

IDENTIFICATION KEYS TO GENERA
AND SPECIES OF THE
DIPTEROCARPACEAE OF THAILAND

by

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In 1954, as a result of a study under the Expansion Technical Assistance Programme granted by the Food and Agriculture Organization of the United Nations, a paper under the above title was published in mimeographed form as Thai Forest Bulletin (Botany) No. 1, which in a short time became exhausted.

In 1957, under the auspices of the Thai-Danish Botanical Study Programme, it was made possible for the author to undertake some further studies in Denmark, where a period of nine weeks was spent, followed by a weeks stay at Kew on the homeward trip. As these studies has led to some revisions being necessary in the above paper, and as there seems to be some demand for a new edition, the author is thankful to the editor of the Natural History Bulletin of the Siam Society for his permission to have the revised paper printed in the Bulletin.

At the same time, the author wish to express his profound thanks to the Committee of the Thai-Danish Botanical Study, whose activity is a great benefit to Thailand in the field of botanical research. The author also wish to convey his gratitude to Professor Th. Soerensen and Dr. O. Hagerup for the permission to work in the Herbarium and Library of the Botanical Museum in Copenhagen and for the kind and hearty attention shown him. During the brief visit to Kew, kind assistance was offered by Dr. N. L. Bor and Mr. L.L. Forman, to whom the author is most indebted.

INTRODUCTION

The first scientists to mention representatives of the *Dipterocarpaceae* from Thailand were the Dutch botanists TEIJSMANN & MIQUEL, who (in *Annal du Museum Botanica I*, Lugdano Batavia I, 1863-64) described as *Dipterocarpus obtusifolius* and *Shorea siamensis* plants collected by TEIJSMANN during a trip to Thailand. Scattered collections were made by visitors to Thailand during the following years, but it was only after the creation of the Section of Botany under the Ministry of Commerce and Transportation in 1920, under the zealous leadership of Dr. A.F.G. KERR, that extensive collections were made all over the country. These collections together with earlier material was studied by Professor W.G. Craib, and the result published in the *Florae Siamensis Enumeratio* (1925-31) which records 10 genera of the family, with a total of 46 species and 7 varieties.

In his "Foresters' Manual of Dipterocarps" (1943) SYMINGTON recorded 10 genera and 36 species from Thailand. The present paper generally follows SYMINGTON's conception, and 9 genera, 50 species and 10 varieties are recorded; it is believed, however, that a considerable amount of species will be discovered in the future when extensive and thorough explorations are undertaken.

In preparing the following key, the author was faced with some difficulties, and as an introduction, the following list contains the authors' views and conceptions:

1. The problems in connection with the genus *Dipterocarpus* GAERTN. F. have already been treated in my recent publication entitled 'The Genus *Dipterocarpus* GAERTN. F. in Thailand', Thai Forest bulletin (Botany) No. 1, September, 1958. and, accordingly will not be repeated here.

2. I have not seen the type specimens of the *Anisoptera marginatiodes* HEIM (cf. CRAIB 1925, p. 139), but HEIM's descriptions (1910) seems to me to agree with *A. costata* KORTH.

and for the time being I list it under the latter species, pending further collections.

3. SYMINGTON (1933-39) pointed out that *Shorea cochinchinensis* PIERRE (cf. CRAIB 1925, p. 142), *Shorea cochinchinensis* var. *saigonensis* PIERRE ex GUERIN, and *Shorea floribunda* KURZ are conspecific with *Shorea talura* ROXB., a point of view which I share. I agree, however, with GUERIN (1910) in considering the pubescent-leaved form cited by him as *S. cochinchinensis* var. *saigonensis* as a variety, its name should then be altered as follows:

Shorea talura var. *saigonensis* (PIERRE ex GUERIN) SMITINAND comb. nov (Basynym: *S. cochinchinensis* PIERRE var. *saigonensis* PIERRE ex GUERIN in LÉCOMTE: Flore General de l'Indo-Chine Vol. I, 1910, CRAIB 1925, p. 142).

In the Kew Herbarium there is a sheet labelled *Shorea harmandii* PIERRE, collected by THOREL during his Mekong expedition 1866-68, which is identical with the above variety.

4. The *Shorea henryana* PIERRE var. *rigida* HEIM, listed by CRAIB (1925, p. 143), seems, judging from the scant material in the Kew Herbarium to be quite a distinct variety, so I have retained it in my list.

5. The relationship between *Shorea thorelii* LANESS. and *Shorea obtusa* WALL. var. *kohchangensis* HEIM is very close, and after an extensive study in the field it can be concluded that they are conspecific. Hence the name *Shorea thorelii* LANESS. having the antecedent, is accepted, and the epithet *Shorea obtusa* WALL. var. *kohchangensis* HEIM is reduced to its synonym.

