

THE GENUS DIPTEROCARPUS GAERTN. F. IN THAILAND

by

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Preface

After my previous work, "Identification Keys to Genera and Species of the Dipterocarpaceae of Thailand", the descriptive part of all genera and species therein was felt to be badly wanted. The present work is, therefore, hoped to meet that purpose and, is intended to be the beginning of a series of the study on the Forest Botany of Thailand. According to the taxonomic point of view, the genus *Dipterocarpus* Gaertn. f. has the antecedence. It will be a great pleasure, if this paper can be of any interest to both scientists and laymen, any criticisms are therefore heartily welcome.

The author wishes to sincerely and respectfully dedicate this work to the late Phya Winit Wanandorn (Toh Komes), who encouraged him to persue on the study of taxonomic botany, and, whose many kind suggestions has rendered the author to further his steps all the way through. To Mr. Khid Suvarnasuddhi, the Deputy Director-General of the Royal Forest Department, my profound thanks are due in his instruction to have this work going on. I am also very much obliged to Mr. Krit Samapuddhi, Chief of Forest Products Research Division, and Mr. John C. Jensen of the University of Bangore, Wales, Great Britain, who kindly took the trouble of critically reading through the manuscript.

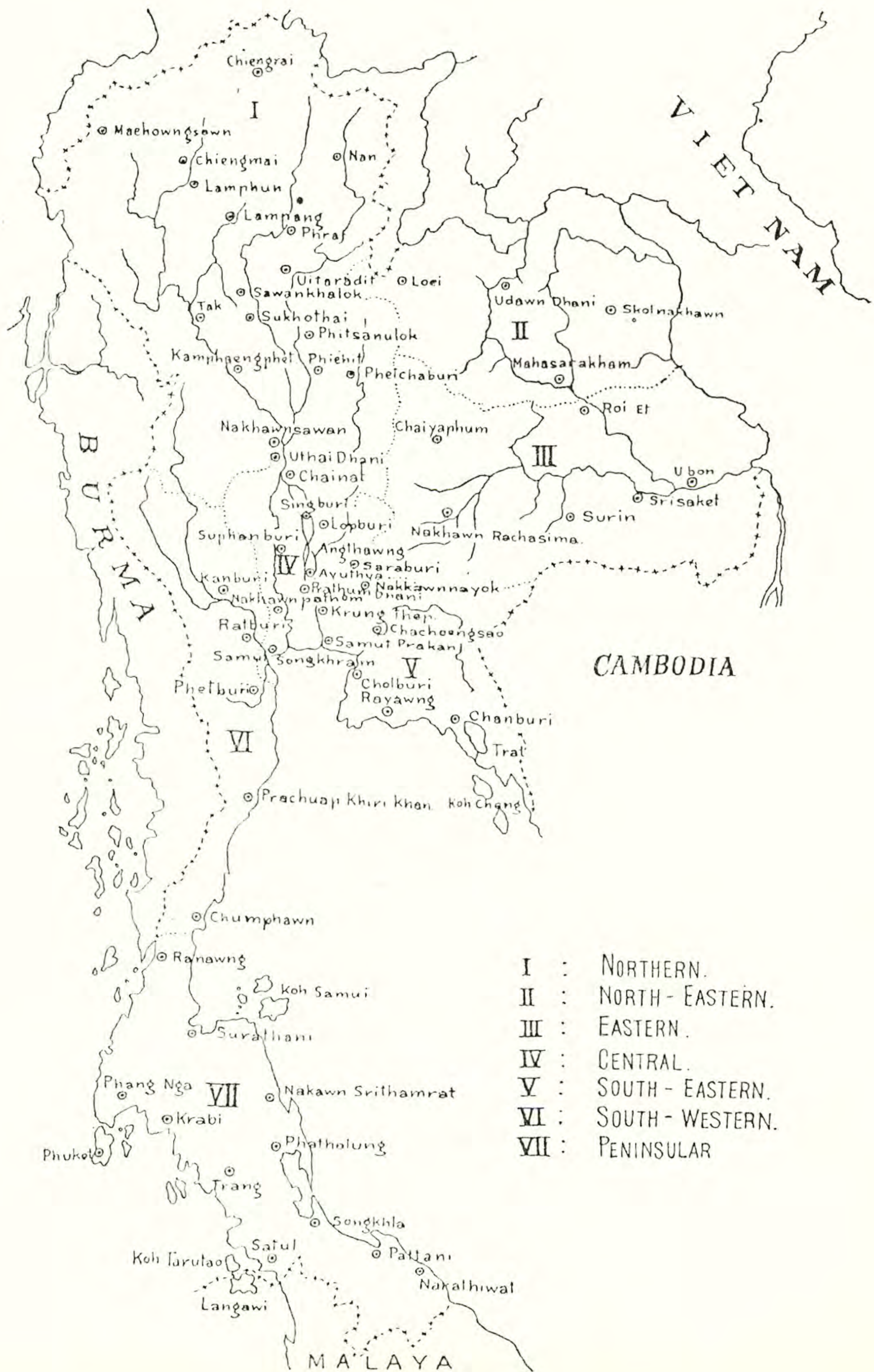
I also wish to tender my deep gratitude to the Director-General of the Royal Forest Department in sanctioning the publication of this work. Thanks are due to authors of many floras and scientiific works, whose

work—done are very indispensable indeed; and to Directors and keepers of various herbaria together with their staffs in giving the author permission to make use of valuable collections and references, in acknowledgement of which, abbreviations signifying their herbaria have been put in parenthesis after the herbarium specimens quoted in this work. The satisfactory typing of this paper is credited to Miss Vilai Chindasanguan. The author is very much grateful to plant collectors, whose undeterred fieldworks in procuring the materials and data, enables this account to be completed. Last but not least my sincere appreciation is due to my wife Ivy, whose linguistic help is always at hand.

The drawing in this work have been done by Mrs. Bunsap Singhasith with some satisfaction.

INTRODUCTION

Before taking further steps, it seems appropriate to have a rough idea on the plant geography of Thailand. Up to the present time, there is no definite conception on the matter yet. During my stay at Kew in 1953, through the kindness of Mr. L.L. Forman, I most fortunately had access to the documents of the late Dr. A.F.G. Kerr. It is evident that Dr. Kerr had an idea on this subject, shown by his provisional note on the floristic division of Thailand as: Northern, North—Eastern, Eastern, South—Eastern, Central, and Peninsular. After some consideration a seventh region seems appropriate, i.e. South-western. In order to make it clear a rough sketch has been drawn up as follow :—



- I : NORTHERN.
- II : NORTH - EASTERN.
- III : EASTERN.
- IV : CENTRAL.
- V : SOUTH - EASTERN.
- VI : SOUTH - WESTERN.
- VII : PENINSULAR

Geographically Thailand is situated in the South-Eastern corner of Asia between the Longitudes 97°E. and 106°E. , and between the Latitudes 21°N. and 6°N. The Northern frontier is on a mountain range, called Phi Pan Nam, which fingers southwards along the tributaries of the four rivers, Ping, Wang, Yom and Nan. This range is continuous to the Tenasserim Range, which is along the Western border adjacent to Burma. The Tenasserim extends further South and diverges eastwards into many ranges, such as the Kalakiri which marks the Southern limit of Thailand and the Khao Luang Range of the district of Nakhawn Srithamarat.

In the East it is demarcated by the river, Mae Khong and the Phnom Dong Rek Range; in the South-Eastern border adjacent to Lower Cambodia, there is a mountain range, the Khao Banthat.

Floristically Thailand can be divided into 7 regions followingly:—

1) Northern Region: This is under the Indo-Burmese floristic tendency. Teak grows abundantly in this region, presumably no teak is to be found growing naturally below the latitude 15°N. Types of forests are ranging from dry deciduous to dry hill evergreen forests; montane temperate forests occur on the high elevation, about 2,500 m. altitude upwards. The highest peak of the country is in this region, it is the Doi Angka or Doi Inthanond of about 2,800 m. altitude. Pines (*Pinus khasya*, and *P. merkusii*) and Rhododendrons are found above the altitude of 600 m. and 1,000 m. respectively. There are extensive tracts of Dipterocarps forests both on the ridges and undulating grounds, the highest elevation that the Dipterocarps are to be found are about 1,000 m. in altitude. The region includes the districts of Chiangmai, Mae Hawnngsawn, Chiangrai, Lamphun, Lampang, Phrae, Nan, Tak, Uttaradit, Sukhothai, Phitsanuloke, Phetchabun, Phichit, Kamphaengphet and Nakhawn Sawan.

2) North-Eastern Region: This corresponds to the Indo-Chinese Flora, but the Indo-Burmese species are also to be found here. Recent

discoveries of many plants hitherto known as Chinese prove the affinity of this region to South China. Types of forests are from dry deciduous to mixed deciduous forests; large tracts of dry evergreen forests occur intermittently. Savannahs are scattered throughout the region. It is the high plateau of the country, table-topped mountains are very characteristic to this region; the plateau is dipping East to South-East, evidently marked by the Dong Phya Yen and the Phnom Dongrek Ranges. Pine forests are from the elevation of 1,000 m. altitude upwards. Dipterocarps forests are the common feature of the region. It comprises the districts of Nawngkhai, Loie, Nakhawn Phnom, Udawndhani Skolnakhawn, and Mahasarakham.

3 Eastern Region: This corresponds to the Central and Southern Indo-Chinese Flora (Dambodia and Cochinchina). Dry Dipterocarps forests is the main feature of the region, extensive savannahs are also common. It is curious to see Pine forests stand side by side with dry Dipterocarps forest on the undulating grounds at the elevation of 500 – 600 m. altitude; between the two types of forests, there is a zone, where Pines and Dipterocarps are mixed together, the Dipterocarps species being usually *D. obtusifolius* Teijsm.; this Pines–Dipterocarps zone is subjected to periodical inundation during the rainy season. The region comprises the districts of Chaiyaphum, Nakhawn Rachasima, Buriram, Srisaket, Surin. Roi Et and Ubolrachadhani.

4) Central Region: This is the central part of the country, and mostly is under cultivation. Virgin forests have almost totally disappeared, only traces and narrow strips of the once rich evergreen forests are scattered here and there in the region. Dipterocarps once formed the evergreen forests. The species present to-day are more or less intruders from neighbouring regions, and form up a heterogenous flora. Along the estuaries of the main rivers, fringes of mangrove swamps and strips of tidal forests are met with. It consists of the following districts, Udheidhani, Chainat, Singhburi, Lopbua, Angthawng, Suphanburi, Saraburi, Ayudhya, Prathumdhani, Nakhawn Nayok Krungthep, Dhonburi, Nakhawn Pathom, Smutsakhawn, smutsongkhram, and Smutprakan.

5) South-Eastern Region: This region is both under the Cochin Chinese and Malayan floristic elements. It is interesting to note that certain Burmese species also present in the region such as the grass, *Eragrostis burmanica* Bor, the climber, *Nyctocalos shanica* McGregor & W.W. Sm., and the Himalayan Ivy, *Hedera himalaica*. The Dipterocarps form the predominating species in the tropical rain forests together with the *Solenospermum* and *Parkia*. Although the tropical rain forests form the main type of the forests present, savannahs are not uncommon in the plains, which during the rainy season are always inundated. In these savannahs two species of the *Dipterocarpus*, *D. obtusifolius* Teijsm. and *D. intricatus* Dyer are unevenly distributed forming open dipterocarps forest. During the dry season the soil, which is sandy, dries up, and all the herbaceous vegetations wither away. This type of forest is subjected to the fire every year; the common low shrub species in this area is *Dillenia hookeri*, which grows in clumps all over the place. Epiphytes are abundant in this arid locality.

Rich mangrove swamps and tidal forests are the common feature of the coast line and along the estuaries of the main rivers. The region includes the districts of Prachinburi, Choburi, Chachoengsao, Rayawng Chaburi and Trat.

6 South - Western Region: This corresponds to the Tenasserim or Lower Burmese Flora. Evergreen forests are to be found in the remote part of the region, which is near to the border between Burma and Thailand; bamboo forests are the common feature of the plains, the common bamboo is *Thyrsostachys siamensis* Gamble; these bamboo forests gradually change into mixed deciduous and dry dipterocarps forests. Fringes of mangrove swamps also occur along the estuaries. It included the districts of Suphanburi, Kanburi, Ratburi, Phetburi, Prachuab Khirikhan and Chumphaw.

7 Peninsular Region: As a whole it is more or less under the Malayan element; workers on the Malayan flora used to draw the line of the Malayan element as far up North as the Latitude 5° N., which includes the 4 Malayan provinces of Thiland, Satul, Yala, Pattani, and Narathiwat. Recent collections show that Malayan species, especially the Dipterocarps such as *Dipterocarpus kerrii* King, *D. baudi* Korth, *D. gracilis* Bl., *D. dyeri* Pierre and *D. grandiflorus* Blanco, have been found fairly common beyond the said limit as far up as Suratdhani; even some species as *D. gracilis* Bl., *D. baudi* Korth and *D. Dyeri* Pierre have been common in the South-Eastern Region.

In the Northern part of this region Burmese elements are also common. The forests are mainly of the tropical rain forest type, and are made up of many Dipterocarps species. Mangrove swamps in this region are very rich, and are the main mangrove-forests of the country, they almost cover the whole Western coast. In the low land swamp forests and the low limestone outcrops, the so-called 'Island Mountains' are common, and quite a characteristic of the landscape. The region is composed of the districts of Ranawng, Langsuan, Surathani, Pang Nga, Krabi, Phuket, Nakhawn Sithamarat, Trang, Phathalung, Songkhla, Satul, Yala, Narathiwat and Pattani.

VERNACULAR NAMES

The spelling of vernacular names of places and plants, dealt with in this paper, is not in accordance to the "General System of Phonetic Transcription" laid down by the Royal Institute of Thailand; this is due to the complexity of the method expounded therein. However, the author hopes that with his own simple way of writing pronunciation will be easier to both Thais and foreigners.

ABBREVIATIONS

The abbreviations of herbaria cited in this paper are in conformity with the work entitled "Herbaria of the World", *Regnum Vegetabilum* No. 1, 3rd edition; those of the literatures with the "International Rules of Botanical Nomenclature", accepted by the 9th Botanical Congress, Paris, 1956. The Singapore Field number is abbreviated as S.F.. Where is on other abbreviation after the collector's name, means the specimens quoted are kept in the Forest Herbarium, Royal Forest Department, Bangkok.

THE GENUS DIPTEROCARPUS GAERTN. F.

Among the Dipterocarps the genus *Dipterocarpus* Gaertn. f. is the most important from the economical point of view, as it has many timber-tree species. It belongs to the Indo-Malayan Region, and is supposed to have its natural home in Borneo, where, according to Symington (1943), 49 species have been recorded.

So far 17 species are at present known in the Flora of Thailand, and none of them are endemic. It is expected that more species will be discovered if a thorough survey is made along the Tenasserim Range down to the Peninsular Region.

