

Plant structure – leaves, stems and roots



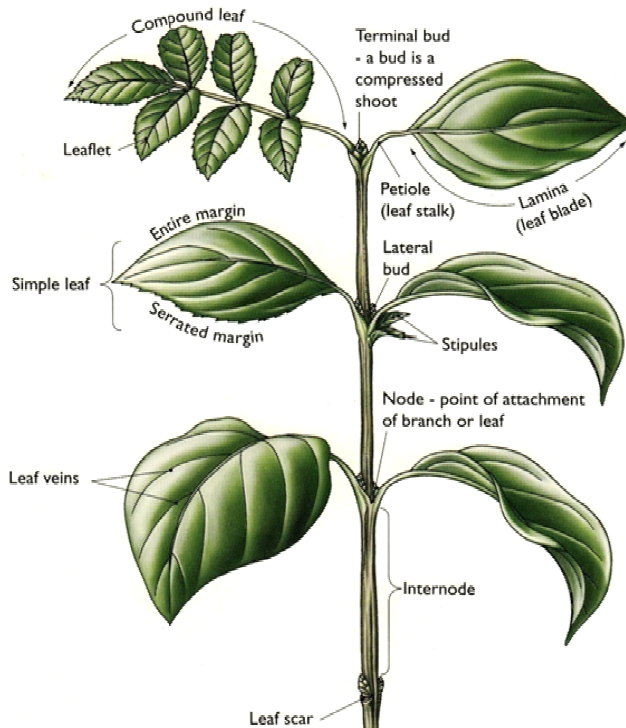
Kew information sheet B3

STRUCTURE

Leaves

Leaves come in a huge variety of shapes and sizes.

Many characters are used in classification and identification.

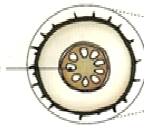


FUNCTION

Leaves are a plant's **food factory**. They are the main site of photosynthesis, where sugars are made from water and carbon dioxide, using sunlight energy.

Stems

Vascular tissue



Stems **support** the leaves, flowers and fruit.

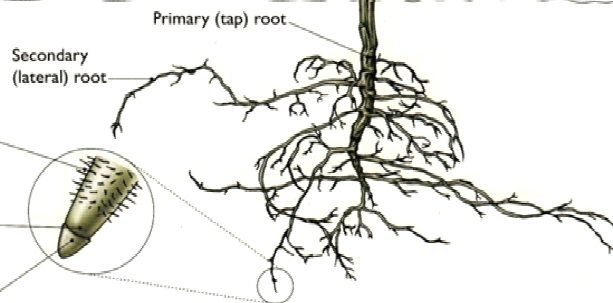
Stems **transport** water, minerals and sugars to leaves and roots.

Roots

Root hairs - provide huge surface area for absorption.

Root tip - area of cell division.

Root cap - protects and lubricates the growing root.

