# IDENTIFICATION KEYS TO GENERA AND SPECIES of the DIPTEROCARPACEAE OF THAILAND

**by**

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## SUMMARY

1) Keys to genera and species are enumerated
2) One new species and one variety is proposed.
3) 3 new combinations are made.

## PREFACE

In 1953 one fellowship on taxonomic botany was granted by the Food and Agriculture Organisation of the United Nations to the Royal Forest Department. The author being awarded the Fellowship had been suggested to make a thorough study on the Dipterocarpaceae of Thailand as this family yields many important timbers of commerce such as **Mai Yang (Dipterocarpus spp.)** and **Mai Takien ( Hopea and Shorea spp. )** and the knowledge on Thai species is relatively poor. Owing to the short period of 12 months, keys to genera and species were only possible.

The preliminary work was made under the guidance of Mr. **A.C. Hoyle** of the Oxford Herbarium, whose advice was indispensible for the further study carried on at the Herbarium and Library, Royal Botanic Gardens, Kew.

The author is deeply indebted to the Directors and keepers of the following institutions and their staffs:– Royal Botanic Gardens, Kew, Richmond, England, Department of Botany, British Museum (Natural History), South Kensington, University of Aberdeen, Scotland, Rijksherbarium,

Leiden, Holland, and also the Laboratoire Phanerogamie, Museum Nationale d'Histoire Naturelle, Paris, France, whose kind permission in the use of herbaria: and libraries has enabled the author to complete this work.

Thanks are also due to Mr. **L.L. Forman,** Scientific Officer, Kew and Mr. **F. White,** Forest Botanist, Oxford whose critism is most valuable and last but not least, Mr. **Khid Suvarnasnddhi,** Chief Forest Products Research Division, Royal Forest Department, Bangkok and my wife, **Ivy,** who constantly helped in reading through this work.

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## INTRODUCTION

Probably for the first time in history, **George Everard Rhumphius,** a Dutch botanist mentioned about this family in his Herbarium Amboinense (1750).

**Carolus Linnaeus,** the great Swedish botanist was the first botanist, who recognised taxonomically the status of this family in the Plant Kingdom by creating the genus, VATICA in Mantissae Plantarum (1771).

**Karl Frederich Gaertner** founded the genus **DIPTEROCARPUS,** the typical genus of the family in his work entitled De Fructibus et Seminibus Plantarum (1805).

**William Roxburgh,** a Scottish botanist, Superintendent of the Royal Botanic Garden at Calcutta recognised the genera SHORCA and HOPEA in Hortus Bengalensis (1813–14).

**A.P. and A.L.P. de Candolle,** Swiss botanists described the genus PENTACME in their Prodomus systematis naturalis regni vegetabili (1824–74).

**Peter W. Korthals,** a **Dutch** botanist described the genus ANISOPTERA in Verhandlung der naturischen Geschichen von Nederlandschen Overzee, Botani (Kruidkunde) 1839–42.

**Sir Joseph Dalton Hooker,** a great English botanist described the genus PACHYNOCARPUS in the Transaction of the Linnean Society, Vol. 23 (1860), but later was reduced under **Vatica, Linn**.

**Sulspius Kurz,** a German botanist, Superintendent of Royal Botanic Garden at Calcutta described the genus PARASHOREA in the Journal of the Asiatic Society of Bengal, Vol. 39 (1870).

**R.H. Beddome,** an English botanist described the genus BALANOCARPUS in Forester's Manual of Botany (1873).

**Louis Pierre,** a French botanist described the genus COTYLELOBIUM in Flore Forestiere de la Cochin–Chine (1889).

The first record of the occurence of the members of this family in Thailand was credited to the Dutch Botanists, i.e. **Teijsmann** and **Miquel** who described **Dipterocarpus obtusifolius** and **Shorea siamensis (Pentacme suavis A. DC., var. siamensis Smitinand)** in Annal du Museum Botanico Lugdano Batavia, I (1863–64), based on the plants collected by **Teijsmann,** who accompanied **London,** Director of the Botanical Garden, Buitenzorg during his trip in Thailand then known as "Siam".