Botanically the genus *Dipterocarpus* is a unique one, the species are quite easy to recognise; in the preparation of this note the conception of Parkinson and Symington are generally based on. The subdivision of the genus is based on the characters of the fruits, which can be readily defined into 5 groups: *Sphaerales*, *Tuberculati*, *Angulati*, *Alati* and *Plicati*. Although this system is not a natural one, it is very practicable indeed, and it is generally accepted. The identification by use of vegetative parts also prove to be a good criterion for the field work.

In Thailand the vernacular generic equivalent of the *Dipterocarpus* is 'Yang', but in some localities certain species are known under other names, such as 'Tueng' or 'Kung' which are used by the Northerners for *D. tuberculatus* Roxb. and 'Hieng' or 'Sabaeng', by the Northerners and North-Easterners respectively for *D. obtusifolius* Teijsm.; whereas *D. intricatus* Dyer is known in the South-Eastern Region as 'Krat' and in the North-Eastern part as 'Sat'. *D. grandiflorus* Blanco is known locally in the Peninsular as 'Yung'.

As vernacular names are at present very confusing, it is thought that the best way to eliminate this, coined or preferred names should be introduced; to encourage the use of such names an endeavour has been made

in this paper to adopt the Thai generic name of 'Yang' as antecedance of the specific names. These preferred names are printed in capitals throughout the work and they are as follow :—

Dipterocarpus	alatus	Roxb.	... .. .	YANG NA
D.	baudii	Korth.	... .. .	YANG KHION
D.	chartaceus	sym.	... .. .	YANG WAT
D.	costatus	Gaertn. f.	... .. .	YANG PAI
D.	crinitus	Dyer	... .. .	YANG KHAH
D.	dyeri	Pierre	.... ... ..	YANG KLAWNG
D.	gracilis	Bl.	.... ... ..	YANG SIAN
D.	grandiflorus	Blanco	... .. .	YANG YUNG
D.	hasseltii	Bl.	.... ... ..	YANG KLIANG
D.	intricatus	Dyer	... .. .	YANG KRAT
D.	kerrii	king	.... ... ..	YANG MANMU
D.	oblongifolius	Bl.	... .. .	YANG KHLAWNG
D.	obtusifolius	Tenism	... .. .	YANG HIENG
D.	retusus	Bl.	.... ... ..	YANG KHUAN
D.	tuberculatus	Roxb.	... .. .	YANG PHLUANG
D.	turbinatus	Gaertn. f.	... .. .	YANG DAENG

In Thailand the species of *Dipterocarpus* occur both in the dry dipterocarps, dry hill evergreen, and tropical rain forests; those occur in the dry dipterocarps forests have their bark fissured. Even *D. costatus* Gaertn. f. if grown in this type of forests has its bark thicker and markedly cracked; *D. turbinatus* Gaertn. f. also has its bark thicker than usual, but it is neither fissured nor cracked. According to the informations available, it is very rare indeed that the genus occurs beyond the altitude of 1,000 m. from the sea level in this country, the species that can thrive in such high elevation are *D. costatus* Gaertn. f. and *D. obtusifolius* Teijsm.

Certain species confine themselves in a limited area, such as the xerophytic *D. intricatus* Dyer and *D. turbinatus* Dyer which never occur below the Latitude of 10 degree North. The following species, *D. chartaceus*

Sym., *D. gracilis* Bl., *D. kerrii* King, *D. retusus* Bl., *D. hasseltii* Bl., *D. dyeri* Pierre, *D. baudii* Korth, *D. oblongifolius* Bl., and *D. grandiflous* Blunco have never been seen North above the Latitude 14° North; the rare species happen to be *D. crinitus* Dyer, *D. oblongifolius* Bl., *D. hasseltii* Bl., and *D. retusus* Bl. where only one collection each has been recorded so far.

The hill species are *D. costatus* Gaertn. f., *D. gracilis* Bl., *D. retusus* Bl., *D. turbinatus* Gaertn. f., *D. obtusifolius* Teijsm. and sometimes *D. chartaceus* Sym.; *D. alatus* Roxb., and *D. oblongifolius* Bl. are both riparian species, the former are very common in the plain along the water ways all over the country, and can be deemed as the most widely spreading of the *Dipterocarps*.

Generally they are found mostly scattered throughout the country, but some species, such as *D. tuberculatus* Roxb., *D. obtusifolius* Teijsm. and *D. intricatus* Dyer are commonly found gregarious; this may be due either to their character of being fire resistant, to their high percentage of germination, or to the peculiar chemical property of the soil they thrive on. In some localities *D. intricatus* Dyer and *D. obtusifolius* Teijsm. are found gregariously together on acid sandy soil. Sometimes *D. obtusifolius* Teijsm. penetrates into the hill evergreen forest, it is also found associating with Pines in certain localities.

The character of the genus *Dipterocarpus* Gaertn. f. can be roughly given as follow:—

Tall, gigantic, deciduous or evergreen tree, without apparent heart-wood. Leaves plicate in bud, simple, usually large (the smallest-leaved species is *D. costatus*), more or less stellate hairy; secondary nerves prominent on the under surface, straight and parallel to each other, abruptly curves up almost to the margin, forming intramarginal veins; tertiary nerves scalariform.

Flowers large, pink or red, sweet scented, on axillary panicles bearing few flowers. Calyx united into a cup, free from the ovary; the 5 lobes are not equal, being 2 outer long and 3 inner short, hairy or glabrous.

Corolla, oblong obtuse in bud, petals united at the base into a short tuba with 5 twisted segments, caducous, partially hairy outside, glabrous inside. Stamens many, with prolonged connectives; anthers oblong, 4-celled, opening, lengthwise, Pistil simple, style filiform, stigma simple, ovary superior, one-locular, hairy.

Nut ovoid, enclosed in the ovoid or globose, smooth or ridged fruiting calyx-tube, free; ridges alternate with calyx lobes, two of which developed into large, 3-nerved, strap-shaped fruiting calyx lobes or wings. Seeds with fleshy, folded up cotyledones, the germination take place after the fruits fall from the tree. During the course of germination, the cotyledones remain inside the woody nut, sending out the radicle through the apex of the nut at the same time the bases of the cotyledones elongate and enable the plumule to free itself from the much folded cotyledones. Usually the nut will lay on the ground.

The structure of the wood is very similar in all species, it has the colour of reddish brown, rather smooth grained, it is easier to work in the green condition.

SILVICULTURAL OBSERVATIONS

RYAN and KERR observed that young trees of *D. obtusifolius* Teijsm. can exude a quantity of water, and is a good water supply for hunters in the dry season.

All species of *Dipterocarpus* are strong light demander, though in younger stage they need some shade, and in suitable conditions they can regenerate very well. Among the xerophytic species, seedlings always develop hardy root system which renders them fire resistant. The evergreen forest species do not have this habit, therefore they are usually killed off

when burnt by shifting cultivators. Most of them can have a very good natural regeneration, but it is very rare that one ever comes across a pure stand like those of the xerophytics.

The flower by nature is entomophilous, and, thus from the genetical point of view it is not self-pollinated. It seems to fruit well every year, but yet the fruit can not produce good seeds at all. It is not too absurd to say that bees are very important to the pollination of the *Diptercocarpus*, especially the evergreen forest species, this can be seen by numbers of bee-hives on Yang trees. Perhaps the swarming of bees, their means of migration, will more or less effect the seed-year of the Yangs, Therefore it is not a wonder to see a marked difference in age class of certain species.

The fruit, although winged, is more water-borne than air-borne, owing to its buoyancy in the water and heavy weight. Only few species are adaptable to be both such as *D. intricatus* Dyer and *D. costatus* Gaertn. f., the former with highly complicate accrescent ridges on the fruiting calyx-tube, while the latter besides the light weight of fruit, the fruiting calyx-tube also furnished with five low accrescent ridges.

After falling from the tree it almost germinate at once, and as it can not travel very far, it is a common sight for groups of seedlings in the forest under neath the mother trees. In the xerophytic species the fruit falls after the period or the forest fire, so it is safe from being burnt; besides this the mother trees serve as the shade, which is necessary for the seedlings in their early stage, and, thus helps them very much to form up a stand.

In the hygrophilous species the seedlings will be killed off in later years by lack of light under the dense and spreading crown of the mother trees or the other species, the survival stock is effected by gaps in the crown canopy or by the water-borne fruits silted up some-where, hence, instead of forming up stands, they scatter all over the forest.

The seed has big, oily and fleshy cotyledones, and is always damaged by animals and insects. This hampers much for the regeneration of

some species, such as *D. costatus* Gaertn. f., of which seeds are eaten by squirrels.

It is accepted that the silvicultural treatment for the hygrophilous species is better to open the crown canopy for the coming up seedlings. It is also advisable to encourage bee-keeping in the forest. For the xerophytic species, they happen to have the tenacity to withstand any damage done to them. One thing to be done is keep a vigilant check on the destroying of the whole forest, or mother trees.

TAXONOMIC OBSERVATIONS

In my former work 2 new varieties of *D. obtusifolius* Teijsm. were recognised, i.e. *D. obtusifolius* Teijsm., var. *glabricalyx* Smitinand and *D. obtusifolius* Teijsm., var. *vestitus* (Vesque) Smitinand. After a thorough study, they prove to be the same form, thence *D. obtusifolius* Teijsm., var. *glabricalyx* Smitinand has to be reduced under *D. obtusifolius* Teijsm., var. *vestitus* (Vesque) Smitinand.

HYBRID DIPTEROCARPUS

It is believed by many authorities in the natural hybridization of *Dipterocarpus*, and can be referred to work of Ryan and Kerr, Parkinson, and Foxworthy.

Besides the hybrid, *D. obtusifolius* x *costatus* Ryan & Kerr which is being treated in this work as a mere form of *D. costatus* Gaertn f., other one was suspected by Kerr according to the remark in his own handwriting on the sheet No. **Kerr 17296!**, in the herbaria of the Royal Botanic Gardens, Kew and the British Museum Natural History. They were collected from Peninsular Thailand, Phang Nga, Kaw Yao Yai.

IDENTIFICATION KEYS TO THE GENUS *DIPTEROCARPUS* GAERTN. F.

As it happens, the genus *Dipterocarpus* Gaertn. f. besides being easily identified by the characters of its fruits, its [vegetative parts or field characters are also of much diagnostic value. Therefore besides the key based on the nature of the fruit, one based on the field characters, following that of Symington, is also given hereunder with a slight modification.

FIELD KEY TO THE SPECIES OF *DIPTEROCARPUS* GAERTN. F.

A. Trees of mixed deciduous or dry *Dipterocarps* forests, bark very thick, scaly or fissured.

B. Trees of mixed deciduous forests, bark very thick, scaly, leaves glabrous or hairy only on the under surface.

C. Leaves glabrous ***D. turbinatus* Gaertn. f.**

CC. Leaves hairy atleast on the under surface.

D. Stipules adpressed tomentose ... ***D. costatus* Gaertn. f.**

DD. Stipules shaggy tomentose ... ***D. obtusifolius* Teijsm.**

BB. Trees of dry *Dipterocarps* forests, bark fissured, leaves glabrous or hairy on the under surface.

E. Leaves glabrous.

F. Leaves cordate—ovate, stipules short tomentose

***D. tuberculatus* Roxb.**

FF. Leaves elliptic—ovate, stipules glabrescent to glabrous

***D. Obtusifolius* Teijsm, var. *subnudus* Ryan & Kerr**

EE. Leaves hairy.

G. Leaves hairy on the under surface.

II. Leaves cordate—ovate.

I. Upper surface of leaves rugous, under surface

with short, stiff stellate hairs, stipules and petioles short tomentose **D. intricatus Dyer**

II. Upper surface of leaves smooth, under surface tomentose, stipules and petioles glaucescent

D. tuberculatus Roxb. , var. grandifolius Craib

HH. Leaves elliptic—ovate. Stipules and petioles shaggy tomentose ... **D. obtusifolius Teijsm.** (anb var. **vestitus (Vesque) Smitinaand**).

GG. Leaves hairy on both sides ... **D. tuberculatus Roxb. , var. tomentosus Craib**

AA. Tree of evergreen forests, tropical rain forests or riparian forests, bark moderately thick, scaly, smooth or lenticellate.

B. Tree of evergreen or riparian forests.

C. Tree of evergreen forests, leaves glabrous, upper surface shining, slaty grey when dry, stipules canescent

D. turbinatus Gaertn. f.

CC. Tree of riparian forests.

D. Leaves glabrous, oblong, acuminate ... **D. oblongifolius Bl.**

DD. Leaves pubescent beneath, elliptic ovate, acute or short acuminate ... **D. alatus Roxb.**

BB. Tree of tropical rain forests

E. Leaves glabrous.

F. Stipules glabrous.

G. Stipules glabrous on both surface ... **D. hasseltii Bl.**

GG. Stipules silvery, silky tomentose inside

D. kerrii King

FF. Stipules more or less pubescent.

H. Leaves elliptic—oblong, exceeding 24 cm. in length with more than 20 pairs of lateral nerves.

I. Tree of low land forests **D. dyeri Pierre**

II. Tree of hill evergreen forests **D. retusus Bl.**

HH. Leaves ovate, frequently exceeding 12 cm. in length,
with less than 12 pairs of lateral nerves

D. grandifloru Blanco

EE. Leaves more or less hairy on the under surface.

J. Leaves tomentose or coarsely hairy on the under surface.

K. Upper surface of leaves roughened with hairs or minute
papillae. **D. ctinitus Dyer**

KK. Upper surface of leaves smooth except for the midrib.

L. Leaves rarely exceeding 15 cm. in length, elliptic
ovate **D. costatus Gaertn. f.**

LL. Leaves frequently more than 15 cm. in length, ellip-
tic or oblong-lanceolate.

M. Twig ends and petioles furnished with tufts of
long golden hairs **D. baudii Korth.**

MM. Twig ends and petioles minutely pale tomentose
... .. **D. gracilis Bl.**

JJ. Leaves glabrescent on the under surface, with sparsely,
golden hairy along veins ... **D. chartaceus Sym.**

IDENTIFICATION KEY TO SPECIES OF THE GENUS DIPTEROCARPUS GAERTN. F.