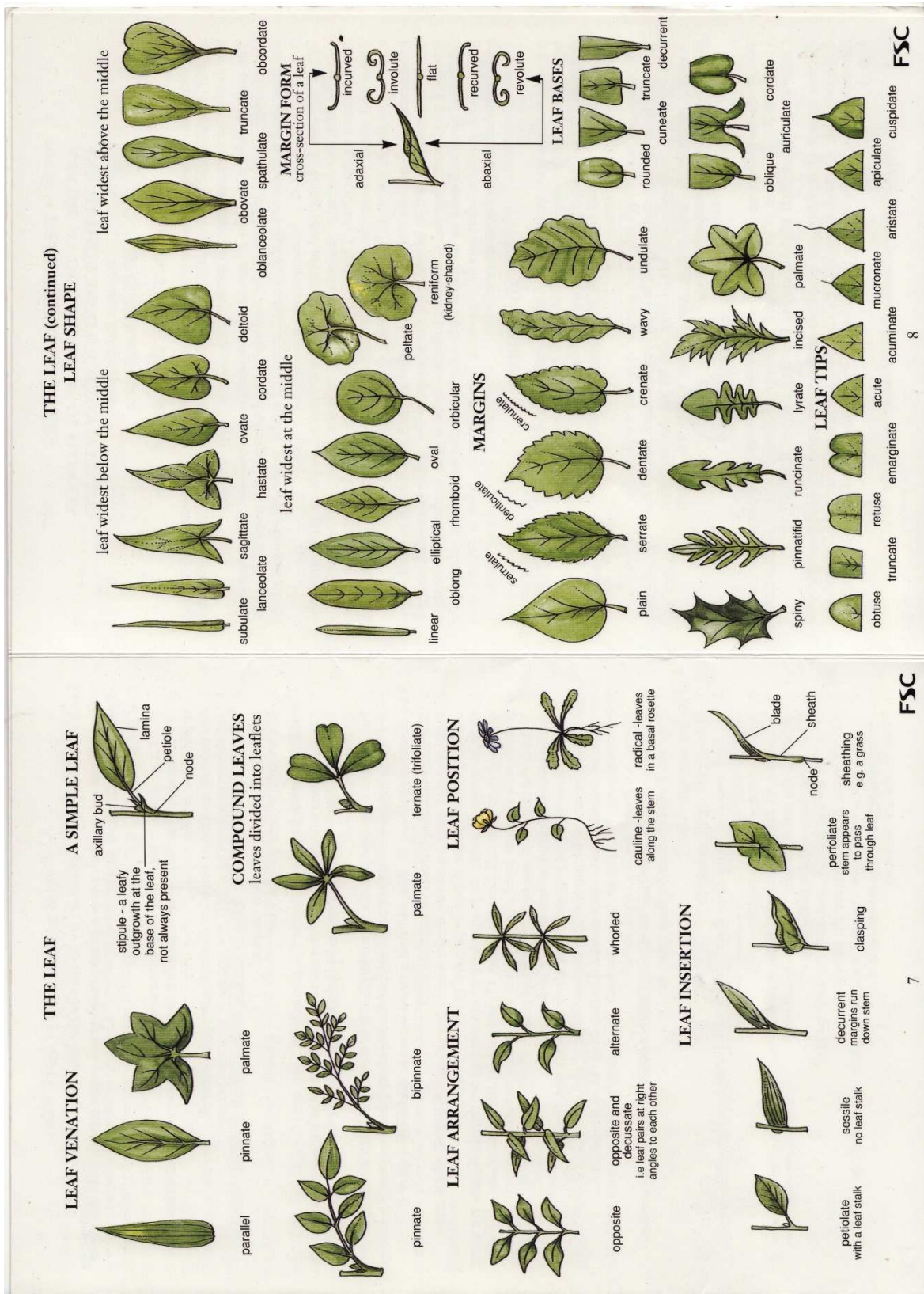


Roots provide **anchorage** in the soil.

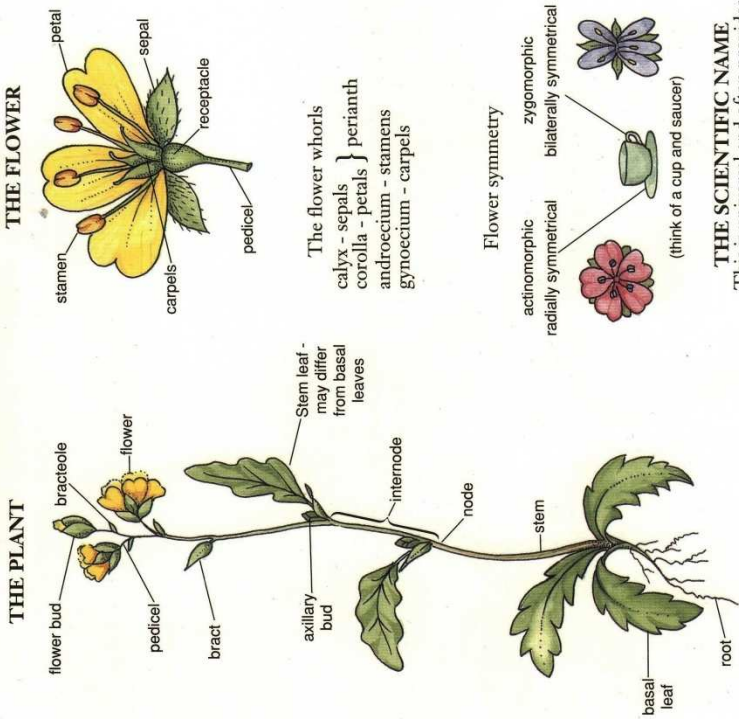
Roots allow **absorption** of water and nutrients.

Roots allow **transport** of water and nutrients.

All life depends on plants



DESCRIBING FLOWERS
A GUIDE TO THE STRUCTURE OF FLOWERS AND TO THEIR IDENTIFICATION FEATURES

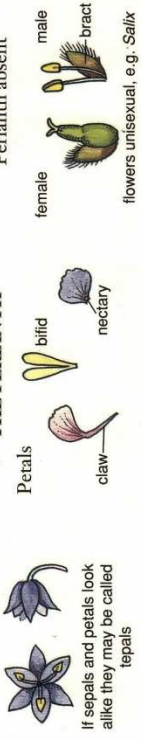


THE SCIENTIFIC NAME
 This is universal and often provides a description of the plant; here, "the common false flower".
 The name should be underlined or printed in italics.

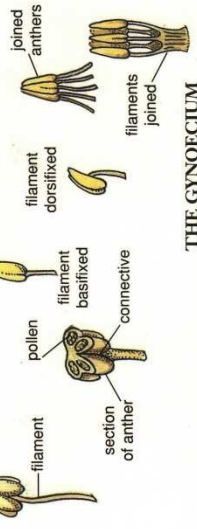
Pseucliflora vulgaris Bebb.
 generic name
 species or trivial name
 1st letter - upper case

naming authority

THE PARTS OF A FLOWER
THE PERIANTH



THE ANDROECIUM



THE GYNOECIUM



To estimate the number of carpels in a syncarpous gynoecium, count the number of:
 1. stigmas and styles
 2. seams on the ovary wall
 3. loculi within the ovary
 4. placentae - see below

THE POSITION OF THE OVARY IN RELATION TO THE OTHER FLORAL PARTS



SUPERIOR - the ovary lies above the receptacle or, if partly below, is not fused to it
a - c: syncarpous gynoecia
d - f: apocarpous gynoecia

INFERIOR - the ovary lies below and is fused to the receptacle which surrounds it

Flower structure and variations

What is a flower?

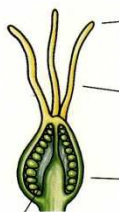
A flower is a functional unit concerned with sexual reproduction.

A flower can be pictured as a very short stem (the receptacle) which holds the components of the flower in sequence. At the very tip of this stem, so they appear in the centre of the flower, are the female organs (the gynoecium). Behind them are the male organs (the androecium), and behind them, on the outside of the flower, are the petals and sepals.



Flower structure

Kew information sheet B4



Stigma – the receptive part of the female reproductive organs on which pollen germinates.

Style – the elongated part of a carpel bearing the stigma, usually at its tip.

Ovary – the hollow basal region of a carpel, containing one or more ovules.

Ovules – the structures in the chamber of an ovary containing the egg cell, within the embryo sac. The ovule develops into the seed after fertilisation.