After the Section of Botany was created under the Ministry of Commerce and Transportation in 1920, having the zealous **Dr. A.F.G. Kerr** as the Director, extensive collections were made all over the country. This collection together with other's had been studied by **Prof. W.G. Craib** the result was published in Florae Siamensis Enumeratio (1925-1931). The known genera are 10 in number chmprising 46 species, and 7 varieties.

**Symington** (20) recorded 10 genera and 36 species from Thailand.

The present work follows most of Symington's conception recognising only 9 genera, 49 species and 11 varieties. based mostly on the collection in the Kew Herbarium. It is believed that many new Malayan and Indo–Chinese as well as Burmese species will be discovered in the future if extensive and thorough explorations are made.

In preparing the keys the author was faced with some difficulties

dealing with the nomenclature of certain species. The following list constitutes the author's view and conception.

**1. Dipterocarpus incanus Craib,** Fl. Siam. Enum., 1 : 133 (1925); non Roxburgh.

**D. incanus Roxb.** has been treated by Parkinson as a synonym of **D. alatus Roxb.,** but the Thai plant from Phu Ket, **Curtis 2926,** quoted by **Craib** is not this species, actually it is **D. costatus Gaertn. f.**

**2. Dipterocarpus kerrii King,** Craib ibid., 136 iu part. The specimen collected by **Kerr** from Yala (Betong) **No. 7349** is not this species, it turns out to be **D. hasseltii Blume**

**3. Dipterocarpus obtusifolius Teysm.,** Craib ibid., 136. This is A very variable species. Ryan et Kerr (15) recognise a variety **subnudus** basing on the naked stipule. Two more forms have been observed, i.e. the canescent form, type of **D. vestitus Vesque** and the glabrous calyx–tube form. These two forms are now proposed as new varieties:–

**Dipterocarpus obtusifolius, var. vestitus** (Vesque) **Smitinand** Comb. nov., basinym **D. vestitus Vesque,** Wall. Cat., No. 954 (nomen); Dyer in Hook. f. Fl. Brit. India, I: 295 175

**Dipterocarpus obtusifolius, var. glabricalyx Smitinand,** var. nov A species typica calices tubi glabri vel glabrescenti differt.

N.E. Thailand: Loie, Wang Sapoong, Koke Dindaeng, c. 300 m., **R.F.D. Herb. No. 7739 (Dee 462).**

**4. Dipterocarpus punctulatus Pierre,** Fl. For. Cochinch. (1889); Guerin in Lecomte, Fl. Gen. Indo–Ch., I: 357 (1910). This is a synonym of **D. obtusifolius Teysm., var. subnudus Ryan et Kerr. Pierre** (14) in describing this species pointed out its resemblance to **D. obtusifolius Teysm. Parkinson** (12) united this species under **D. obtusifolius, Teysm.** together with **D. vestitus vesque.**

**5. Dipterocarpus schmidtii Heim.** Craib., ibid 137. This is probably a synonym of **D. gracilis Blume.** The only specimen in Kew Herbarium is

just a fragment of the truit. Judging from **Heim's** description (6) I decide to put it under **D. gracilis Bl.** A further complete collection will clear its correct position.

**6. Anisoptera marginatiodes Heim.** Craib, ibid., 139. I have not seen the type specimen of this species. **Heim's** description (6) based on the fruiting speciemen seems to agree with **A. costata Korth.** I therefore decide to put it under **A. costata Korth.** pending additional complete material.

7. **Shorea conchinchinensis Pierre,** Craib, ibid., 142; S. cochinchinensis, **var. saigonensis Pierre ex Guerin,** Craib, ibid.; S. floribunda Kurz, Craib, ibid, **Syminton** (17) pointed out these that three species are conspecific with **S. talura Roxb.**. Following **Syminton's** opinion I accept the name **S. talura** Roxb. for the above three. As **Guerin** (5) recognises the pubescent-leaved form of **S. cochinchinensis,** as variety: **S. cochinchinensis, var. saigonensis,** I, therefor transfer **Guerin's** varietal name to **S. talura Roxb.: S. talura, var. saigonensis (pierre ex Guerin) Smitinand comb, nov.** (basinym: **S. cochinchinensis Pierre, var. saigonensis Pierre ex Guerin** in Lecomte, Fl. Gen. Indo-ch., I: (1910), Craib, ibid., 142).

