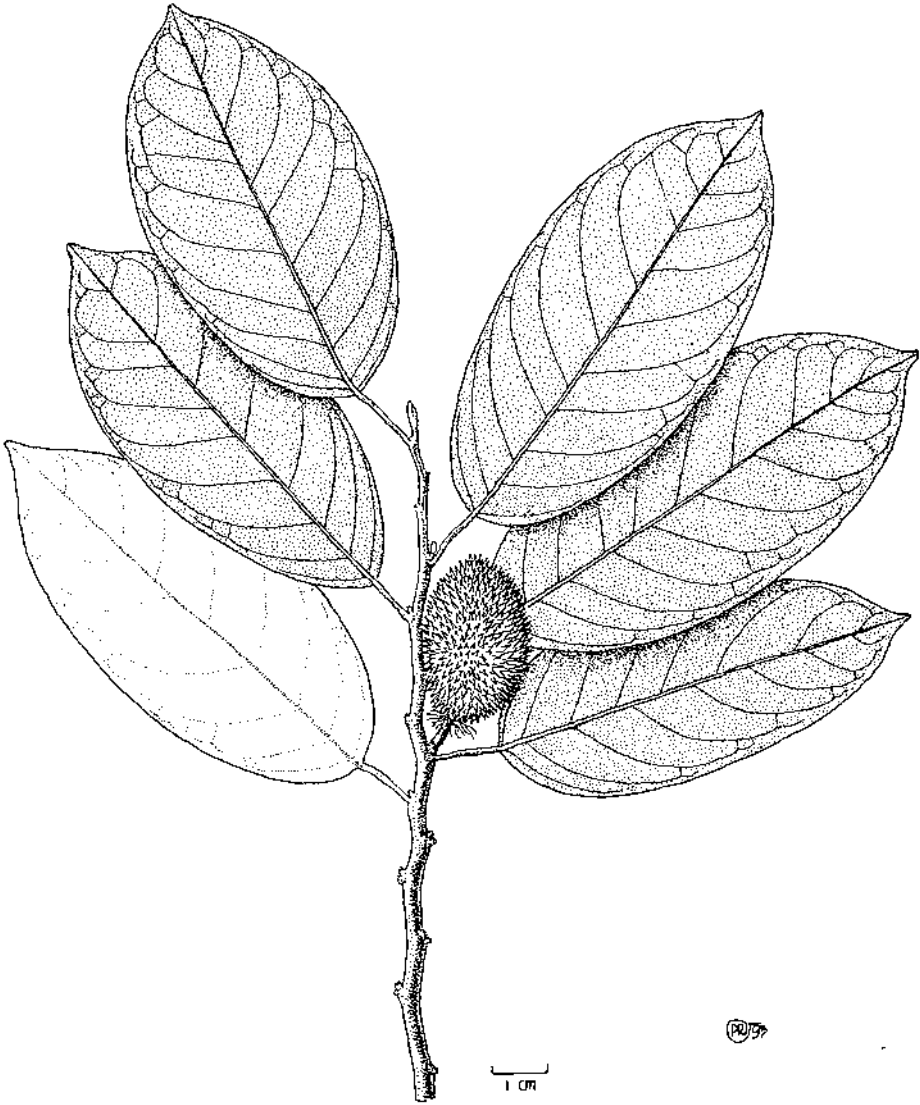
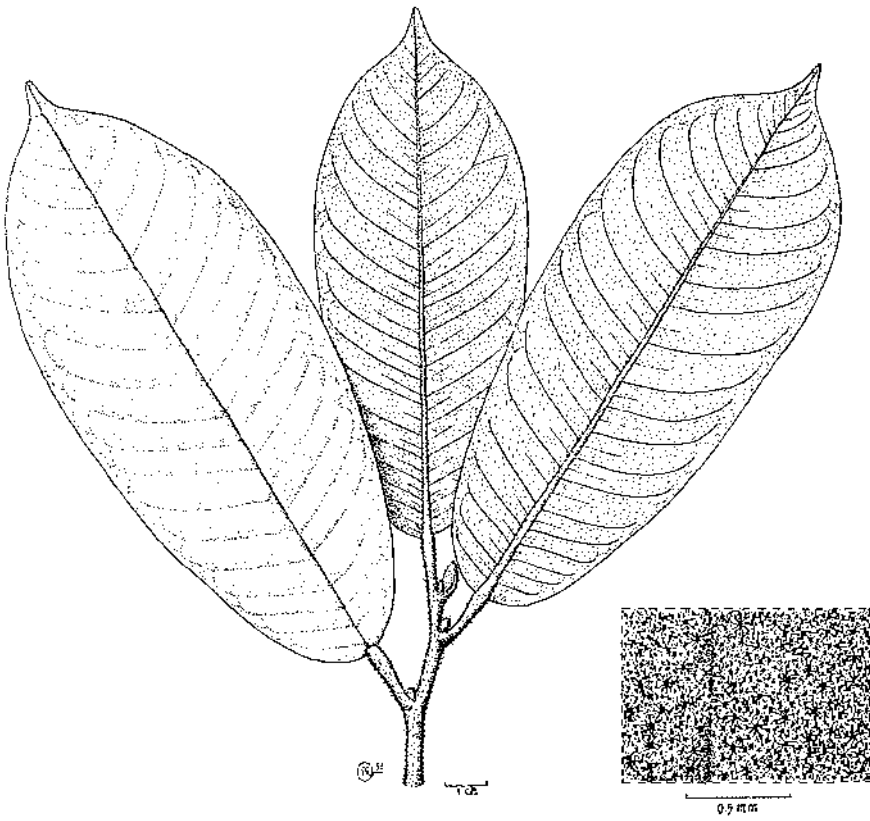


Fig. 19. *Durio acutifolius* (Mast.) Kosterm.

(Bombacaceae)



(Bombacaceae)

Fig. 20a. *Durio oxleyanus* Griff.



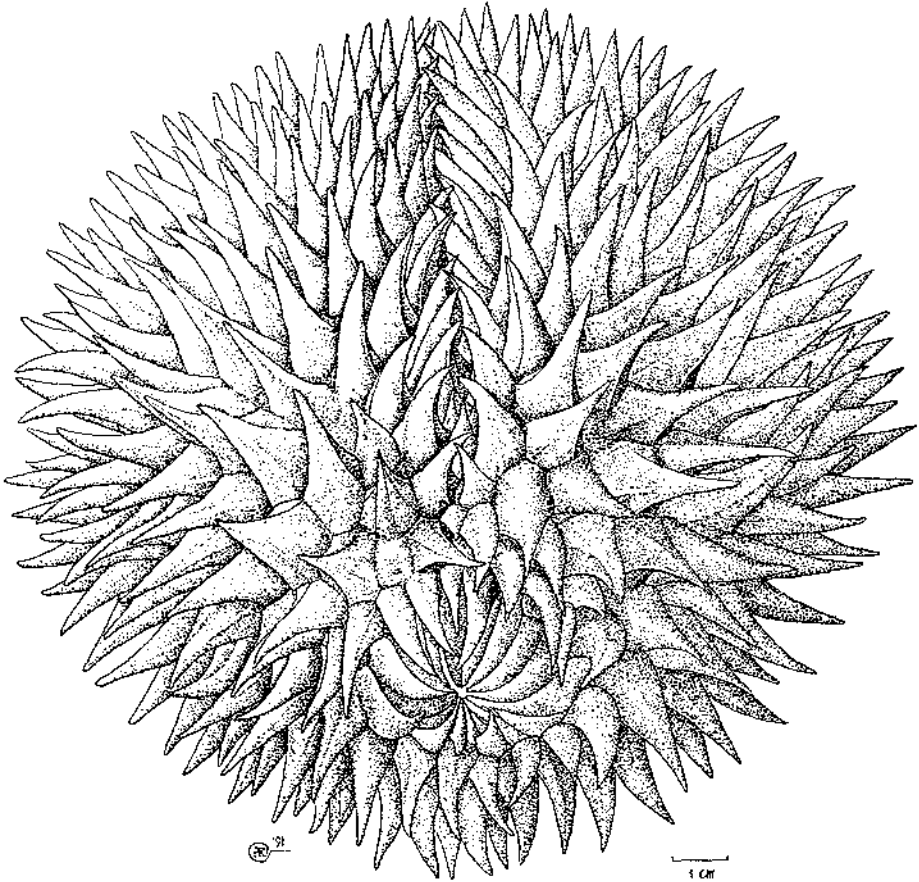
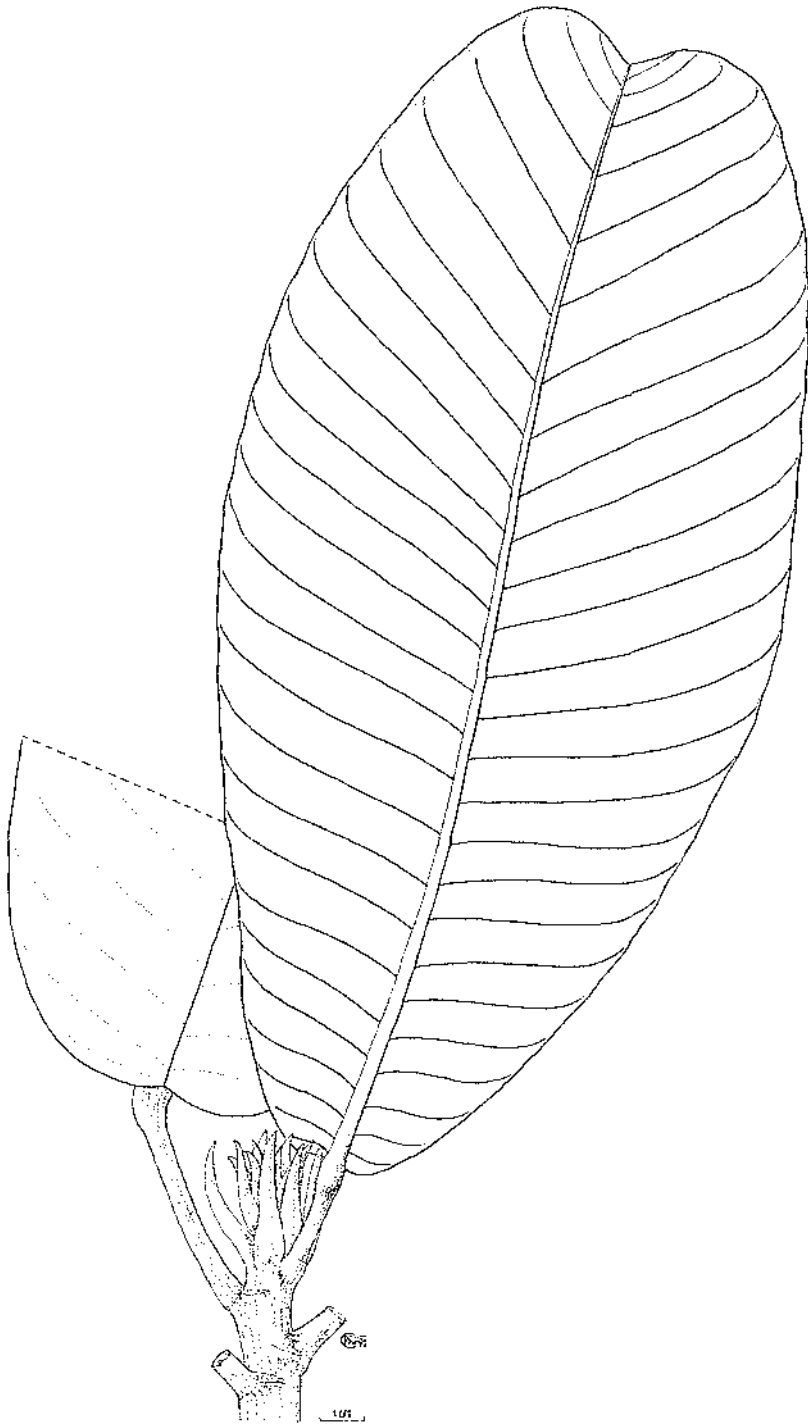


Fig. 20b. *Durio oxleyanus* Griff.

(Bombacaceae)



(Bombacaceae)

Fig. 21a. *Neesia synandra* Mast.

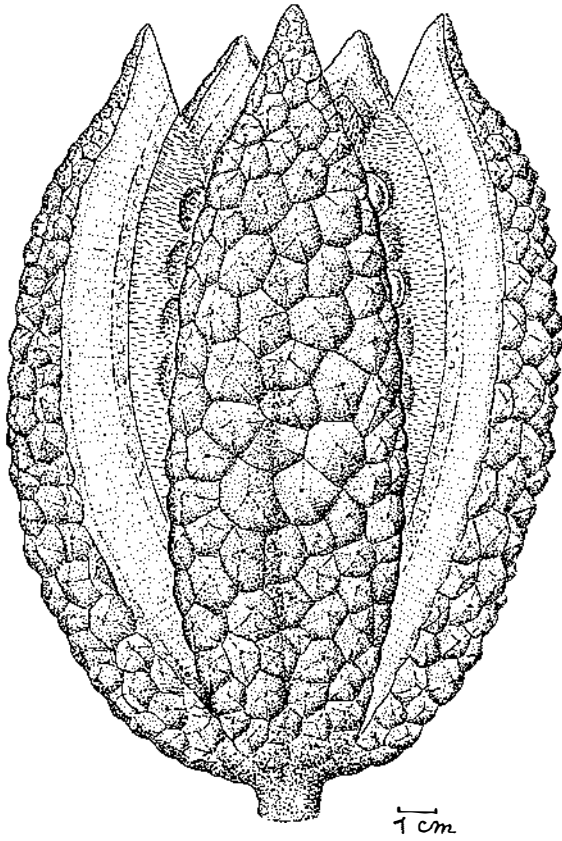
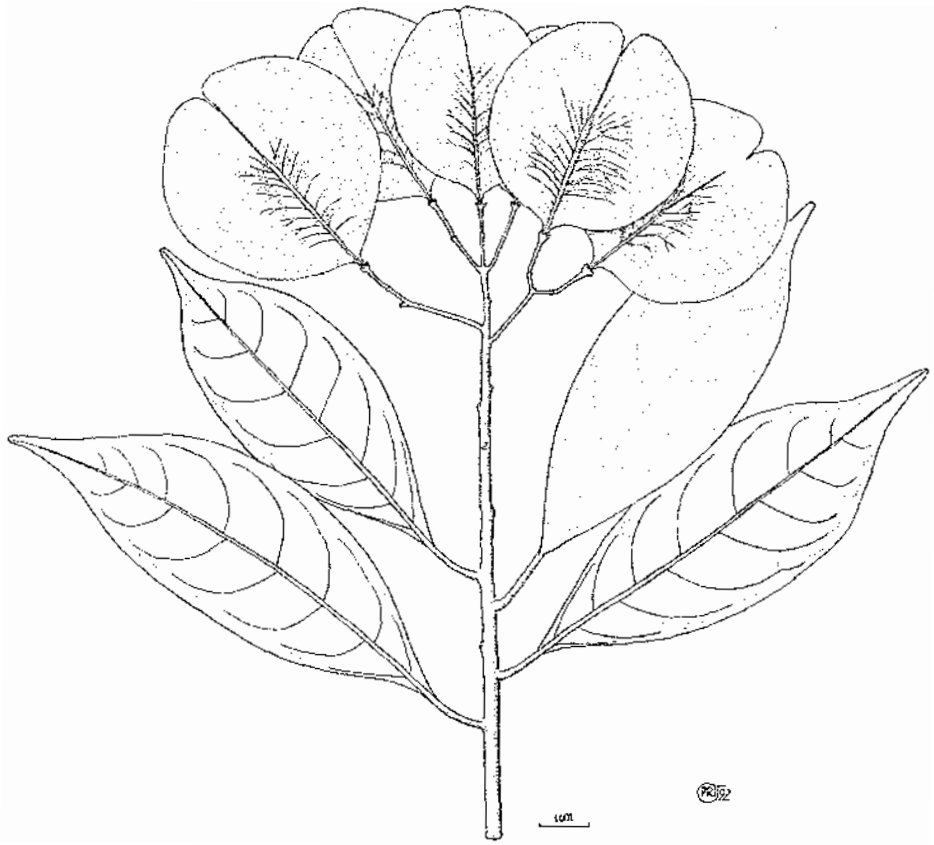


Fig. 21 b. *Neesia synandra* Mast.

(Bombacaceae)



(Boraginaceae)

Fig. 22. *Pteleocarpa lamponga* (Miq.) Bakh. ex Heyne

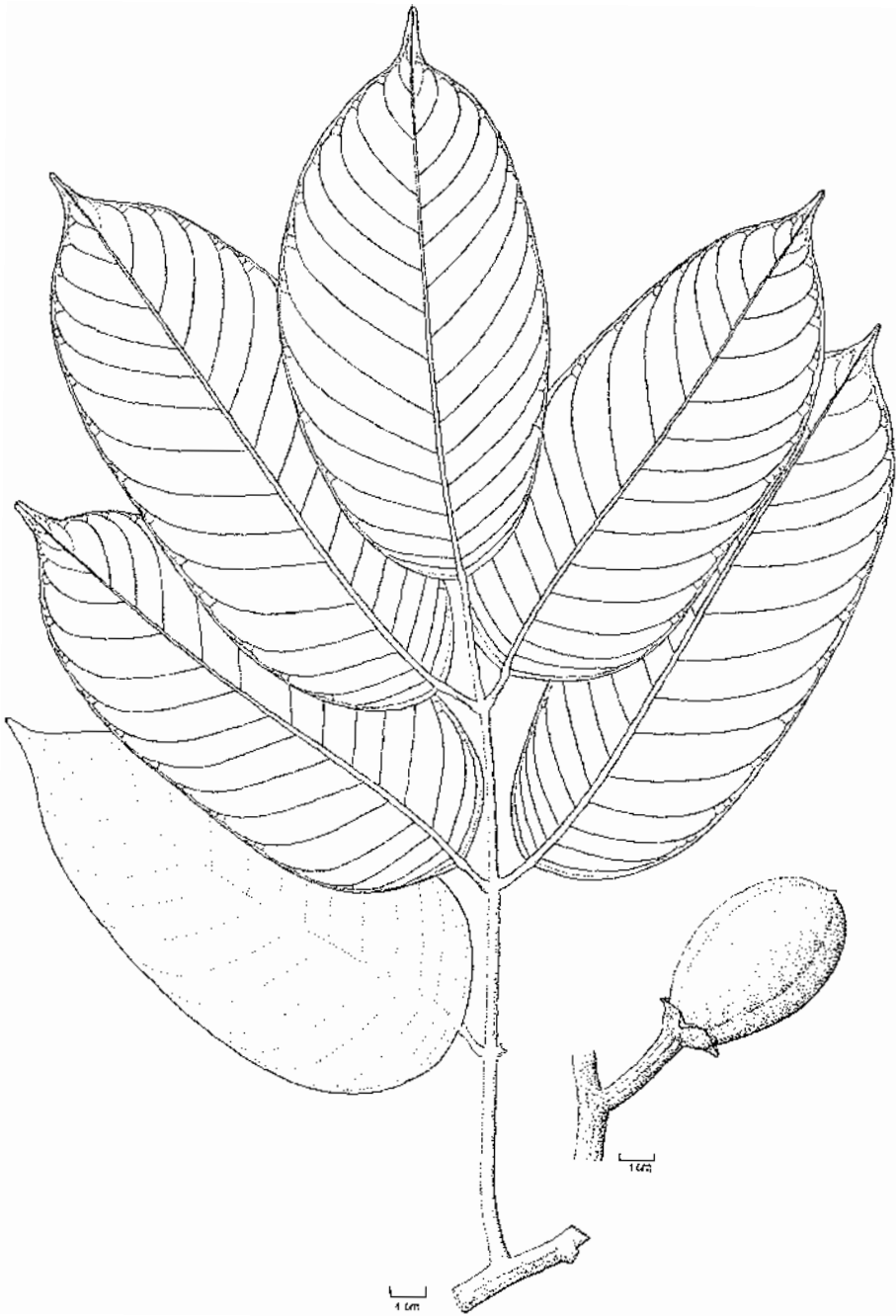
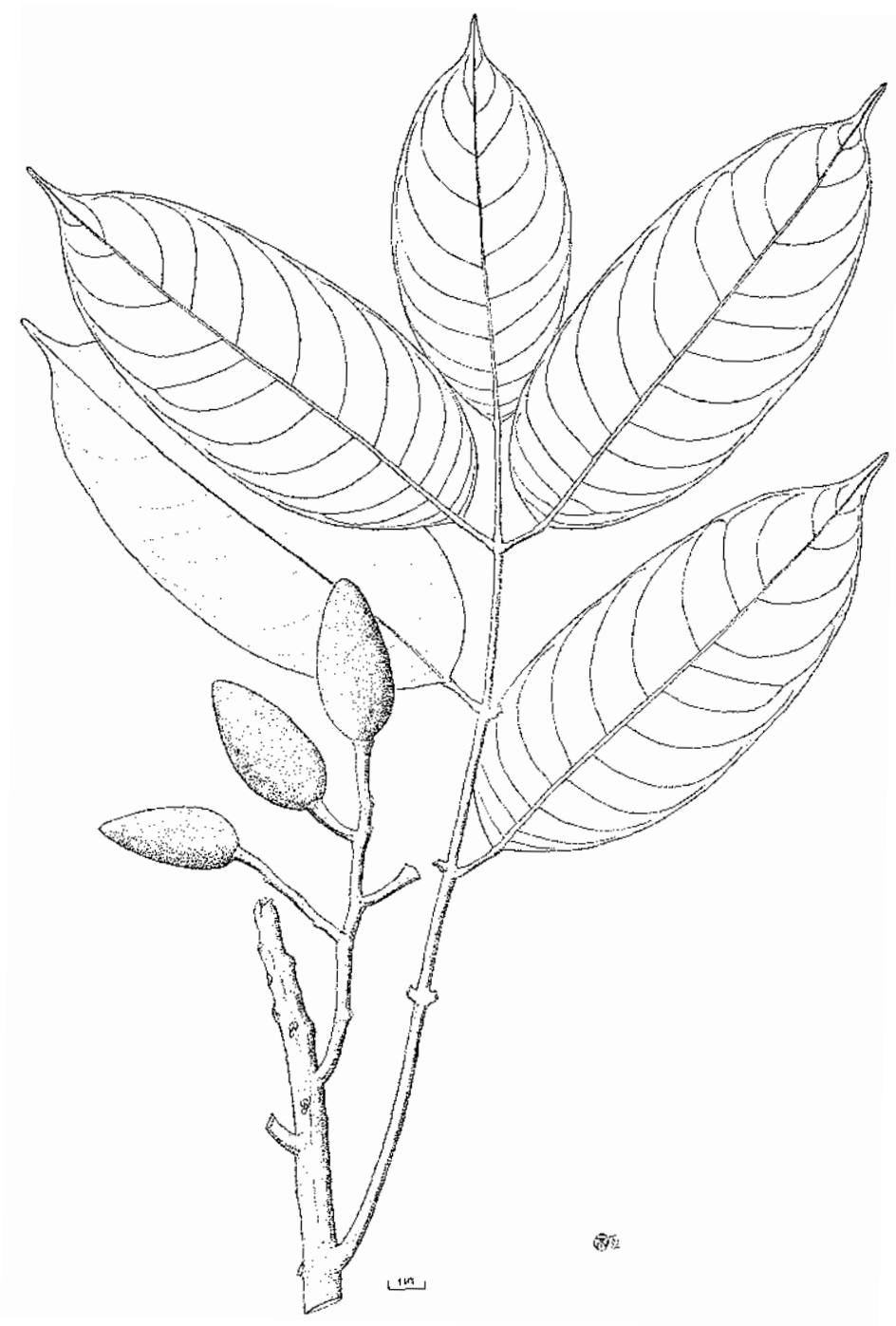


Fig. 23. *Canarium megalanthum* Merr.

(Burseraceae)



(Burseraceae)

Fig. 24. *Dacryodes rostrata* (Blume) H.J. Lam

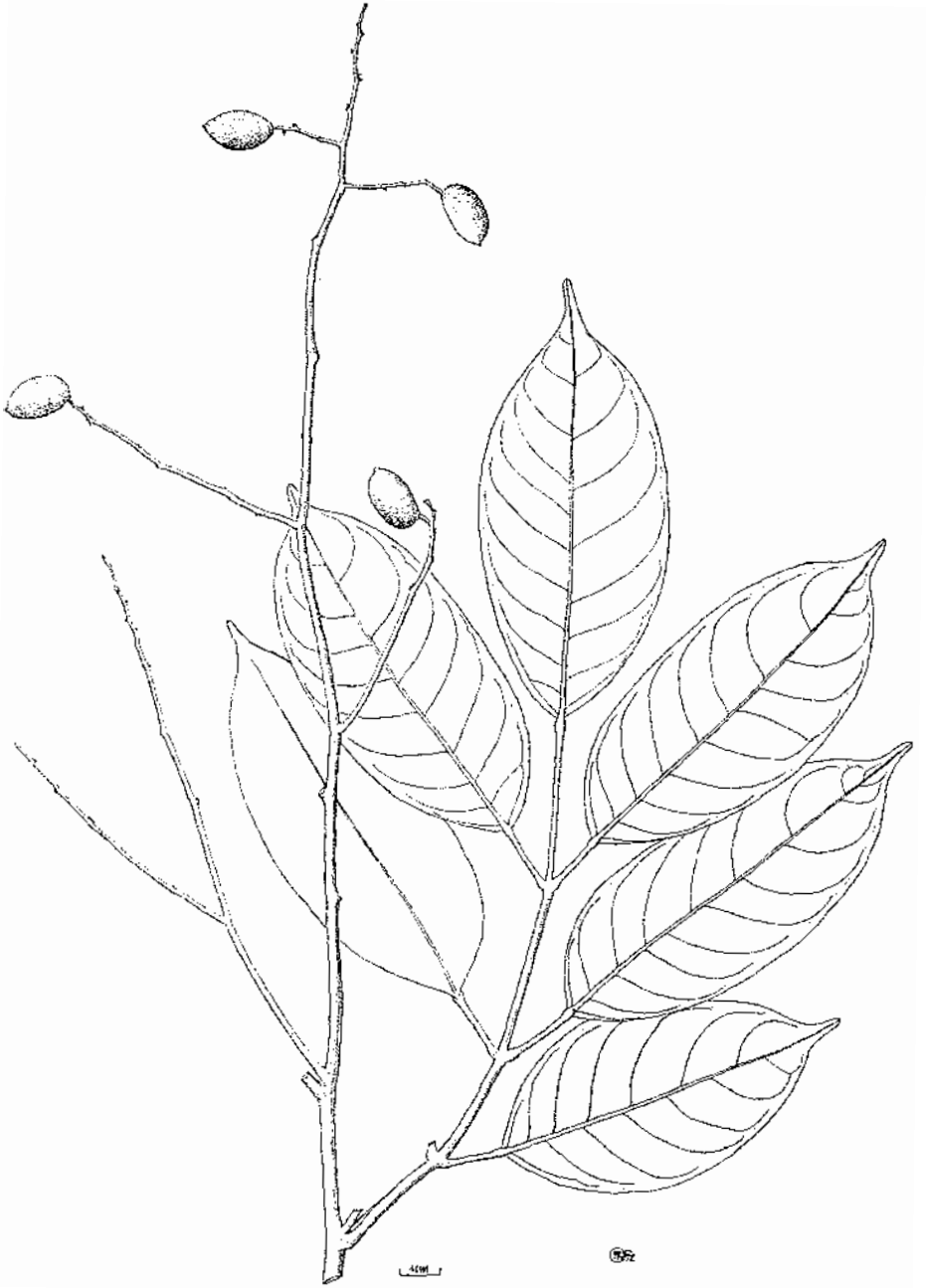
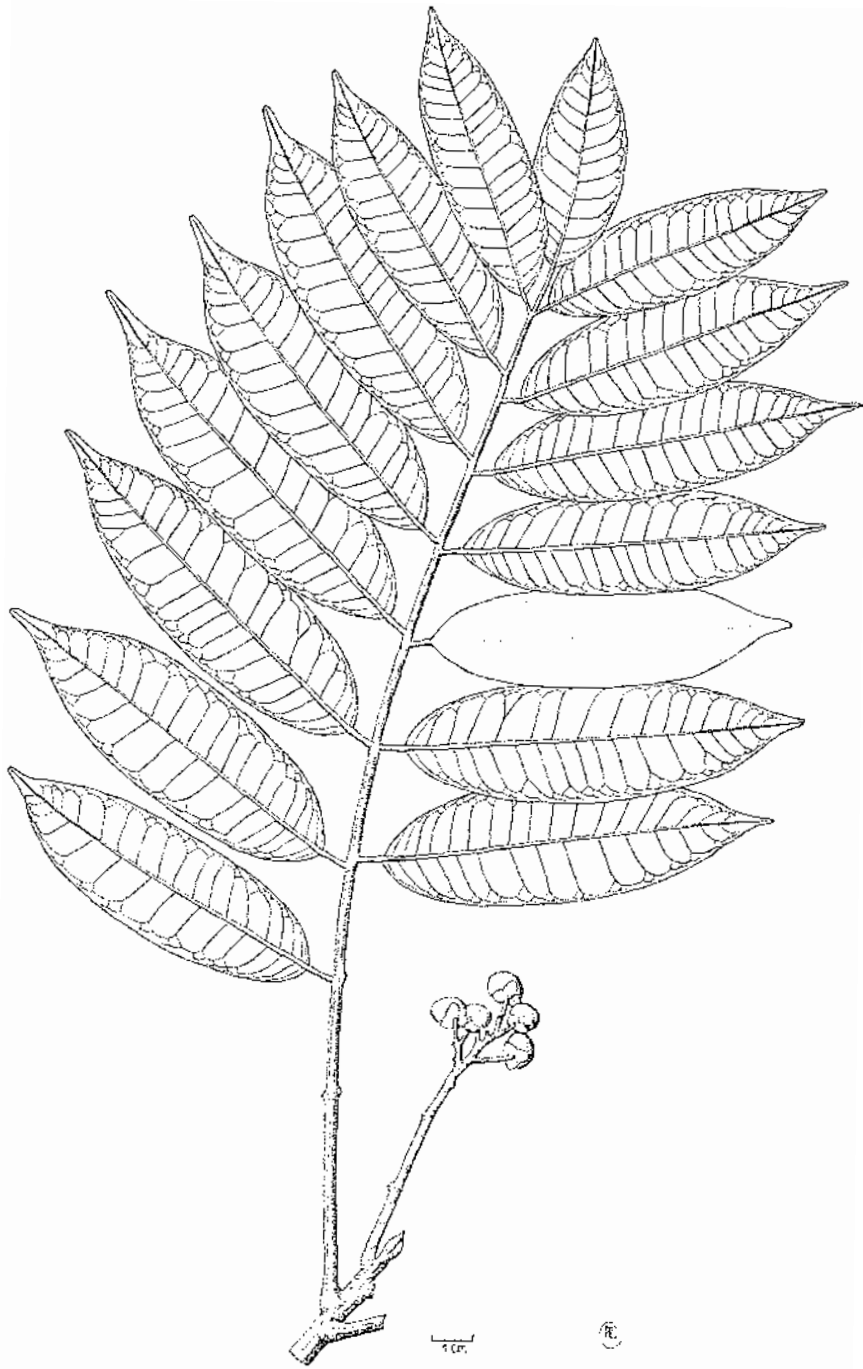


Fig. 25. *Dacryodes rugosa* (Blume) H.J. Lam

(Burseraceae)



(Bursaceae)

Fig. 26. *Santiria griffithii* (Hook. f.) Engl.



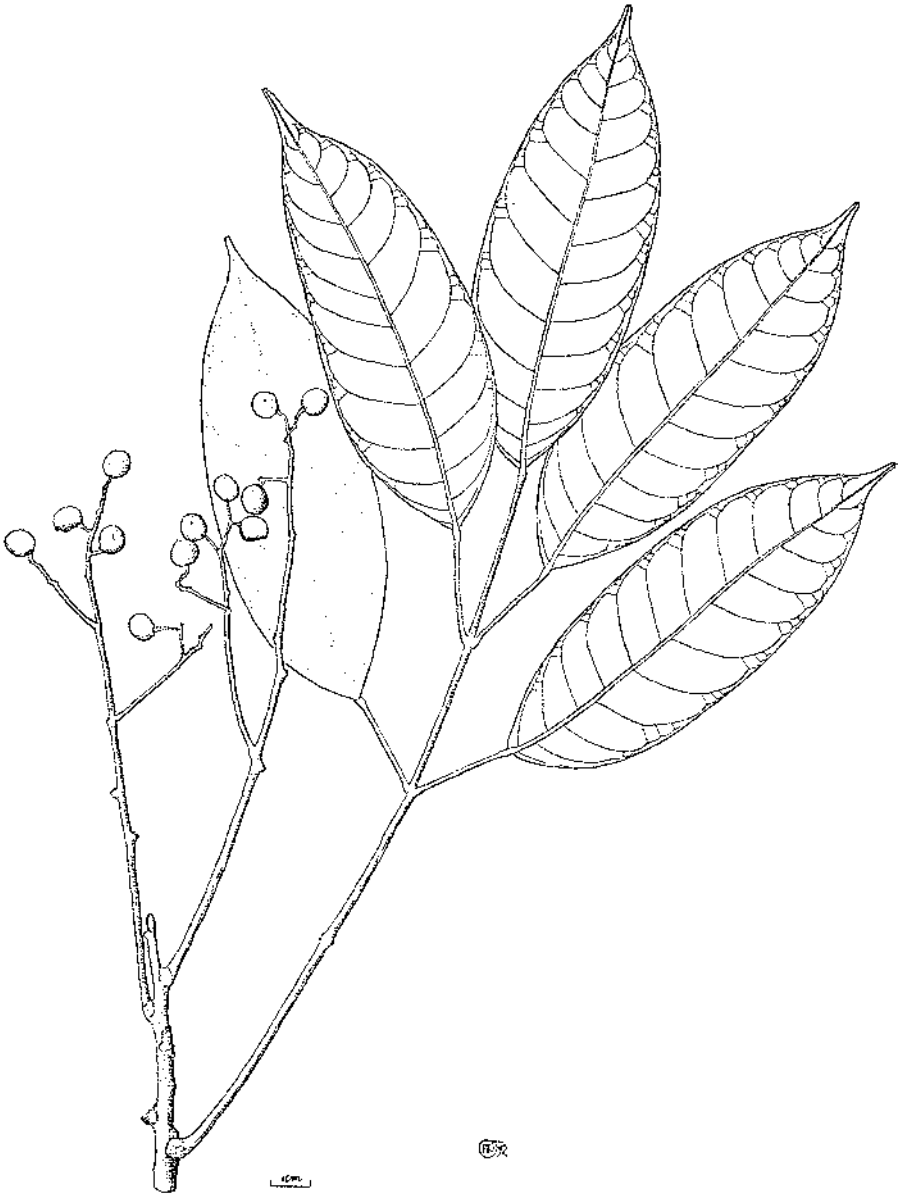
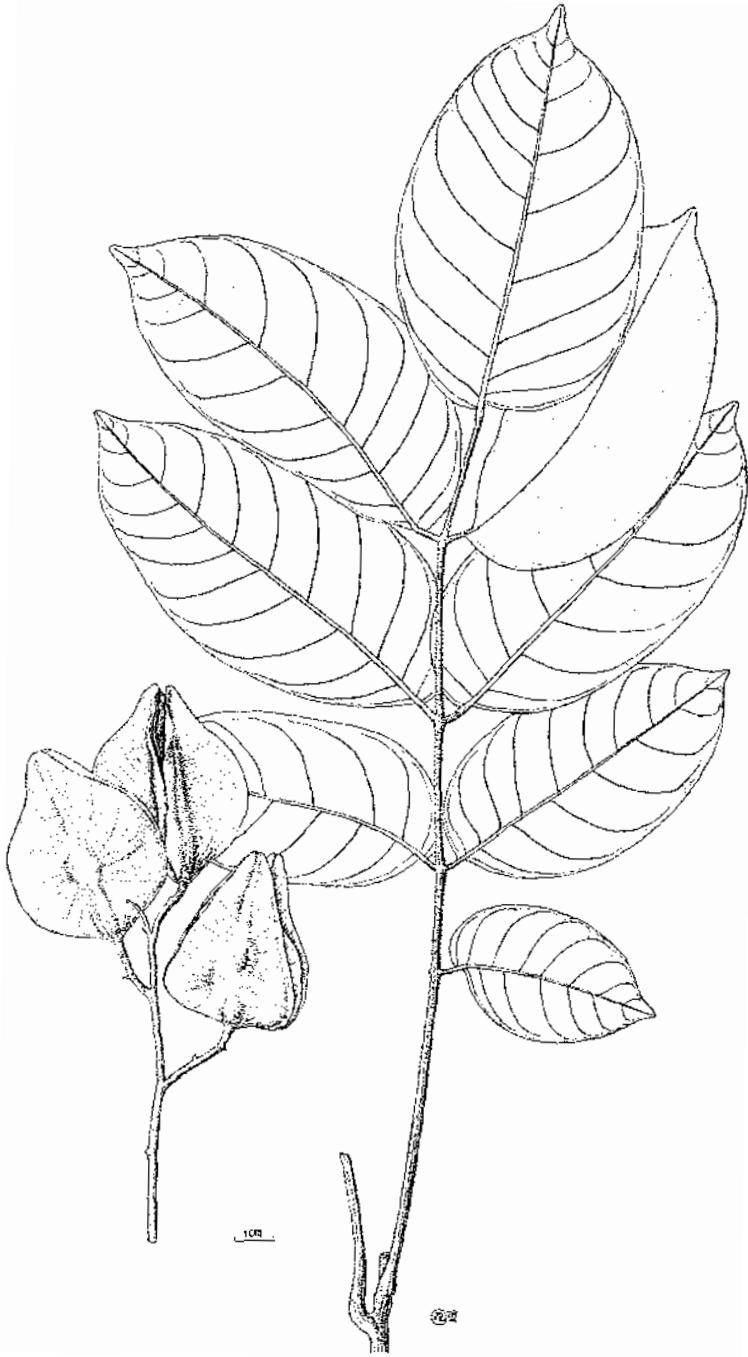


Fig. 27. *Santiria oblongifolia* Blume

(Burseraceae)



(Bursaceae)

Fig. 28. *Triomma malaccensis* Hook. f.



Fig. 29. *Dialium indum* L. var. *bursa* (De Wit) Rojo (Caesalpinaceae)



(Caesalpinaceae) Fig. 30. *Koompassia malaccensis* Maing. ex Benth.

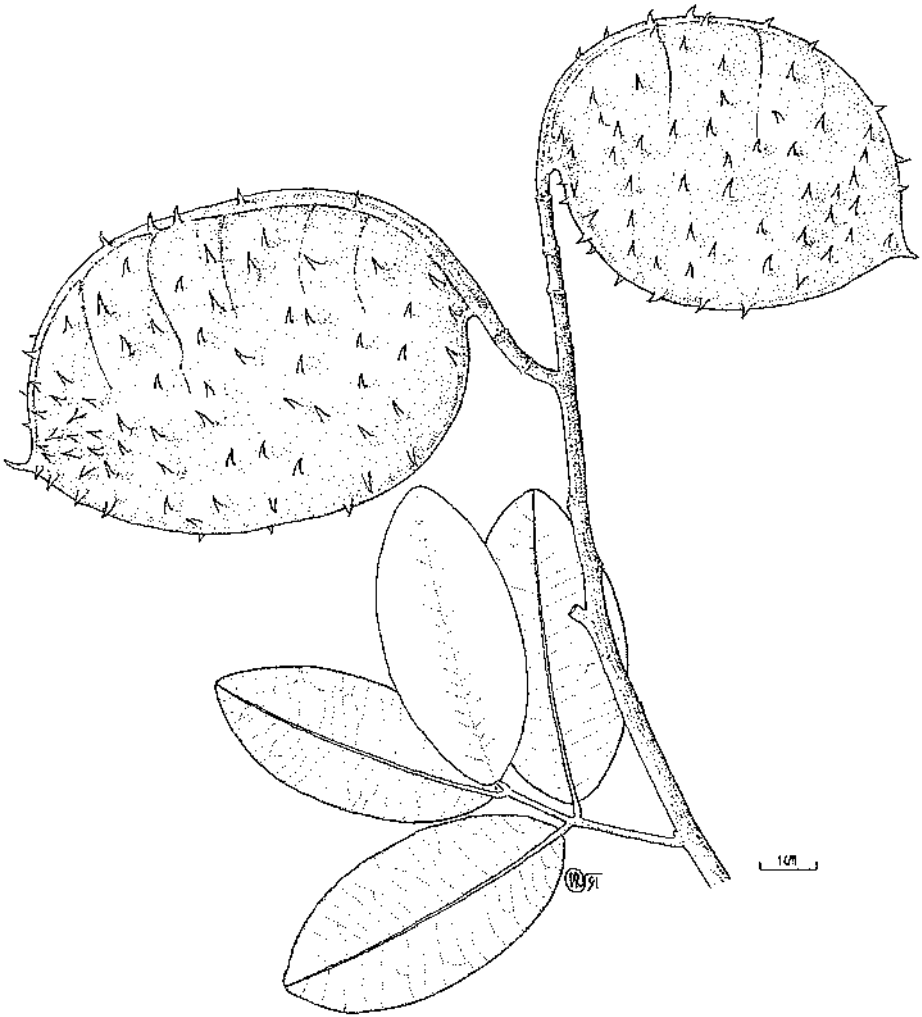


Fig. 31. *Sindora wallichii* Graham ex Benth.

(Caesalpinaceae)



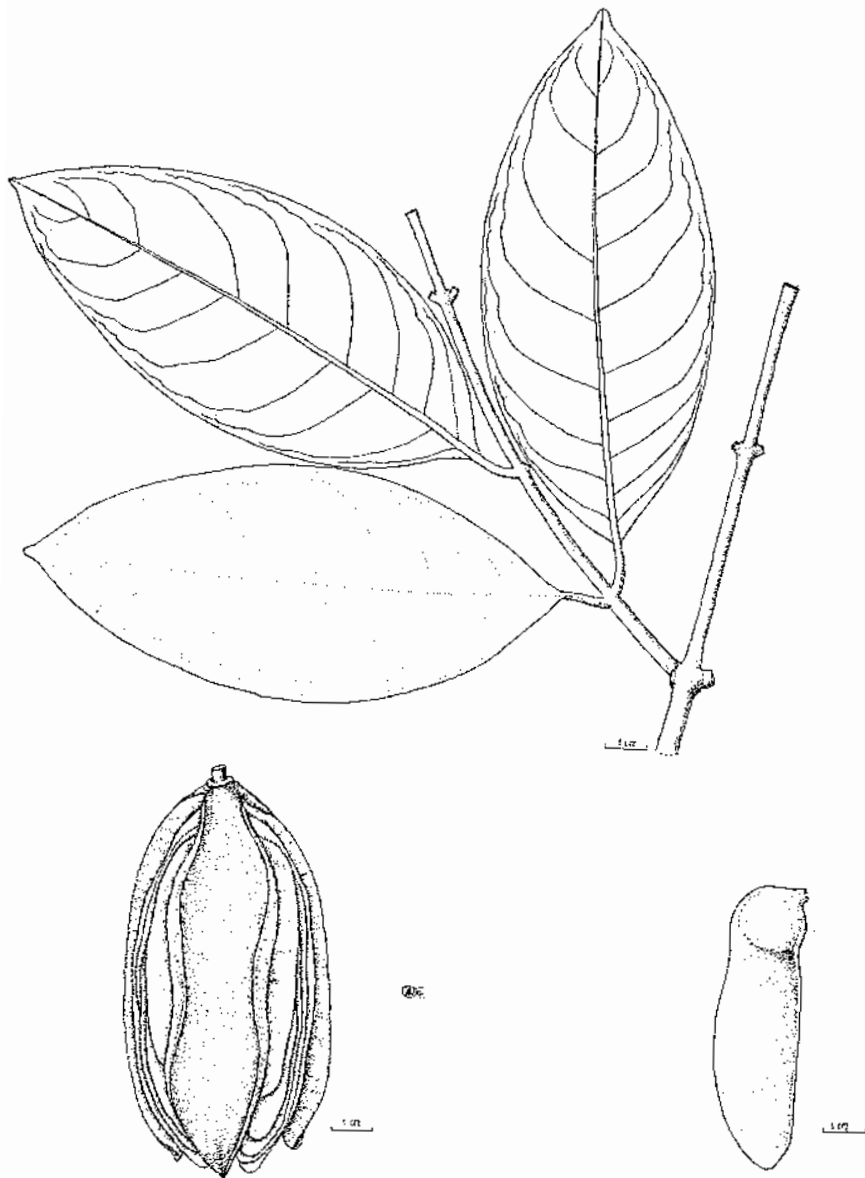
(Casuarinaceae)

Fig. 32. *Casuarina equisetifolia* J.R. & G. Forst.



Fig. 33. *Bhesa paniculata* Arn.

(Celastraceae)



(Celastraceae)

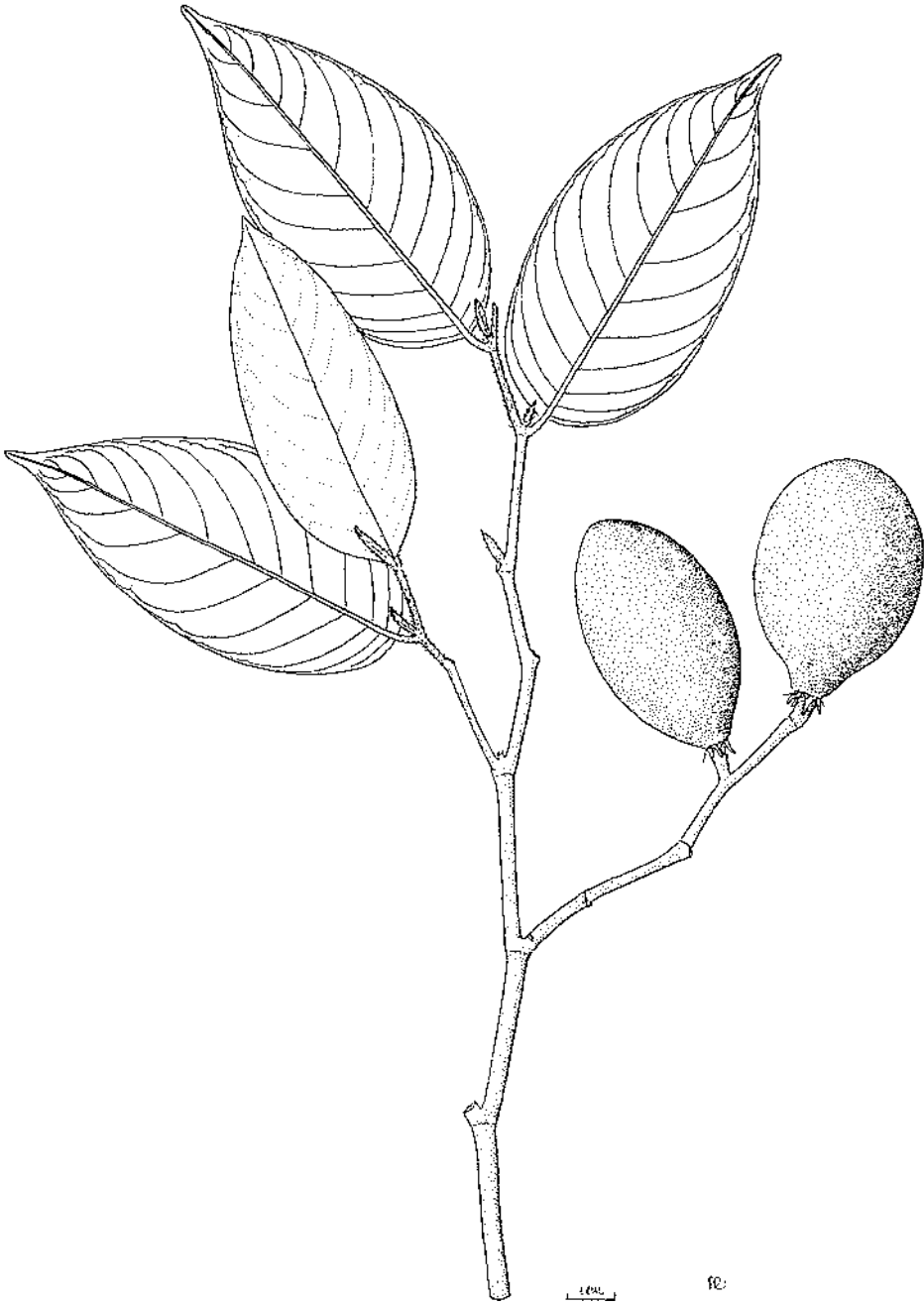
Fig. 34. *Kokoona ochracea* (Elmer) Merr.





Fig. 35. *Lophopetalum beccarianum* Pierre

(Celastraceae)



(Chrysobalanaceae) Fig. 36. *Atuna racemosa* Raf. subsp. *excelsa* (Jack) Prance

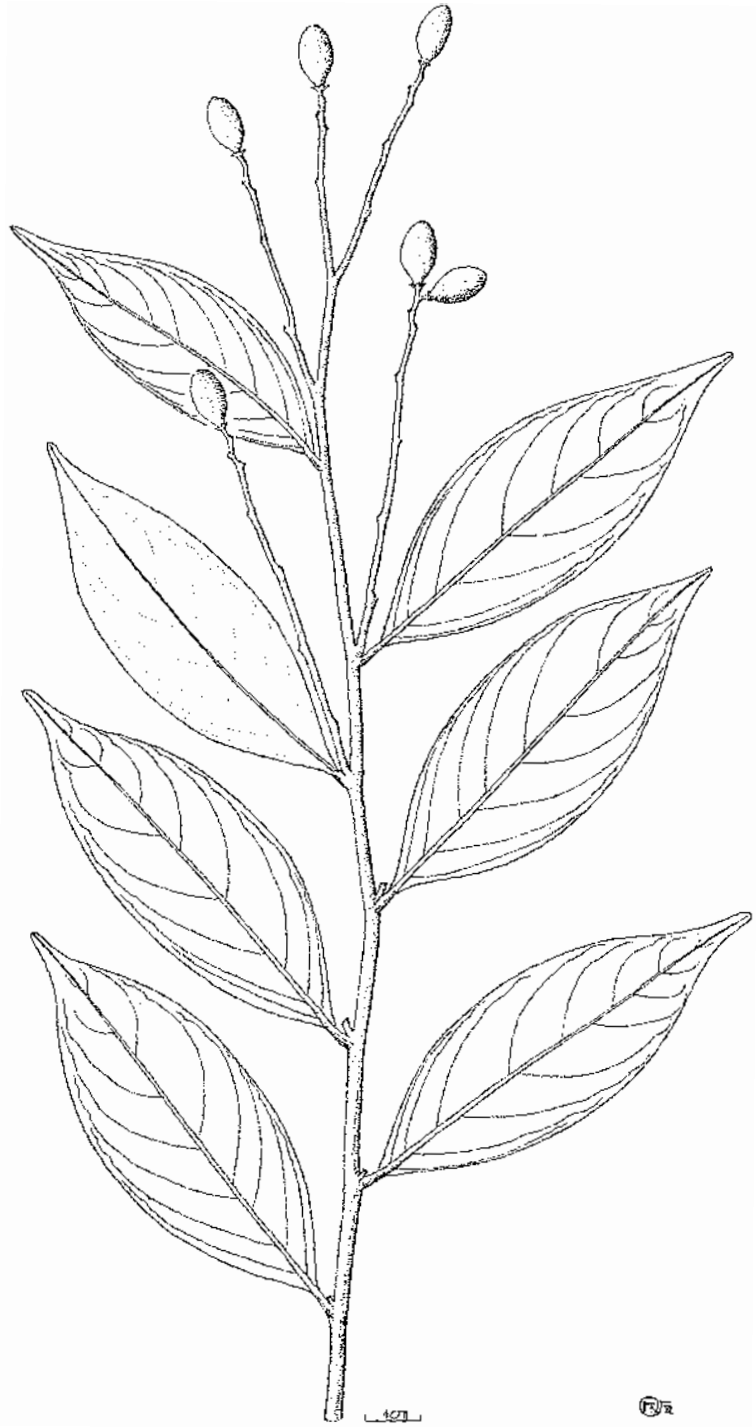


Fig. 37. *Licania splendens* (Korth.) Prance

(Chrysobalanaceae)



(Chrysobalanaceae)

Fig. 38. *Maranthes corymbosa* Blume

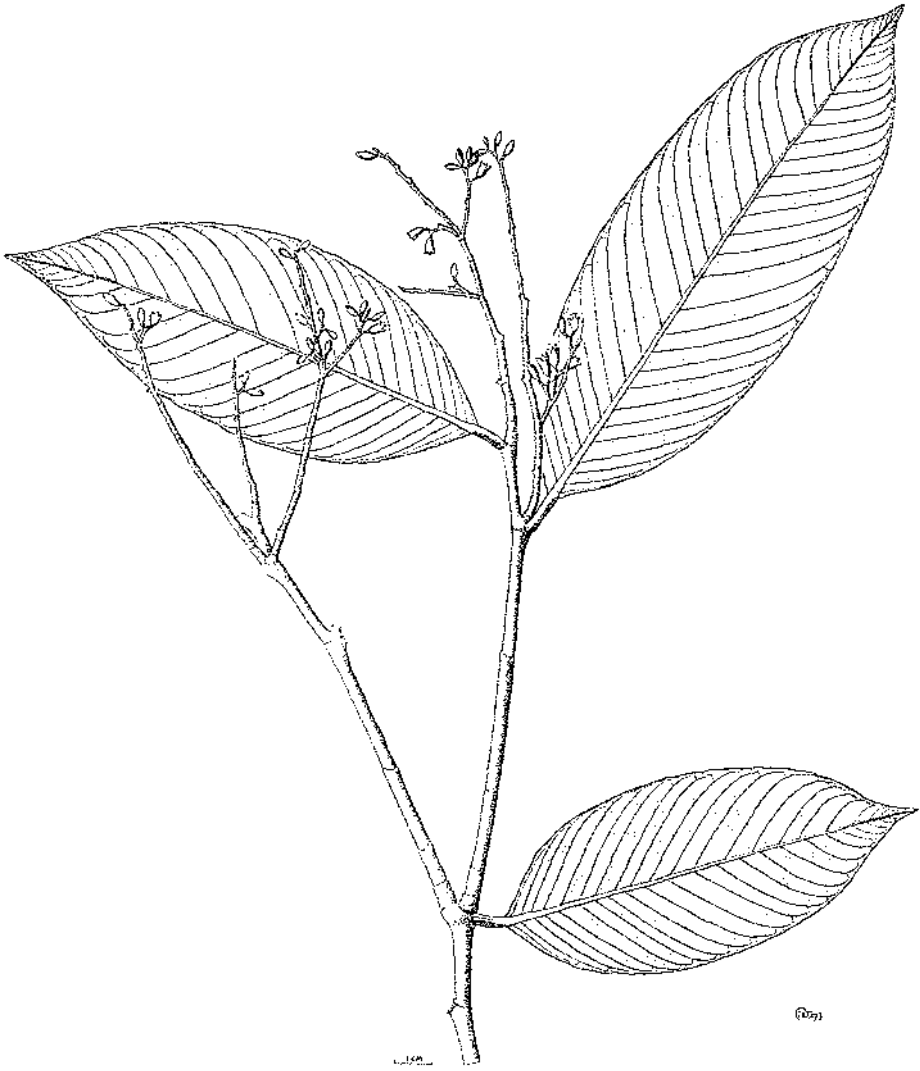
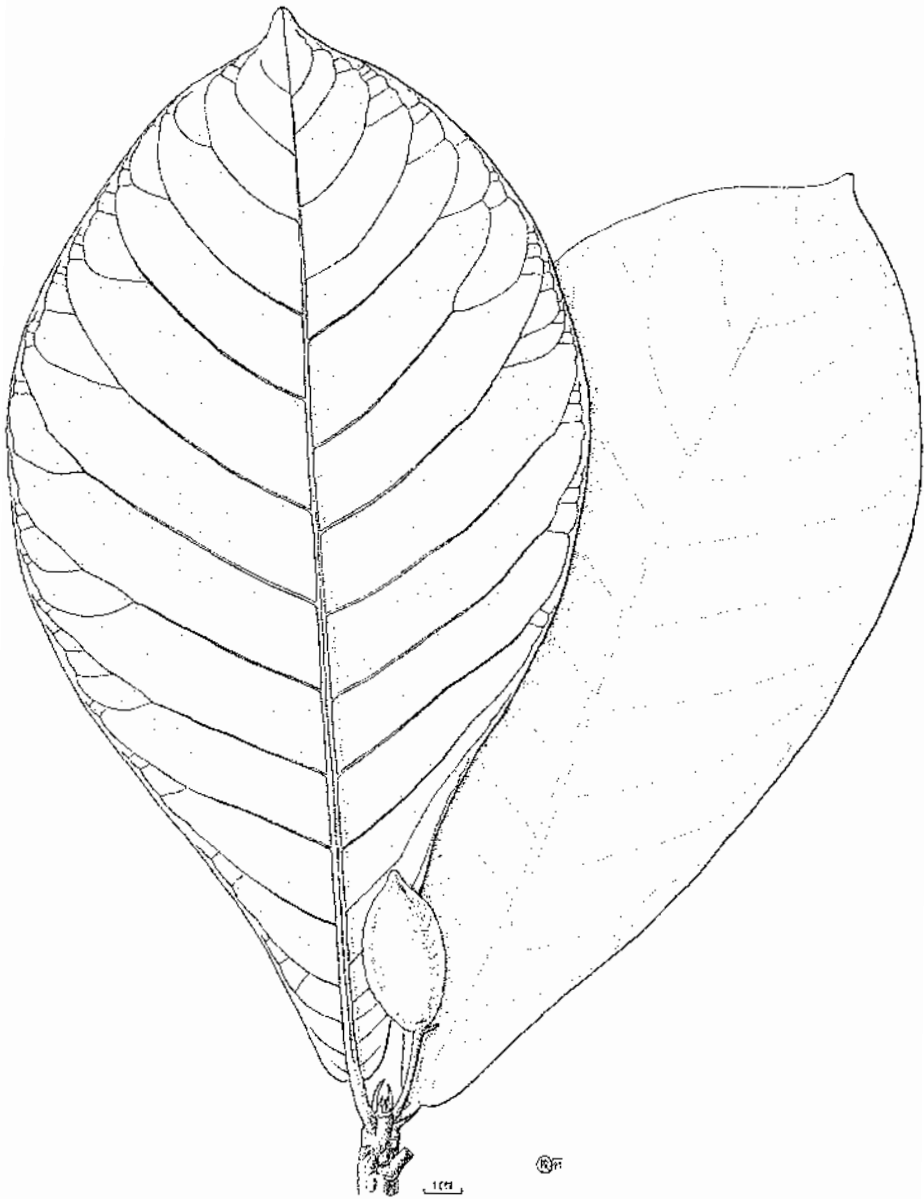


Fig. 39. *Parinari oblongifolia* Hook. f.