Anther – usually bilobed. Contains the pollen.

Filament – the stalk



Petal – a non-reproductive (sterile) part of the flower, usually brightly coloured.



Sepal – a floral leaf or individual segment of the calyx of a flower, generally green, which usually forms the outer protective layer in a bud.



Receptacle – flat, concave or convex part of the stem from which all parts of the flower arise.

Carpel – one of the flower's female reproductive organs, comprising a stigma, a style and an ovary.

Gynoecium (=pistil) – collective term for all the female reproductive organs of a flower comprising one or more free or fused carpels.

Stamen – the male reproductive organ of a flower consisting of an anther and filament.

Androecium – collective term for all the male reproductive organs of a flower (stamens).

Corolla – collective term for all the petals of a flower.

Perianth – the floral envelope, usually divisible into an outer whorl (calyx) of sepals and an inner whorl (corolla) of petals.

Calyx – collective term for all the sepals of a flower.

A complete flower is one with all parts (calyx, corolla, stamens and pistil) present. A flower lacking one or more of these parts is said to be incomplete. A perfect flower is one with both androecium and gynoecium. If either are lacking, the flower is said to be imperfect.

All life depends on plants

B4 Flower structure and variations

Variations on a theme

Modifications of the four basic components of the flower (sepal, petal, androecium and gynoecium), together with how groups of flowers are arranged in an inflorescence, lead to the world's overwhelming floral diversity. The details of floral morphology form the basis of flowering plant classification, so accurate descriptions are fundamental to identifying plants.

The presence or absence, number, arrangement, form and colour of these structures are all important.

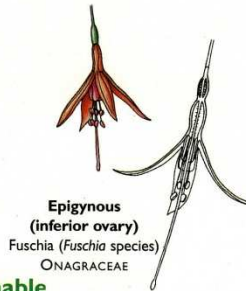
Ovary position in relation to perianth



Hypogynous (superior ovary)
Cranesbill (*Geranium sylvaticum*)
GERANIACEAE



Perigynous (around ovary)
Cherry (*Prunus avium*)
ROSACEAE



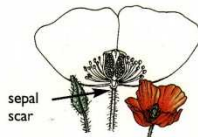
Epigynous (inferior ovary)
Fuschia (*Fuschia* species)
ONAGRACEAE

Inflorescences – reproductive shoot bearing flowers



Cyme
Comfrey (*Symphytum officinale*)
BORAGINACEAE

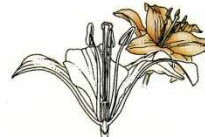
Perianth parts absent, reduced or indistinguishable



Sepals lost when flowers open
Poppy (*Papaver species*)
PAPAVERACEAE



Reduced petals
Petals reduced to nectaries.
Hellebore (*Helleborus viridis*)
RANUNCULACEAE

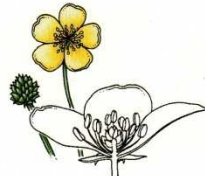


Petals and sepals identical (tepals) – Monocot plants
Lily (*Lilium* species)
LILIACEAE



Raceme
Shepherd's purse (*Capsella bursa-pastoris*)
BRASSICACEAE
The lowest structures are seed capsules

Parts free/fused



Sepals, petals, anthers & carpels free
Creeping buttercup (*Ranunculus repens*)
RANUNCULACEAE



Sepals fused
Petals free, carpels fused.
Bladder campion (*Silene vulgaris*)
CARYOPHYLLACEAE



Petals fused
Sepals free, carpels fused.
Strawberry tree (*Arbutus unedo*)
ERICACEAE



Umbel
Fool's parsley (*Aethusa cynapium*)
APIACEAE

Terminology: parts free, e.g. petals = polypetalous parts fused, e.g. sepals = gamosepalous

Flower symmetry



Actinomorphic (radially symmetrical)
Mallow (*Althaea cannabina*)
MALVACEAE



Zygomorphic (bilaterally symmetrical)
Perennial pea (*Lathyrus latifolia*)
FABACEAE



Capitulum – flower head
Sea aster (*Aster tripolium*)
ASTERACEAE

Illustrations: Debbie Mizards

Further information

Beil A. D. & Bryan A. (1993) *Plant Form: an Illustrated Guide to Flowering Plant Morphology*. Oxford University Press, Oxford.

Heywood V. H. (1993) *Flowering Plants of the World*. Batsford Press, London.

Baumgardt J. P. (1982) *How to Identify Flowering Plant Families*. Timber Press, Portland, Oregon.

HOW TO WRITE A FLORAL FORMULA

A floral formula provides a very useful shorthand for describing flowers. Use the following abbreviations:

K = calyx (sepals); C = corolla (petals); P = perianth (where sepals and petals cannot be distinguished); A = androecium (stamens); G = gynoecium (carpels). Where the number is too high to count, use the symbol ∞ .

A bracket shows that the parts are joined, e.g. $C(5) = 5$ joined petals; $\overline{C5 A5}$ = the stamens arise on the petals. A line below the gynoecium number denotes that the ovary is superior or and a line above it, inferior. Some examples:

K5 C5 A10 $\overline{G5}$ = 5 sepals, 5 petals, 10 stamens, 5 free (not joined) superior carpels.

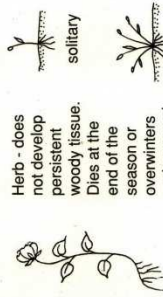
$\overline{P6 A6 G(3)}$ = 6 perianth parts (tepals), 6 stamens arising from them, 3 fused inferior carpels.

K2+2 C(4) A ∞ $\overline{G(2)}$ = 2 large and 2 small sepals, 4 fused petals, a large number of stamens, 2 fused superior carpels.