6. I have left out *Shorea obtusoides* BOERL., listed by CRAIB (1925, p. 144) as it seems to be a *nomen dubia*.

7. *Shorea robusta* GAERTN. F. var. *schmidtii* HEIM, listed by CRAIB (1925, p. 144) I consider a synonym of *Shorea guiso* BL. HEIM (1902, p. 263) himself observed that the plant might be *S. vulgaris* PIERRE ex LANESS, which SYMINGTON

consider a synonym of *S. guiso* in his later work (1943, p. 16). *Shorea robusta* GAERTN. F. is a native of India and Burma and has so far not been recorded this side of Tenasserim.

8. *Shorea symingtoniana* PARKINSON mss. At Kew and at the British Museum I found two specimens bearing this name on the label. SYMINGTON (1941) mentions that PARKINSON in 1937 named a *Shorea* from Thailand in the *Barbata*-group after him, but as apparently no description exists, I am afraid the name must be considered a *nomen nudum*.

During my work I was informed by Mr. M.B. RAIZADA at Dehra Dun, that he intended to publish a new species of *Shorea*, based on material collected by O.C. ROGERS in Lower Burma, and it was found that this species was identical with the two specimens mentioned above. We accordingly agreed to common authorship of this species as follows:

Shorea rogersiana RAIZADA & SMITINAND *sp. nov.*
(*Shorea symingtoniana* PARKINSON in Herb. Kew).

Species plane distincta in se, affinis *Shorea laevi* RIDL. a quatenus differt praecipue alabastris conicis ovatis, antheris corniculatis atque stylo paululum elongato (see fig. 1).

A large tree, the bark exfoliating in large strips which remains attached to stem by the upper ends (ROGERS). Branchlets and twigs dark grey, glabrous, lenticellate. Leaves alternate, coriaceous ovate-lanceolate or lanceolate, glabrous, dark green above, lighter beneath, acuminate at the apex, somewhat rounded or subcuneate at the base, 5-6 cm long, 2-3 cm wide; secondary nerves 8-12 pairs, fairly prominent on either side; tertiary nerves parallel; petiole 1, 5-2 cm long, (each flower very shortly stalked subtended by 2 bracteoles which are deciduous). Flower buds ovate or globose. Sepals 5, ovate orbiculate, tomentose outside, about 3 mm long, 2 mm broad, coriaceous strongly imbricate in bud, 1 mm in diameter. Petals 5, ovate or ovate-lanceolate, densely hairy or tomentose, or hairy only along the margin outside, glabrous within, 6-7, 5 mm



Fig. 1. *Shorea rogersiana* RAIZADA & SMITINAND. Specimen from Tavoy (C.G. Royers 350 T, TYPE).

long, 3,5–4 mm wide, 2–3 times the calyx. Stamens about 40–45 (30–36) up to 2–2,5 mm long, filaments long and slender, some of them slightly broadened above the base, up to 1,25 mm long, anther about 5 mm long, bearded or covered

with a number of short ciliae; appendage to connective rather shorter than anther, covered with scattered ciliae. Ovary almost ovate, not spherical, densely tomentose, 1,5 mm high, 1,25 mm broad, style hardly longer than the ovary, densely tomentose except the distal part which is glabrous (3/4 of style tomentose below, rest glabrous), stigma terminal, entire. Fruits not seen.

BURMA: Tavoy distr., Sin Yat Hill 1500 ft. and over. 13 Jan. 1919, C.G. Rogers 350 T. (Type in the Herbarium, Dehra Dun).

THAILAND: Peninsula, Lang Suan, Khao Nom Sao, ca. 400 m. 20. Febr. 1927 A.F.G. KERR 12023 and 12023 A (Co-type, in the Herbarium Kew, British Museum and Herb. Department of Agriculture, Bangkok).

This distinct species belongs to the section *Eushorea* PIERRE ex BRANDIS, and the *Barbata*-group as defined by SYMINGTON (l.c.). It is related to *Shorea laevis* RIDL.

9. I retain the *Parashorea stellata* KURZ, listed by CRAIB (1925, p. 144) as I do not agree with SYMINGTON (1943, p. 102) that it is identical with *P. lucida* (MIQ.) KURZ, a native of Indonesia. SYMINGTON (l.c.) agreed that a thorough collection is needed to back up his interpretation, and it seems to me that there are many differences between the two species, e.g. the shape of the leaves and the length of the fruiting calyces. Except for the type, there are no specimens of *P. lucida* in the Kew Herbarium.