(Chrysobalanaceae)



(Combretaceae)

Fig. 40. *Terminalia catappa* L.

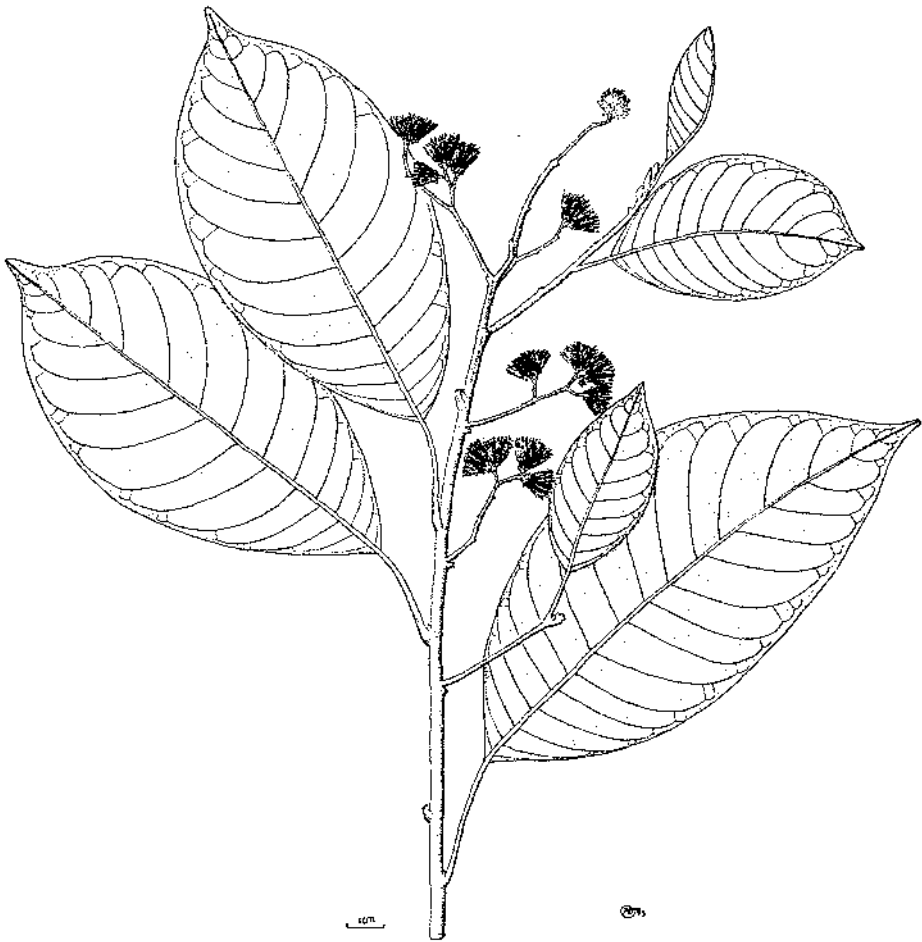


Fig. 41. *Vernonia arborea* Buch.-Ham.

(Compositae)



(Connaraceae) Fig. 42. *Ellipanthus tomentosus* Kurz. var. *gibbosus* Leenh.



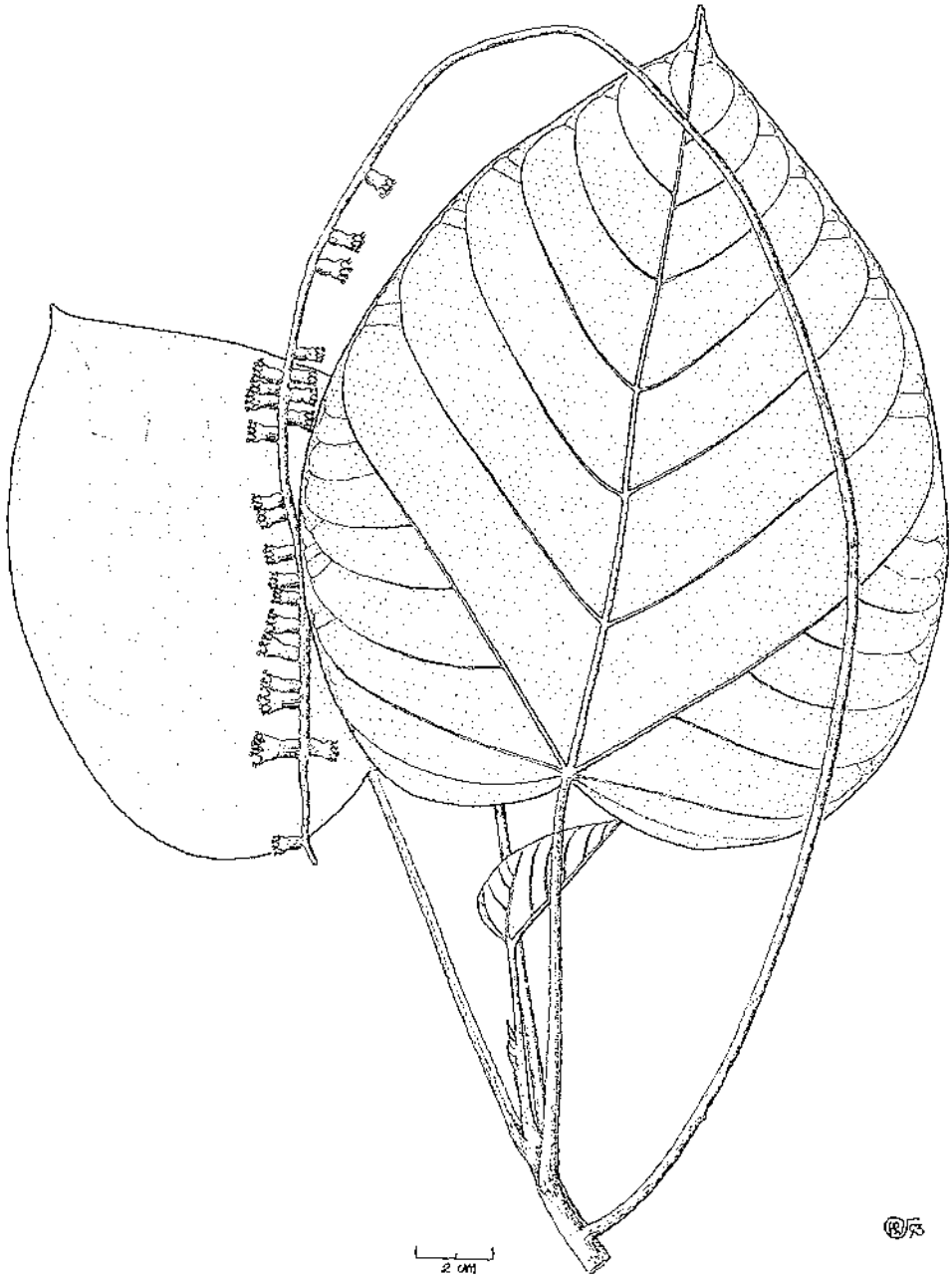


Fig. 43. *Octomeles sumatrana* Miq.

(Datisceae)



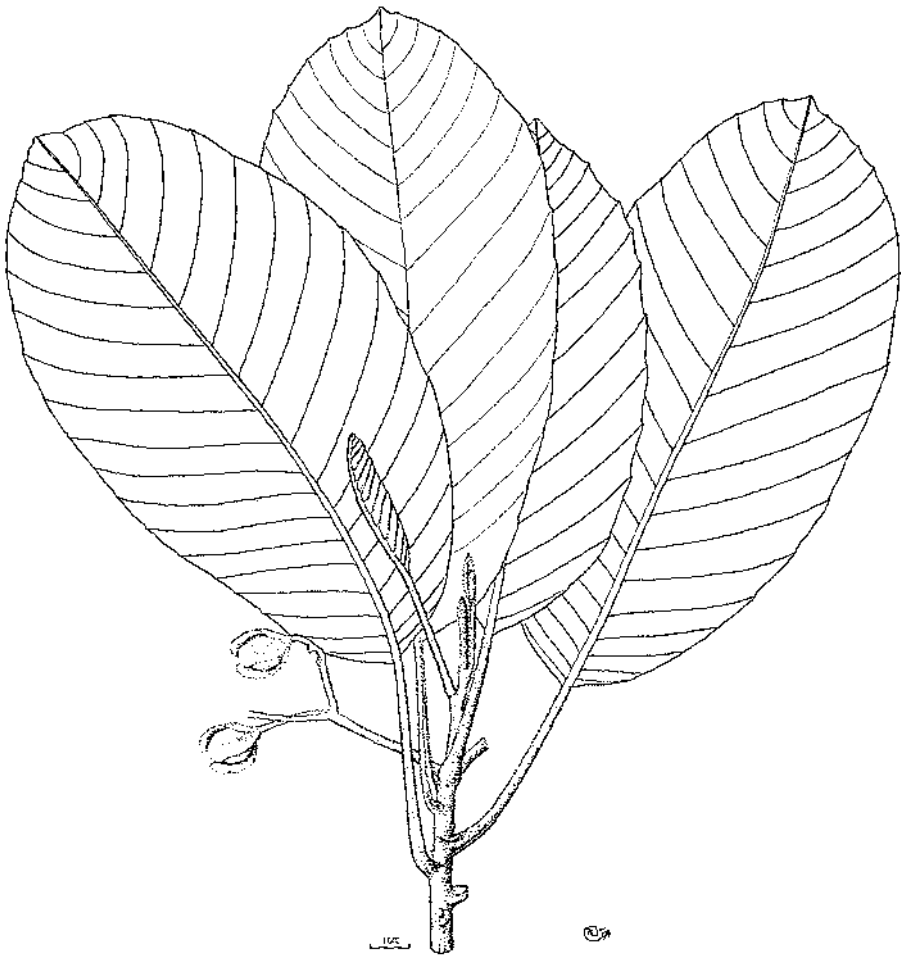
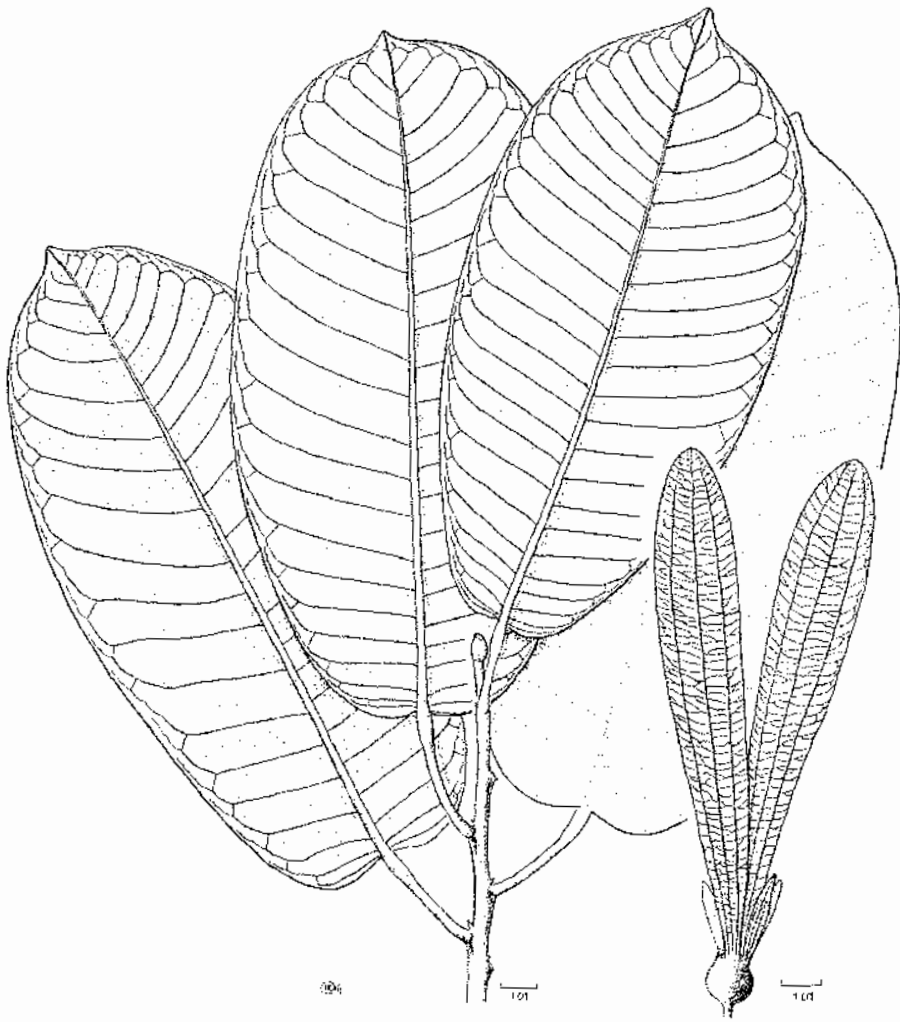


Fig. 44. *Dillenia grandifolia* Hook. f. & Thomson

(Dilleniaceae)



(Dipterocarpaceae)

Fig. 45. *Anisoptera costata* Korth.

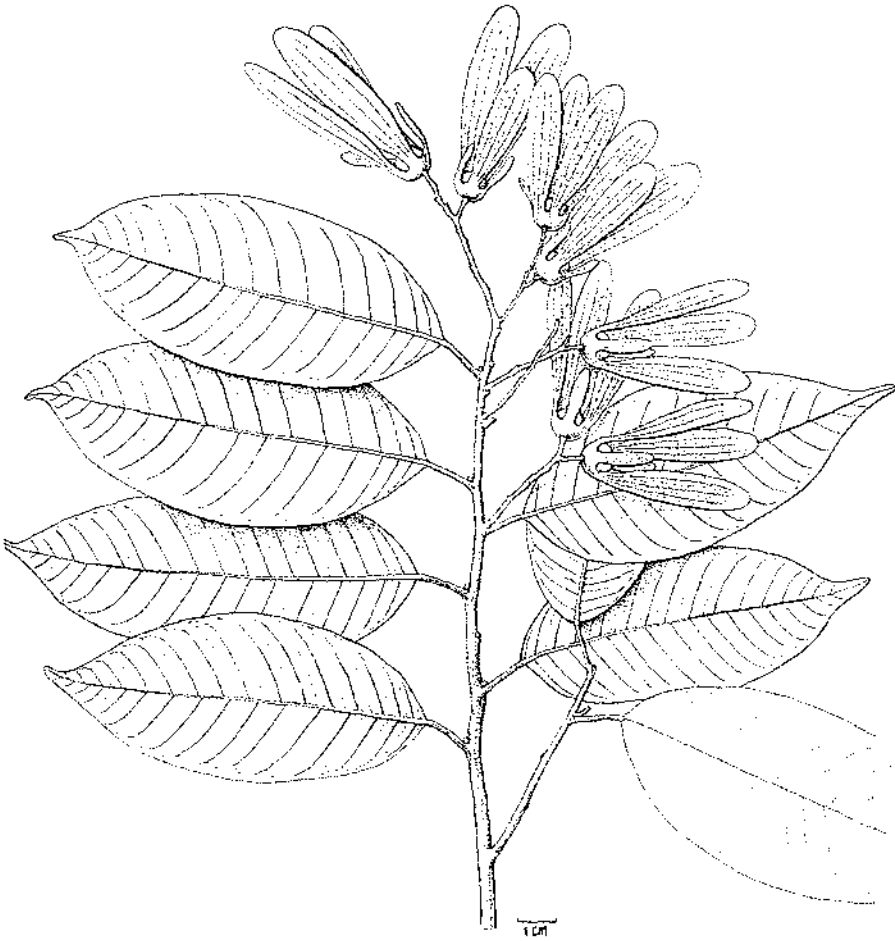
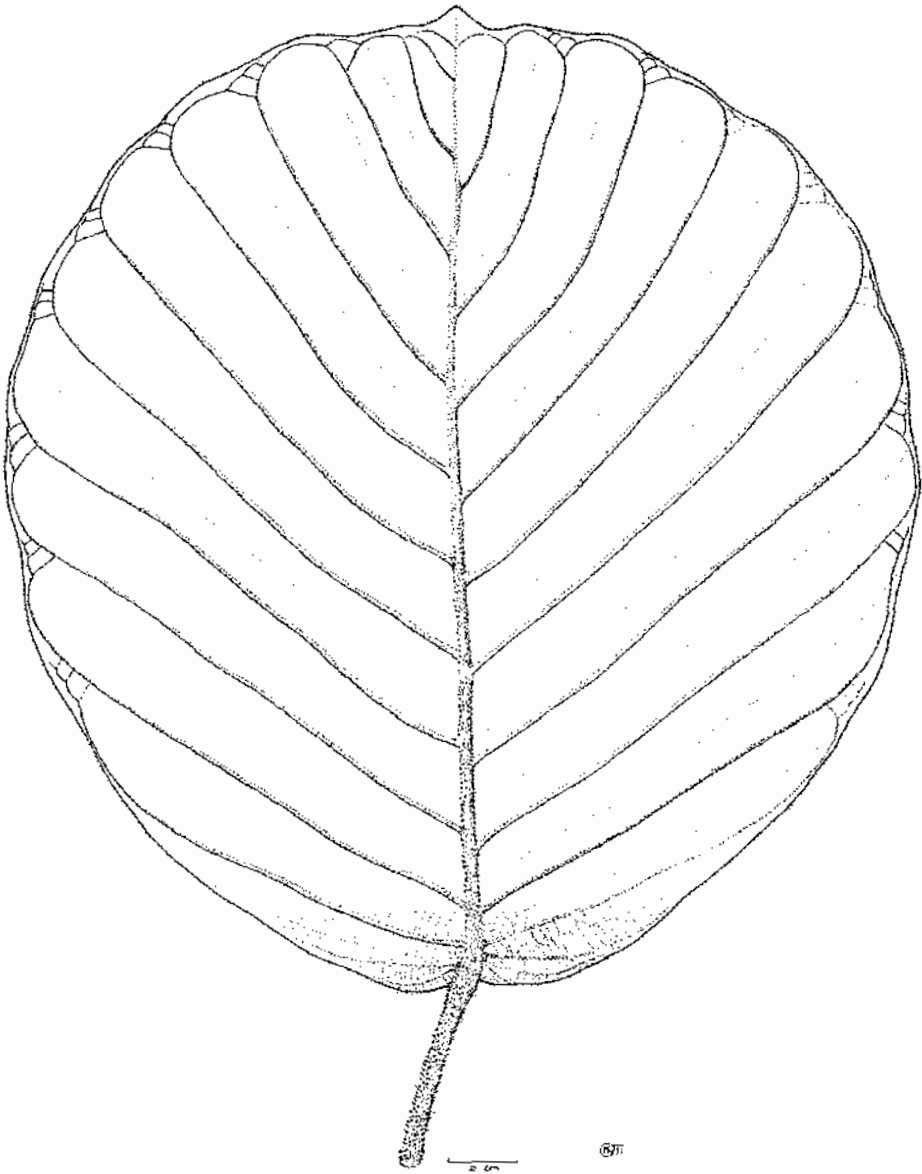


Fig. 46. *Corylelobium melanoxyton* (Hook. f.) Pierre (Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 47a. *Dipterocarpus confertus* Sloot.

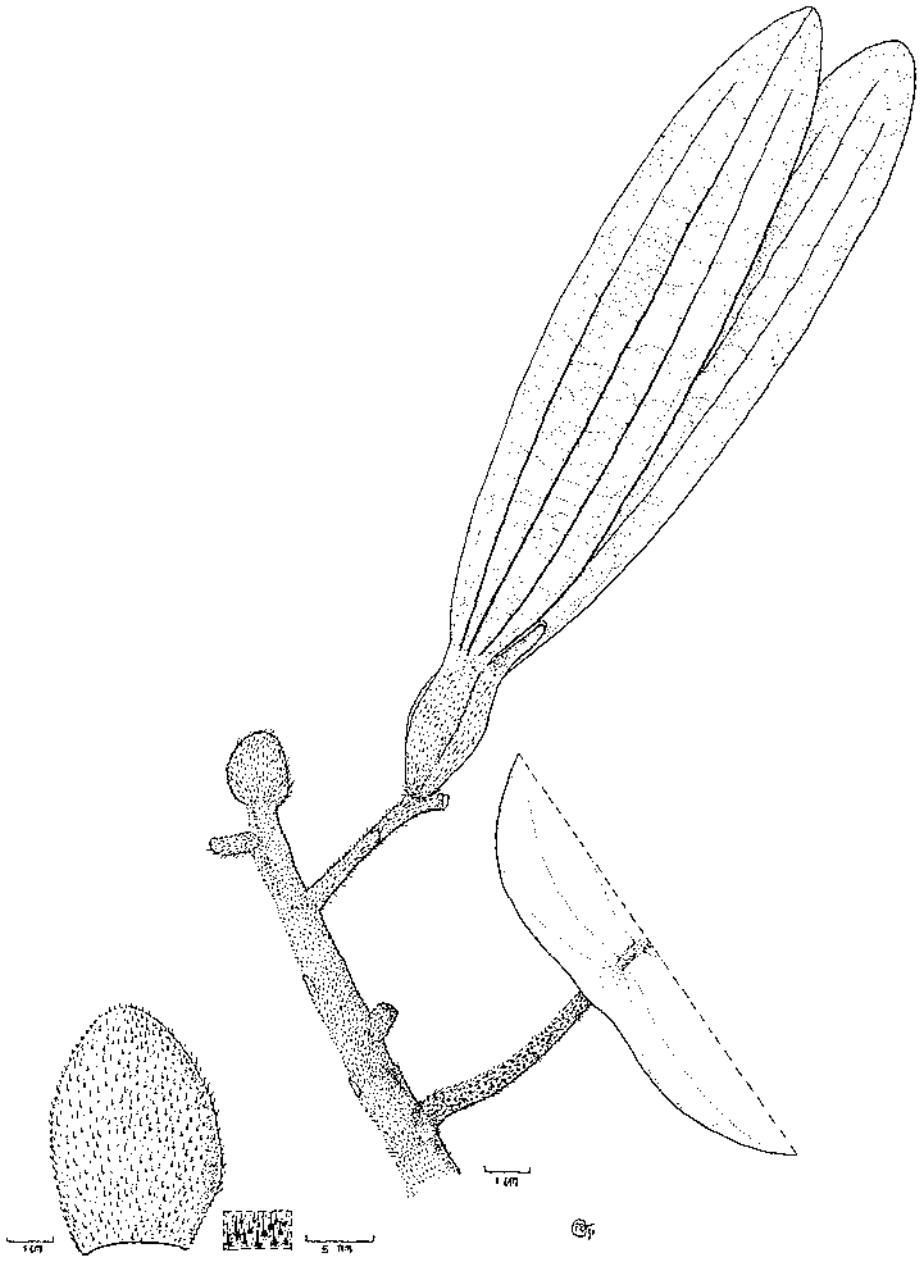
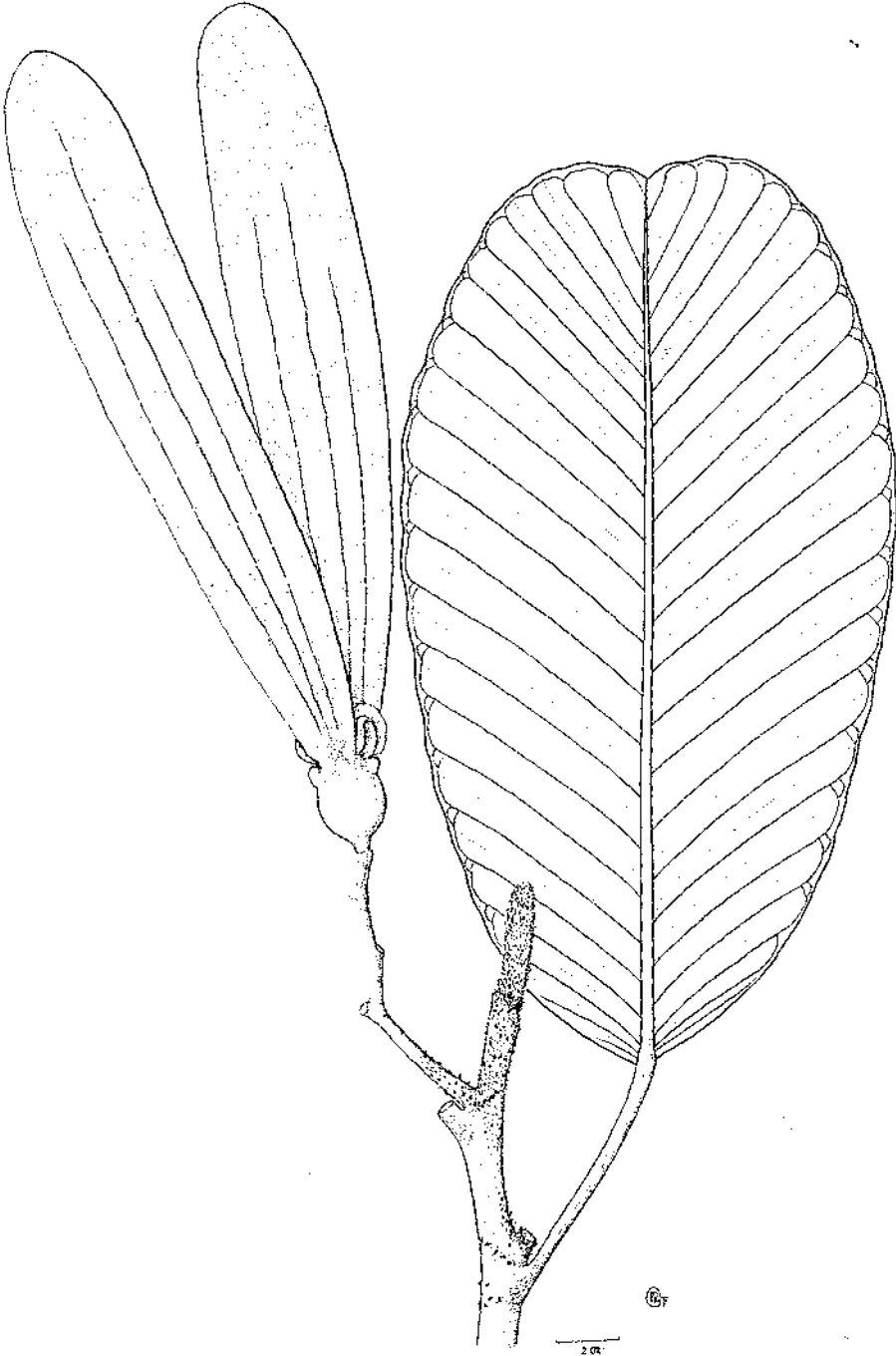


Fig. 47b. *Dipteroarpus confertus* Sloot.

(Dipteroarpaceae)



(Dipterocarpaceae)

Fig. 48. *Diptercarpus cornutus* Dyer



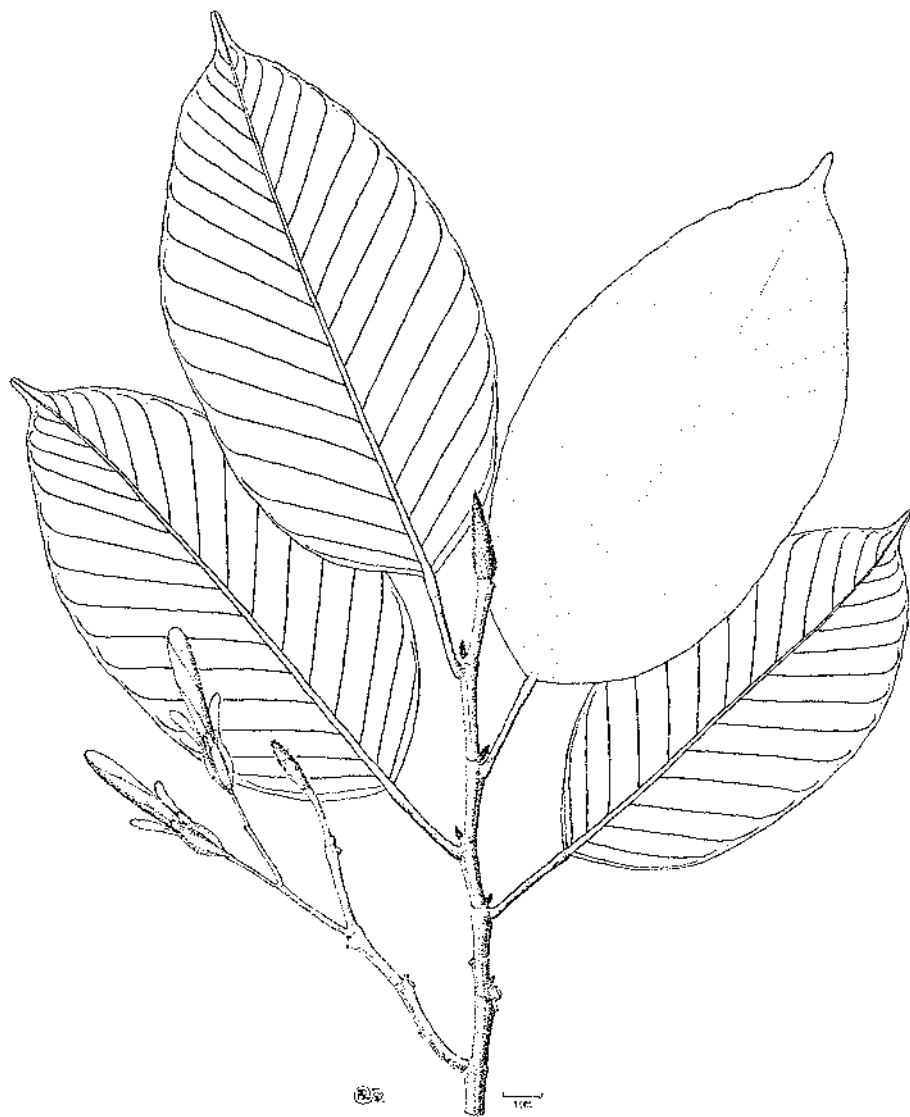
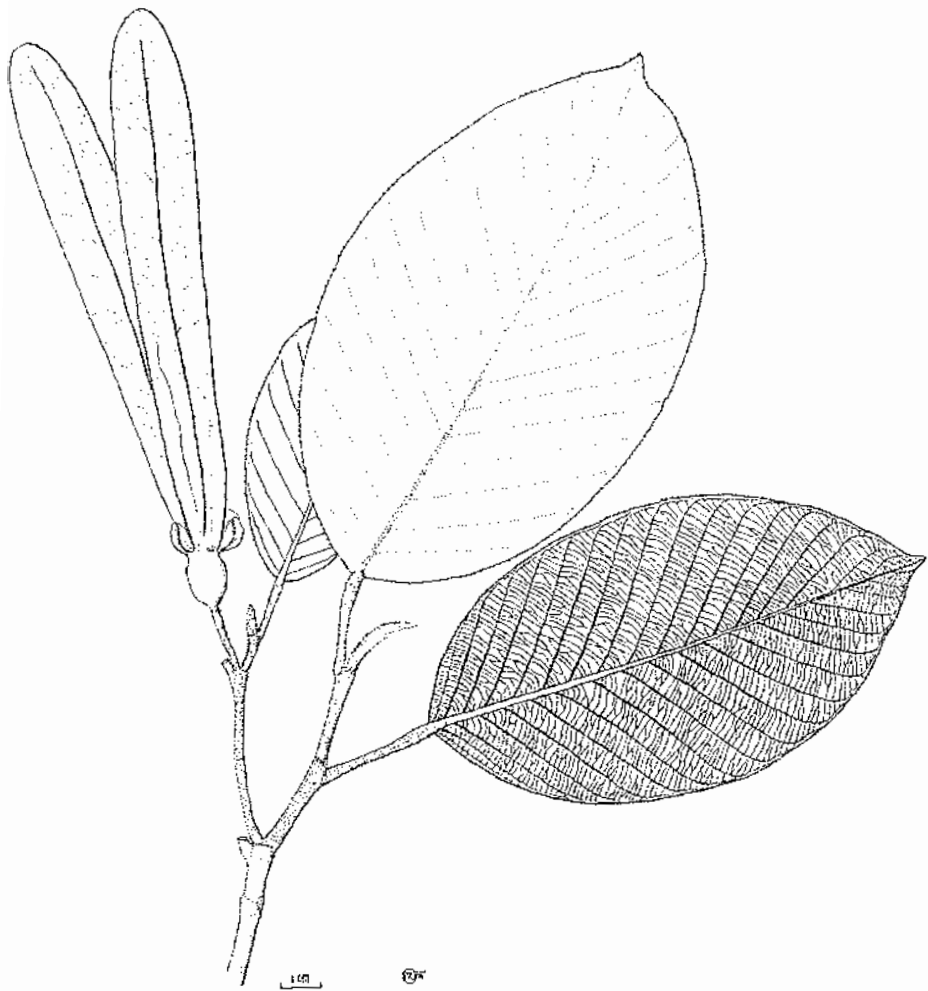


Fig. 49. *Diptercarpus fusiformis* Ashton

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 50. *Dipterocarpus gracilis* Blume

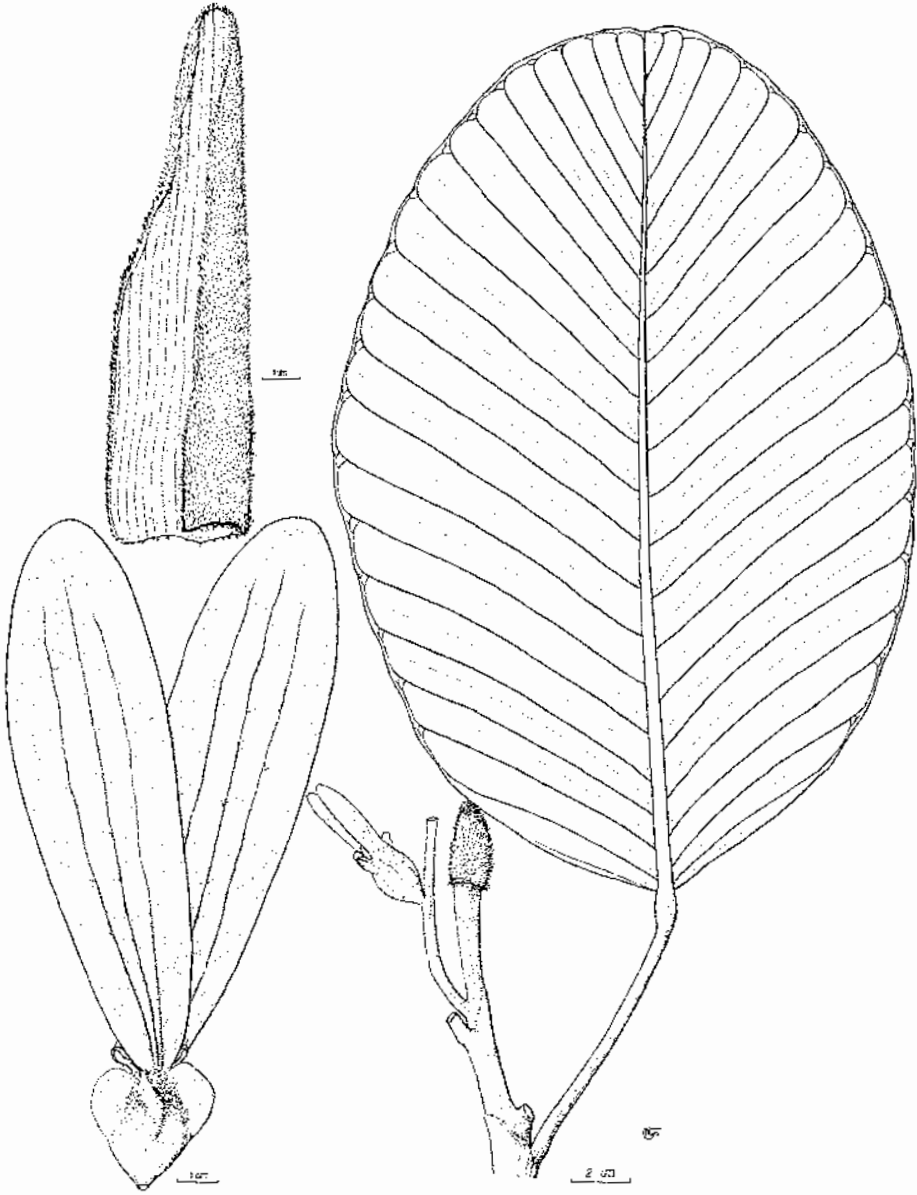
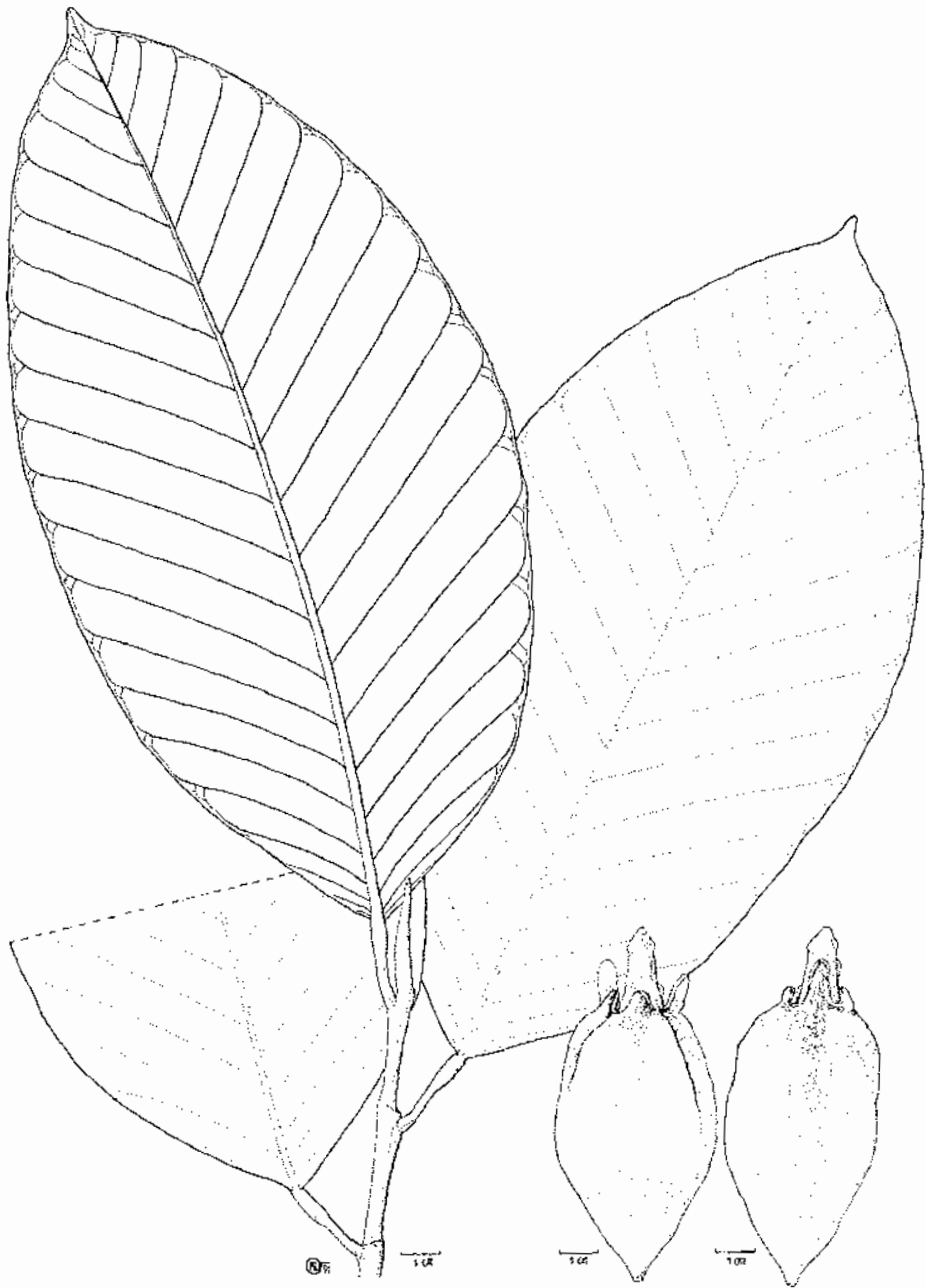


Fig. 51. *Dipterocarpus humeratus* Sloot.

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 52. *Diptercarpus tempehes* Sloot.



Fig. 53. *Dryobalanops beccarii* Dyer

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 54. *Hopea cernua* Teijsm. & BInn.

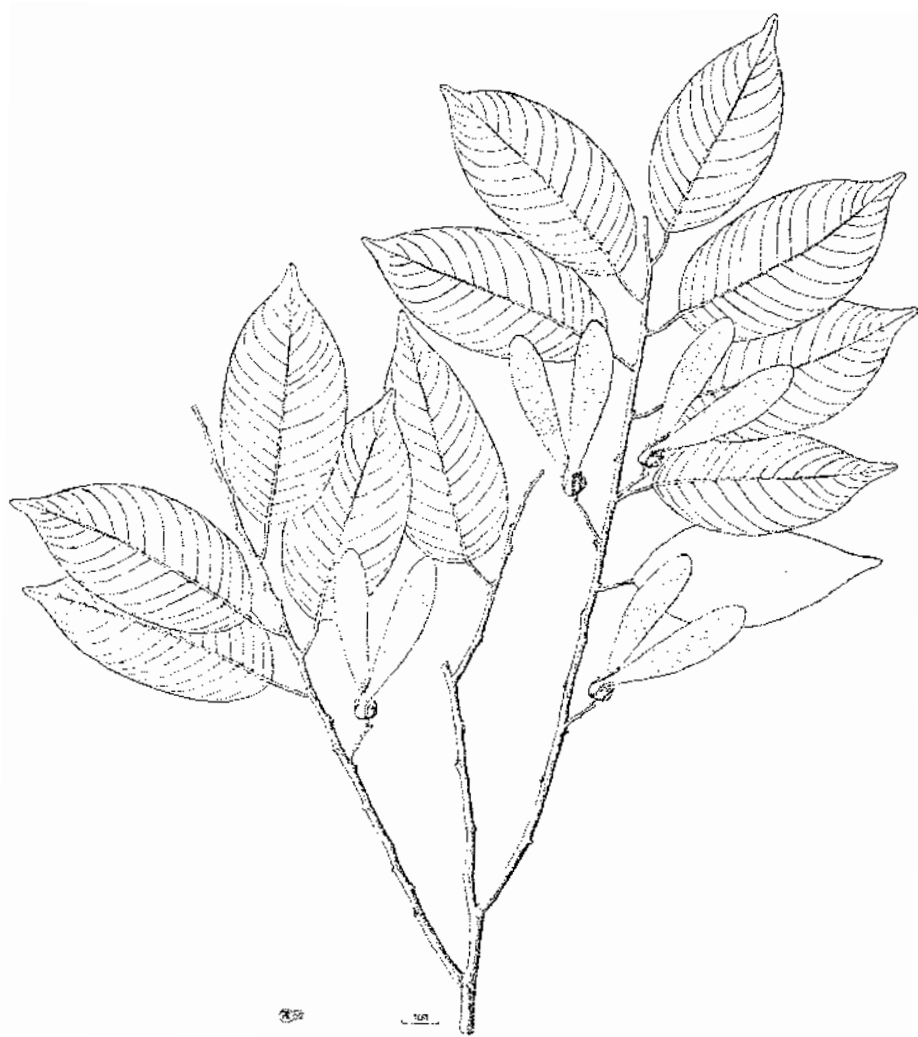
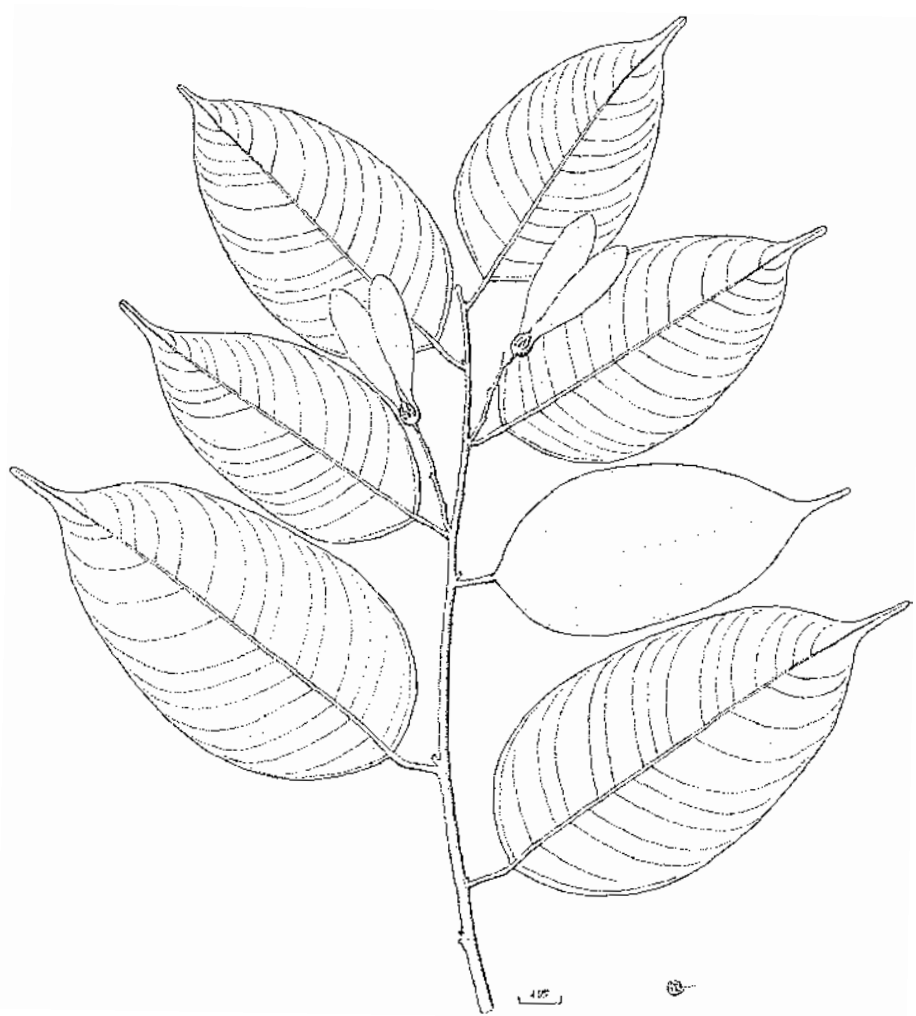


Fig. 55. *Hopea dryobalanoides* Miq.

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 56. *Hopea mengerawan* Miq.



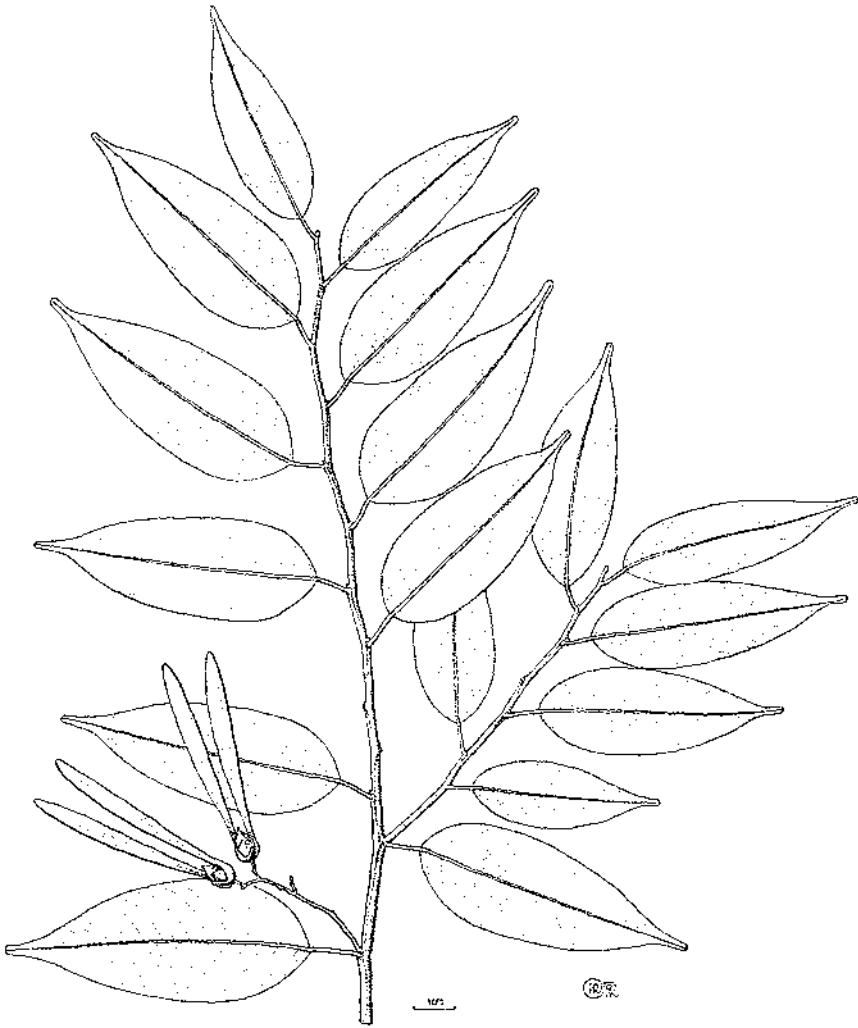


Fig. 57. *Hopea pedicellata* (Brand.) Sym.

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 58. *Hopea rudiformis* Ashton

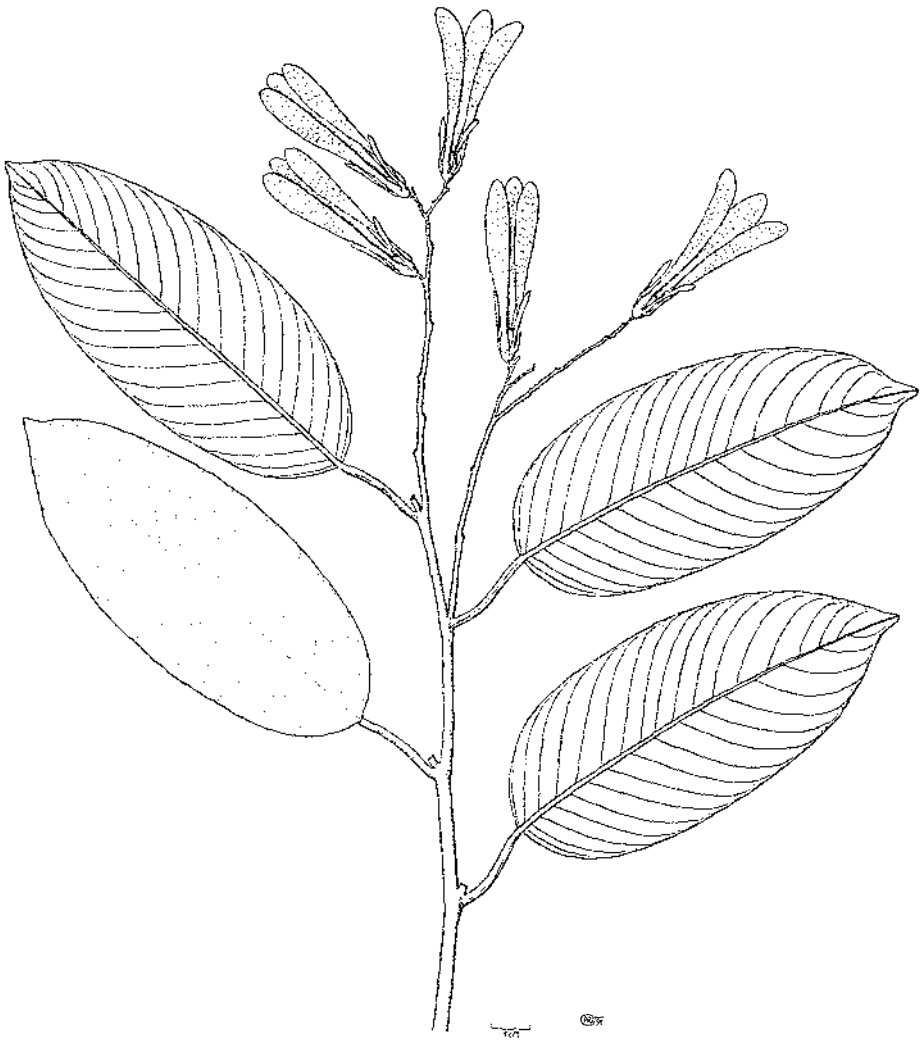
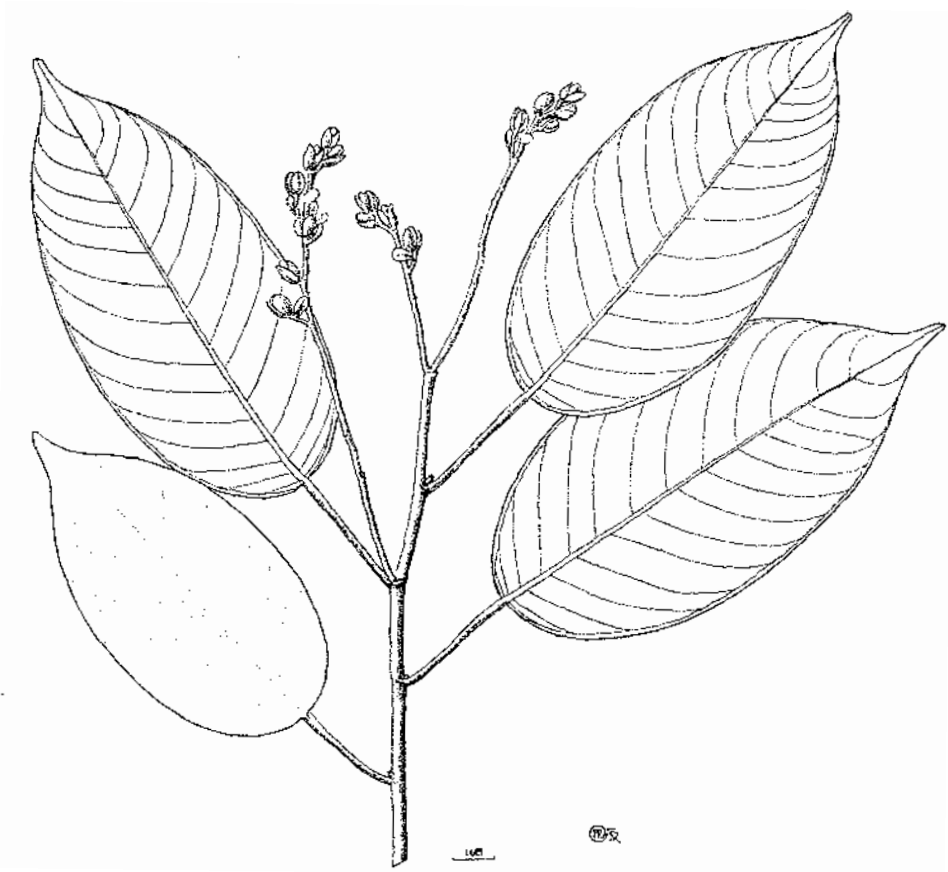


Fig. 59. *Shorea balangeran* (Korth.) Burck

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 60. *Shorea coriacea* Burck



Fig. 61. *Shorea gibbosa* Brandis

(Dipterocarpaceae)



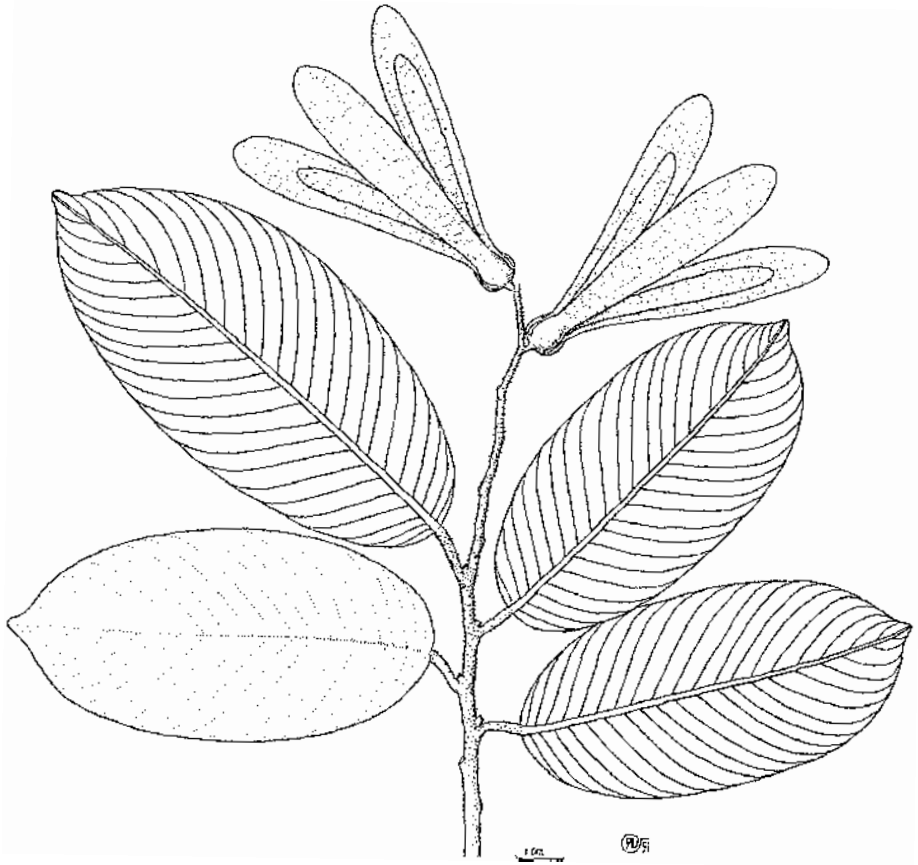
(Dipterocarpaceae)

Fig. 62. *Shorea johorensis* Foxw.