There is a specimen, keeping in the Kew Herbarium, collected by **Thorel** during his Makong expedition in 1866 – 1868 has been ciphered on the label as **Shorea harmandii Pierre,** but it is identical with the above proposed variety.

8. **Shorea henryana Pierre, var. rigida Heim.** Craib, ibid., 143. Judging from scanly specimens at the Kew Herbarium I have decided to retain this variety as it seems to be quite distinct.

9. **Shorea obtusa Wall., var. kochangensis Heim.** Craib, ibid., 144. All specimens at the Kew Herbarium except **Schmidt 726-c** were determined as **S. thorelii Laness.** Fruiting specimens all agree well with Schmidt's type. The only flowering specimen, **Kerr 4884** approaches **S. thorelii Laness.**. For the present I place this sheet under Heim's variety; further collections will help to solve its true status. **S. thorelii Laness.** differs from **S. obtusa Wall.**

by the acuminate leaves and much shorter fruiting calyces. There is a possibility that it might be a variety of **S. thorelii Laness.**

**10. Shorea obtusoides Boerl.,** Craib, ibid., 144 is excluded as it happens to be a nomen dubia.

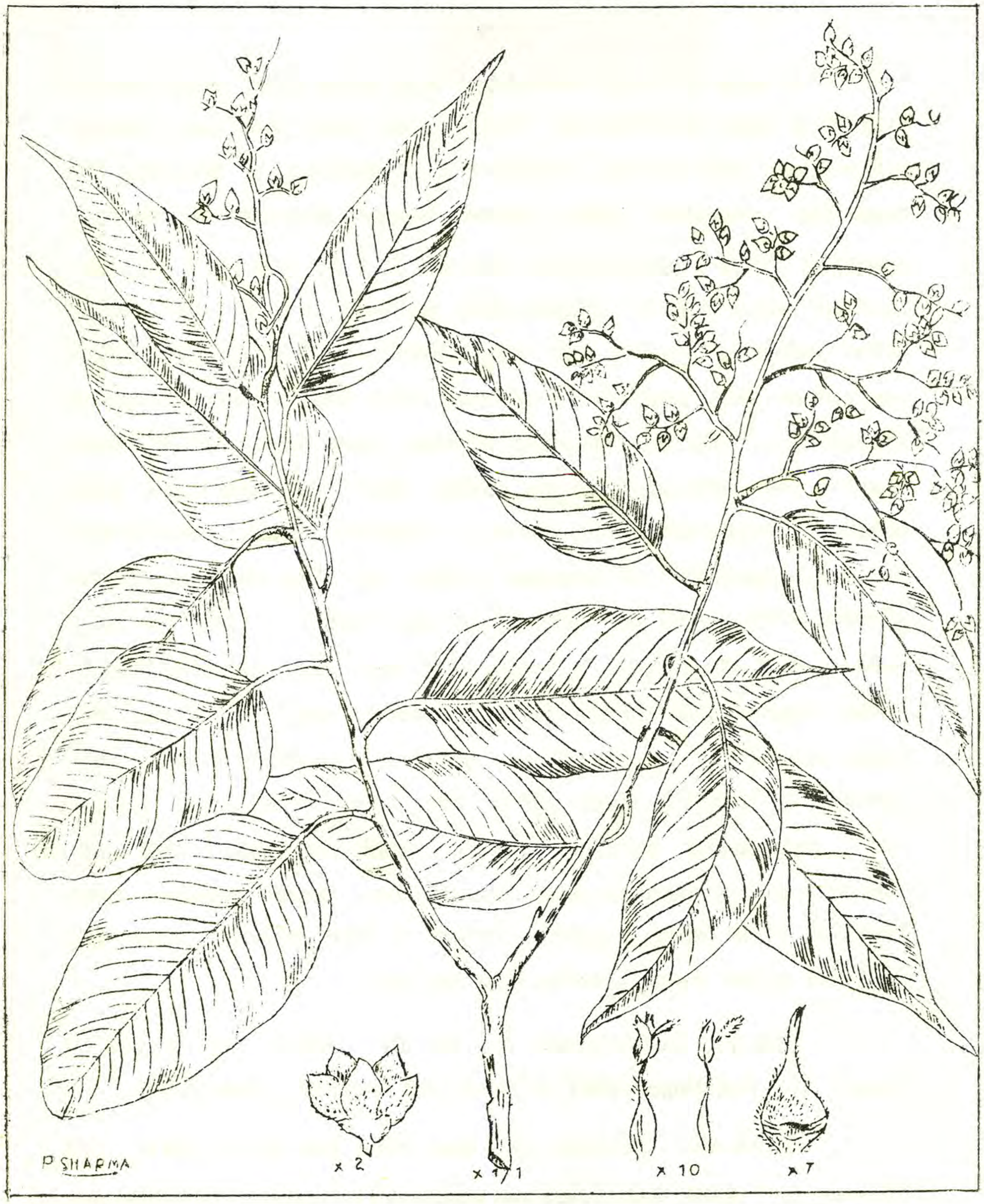
**11. Shorea robusta Gaertn. f., var. Schimdtii Heim,** Craib, ibid., 144. This species is treated as a synonym of **S. guiso Bl**. My decision on reducing this plant under **S. guiso Bl.** is because **Heim** observed that it might be **S. vulgaris Pierre ex Laness.,** which **Symington** reduced to **S. guiso Bl.** in his recent work. **S. robusta Gaertn. f.** is a native of India and Burms, so far, no record has been made on this side of the Tenasserim.