Life Cycles

- Annual - completes its life cycle within a year
- Biennial - germinates and grows in its first year. Flowers and completes its growth cycle in the second year.
- Perennial - lives for more than 2 years, normally flowering annually but not necessarily in the first year.

Plant form



Herb - does not develop persistent woody tissue. Dies at the end of the season or overwinters underground

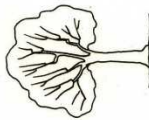


solitary



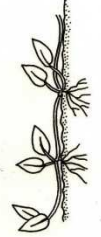
tufted

Shrub - a perennial with much-branched woody stems. Usually less than 10m tall

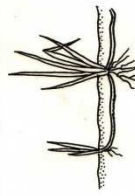


Tree - a perennial with a single woody trunk. Usually large - more than 10m tall

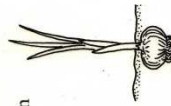
Organs of vegetative reproduction



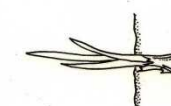
a) stolon - a creeping short-lived stem, usually above ground



b) rhizome - a horizontal underground stem



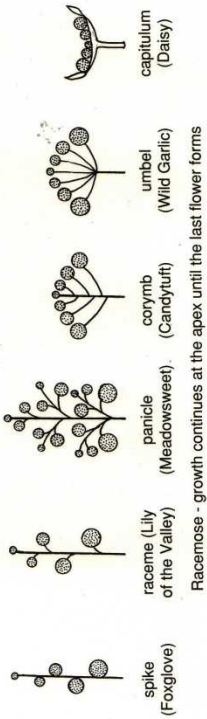
c) corn - swollen stem base



d) bulb - swollen leaf bases or bud

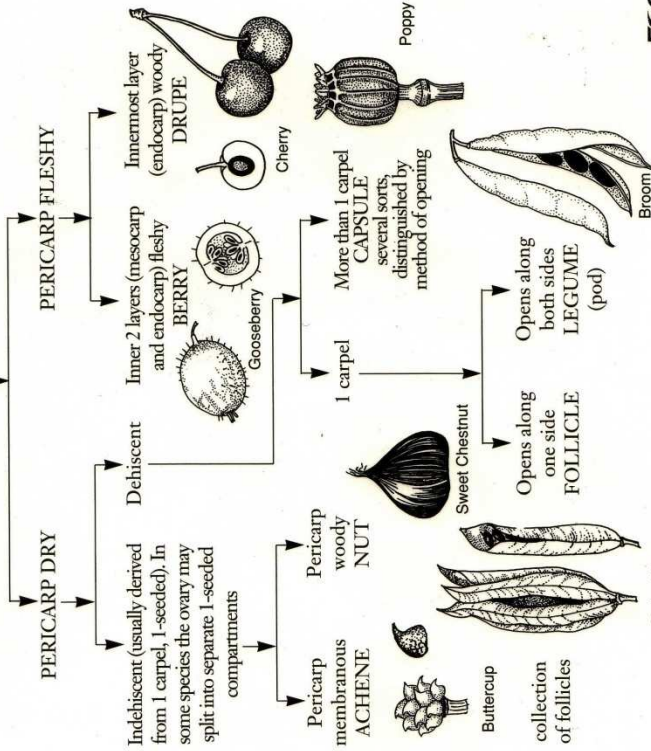
b) - d) are also overwintering organs

THE INFLORESCENCE - the arrangement of flowers

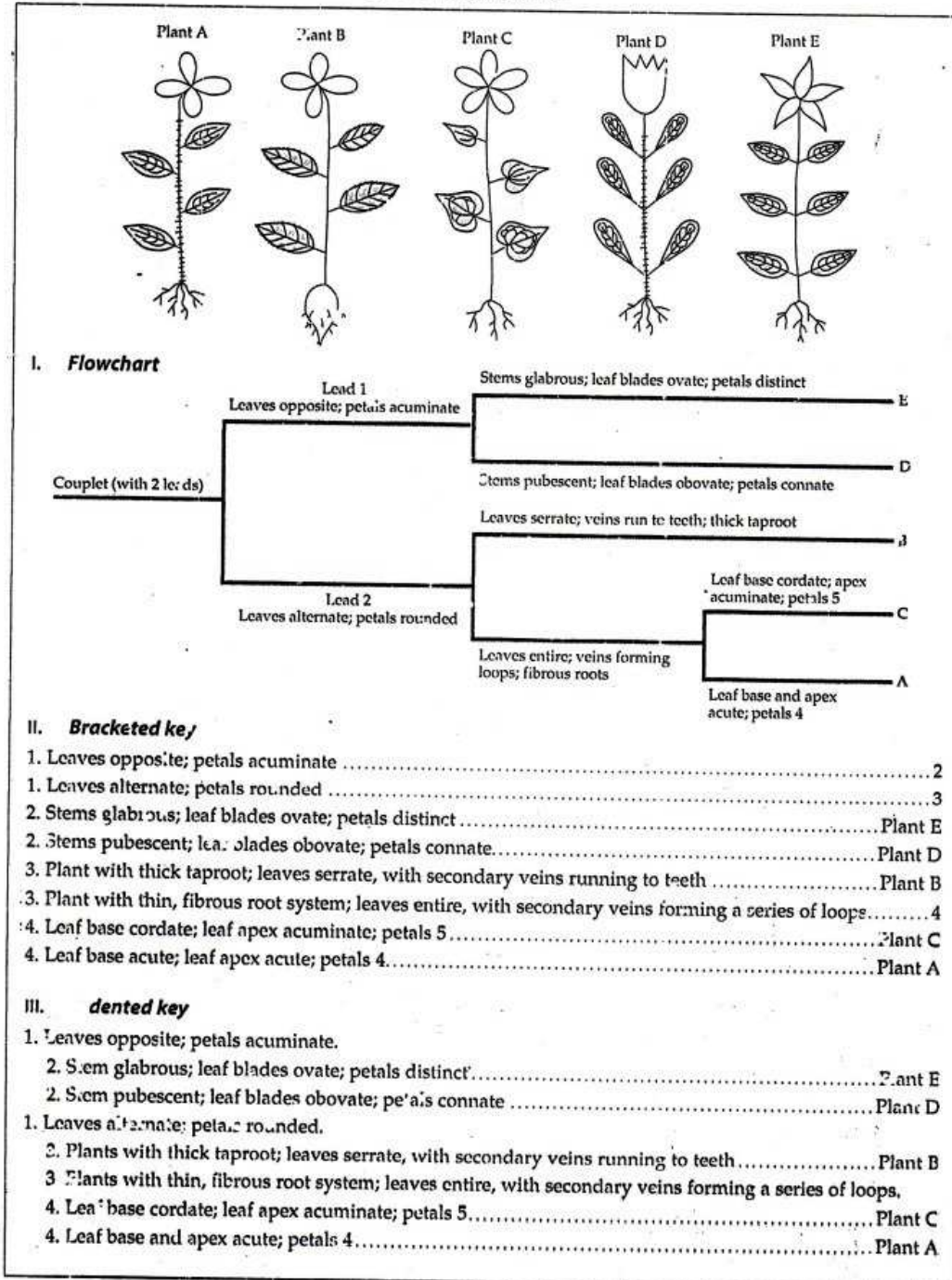