Fig. 63. *Shorea laevis* Ridley

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 64. *Shorea lamellata* Foxw.



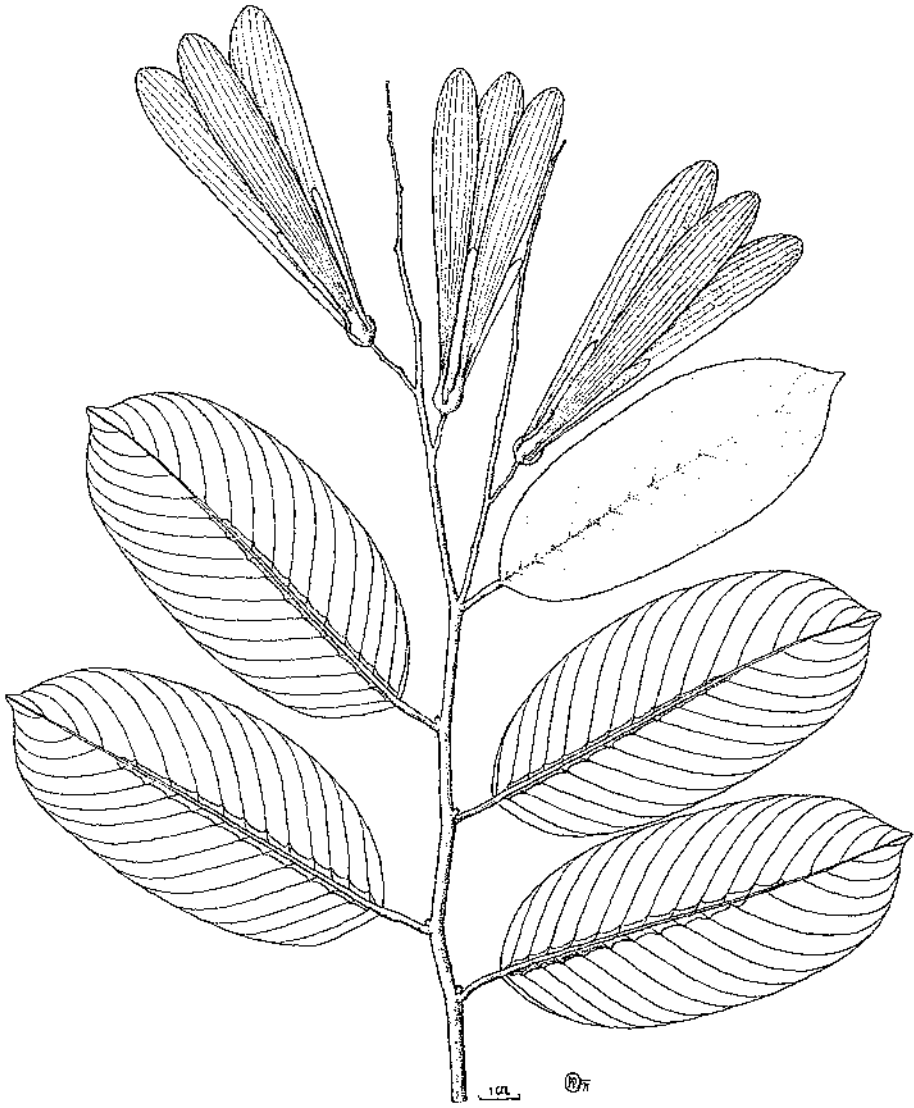


Fig. 65. *Shorea leprosula* Miq.

(Dipterocarpaceae)

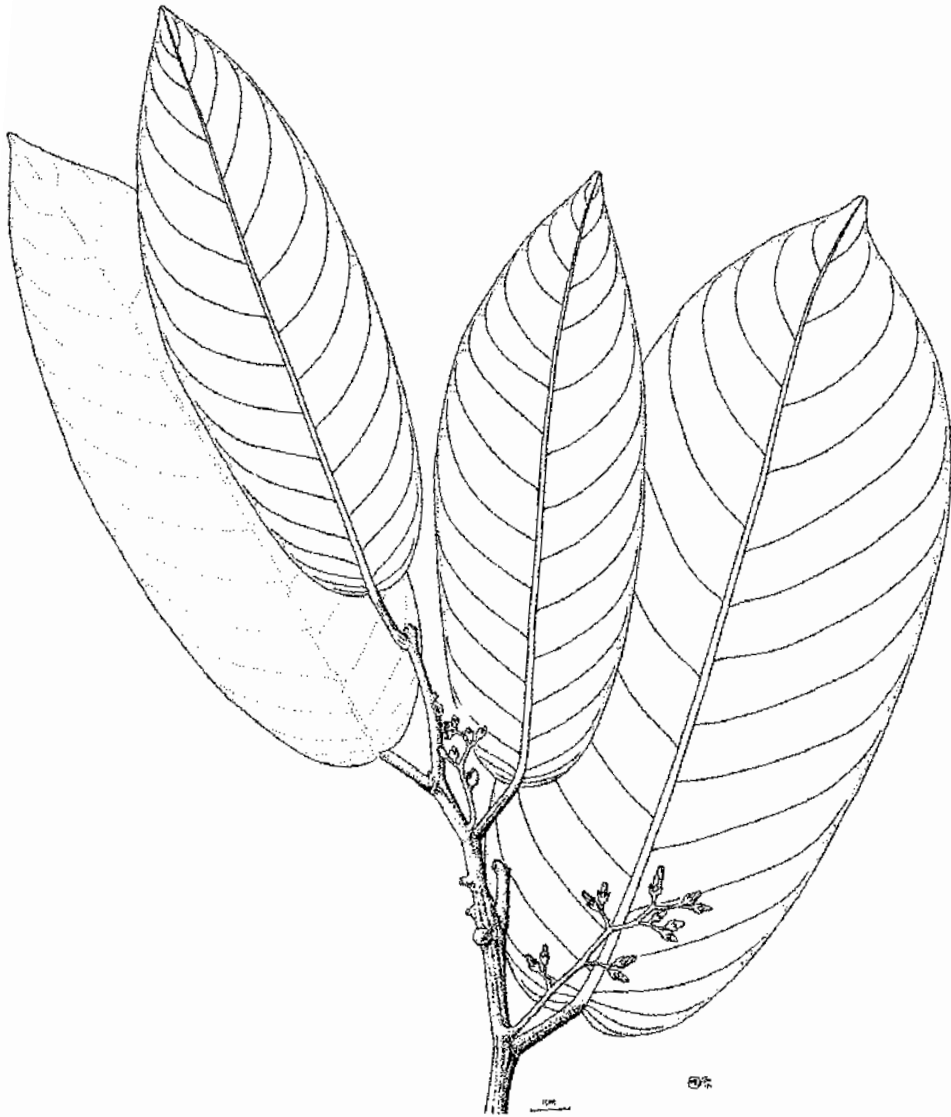


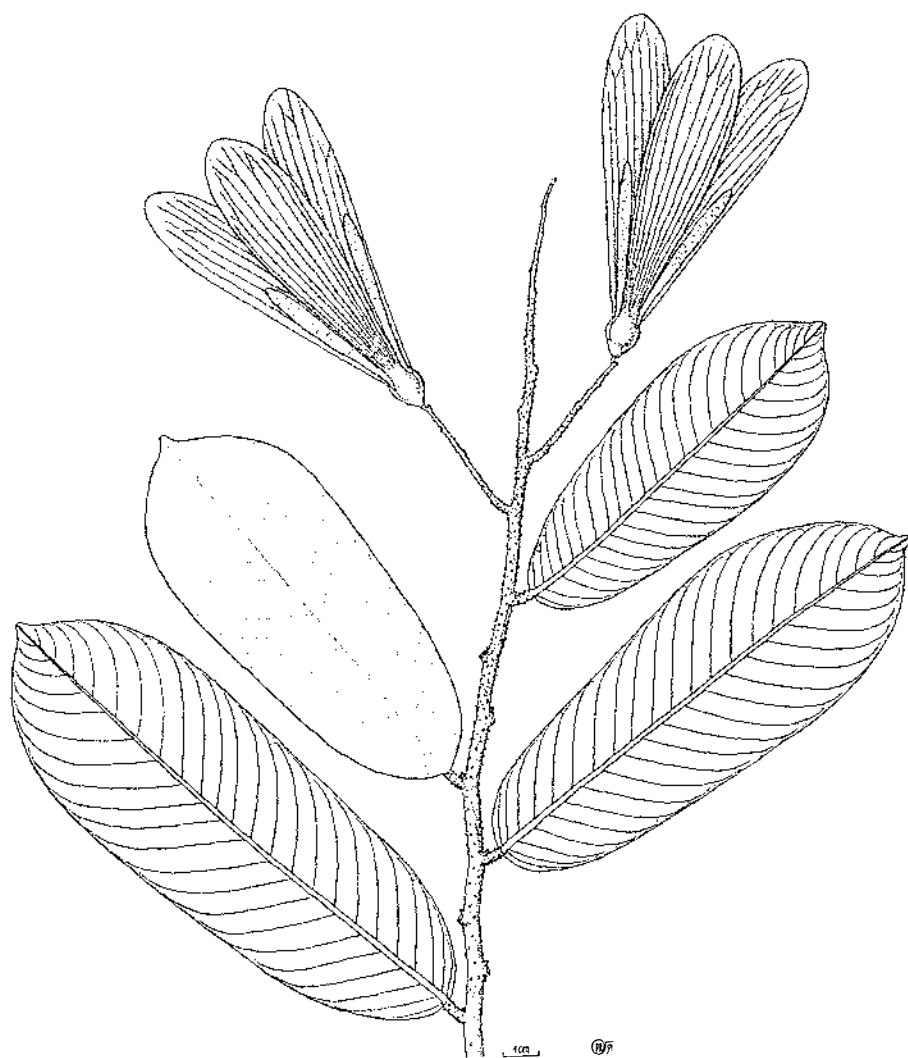
Fig. 66. *Shorea macrobalanos* Ashton

(Dipterocarpaceae)



Fig. 67. *Shorea mujongensis* Ashton

(Dipterocarpaceae)



(Dipterocarpaceae) Fig. 68. *Shorea ovalis* (Korth.) Blume subsp. *ovalis*

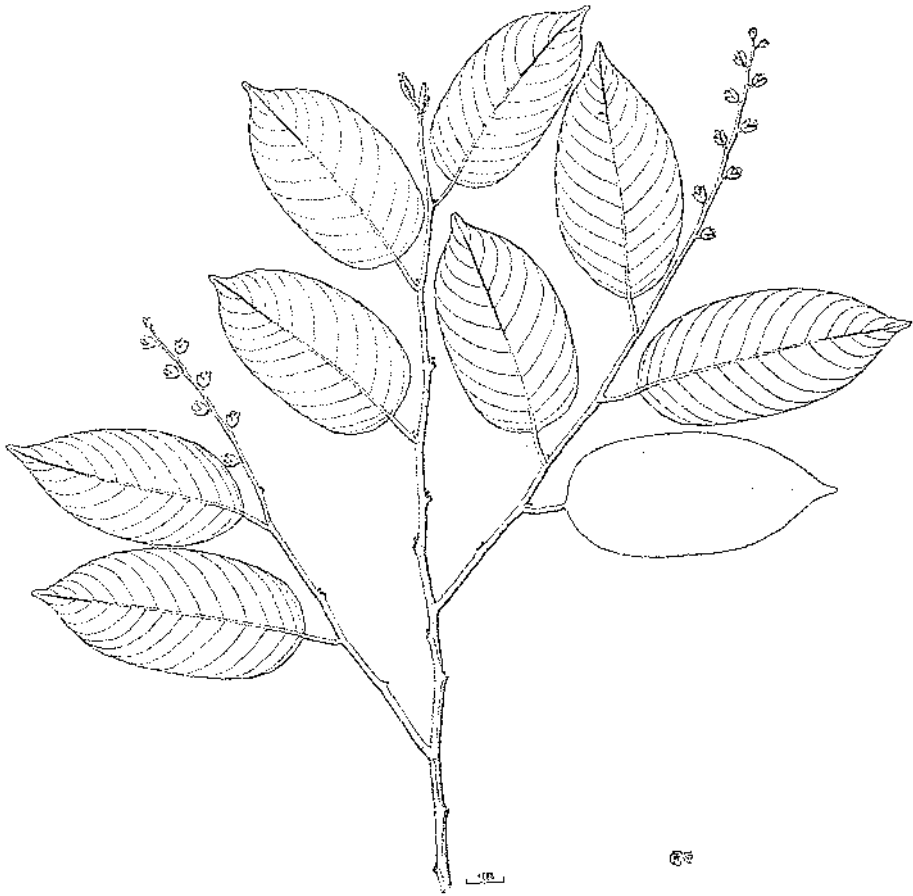
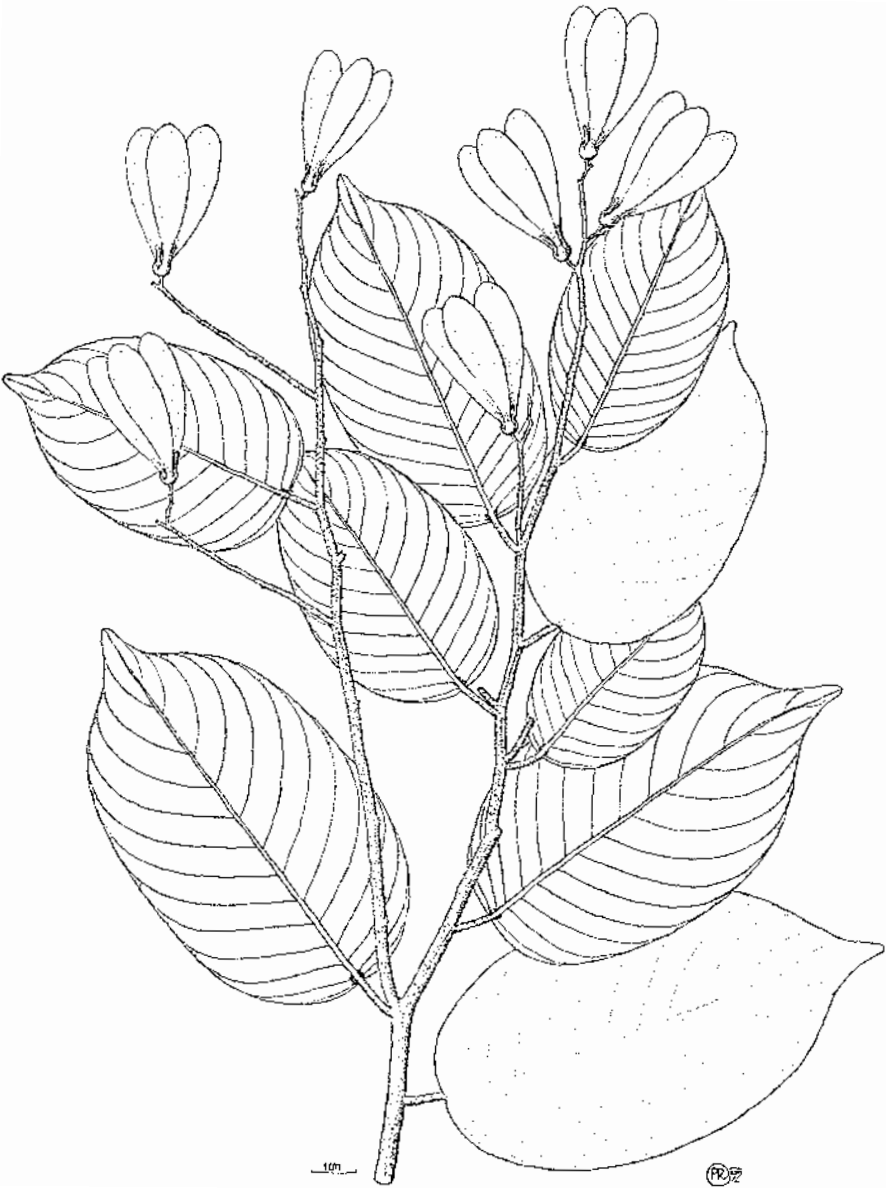


Fig. 69. *Shorea parvifolia* Dyer subsp. *parvifolia* (Dipterocarpaceae)



(Dipterocarpaceae) Fig. 70. *Shorea parvifolia* Dyer subsp. *velutinata* Ashton

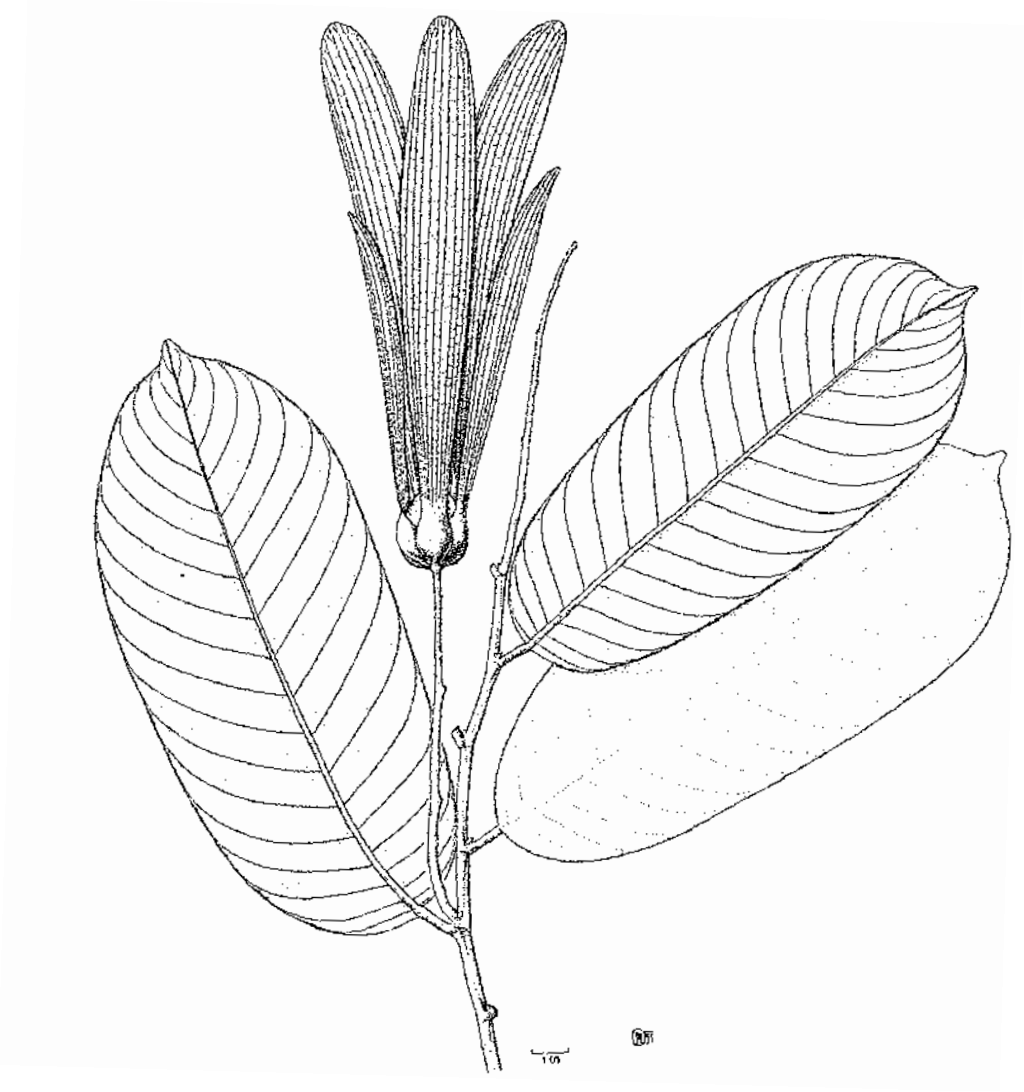
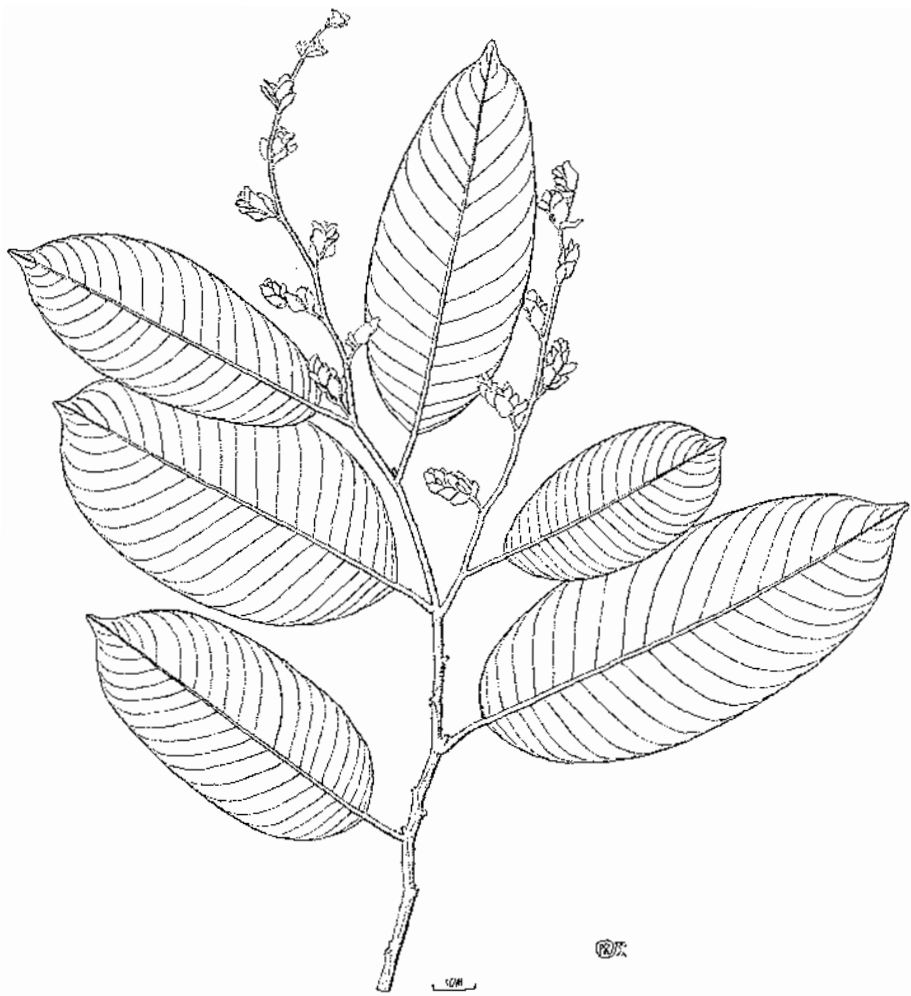


Fig. 71. *Shorea parvistipulata* Heim subsp. *albifolia* Ashton (Dipterocarpaceae)



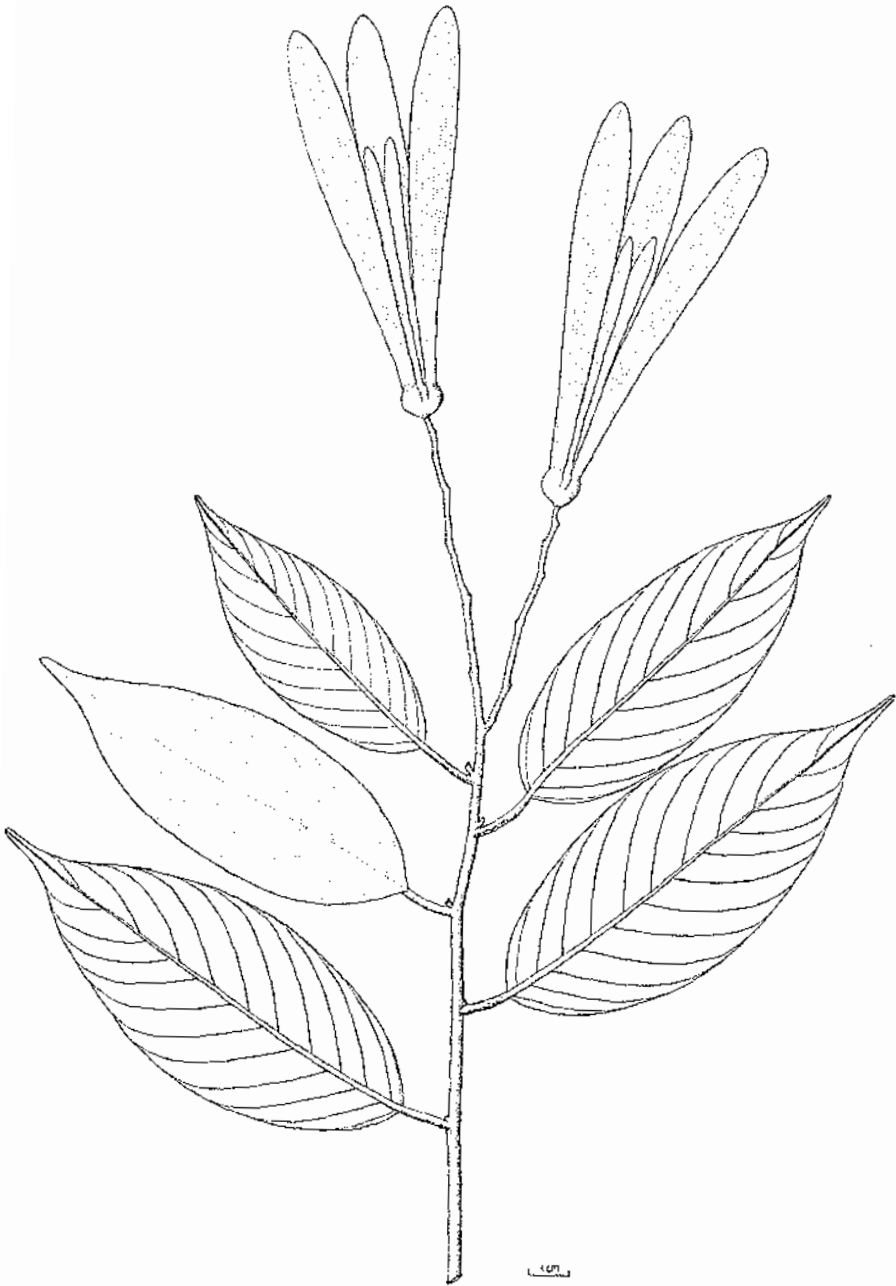
(Dipterocarpaceae) Fig. 72. *Shorea parvistipulata* Heim subsp. *parvistipulata*





Fig. 73. *Shorea patoiensis* Ashton

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 74. *Shorea pauciflora* King

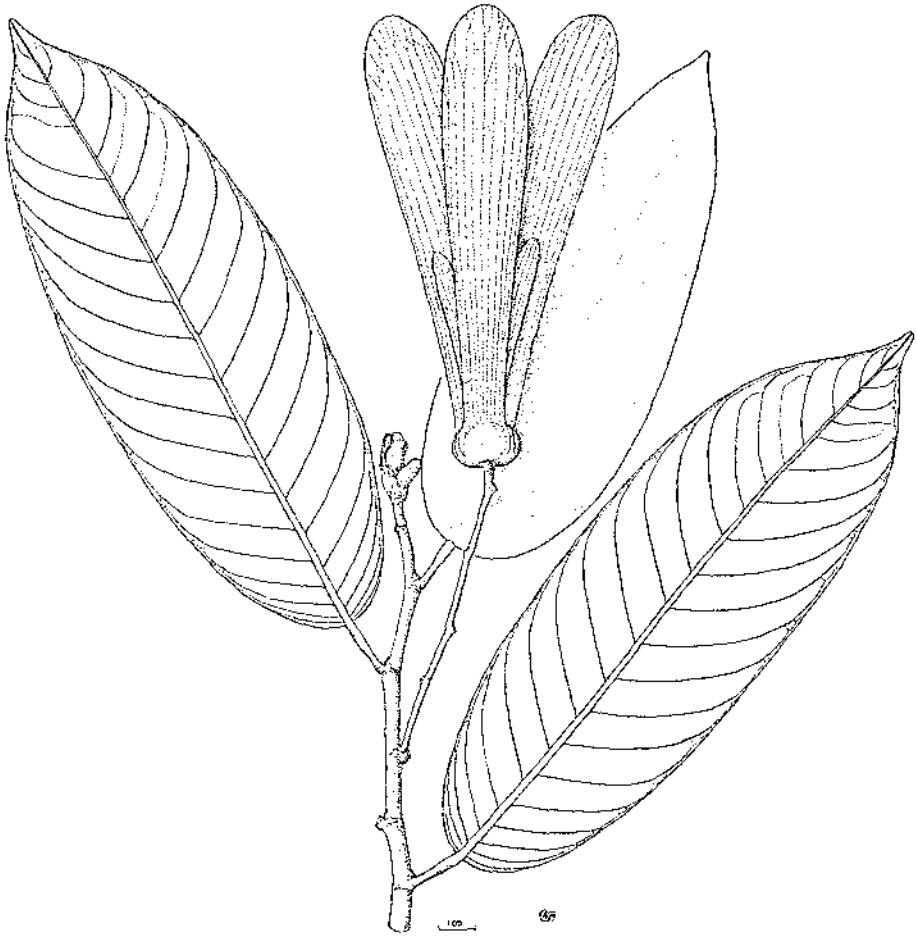
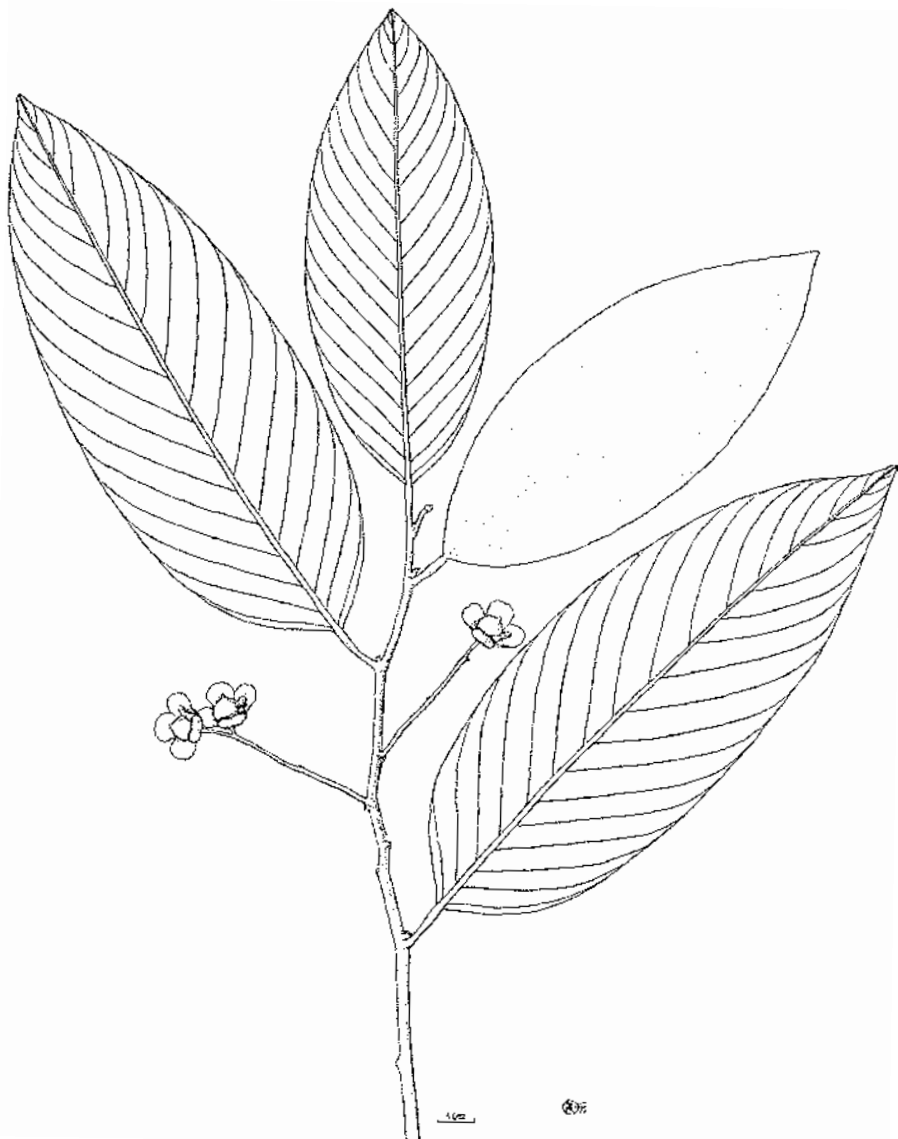


Fig. 75. *Shorea pinanga* Scheff.

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 76. *Shorea seminis* (De Vriese) Sloot.

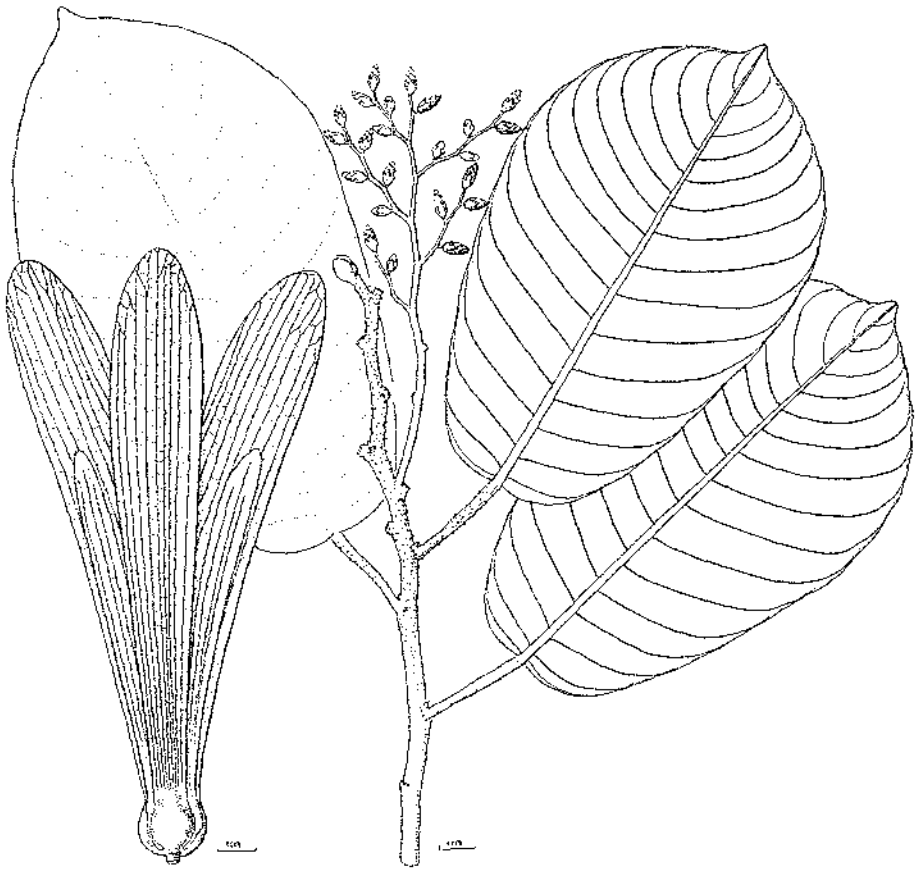
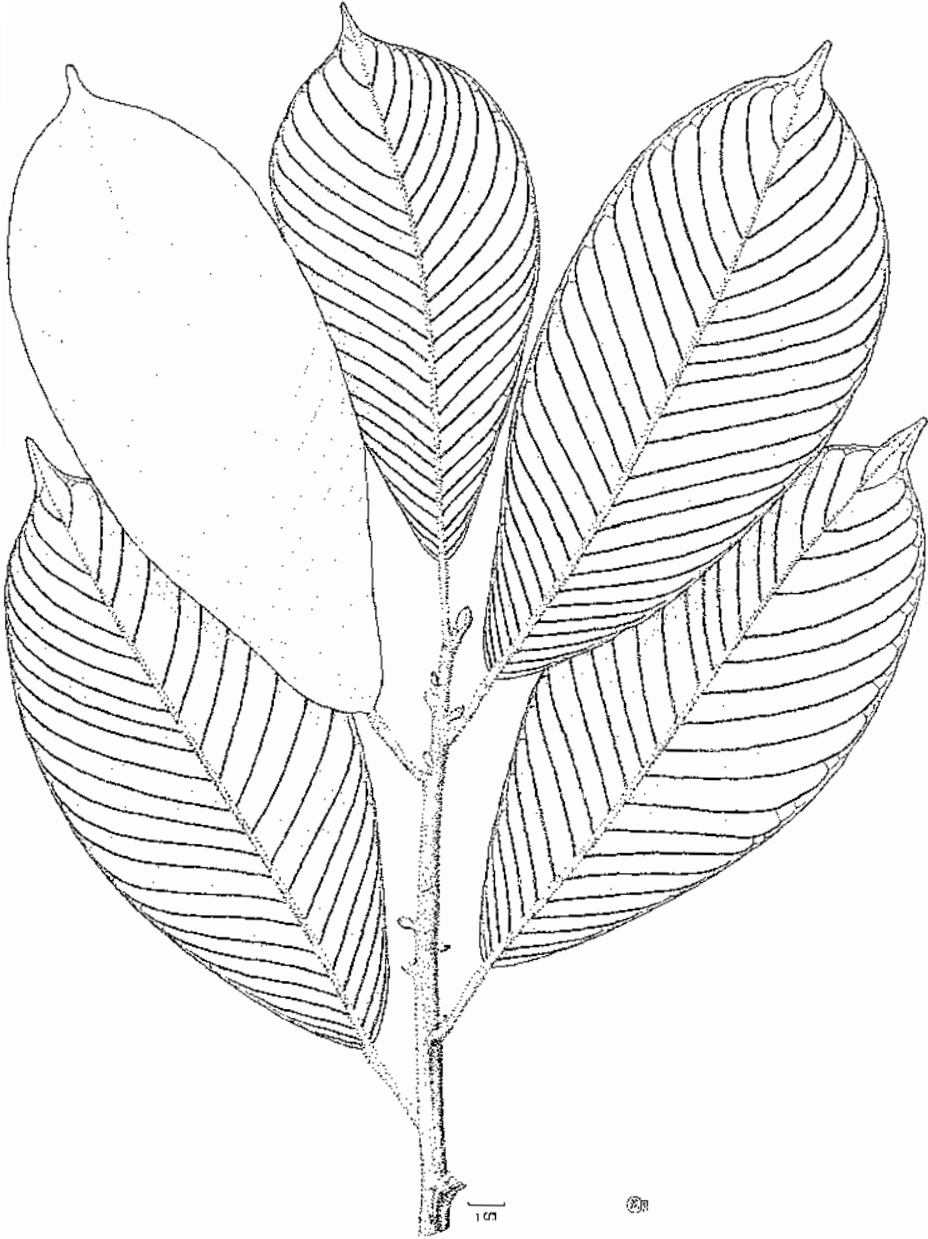


Fig. 77. *Shorea smithiana* Sym.

(Dipterocarpaceae)



(Dipterocarpaceae) Fig. 78. *Vatica javanica* Sloot. var. *scaphifolia* (Kosterm.) Ashton



Fig. 79. *Vatica oblongifolia* Hook. f. subsp. *oblongifolia* (Dipterocarpaceae)



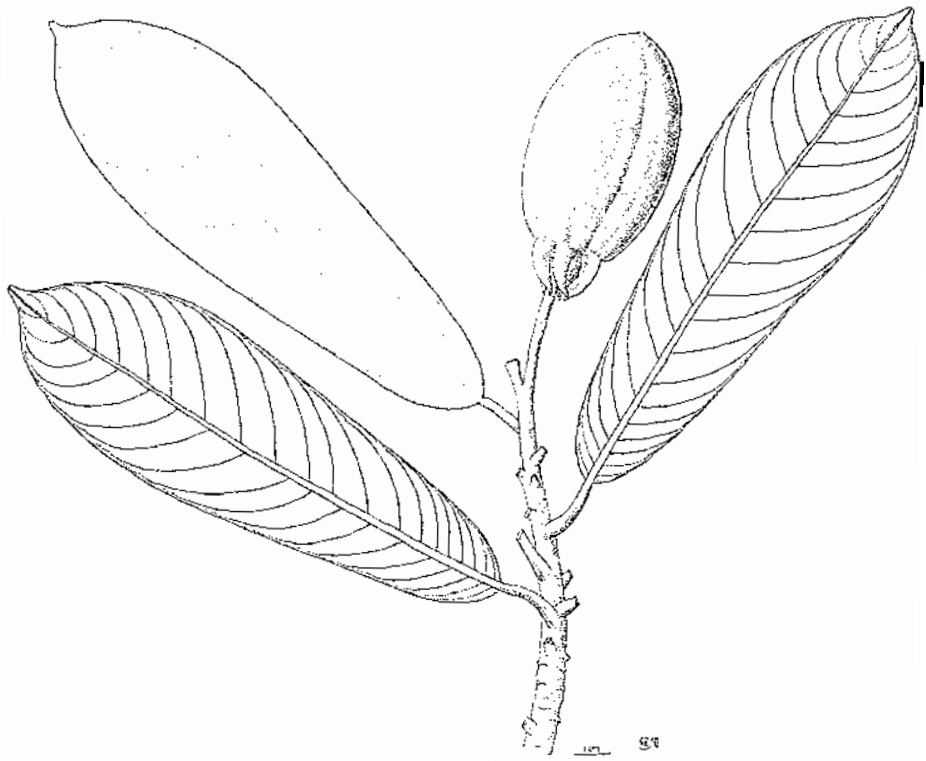
(Dipterocarpaceae) Fig. 80. *Vatica odorata* (Griff.) Sym. subsp. *odorata*





Fig. 81. *Vatica pauciflora* (Korth.) Blume

(Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 82. *Vatica rassak* (Korth.) Blume

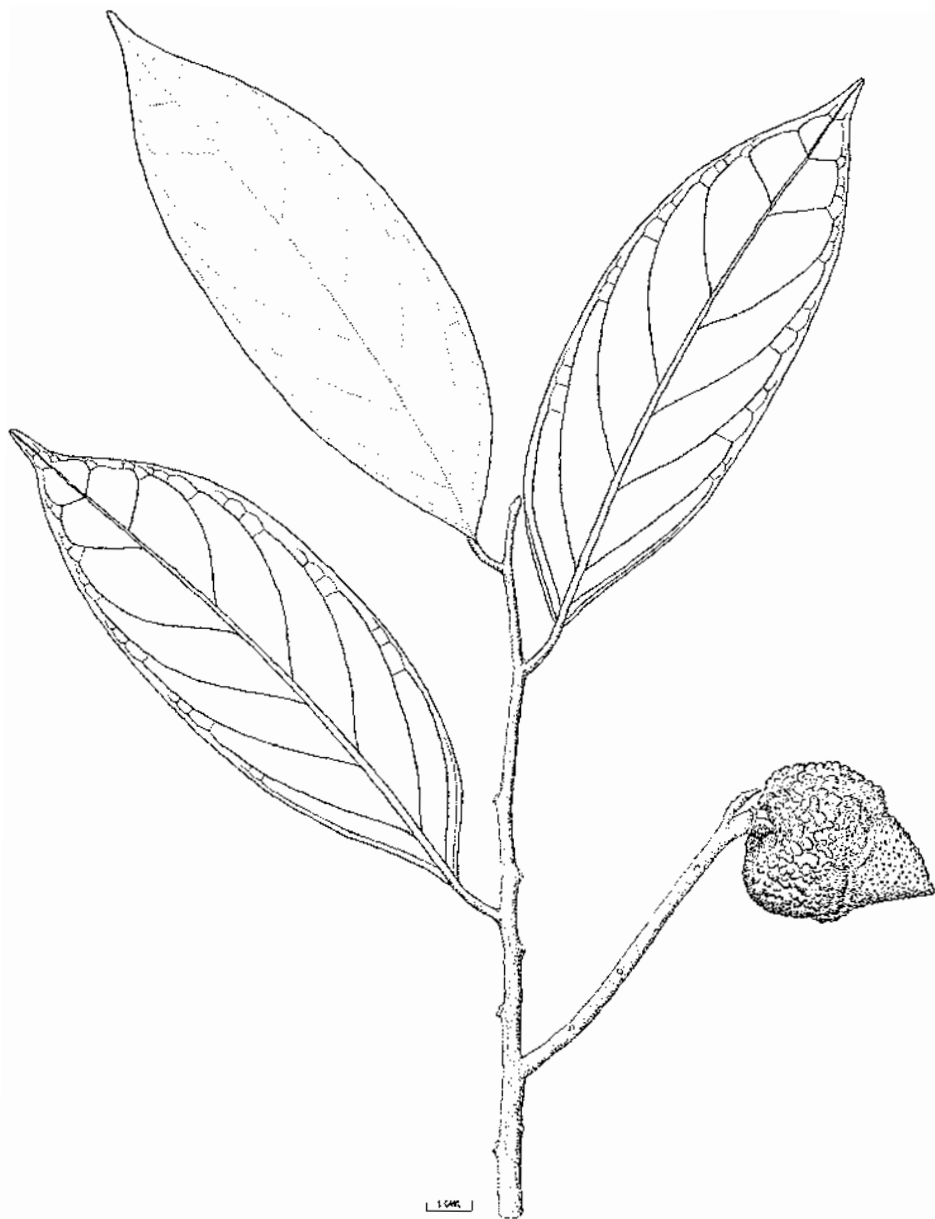
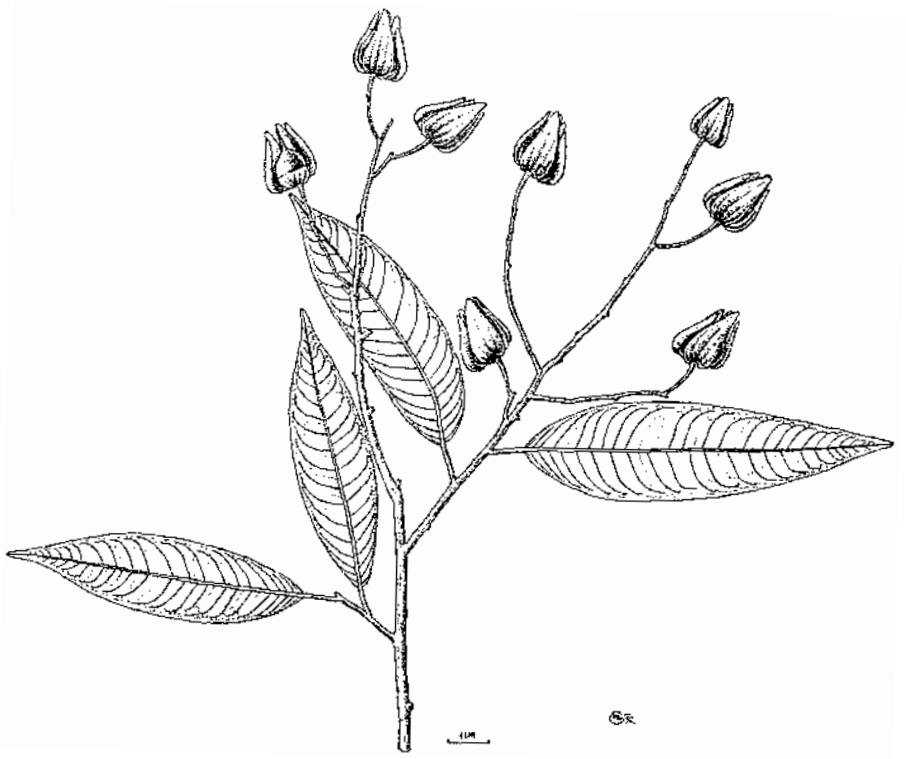


Fig. 83. *Vatica umbonata* (Hook. f.) Burck subsp. *umbonata* (Dipterocarpaceae)



(Dipterocarpaceae)

Fig. 84. *Vatica venulosa* Blume

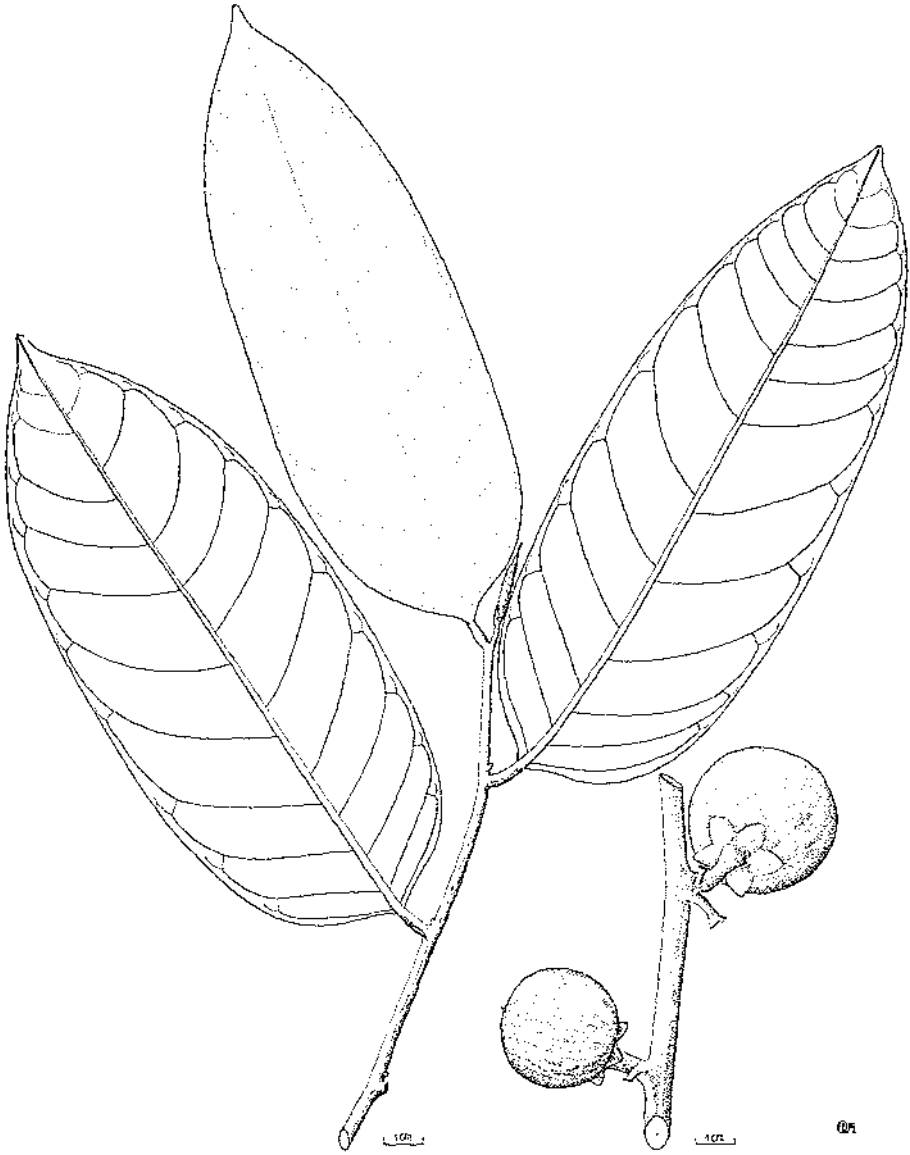


Fig. 85. *Diospyros borneensis* Hiern

(Ebenaceae)



(Elaeocarpaceae)

Fig. 86. *Elaeocarpus glaber* Blume

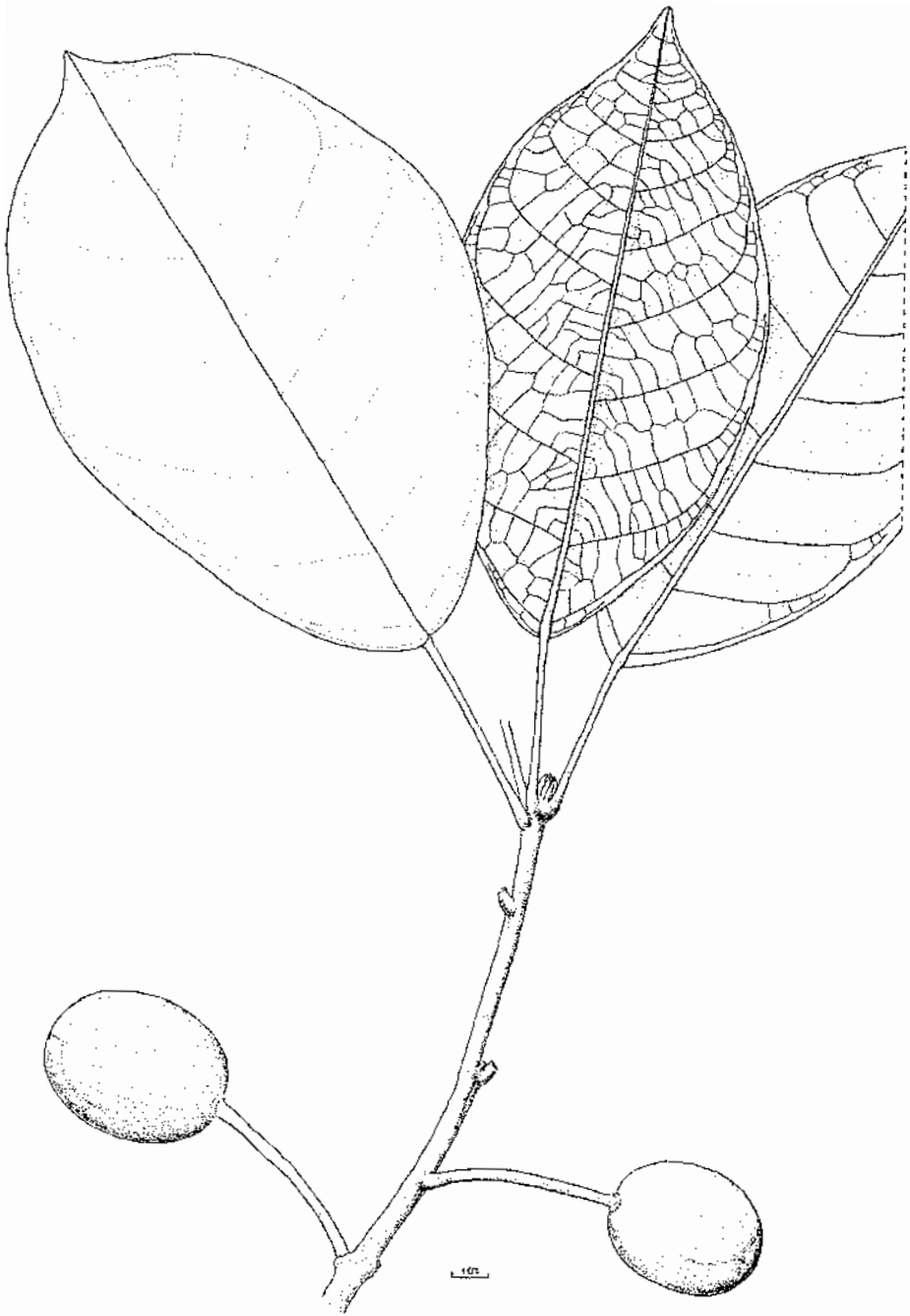
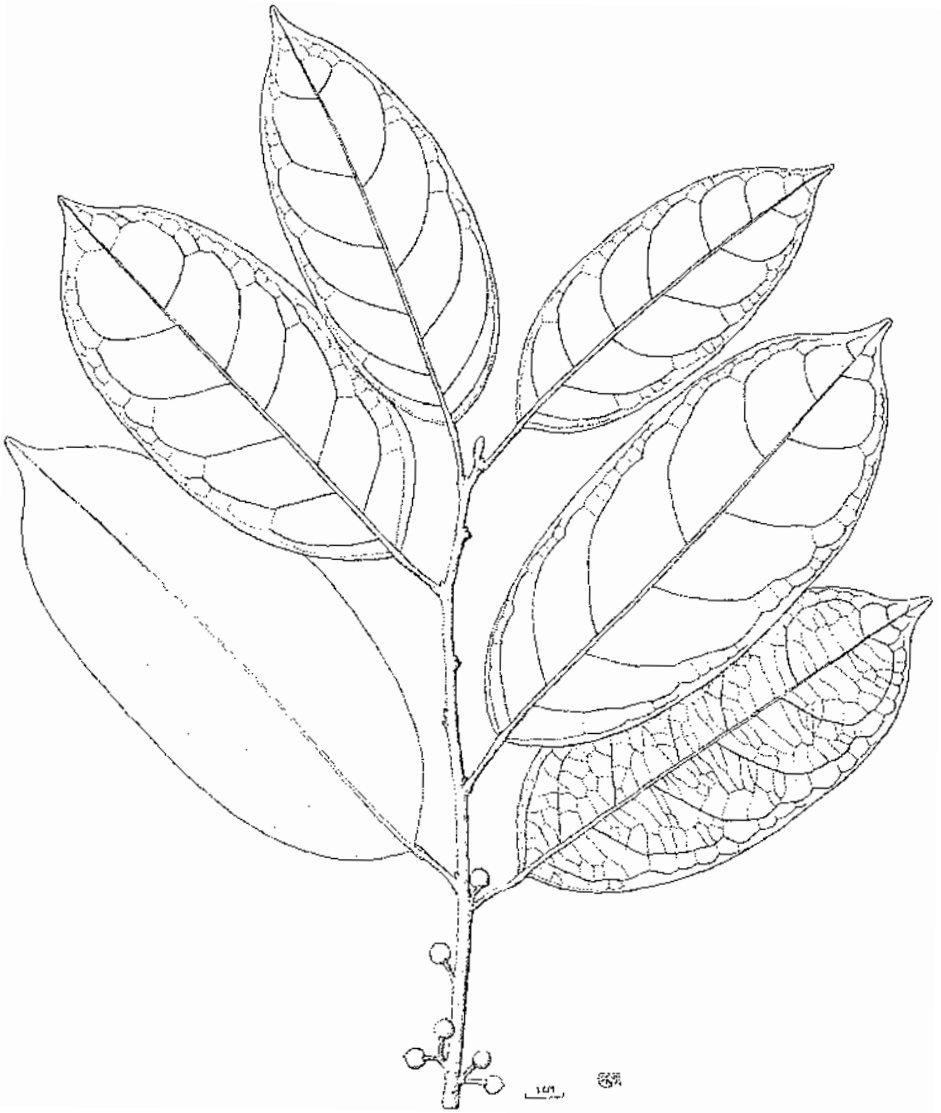


Fig. 87. *Sloanea javanica* (Miq.) K. Schum.