**12. Shorea symingtoniana Parkinson Mss**. I come across 2 specimens collected by **Dr. A.F.G. Kerr** at Kew and the British Museum of Natural History being kept under this name. **Symington (19)** mentioned that **Parkinson** in 1937 named a new species of Shorea of the Barbata group from Thailand after him, but, asthere is no apparent description of this species in any publication, **Parkinson's** name is therefore a nomen nudum according to the Rules of the Botanical Nomemclature, 1952. The validation is also needed.

At the same time I was informed by **Mr. M.B. Raizada** of Dehra Dun that he was in the course of publishing a new species of Shorea basing on the specimen collected by **C.G. Rogers** from Lower Burma and the sheet is ciphered that it is identifical with those collected by **Dr. A.F.G. Kerr** from Thailand. An agreement of having a joint authority of this species has been made, therefore a new name is here proposed with the description and illustration as follows:—

**Shorea rogersiana Raizada et Smitinand, spec. nov.**
**Shorea symingtoniana Parkins., Mss. in Herb. Kew.**

Species plane distincta in se, affinis **Shorea laevi Ridl.** a quatamen differt praecipue alabastris conicis ovatis, antheris corniculatis atque stylo paululum elongato.




SHOREA ROGERSIANA RAIZADA ET SMITINAND

From G.G Rogers 350 T ( type of the species ) Tavcy

A large tree, bark exfoliating in large strips which remains attached to stem by upper ends (Rogers). Branchlets and twigs dark grey, glabrous, lenticellate. Leaves alternate, coriaceous ovate – lanceolate or lanceolate, glabrous, dark green above, lighter coloured beneath, acuminate at the apex, somewhat rounded or subcuneate at the base, 5 – 6 cm. long, 2 – 3 cm. wide; secondary nerves about 8 – 12 pairs, fairly prominent on either side; tertiary nerves parallel; petiole 1.5 – 2 cm. long, glabrous. Flowers in large, axillary and terminal hoary panicles 6 -- 9 cm. long, (each flower very shortly stalked subtended by 2 bracteoles which are decidous). Flower buds ovate or globose. Sepals 5, ovate orbicular, 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. long 3.5 – 4 mm. wide, 2 – 3 time the calyx. Stamens about 40 – 45, (30 – 36) upto 2 – 2.5 mm. long, filaments long and slender, some of them slightly broadened above the base, upto 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 portion which is glabrous, ($\frac{3}{4}$ part of style tomentose below, rest glabrous) stigma terminal, entire, Fruit not seen.