10. CRAIB (1925, p. 145) lists four species of *Pentacme*, viz. *P. malayana* KING, *P. siamensis* KURZ, *P. suavis* A.DC., and *P. tomentosa* CRAIB.

Both FOXWORTHY (1932) and SYMINGTON (1943) are of the opinion that these should be considered as one single species, which they list as *P. siamensis* (MIQ.) KURZ, and SYMINGTON (l.c.) is after a critical study of the inland

species of the opinion that there is a need of splitting *P. siamensis* into subspecies or varieties.

I therefore follow SYMINGTON'S hint and feel that 3 distinct forms can be recognized. One form is the glabrous-leaved form (*P. malayana* KING and *P. suavis* A.DC.), another form has the under part of the leaves tomentose (*P. siamensis* KURZ) and the third form has both sides of the leaves tomentose (*P. tomentosa* CRAIB). The split-up of *P. siamensis* (MIQ.) KURZ, undertaken by GUÉRIN (1910) complicates matters, but I feel that the right solution is to work with the three forms mentioned above. *P. siamensis* might be the oldest name for the main-species, but it was only in 1870 that KURZ transferred it from *Shorea* to *Pentacme*, therefore I think I am right in reaching the solution that the name of the main-species should be *P. suavis* A.DC (with *P. malayana* KING as a synonym), and I propose the following two varieties of this:

P. suavis A.DC. var. *siamensis* (MIQ.) SMITINAND
comb. nov. (Basynym: *Shorea siamensis* MIQ. in Ann Mus.
Lugd. Bat. Vol. I, p. 214 1863-64), and

P. suavis A.DC. var. *tomentosa* (CRAIB) SMITINAND,
comb. nov. (Basynym: *P. tomentosa* CRAIB, in Kew Bull. p.
423, 1915).

11. The type specimen of *Hopea avellanea* HEIM in the University Botanical Museum of Copenhagen shows its clear specific status, and thus *Hopea beccariana* BURCK, which in my former work temporarily was considered to cover this species, has to be omitted from this revised paper. As evidently there is no figure of *H. avellanea* published anywhere a line drawing is given in this paper (fig. 2 and 3).

12. Again, I have not seen the type of *Hopea siamensis* HEIM, listed by CRAIB (1925, p. 147). In the first edition I treated this species provisionally as a synonym of *H. pedicellata* (BRANDIS) SYM., but one sheet collected (SMITINAND 2206) from the type locality seems to tally with HEIM'S description. If this sheet can be deemed as *H. siamensis*,