(Elaeocarpaceae)



(Euphorbiaceae)

Fig. 88. *Aporosa lucida* (Miq.) Airy Shaw



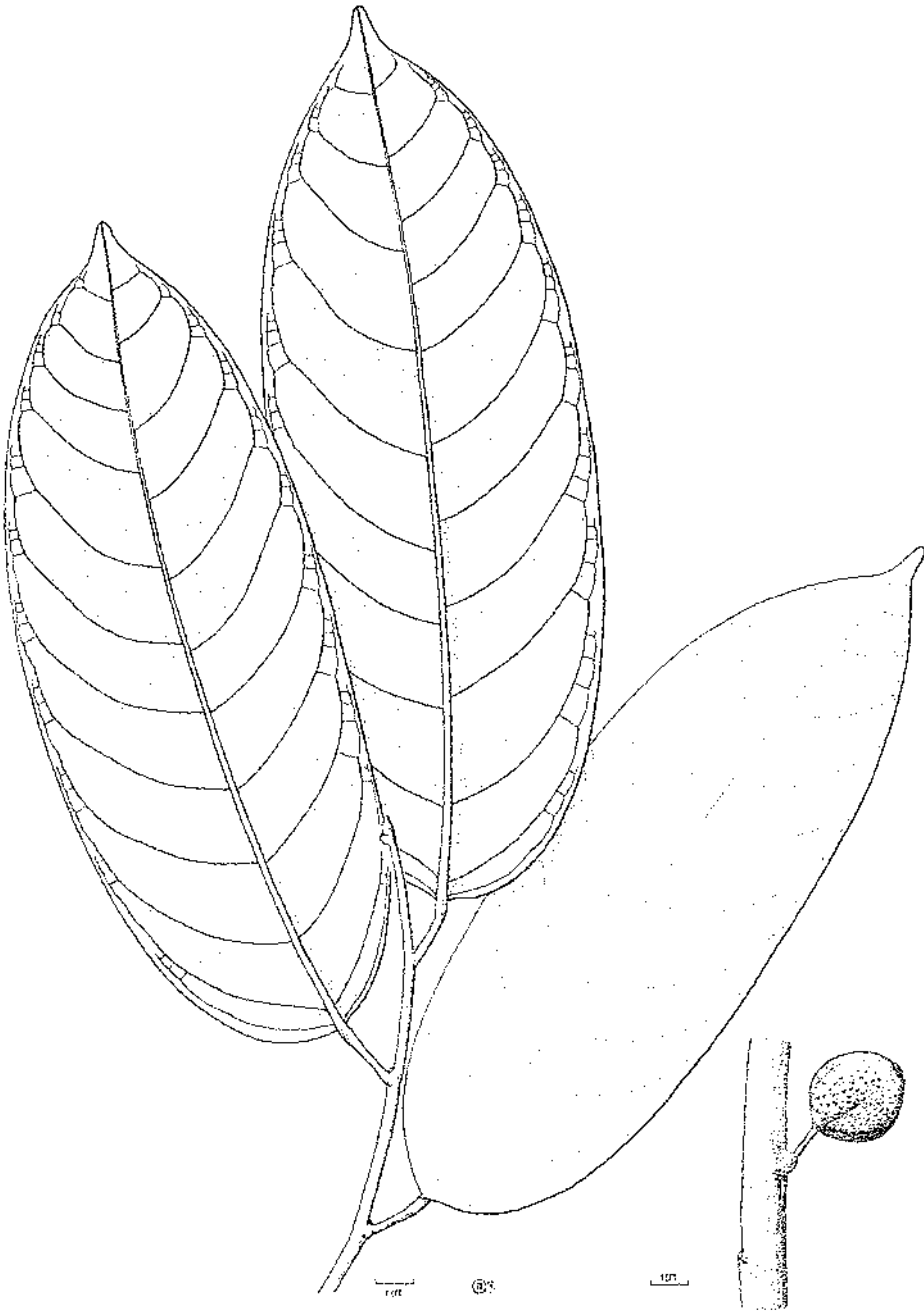
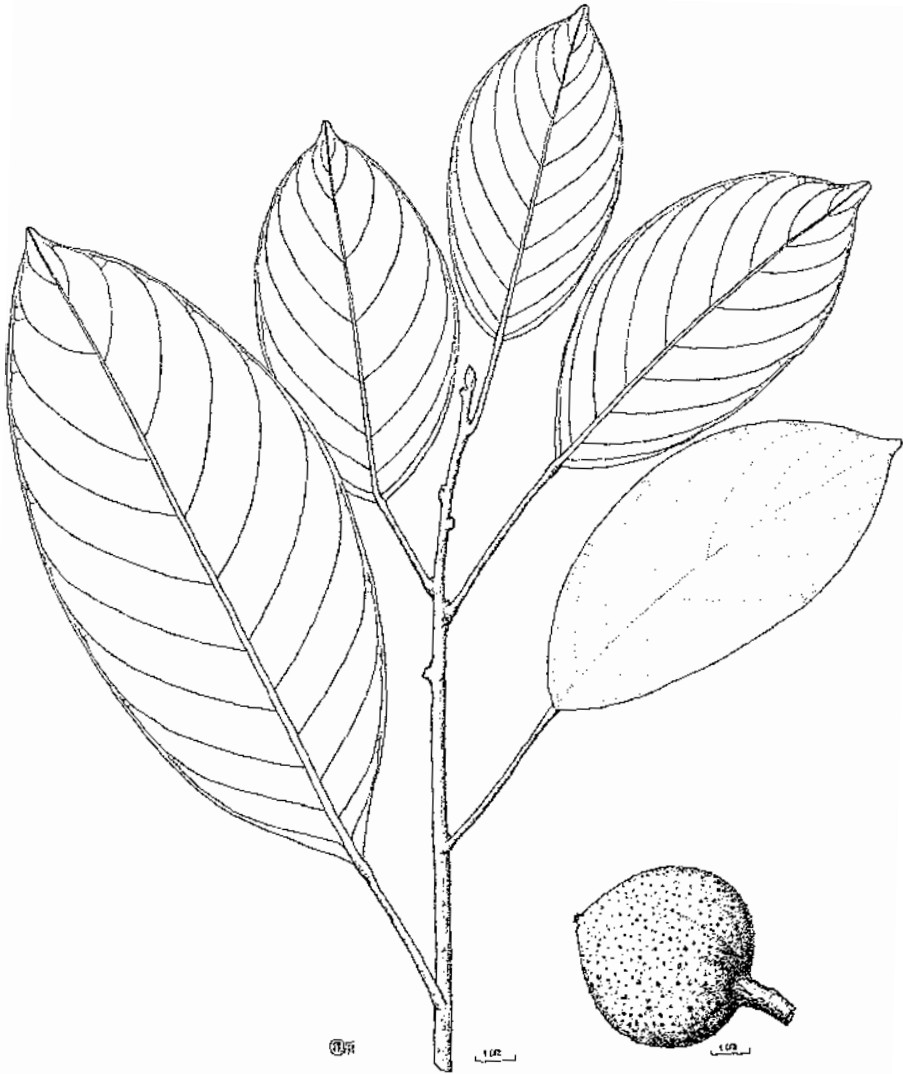


Fig. 89. *Aporusa nitida* Merr.

(Euphorbiaceae)



(Euphorbiaceae)

Fig. 90. *Baccaurea macrocarpa* (Miq.) Muell. Arg.

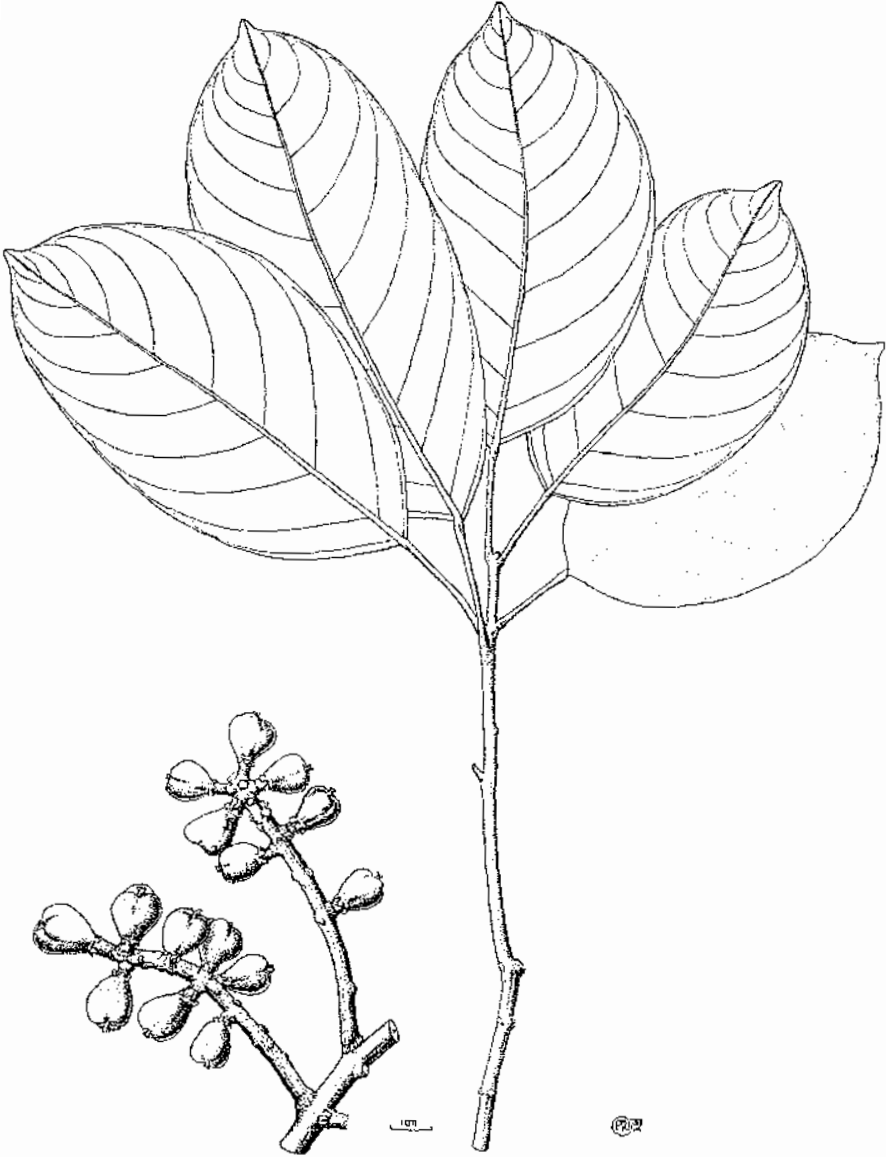
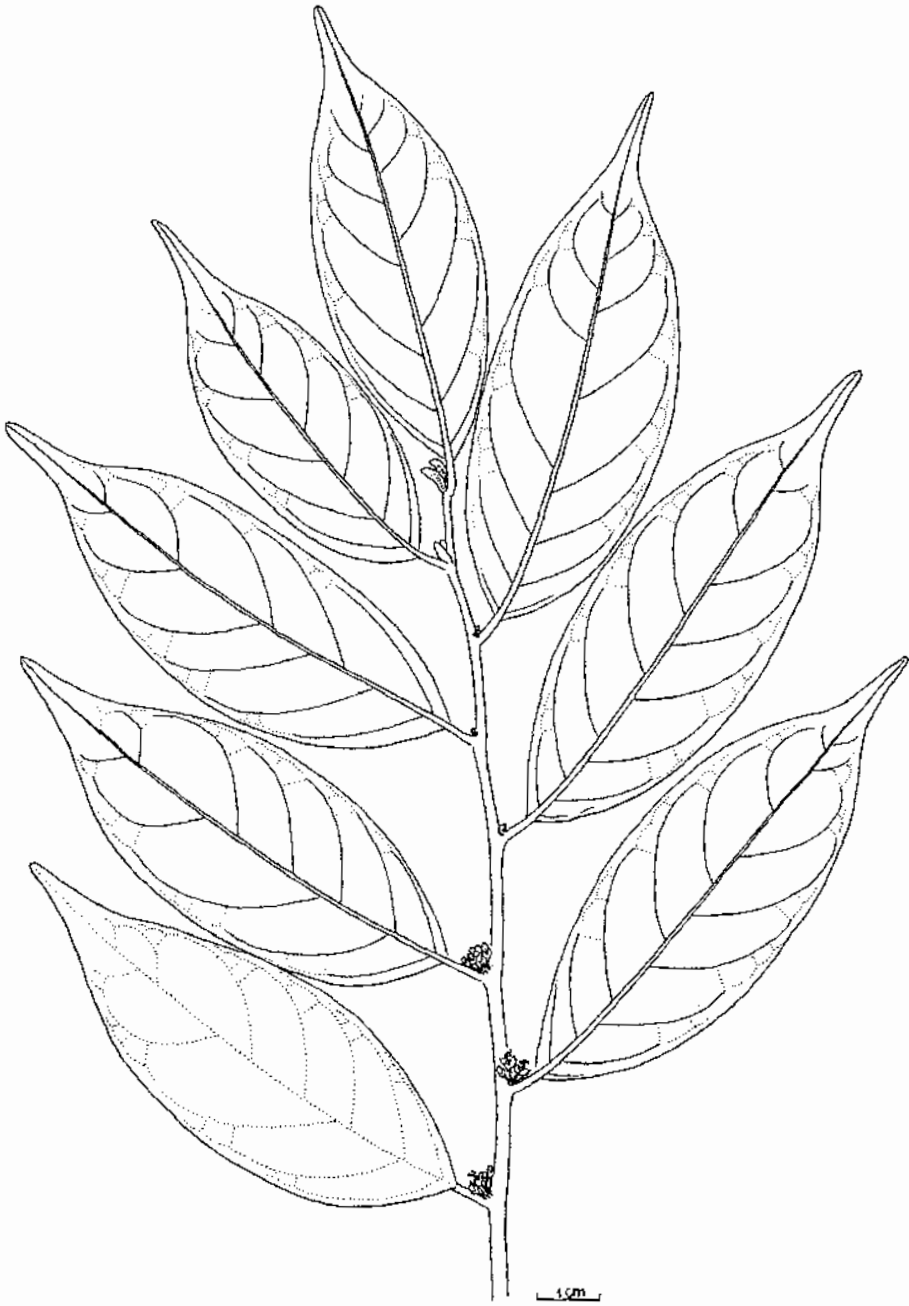


Fig. 91. *Blumeodendron tokbrai* (Blume) J.J. Smith (Euphorbiaceae)



(Euphorbiaceae)

Fig. 92. *Chaetocarpus castanocarpus* (Roxb.) Thwaites



Fig. 93. *Drypetes kikir* Airy Shaw

(Euphorbiaceae)



(Euphorbiaceae)

Fig. 94. *Drypetes polyneura* Airy Shaw

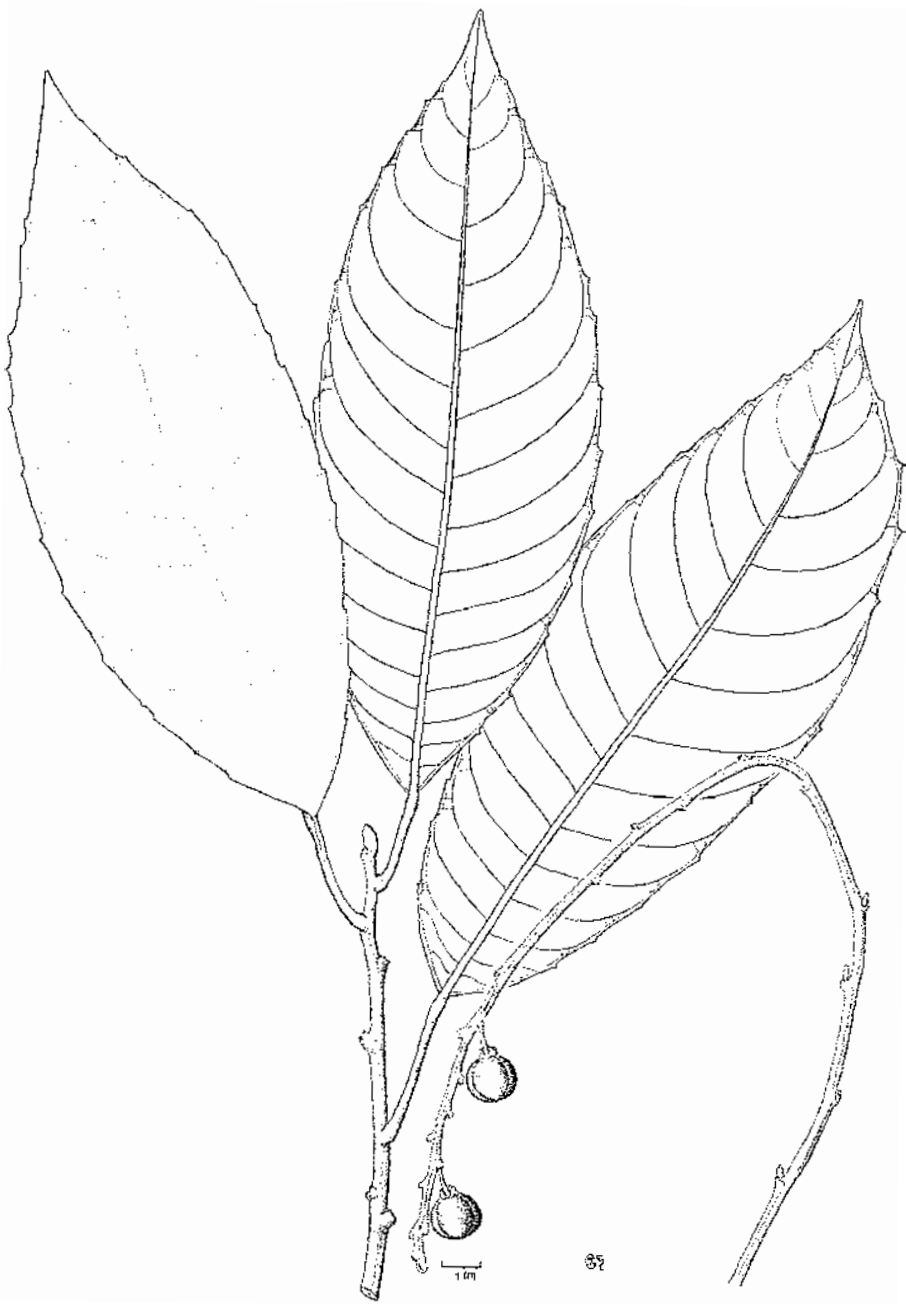
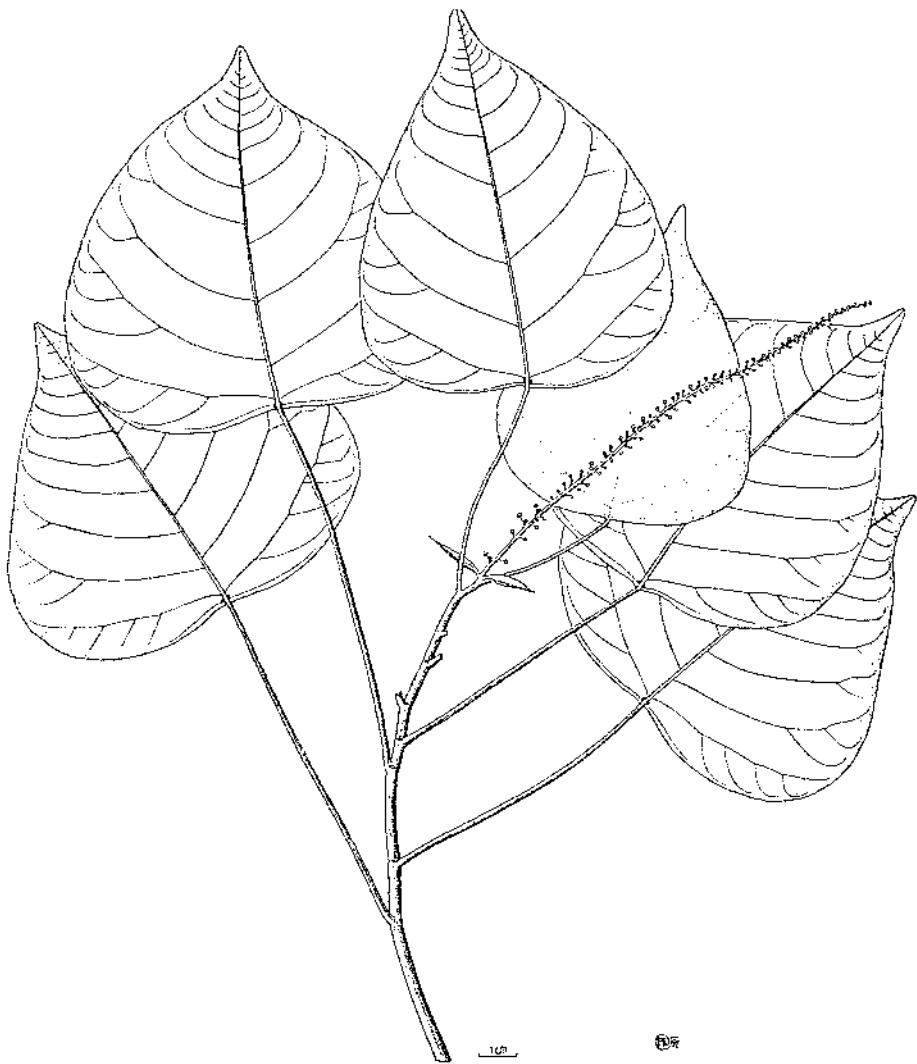


Fig. 95. *Fahrenheitia pendula* (Hassk.) Airy Shaw (Euphorbiaceae)



(Euphorbiaceae)

Fig. 96. *Homalanthus populneus* (Geisel.) Pax





Fig. 97. *Koilodepas pectinatus* Airy Shaw

(Euphorbiaceae)



(Euphorbiaceae)

Fig. 98. *Macaranga confera* (Zoll.) Muell. Arg.

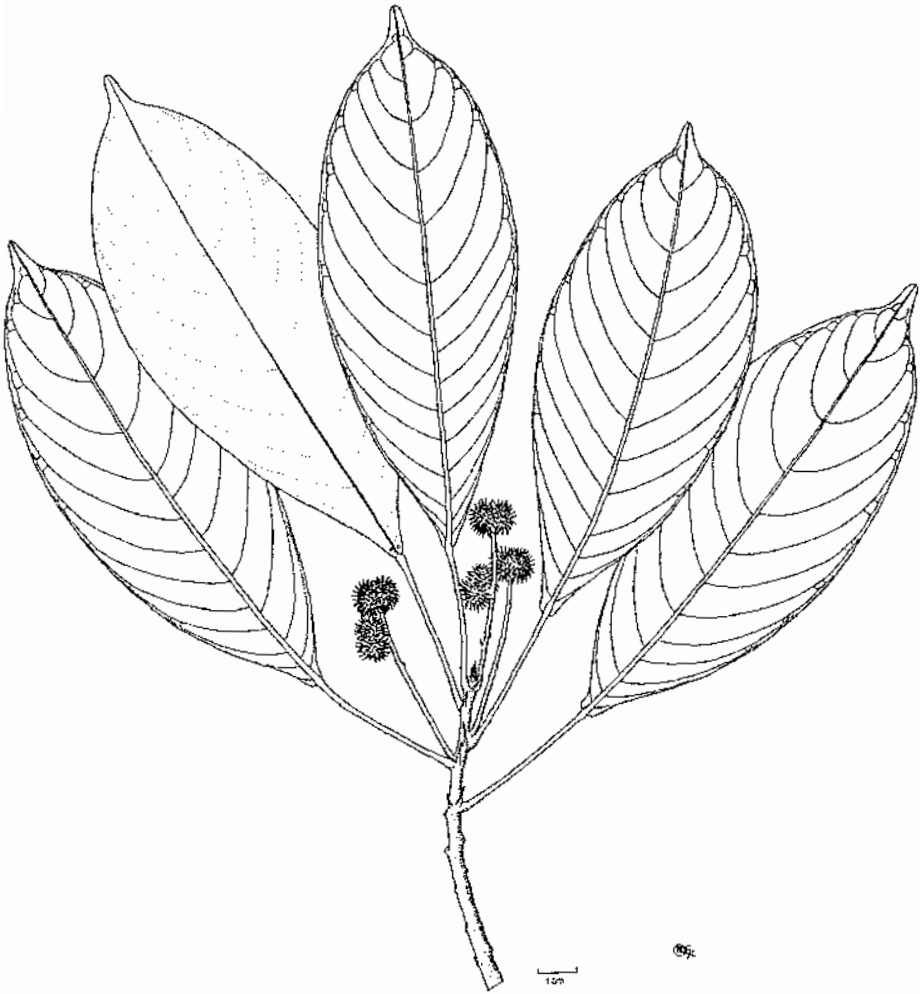
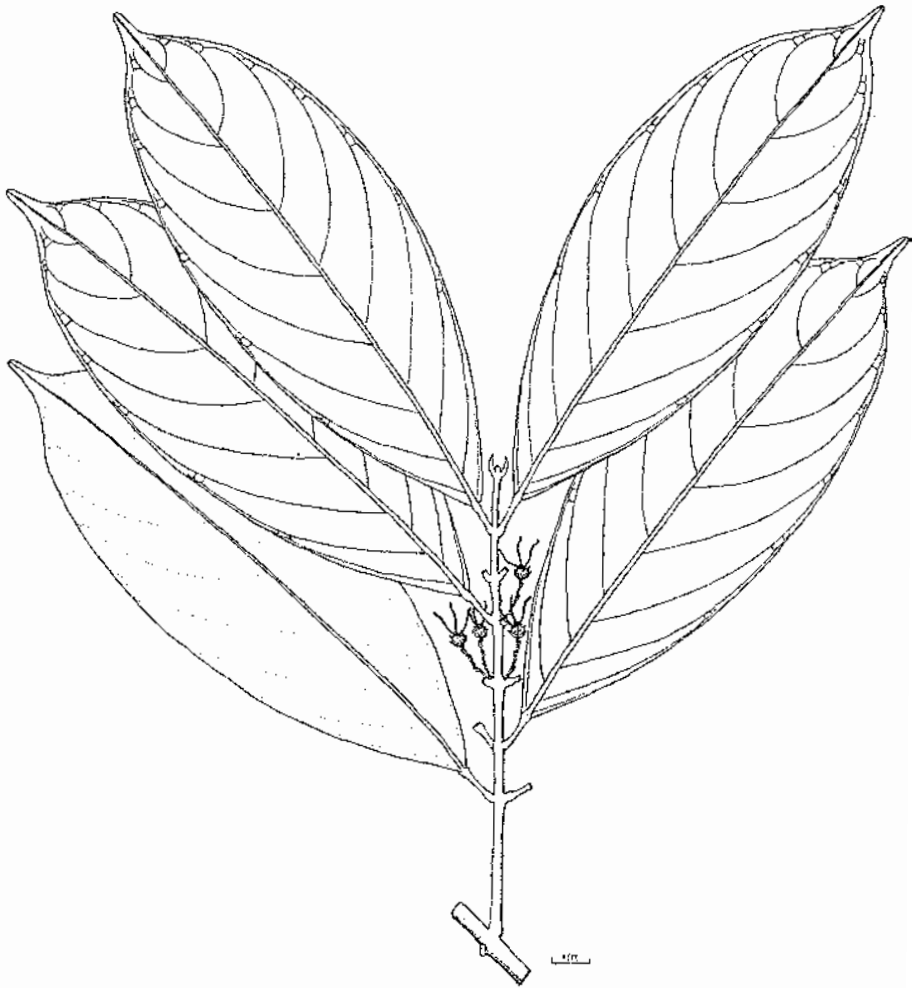


Fig. 99. *Macaranga lowii* King ex Hook. f. var. *lowii* (Euphorbiaceae)



(Euphorbiaceae)

Fig. 100. *Mallotus penangensis* Muell. Arg.

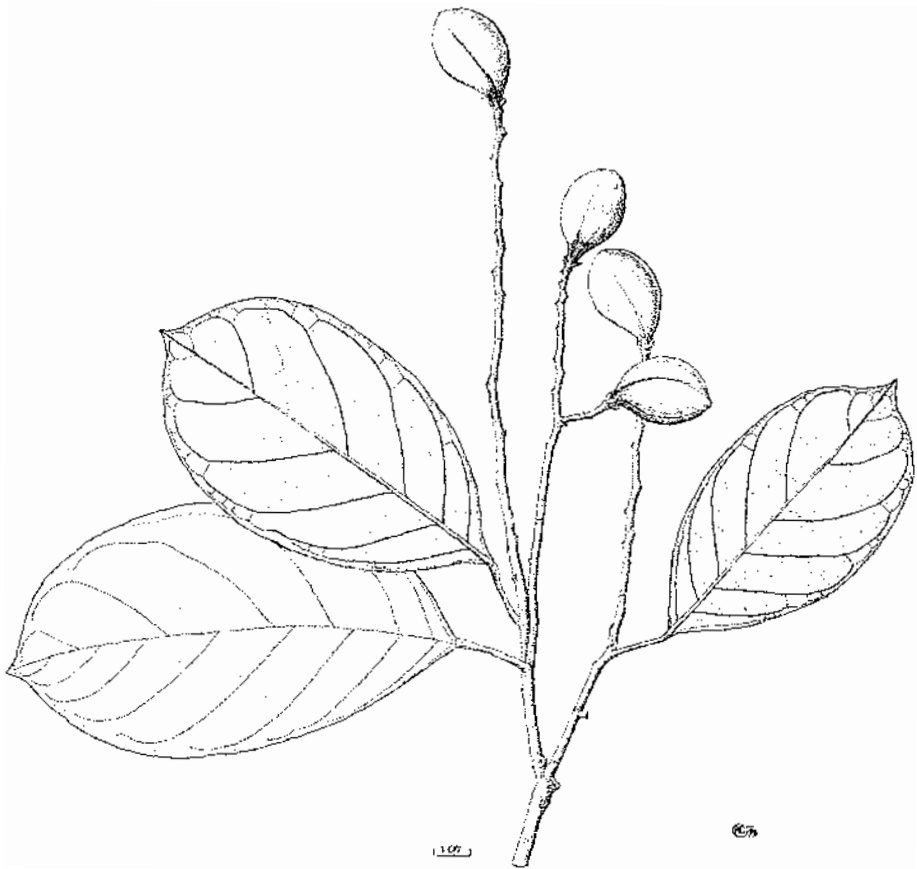
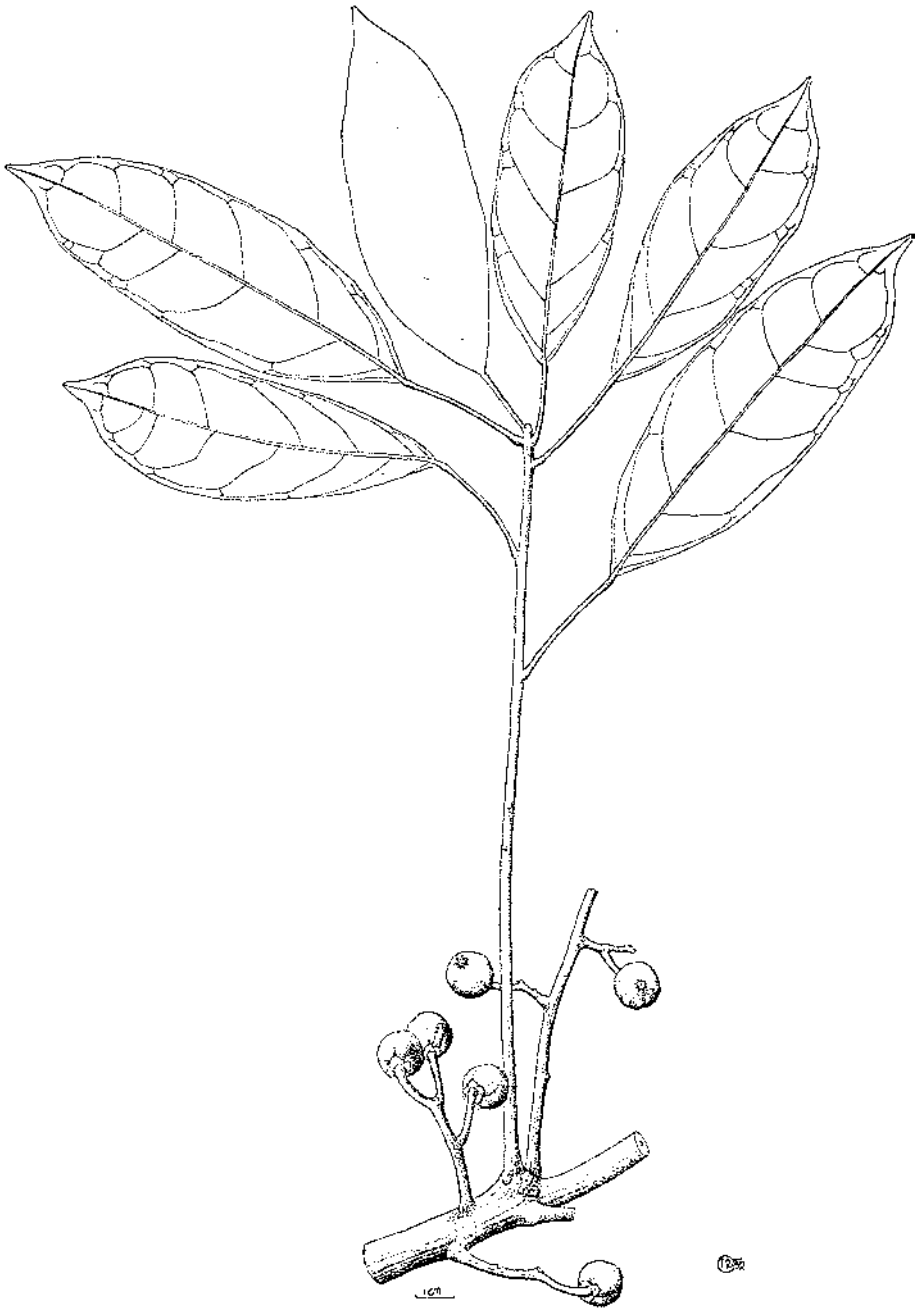


Fig. 101. *Neoscortechinia kingii* (Hook. f.) Pax & Hoffm. (Euphorbiaceae)



(Euphorbiaceae) Fig. 102. *Pimelodendron griffithianum* (Muell. Arg.) Benth.

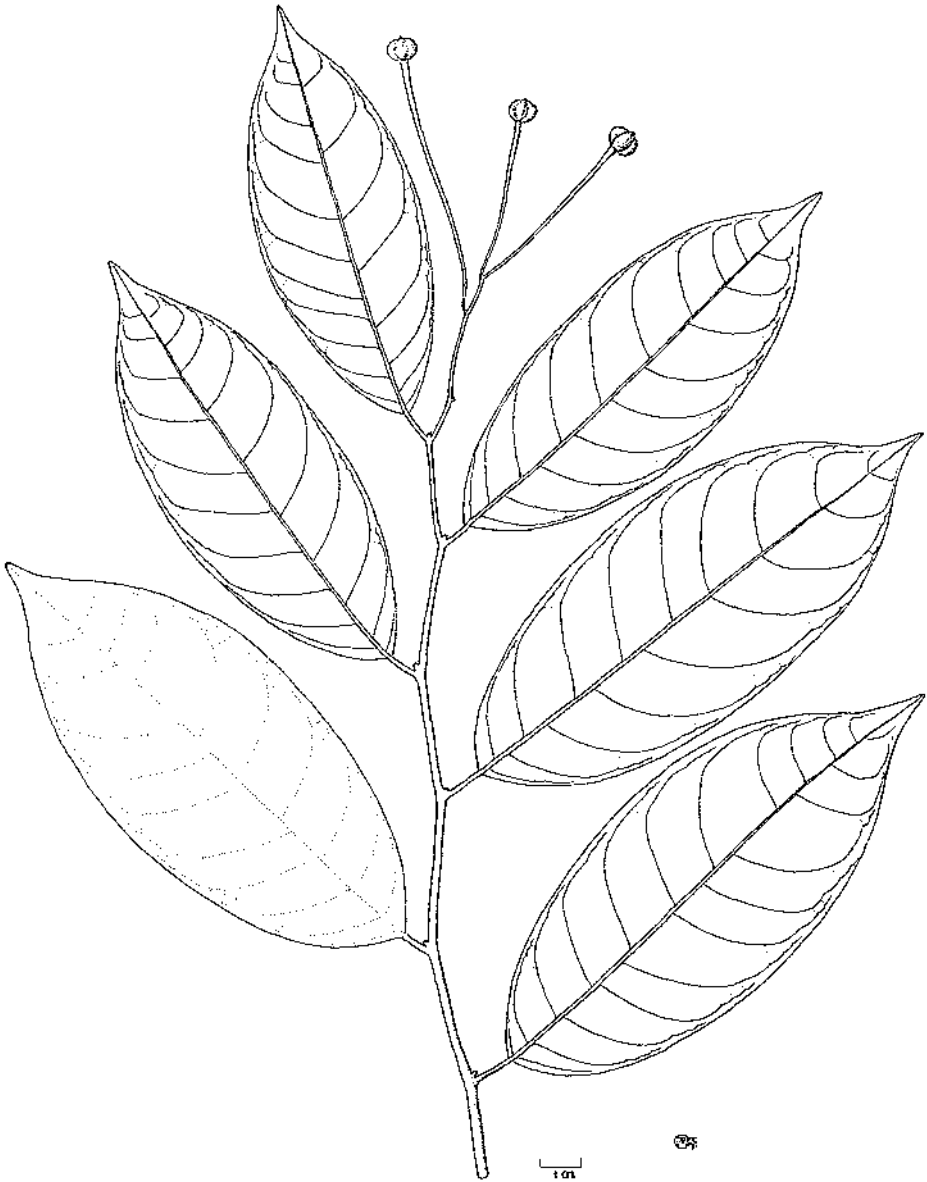
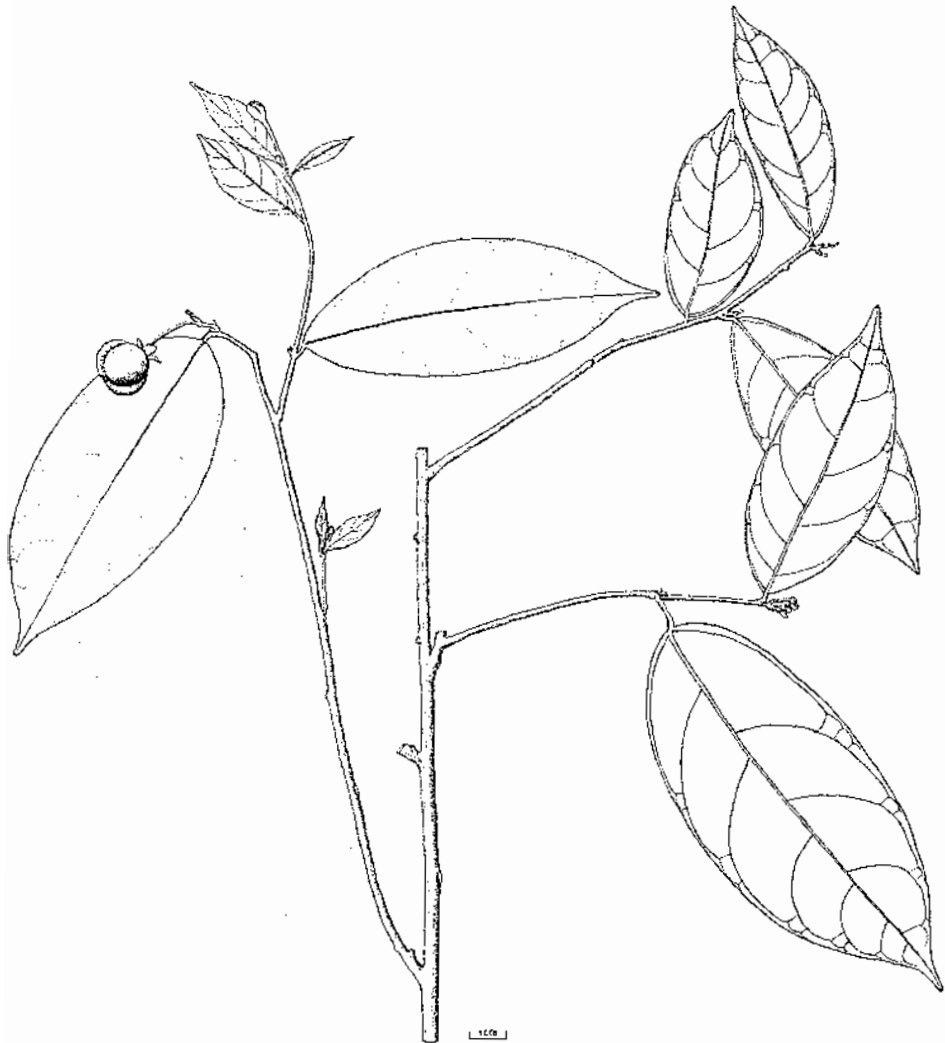


Fig. 103. *Sebastiania borneensis* Pax

(Euphorbiaceae)



(Euphorbiaceae)

Fig. 104. *Trigonostemon laevigatus* Muell. Arg.



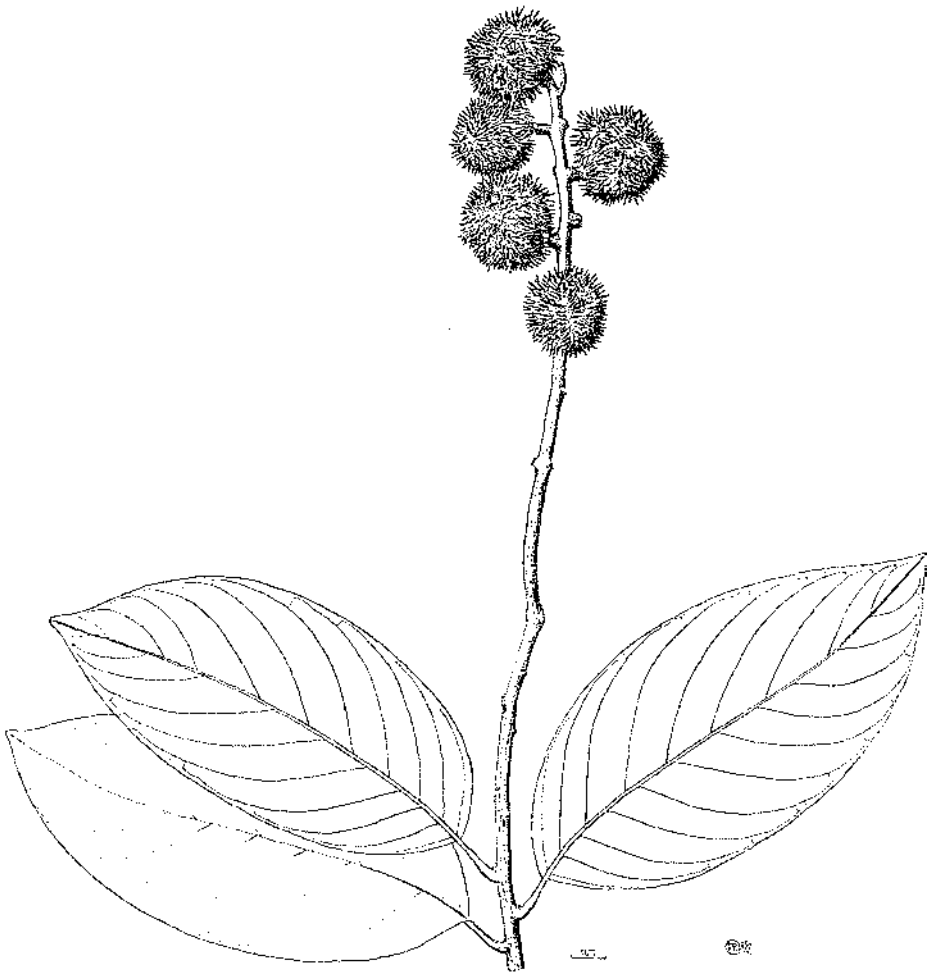
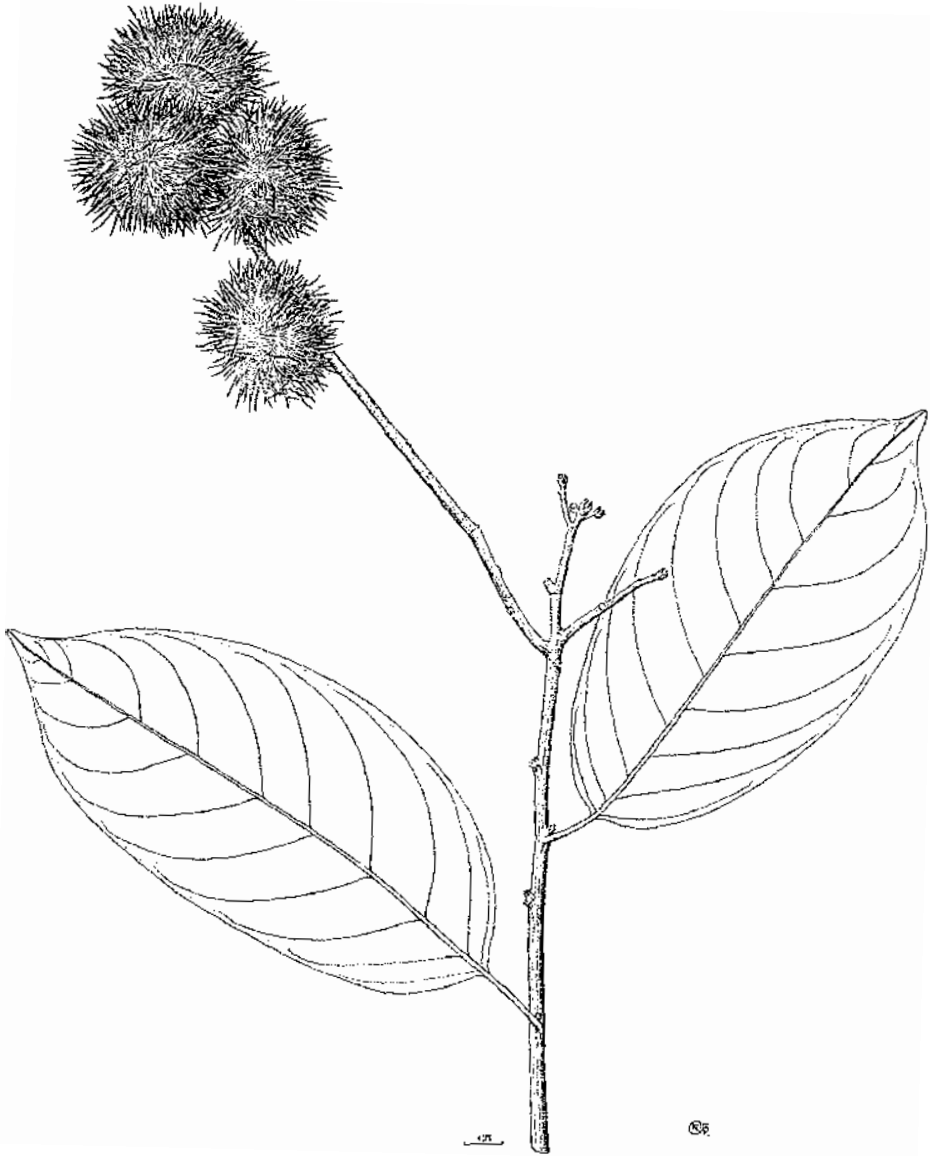


Fig. 105. *Castanopsis argentea* (Blume) A. DC.

(Fagaceae)



(Fagaceae)

Fig. 106. *Castanopsis evansii* Elmer

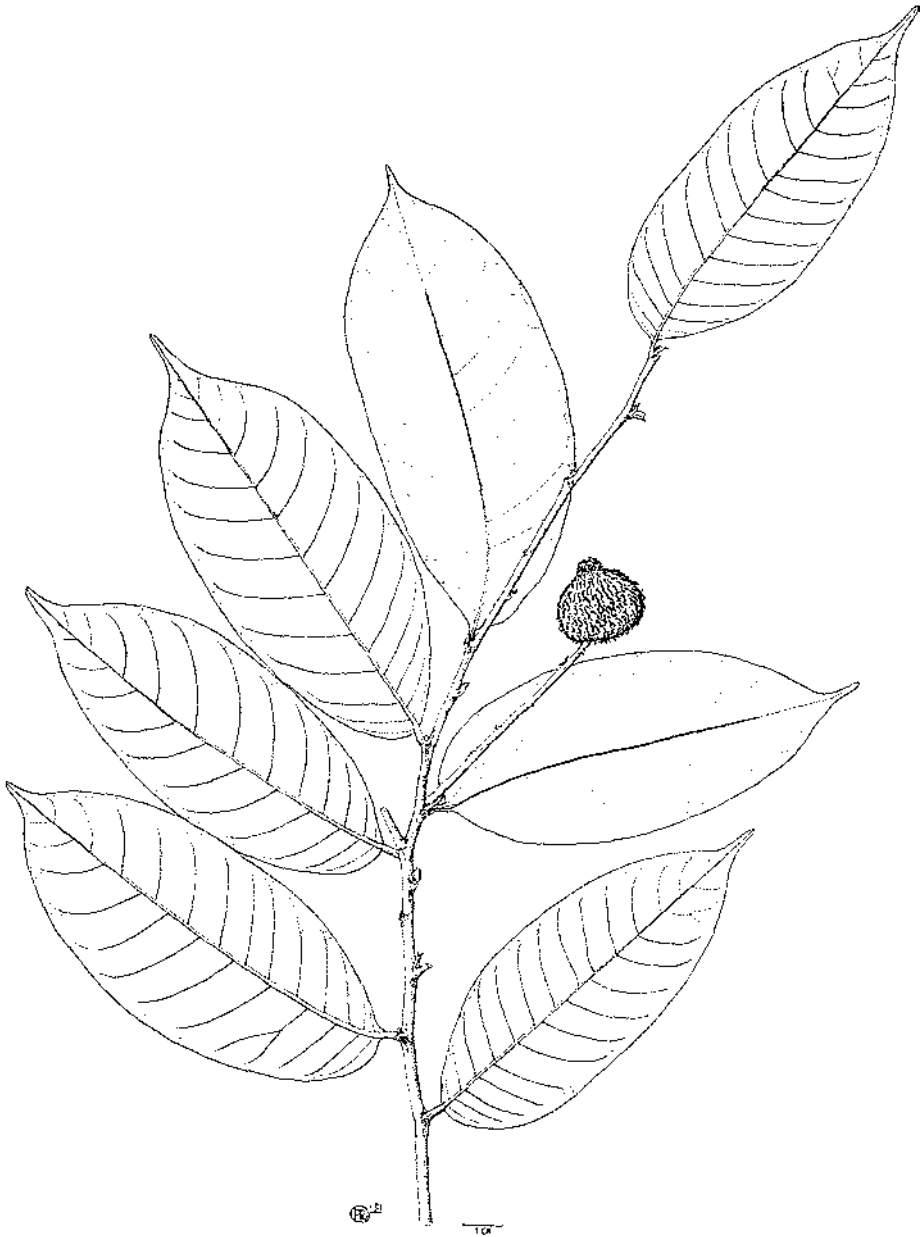


Fig. 107. *Lithocarpus coopertus* (Blanco) Rehd.