BURMA: Tavoy district, Sin Yat Hill, 1,500 ft. and over. 13 th January 1919 **C.G. Rogers 350T.** (Type in the Herbarium, Dehra Dun).

THAILAND: Peninsula, lang Suan, Khao Nom Sao, c. 400 m. 20 th February 1927 **A.F.C. Kerr 12023 and 12023–A** (Co–type, in the Herbarium, Kew, Herbarium, British Museum, Kensingon and Herbarium, Department of Agriculture, Bangkok).

This distinct species belongs to the section **Eushorea Pierre ex Brandis & Barbata** group as defined by **Symintong** and is related to **S. laevis** Ridley.

**13. Parashorea stellata Kurz,** Craib, ibid., 144. I retain this name as I do not agree with **Symington's** point of view in the recognition of **P. lucida (Miq.)** Kurz, a native of Indonesia.

**Symington** (17) observed that a thorough collection is needed to back up his interpretation of this species. There are many minute differences between these two species, e.g. the shape of leaves and the length of fruiting calyces. Except the type, there is no other specimen of **P. lucida** at the Kew Herbarium.

**14. Pentacme malayana King,** Craib, ibid., 145; **P. siamensis (Miq.) Kurz,** Craib, ibid.; **P. suavis A. DC.,** Craib, ibid., 145; **P. tomentosa Craib,** ibid., 146.

Foxworthy (4) and Symington (20) recognised only **P. siamensis (Miq.) Kurz,** as a valid Malayan species and reduced the other three species as its synonyms. **Symington** (20) observed that after a critical study on the inland species, there is need to split **P. siamensis (Miq.) Kurz** into subspecies or varieties.

I quite agree with his observation, but to split **P. siamensis (Miq.) Kurz,** there are also other problems to consider. As it happens, the above 4 species represent 3 forms of the same plant, i.e. **P. malayana King** and **P. suavis** A. **DC.** is the glabrous–leaved form, **P. siamensis (Miq.) Kurz,** is a form with the underpart of its leaves tomentose, and **P. tomentosa Craib** is a form with both sides of its leaves tomentose.

**Guerin** (5) splits **P. siamensis (Miq.) Kurz,** into 3 varieties which I do not agree as he still keeps other species separate. After some consideration I decide to retain **de Candolle's** species, **P. suavis** as the only valid one for the reason that it is the type of the genus, and antidate **P. siamensis (Miq.) Kurz.**

Although the latter was known to science before **P. suavis A. DC.,** but it was known as a **Shorea** later **Kurz** transferred it to Pentacme in 1870.

Therefore I propose to split **P. suavis A. DC.** as follows:–

**1. P. suavis A. D.C., var: siamensis (Miq.) Smitinand, comb. nov.** (basinym: **Shorea siamensis miq.,** Ann. Mus. Lugd. Bat., I: 214 (1863–64)

**2. P. suavis A. D.C., var. tomentosa (Craib) Smitinand, comb. nov.** (basinym: **P. tomentosa Craib** in Kew Bull. 1915: 423)

**15. Hopea avellanea Hiem,** Craib, ibid., 147. I did not have the opportunity to see the type of **Heim's** species, judging from the description based on the characters of leaves and young fruit I presume that it is the same as **H. beccariana Burck.** for the present, further collections from this region will solve the problem.

**16. Hopea siamensis Hiem**, Craib, ibid., 147. I did not see the type specimen of Heim's species, but judging from the description I cannot see any difference from **P. pedicellata (Brandis) Sym**. so that I reduce it to a synonym of the latter.

## ABBREVIATIONS

The following abbreviations are used in this work :-

An. Mus. Lugd. Bat.: Annal du Museum Bitanico Lugdano Batavia.

Fl. Brit. India: Hooker, Flora of British India.

Fl. Siam. En : Craib, Florae Siamensis Enumeratio.

Fl. Gen. Indo–Ch.: Locomte: Flore Generale de 1' Indo–Chine.

Wall. Cat.: Wallich's Catalogues Martabanicus.