(Based on the characters of fruits)

1. Tube of fruiting calyx smooth, globose, conic or obconic, never angular

... .. Section **1. Sphaerales**

2. Tube of fruiting calyx with 5 protuberances in its upper portion,
between them tubercles with flat sides, hence more or less angular

... .. Section **2. Tuberculati**

3. Tube of fruiting calyx 5-angular, at least in its upper portion,
with more or less conspicuous ridges Section **3. Angulati**
4. Tube of fruiting calyx with 5 straight or slightly undulate wings
from top to base Section **4. Alati**
5. Tube of fruiting calyx entirely hidden by strongly transversely
plicate wings Section **5. Plicati**

Section 1. SPHAERALES

- A. Calyx tube 3 cm. in diameter or more when mature:
 - B. Wing exceeding 21 cm. in length **D. retusus Bl.**
 - BB. Wing less than 21 cm. in length:
 - C. Wing distinctly stellate hairy or totally glabrous when mature
... **D. obtusifolius Teijsm. & varieties**
 - CC. Wing glabrescent when mature:
 - D. Leaves usually with less than 12 pairs of lateral nerves;
stipules glabrous outside silky inside **D. kerrii King**
 - DD. Leaves usually with more than 12 pairs of lateral nerves,
stipules glabrous on both surfaces **D. hasseltii Bl.**
- AA. Calyx tube less than 3 cm. in diameter when mature:
 - B. Calyx tube globose:
 - C. Small calyx lobes less than half the length of the tube ...
... **D. chartaceus Sym.**
 - CC. Small calyx lobes exceeding half the length of the tube:
 - D. Stalk and neck of calyx tube furnished with rather long
reddish hairs ... **D. baudii Korth.**
 - DD. Stalk and neck of calyx tube sparsely furnished with short
fulvous hairs **D. giracilis Bl.**

BB. Calyx tube not globose:

E. Calyx tube obconic, obovoid or cylindrical, tomentose

.... **D. crinitus Dyer**

EE. Calyx tube fusiform, glabrous and glaucescent

.... **D. turbinatus Gaertn. f.**

Section 2. TUBERCULATI

Calyx tube with 5 blunt protuberances in its upper portion

... .. **D. tuberculatus Roxb. & varieties**

Section 3. ANGULATI

A. Angles slightly prominent on the shoulders than on the sides of the calyx tube **D. dyeri Pierre**

AA. Angles evenly prominent all along the calyx tube:

B. Calyx tube globose **D. costatus Gaertn. f.**

BB. Calyx tube elliptic oblong **D. oblongifolius Bl.**

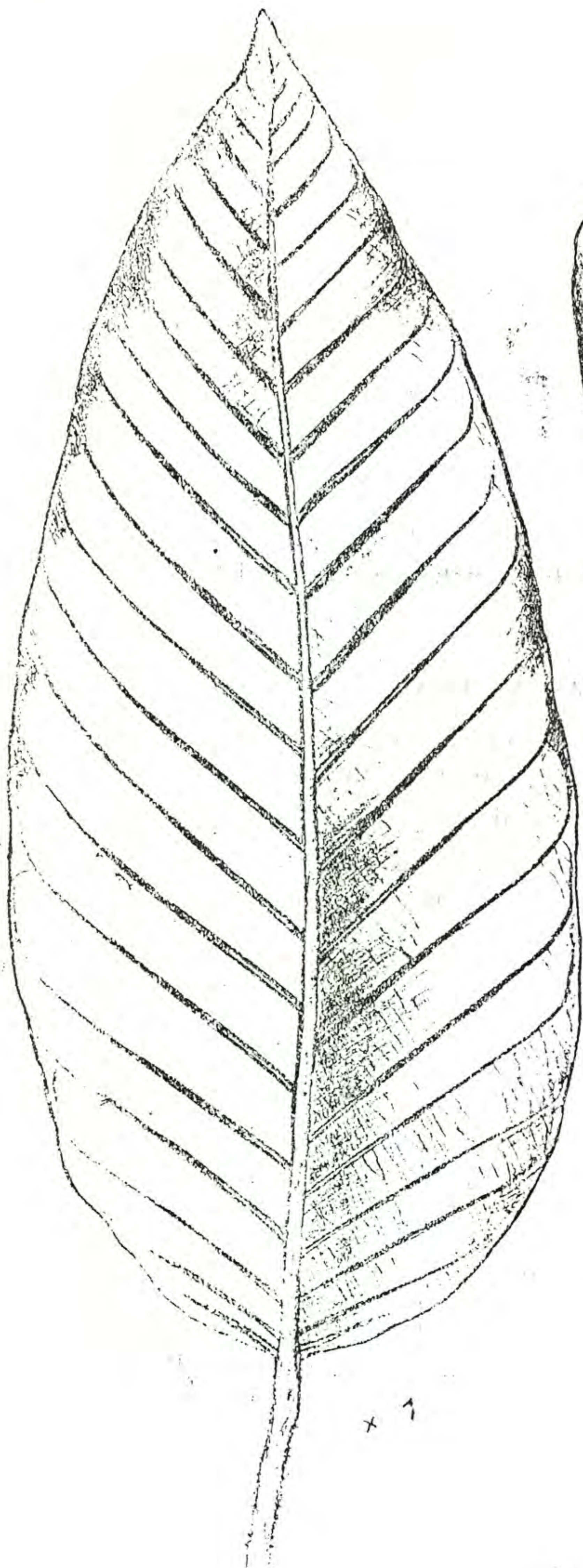
Section 4. ALATI

A. Wings frequently exceeding 21 cm. in length, calyx tube oblong, 8 cm. long **D. grandiflorus Blanco**

AA. Wings not exceeding 16 cm. in length, calyx tube ovate to globose, 3.5 cm. long **D. alatus Roxb.**

Section 5. PLICATI

Angles of calyx tube forming intricately laminated wings completely obscuring the tube **D. intricatus Dyer**



1. DIPTEROCARPUS ALATUS

D. alatus Roxb., Hort. Beng. 42. 1814.; ex G. Don, Gen. Syst. 1: 812. 1831; Roxb., Fl. Ind. 2: 614. 1832.; Dyer in Hook. f., Fl. Brit. Ind. 1: 298. 1874.; Kurz, For. Fl. Brit. Burm. 1: 116. 1877., Pierre, Fl. For. Cochinch. t. 212. 1880; Guerin in Lecomte, Fl. Gen. Indo-Chine. 1: 362. 1910; Gilg in Engler & Prantl, Nat. Pflanzenfam. 21. 253. 1925; Graib, Fl. Siam.Enum. 1: 133. 1925.; Parker, Ind. For. Rec, 13 : 27. pl. 5 1927.; Parkinson, Burm. For. Bull. 27: 9. pls. 2, 3, 4, 5. 1932; Foxwothy, [Mal. For. Rec. 10 : 89. 1932. in part; Symington, Mal. For. Rec. 16: 166. 1942.; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine 1 : 340. 1943.

D. incanus Roxb., Hort. Beng. 42. 1814.; Brandis in Journ. Linn. Soc. Bot. 31: 35. 1895.

D. costatus Ridl., Fl. Mal. Penins. 1: 217. 1922. in part, non Gaertn. f.

Lofty tree 30 – 40 m. high with smooth clear bole 20 m. up to the first branch, 200 cm. up in girth. Bark grey, more or less scaly. Young twigs and stipules yellow pubescent.

Leaves ovate, elliptic ovate or elliptic oblong, slightly crenate, obtuse or short acuminate, slightly cordate, rounded or sometimes cuneate, 15 – 25 cm. long, 6 – 15 cm. broad lateral nerves 14 – 16 pairs, glabrous on the upper surface except midrib, yellow, short pubescent on the under surface; petioles 3 – 4.5 cm. long, yellow pubescent.

Flowers pink or almost white, calyx with 5 ridges, tomentose. Fruits globose, 3.5 cm. in diameter with 5 straight or undulate accrecent ridges; wings oblong oblong obtuse, coriaceous, 10 – 17 cm. long, 1.5 – 3.5 cm. wide, glabrescent.

Flowering from December to April; fruiting from January to May.

Northern: Chiangmai, **Kerr 532!** (BM, K); **Vanpruk 984!, 985!, 987!;**

Saraphi Phana Nuchorn 19!

Kamphaeng Phet, Kerr s.n.! (BKK, BM).

Nakhawn Sawan, below Pak Nam Pho, **Witt 16!**; **R.F.D. Thailand s.n.!** (A); **F. Kerr 65!** (A).

North-Eastern: Loei, Sithan, **Smitinand 1804!**

Khawnkaen, Pha Nok Khao, **Phloenchit 1280!**

Eastern: Nakhawn Rachasima, **Witt s.n.!** (K); Ban Chumsaeng, **Noei 187!** (A, BKK, BM, K); Sikhiu, **Chaem 3!**; Non Wat, **Khong 4!**

Central: Krungthep, **Marcan 580!** (BM, K); Khao Din, **Smitinand 1554!**
Saraburi, Phu Khae, **Smitinand 1550!**; **Rananand 1!**
Angthawng, **Put 2559!** (BKK, BM, K).

South-Eastern Prachinburi, Krabin, Thung Pho, **Kerr s.n.!** (BM), Aran Prathet, **Put 33!**; Choburi, near Sriracha, **Collins 57!** (A, BM, K), 404! (BM, K), **1764!** (A, BKK, BM, K), Nawng Khaw, **Kerr s.n.!** (BM).

Chanburi, Makham, **Put 393!**, Pong Nam Rawn, Ban Pratrang, **Smitinand 3184!**, **Bunnak 583!**

Trat, Kaw Chang, Khlawng Salak Phet, **Schmidt 742!** (K), Salak Khaw, **Smitinand 2261!**

South-Western: Kanburi, Chorakhe Phuak, **R.F.D. Thailand s.n.!**

Prachuap Khirikhan, Bang Taphan, **Put 1411!** (A, BKK, BM, E, K), Ban ThungMaha, **Kerr 11353!** (A, BKK, BM, E, K).

Peninsular: Ranawng, Nok Nang, **Kerr 17532!** (BKK, BM, K), **Haniff 389!** (BM, K).

Surat, Ban Dawn, **R.F.D. Thailand 872!** (BKK, K), Kaw Tao, **Kerr 11165!** (BKK, BM), **s.n.!** (BM), **Put s.n.!** (BKK, BM), Tha Kham, **R.F.D. Thailand 424!**; Tha Khanawn, **Kerr s.n.!** (BKK)
Nakhawn Srithamarat, Tha Samet, **Kerr 14287!** (BKK, BM, K).

Trang Huay Yawt, Khao Kawp, **Smitinand s.n.!**

Without exact locality: The United Baltic Corp. Ltd., 18! (K).

Distribution: Burma, Indo-China and Malaya.

Local names: YANG NA (Central and Peninsular); Yang (Generally).

This is a riparian species, and confines itself in the low land. According to the accessibility of exploitation, now-a-days the number is highly depleted. The species yields a valuable timber, and it is highly esteemed in the market.

Trees found in the Peninsular part have cuneate-based leaves, and the accrescent ridges on calyx tubes are almost straight and shorter than those found elsewhere.

2. DIPTEROCARPUS BAUDII

D. baudii Korth. Verh. Nat. Gesch. Ned. Overz. Bot., p. 59, t. 5. 1830 – 1842; van Slooten in Bull. Jard. Buitenz. Ser. 3. 8: 273. 1927; Parker in Ind. For. Rec. 16: 3. 1931. pl., VI; Parkinson, Burm. For. Bull. 27. 11; pl. 6. 1932. Foxworthy in Mal. For. Rec. 10: 64. 1932; Symington in Mal. For. Rec. 16: 168. 1943; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine 1: 338. 1943.

D. duperreana Pierre, Fl. For. Cochinch. t. 219. 1889; Guerin in Lecomte, Fl. Gen. Indo-Chine 1: 358. 1910; Ridley, Fl. Mal. Penins. 1: 214. 1922; Craib, Fl. Siam. Enum. 1: 134. 1925.

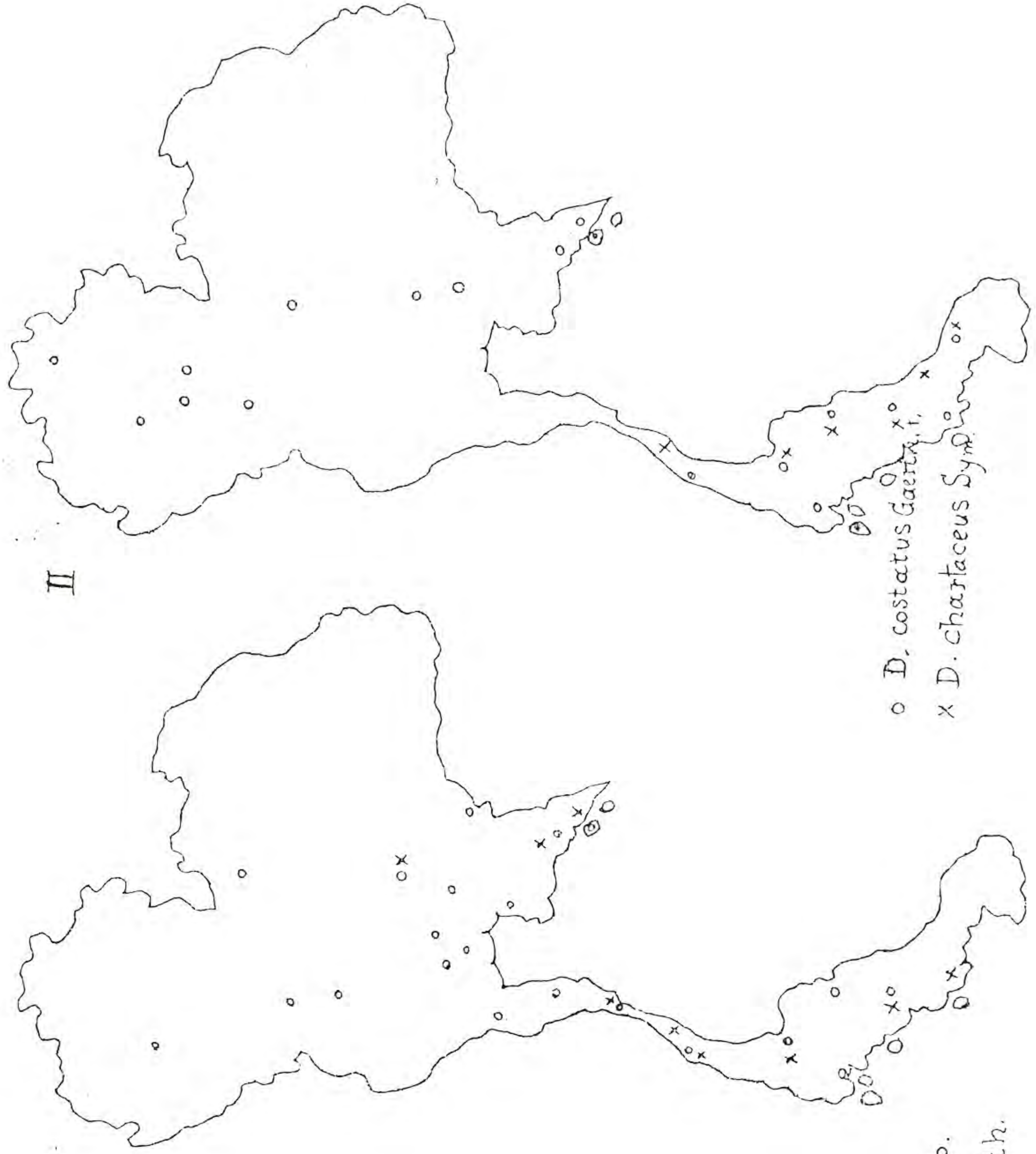
D. scortechinii King, Brandis in Journ. Linn. Soc. Bot. 31: 28. 1895; Foxworthy in Mal. For. Rec. 3: 42. 3 pls. 1927.