(Fagaceae)



(Fagaceae)

Fig. 108. *Quercus argentata* Korth.

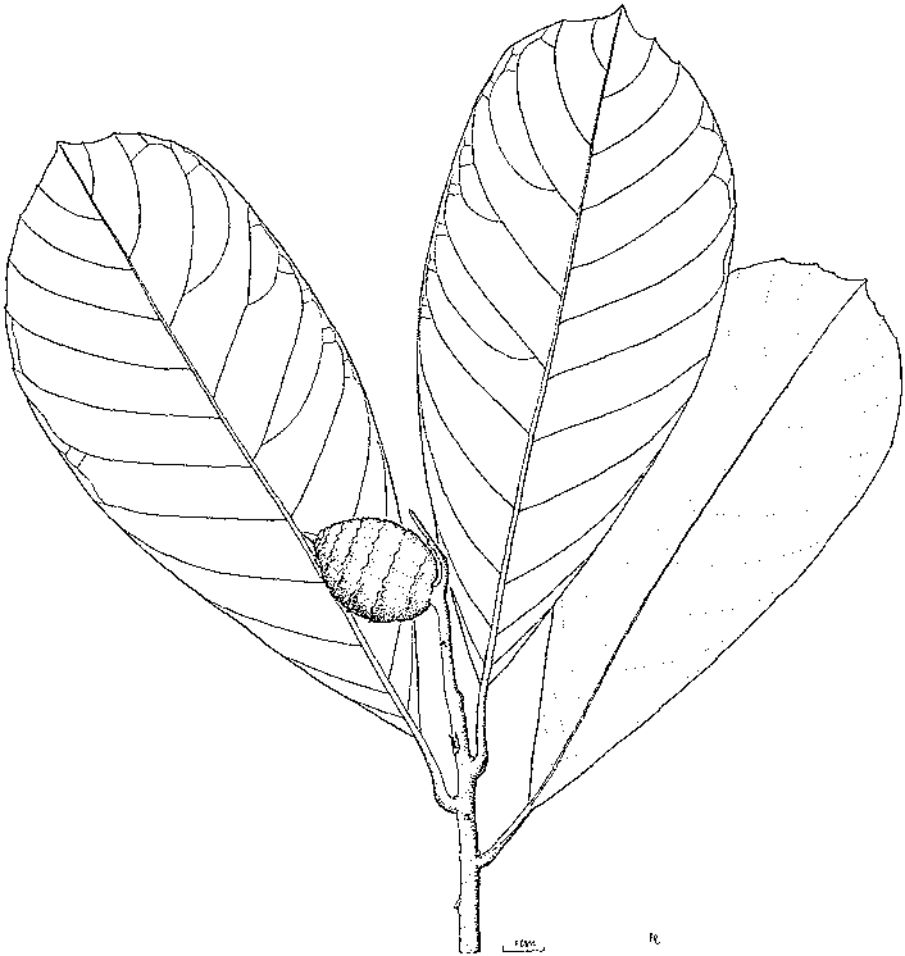


Fig. 109. *Quercus gaharuensis* Soepadmo

(Fagaceae)



(Flacourtiaceae)

Fig. 110. *Hydnocarpus polypetala* (Sloot.) Sleumer

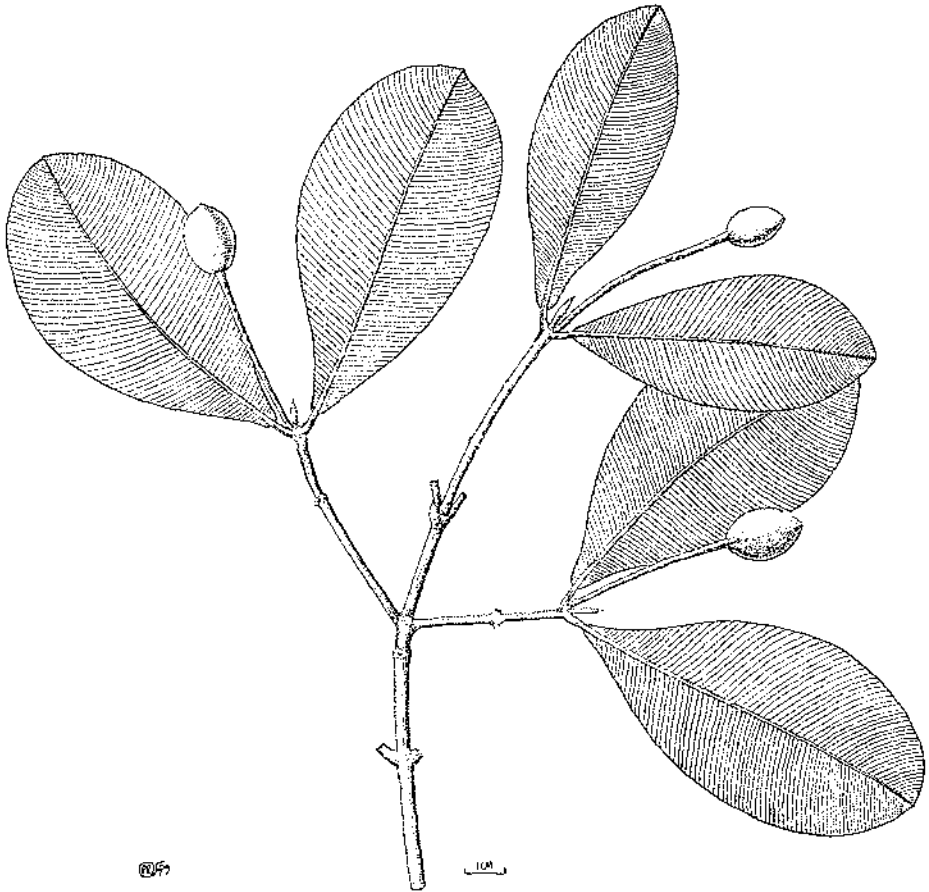
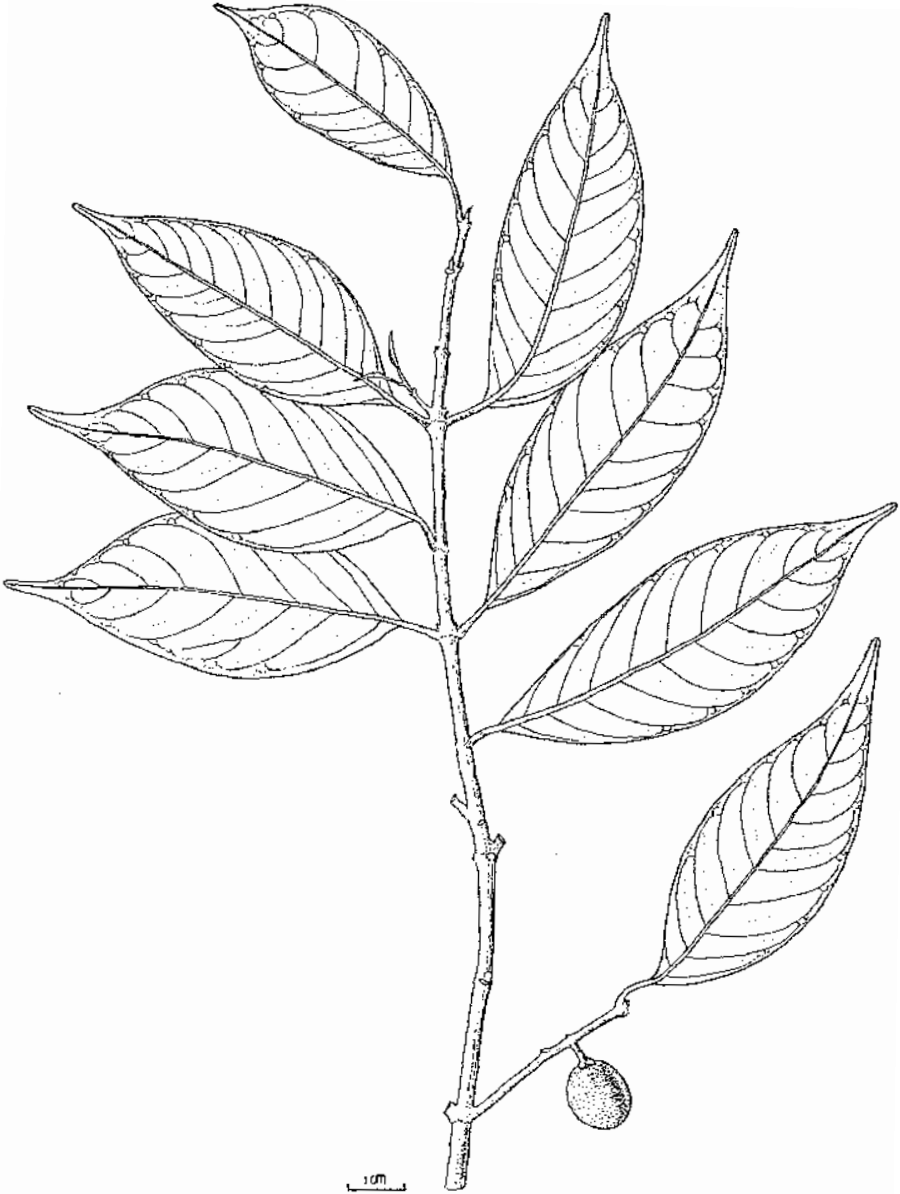


Fig. 111. *Calophyllum venulosum* Zoll.

(Guttiferae)



(Guttiferae)

Fig. 112. *Garcinia parvifolia* (Miq.) Miq.



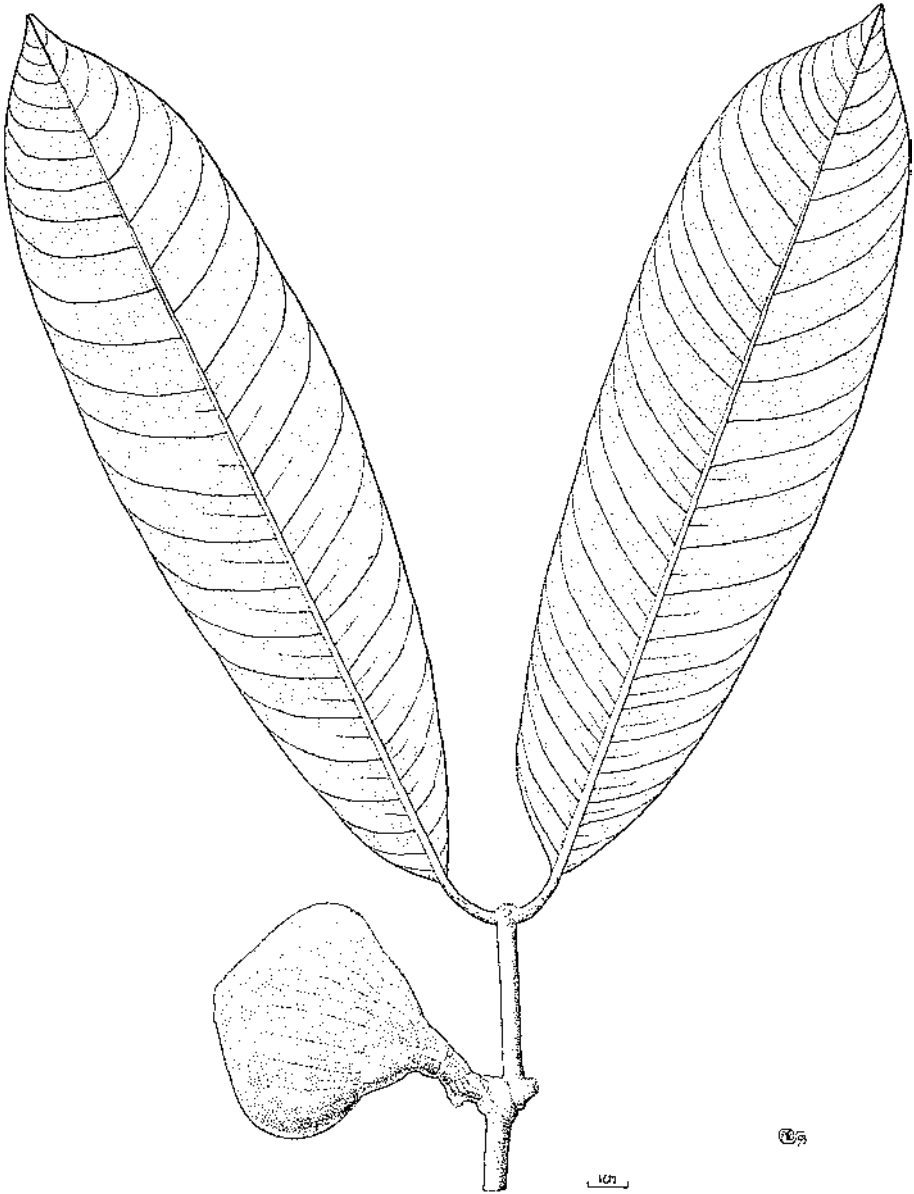
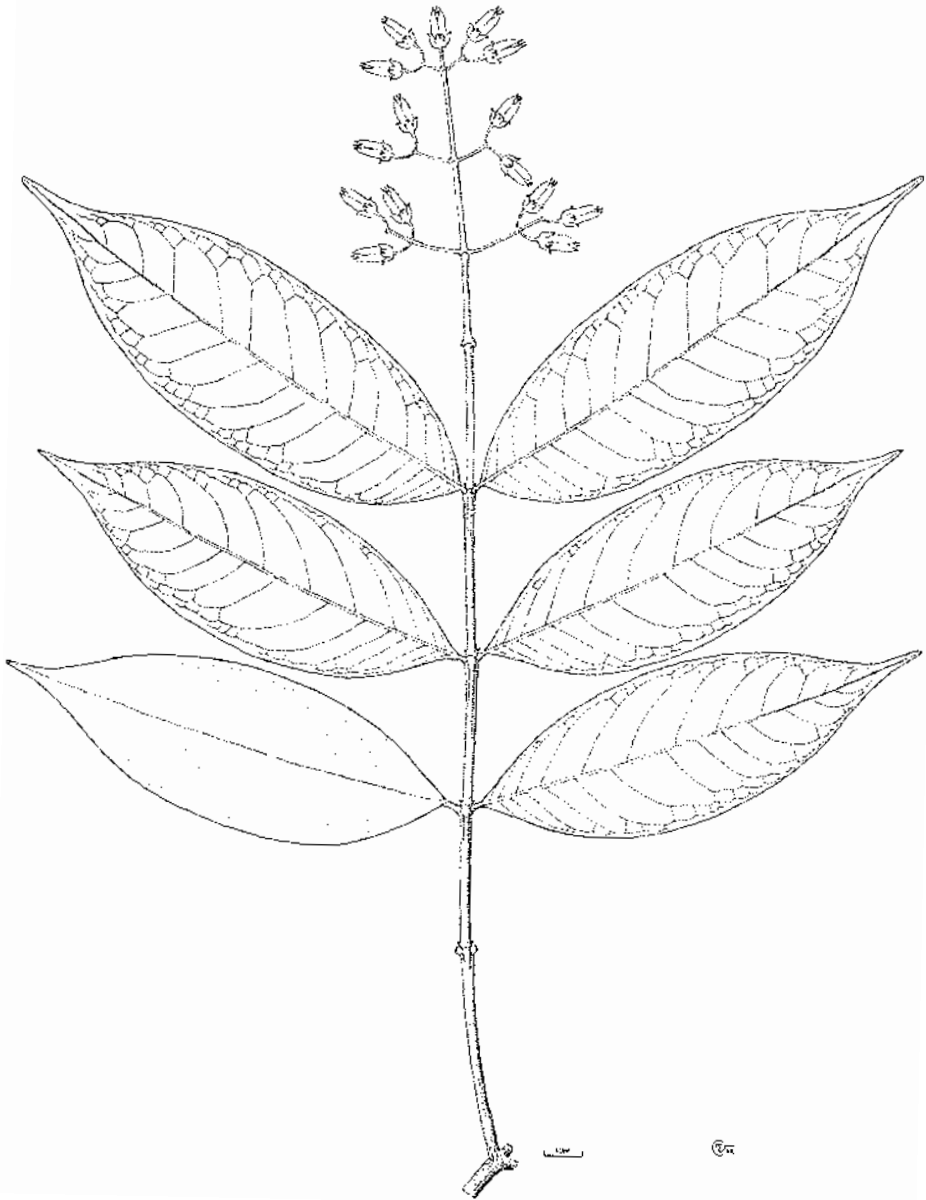


Fig. 113. *Mesua macrantha* (Baillon) Kosterm.

(Guttiferae)

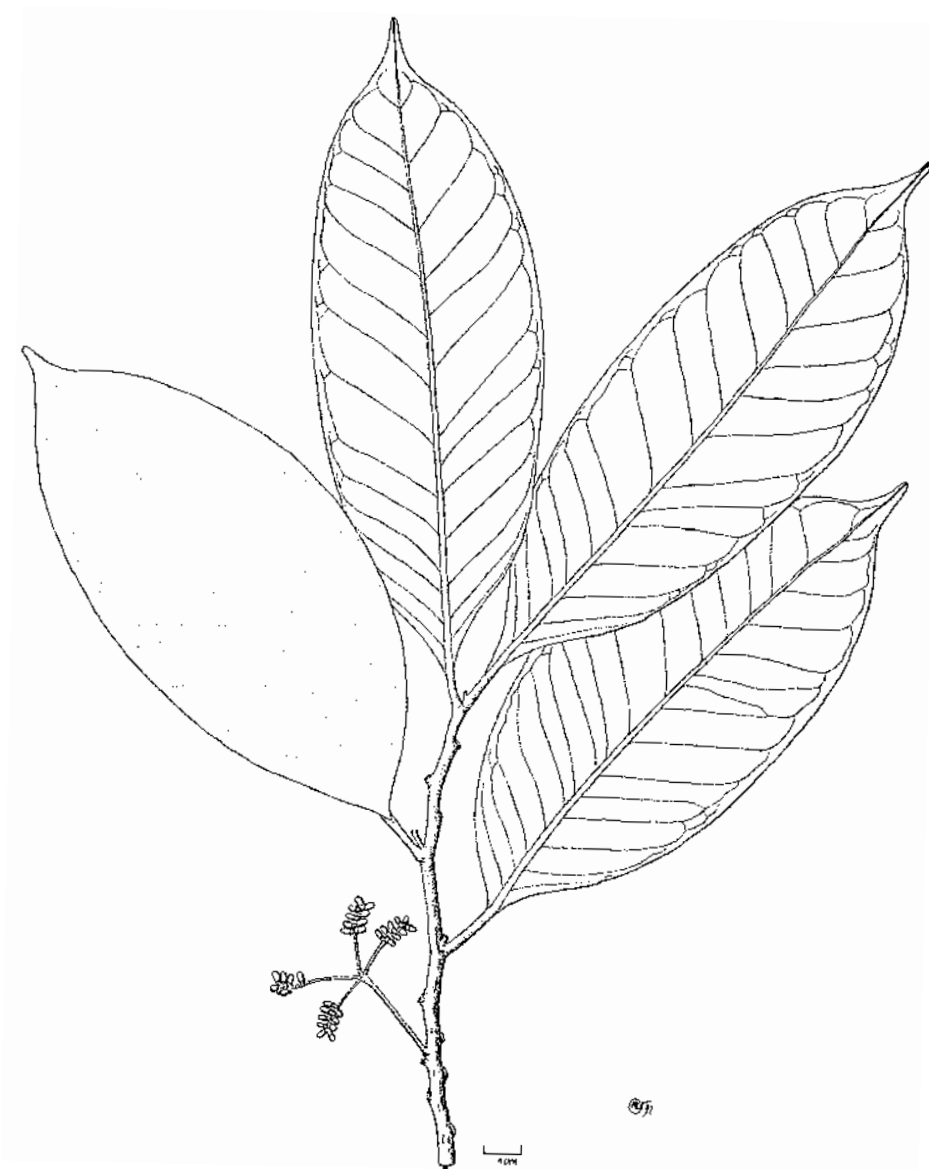


(Hypericaceae)

Fig. 114. *Cratoxylum sumatranum* (Jack) Blume



Fig. 115. *Platea excelsa* Blume var. *borneensis* (Heine) Sleumer (Icacinaceae)



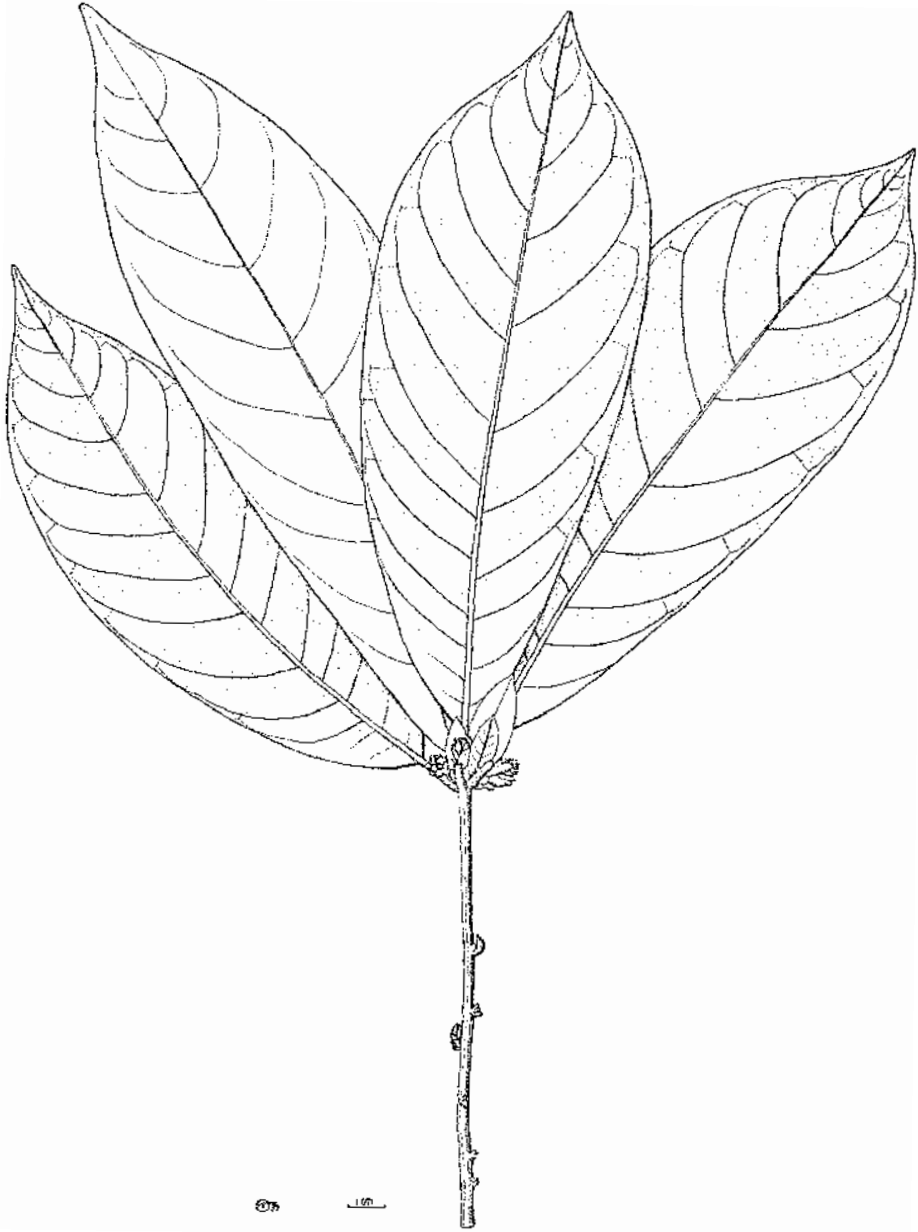
(Icacinaceae)

Fig. 116. *Stemonurus scorpioides* Becc.



Fig. 117. *Engelhardia serrata* Blume

(Juglandaceae)



(Lauraceae)

Fig. 118. *Actinodaphne glabra* Blume

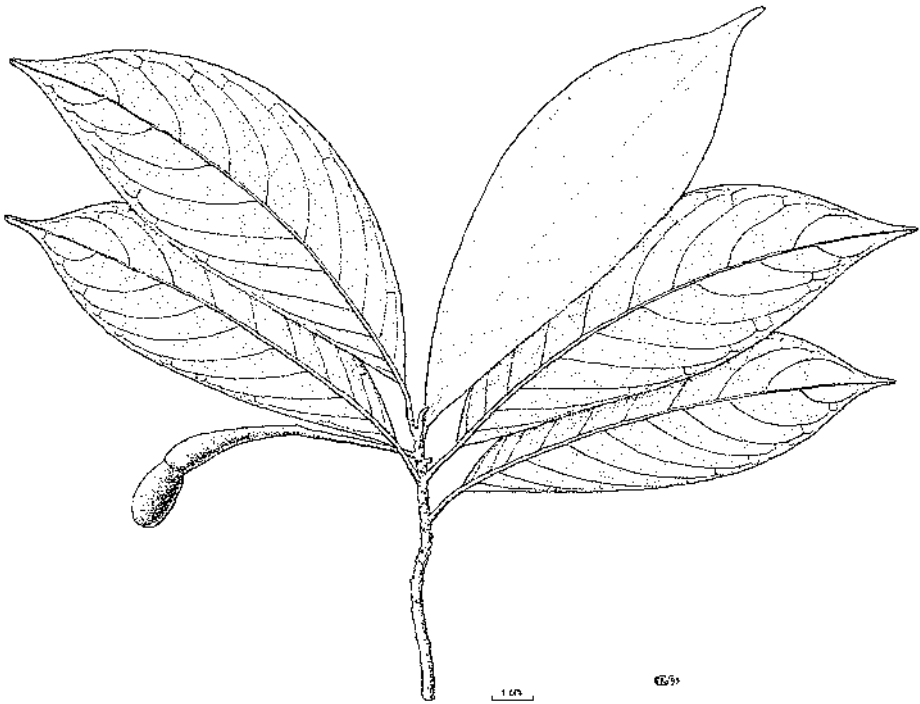


Fig. 119. *Alseodaphne peduncularis* (Wall. ex Nees) Meissn. (Lauraceae)



(Lauraceae)

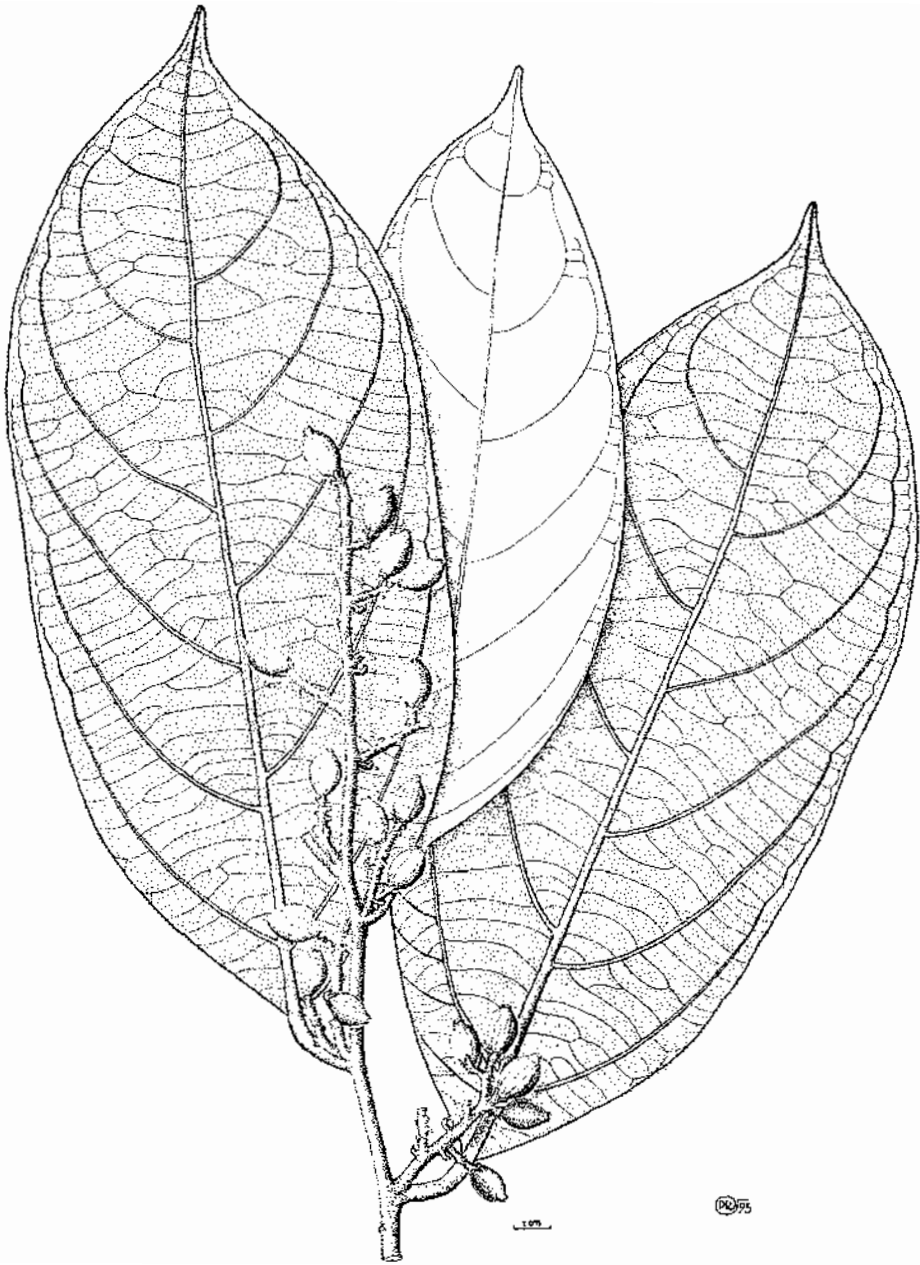
Fig. 120. *Beilschmiedia dictyoneura* Kosterm.





Fig. 121. *Cinnamomum cuspidatum* Miq.

(Lauraceae)



(Lauraceae)

Fig. 122. *Cryptocarya crassinervia* Miq.

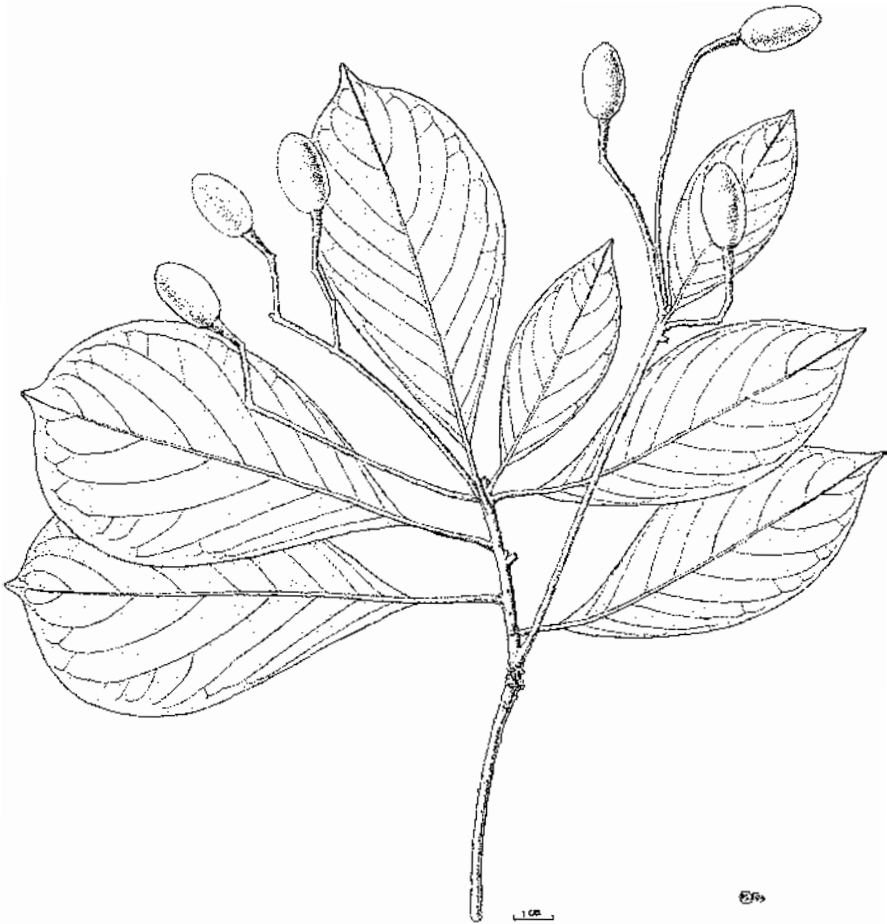
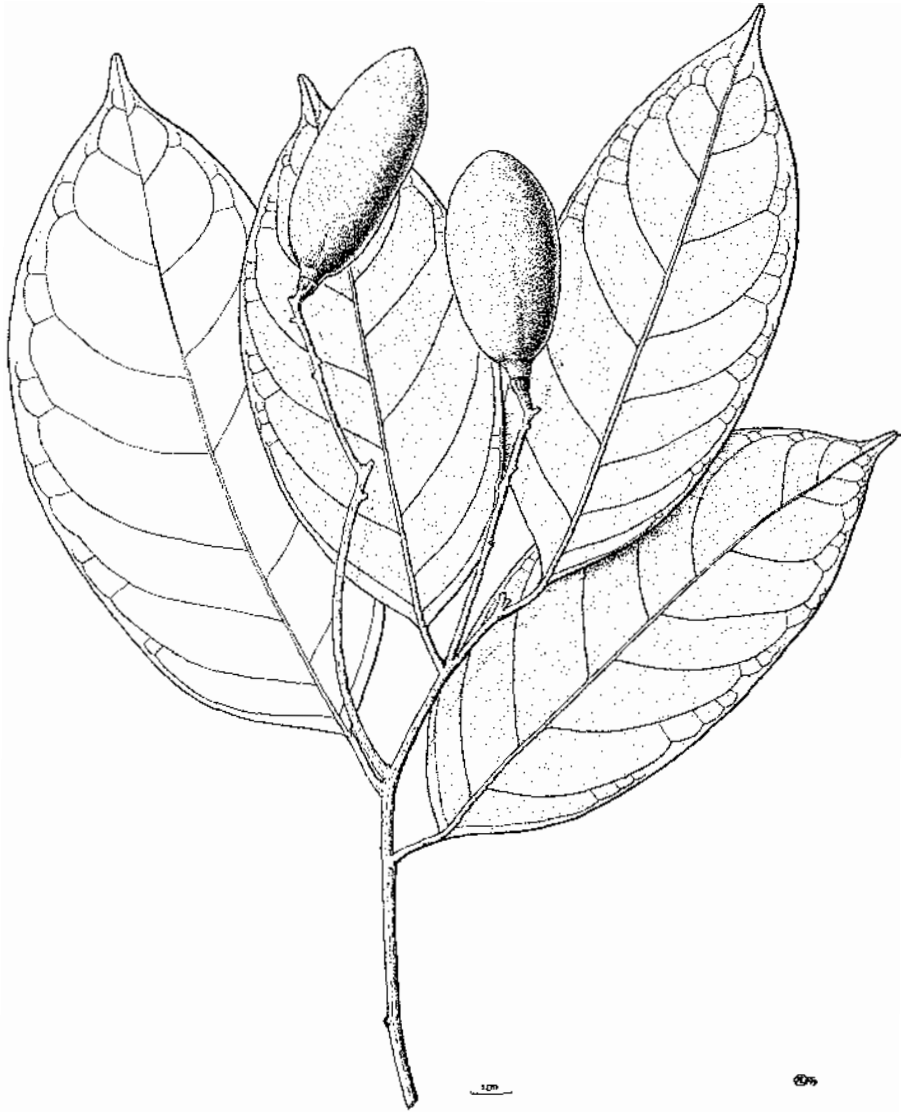


Fig. 123. *Dehaasia cuneata* (Blume) Blume

(Lauraceae)



(Lauraceae)

Fig. 124. *Endiandra kingiana* Gamble

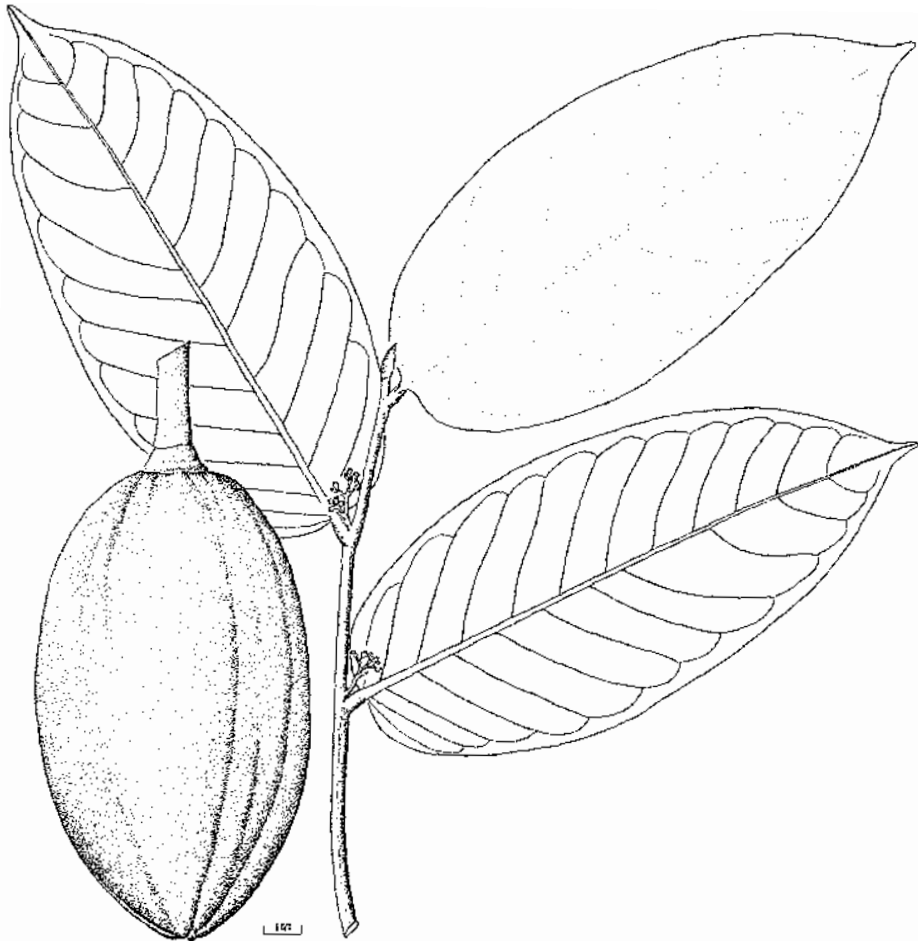


Fig. 125. *Eusideroxylon zwageri* Teijsm. & Binn.

(Lauraceae)



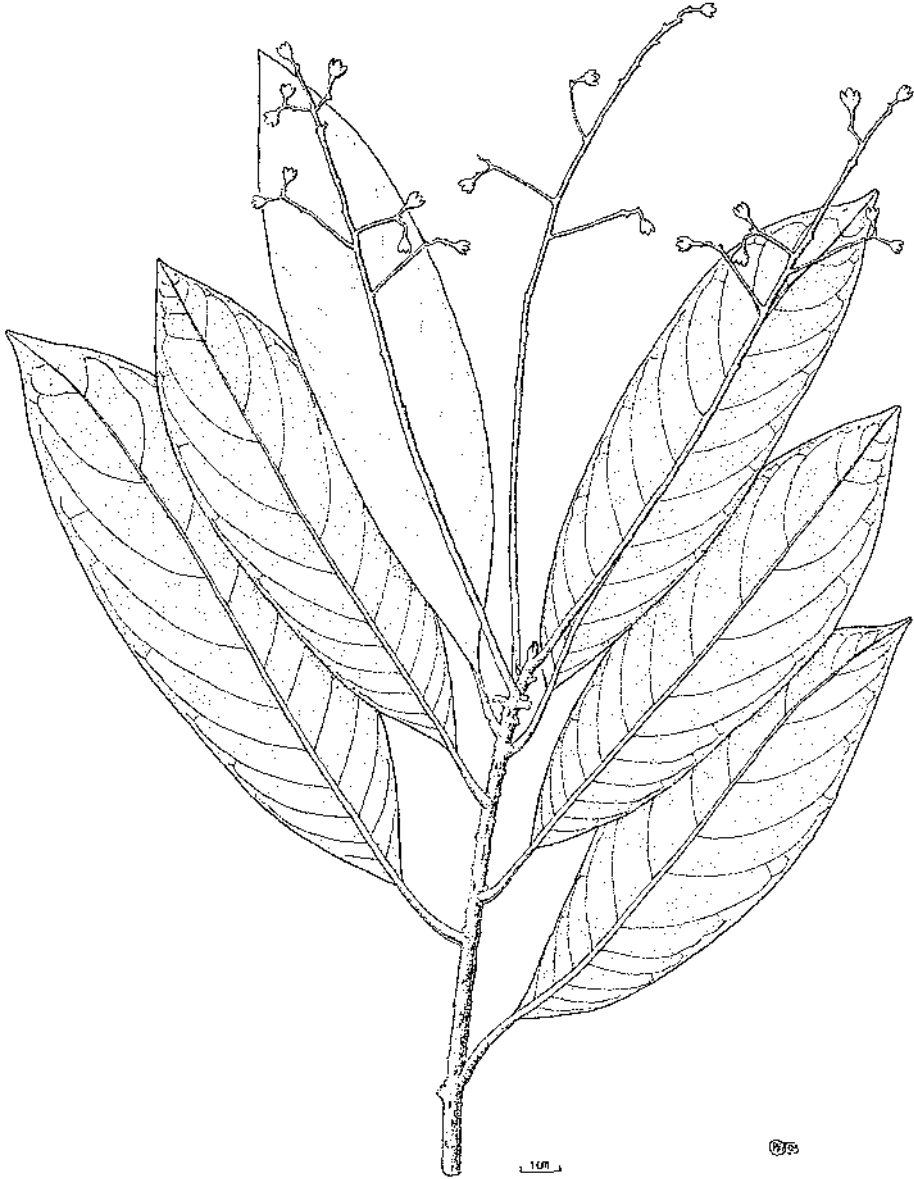
(Lauraceae)

Fig. 126. *Litsea firma* (Blume) Hook. f.



Fig. 127. *Nothaphoebe umbelliflora* Blume

(Lauraceae)



(Lauraceae)

Fig. 128. *Phoebe grandis* (Nees) Merr.



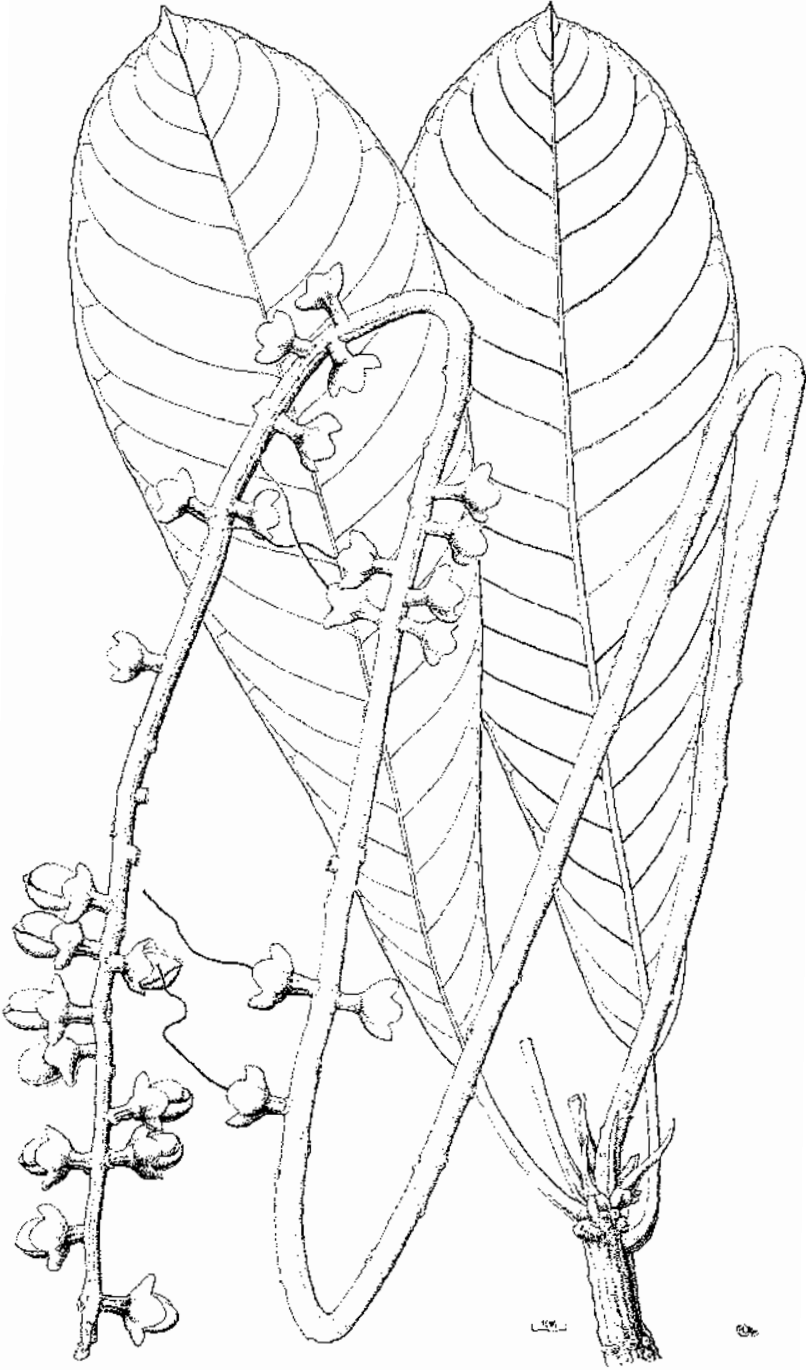
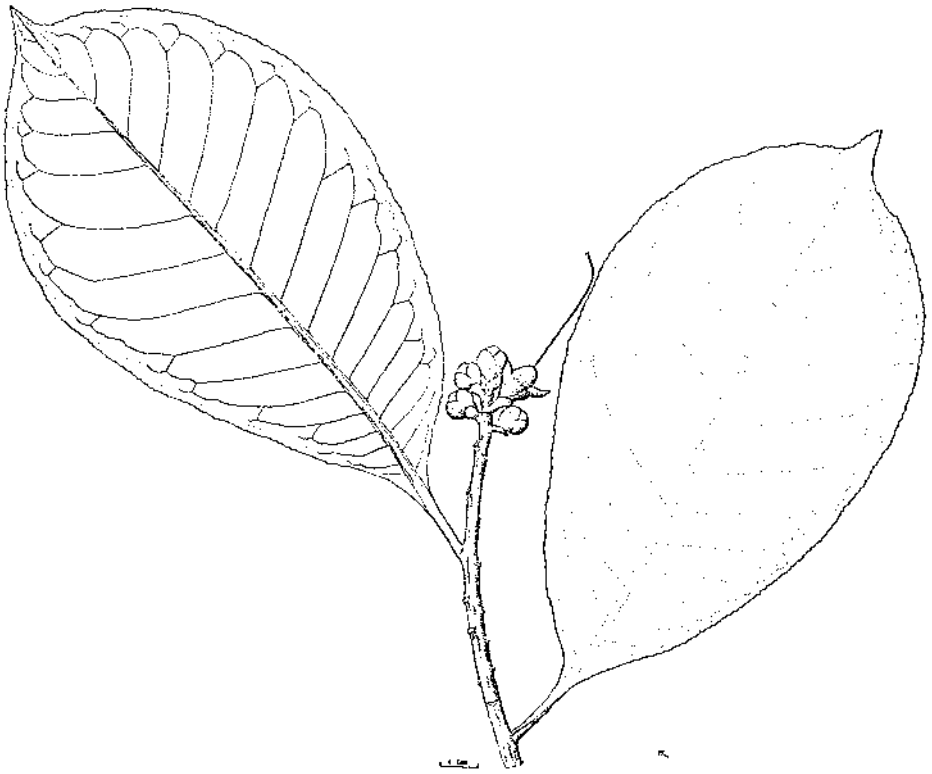


Fig. 129. *Barringtonia curranii* Merr.

(Lecythidaceae)



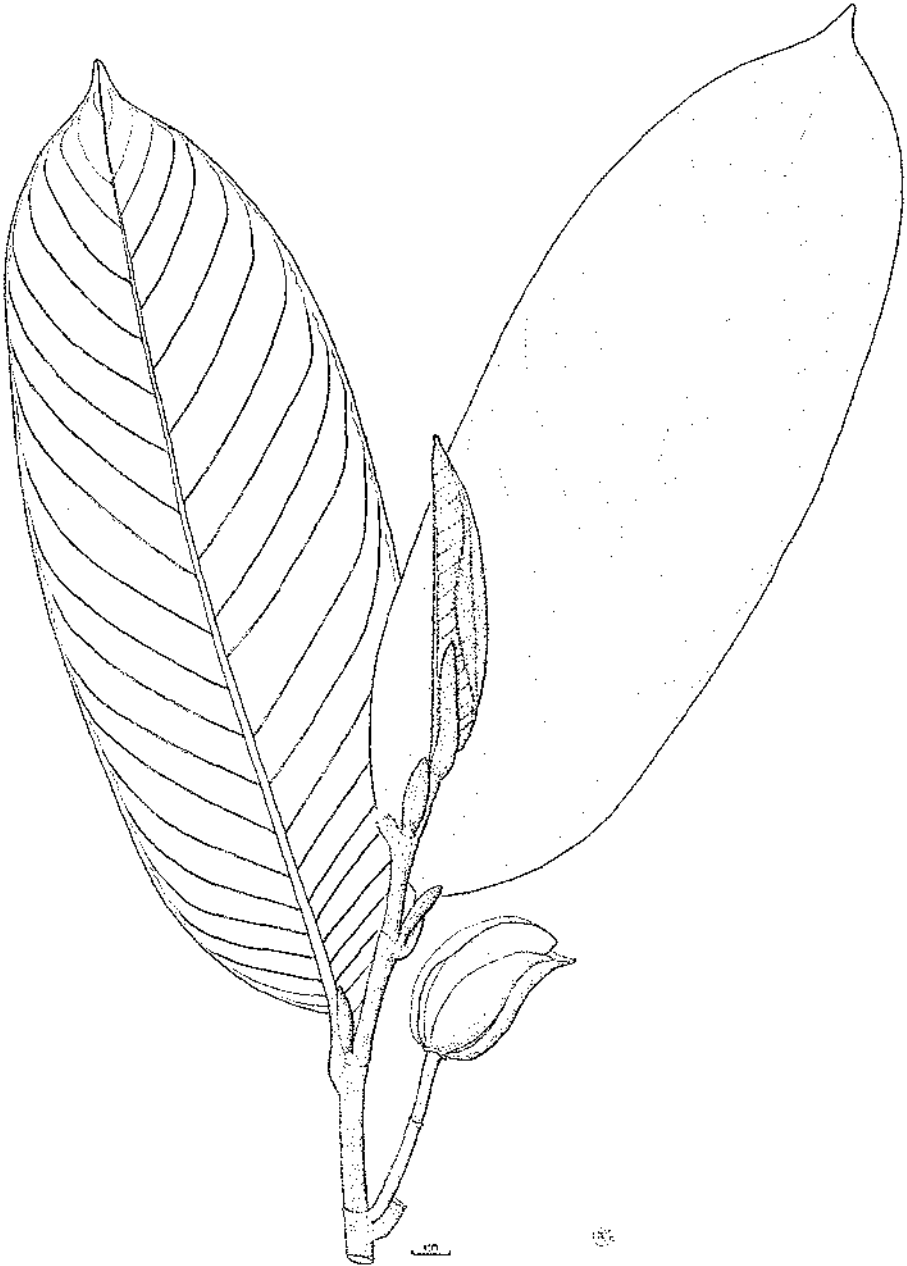
(Lecythidaceae)

Fig. 130. *Planchonia valida* (Blume) Blume



Fig. 131. *Fagraea racemosa* Jack ex Wall.

(Loganiaceae)



(Magnoliaceae)

Fig. 132. *Elmerillia tsiampacca* (L.) Dandy

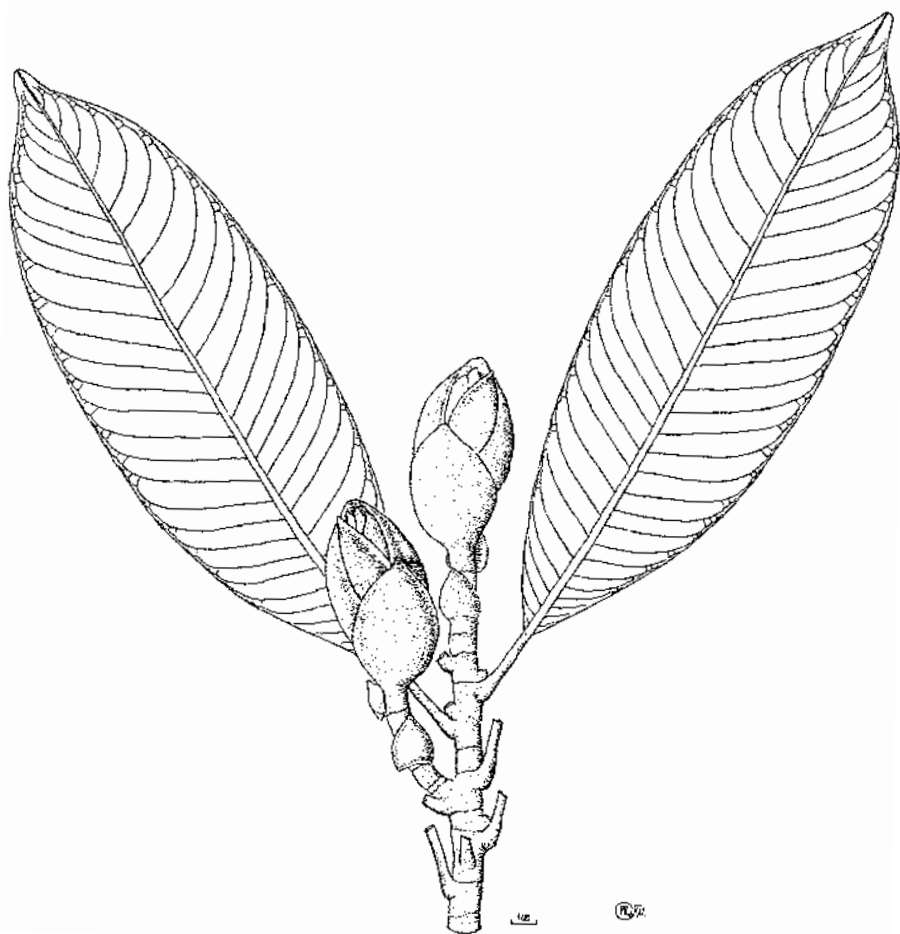
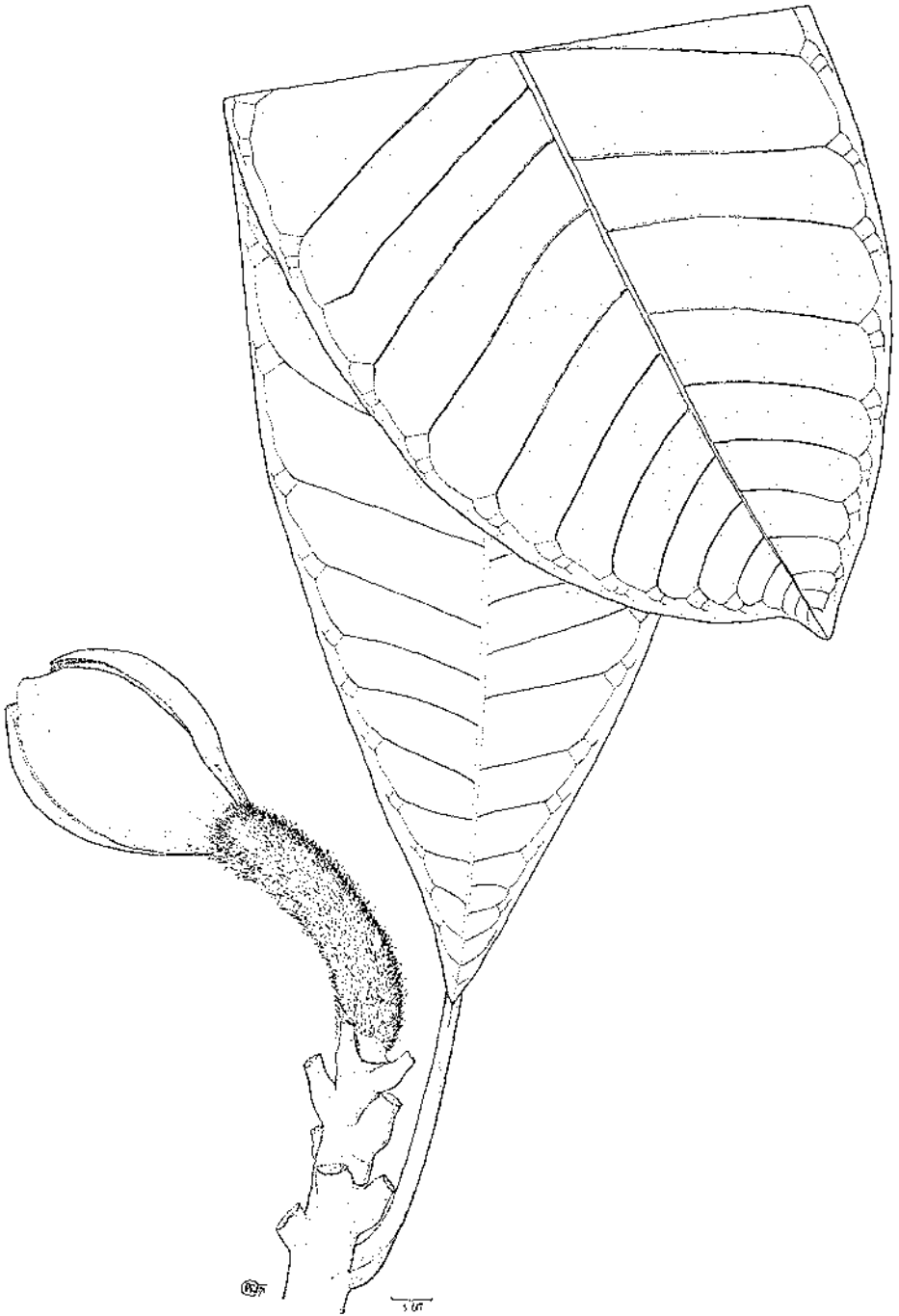


Fig. 133. *Magnolia candollii* (Blume) H. Keng  
var. *singapurensis* (Ridley) Noot.