simple monochasial cyme (Houndstongue)
 Cymose - each flower terminates the growth of the shoot; growth is continued by a lateral shoot.
 dichasial cyme (Greater Stitchwort)
 Racemose - growth continues at the apex until the last flower forms

FRUITS



Lampiran 6-a. Diagram pembuatan Kunci Identifikasi



Lampiran 6-b. Langkah dalam pembuatan kunci identifikasi

urutan	Karakter	Pohon
1.	Daun berselang seling	ABC
1.	Daun berhadapan	DE
2.	Helaian daun bentuk ovata	ABCE
2.	Helaian daun bentuk obovate	D
3.	Pinggiran daun bergerigi	B
3.	Pinggiran daun rata	ACDE
4.	Batang berambut atau berduri halus	AD
4.	Batang halus atau licin	BCE
5.	Bentuk akar berumbi atau tebal, ada taproot	B
5.	Taproot tidak ada	ACDE
6.	Pertulangan daun sekunder membentuk lengkungan	ACDE
6.	Pertulangan daun sekunder menuju pinggiran daun	B
7.	Pangkal Daun berbentuk jantung	C
7.	Pangkal daun acuta atau cuneata	ABDE
8.	Jumlah mahkota bunga (petal) 4	ABD
8.	Jumlah mahkota bunga (petal) 5	CE
9.	Mahkota bunga terpilah	ABCE
9.	Mahkota bunga berbentuk mangkok	D
10.	Ujung mahkota bunga acuminata	DE
10.	Ujung mahkota bunga bulat	ABC

Lampiran 7a. Contoh specimen herbarium yang sudah di mounting pada kertas *acid free*.