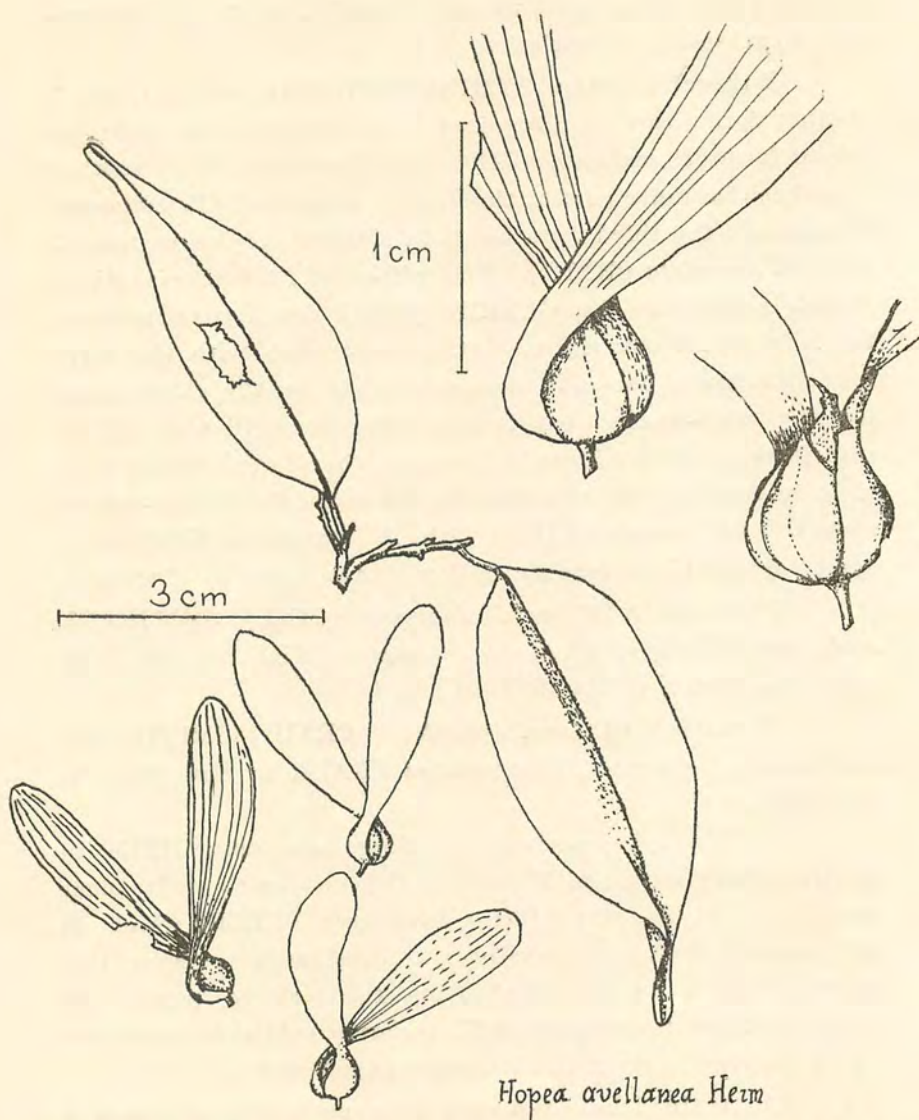


Fig. 2. *Hopea avellanea* HEIM. From type-collection from Koh Chang (SCHM.420) in the Copenhagen herbarium.

it shows a close affinity between *H. avellanea* and *H. pierrei* with itself as the extreme form. The status of *H. siamensis* can not be decided yet in this paper, owing to the untraceable type specimen.

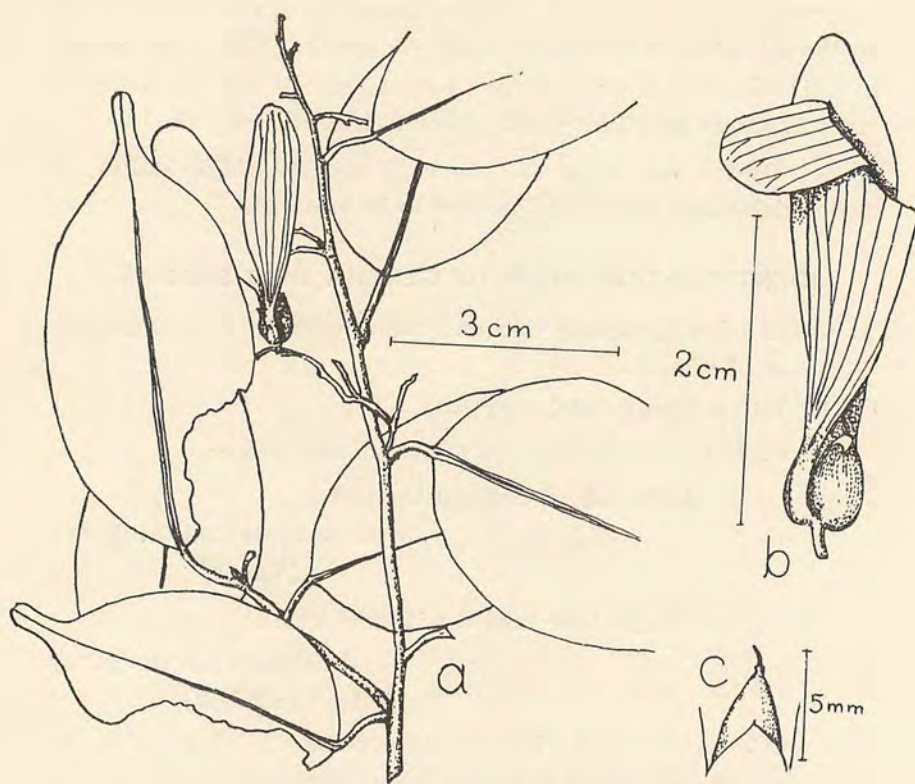


Fig. 3. *Hopea avellanea* HEIM. Koh Chang (SMITIN. 2231).

13. The collection of *Hopea schmidtii* HEIM in the Herbarium of the University Botanical Museum of Copenhagen consists of one sheet (SCHMIDT 508) representing the type, and two spirit collections.