(Magnoliaceae)



(Magnoliaceae) Fig. 134a. *Magnolia lasia* Noot. Twig in flower (young).

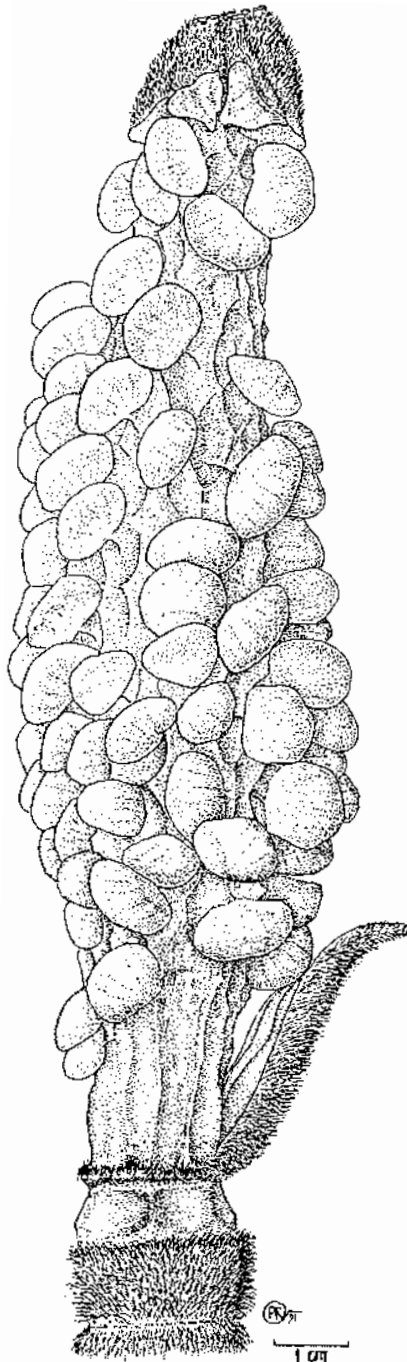
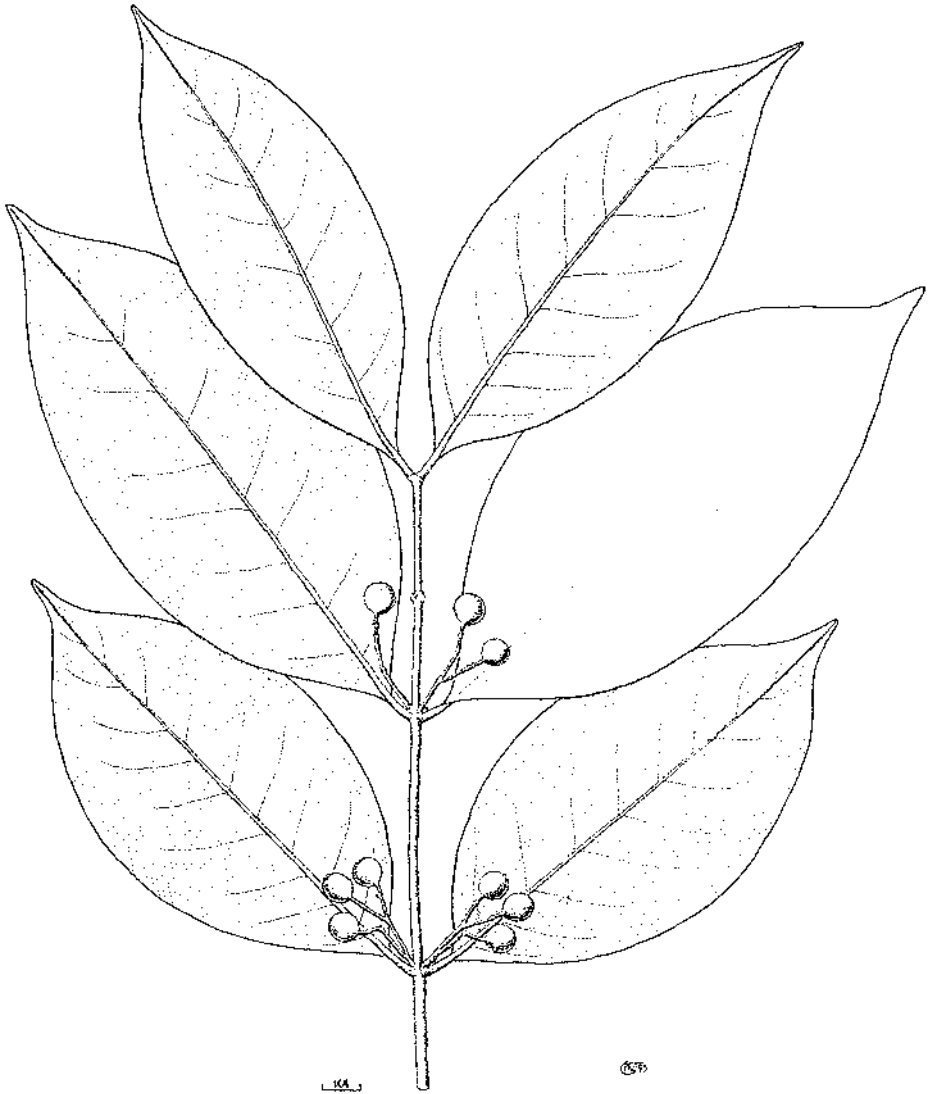


Fig. 134b. *Magnolia lasia* Noot. Fruit.

(Magnoliaceae)



(Melastomataceae)

Fig. 135. *Memecylon borneense* Merr.



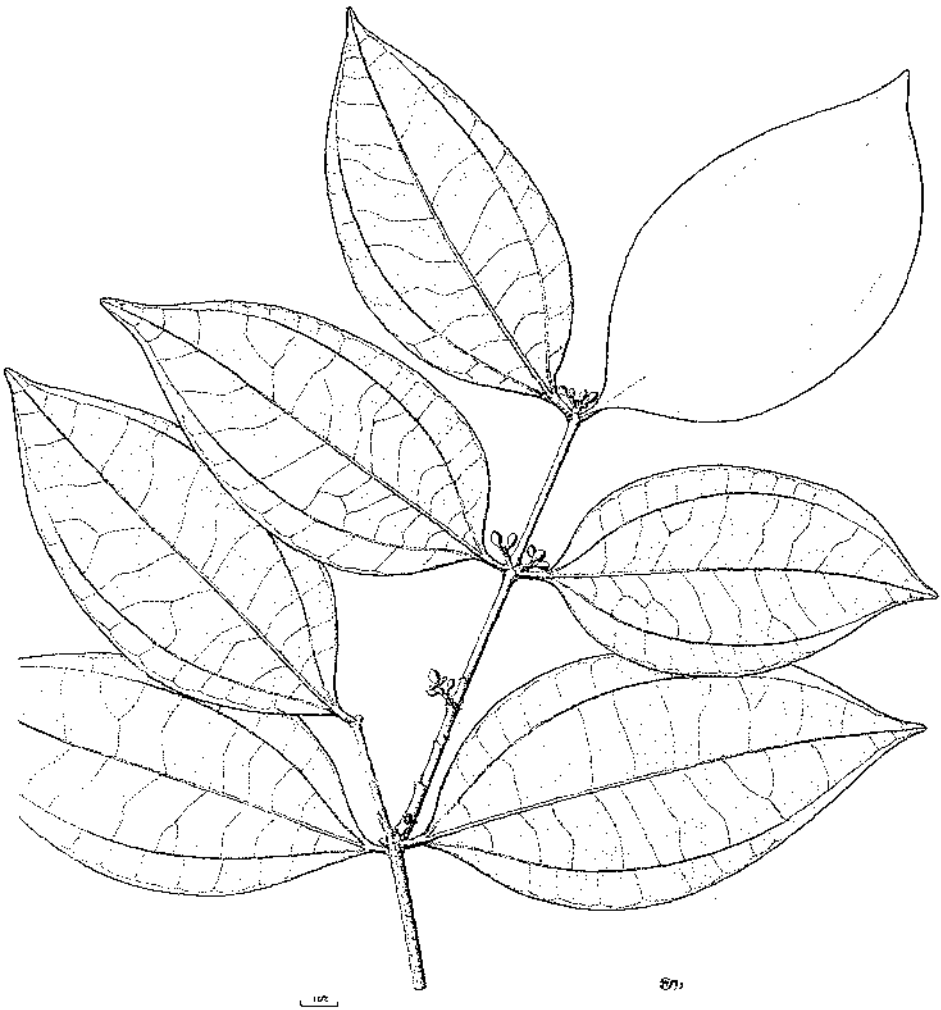
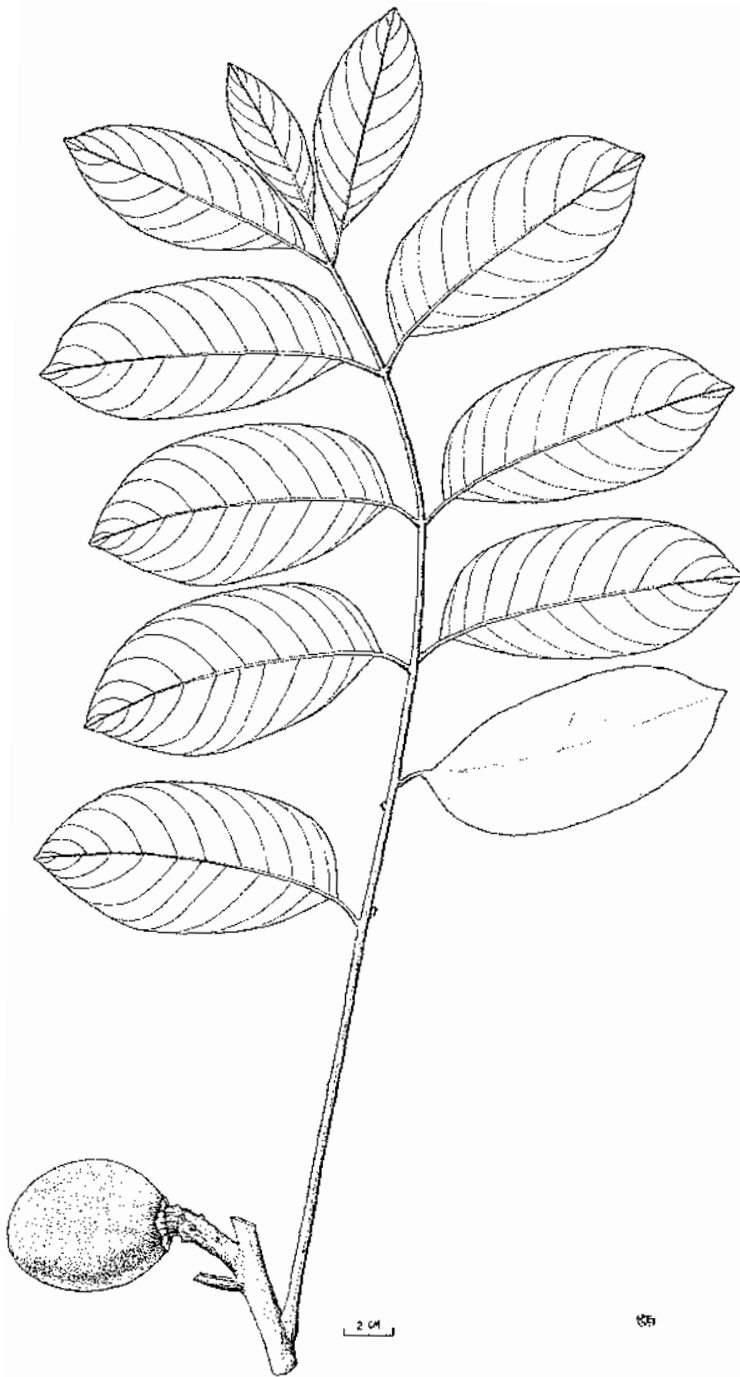


Fig. 136. *Pierandra rostrata* (Cogn.) Nayar

(Melastomataceae)



(Meliaceae)

Fig. 137. *Aglaia spectabilis* (Miq.) Jain & Bennett



Fig. 138. *Dysoxylum alliaceum* Blume

(Meliaceae)



(Mimosaceae)

Fig. 139. *Archidendron havilandii* (Ridley) Nielsen

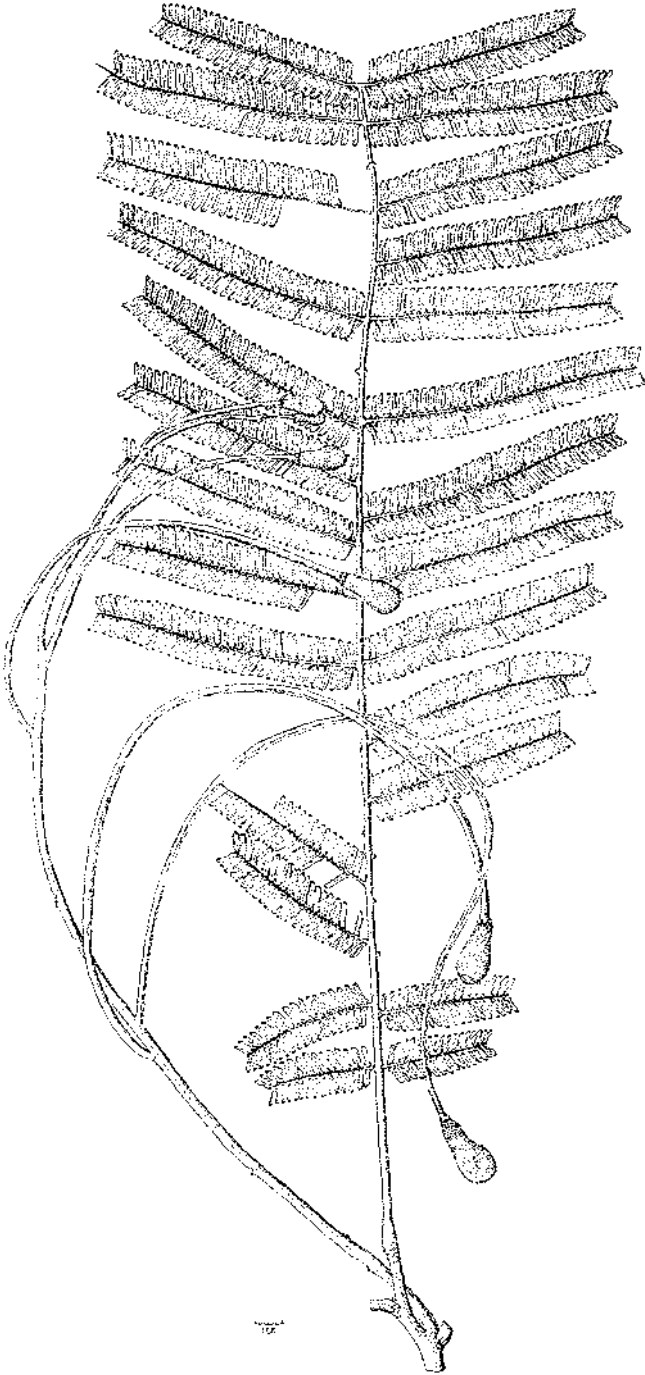
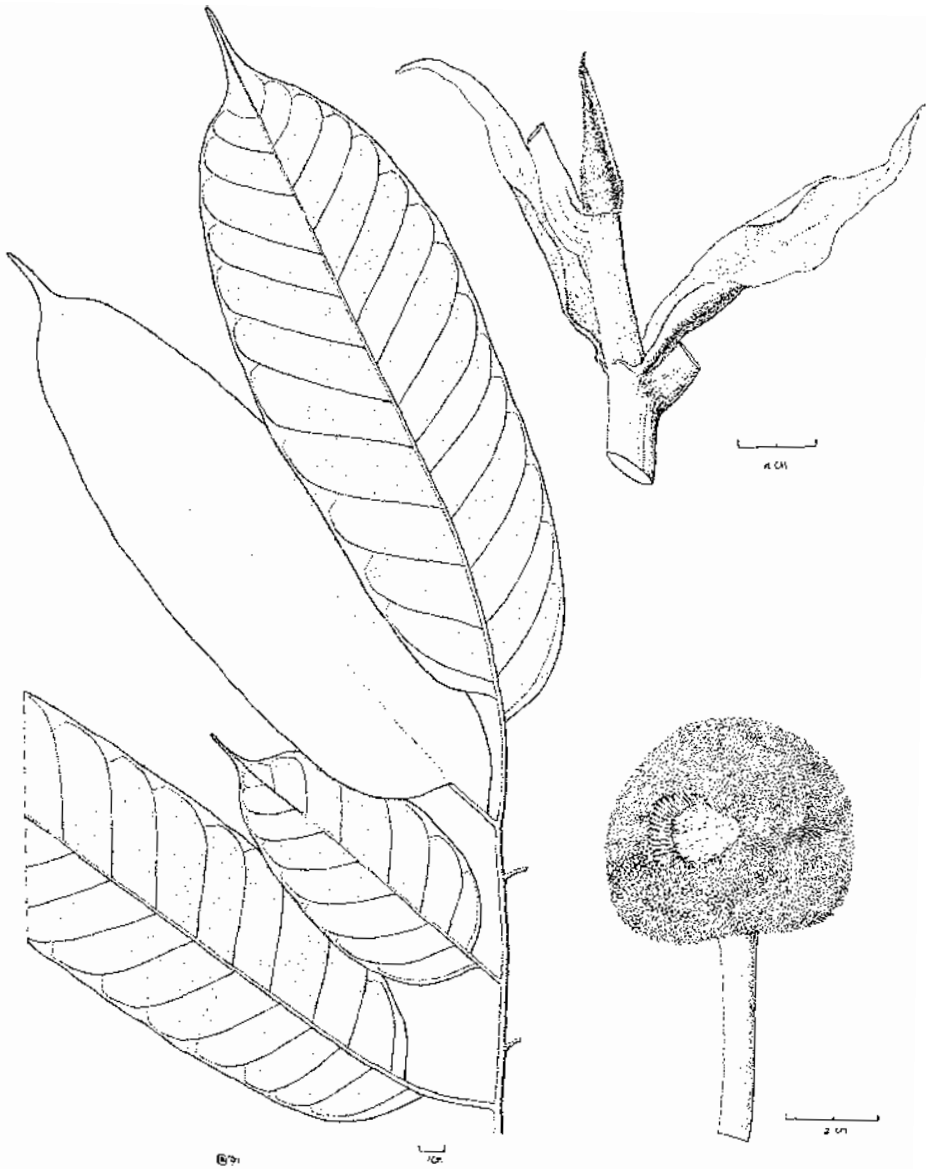


Fig. 140. *Parkia timoriana* (DC.) Merr.

(Mimosaceae)



(Moraceae)

Fig. 141. *Artocarpus anisophyllus* Miq.

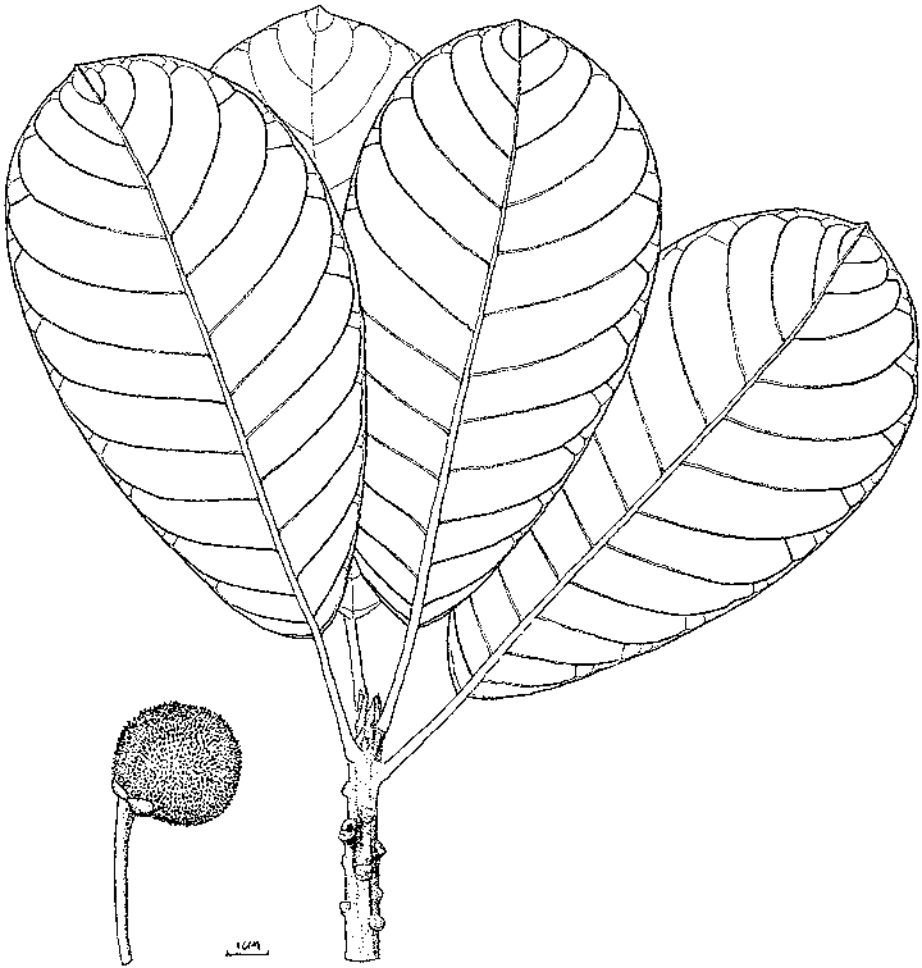
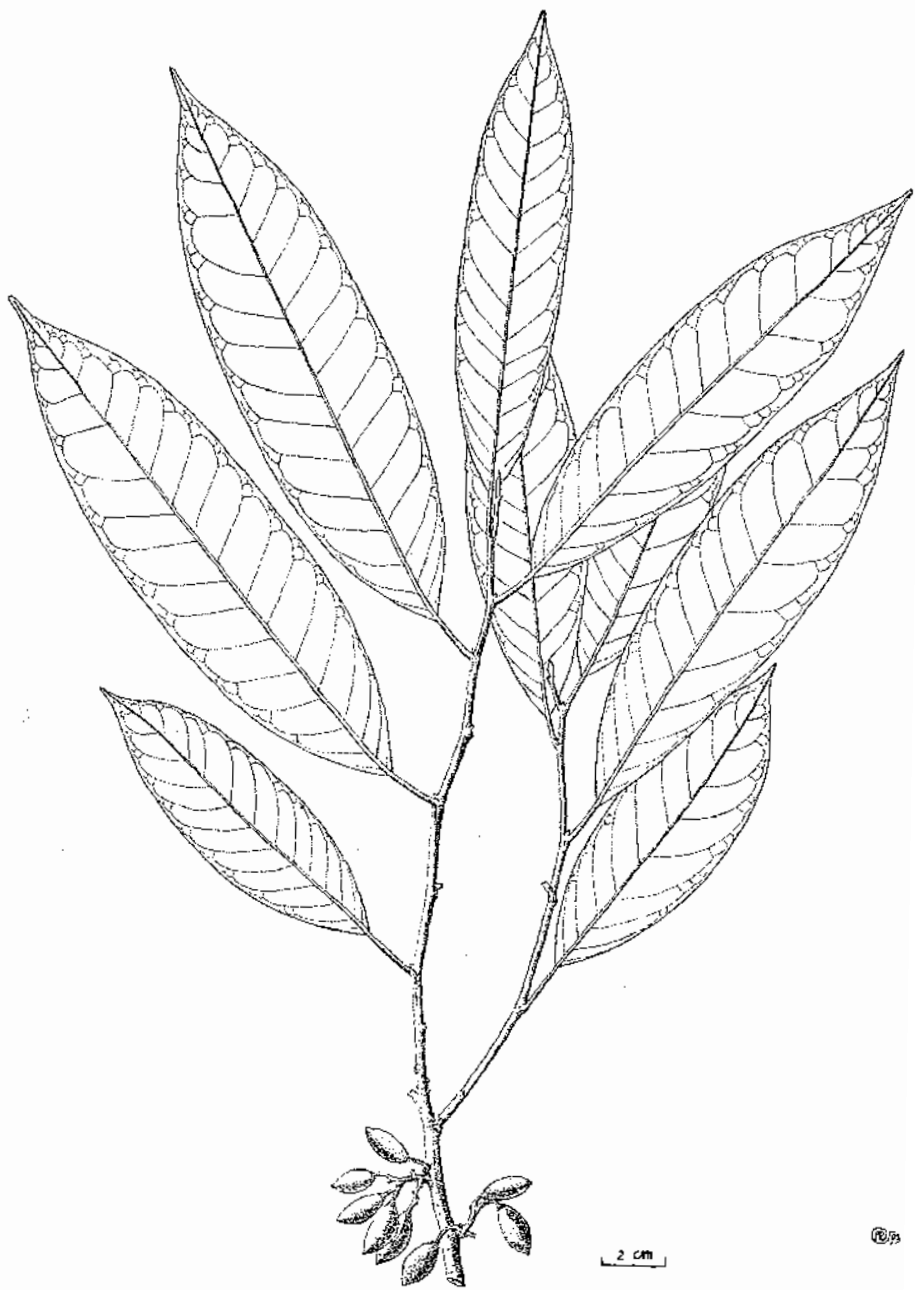


Fig. 142. *Parartocarpus bracteatus* (King) Becc.

(Moraceae)



(Myristicaceae) Fig. 143. *Gymnacranthera farquhariana* (Hook. f. & Th.) Warb.  
var. *zippeliana* (Miq.) Schouten



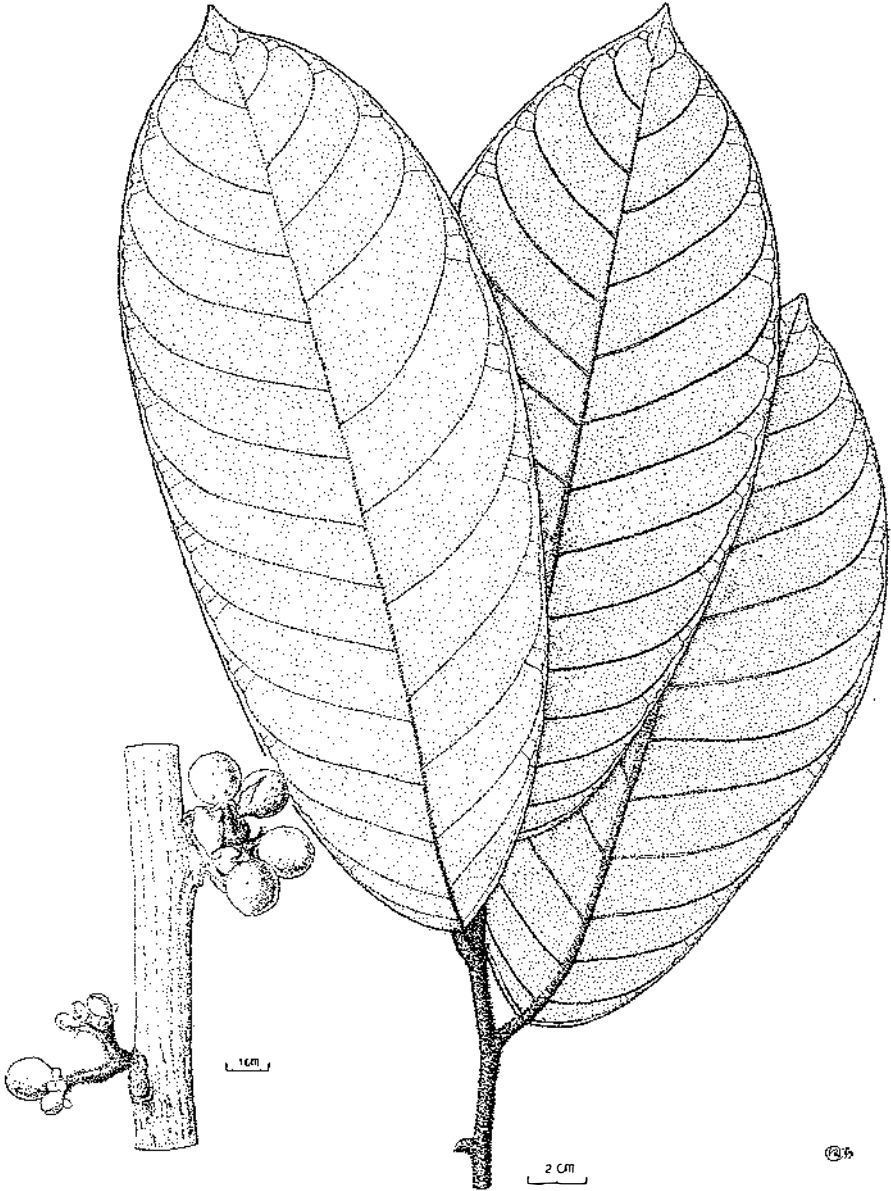
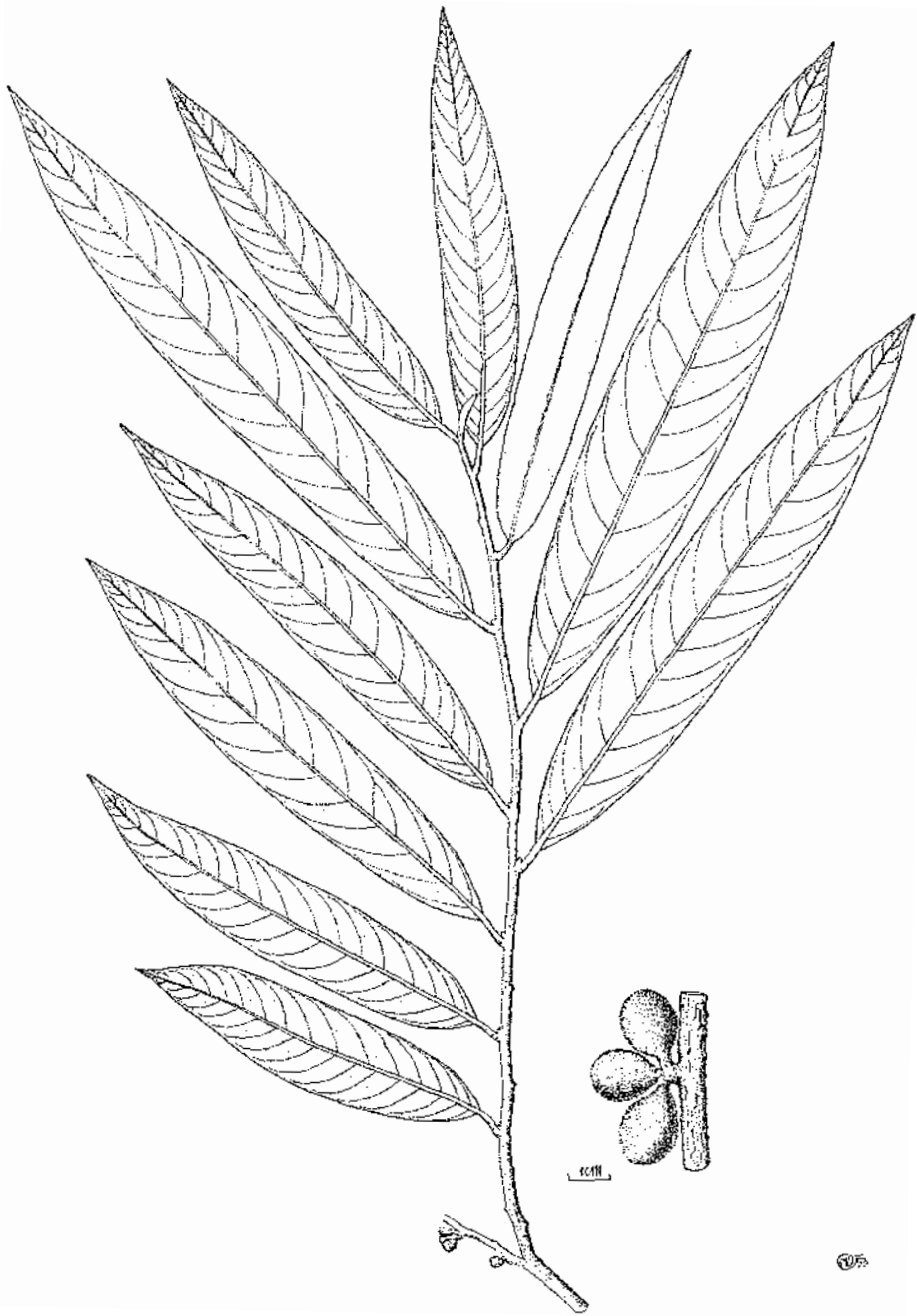


Fig. 144. *Horsfieldia grandis* (Hook. f.) Warb.

(Myristicaceae)



(Myristicaceae) Fig. 145. *Knema latericia* Elmer subsp. *albifolia* (Sinclair) De Wilde

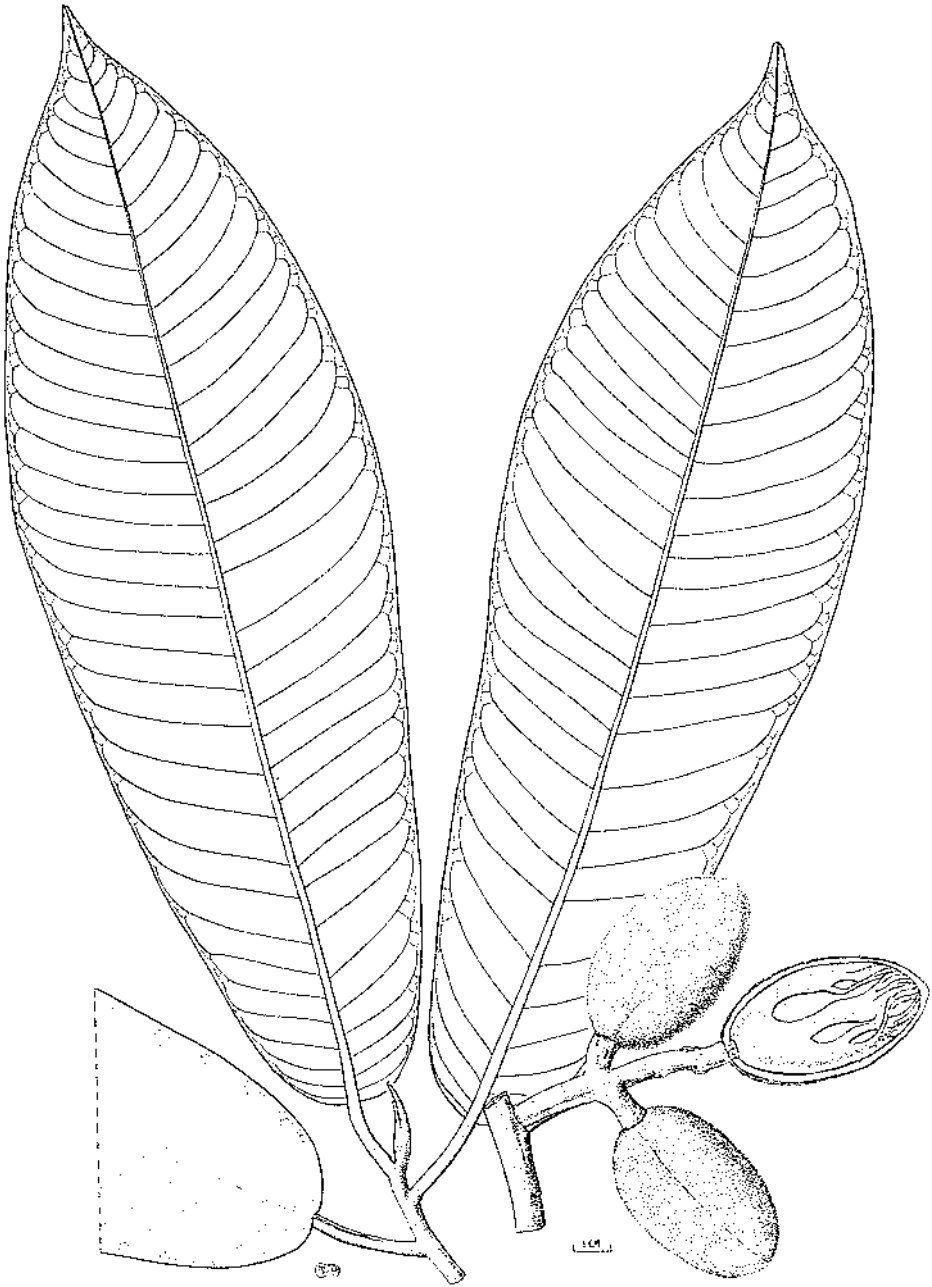
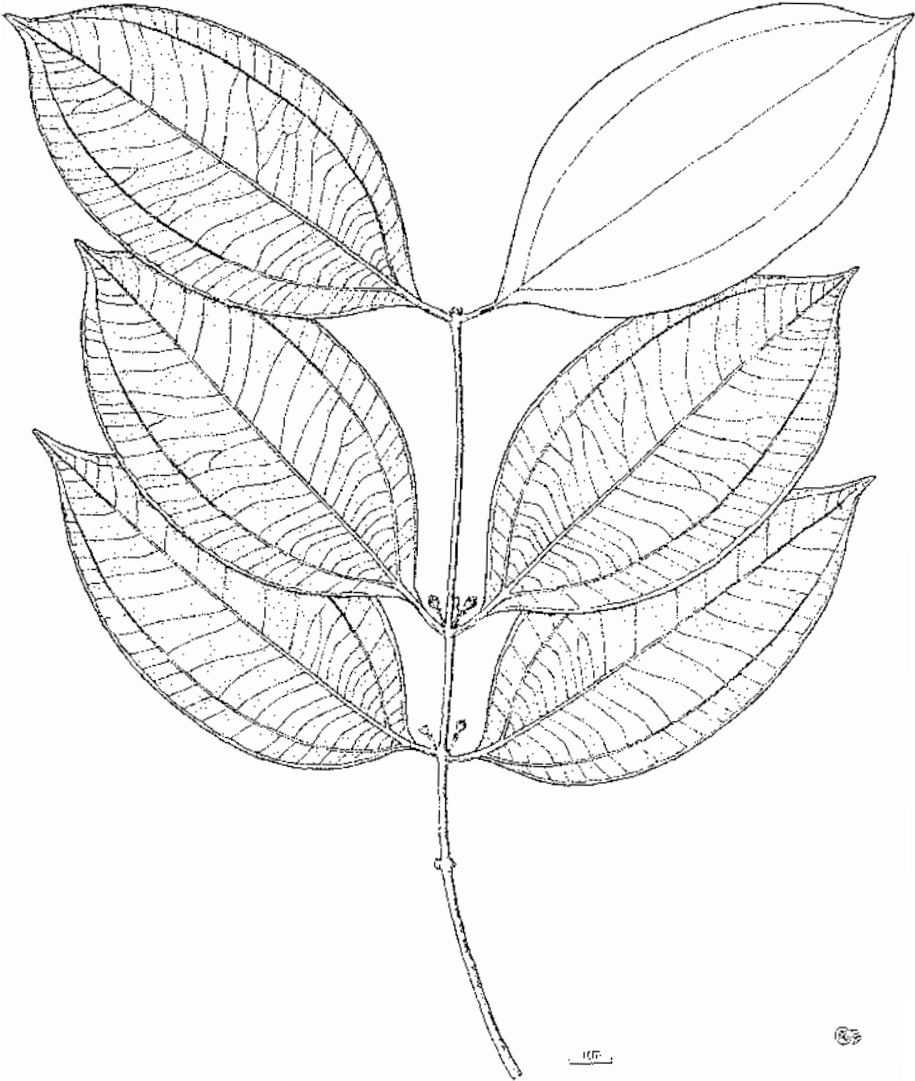


Fig. 146. *Myristica maxima* Warb.

(Myristicaceae)



(Myrtaceae)

Fig. 147. *Rhodammia cinerea* Jack

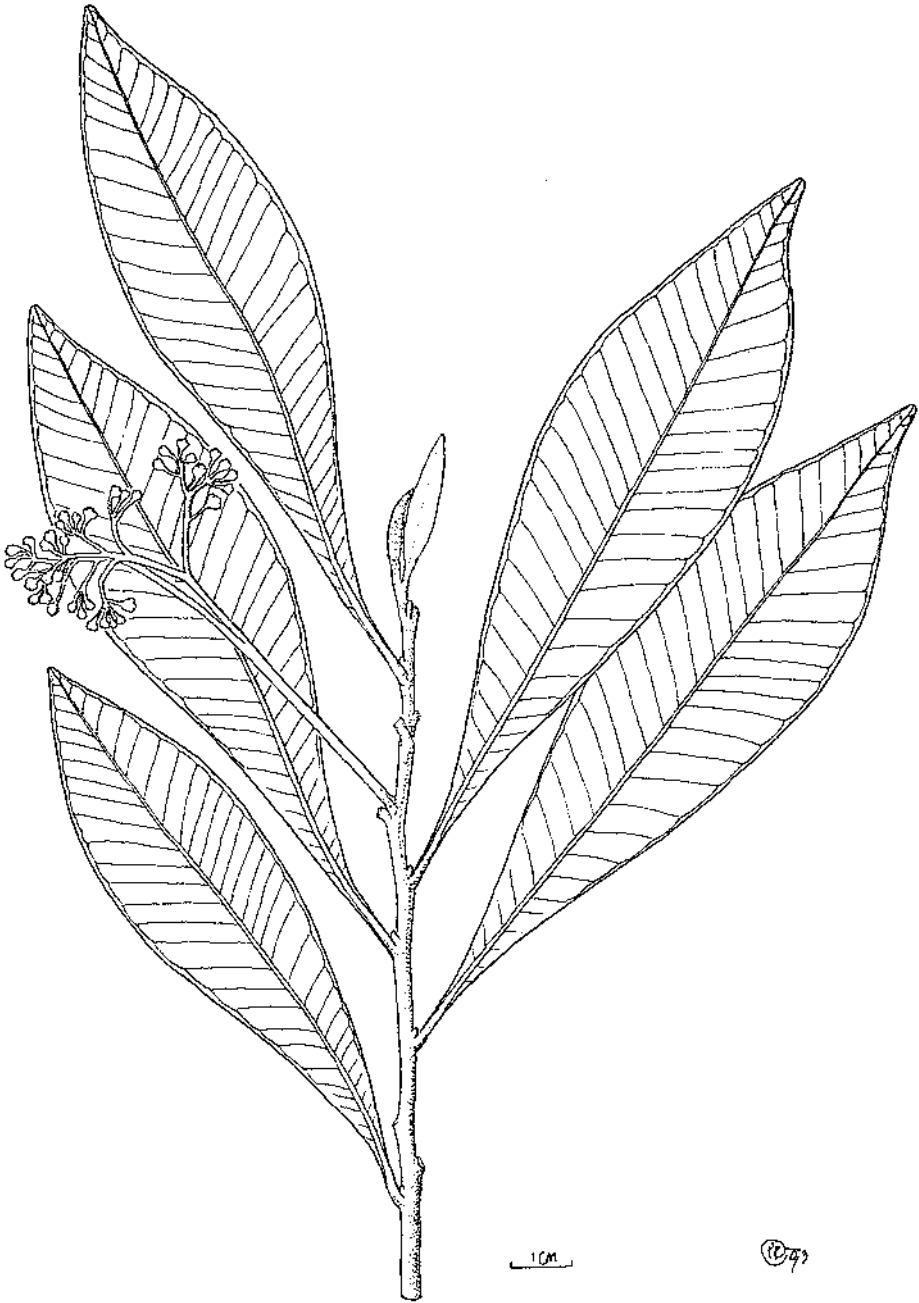


Fig. 148. *Tristaniopsis whiteana* (Griff.) Wilson & Waterhouse (Myrtaceae)



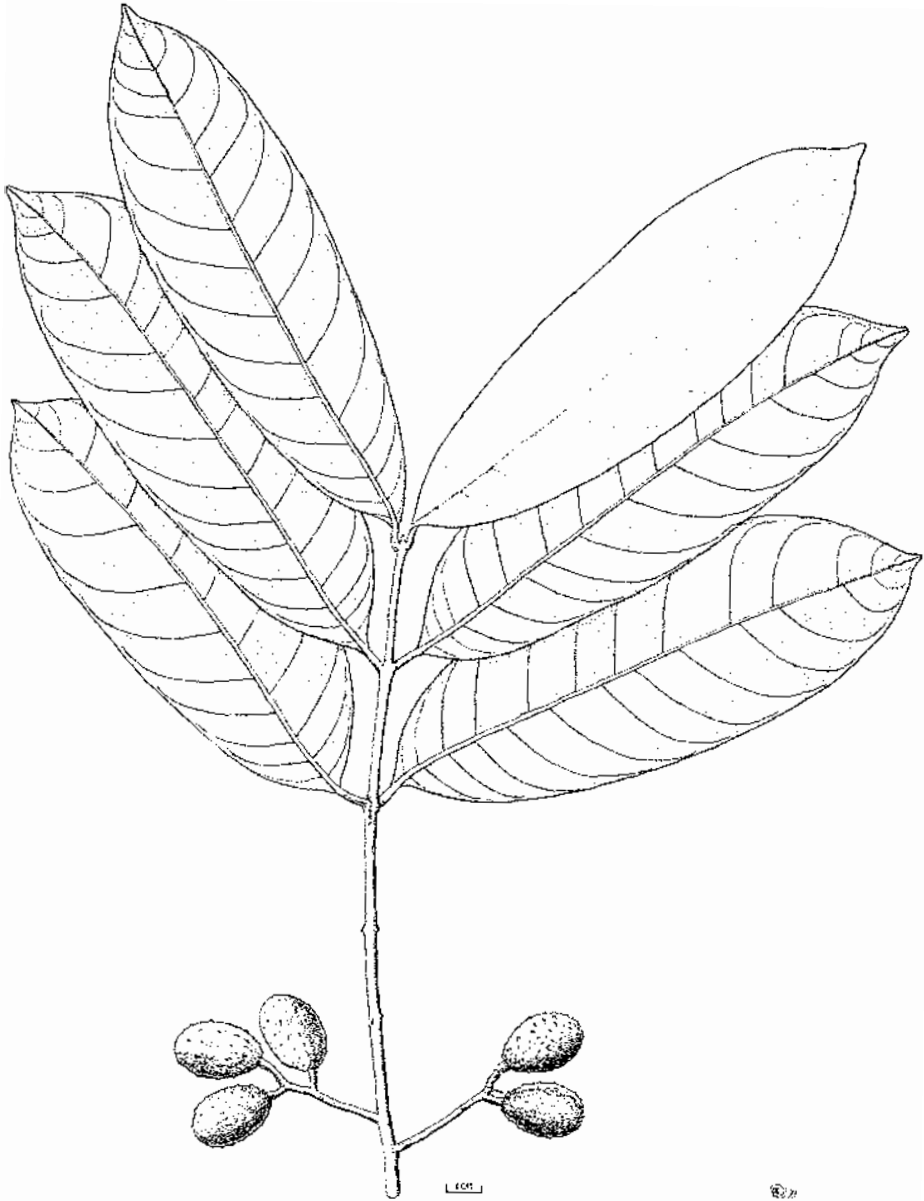
(Olacaceae)

Fig. 149. *Ochanostachys amentacea* Mast.



Fig. 150. *Scorodocarpus borneensis* (Baillon) Becc.

(Olacaceae)



(Oleaceae)

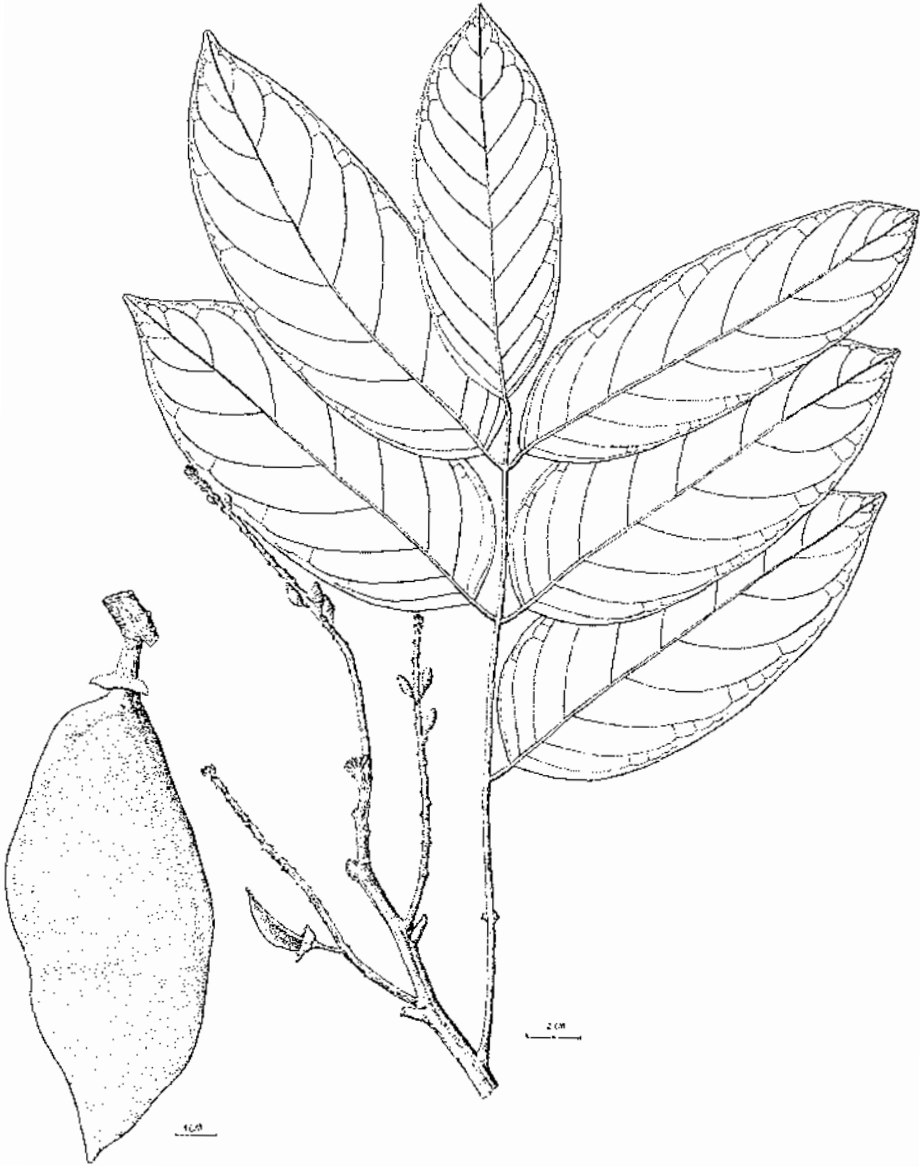
Fig. 151. *Chionanthus pluriflorus* (Knobl.) Kiew





Fig. 152. *Sarcotheca diversifolia* (Miq.) Hall. f.

(Oxalidaceae)



(Papilionaceae)

Fig. 153. *Callerya atropurpurea* (Wall.) Schot

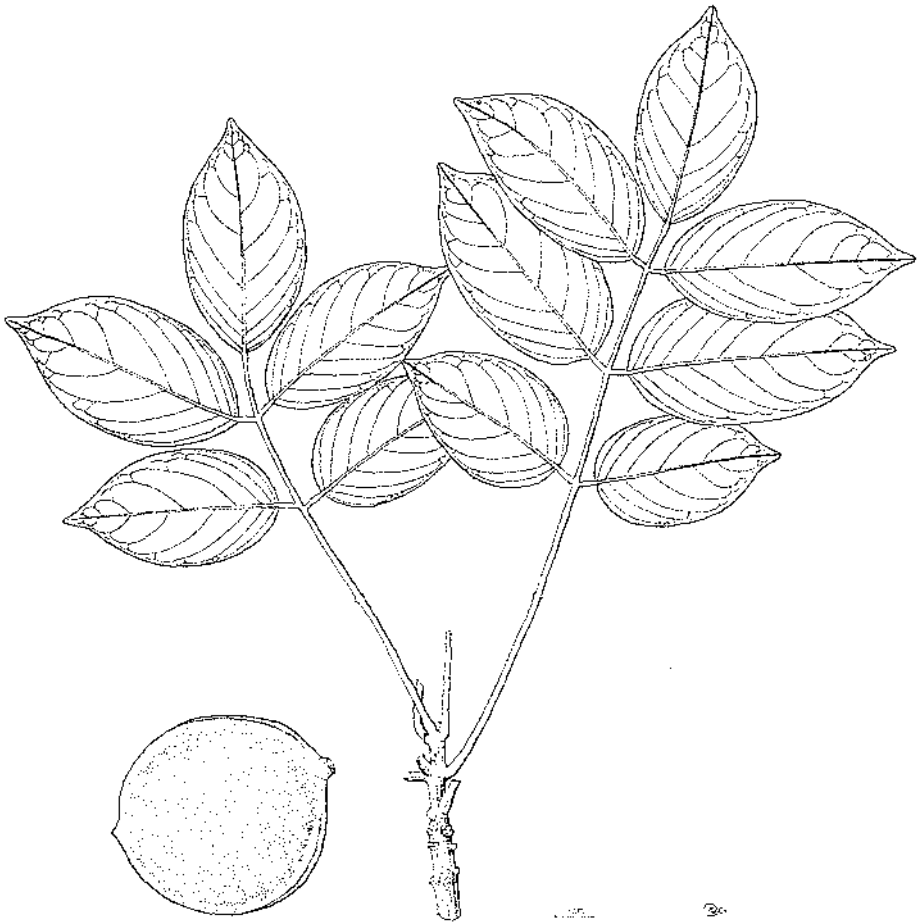
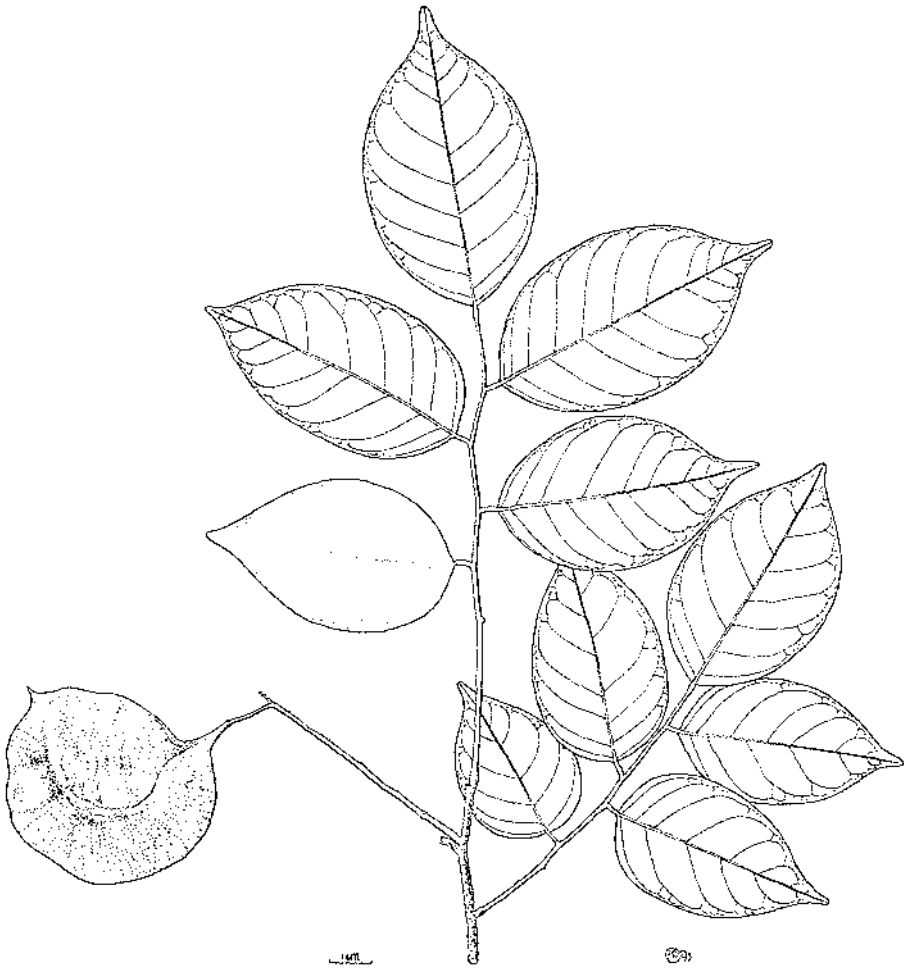


Fig. 154. *Ormosia macrodisca* Baker

(Papilionaceae)



(Papilionaceae)

Fig. 155. *Pterocarpus indicus* Willd.