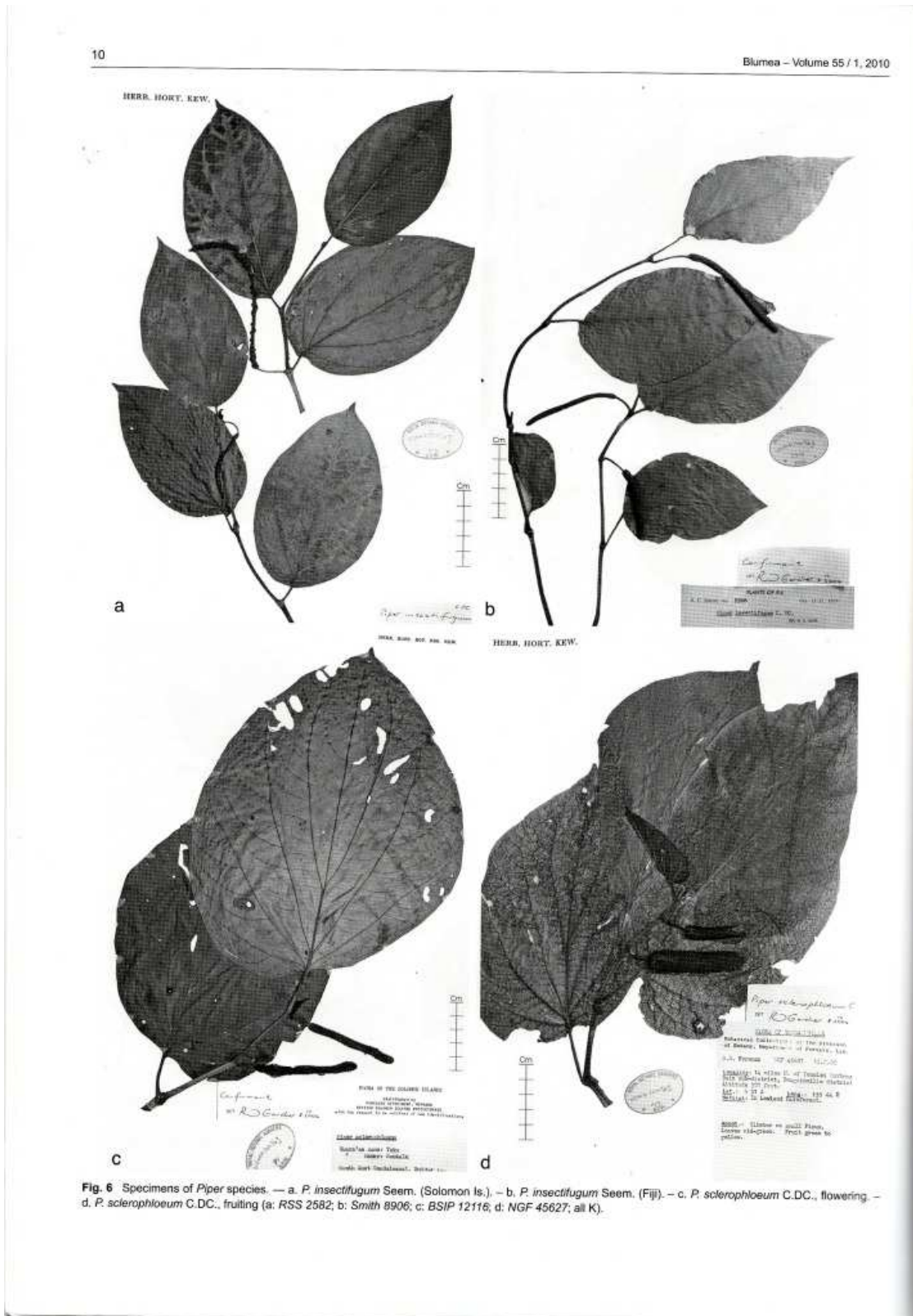


Fig. 6 Specimens of *Piper* species. — a. *P. insectifugum* Seem. (Solomon Is.), — b. *P. insectifugum* Seem. (Fiji). — c. *P. sclerophloeum* C.DC., flowering. — d. *P. sclerophloeum* C.DC., fruiting (a: RSS 2582; b: Smith 8906; c: BSIP 12116; d: NGF 45627; all K).

Lampiran 7b. Contoh specimen herbarium yang sudah di mounting pada kertas *acid free*.

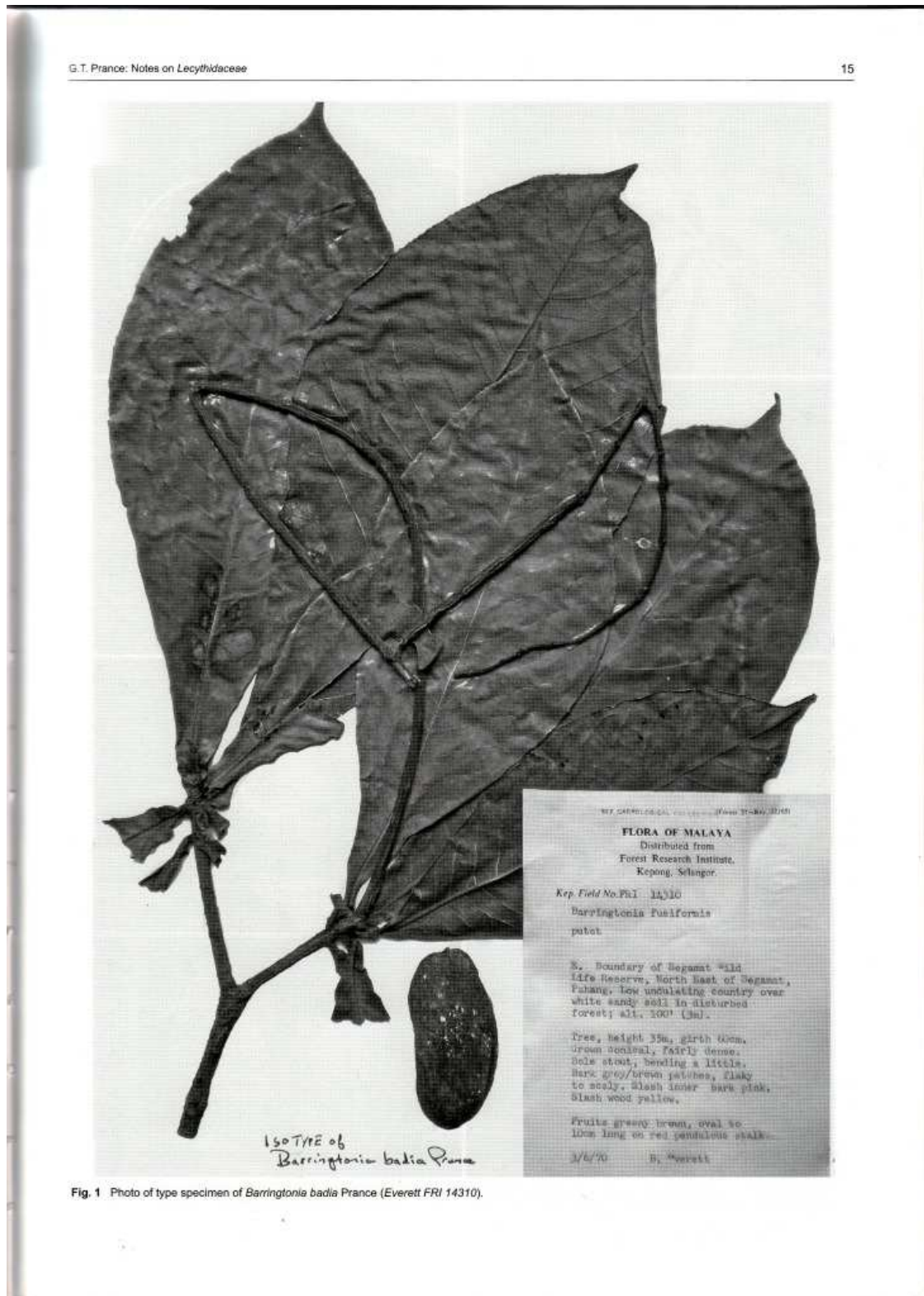


Fig. 1 Photo of type specimen of *Barringtonia badia* Prance (Everett FRI 14310).