The sheet is composed of one leaf unmistakably belonging to a *Lagerstroemia* and fragments of a fruit of the *Hopea helferi* group. The two spirit collection are without of collector, the one, represented by a leaf and a fruit, is actually *Shorea hypochra* HANCE, the commonest species of the island of Koh Chang. HEIM (1902, p. 263) records this species quoting SCHMIDT 279, 508*d* and 818, all of which I have not seen. This spirit collection might represent SCHMIDT 508*d* and have been mislabelled. The

other one spirit collection consist of a number of fruits and might be the mislabelled specimen of *H. siamensis* HEIM, for which SCHMIDT 508e has been given as type, and if the guessing is right it shows an affinity to *P. pierrei* HANCE (see note 12.)

By far and large the name *Hopea schmidtii* HEIM is quite misleading and therefore has to be rejected.

IDENTIFICATION KEYS TO GENERA AND SPECIES

- A. Calyx lobes distinctly unequally developed in size, into the shape of wings:—
- B. Wings 2 long and 3 short:—
- C. Large wings with only 3 prominent veins:—
- D. Calyx tube free from the nut:—
Dipterocarpus Gaertn. (p. 68)
 (Yang)*
- DD. Calyx tube united with the nut:—
Anisoptera Korth. (p. 72)
 (Krabak)
- CC. Large wings with 5 or more veins
- E. Large wings with 5 conspicuous veins:—
- F. Nut densely woolly tomentose; leaf-venation looped:—
Cotylolobium Pierre (p. 76)
 (Kiam)
- FF. Nut not so, leaf-venation reticulate or scalariform:—
Vatica Linn. (Synaptea) (p. 75)
 (Phancham)
- EE. Large wings with at least 7 veins (on lower part):—
Hopea Roxb. (p. 73)
 (Takian)

*) The names in parenthesis are the Thai names

BB. Wings 3 long, 2 short:—

G. Leaves oblong, elliptic-ovate or ovate-lanceolate, base cuneate or rounded; lower pairs of lateral veins not forked:—

Shorea Roxb. (p. 76)

(Teng & Saya)

GG. Leaves ovate, cordate; lower pairs of lateral veins forked:—

Pentacme A. DC. (p. 79)

(Rang)

AA. Calyx lobes equally developed or almost so:—

H. Lobes developed into long wings considerably exceeding the nut, base contracted to stalk;—

Parashorea A. DC. (p. 79)

(Khai Kheo)

HH. Lobes not developed into wings.

I. Calyx lobes overlapping or united to form a cupule embracing or united with the base of the nut:—

J. Lobes united with the nut:—

Vatica stapfiana (King) Van. Sl.

(Sak thale)

JJ. Lobes not united with the nut:—

Balanocarpus Bedd. (p. 80)

(Takian chantamaew)

II. Calyx lobes not forming a cupule embracing the base of the nut:—

K. Lobes woody in texture.

L. Lobes auriculate, spreading beyond the periphery of the nut:—

Shorea sumatrana (V. Sl. ex Foxw.) Sym. *)

(Palawsali)

*. The only specimen seen in the collections from Thailand is LAKSHNA-KARA 592 collected from Tomo in Yala.

LL. Lobes thick not spreading beyond the periphery of the nut:—

Vatica wallichii Dyer
(Sak nam)

KK. Lobes leathery in texture:—

Vatica diospyroides Sym.
(Chankapaw)

1. *DIPTEROCARPUS GAERTN. F.*

A. Tube of fruiting calyx smooth or with protuberances on its upper part, globose, conic or obconic, never angular:—

B. Fruiting calyx smooth, without protuberances on its upper part.

C. Mature fruiting calyx 2.5 cm. or more in diameter.

D. Large wings 17.5 cm. or more in length:—

D. retusus Bl.
(Yang kuan)

DD. Large wings at most 16 cm. long.

E. Large wings distinctly saellate hairy in mature state.

F. Stipules clothed with long stellate hairs.

G. Leaves obtuse or rounded at the apex; stipules shaggy tomentose; fruiting calyx tube globose.

D. obtusifolius Teysm.
(Yang hiang)

GG. Leaves acuminate, stipules pilose, with stellate hairs. Fruiting calyx tubes pyriform, contracted at the top:—

D. baudii Korth.
(Yang khon)

FF. Stipules canescent or glabrescent:—

H. Stipules canescent :—

D. obtusifolius Teysm.,
var. *vestitus* (Vesque)
Smitinand
(Yang hiang)

HH. Stipule glabrescent or glabrous :—

D. obtusifolius Teysm.
var. *subnudus* Ryan et Kerr
(Yang hiang)

EE. Large wings glabrescent in mature state.