Lofty tree 20 – 30 m. high with clear bole of 20 m. upto the first branch, 200 cm. up girth; bark grey, lenticellate; young twigs and stipules clothed with shaggy fulvous stellate tomentose.

Leaves broad elliptic, shallowly and distantly crenate, cuspidate, and obtuse at the base, 20 – 25 cm. long, 13 – 15 cm. broad; secondary nerves 15 pairs, stellate pilose; petioles 3.5 – 6 cm. long, shaggy fulvous stellate tomentose.

DISTRIBUTION MAPS

II



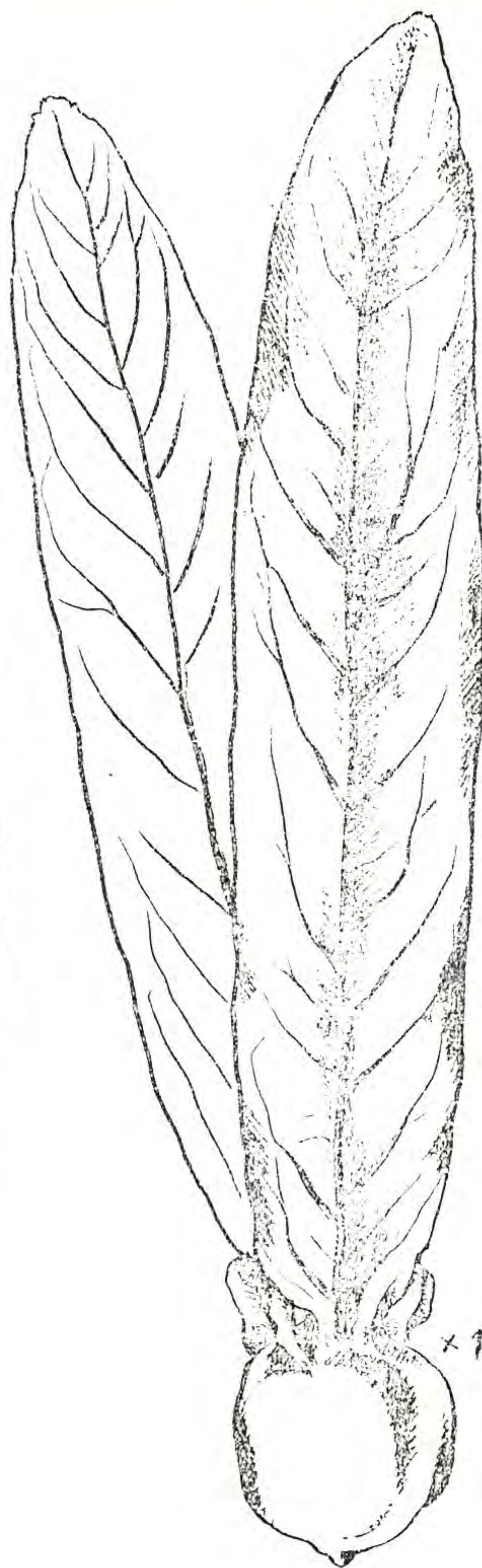
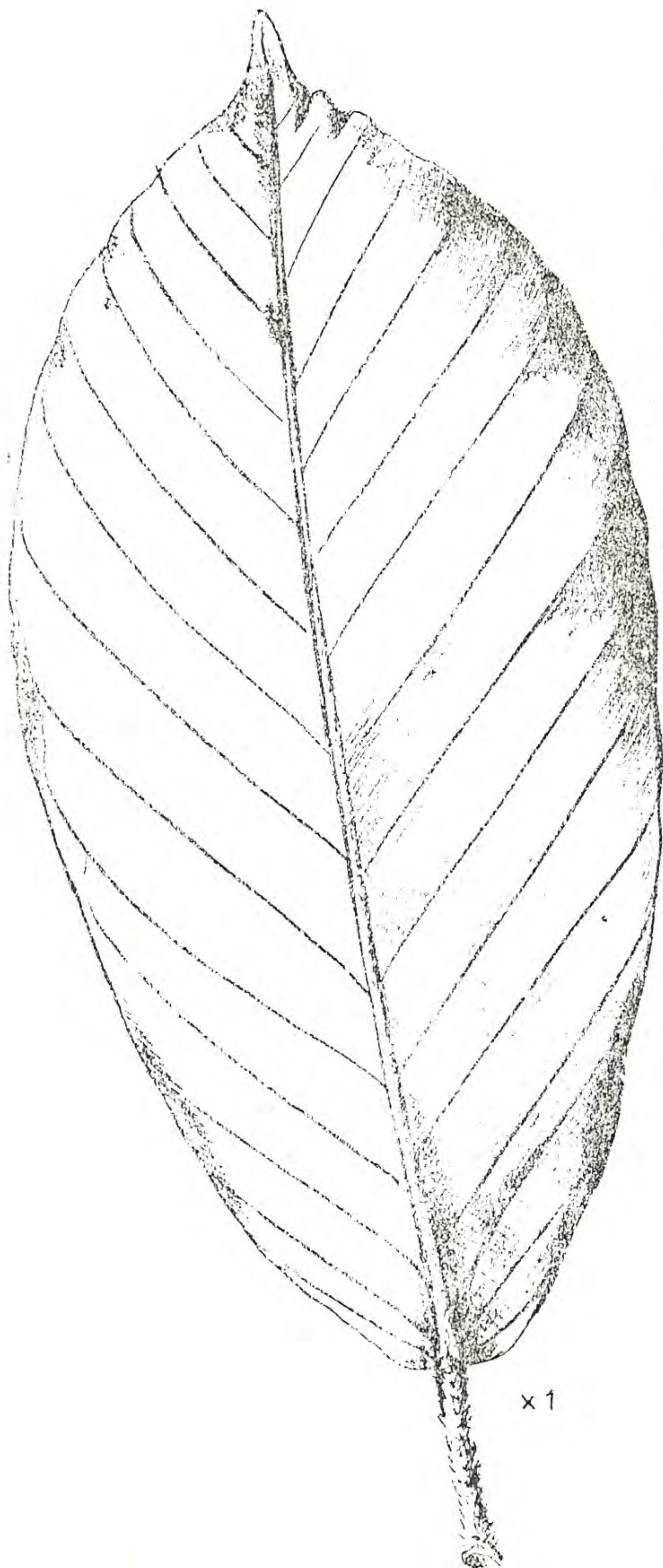
o *D. alatus* Roxb.
x *D. baudii* Korth.

o *D. costatus* Gaertn. t.
x *D. chartaceus* Sym.

Flowers pink, calyx fulvous tomentose, subinfundibuliform. Fruits globose, contracted at both ends, 1.5 – 2.5 cm. long, 2 – 2.5 cm. in diameter, sparsely yellowish hairy, wings about 18×3.5 cm., 3 – nerved, median nerve runs right through the whole length, other 2 only half way up; calyx lobes round about 2 cm. long.

Flowering in November - January; Fruiting from December – June.

- Eastern :** Nakhawn Rachasima, Sikhiu, **R.F.D. Thailand 464!**
- South–Eastern :** Chanburi, Makham, **Bunnak 309!**; **Put 443!**, **317!**, **606!** (BKK, BM, A), **s.n.!** (BKK); Pong Nam Rawn, **Smitinand 3160!**
- Trat, Khao Saming, **Kerr 9411!** (BM, BKK), **17896!** (BKK, BM, K); **Put 511!** (A, BKK, BM); Huay Raeng, **Smitinand 1343!**
- South–Western :** Prachuap Khirikhan, Pak Chan, **S.F. 3788!** (K). Chumphawn, Ban Map Amarit, **Kerr 11436!** (A, BM, BKK); Tha Ngaw, **Kerr 11436 A!** (A, BM, BKK).
- Peninsular :** Langsuan, Tha Ko, **Put 1609!** (A, BM, BKK). Ranawng, Khlawng Kampuan, **Kerr 16889!** (A, BM, BKK). Kraburi, **Kerr 16375!** (A, BM, BKK); Lam Liang, **Kerr 11736!** (BKK). Surat, Yan Yao, **Kerr 18171!** (BM, BKK, K); Prasaeng, **Kerr 12488!** (A, BM, BKK); Ban Dawn, Huay Cham Luang, **R.F.D. Thailand 878!** (BKK), in part; Tha Khanawn, **R.F.D. Thailand 470!**; Bangbao, **Smitinand 2829!** **R.F.D. Thailand 15838!**
- Trang, Thale Sawng Hawng, **Smitinand 3021!**
- Satul, Khuan Pho, **Kerr 13754!** (A, BM, BKK).
- Without exact locality: R.F.D. Thailand 471!**



Distribution: Burma, Indo-China and Malaysia.

Local Name: YANG KHON, Yang Klawng (Trat and Chanburi); Yang Dam (Prachuap Khirikhan); Yang Phluang (Chumphawn); Yung Krabuang (Langsuan); Yang daeng (Nakhawn Rachasima, Ranawng and Surat); Yung, Yung daeng, Yung dam (Surat).

This is a typical lowland species, being found at the altitude of 10 – 200 m. from the sea level in savannah and tropical rain forest. The natural regeneration is fairly good. It always grows together with **D. dyeri Pierre**, and can be readily distinguished by the drooping foliage and pinkish brown lenticellate trunk.

3. DIPTEROCARPUS COSTATUS

D. costatus Gaertn. f., De Fruct. 3. 50, t. 187 1805; Kurz, For. Fl. Brit. Burma 1: 117. 1877; Brandis, Ind. Trees. 66. 1921; Ridloy, Fl. Mal. Penins. 1: 217. 1922; Craib, Fl. Siam. Enum. 1: 133. 1925; Parker in Ind. For. Rec. 13: 4. t. 1927; Foxworthy, Mal. For. Rec. 10. 85. 1932; Parkinson, Burm. For. Bull. 27: 13. pl. 8. 1932; Symington, Mal. For. Rec. 16: 173. 1943; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine, 1: 340. 1943.

D. artocarpifolius Pierre, Fl. For. Cochinch. t. 213 A. 1889

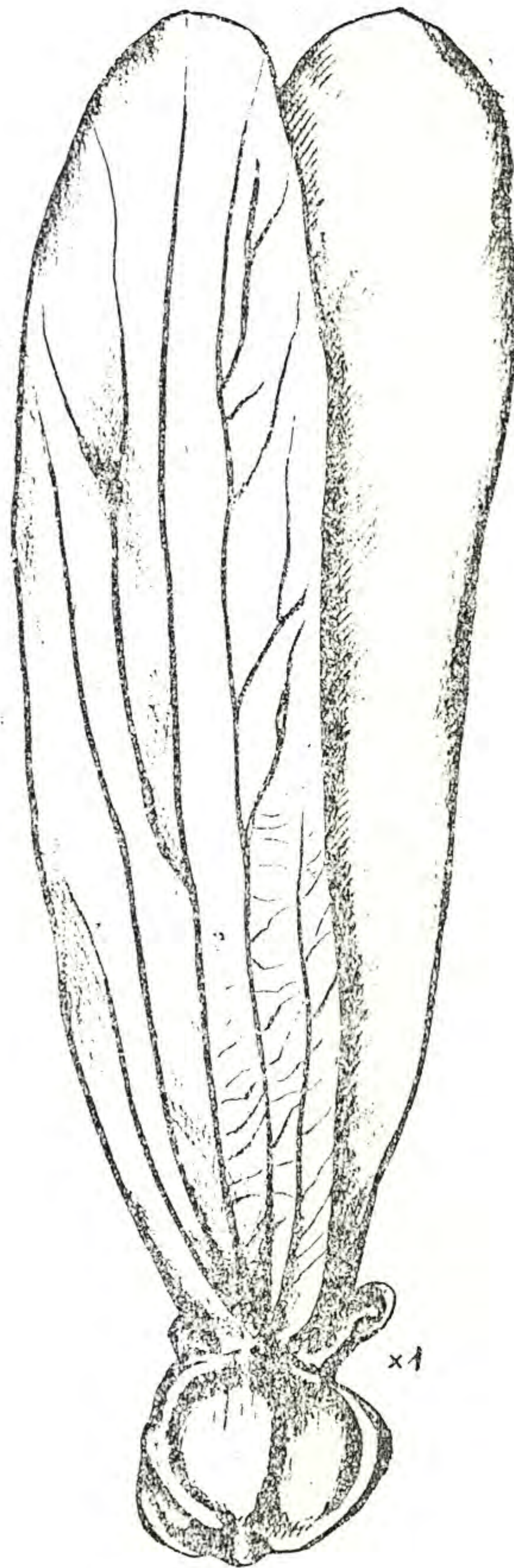
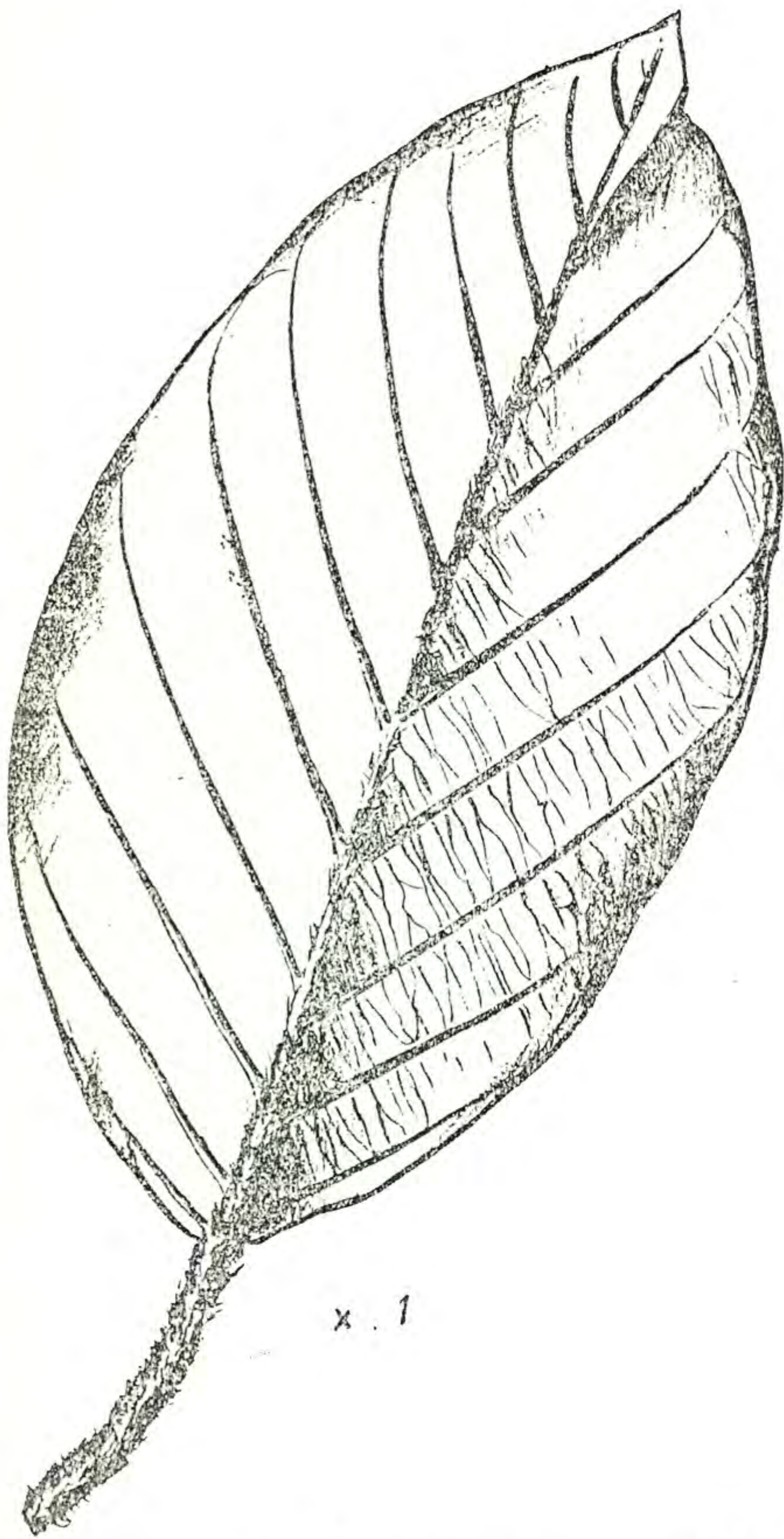
D. incanus Craib, Fl. Siam. Enum. 1: 135. 1925. non Roxburgh.