Lampiran 8b. Daftar nama-nama jenis pohon kategori kayu komersil minor

No.	Famili	Genus	Spesies
	FABACEAE	<i>Acacia</i>	<i>aulacarpa</i> A. Cunn. ex. Benth.
		<i>Acacia</i>	<i>auriculiformis</i> A. Cunn. ex. Benth.
		<i>Acacia</i>	<i>crassicarpa</i> A. Cunn. ex. Benth.
		<i>Acacia</i>	<i>leptocarpa</i> A. Cunn. ex. Benth.
		<i>Acacia</i>	<i>mangium</i> Willd
		<i>Acacia</i>	<i>mearnsii</i> De Wild.
	MELIACEAE	<i>Aglaia</i>	<i>agglomerate</i> Merr. & Perry
		<i>Aglaia</i>	<i>aspera</i> Teijsm. & Binnend.
		<i>Aglaia</i>	<i>cucullata</i> (Roxb.) Pellegrin.
		<i>Aglaia</i>	<i>flavida</i> Merr. & Perry
		<i>Aglaia</i>	<i>parviflora</i> C.DC.
		<i>Aglaia</i>	<i>penningtoniana</i> Pannell
		<i>Aglaia</i>	<i>rimosa</i> Merr.
		<i>Aglaia</i>	<i>sapindina</i> (F.v. Mueller) Harms.
		<i>Aglaia</i>	<i>smithii</i> Koord.
		<i>Aglaia</i>	<i>spectabilis</i> (Miq.) Jain & Bennett
		<i>Aglaia</i>	<i>Subcuprea</i> Merr. & Perry
	MORACEAE	<i>Arthocarpus</i>	<i>fretessii</i> Teijsm & Binnend.
		<i>Arthocarpus</i>	<i>sepicanus</i> Diels.
		<i>Arthocarpus</i>	<i>teijsmannii</i> Miq.
	MELIACEAE	<i>Azadirachta</i>	<i>excels</i> (Jack.) Jacobs
	LAURACEAE	<i>Beilschmiedia</i>	<i>acutifolia</i> Teschn.
		<i>Beilschmiedia</i>	<i>dilmyana</i> Kosterm.
		<i>Beilschmiedia</i>	<i>morobensis</i> Kosterm.
		<i>Beilschmiedia</i>	<i>novoguineensis</i> Teschn.
		<i>Beilschmiedia</i>	<i>podagrica</i> Kosterm.
		<i>Beilschmiedia</i>	<i>pustulata</i> Kosterm.
	SAPOTACEAE	<i>Burckella</i>	<i>erythrophylla</i> H.J. Lam.
		<i>Burckella</i>	<i>macropoda</i> (Krause.) H.J. Lam.
		<i>Burckella</i>	<i>obovata</i> (J.G. Foster) Piere.
		<i>Burckella</i>	<i>polymera</i> P. v. Royen
		<i>Burckella</i>	<i>pookei</i> H.J. Lam.
		<i>Burckella</i>	<i>sorei</i> P.v. Royen
	BURSERACEAE	<i>Canarium</i>	<i>acutifolium</i> (A.D.C.) Merr.
		<i>Canarium</i>	<i>asperum</i> Benth.
		<i>Canarium</i>	<i>australianum</i> F.v. Mueller.
		<i>Canarium</i>	<i>decumanum</i> Gaertner.
		<i>Canarium</i>	<i>hirsulum</i> wild.
		<i>Canarium</i>	<i>indicum</i> L.
		<i>Canarium</i>	<i>kaniense</i> Lauterb.
		<i>Canarium</i>	<i>maluense</i> Lauterb.
		<i>Canarium</i>	<i>oleosum</i> (Lamk.) Engl.
		<i>Canarium</i>	<i>rigidum</i> (Blume) Zipp.ex. Miq.