I. Leaves drying blackish; stipules silvery tomentose
within, fruits more or less spindle shape :—

D. kerrii King
(Yang manmu)

II. Leaves drying brownish; stipules glabrous within;
fruits more or less globose :—

D. hasseltii Blume,
(Yang kliang)

CC. Mature fruiting calyx at most 2.5 cm. in diameter.

J. Fruiting calyx globose; leaves glabrous or pubescent;
stipules tomentose.

K. Leaves glabrous on both surfaces, fruiting calyx
2.5 cm. in diameter :—

D. turbinatus Gaertn. f.
(Yang daeng)

KK. Leaves yellow pubescent beneath; fruiting
calyx less than 2 cm. in diameter.

L. Large wings 3-nerved along the whole
length :—

D. chartaceus Sym.
(Yang wat)

LL. Large wings 3-nerved but only the
median reaching the apex :—

D. gracilis Blume.
(Yang sian)

JJ. Fruiting calyx elliptic; leaves pilose-tomentose; stipules fulvous pilose-tomentose:—

D. crinitus Dyer
(Yang khai)

BB. Fruiting calyx with 5 smooth protuberances on its upper part:—

M. Stipules tomentose and all parts either glabrous or tomentose:—

N. Young twigs, petioles and peduncles glabrous, glaucescent:—

D. tuberculatus Roxb.
(Yang phluang)

NN. Young twigs, petioles and peduncles fulvous tomentose:—

D. tuberculatus Roxb.,
var. tomentosus Ryan et Kerr
(Yang phluang)

MM. Stipules and all parts canescent:—

D. tuberculatus Roxb.,
var. grandifolius (Teyssm.) Craib
(Yang phluang)

AA. Tube of fruiting calyx 5-angled, at least on its upper portion, with more or less conspicuous ridges, or accrescent into 5 straight or plicate wings.

O. Fruiting calyx 5-angled, not accrescent into wings.

P. Angular ridges running down beyond the middle of the tube (but not reaching the base); tube of fruiting calyx 3.75 cm. in diameter; large wings more than 15 cm. long:—

16. *D. dyeri* Pierre
(Yang klawng)

PP. Angular ridges running all the way down from top to base, tube of fruiting calyx 1.8 cm. in diameter; large wings at most 15 cm. long.

Q. Leaves and stipules pubescent, tube of fruiting calyx globose; ridges straight.

D. costatus Gaertn. f.

(Yang pai)

QQ. Leaves and stipules glabrous; tube of fruiting calyx elliptic, or elliptic-oblong; ridges undulate :-

D. oblongifolius Blume

(Yang khlawng)

OO. Tube of fruiting calyx with 5 straight, slightly undulated, or strongly transversely plicated wings from top to base or to the middle only.

R. Tube of fruiting calyx with 5 straight or slightly undulated wings.

S. Mature leaves glabrous on both surfaces, large wings more than 18 cm. long, 3.75 cm. broad; tube of fruiting calyx elliptic-ovate to oblong :-

D. grandiflorus Blance

(Yang yung)

SS. Mature leaves more or less pubescent beneath; large wings at most 18 cm. long, 2.5 cm. broad; tube of fruiting calyx globose :-

D. alatus Van Sl.

(Yang na)

RR. Tube of fruiting calyx with strongly transversely plicate wings :-

D. intricatus Van Sl.

(Yang krat)

2. ANISOPTERA, KORTH.

A. Leaves furnished with stellate hairs on the veins on the undersurface.

B. Leaves frequently exceeding 20 cm. in length, ferruginous hairy on the undersurface.

A. megistocarpa Van Sl.¹

(Krabak daeng)

BB. Leaves rarely exceeding 20 cm. in length, yellow or glaucescent on the undersurface.

C. Leaves elliptic-oblong, frequently less than 10 cm. long, oftenly bright yellow lepidot on the undersurface *A. curtisii* Dyer²

(Krabak thawng)

CC. Leaves oblong-obovate, frequently more than 12 cm. long, usually dull yellow or glaucescent on the undersurface.

D. Undersurface of leaves glabrescent and glaucescent; large wings on fruit elliptic-oblong.

..... *A. oblonga* Dyer.

(Krabak dam)

DD. Undersurface of leaves dull yellow pubescent; large wings on fruit spatulate

A. costata Korth

(Krabak khok)

AA. Leaves glabrous on the undersurface

..... *A. scaphula* (Roxb.) Pierre

(Krabak khao)

1. The only specimen in the Thai collections is that of CURTIS from Phan Nga, represented by one fruit only.

2. The only sterile specimen seen of the Thai species is that of PUT 300 from Trang, which I believe to represent this species.

3. *HOPEA ROXB.*

A. Stem fissured bark; leaves acute, never caudate, base asymmetric, more or less pubescent or if acuminate, then with symmetric base, glabrous; not dryobalanoid venation.