# DISIRIBUTION OF DIPTEROCAPACEAE IN THAILAND

# IDENTIFICATION KEYS TO GENERA AND SPECIES

## of the

## DIPTEROCARPACEAE OF THILAND

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A. Calyx lobes distinctly unepually 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 :– **1. Dipterocarpus Gaertn.** (Yang)

DD. Calyx tube united with the nut :– **2. Anisoptera Kortk.** (Kabak)

CC. Large wings with 5 – 7 veins :–

E. Large wings with 5 conspicuous veins :–

F. Nut densely woolly tomentose ; leaf–venation looped :– **3. Cotylolobium Pierre** (Kiam)

FF. Nut not so, venation reticulate or scalariform :– **4. Vatica Linn.** (Synaptea) (Phancham)

EE. Large wings with at least 7 veins (on lower part ) :– **5. Hopea Roxb.** (Takian)

BB. Wing 3 long, 2 short :–

G. Leaves oblong, elliptic ovate or ovate lanceolate, base cuneat or rounded : lower pairs of lateral veins not forked :– **6. Shorea Roxb.** (Teng & Sya)

GG. Leaves ovate, cordate; lower pairs of lateral veins forked :– **7. Pentacme A. DC.** (Rang)

AA. Calyx lobes equally developed or almost so:—

H. Lobes developed into long wings considerably exceeding the nut, base contracted to stalk:— **8. Parashorea A. DC.**
(Takiansuai)

HH. Lobes not developed into wings.

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

J. Lobes united with the nut :— **Vatica stapfiana (King) V. Sl.**
(Sakthale)

JJ. Lobes not united with the nut :— **9. Balanocarpus Bedd.**
(Takianchantamaew)

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)

LL. Lobes thick not spreading beyond the periphery of the nut :— **Vatica wallichii Dyer**
(Saknam)

KK. Lobes leathery in texture :— **Vatica biospyroides 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.

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

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

**1. D. retusus Bl.**
(Yangkuan)

DD. Large wings less than 17.5 cm. in length.

E. Large wings distinctly stellate hairy mature state.

F. Stipules clothed with long stellate hairs.

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

H. Flowering calyx puberulous or tomentose:—

**2. D. obtusifolius Teysm.**

(Yanghiang)

HH. Flowering calyx glabrous or glaucescent:—

**3. D. obtusifolius var. glabicalyx Smitinand**

(Yanghiang dawk kliang)

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

**4. D. baudii Korth.**

(Yangkhon)

FF. Stipules canescent or glabrescent:—

I. Stipules canescent:— **5. D. obtusifolius Teysm., var. vestitus (Vesque) Smitinand**

(Yanghiang bai nuan)

II. Stipule glabrescent or glabrous:—

**6. D. obtusifolius Teysm. var. subnudus Ryan et Kerr**

(Yanghiang yawt kliang)

EE. Large wings glabrescent in mature state.

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

**7. D. kerrii King**

(Yangmanmu)

JJ. Leaves drying brownish; stipules glabrous within; fruits more or less globose:— **8. D. hasseltii Blume**

(Yangkliang)

CC. Mature fruiting calyx less than 2.5 cm. in diameter.

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

L. Leaves glabrous on both surfaces, fruiting calyx 2 cm. or more in diameter :— **9. D. turbinatus Gaertn. f.**
(Yangkhao)

LL. Leaves yellow pubescent bencath; fruiting calyx less than 2 cm. in diameter.

M. Large wings 3–nerved along the whole length :—
**10. D. chartaceus Sym.**
(Yangwat)

MM. Large wings 3–nerved but only the median reaching the apex :— **11. D. gracilis Blume.**
(Yangsian)

KK. Fruiting calyx elliptic; leaves pilose–tomentose; stipules fulvous pilose–tomentose :— **12. D. crinitus Dyer**
(Yang bai khai)

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

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

O. Young twigs, petioles and peduncles glabrous, glaucescent :—
**13. D. tuberculatus Roxb.**
(Yangphluang)

OO. Young twigs, petioles and peduncles fulvous tomentose :—
**14. D. tuberculatus Roxb.,**
**are. tomemtosus Ryan et Kerr**
(Yangphluang bat khon)

NN. Stipules and all parts canescent :—
**15. D. tuberculatus Roxb.,**
**var. grandifolius (Teysm.)**
**Craib**
(Yangphluang bai yai)

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.