		<i>Canarium</i>	<i>salomoense</i> B.L. Burtt.
		<i>Canarium</i>	<i>sylvestre</i> Gaertner.
	FAGACEAE	<i>Castanopsis</i>	<i>acuminatissima</i> (Blume) A.DC.
	LAURACEAE	<i>Cinnamomun</i>	<i>eugenoliferum</i> Kosterm.
		<i>Cinnamomun</i>	<i>grandiflorum</i> Kosterm.
	BORAGINACEAE	<i>Cordia</i>	<i>subcordata</i> Lamk.
	LAURACEAE	<i>Cryptocarya</i>	<i>alleniana</i> C.T. White
		<i>Cryptocarya</i>	<i>aureosericea</i> Kosterm.
		<i>Cryptocarya</i>	<i>idenburgensis</i> C.K. Allen
		<i>Cryptocarya</i>	<i>invasiorum</i> Kosterm.
		<i>Cryptocarya</i>	<i>longipetiolata</i> Kosterm
		<i>Cryptocarya</i>	<i>massoy</i> (Okem) Kosterm
		<i>Cryptocarya</i>	<i>mutipaniculata</i> Teschner
		<i>Cryptocarya</i>	<i>palmerensis</i> C.K. Allen
		<i>Cryptocarya</i>	<i>verrucosa</i> Teschner
	PODOCARPACEAE	<i>Dacrycarpus</i>	<i>cinctus</i> (Pilger.) de Laubenf.
		<i>Dacrycarpus</i>	<i>expansus</i> de Laubenf.
		<i>Dacrycarpus</i>	<i>imbricatus</i> (Blume) de Laubenf.
		<i>Dacrycarpus</i>	<i>steupii</i> (Wascher) de Laubenf.
		<i>Dacrydium</i>	<i>beccarii</i> Parl.
		<i>Dacrydium</i>	<i>cornwalliana</i> de Laubenf.
		<i>Dacrydium</i>	<i>nidulum</i> de Laubenf.
		<i>Dacrydium</i>	<i>xanthandrum</i> Pilger.
	DILLENIAEAE	<i>Dillenia</i>	<i>alata</i> (R.Br. ex. DC.) Martelli
		<i>Dillenia</i>	<i>auriculata</i> Martelli
		<i>Dillenia</i>	<i>castaneifolia</i> (Miq.) Diels
		<i>Dillenia</i>	<i>nalagi</i> Hoogl.
		<i>Dillenia</i>	<i>ovalifolia</i> Hoogl.
		<i>Dillenia</i>	<i>papuana</i> Martelli
		<i>Dillenia</i>	<i>quercifolia</i> (C.T. White & Francis ex. Lane Poole) Hoogl.
		<i>Dillenia</i>	<i>schlechteri</i> Diels
	EBENACEAE	<i>Diospyros</i>	<i>buxifolia</i> (Blume) Hiern
		<i>Diospyros</i>	<i>insularis</i> Bakh.
		<i>Diospyros</i>	<i>maritime</i> blume
		<i>Diospyros</i>	<i>papuana</i> Valetton ex. Bakh
	ANACARDIACEAE	<i>Dracontomelon</i>	<i>dao</i> (Blanco) Merr. & Rolfe

Lampiran lanjutan 8b. Daftar nama-nama jenis pohon kategori kayu komersil minoritas

No.	Famili	Genus	Spesies
		<i>Dracontomelon</i>	<i>lenticulatum</i> Wilkinson
	SONNERATIACEAE	<i>Duabanga</i>	<i>moluccana</i> Blume
	BOMBACACEAE	<i>Durio</i>	<i>zibethinus</i> Murray
	MAGNOLIACEAE	<i>Elmerrillia</i>	<i>tsiampacca</i> (L.) Dandy
	LOGANIACEAE	<i>Fragraea</i>	<i>berteriana</i> A. Gray ex. Benth.
		<i>Fragraea</i>	<i>bodenii</i> Wernham
		<i>Fragraea</i>	<i>elliptica</i> Roxb.
		<i>Fragraea</i>	<i>fragrans</i> Roxb.
		<i>Fragraea</i>	<i>gracilipes</i> A. Gray
		<i>Fragraea</i>	<i>racemosa</i> Jack ex. Wallich
	ANACARDIACEAE	<i>Gluta</i>	<i>papuana</i> Ding Hou
	FLACOURTIACEAE	<i>Homalium</i>	<i>foetidum</i> (Roxb.) Benth.
	ANACARDIACEAE	<i>Koordersiodendron</i>	<i>pinnatum</i> (Blanco) Merr.
	CUPRESSACEAE	<i>Libocedrus</i>	<i>papuana</i> F.v. Mueller
	FAGACEAE	<i>Lithocarpus</i>	<i>celebicus</i> (Miq.) Rehder
		<i>Lithocarpus</i>	<i>lauterbachii</i> (von Seemen) Markgr.
		<i>Lithocarpus</i>	<i>megacarpus</i> Soepadmo
		<i>Lithocarpus</i>	<i>rufovillosus</i> (Markgr.) Rehder
		<i>Lithocarpus</i>	<i>schlechteri</i> Markgr.
		<i>Lithocarpus</i>	<i>sogerensis</i> (S. Moore) Markgr. ex A Camus
		<i>Lithocarpus</i>	<i>vinkii</i> Soepadmo
	LAURACEAE	<i>Litsea</i>	<i>calophyllantha</i> K. Schumann
		<i>Litsea</i>	<i>collina</i> S. Moore
		<i>Litsea</i>	<i>densiflora</i> (Teschner.) Kosterm.
		<i>Litsea</i>	<i>domarensis</i> O.C. Schmidt
		<i>Litsea</i>	<i>elliptica</i> Blume
		<i>Litsea</i>	<i>engleriana</i> Teschner
		<i>Litsea</i>	<i>irianensis</i> Kosterm.
		<i>Litsea</i>	<i>ledermannii</i> Teschner
		<i>Litsea</i>	<i>maluensis</i> Teschner
		<i>Litsea</i>	<i>timoriana</i> Span.
		<i>Litsea</i>	<i>versteeghii</i> Allen
	ANACARDIACEAE	<i>Mangifera</i>	
		<i>Mangifera</i>	
		<i>Mangifera</i>	
		<i>Mangifera</i>	
		<i>Mangifera</i>	
	MYRISTICACEAE	<i>Myristica</i>	
		<i>Myristica</i>	
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PODOCARPACEAE	<i>Nageia</i>	
FAGACEAE	<i>Nothofagus</i>	
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DATISACEAE	<i>Octomeles</i>	<i>sumatrana</i> Miq.
ANACARDIACEAE	<i>Pentaspadon</i>	<i>motley</i> Hook. f.
PODOCARPACEAE	<i>Phylcladus</i>	<i>hypophyllus</i> Hook.f.
	<i>Podocarpus</i>	
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STERCULIACEAE	<i>Pterocymbium</i>	<i>beccarii</i> K. Schumann
BURSERACEAE	<i>Santiria</i>	<i>rubiginosa</i> Blume
STERCULIACEAE	<i>Sterculia</i>	
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