D. obtusifolius Teijsm. var. *costatus* Tardieu-Blot in Humbert Fl. Gen. Indo-Chine, 1: 338. 1943.

D. obtusifolius x *costatus* Ryan & Kerr in Journ. Siam Soc. 11. 9. 1914, cam tab.

D. parvifolius Heim in Bot. Tidsk. 25: 43. 1903; Guerin in Lecomte, Fl. Gen. Indo-Chine, 1. 365. 1910; Craib, Fl. Siam. Enum. 1: 135. 1925.

Lofty tree 20 – 35 m. high with clear bole up to 20 m. at the



Dipterocarpus costatus Gaertn. f.

first branch. Young twigs and stipules yellow shaggy tomentose with stellate and pilose hairs. Stem with low buttresses; bark scaly, rather thick.

Leaves elliptic ovate, entire or waguely crenate, apex obtuso to short cuspidate, base cuneate, obtuse or rounded, 8–14 cm. long, 4–8 cm. wide, lateral nerves 10–14 pairs, pubescent on the under surface; petioles shaggy stellate–pilose, 2–2.5 cm. long.

Flowers pink, calyx with 5 ridges, tomentose. Fruits globose with 5 straight ridges from top to bottom, 1.2–1.4 cm. across, pubescent; wings oblong, obtuse to rounded, coriaceous, 6–8 cm. long, 1.7–2 cm. wide.

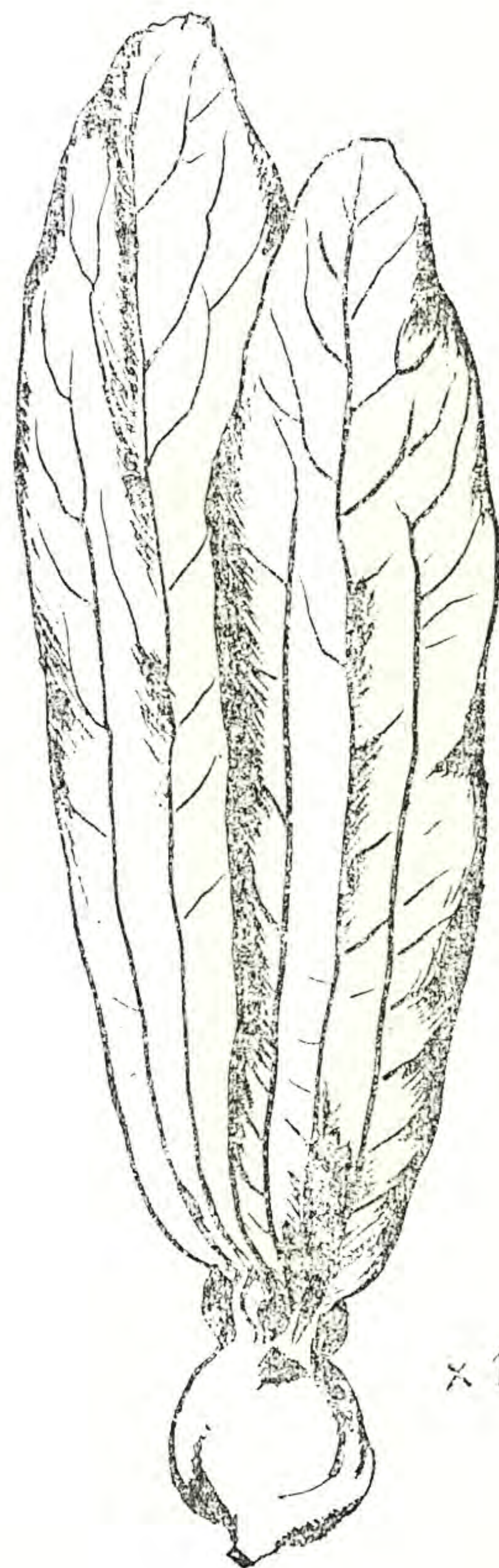
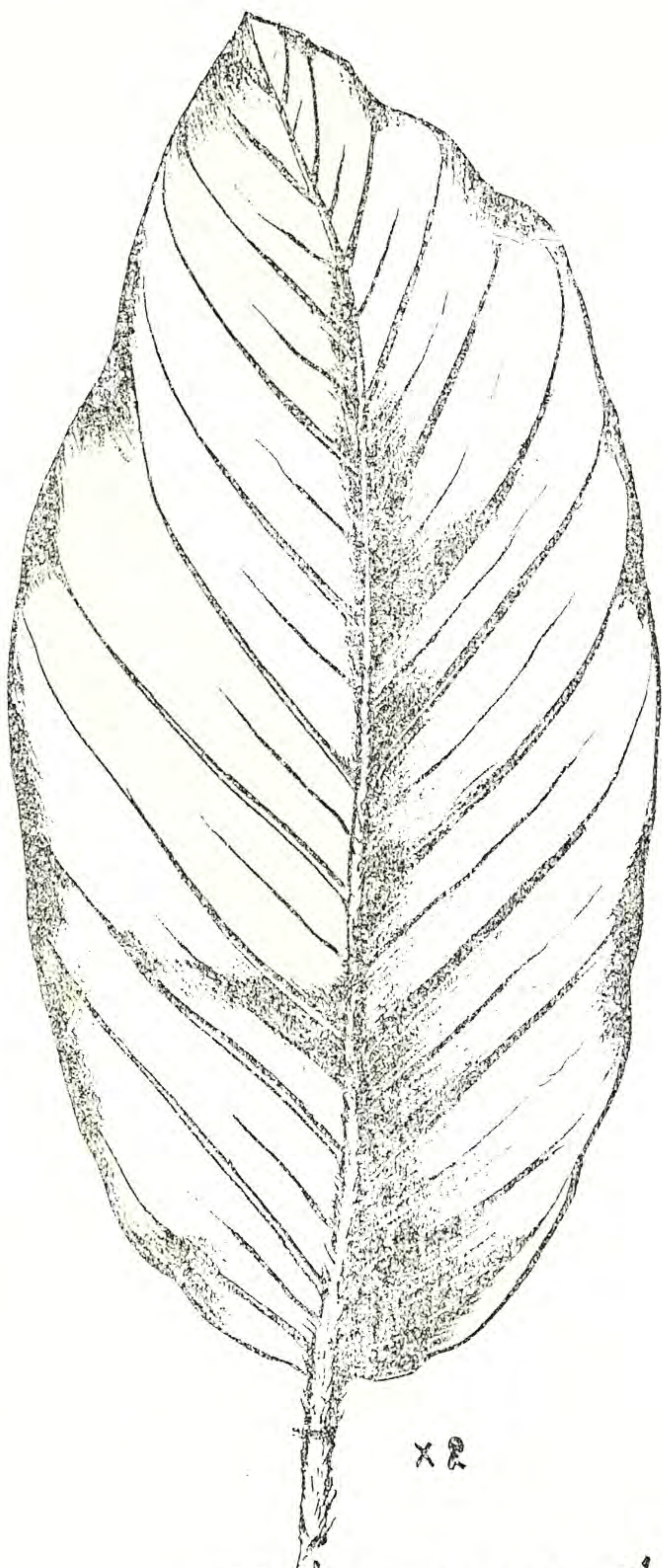
Flowering from December to March; fruiting from February to July.

- Northern :** Chiengrai, Chiergkham, Ban Wangtham, **Smitinand 1621!**
 Chiengmai, Doi suthep, **Kerr 1067!** (A, BM, K), **R.F.D. Thailand 14590!**; **Kerr 3130! 3130 A!** (A, BM, K); Khun Awn, **Kerr 4727!** (A, BKK, BM, K); Chiengdao, **Phloenchit 1026!, 1086!, Khanthachai 59!, Smitinand 2783! 2131!**; Mae Rim, **R.F.D. Thailand 15808!**
 Lampang, Mae Ang, **Winit 1580!** (BKK, K)
 Phrae, Sungmen, **Maiya 26!**
 Petchabun, Lomkao, **Smitinand 2625!**
 Sukhothai, **D. Bourke s.n.!** (BKK)
- Eastern :** Nakhawn Rachasima, Kathok, **Kerr s.n.!** (BKK, BM)
- South–Eastern :** Prachinburi, Srakaew, **Put 70!**
 Chanburi, Makham, **Chit 102!, Put 353!**
 Trat, Kaw Chang, **Schmidt 620 A!** (Type of *D. parvifolius* Heim, C, K), **Kerr 9174** (BKK, BM, K); Khlawng Mayom, **Kerr s.n.!** (BM), **R.F.D. Thailand 15353!** Khlawng Makawk, **Smitinand 2184!, R.F.D. Thailand 11559!**; Laem Ngawp, **Bunnak 390!**; Khao Saming, **Put 620!** (BKK, BM, K).

- Peninsular :** Ranawng, Lam Lieng, **Kerr 16395!** (BKK, BM, K), **Haniff 388!** (K); Ban Pak Khlawng, **Kerr 11390!** (BKK, BM, K).
 Surat, King Phanom, **Kerr s.n.!** (BM); Ban Dawn, **R.F.D. Thailand 869** (in part, BKK).
 Nakawn Srithamarat, Rawn Phibul **Snan 655! 662! 666!** ;
 Chawang, Khao Sun, **Snan 75!**
 Phang Nga, Kaw Yao Yai, **Kerr 17566!** (BKK, BM, K).
 Phuket, Thung Kha, **Curtis 2926!** (K).
 Trang, Chawng, **R.F.D. Thailand 12797** ; Kantang, **R.F.D. Thailand 15196 : 15190!**
 Satul, Terutao, **Kerr s.n.!** (BKK, BM)
 Pattani, Bachaw, **Kerr 7163!** (A, BKK, BM, K).
- Distribution :** Burma, Indo-China and Malaysia.
- Local names :** Yang hee (Chiengmai); YANG PAI (Lampang); Yang daeng (Trat, Trang, Prachinburi); Yang sian, Ygng bueang, Yang Krabueang (Ranawng); Yang huawaen (Satul); Yang bai iat, Yang manmu, Yang motkhan (Nakhawn Sritamarat); Yang tai (Trat).

This is a hill evergreen jungle species, but also found in the lower elevation from 50 m. up to 1,100 m. altitude. It can be detected by the round crown with small leaves making more or less lighter in foliage with clear dole stem. The wood is also esteemed in the market.

Ryan & Kerr convinced that a hybrid between **D. costatus Gaertn. f.** and **D. obtusifolius Teijsm.** occurs in the forest of the North. The said hybrid turns up to be a tomentose form of this species. **Tardieu-Blot's** epithet: **D. obtusifolius Teijsm., var. costatus Kerr** can not be traced, it is probably referred to **Ryan & Kerr's** hybrid.



Dipterocarpus chartaceus Sym.

4. DIPTEROCARPUS CHARTADEUS

D. chartaceus Sym, in Gard. Bull. 9: 332. 1938, et Mal. For. Rec. 16: 169, 1943.

D. skinneri var. *hirtus* Ridl., Fl. Mal. Penins. 1: 215. 1922.

Lofty tree 20 – 30 m. high, 200 cm. up in girth. Bark greyish brown, scaly. young twigs and stipules sohr yellow pubescent.

Leaves elliptic, distantly crenate, obtuse or shorth cuspidate, base obtuse or rounded, 8 – 13 cm. long, 5 – 8 cm. broad; lateral nerves 10 – 11 pairs, sparsely pilose beneath. Dried leaves crisp and paperly.

Flowers pink, calyx tube with sparse, short stellate hairs. Fruits ovate 1.2 – 1 – 4 cm. in diametre; wings oblong, obtuse, coriaceous, 8 – 12.5 cm. long, 2 – 2.5 cm. wide, prominently 3-nerved, all run up to the tip of wings.

Flowering from January to March; fruiting February to August.

South–Western : Dhumphawn, Tha sae, **Kerr 11620!** (BKK, BM, K).