B. Leaves acute with asymmetric base, more or less pubescent; nut ovate.

C. Leaves oblong, 13 cm. or more long, pubescent; fruit with large wings coriaceous, 10 cm. or more long.

D. Leaves coriaceous, venation obvious on the upper surface;—

H. recopei Pierre
(Chanphu)

DD. Leaves chartaceous, venation obscure on the upper surface.

E. Leaves yellowish pubescent beneath.

F. Wings loosely clasping the nut; large wings oblong, base smooth; small wings shorter than the nut;—

H. oblongifolia Dyer
(Mawran)

FF. Wings tightly clasping the nut; large wings spatulate, base furrowed, small wings longer than the nut;—

H. oblongifolia Dyer, var.
grandis C.E.C. Fischer
(Mawran)

EE. Leaves silvery white beneath;—

H. helferi Dyer
(Kabok kang)

CC. Leaves ovate, elliptic ovate or ovate oblong, less than 10 cm. long; large wings 5 cm. or less long; chartaceous.

- G. Domatia present on undersurface of leaves.
- H. Domatia glabrous; leaves ovate-oblong:—
5. *H. odorata* Roxb.
(Takian thawng)
- HH. Domatia pubescent; leaves ovate-elliptic or very variable.
- I. Domatia conspicuously present; leaves ovate elliptic:—
- H. minutiflora* C.E.C. Fischer¹
(Takian khon)
- II. Domatia few, sparsely present; leaves very variable:—
- H. sangal* Korth.
(Takian lek)
- GG. Domatia totally absent:—
- H. odorata* Roxb., var
eglandulosa Pierre
(Takiem thawng)
- BB. Leaves caudate, base symmetric, glabrous; nut oblong.
- H. ferrea* Laness.
(Takian hin)
- AA. Stem smooth bark often with stilt roots; leaves caudate, dryobalanoid venation.
- J. Leaves elliptic or narrowly elliptic, small wings all equal in length.
- K. Midrib raised on the upper surface; stylopodium conspicuous in fruiting state:—
- H. pedicellata* (Brandis) Sym.²
(Takian khao)
- KK. Midrib sunk on the upper surface, stylopodium inconspicuous in fruiting state:—
- H. pierrei* Hance
(Takian sai)

1. Represented by KERR 17104 from Phang Nga.

2. Represented by KERR 7459 from Yala.

JJ. Leaves ovate-elliptic or broadly elliptic, small wings unequal.

L. Leaves ovate-elliptic, thin coriaceous, lateral nerves about 8 pairs, fruit with one small wing longer than the other two:—

H. avellanea HEIM
(Takian dong)

LL. Leaves broad elliptic thick coriaceous, lateral nerves about 10 pairs; fruit not as above:—

H. latifolia Sym.¹
(Takian rak)

4. *VATICA* LINN.

A. Calyx developed into wings in the fruiting state:—

B. Nut partially inferior; calyx lobes united in a cup adherent to the basal part of the nut:—

C. Young twig fulvous tomentose, usually with fulvous flocculent galls; large wings oblanceolate-oblong:—

V. odorata (Griff.) Sym.
(Phancham khon)

CC. Young twig grey tomentose or cinereous; without gall; large wings spathulate oblong:—

V. cinerea King
(Phancham)

BB. Nut totally superior; calyx lobes not united in a cup and free from the nut:—

V. lowii King emend. Sym.²)
(Phancham dong)

1. So far only incomplete specimens of this common species has been seen (Singapore Field No. 24240 / HAMID 1 from Surat and KERR 15995 from Songkhla). According to SYMINGTON (1943, p. 131 this species is rare and endemic to Malaya.

2. SYMINGTON (1941), records this species based on the Forest Department F.M.S. No. 56212 from Thailand, the specimen which I have not seen; but a fruit collected from Surat, Singapore Field No. 24238 / HAMID, confirms this.

AA. Calyx not developed into wings in the fruiting state:—

D. Calyx lobes united in a cup and adherent to the nut:—

V. stapfiana (King) V. Sl.
(Sak thale)

DD. Calyx lobes not as above.

E. Calyx lobes leathery in texture free from the nut;
nut globose indehiscent:—

V. diospyroides Sym.
(Chankapaw)

EE. Calyx lobes thick woody in texture, adherent to the
basal part of the nut; nut ovate, dehiscent:—

V. wallichii Dyer
(Sak nam)

5. *COTYLELOBIUM PIERRE*

Leaves lanceolate, parallel venation, obscure on the upper
surface; fruits, calyx lobes developed into wings, nut globose,
velvety pubescent:—

C. lanceolatum Craib
(Kiam)

6. *SHOREA ROXB.*

A. Calyx lobes equally developed in length, woody, auriculate,
reflexed wings, spreading beyond the periphery of the nut:—

S. sumatrana (van Sl. ex
Foæworthy) Sym.
(Palawsali)

AA. Calyx lobes distinctly unequally developed into leathery,
more or less erect wings.