P. Fruiting calyx 5–angled.

Q. 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**
(Yangklawng)

QQ. 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.

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

S. Stipules adpressed tomentose:—

**17. D. costatus Gaertn. f.**
(Yangdaeng)

SS, Stipules shaggy tomentose:—

**18. D. obtusifolius X costatus Kerr**

RR. Leaves and stipules glabrous; tube of fruiting calyx elliptic, or elliptic–oblong; ridges undulate:—

**19. D. oblongifolius Blume**
(Yangkhlawng)

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

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

U. Tube–wings running down from top to base; tube of fruiting calyx 2.5 cm. or more in diameter.

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

**20. D. grandiflorus Blanco**
(Yangyung)

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

**21. D. alatus Boxb.**
(Yangna)

UU. Tube—wings only in the upper part of tube; tube of fruiting calyx less than 2 cm. in diameter:—

**22. D. cornutus X alatus.**

TT. Tube of fruiting calyx with strongly transversely plicate wings:— **23. D. intricatus Dyer.**
(Yangkrat)

## 2. ANISOPTERA KORTH.

A. Fruits, large wings more than 12 cm. long, undersurface of leaves ferruginous:— **1. A. megistocarpa v. Sl.**
(Kabakdaeng)

AA. Fruits, large wings less than 12 cm. long, undersurface of leaves yellow pubescent or glabrous.

B. Under surface of leaves glabrous:—

**2. A. scaphula (Boxb.) Pierre**
(Kabak khao)

BB. Undersurface of leaves yellowish glabrescent or pubescent.

C. Fruits, large wings elliptic oblong; undersurface of leaves glabrescent:— **3. A. oblonga Dyer**
(Kabakdam)

CC. Fruits, large wings spathulate; undersurface of leaves pubescent:— **4. A. costata Korth.**
(Kabak khoke)

## 3. HOPEA ROXB.

A. Leaves acute, never caudate, base asymmetric, more or less pubescent.

B. Leaves oblong, 13 cm. or more long, pubescent and sub–peltate in fruiting state. Large wings coriaceous, 10 cm. or more long.

C. Leaves coriaceous, venation obvious on the upper surface:–

**1. H. recopei Pierre**
(Chanphu)

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

D. Leaves yellowish pubescent beneath.

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

**2. H. oblongifolia Dyer**
(Mawran)

EE. Wings tightly clasping the nut; large wings spathulate, base furrowed, small wings longer than the nut:–

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

DD. Leaves silvery white beneath:–

**4. H. helferi Dyer**
(Kabok kang)

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

F. Domatia present on undersurface of leaves.

G. Domatia glabrous; leaves ovate–oblong:–

**5. H. odorata Roxb.**
(Takianthawng)

GG. Domatia pubescent; leaves ovate–elliptic or very variable.

H. Domatia conspicuously present; leaves ovate elliptic:–

**6. H. minutiflora C.E.C. Fischer**
(Takiankhon)

HH. Domatia few, sparsely present; leaves very variable:–

**7. H. sangal Korth.**
(Takianlek)

FF. Domatia totally absent :— **8. H. odorata Roxb , var: eglandulosa Pierre**
(Takinanthawng bai kliang)

AA. Leaves caudate, base symmetric, glabrous.

I. Leaves ovate–lanceolate, reticulate venation; nut oblong :—
**9. H. ferrea Laness.**
(Takianhin)

II. Leaves elliptic, ovate, or broad elliptic, dryobalannoid venation; nut ovate :—

J. Leaves elliptic or narrowly elliptic, small wings all equal in length.

K. Midrib raised on the upper surface; stylopodium conspicuous in fruiting state :— **10. H. pedicellata (Brandis) Sym.**
(Takiankhao)

KK. Midrib sunk on the upper surface, stylopodium inconspicuous in fruiting state :— **11. H. pierrei Hance**
(Takiansai)

JJ. Leaves ovate–elliptic or broadly elliptic. small wings unequal.