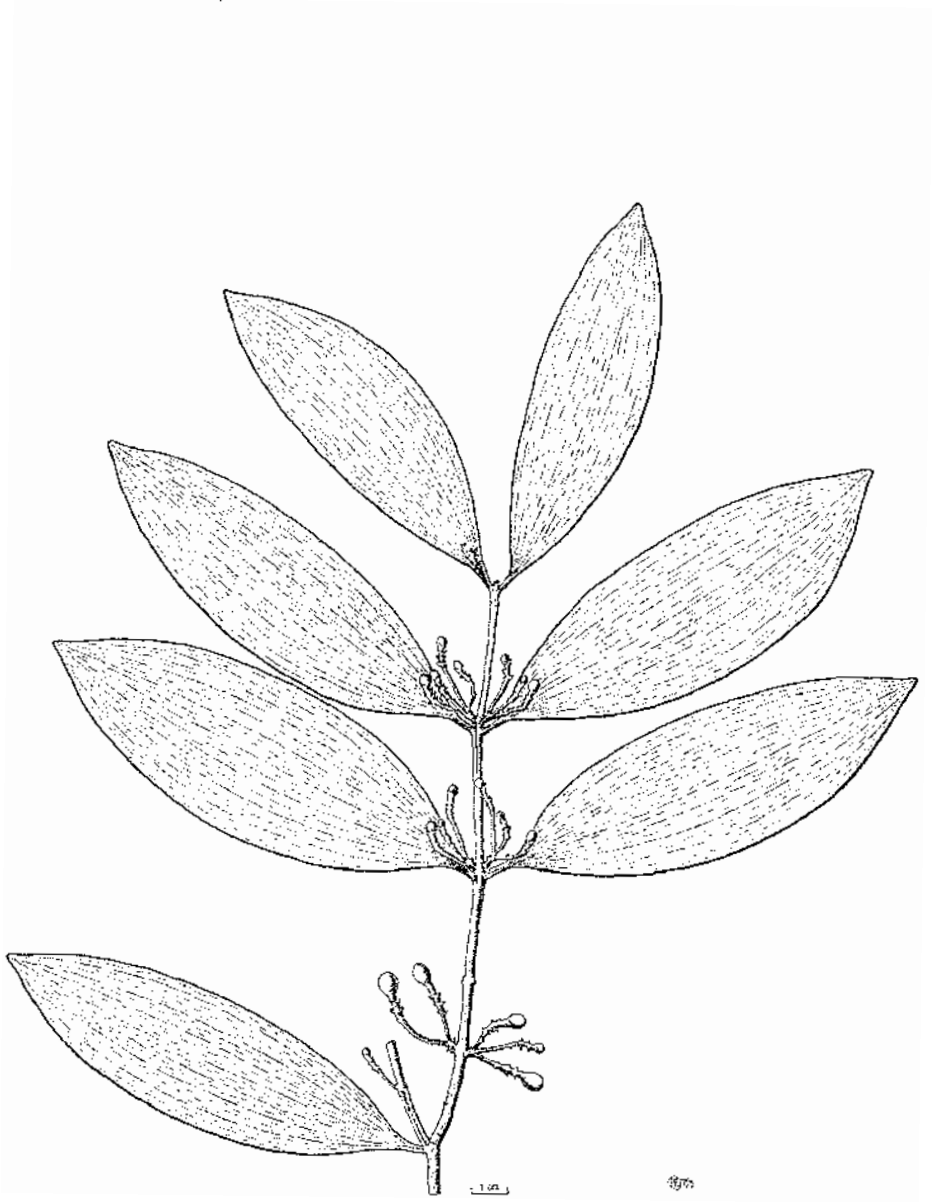
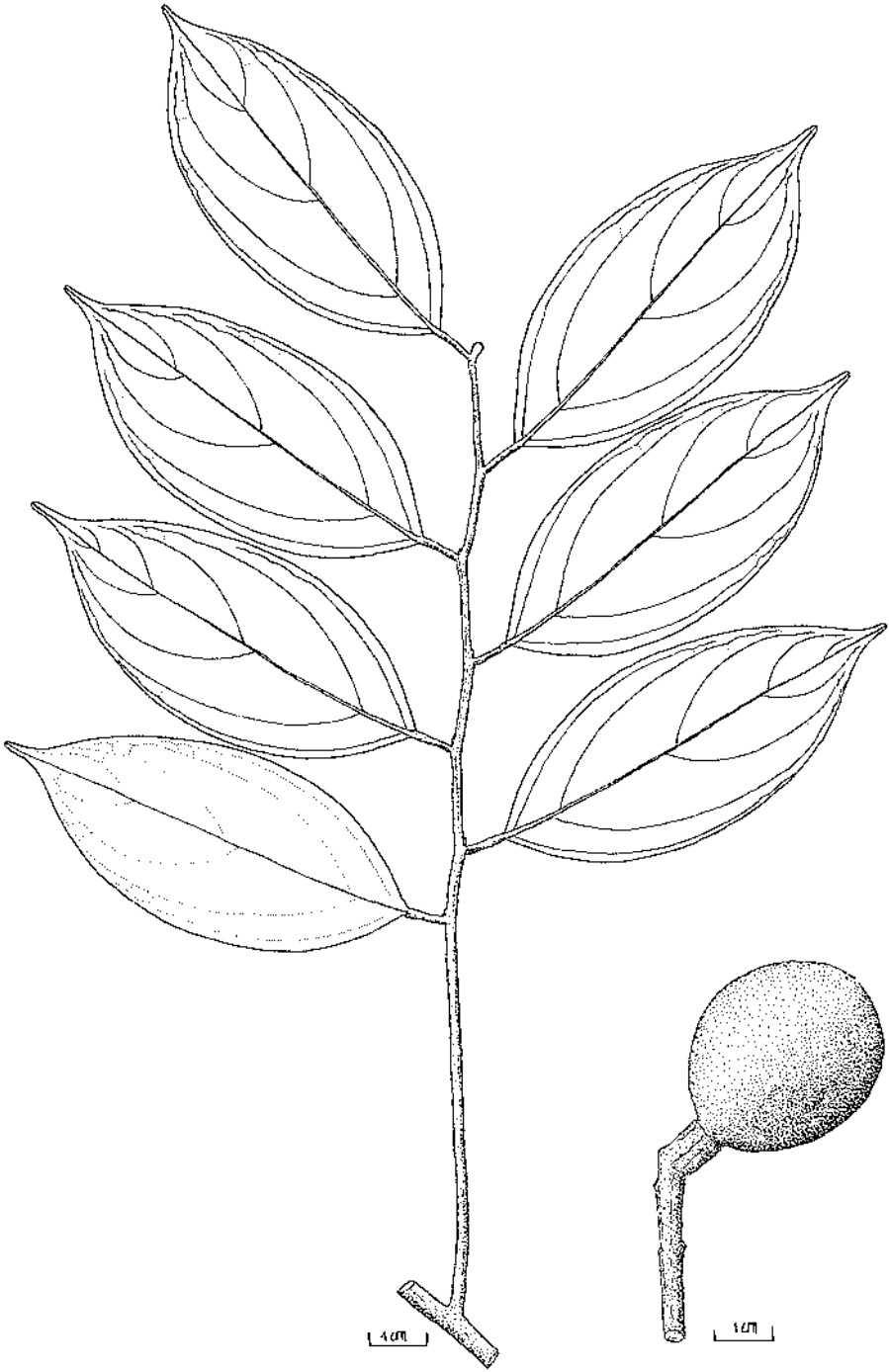


Fig. 156. *Nageia wallichiana* (Presl) O. Kuntze

(Podocarpaceae)

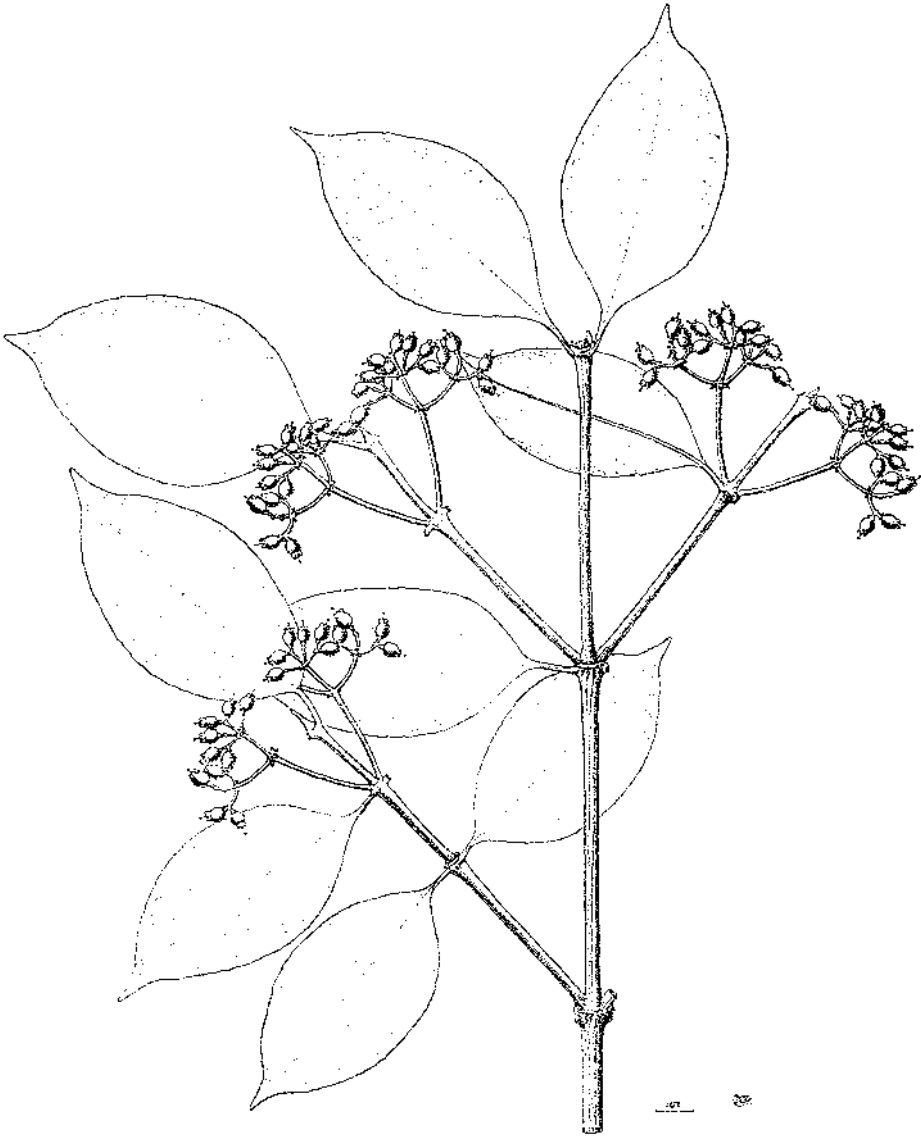


(Polygalaceae)

Fig. 157. *Xanthophyllum obscurum* Bennett



Fig. 158. *Alphonsoia incana* (Roxb.) Teijsm. & Binn. ex Kurz (Rhamnaceae)



(Rhizophoraceae)

Fig. 159. *Carallia brachiata* (Lour.) Merr.



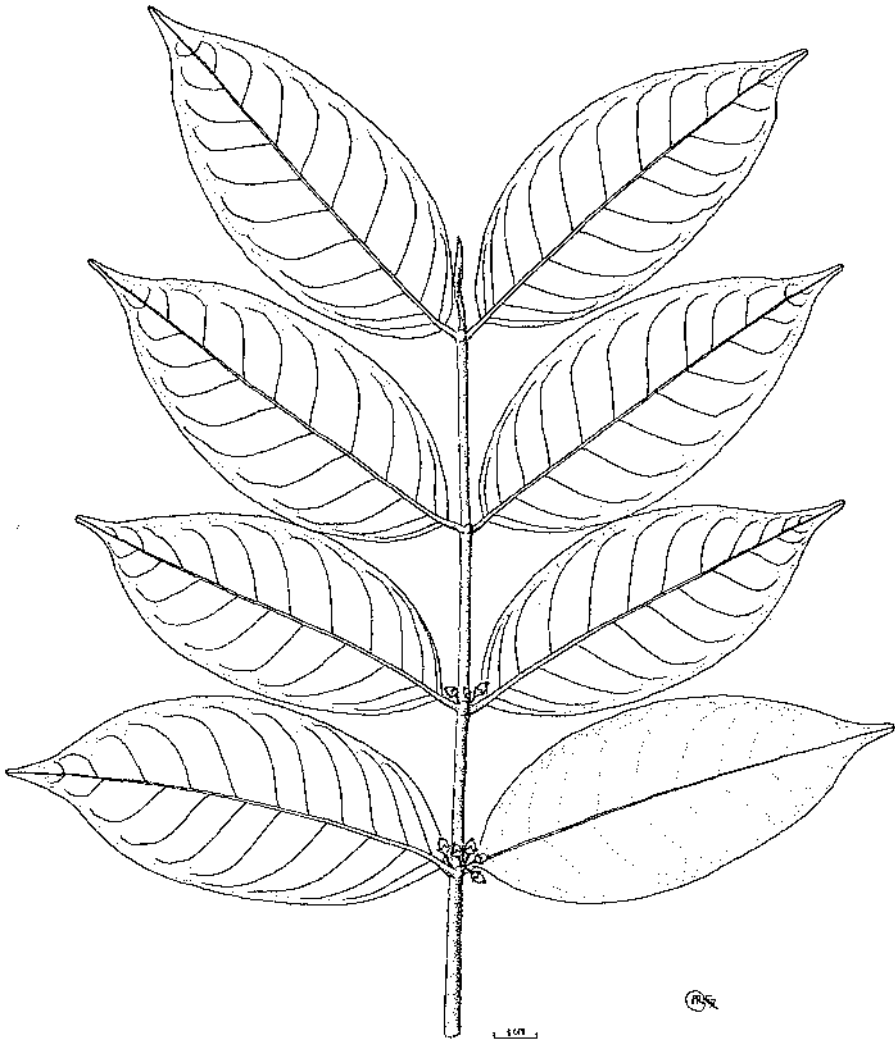
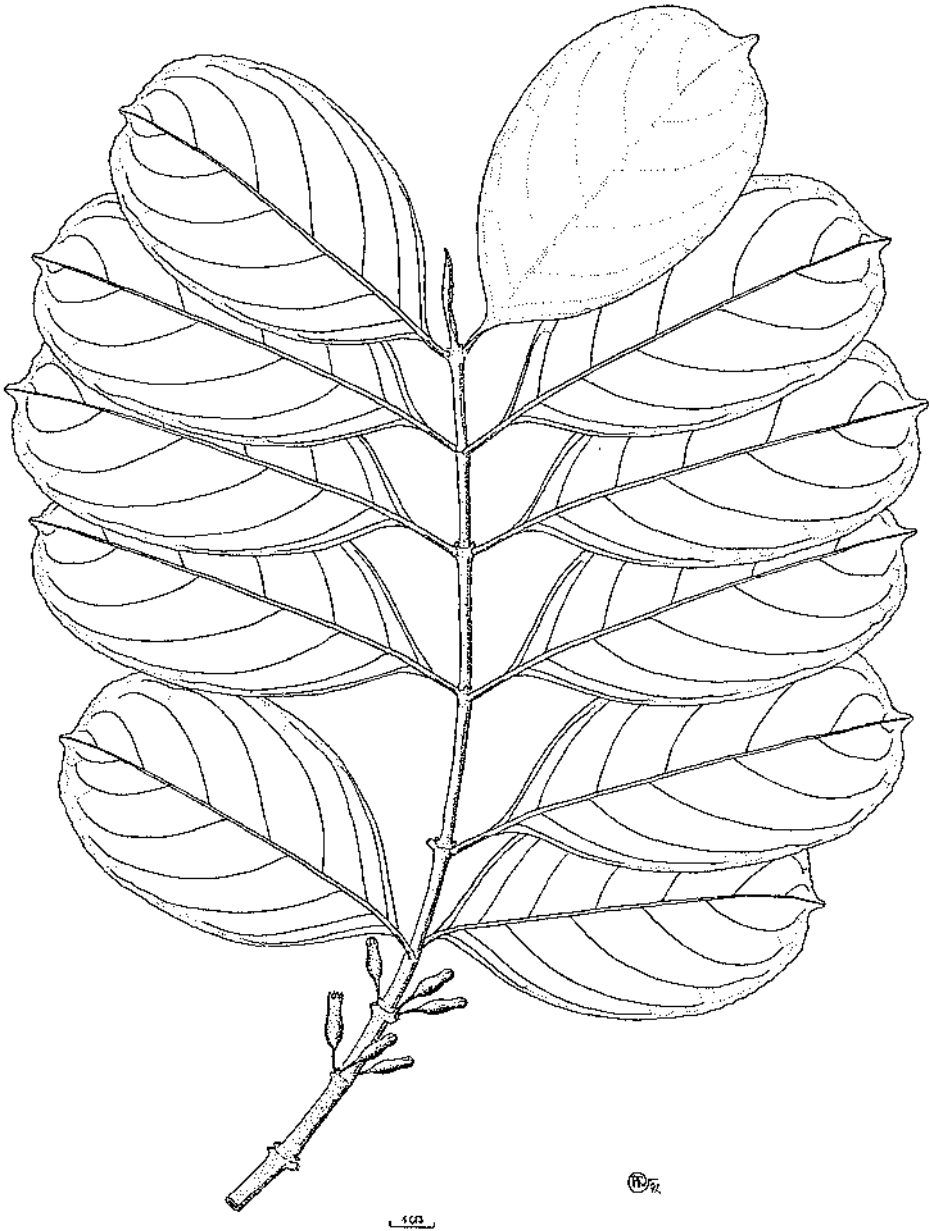


Fig. 160. *Gynotroches axillaris* Blume

(Rhizophoraceae)



(Rhizophoraceae)

Fig. 161. *Pellacalyx lobbii* (Hook. f.) Schimp.

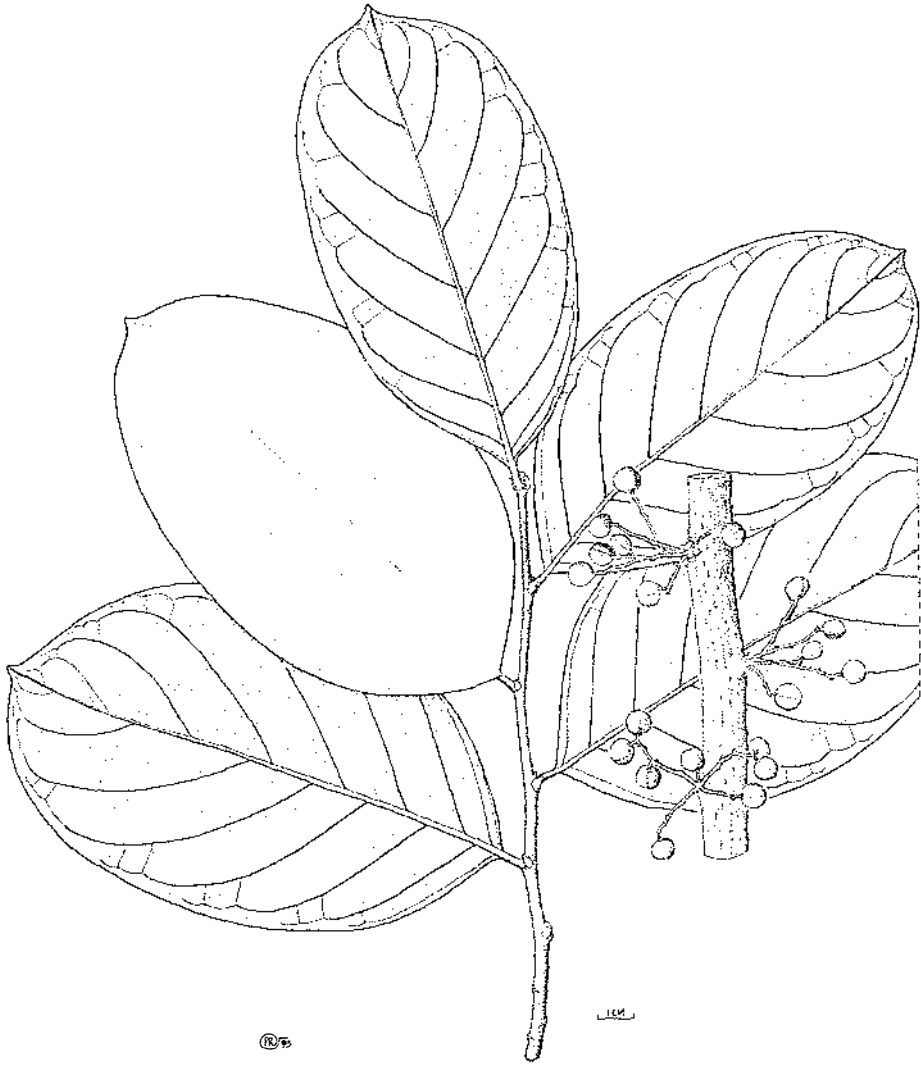
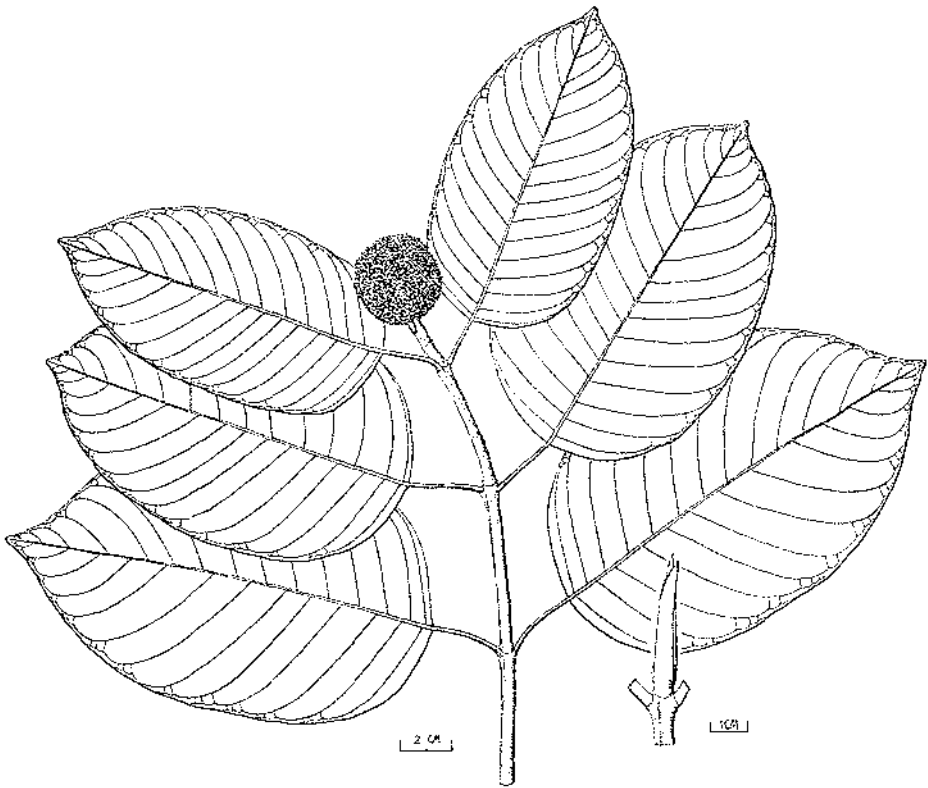


Fig. 162. *Prunus beccarii* (Ridley) Kalkman

(Rosaceae)



(Rubiaceae)

Fig. 163. *Anthocephalus chinensis* (Lam.) A. Rich. ex Walp.

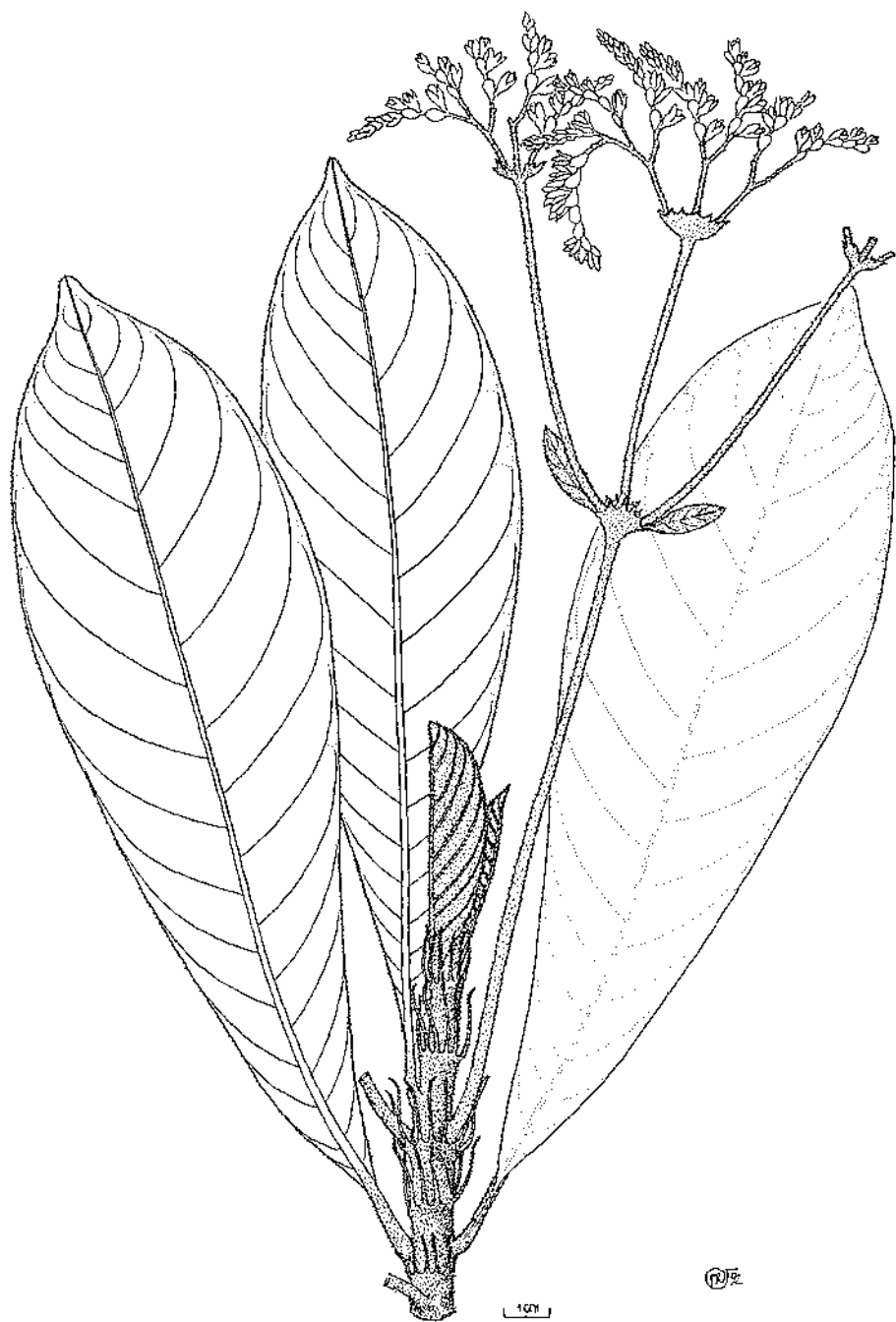


Fig. 164. *Jackiopsis ornata* (Wall.) Ridsdale

(Rubiaceae)



(Rubiaceae)

Fig. 165. *Nauclea officinalis* (Pierre ex Pitard) Merr. & Chun

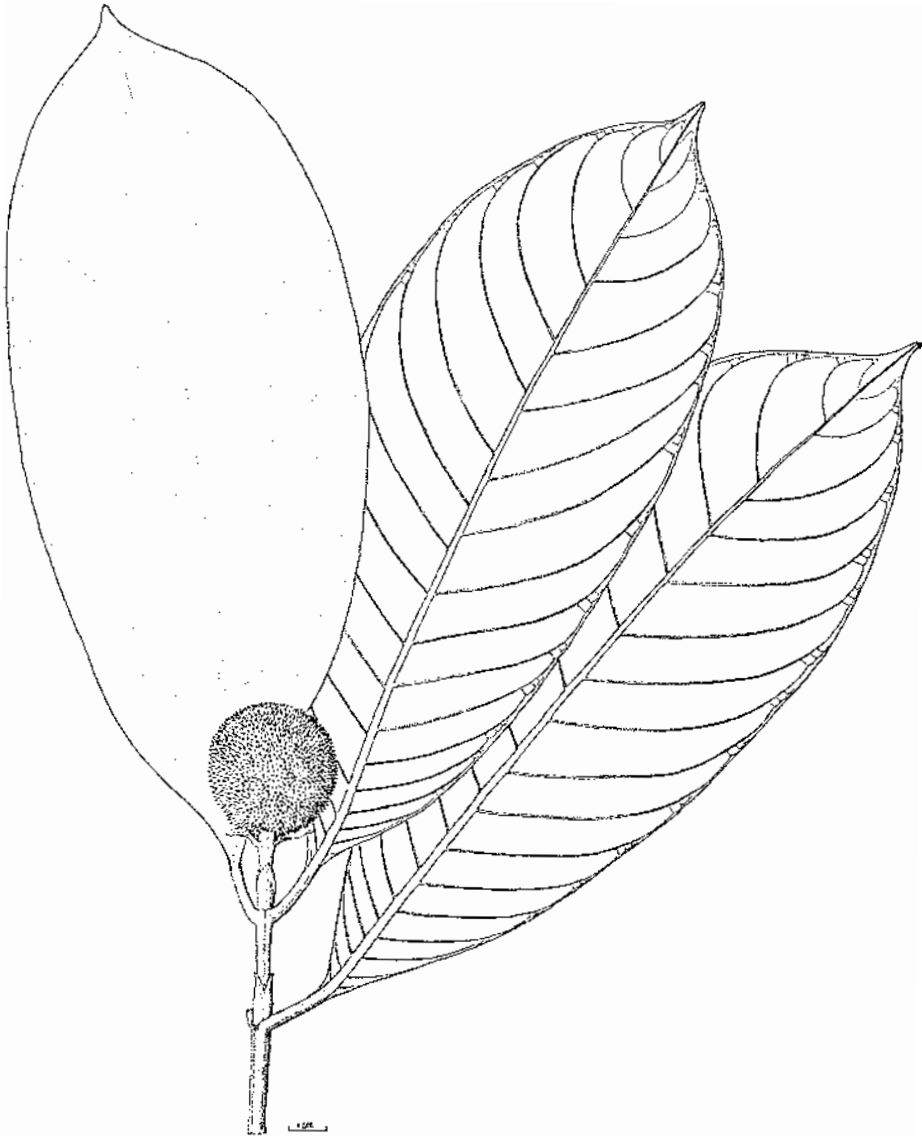


Fig. 166. *Ochreinauclea maingayi* (Hook. f.) Ridsdale

(Rubiaceae)



(Rubiaceae)

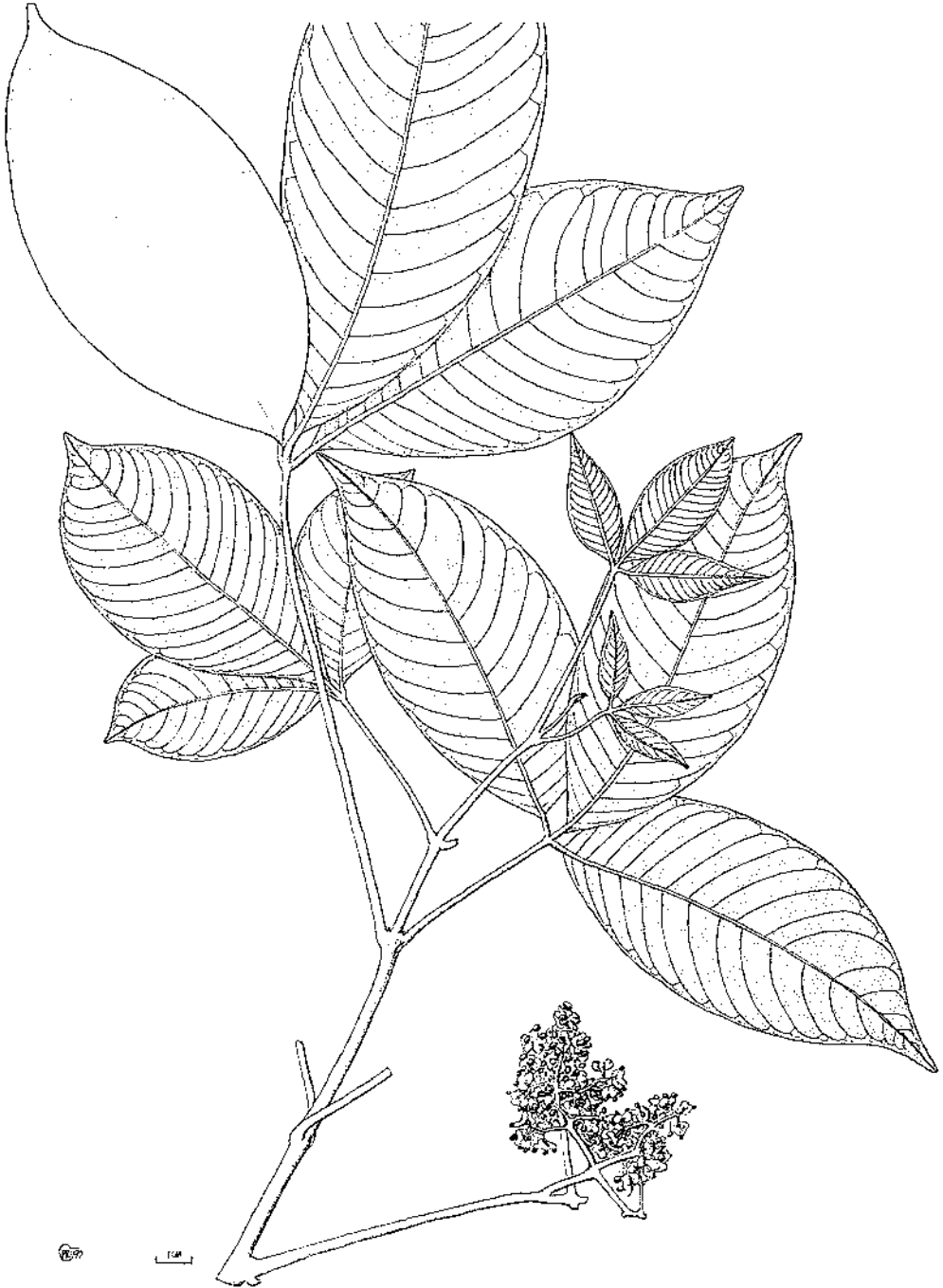
Fig. 167. *Pertusadina eurhyncha* Ridsdale





Fig. 168. *Rothmannia* spec. nov.

(Rubiaceae)



(Rutaceae)

Fig. 169. *Euodia glabra* (Blume) Blume

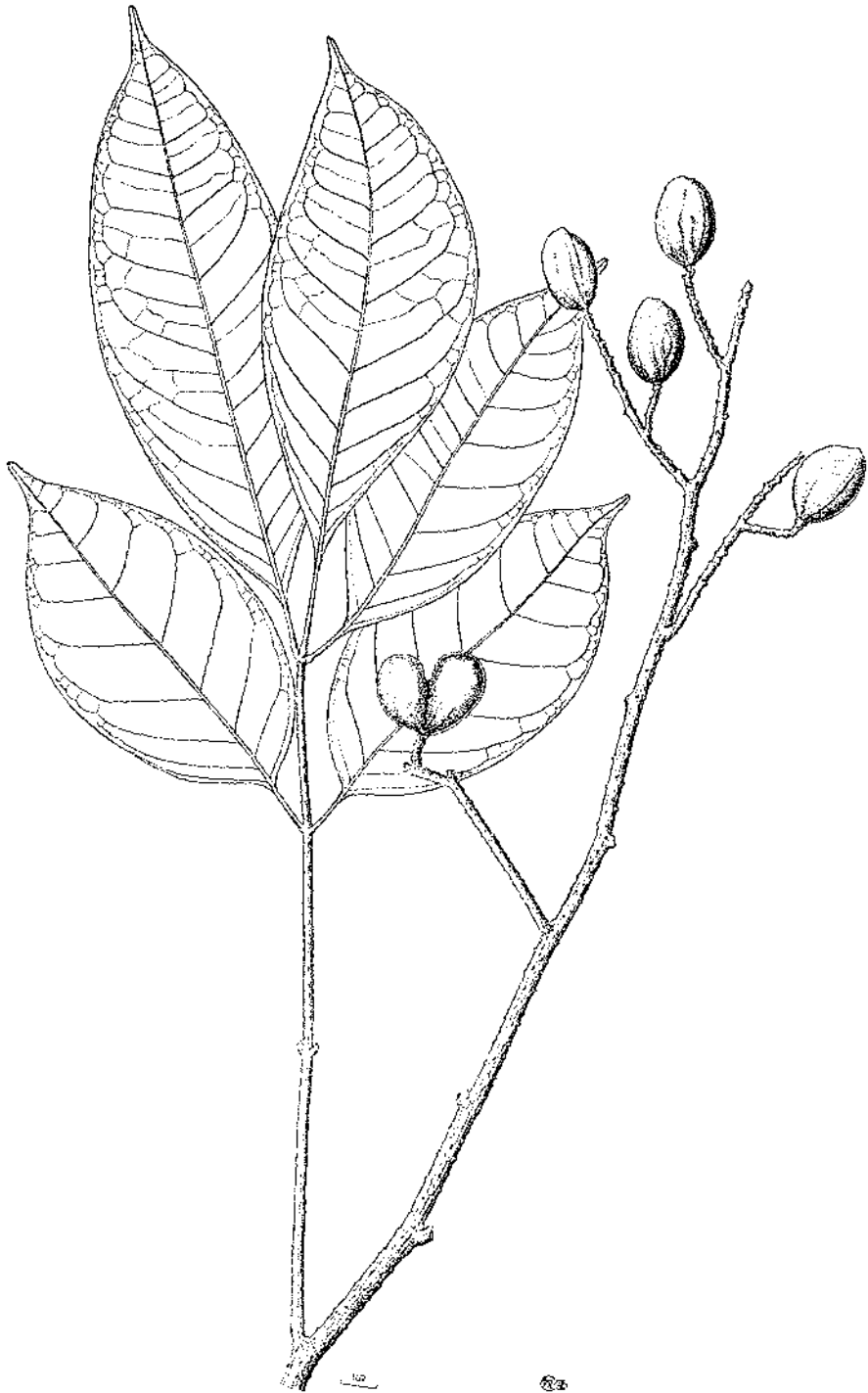
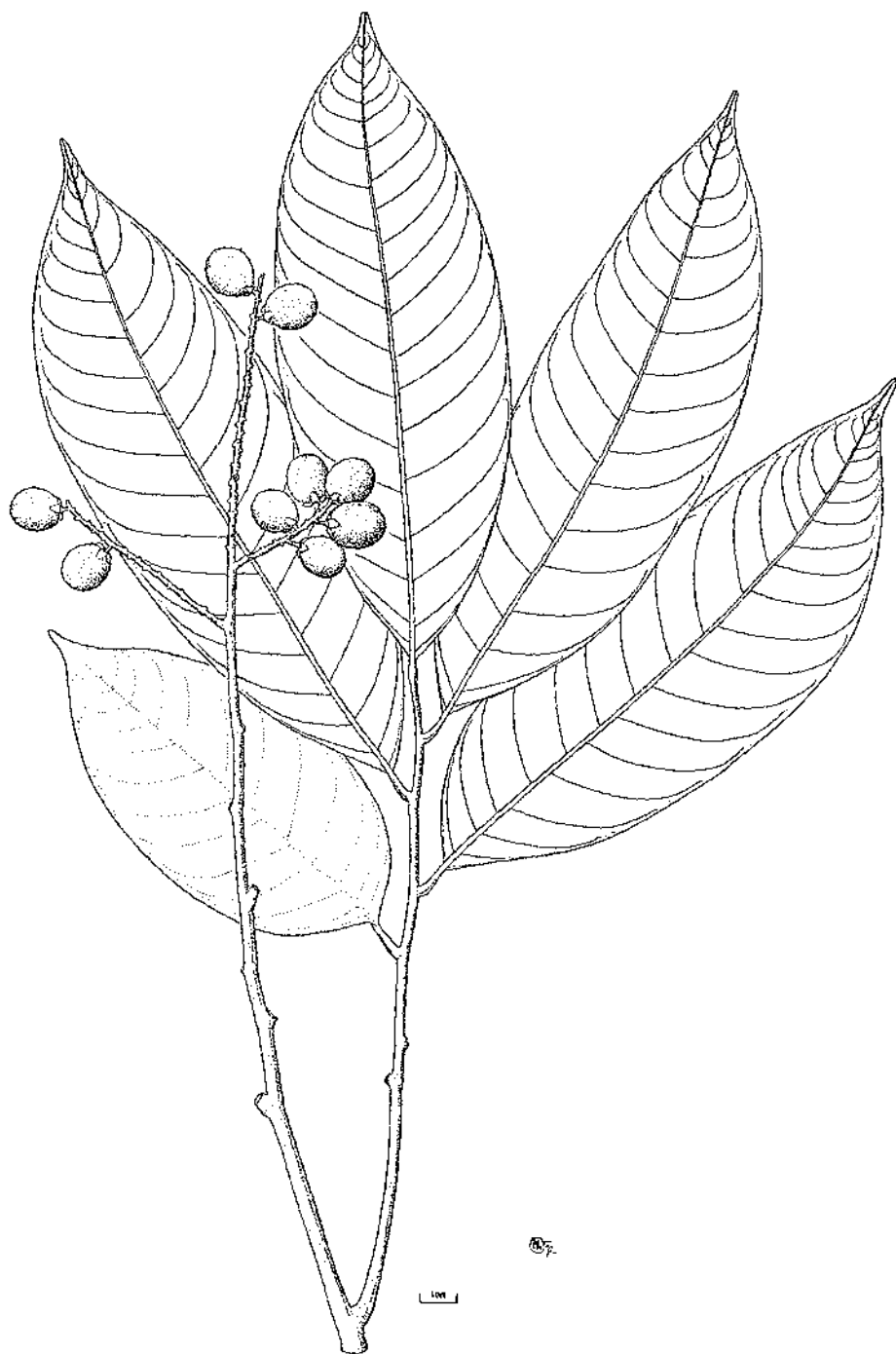


Fig. 170. *Meliosma sumatrana* (Jack) Walp.

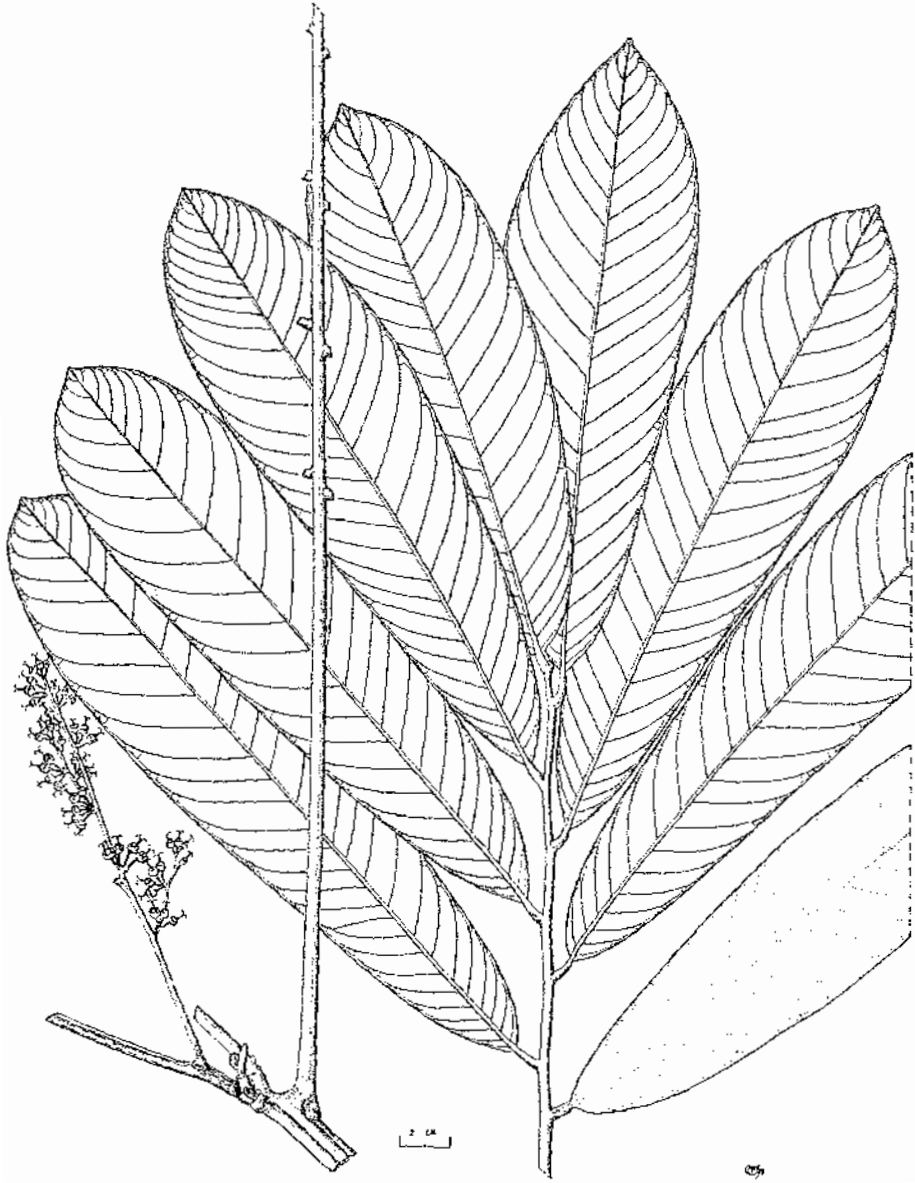


(Sapindaceae) Fig. 171. *Dimocarpus longan* Lour. subsp. *malesianus* Leenh.



Fig. 172. *Mischochloa pentapetalus* (Roxb.) Radlk.

(Sapindaceae)



(Sapindaceae) Fig. 173. *Nephelium cuspidatum* Blume var. *robustum* (Radlk.) Leenh.

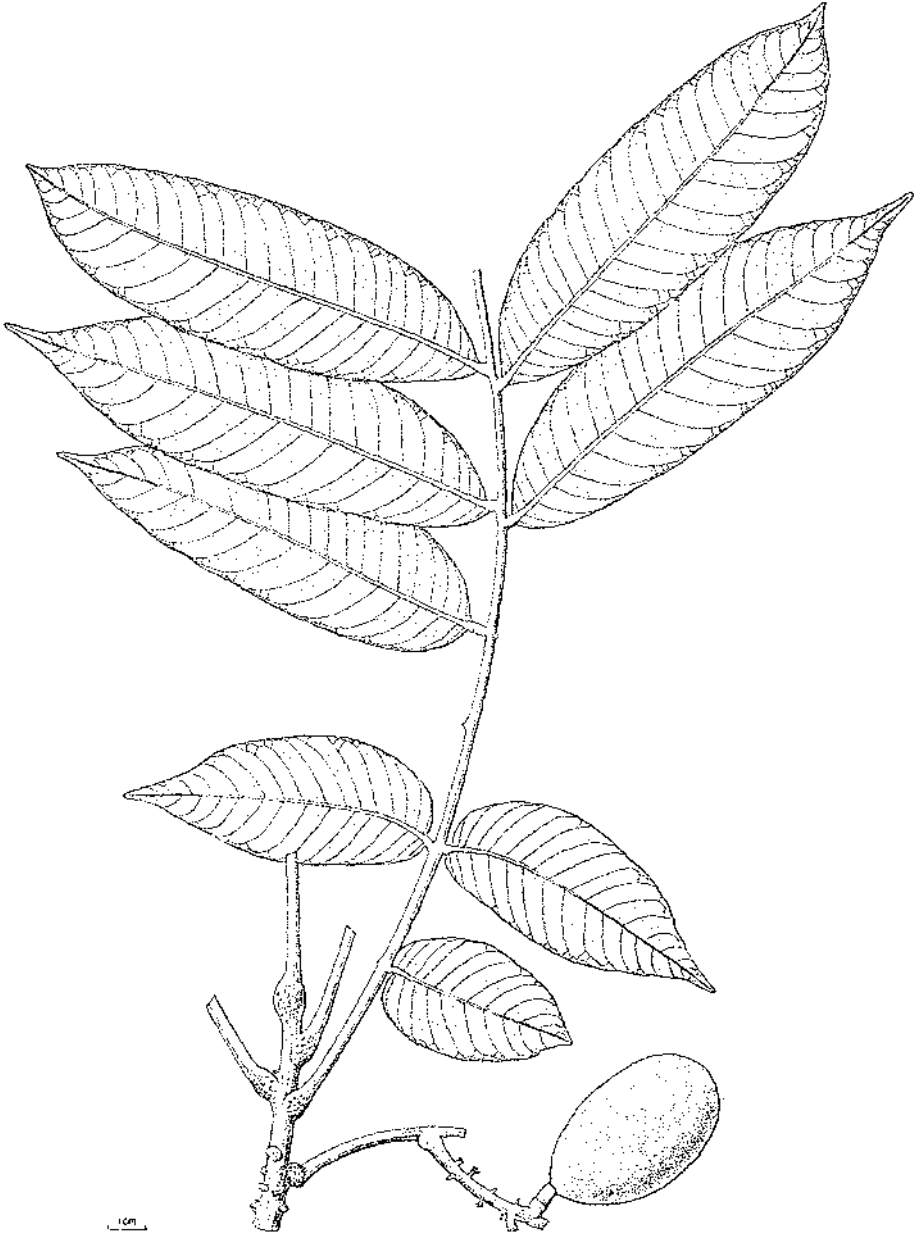
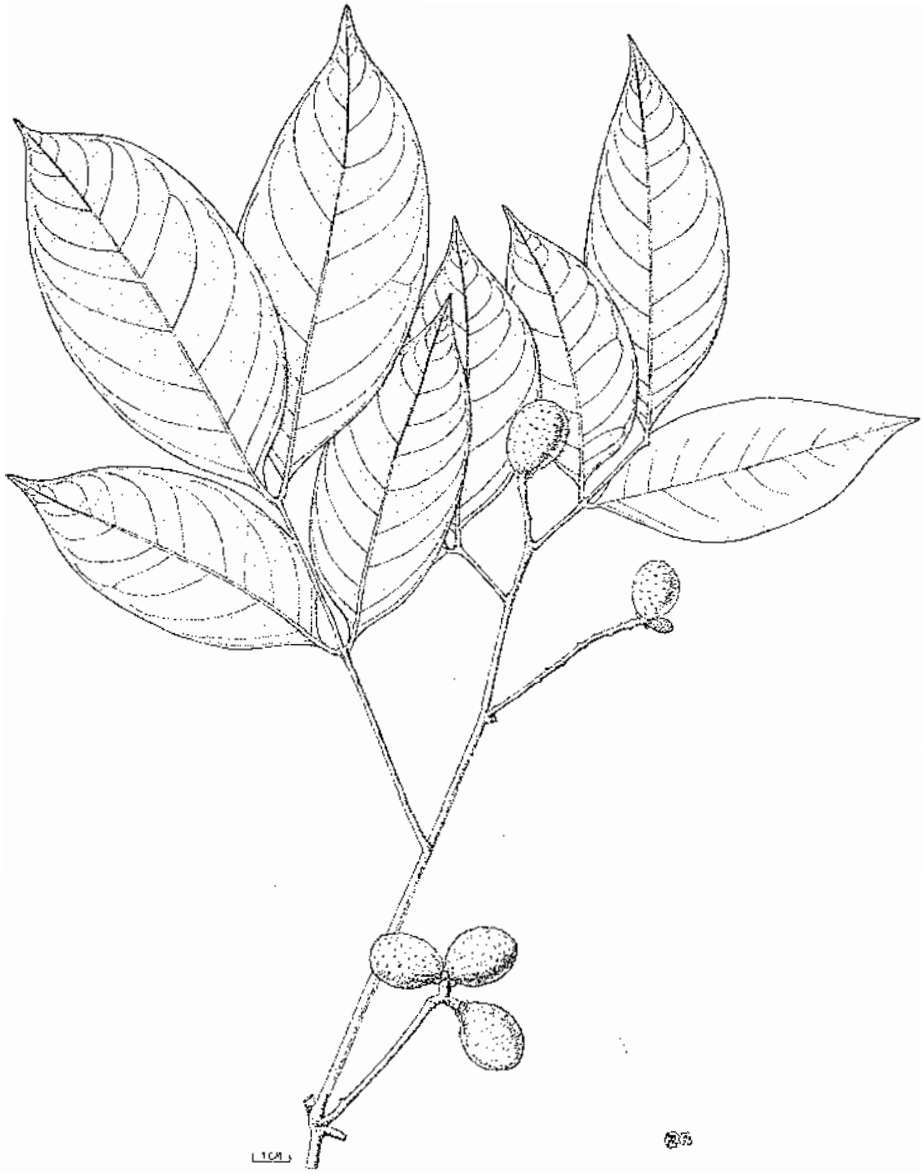


Fig. 174. *Pometia pinnata* Forst.