B. Base of wings more or less thickened:—

C. Base of wings obviously thickened and woody.

D. Base of wings elated:—

S. macroptera Dyer*
(Chan hoi)

*) KERR 7478 from Yala represents this species

DD. Base of wings not elated:—

E. Leaves lanceolate, undersurface glaucous:—

S. curtisii Dyer ex King
(Saya lueang)

EE. Leaves elliptic, undersurface stellate or scaly:—

F. Leaves 10 cm. long, undersurface stellate and with domatia:—

S. leprosula Miq.
(Phayawm daeng)

FF. Leaves 5-8 cm. long, undersurface scaly without domatia:—

S. parvifolia Dyer
(Phayawm nok khao)

CC. Base of wings thickened, but not woody.

G. Leaves with equal base; base of wings smooth; nuts ovate:—

H. Fruits (including calyx tube) 2.5 cm. or more in diameter:—

S. hypochra Hance
(Phnawng)

HH. Fruits (including calyx tube) less than 2.0 cm. in diameter.

I. Leaves oblong:—

S. farinosa C.F.C. Fischer
(Phnawng daeng)

II. Leaves oblong-lanceolate:—

J. Leaves drying yellowish or reddish brown; large wings 6 cm. long:—

S. gratissima Dyer
(Takien suai)

- JJ. Leaves drying dull purplish brown;
large wings 8 cm. long:—
S. sericeiflora Fischer et Hutch.
(Khiem khanawng)
- GG. Leaves with unequal base; base of wings transversely
rugous; nut oblong:—
S. faguetiana Heim
(Kalaw)
- BB. Base of wings not thickened.
- K. Fruits spheroid or ovate:—
- L. Fruits spheroid calyx clasping only the base of
nut; leaves glaucous beneath:—
S. glauca King*
(Aek)
- LL. Fruits ovate calyx not as above; leaves not
glaucous beneath:—
- M. Leaves oblong.
- N. Leaves oblong obtuse:—
S. obtusa Wall.
(Teng)
- NN. Leaves oblong apiculate:—
S. thorelii Laness.
(Teng tani)
- MM. Leaves lanceolate
- O. Lateral veins 16–25 pairs:—
S. guiso (Blanco) Bl.
(Saya daeng)
- OO. Lateral veins 8–12 pairs
S. rogersiana Raizada et Smitinand
(Takhien Samphawn)
- KK. Fruits fusiform:—

* I have not seen any collection of this species from Thailand. FOXWORTHY (1932 p. 232) and SYMINGTON (1943, p. 15) records this species from Peninsular Thailand.

P. Leaves glabrous on both surfaces:—

S. talura Roxb.
(Phayawm)

PP. Leaves pubescent beneath:—

S. talura Roxb., var.
saigonensis (Pierre)
Smitinand

(Phayawm dong)

Species not sufficiently known:— S. henryana Pierre,
var. rigida Heim

7. PARASHOREA A. DC.

Leaves upto 9 cm. long; calyx lobes equally developed in length, contracted into stalks and widened again at the base; nut ovate pubescent;—

P. stellata Kurz
(Khaikheo)

8. PENTACME A. DC.

A. Mature leaves glabrous on both surfaces; foliar bract present:—

P. suavis A. DC.
(Rang)

AA. Mature leaves pubescent; foliar bract absent.

B. Leaves pubescent beneath:—

P. suavis A. DC., var.
siamensis (Miq.) Smitinand
(Rang khaow)

BB. Leaves pubescent on both surfaces:—

P. suavis A. DC., var.
tomentosa (Craib)
Smitinand
(Rang daeng)

9. *BALANOCARPUS* *BEDD.*

Calyx lobes equally developed but not exceeding the nut, united to form a cupule embracing the lower part of the woody nut:—

B. heimii *Bedd.*

(Takian chantamaew)

ABBREVIATIONS:

An. Mus. Lugd. Bat.: Annal du Museum Botanico Lugdano Batavia
 Fl. Brit. Ind.: HOOKER: Flora of British India
 Fl. Siam. En. CRAIB: Florae Siamensis Enumeratio
 Fl. Gen. Indo-Ch.: LECOMTE: Flore General de l'Indo-Chine
 WALL. Cat.: WALLICH: Catalogus Martabanicus

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