Peninsular : Surat, Yan yao, **Kerr 18250!** (BKK, BM, K); Khlawng Nam-wing, **Kerr 12245!** (BKK, BM, K); Tha Rongchang, **R.F.D. Thailand 441!**; Bangbao, **Smitinand s.n.!**

Songkhla, Wat Chaimongkhol, **R.F.D. Thailand 430!**

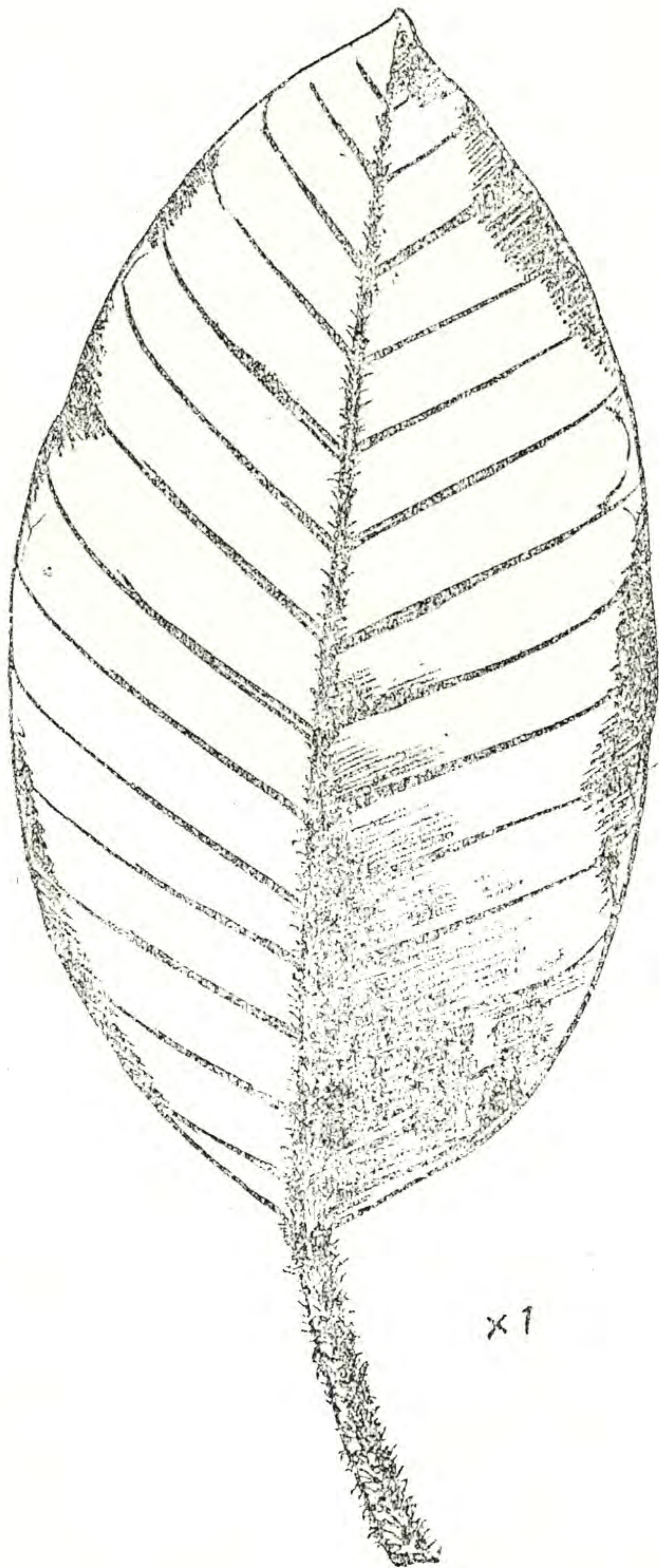
Trang, Chawng, **Smitinand s.n. !**

Pattani, Chana, **R.F.D. Thailand 465!**; Yamu,? **Dechakaisya 3!**

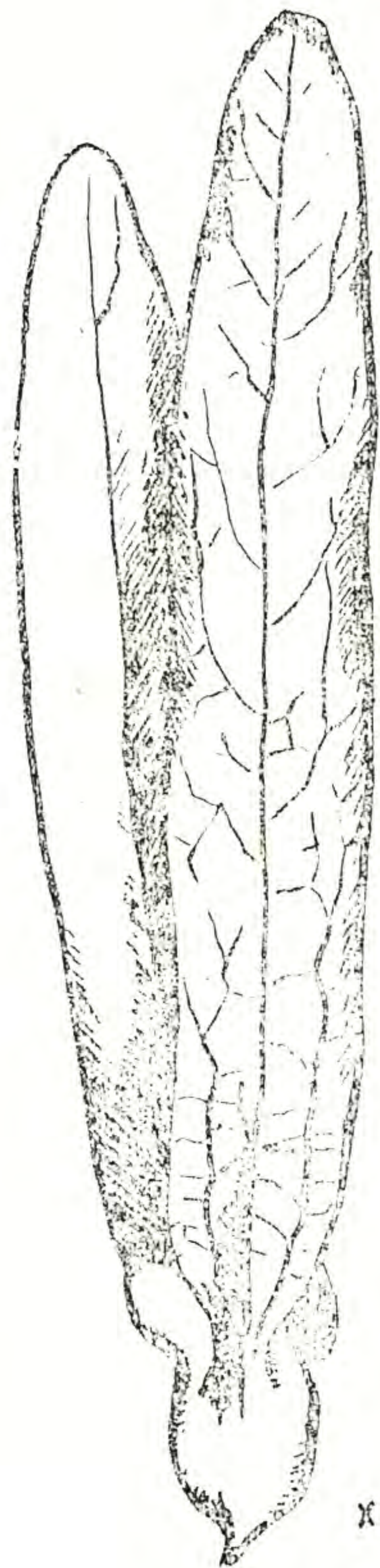
Distribution : Malaya.

Local names : YANG WAT (Surat and Nakhawn Srithamarat); Yang Man-khon (Songkhla); Yang sai (Pattadi); Yang tang (Chumphawn); Yang sian (Surat and Trang).

This is a typical lowland species, found at 50 – 100 m.



x 1



x 1

Dipterocarpus orinitus Dyer

altitude in tropical rain forests, sometimes occurs up to 600 m. altitude (khao luang in Nakhawn Srithamarat). It is closely allied to **D. gracilis Bi.**, and oftenly subjected to some confusion. It can be readily recognised by the oblong, obtuse wings of the fruits, and the yellow pilose hairs on the venation of the under surface of the leaves.

5. DIPTEROCARPUS CRINITUS

D. crinitus Dyer in Hook. f., Fl. Brit. Ind. 1. 296. 1872; Ridl., Fl. Mal. Penins. 1. 214. 1922; Heyne, Nutt, Pl. Ned. Ind. 2nd ed. 3. 273. 1926; van Slooten in Bull. Jard. Bot. Buitenz. Ser. 3. 288. 1927; Foxworthy, Mal. For. Rec. 10. 66. 1932; Symington, Mal. For. Rec. 16. 175. figs. 85, 89. 1943.

Lofty tree 30 m. high. Young twig and stipules clothed with long, spreading, brown stellate and pilose hairs. Stem sometimes fluted, bark grey.

leaves lanceolate, elliptic-lanceolate, margin entire, apex obtuse to short cuspidate or acuminate, base slightly cordate to obtuse, 8–17 cm. long, 5–5.7 cm. wide; secondary nerves 18 pairs, pubescent on both surface, often pink tinged when flesh; petioles 2–3 cm. long, clothed with brown, spreading, long, stellate hairs.

Flowers pink. Fruits smooth, ovate oblong, pointed at the base, 1–1.3 cm. across glabrous, glaucous; wings oblong, rounded tip, chartaceous, 7.5–8.5 cm. long, 1.8–2 cm. wide, glabrous, reddish brown when mature, the midrib is very conspicuous.

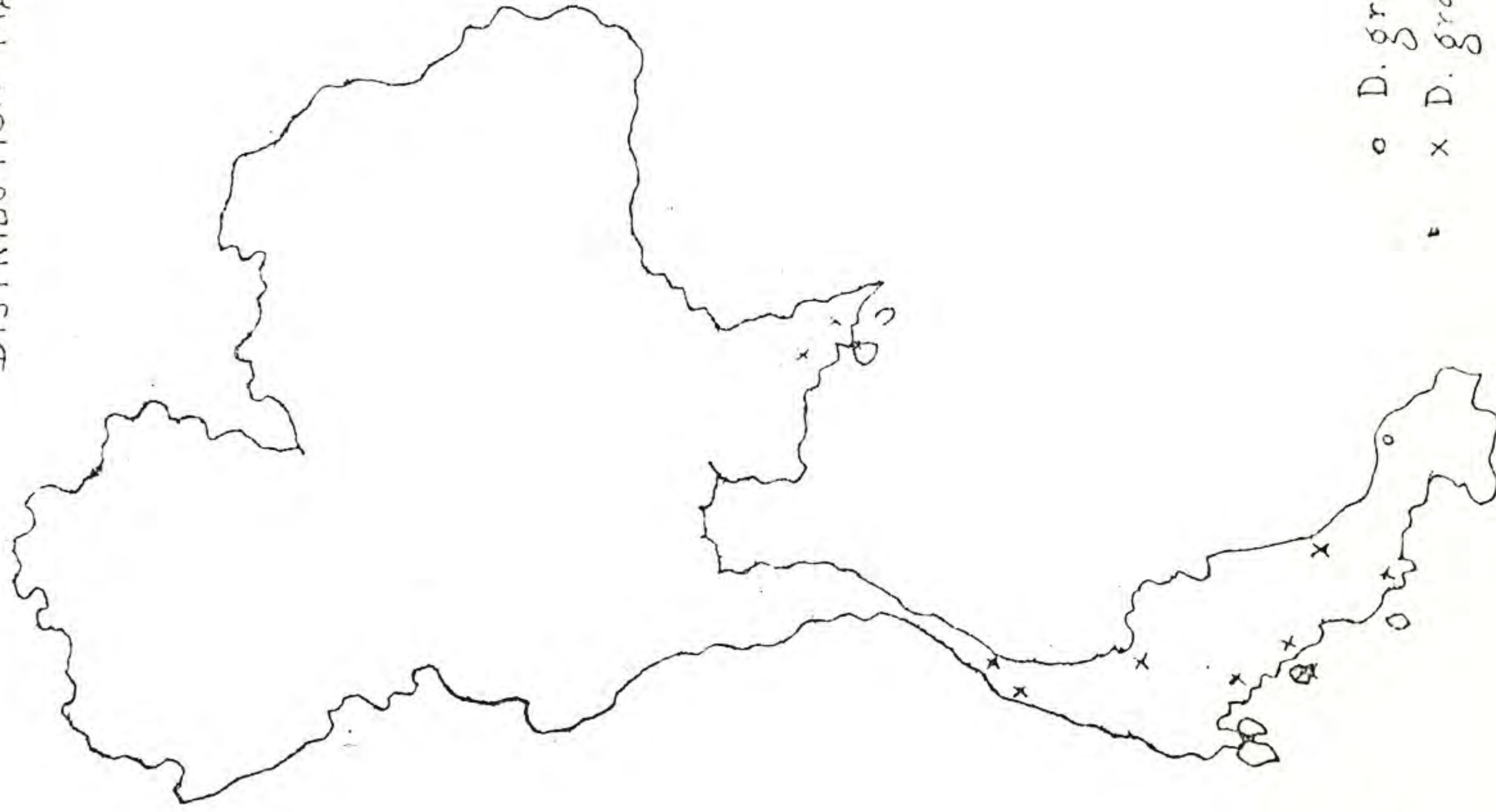
Peninsular : Pattani (ex Foxworthy).

Distribution : Malaysia.

Local name ; As there is no local name for this species, a coined up one is hereby proposed: YANG KHAL, pertaining to the long spreading stellate hairs.

DISTRIBUTION MAPS

III



o *D. crinitus* Dyer
x *D. dyeri* Perre

IV



o *D. gracilis* Bl.
x *D. grandiflorus* Blanco

So far no other record of the occurrence of this species in Thailand has been made except that of Foxworthy, the above description is being based on Symington's.

The tree is a tropical rain forest species, and occurs sporadically in the low-land of the Peninsular part, but sometimes found at the altitude of 500 m. (ex Symington). It seems to be a rare species in Thailand.

6. DIPTEROCARPUS DYERI

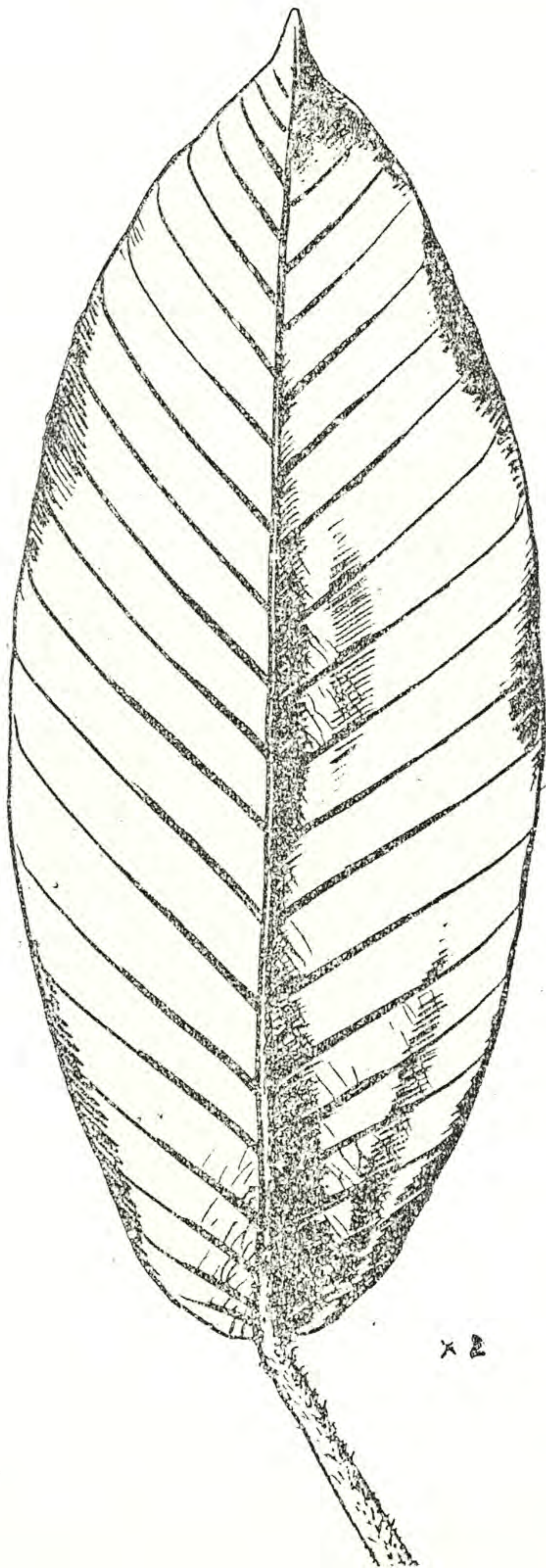
D. dyeri Pierre ex Lanessan, Pl. Utiles Col. Fr. 297. 1886; Pierre, Fl. For. Cochinch. 14. tt. 216, 217. 1889; Brandis in Journ. Linn. Soc. Bot. 31. 33. 1895; Guerin in Lecomte- Fl. Gen. Indo-Chine. 1. 363. 1910; Parker, Ind. For. Rec. 16. 13. pl. ix. 1931; Parkinson, Burm. For. Bull. 27. 15. pl. 9. 1932; Foxworthy, Mal. For. Rec. 10. 79. 1932; Symington, Mal. For. Rec. 16. 176. 1943; Tardieu-Blot, in Humbert, Suppl. Fl. Gen. Indo-Chine. 1. 340. 1943.

Lofty tree 30 m. or more tall with clear bole 20 m. or more up to the first branch, 200 cm. up in girth. Young twigs sparsely clothed with stellate hairs; stipules brown, pilose tomentose. Stem with grey, scaly bark, slightly buttressed.

Leaves large elliptic ovate, obtuse, crenate, 17 - 40 cm. long, 11 - 18 cm. broad; lateral nerves 18 - 22 pairs, glabrous on both surfaces except very sparsely pubescent along the midrib of the under surface; petioles 5.7 cm. long, glabrescent.