(Sapindaceae)



(Sapindaceae)

Fig. 175. *Xerospermum noronhianum* Blume



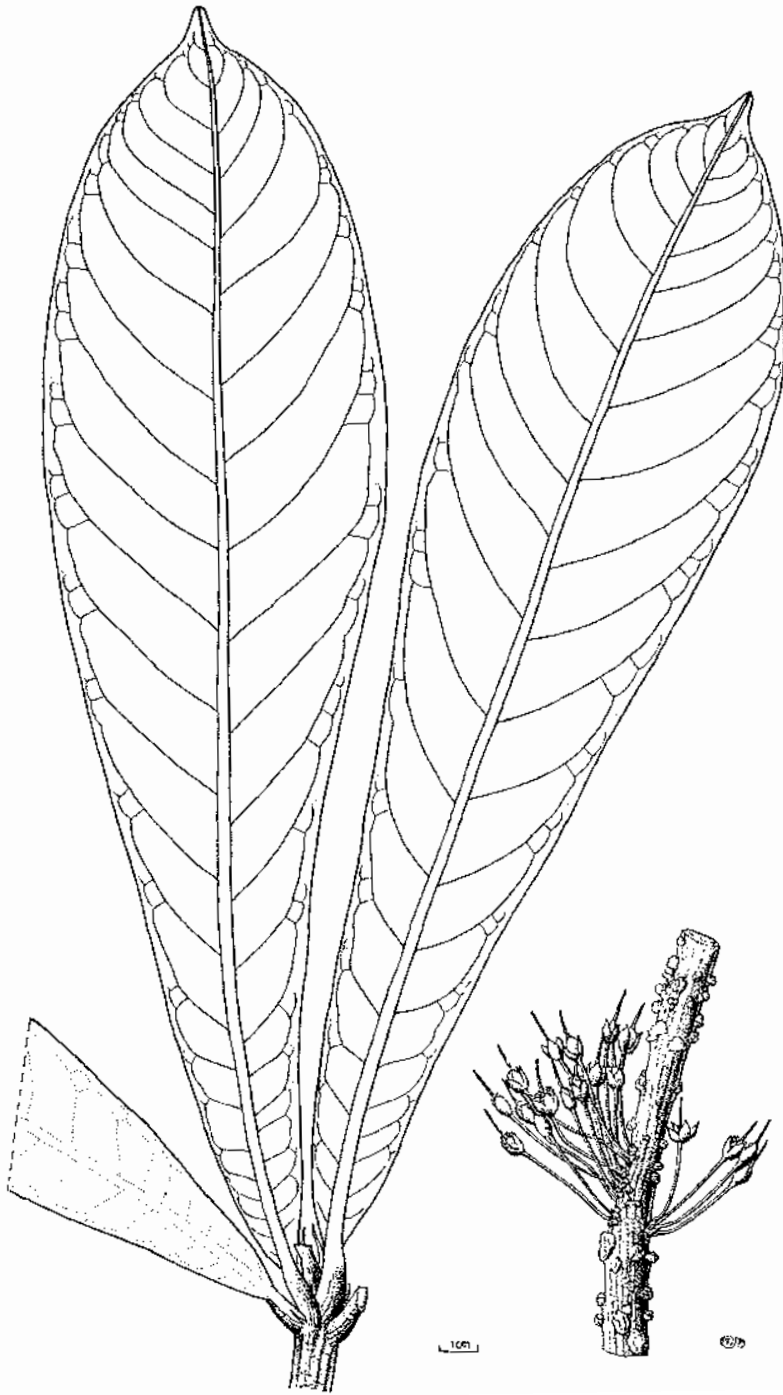
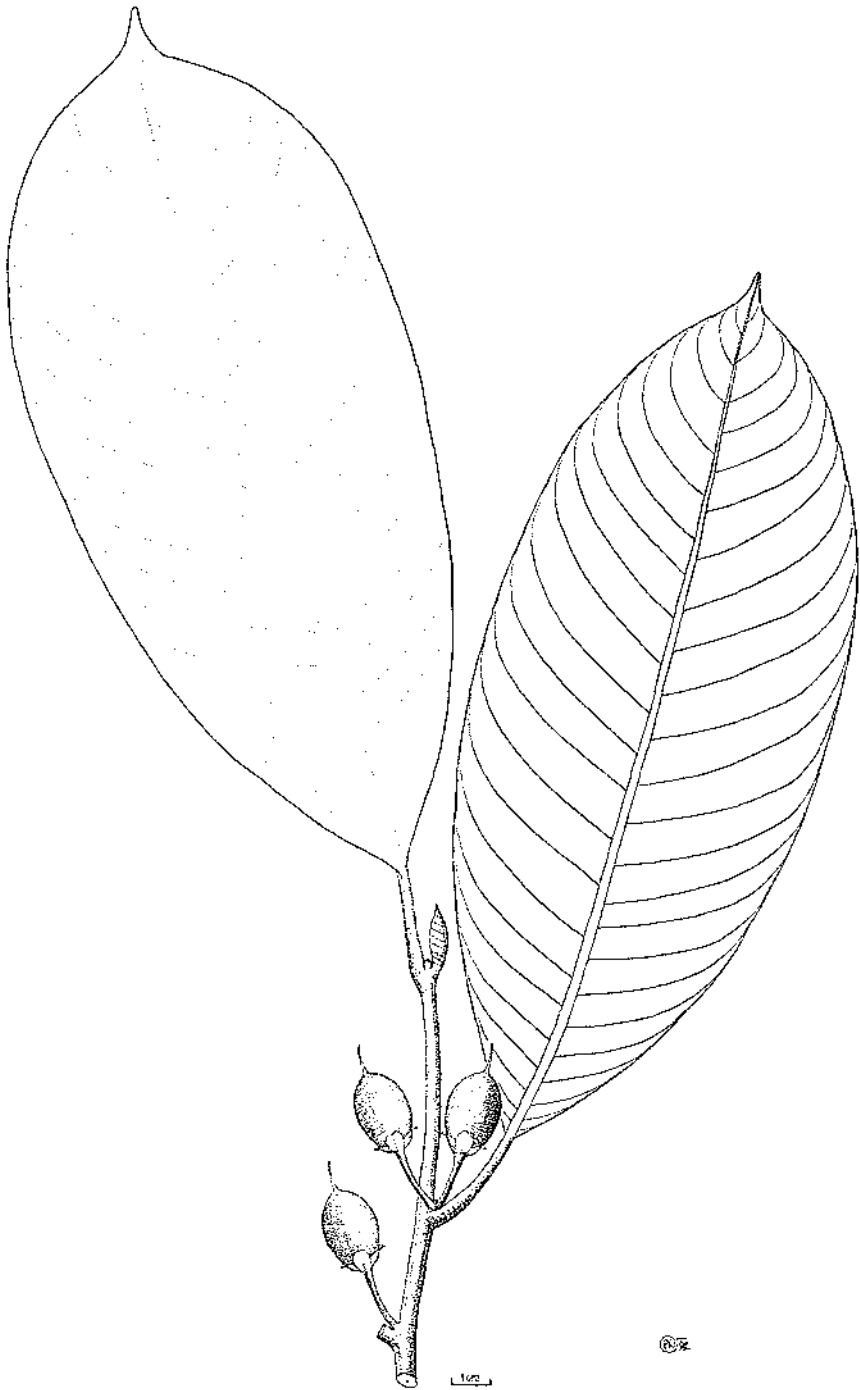


Fig. 176. *Madhuca pallida* (Burck) Baehni

(Sapotaceae)



(Sapotaceae)

Fig. 177. *Madhuca sericea* (Miq.) H.J. Lam

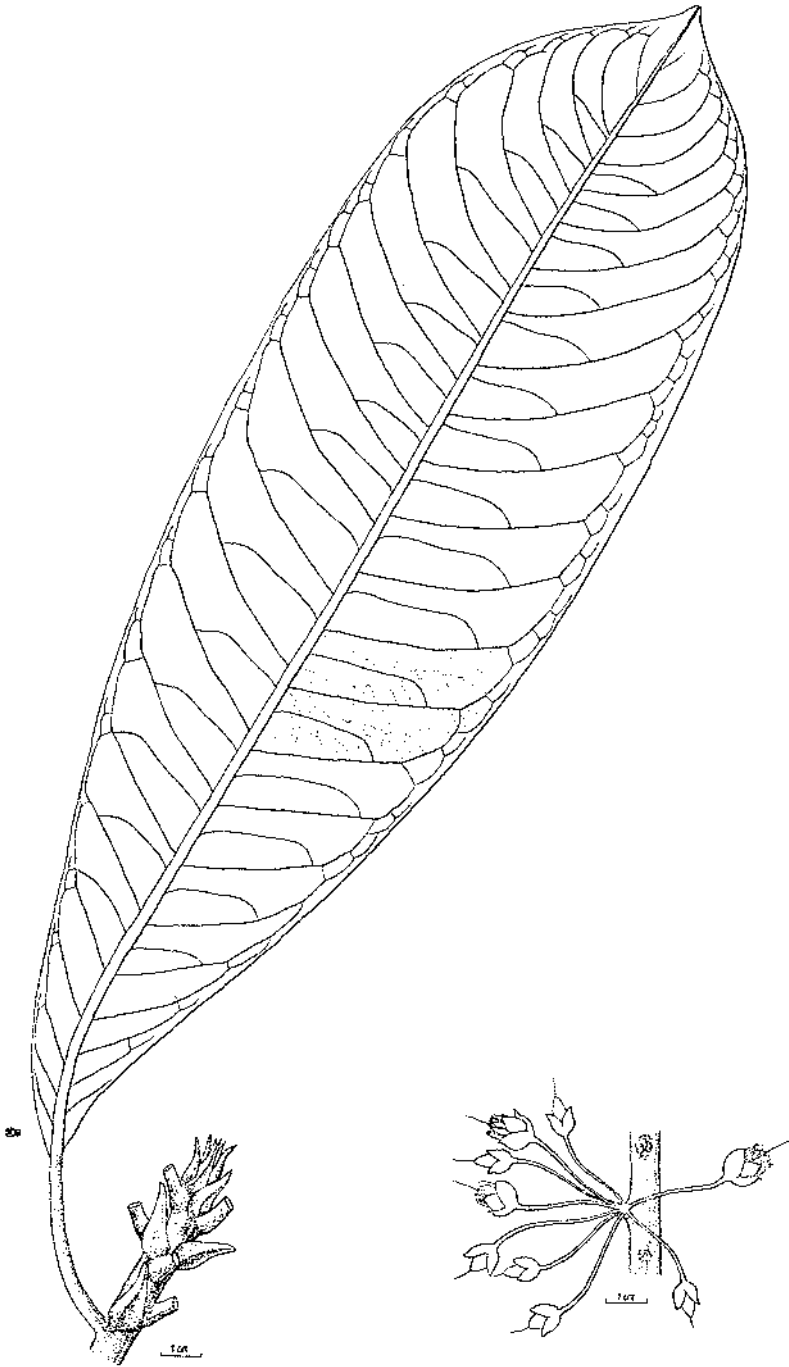
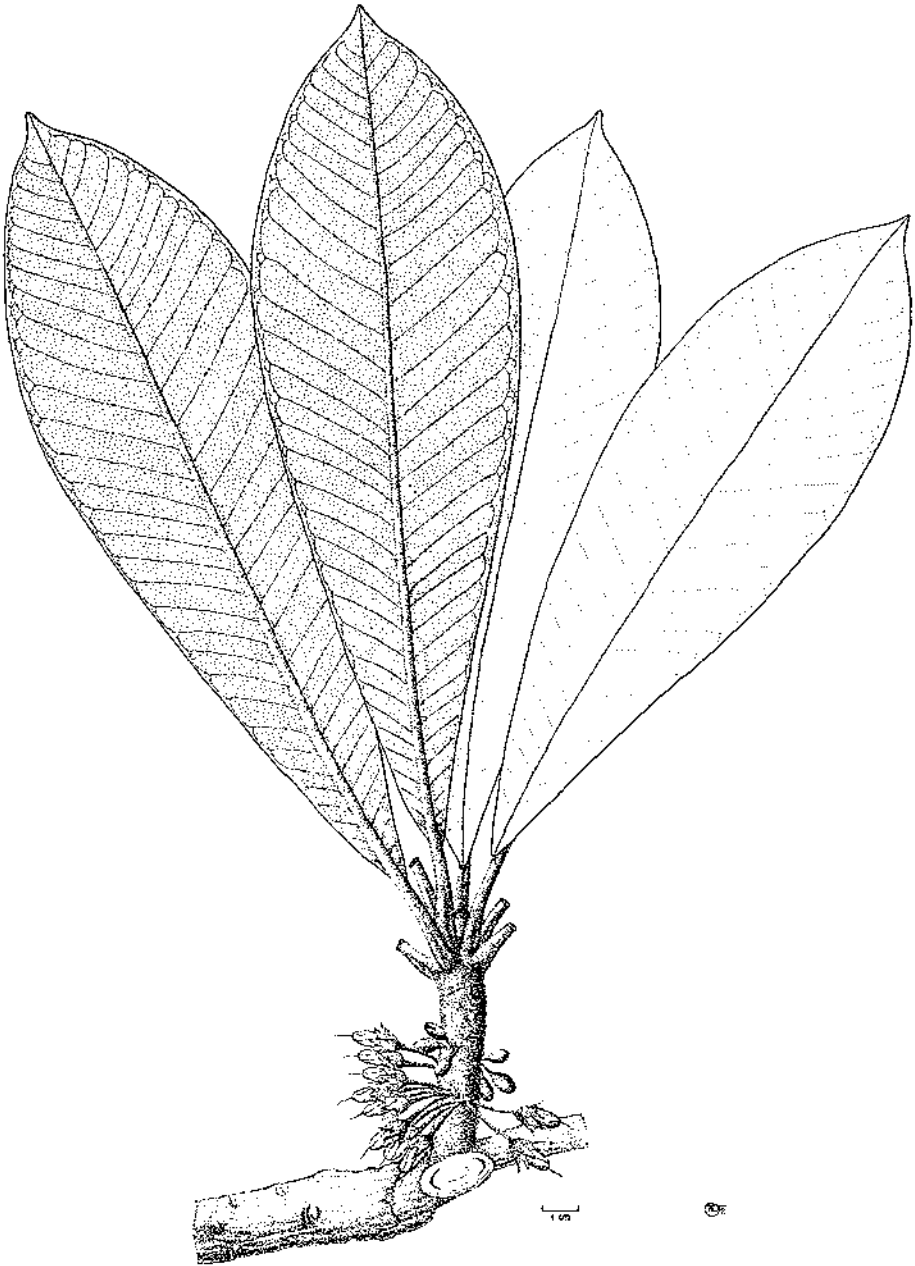


Fig. 178. *Madhuca spectabilis* Van Royen

(Sapotaceae)



(Sapotaceae)

Fig. 179. *Palaquium beccarianum* (Pierre) Van Royen

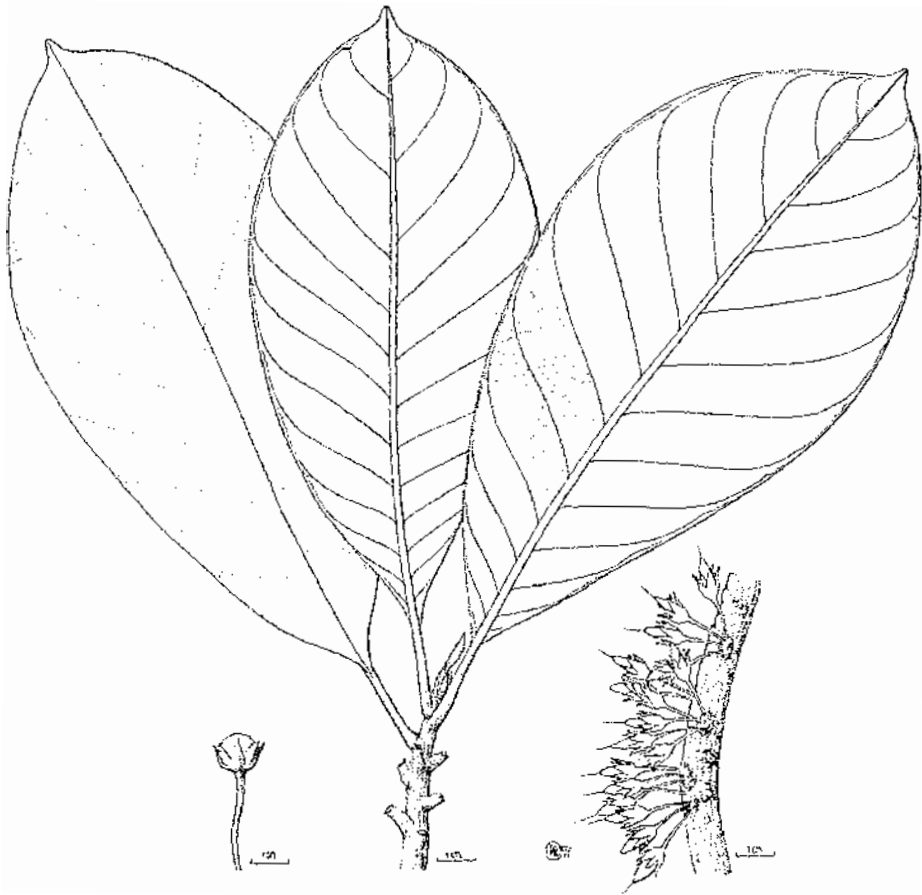
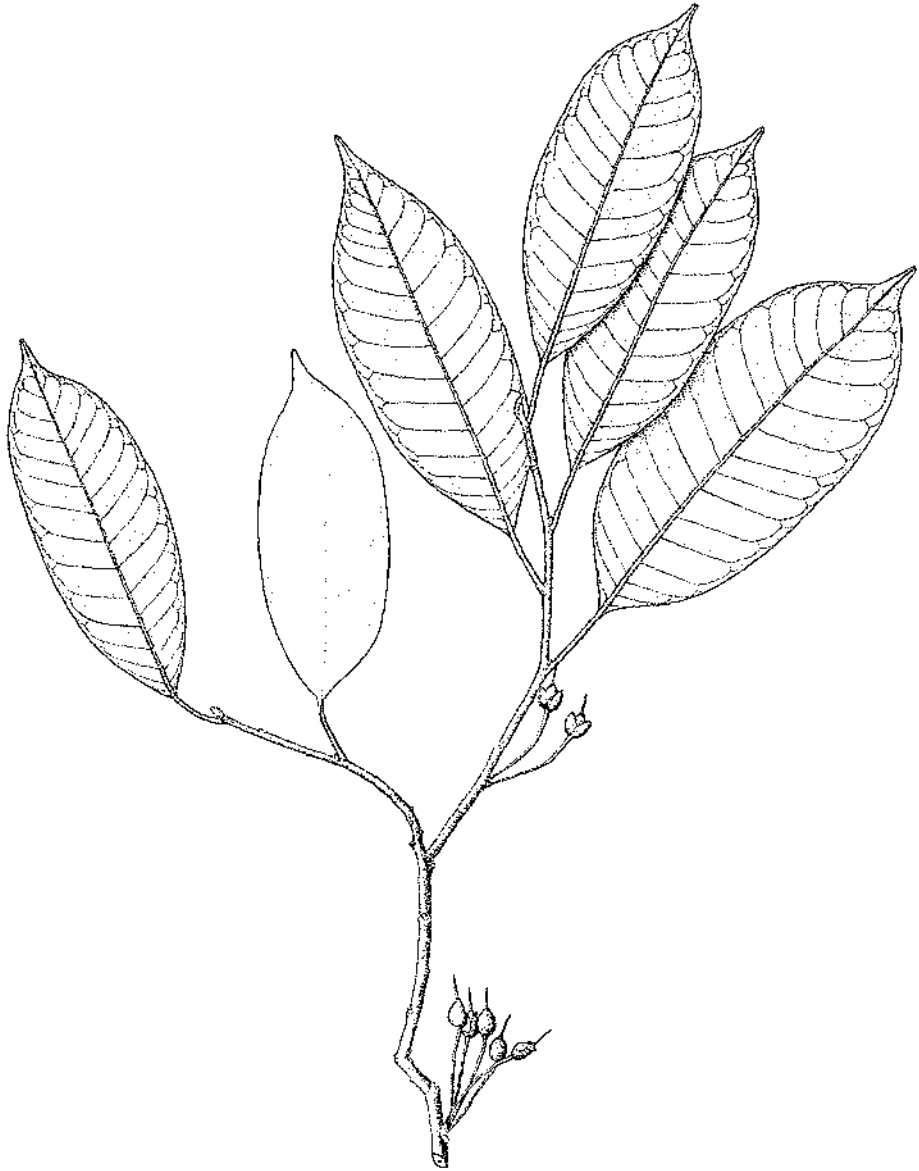


Fig. 180. *Palaquium quercifolium* (De Vriese) Burck (Sapotaceae)



(Sapotaceae)

Fig. 181. *Payena lucida* (G. Don) DC.

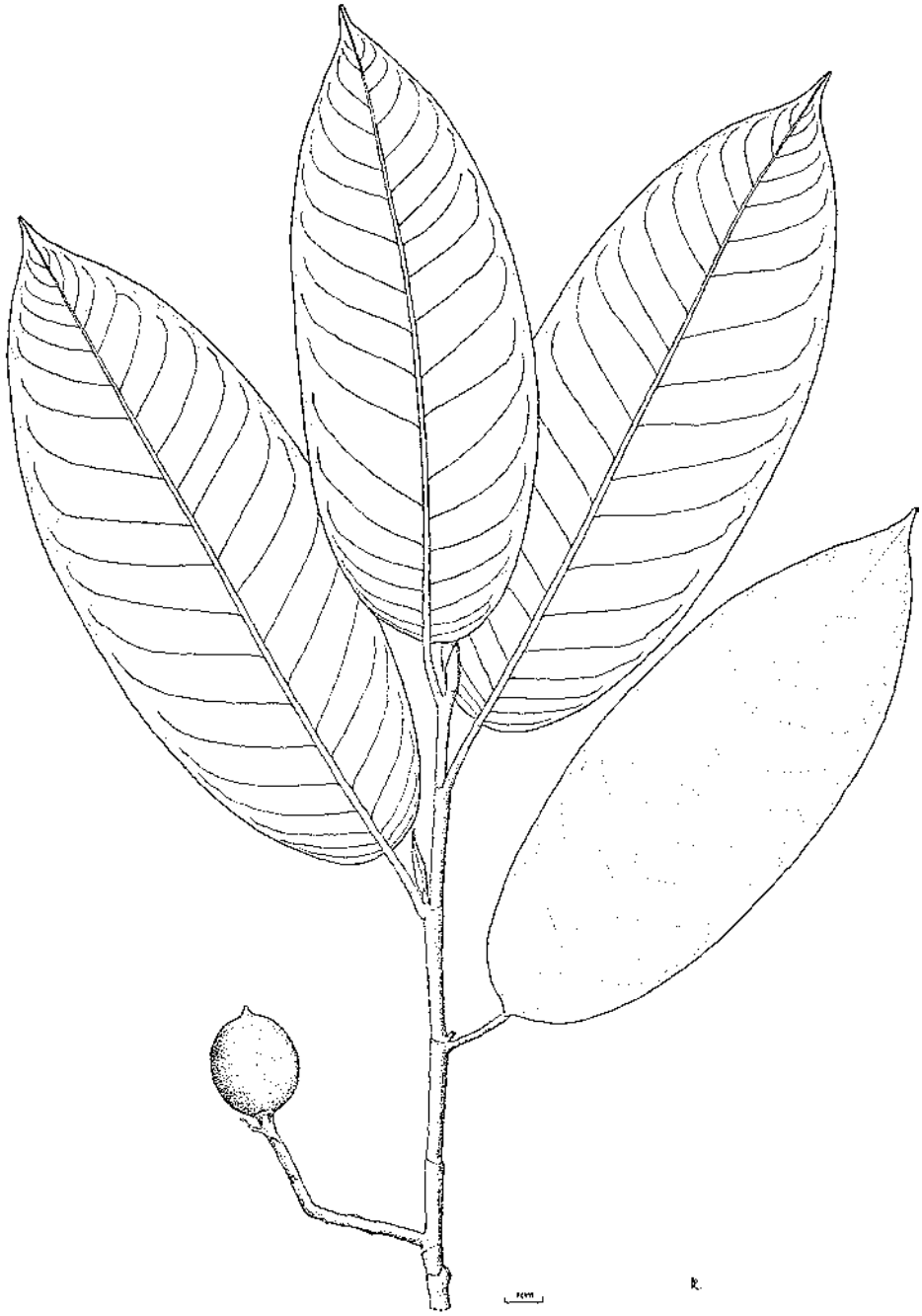
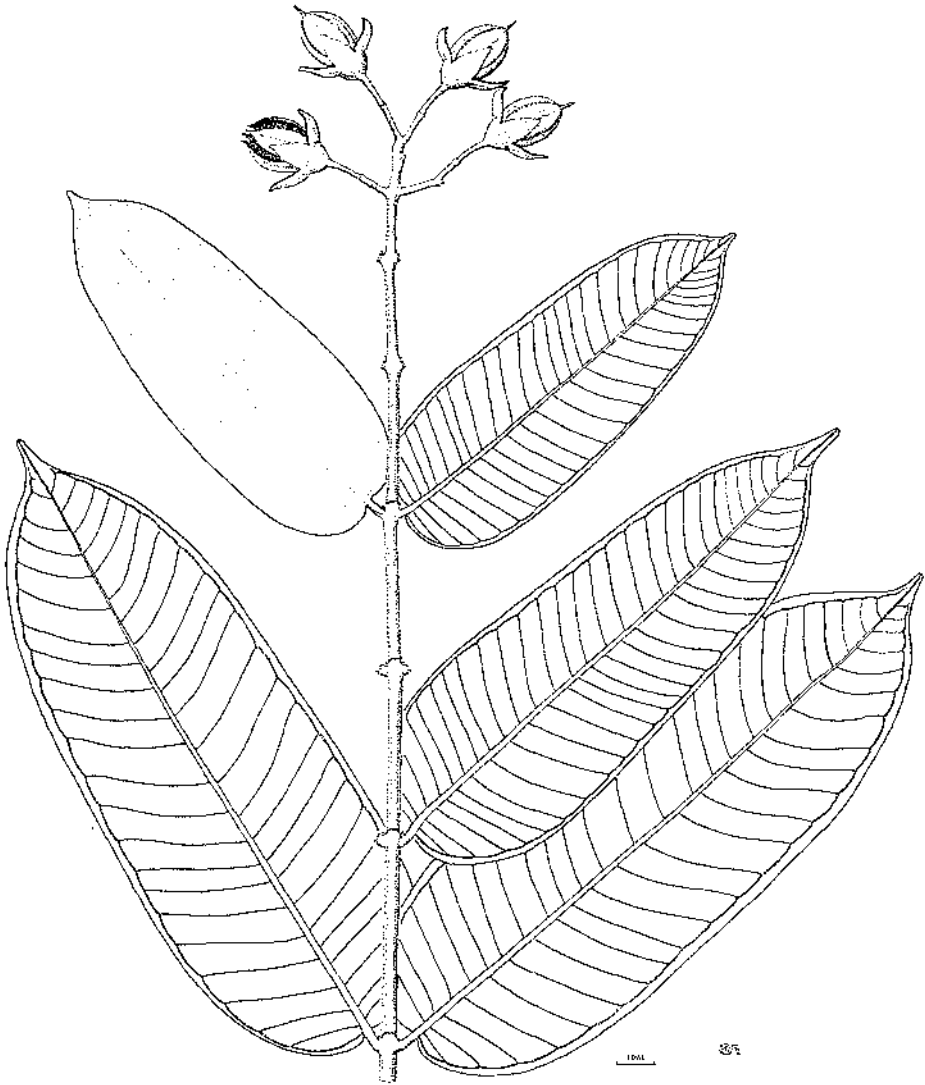


Fig. 182. *Irvingia malayana* Oliv. ex Bennett

(Simaroubaceae)



(Sonneratiaceae

Fig. 183. *Duabanga moluccana* Blume



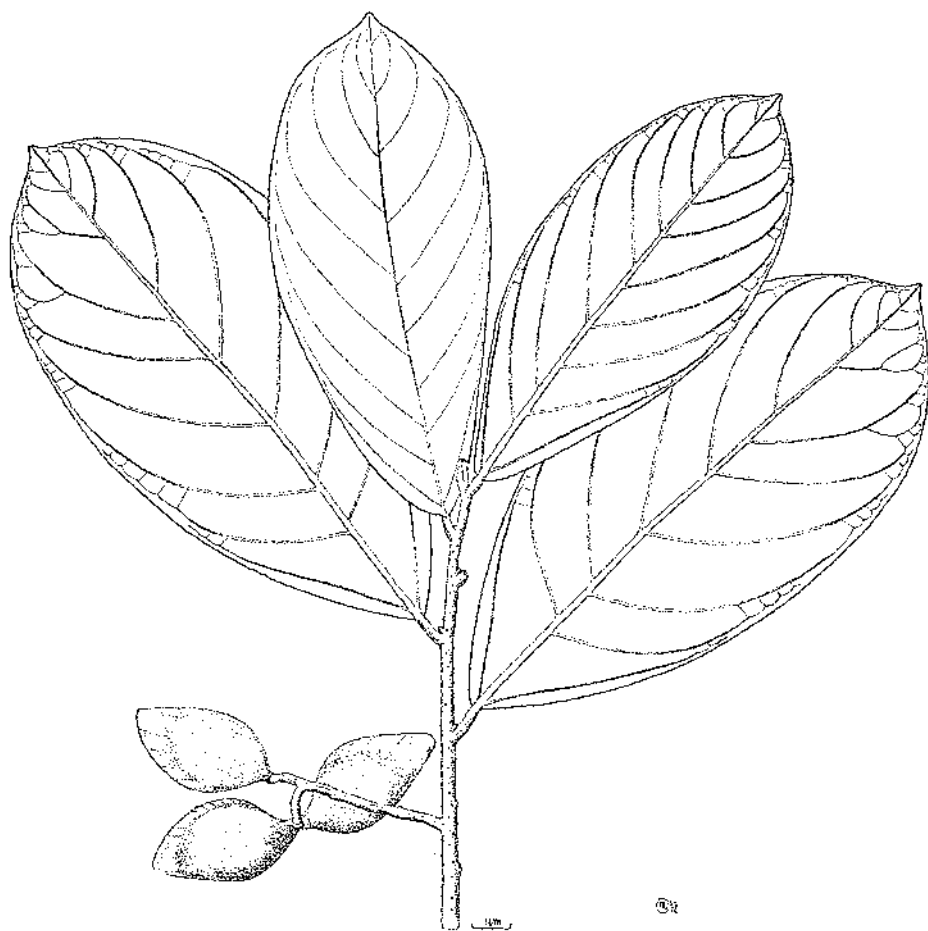


Fig. 184. *Heritiera elata* Ridley

(Sterculiaceae)



(Sterculiaceae)

Fig. 185. *Pter spermum javanicum* Jungh.



Fig. 186. *Scaphium macropodum* (Miq.) Beumée ex Heine (Sterculiaceae)



(Theaceae)

Fig. 187. *Adinandra dumosa* Jack

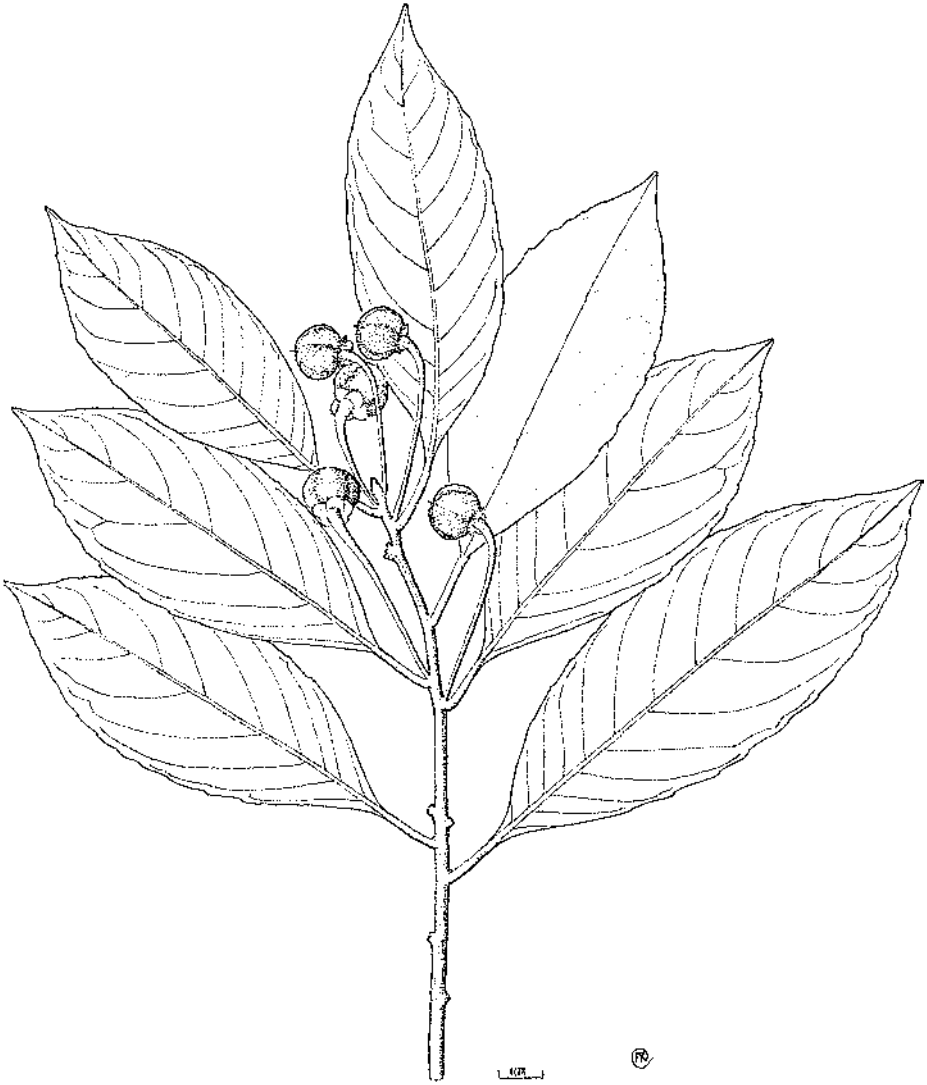
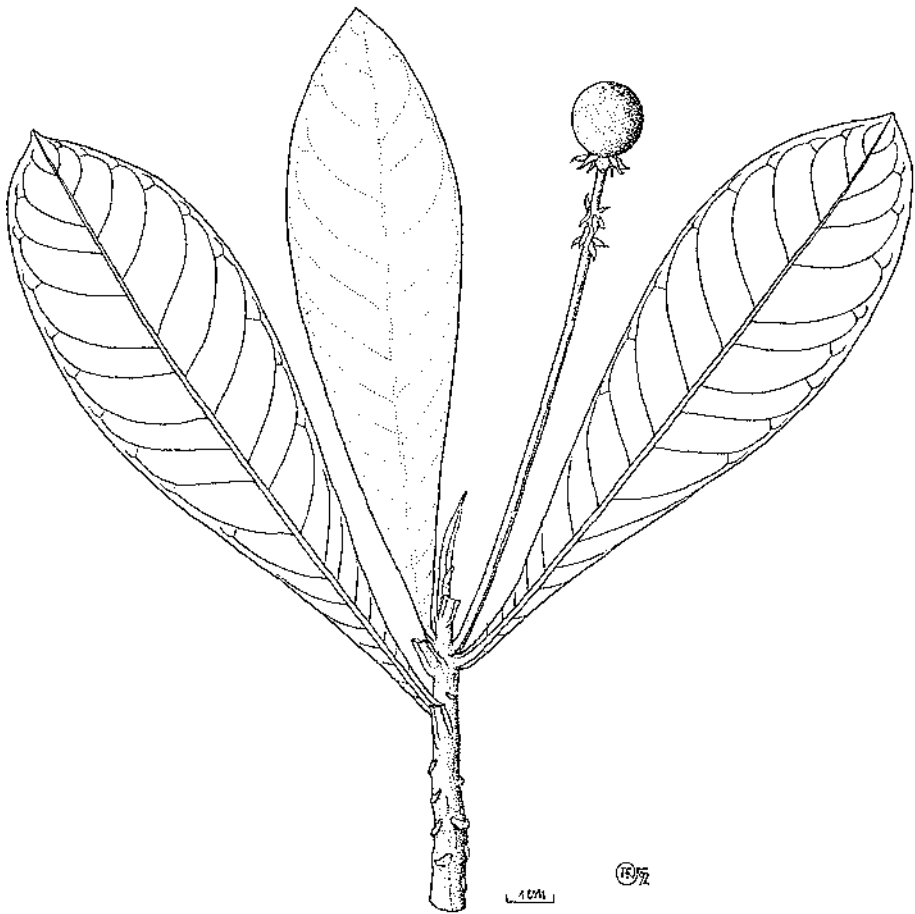


Fig. 188. *Schima wallichii* (DC.) Korth.

(Theaceae)



(Theaceae)

Fig. 189. *Tetramerista glabra* Miq.

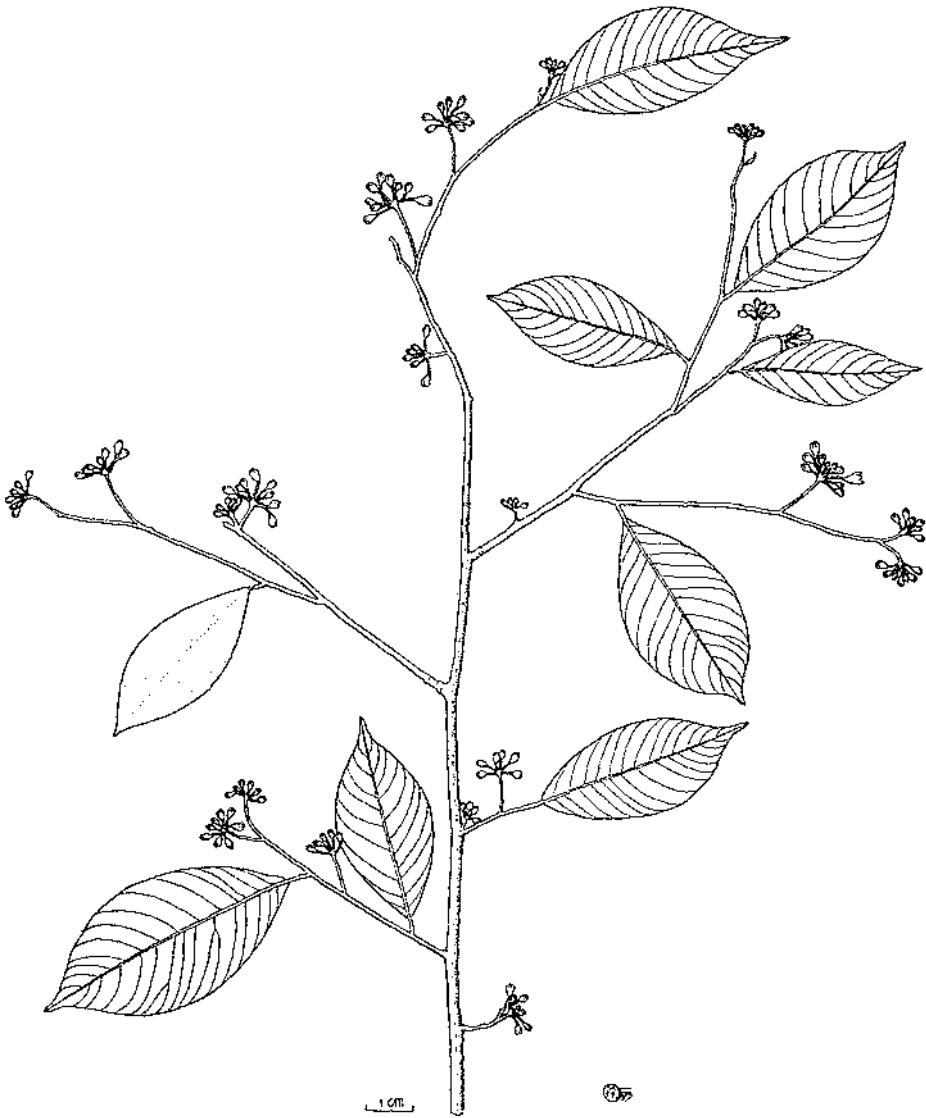
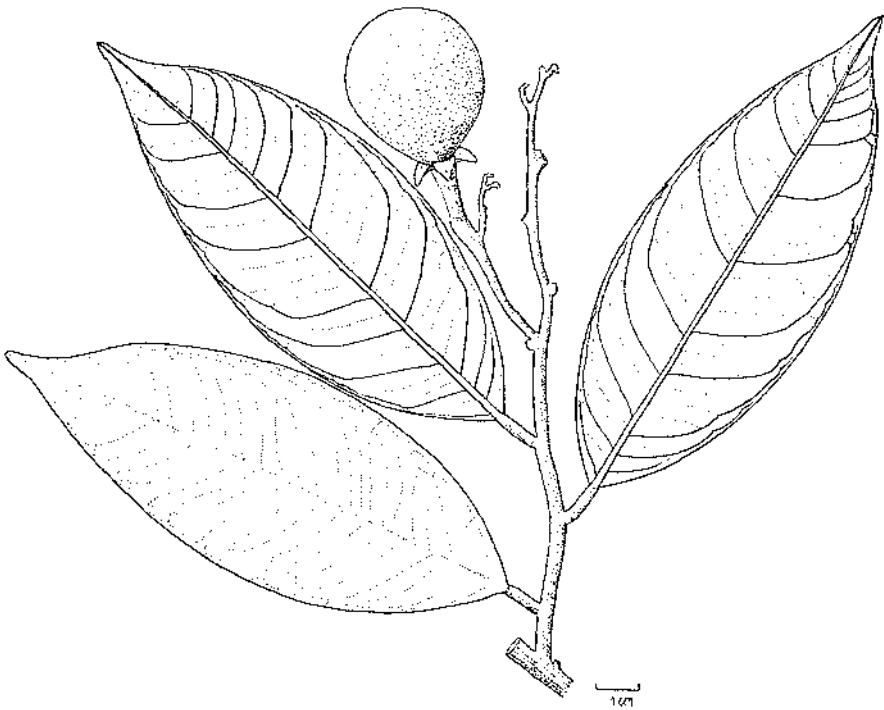


Fig. 190. *Aquilaria malaccensis* Lam.

(Thymelaeaceae)



(Thymelaeaceae)

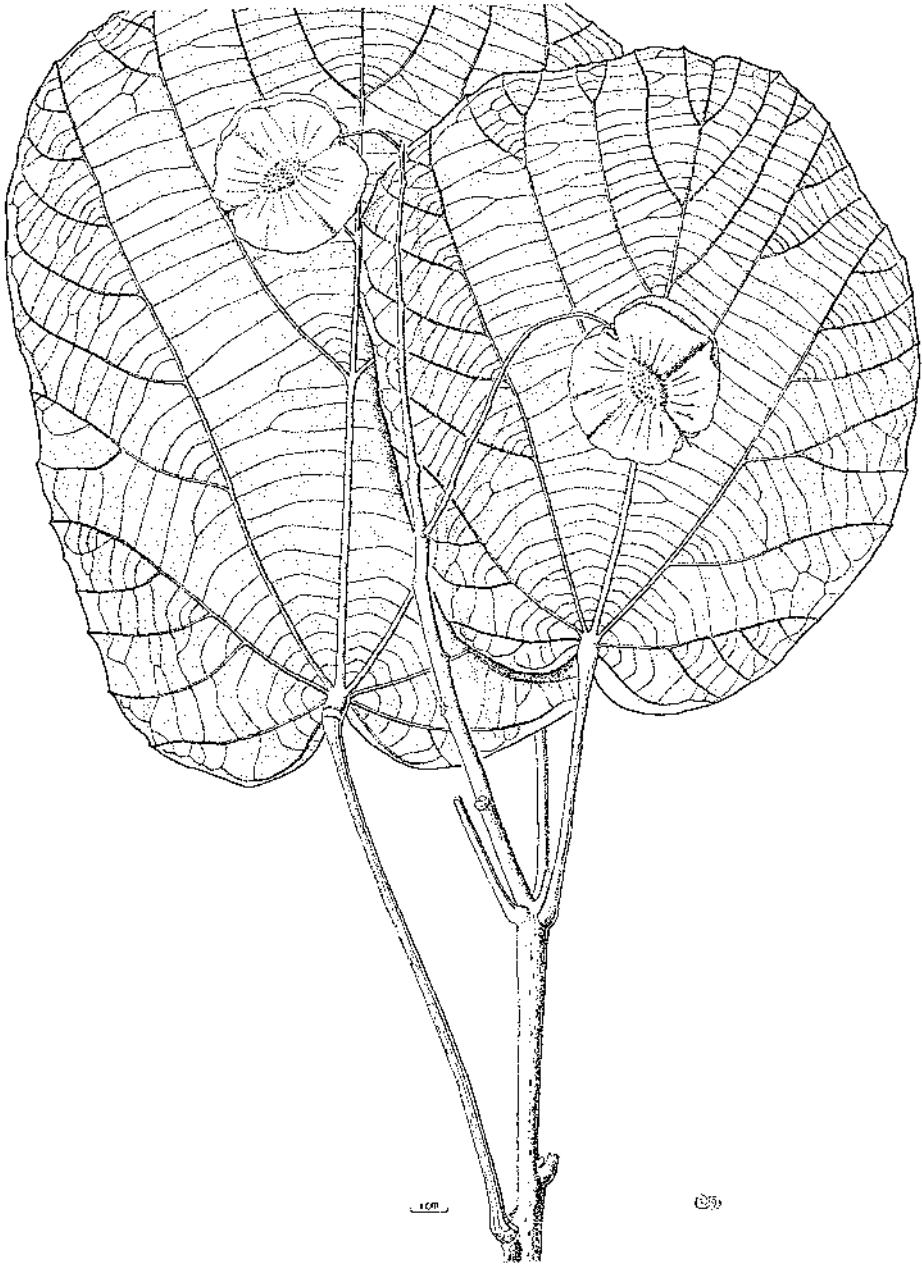
Fig. 191. *Gonystylus brunnescens* Airy Shaw





Fig. 192. *Microcos cinnamomifolia* Burr.

(Tiliaceae)



(Tiliaceae)

Fig. 193. *Pentace adenophora* Kosterm.

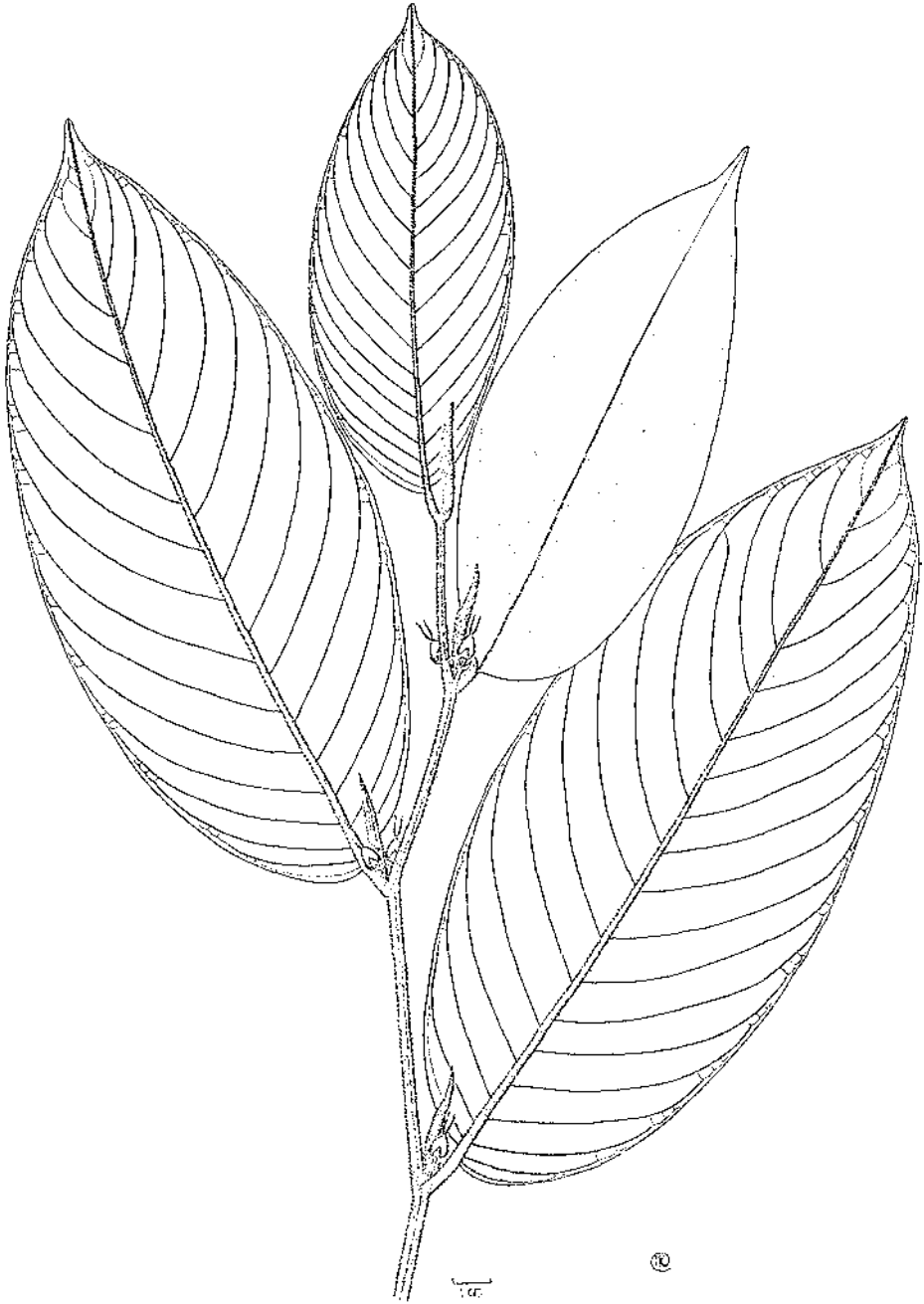
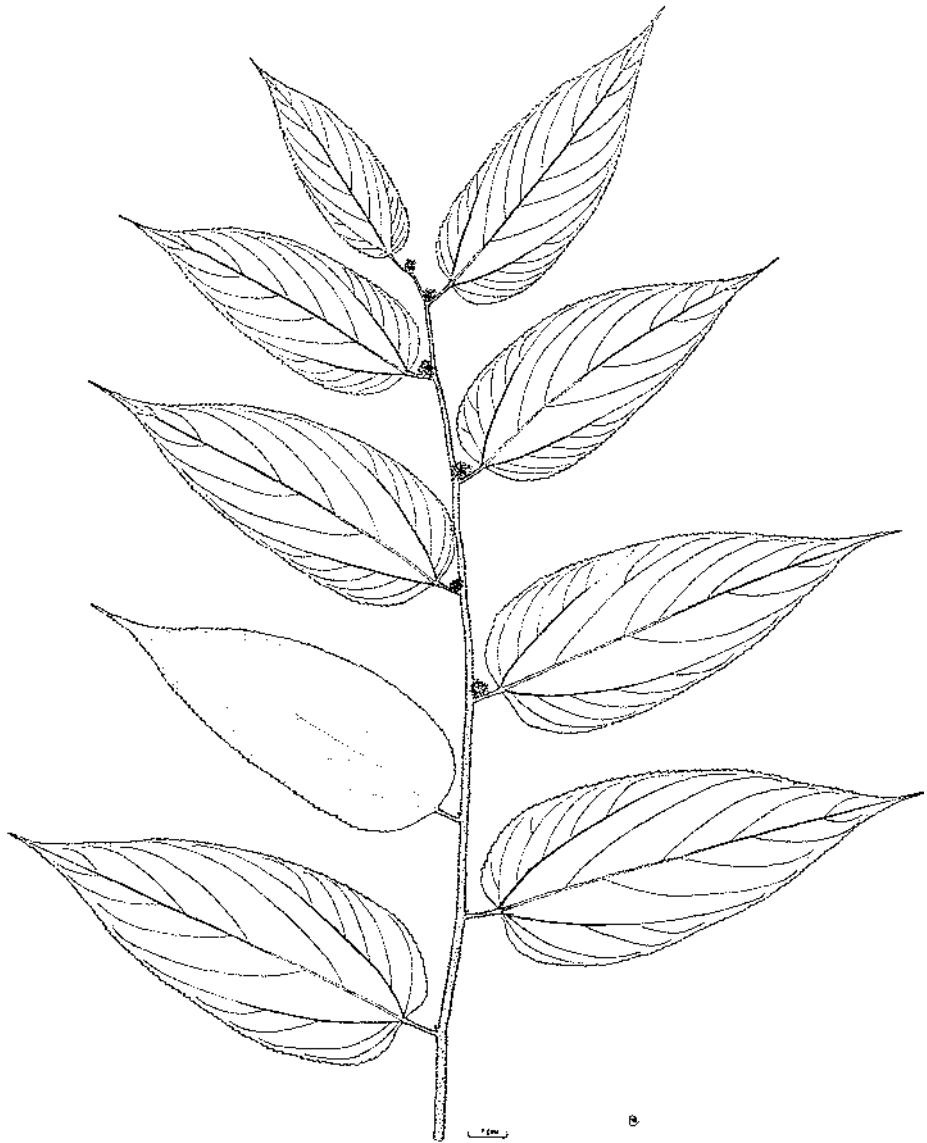


Fig. 194. *Gironniera nervosa* Planch.

(Ulmaceae)



(Ulmaceae)

Fig. 195. *Trema tomentosa* (Roxb.) Hara

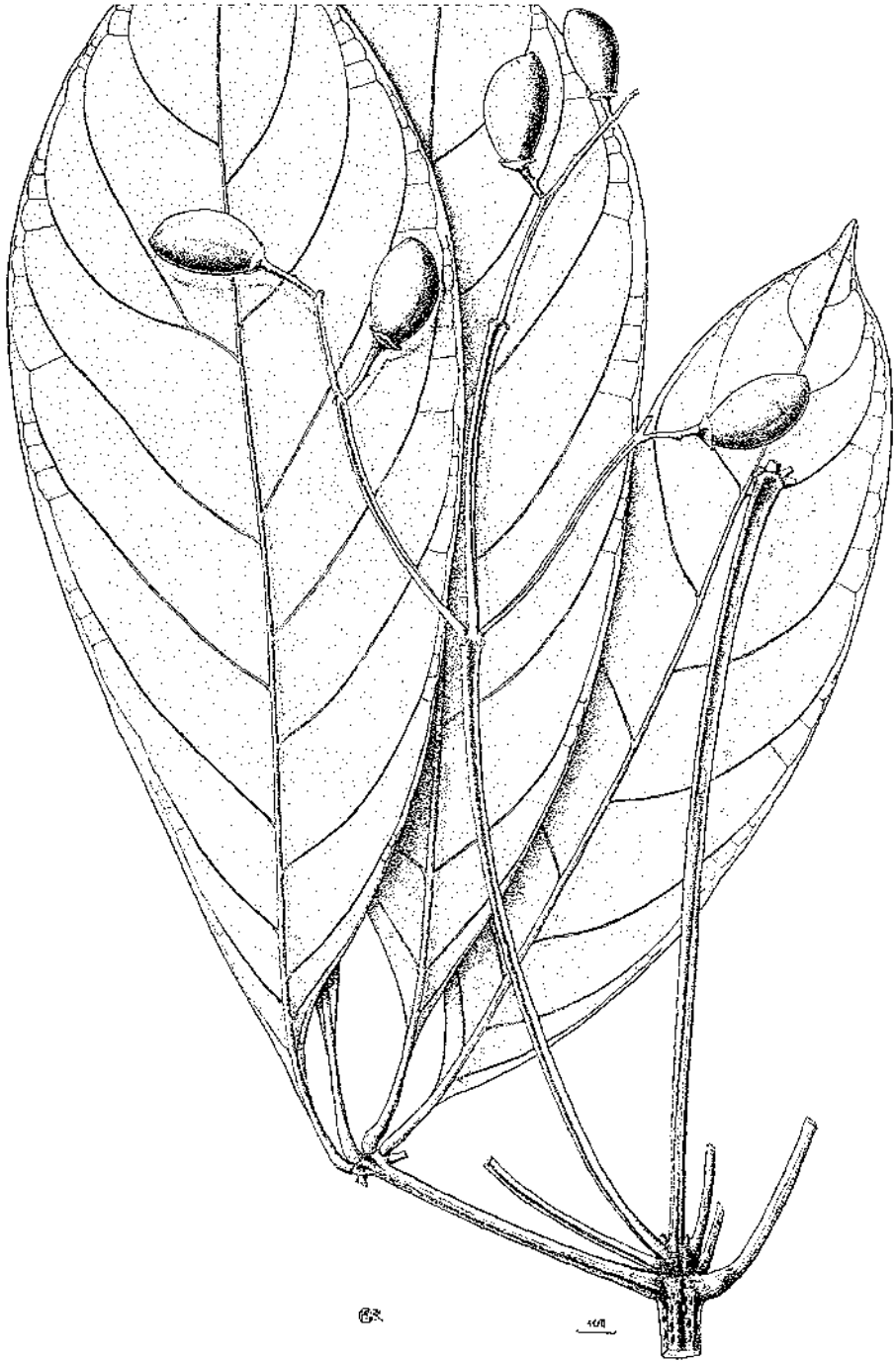


Fig. 196. *Teijsmanniodendron bogoriense* Koord.

(Verbenaceae)



(Verbenaceae)

Fig. 197. *Vitex vestita* Wall.