L. Leaves thin coriaceous lateral nerves about 8 pairs, fruit with onosmall wing longer than the other two :—
**12. H. beccariana Burck**
(Takiandong)

LL. Leaves thick coriaceous, lateral nerves about 10 pairs; fruit not as above:— **13. H. latifolia Sym.**
(Takianrak)

**Doubtful species :— H. schmidtii Heim**

## 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 :–

**1. V. odorata (Griff.) Sym.**
(Phanchamkhon)

CC. Young twig grey tomentose or cinereous; without grll; large wings spathulate oblong :–

**2. V. cinerea King**
(Phancham)

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

**3. V. lowii King emend. Sym.**
(Phanchamdong)

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

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

**4. V. stapfiana (King) V. Sl.**
(Sakthale)

DD. Calyx lobes not as above.

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

**4. V. diospyroiddes Sym.**
(Chankapaw)

**EE.** Calyx lobes thick woody in texture, adherent to the basal par of the nut; nut ovate, dehiscent :–

**6. V. wallichii Dyer.**
(Saknam)

## 5. COTYLEOBIUM PIERRE

Leaves lanceolate, parallel venation, obscure on the upper surface; fruits, calyx lobes developed into wings. nut globose, velvetty pubscent :–

**C. lanceolatum Craib**
(Kiam)

## 6. SHOREA ROXB.

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

**1. S. sumatrana (v. Sl. ex Foxworthy) 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:— **2. S: macroptera Dyer**
(Chanhoi)

DD: Base of wings not elated:—

E. Leaves lauceolate, undersurface glaucous:—

**3. S. curtisii Dyer ex King**
(Syalueang)

EE. Leaves elliptic, undersurface stellate or scaly:—

F. Leaves 10 cm. long, undersurface stellate and with domatia:— **4. S. leprosula Miq.**
(Phayawmdaeng)

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

**5. S. parvifolia Dyer**
(Phayawn 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:— **6. S. hypochra Hance**
(Phnawng)

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

I. Leaves oblong:— **7. S. farinosa C.F.C. Fischer**
(Phnawngdaeng)

II. Leaves oblong – lanceolate :–

J. Leaves drying yellowish or reddish brown; lare wings; 8 cm. long :– **8. S. gratissima Dyer**
(Khaikhieow)

JJ. Leaves drying dull purplish brown; lare wings 6 cm. long: –

**9. S. sericeiflora Fischer et Hutch.**
(Chanrung)

GG. Leaves with unequal base; base of wings transversely rugous; nut oblong :– **10. 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 :– **11. S. glauca King**
(Aek)

LL. Fruits ovate calyx not as above; leaves not glaucous beneath :–

M. Leaves oblong, obtuse or oblong, apiculate :–

N. Leaves oblong obtuse :–

**12. S. obtusa Wall.**
(Teng)

NN. Leaves oblong apiculate :–

**13. S. obtusa Wall., var. kohcangensis Heim**
(Tengtani)

MM. Leaves oblong – lanceolate or ovate – lanceolate :–

O. Leaves oblong – lanceolate :–

**14. S. guiso (Blanco) Bl.**
(Syadaeng)

OO. Leaves ovate – lanceolate :–

**15. S. rogersiana Raizada et Smitinand**
(Syadong)

KK. Fruits fusiform :—

P. Leaves oblong, glabrous on both surfaces:

**16. S. talura Roxb.**
(Phyawm)

PP. Leaves oblong, pubescent beneath :—

**17. S. talura Roxb., var. saigonensis (Pierre) Smitinand**
(Phyawmdong)

**Doubtful species:— 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**
(Takiansuai)

## 8. PENTACME A. DC.

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

**1. P. suavis A. DC.**
(Rang)

AA. Mature leaves pubescent; foliar bract absent.

B. Leaves pubescent beneath :—

**2. P. suavis A. D.C., var. siamensis (Miq.) Smitinand**
(Rangkhaow)

BB. Leaves pubescent on both surfaces :—

**3. P. suavis A. DC., var. tomentosa ( Craib ) Smitinand**
(Rangdaeng)

## 9. BALANOCARPUS BEDD.

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

**B. heimii Bedd.**

( Takianchantamaew )

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