Flowers pink, calyx with 5 ridges on the tube, canescent. Fruits elliptic-ovate with 5 inconspicuous ridges on the upper half 2.8 - 3.5 cm. across; glabrous, often with white bloom; wings oblong, obtuse, chartaceous, 14 - 16 cm. long, 3.5 - 4 cm. wide,

Flowering from November to January; fruiting from December to August.



x 2



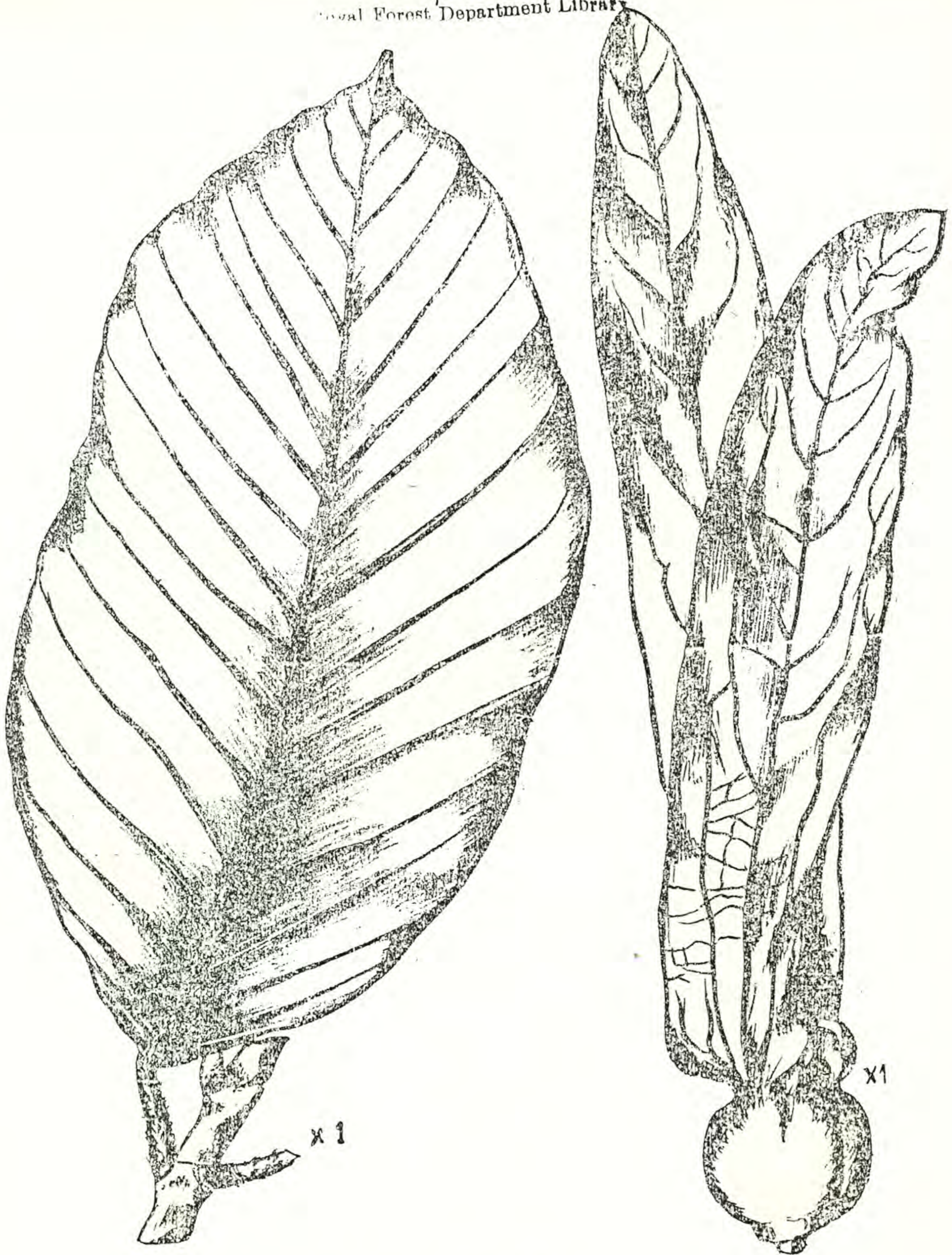
x 1

- South—Eastern :** Chanburi, Khao Sabap, **Kerr 9563 !** (BM, K), **10031 !** (K); **Smitinand 1816 !** Makham, Rong Sen, **Smitinand s.n. !** Na Ang, **Put 336 !, 356 !, 352 !** Trat, Baw Rai, **Kerr 10029 !** (BKK, BM, K); Khao Saming, **Kerr 9418 A !** (BKK, BM, K), **9418 !** (BKK, BM); Huay Raeng, Khao Maisi, **Smitinand 1400 !**
- South—Western :** Chumphawn, Siepyuan, **Kerr 16252 !** (BM, K); Ban Map Amarit. **Kerr 11433 !** (BKK, BM, K)
- Peninsular :** Surat, Kongta, **Seidenfaden 2486 !** (C); Bangbao, **Smitinand s.n. ! 2828 !**; Tha Kham, **Seng 23 !** Ranawng, La—un, **Kerr 16490 !** (BKK, BM, K) Krabi, Kaw Satow, **Kerr 12425 !** (BM, BKK). Trang, Kaw Libong, **Kerr s.n. !** (BM); Chawng, **Smitinand s.n. !**; Huay Yawt, Thale Sawnghawng, **Smitinand s.n. !** Songkhla, Amphur Khao Khaow, Rabil 282 ! (BKK, BM, K) Satul, Thung Wah, **Kerr 13892 !** (BKK, BM, K).
- Distribution :** Burma, Indo-China and Malaya.
- Local names :** YANG KLAUNG. Yang Tai (Trat); Yang Man Moo (Ranawng and Songkhla); Yang Sian (Surat); Yung (Chumphawn, Trang); Yung Dam (Krabi, Surat).

This is a typical low—land tropical rain forests species, occurs from 10—100 m. altitude from the sea level, sometimes found in savannahs (perhaps left over by the shifting cultivators). It is found associated with **D. baudii Korth.**, and can be readily recognised by the greyish white stem and the dense foliage of the crown. It has the largest fruit of all species found in Thailand. The natural regeneration is rather good.

7. DIPTEROCARPUS GRACILIS

D. gracilis Blume, van Slooten in Bull. Jard. Bot. Buitenz. Ser. 3. 8. 276. 1927; Symington in Gard, Bull. 9. 321. 1938 et Mal. For. Rec. 16. 176. 1943.



D. gracilis Bl.

D. Pilosus Roxb., sen su Parker, Ind. For. Rec. 13. 15. 1927.

D. vermicifluus Blanco, Fl. Filip. ed. 2. 314. 1905.

D. skinneri King, Ridley, Fl. Mal. Penins. 1. 214. 1922; van Slooten, ibid. 294; Craib, Fl. Siam. Enum. 1. 137. 1925; Foxworthy, Mal. For. Rec. 10. 70. 1932.

D. angustialatus Heim in Bot. Tidsk. 25. 43. 1903; Fischer in Kew Bull. 1926. 457; Guerin in Lecomte, Fl. Gen. Indo-Chine, 1. 365. 1910; Craib, ibid. 133.

D. Schmidtii Heim, ibid. 42; Guerin, ibid. 367; Craib, ibid. 135.

Lofty tree about 30 m. tall, 200 cm. up in girth; young twigs glabrescent to short yellow pilose pubescent; stipules yellow pilose tomentose. Stem slightly buttressed, bark brownish, scaly.

Leaves elliptic, slightly and distantly crenate, short acuminate, base obtuse, 11–23 cm. long, 5.5–8.5 cm. wide, lateral nerves 13–20 pairs, glabrous above, yellow pilose pubescent beneath, especially on the venation; petioles 2.5–4 cm. long, glabrescent to short yellow pilose pubescent.

Flowers pink, calyx pubescent; fruits 1–1.2 cm. diameter, sparsely pubescent; wings oblong, rounded tip, coriaceous, sttenuate toward the base, 10–13.5 cm. long, 1.8–2.5 cm. wide, sparsely pubescent, 3-nerved, only the median one runs up to the tip, the other two to the lower half of the wing.

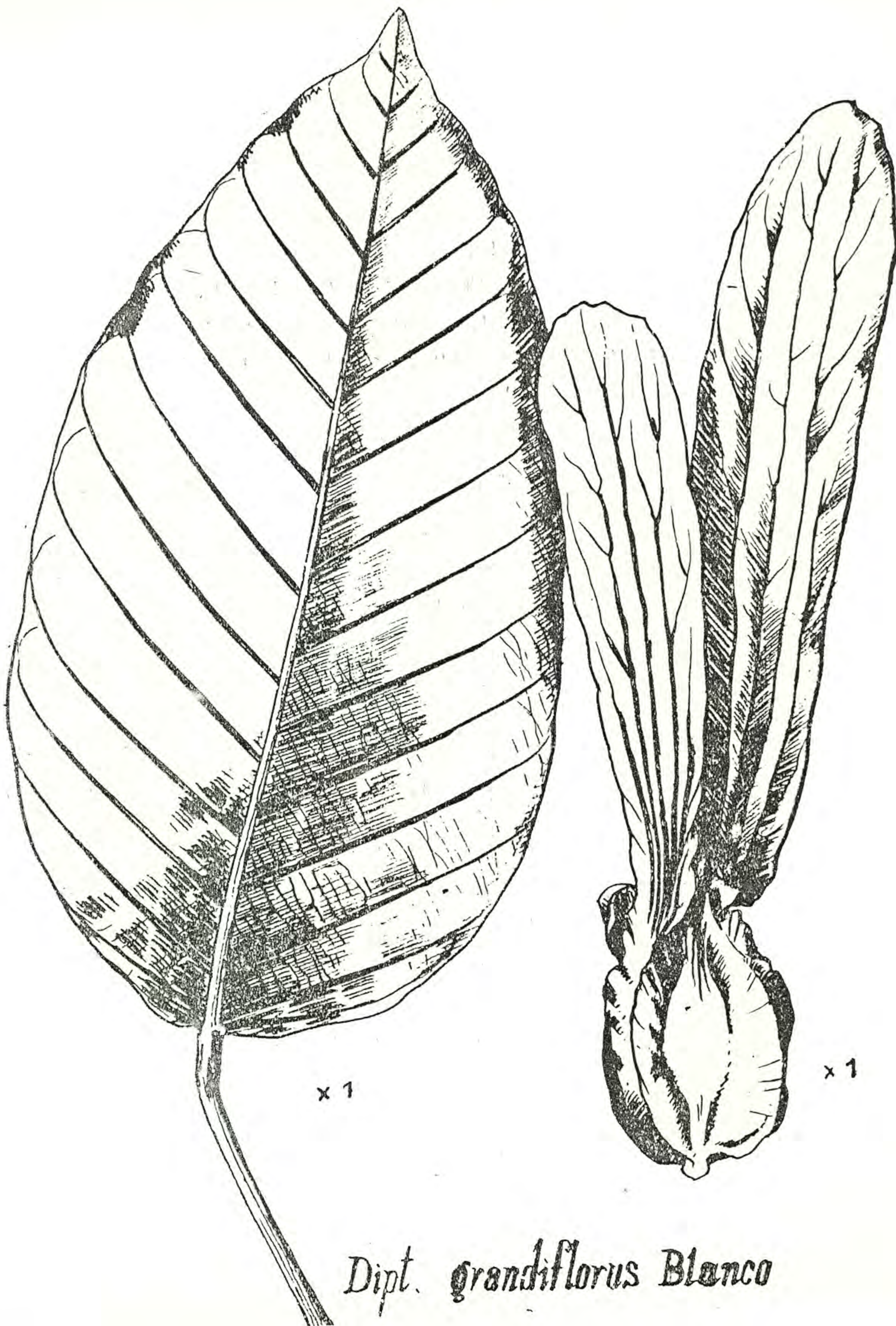
Flowering from February to April; fruiting from April to August.

South-Eastern: Rayawng, Ban Phae, **Put 2736!** (BKK, BM, K)

Chamburi, Pong Nam Rawn, Khao Soi Dao, Namtok Tat, **Bunnak 501!**

Trat, Kaw Chang, Khlawng, Son, **Schmidt 518!** (Type of *D. angustialatus* Heim, C); Laem Dan, **Schmidt 518!** (Type of *D. schmidtii* Heim, K); Khlawng Mayom, **Smitinand s.n. 2159!** Salak, Khawk, **Smitinand 2262!**

South-Western: Chumphawn, Tha San, **S.F. 3872!** (Hamid, K)



Dipt. grandiflorus Blanco

- Peninsular :** Ranawng, Lamlieng, **Kerr 11738!** (BM, K)
 Surat, Kaw Samui, **Kerr 12557!** (BKK, BN, K)
 Nakhawn Srithamarat, Khao Luang **Phloenchit 638!**;
Smitinand 2315! 2345!
 Phang Nga, Rai Chawng, **Kerr 17037!** (BKK, BM, K)
 Trang, Chawng, **Kerr 15187!** (BKK, BM, K); **Din 333!**
 Yala, Betong, **Kerr 7463!** (A, BKK, E, K), **7916!** (BM);
S F. 3874! (K)
- Distribution :** Burma and Malaysia.
- Local names :** YANG SIAN (Surat), Yung Huawaen, Yung (Phang Nga),
 Tial Kahawm (Khamer, Chanburi).

This is also a tropical rain forest species, found from the altitude of 10 – 600 m. It differs from **D. chartaceus** Sym. by the narrow, nearly cuneate base of wings, which are also thickened in texture.

8. DIPTEROCARPUS GRANDIFLORUS

D. grandiflorus Blanco, Fl. Filip. ed. 2. 314. 1845 et ed. Naves, 2. 218. t. 263. 1871; Burck in Ann. Jard. Bot. Buitenz. 6. 201. 1887; Brandis in Journ. Linn. Soc. Bot. 31. 37. 1895; Ridl., Fl. Mal. Penins. 1. 216. 1922; Craib, Fl. Siam. Enum. 1. 134. 1925; van Slooten in Journ. Bull. Jard. Bot. Buitenz. Ser. 3.8. 333. 1927; Parker in Ind. For. Rec. 16. 5. pl. VII. 1931; Foxworthy, Mal. For. Rec. 10. 87. 1932; Symington, Mal. For. Rec. 16. 178. 1943.

D. blancoi Bl., Mus. Bot. 2. 35. 1892.

D. motleyana Hk. f., Trans. Linn. Soc. 23. 159. 1860; DeCandolle, Prodr. 16 part 2. 611. 1868.

D. griffithii Miq., Annales 1. 213. 1863–4; DeCandolle, ibid. 612; Dyer in Hk. f., Fl. Brit. Ind. 1. 299. 1874; Kurz, For. Fl. Brit. Burm. 1. 116. 1877; Brandis, ibid. 37.

D. pterygocalyx Scheff., Nat. Tijdschr. Ned. Ind. 31. 347. 1870 :
Dyer, ibid. 298.

Lofty tree 20 – 35 m. tall, clear bole up to 20 – 25 m. to the first branch; 200 cm. up in girth. Young twigs and stipules canescent.

Leaves elliptic ovate, short acuminate, slightly crenate, 13 – 24 cm. long, 8 – 14 cm. wide; lateral nerves 15 – 17 pairs, glabrous; petioles canescent, later glabrous, 4 – 5.5 cm. long.

Flowers pink, calyx with 5 ridges, glaucescent. Fruits ovate to ovate-oblong, with 5 wavy ridges, 3 – 5 cm. across, glabrous; wings oblong obtuse, horny, 15 – 18 cm. long, 3.5 – 4.5 cm. broad, glabrous.

Flowering from January to February; Fruiting from January to July.

South-Western: Chumphawn, Ban Map Amarit, Kerr 11432! (A, BKK, BM, E, K).

Peninsular : Ranawng, Lamlian, Kerr 11776! (A, BKK, BM, K).
Nakhawn Srithamarat, Khao Ram, **E. Smith 390!** (BKK, BM);
Chawang. Rai Tok, **Snan 653!**, Huay Yuan, **Snan 635!**
Trang. **Vanpruk 817!** (K); Chawng, **Kerr 15184!** (A, BKK, BM, E, K); **Smitinand 2995**; **R.F.D. Thailand 12779!**;
12796, **Put 259!**; **173!**; **Kaw Libong**, **Kerr s.n.!** (BM);
Kantag, Khuan Nang Hong, **R.F.D. Thailand 15193!**;
15197!; **Put 310!**
Satul, Adang, **Kerr 14007!** (A, BKK, BM, K),
Yala, Banang Sta, **Kerr 7420!** (A, BKK, BM, K).

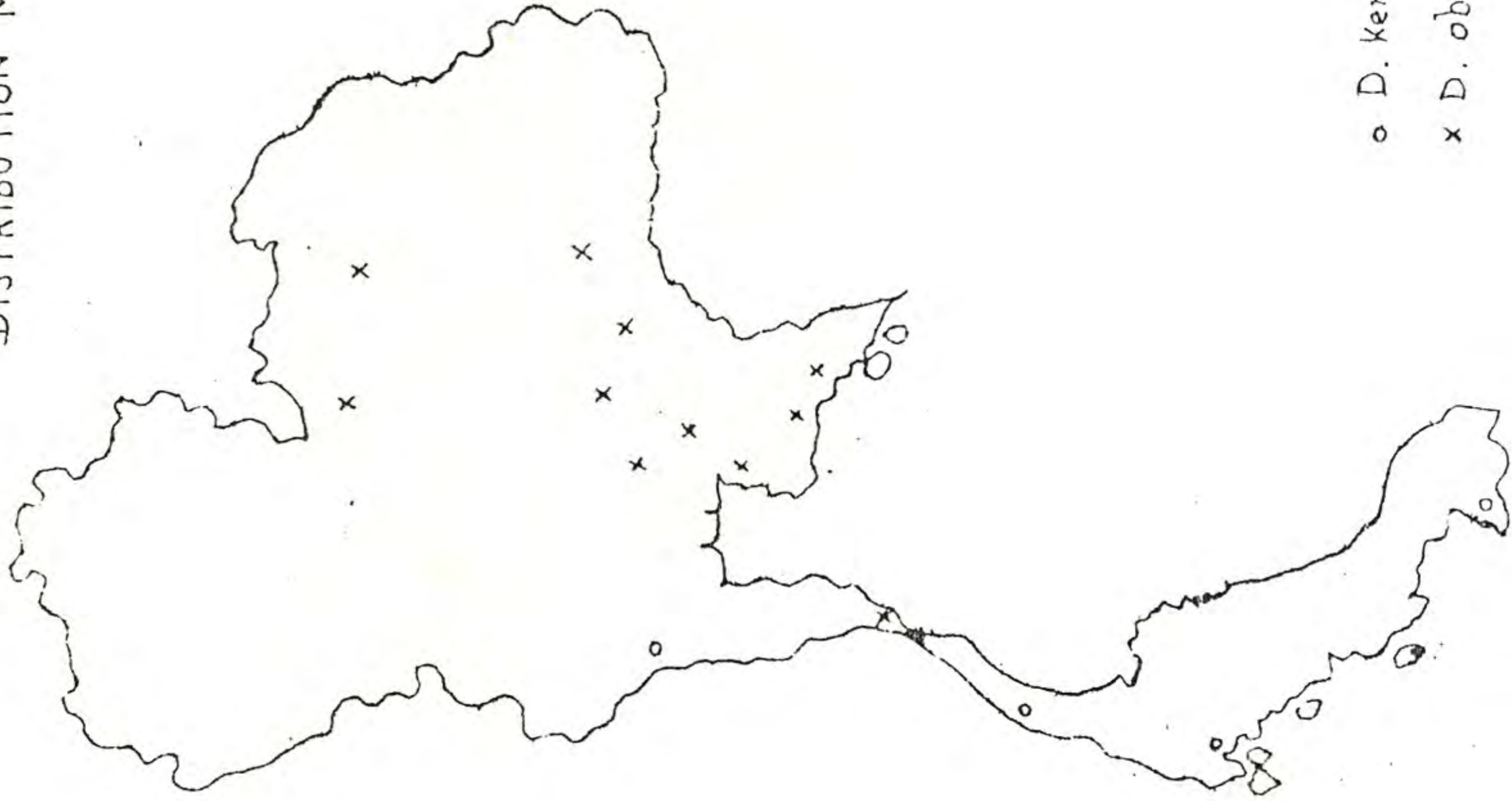
Distribution : Burma and Malaysia.

Local names : Yang sian (Ranawng); Yang tang (Chumphawn); Yang man mu, Yang (Trang); **YANG YUMG** (Surat, Trang); Yang hua waen (Srithamarat, Trang).

The species occurs from 20 – 300 m. altitude in the tropical rain forests. In the district of Surat, where it is very common, wood oil is being tapped. It is always associating with **D. alatus Roxb.** in the lowland.

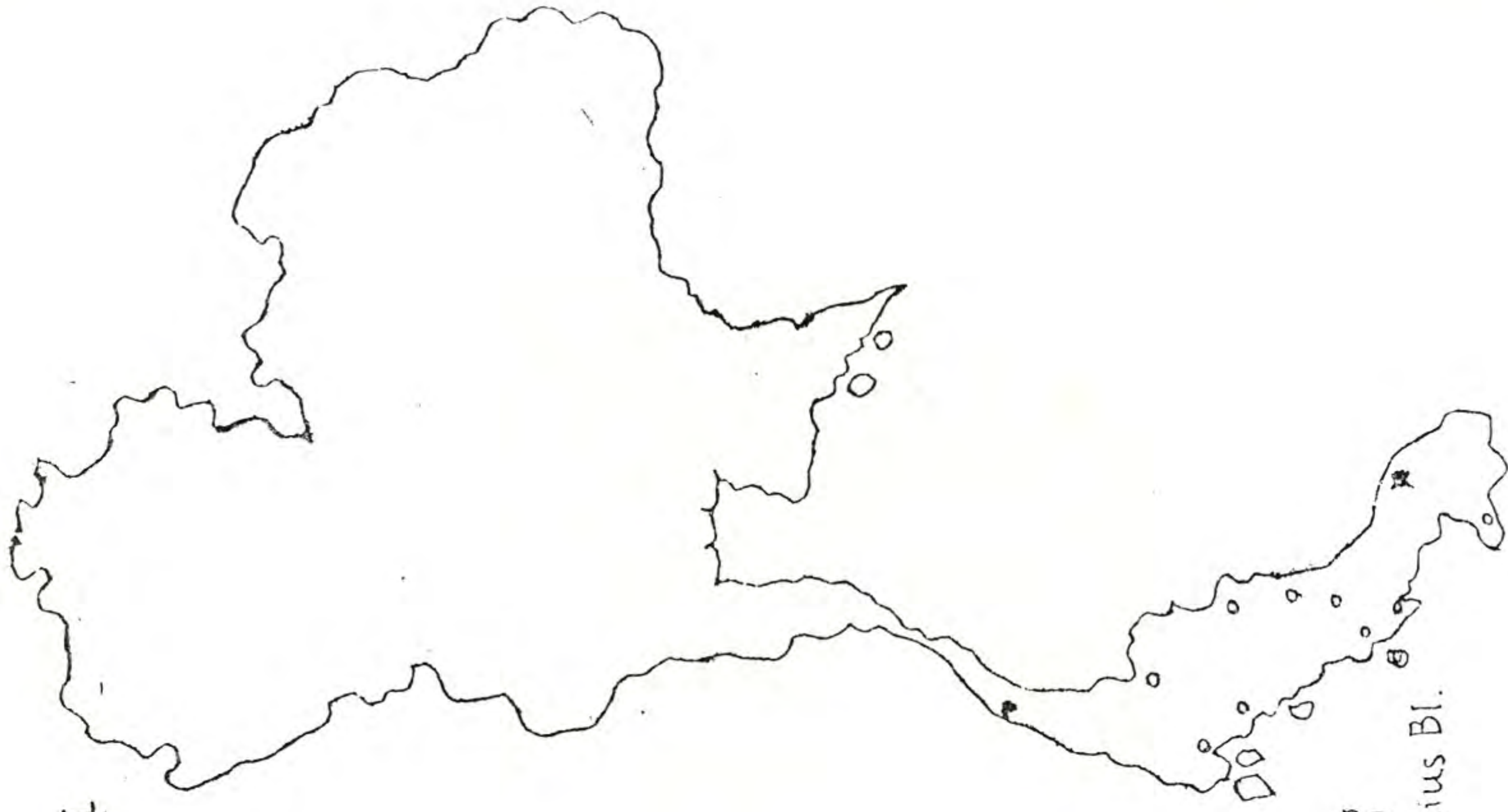
DISTRIBUTION MAPS

V



o *D. hasselti* Bl.
x *D. intricatus* Dyer

VI



o *D. kerrii* King
x *D. oblongifolius* Bl.

9. DIPTEROCARPUS HASSELTII

D. hasseltii Bl., Fl. Jav. 2. 22. t. 6. 1828 – 29; Ridley in Journ. Str. Br. R. As. Soc. 33. 42. 1900 et 34. 94. 1900; Craib, Fl. Siam. Enum. 1. 135. 1923; van Slooten in Bull. Jard. Bot. Buitenz. Ser. 3. 8. 280. 1927; Foxworthy, Mal. For. Rec 10. 67. 1932; Symington, Mal. For. Rec. 16. 180. 1943.

D. kerrii Craib, *ibid.* 135, in part (non King).

Lofty tree 20 – 30 m. tall, 200 cm. up in girth. Young twigs and stipules drying black, glabrous, glaucescent.

Leaves drying brown, elliptic to elliptic ovate, short acuminate, crenat; 10 – 14 cm. long, 4.5 – 9.0 cm. wide; secondary nerves 10 – 16 pairs; petioles drying black, glabrous, glaucescent, 2 – 3.5 cm. long.

Flower pink, glabrous, glaucescent. Fruits globose, 3 cm. across, glabrous, lenticellate; wings oblong, tip rounded, coriaceous, glabrous 14–16 cm. long, 2.5 cm. wide.

Flowering from November to February; fruiting from March to July.

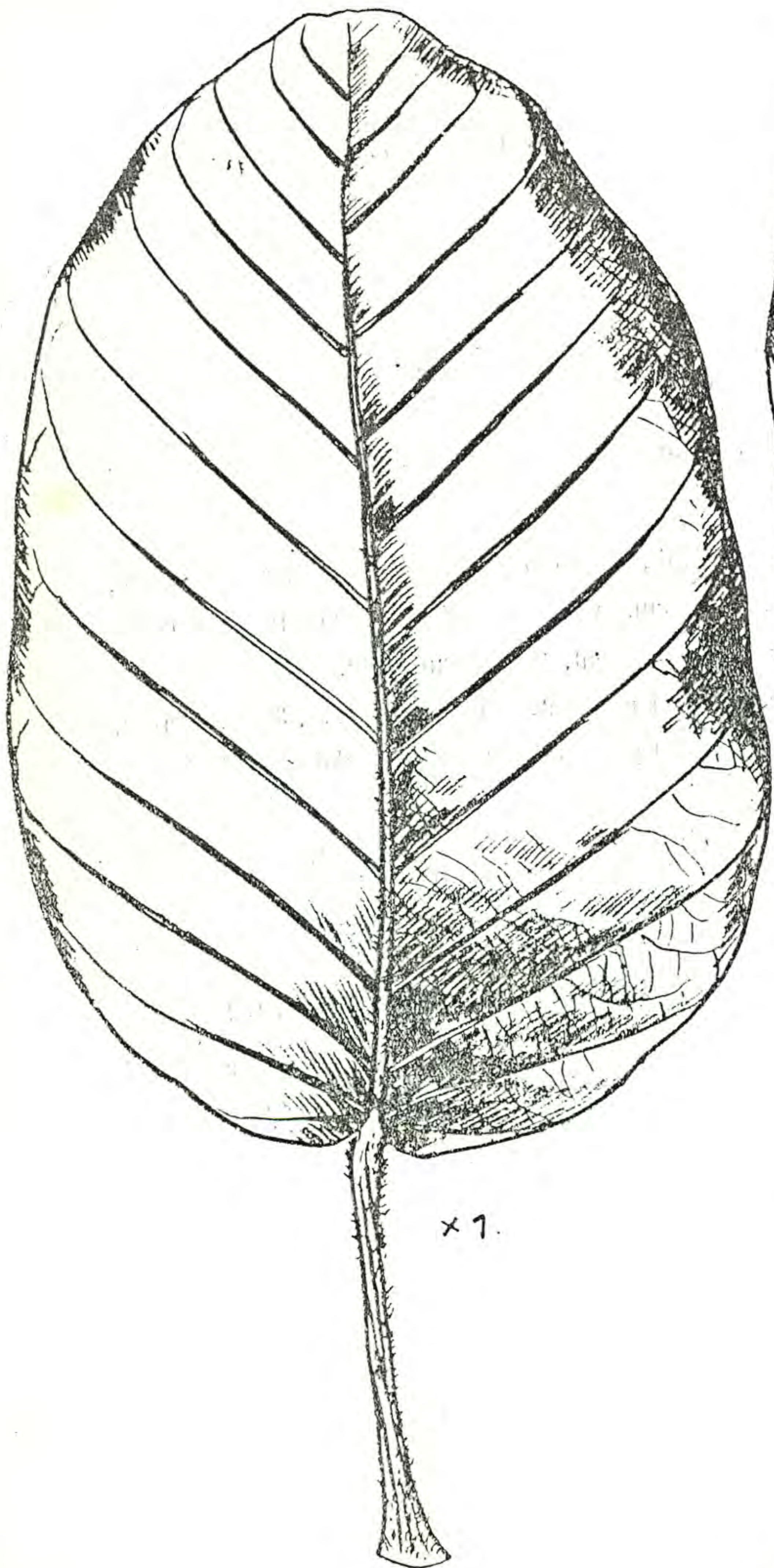
South-Western, Kanburi, Wang Khanai, **Marcus 2184!** (A).

Peninsular: Ranawng, Khao Phawta Chongdong, **Kerr 16745!** (BKK, BM, K). Phang Nga, Khao Kathakhwam, **Kerr 18493!** (BKK, BM, K). Khao Bang To, **Kerr 17208!** (BKK, BM, K), Yala, Banang Sta, **Kerr 7349!** (A, BKK, BM, K)

Distribution: Malaysia.

Local names: Dama Lamaw Bobi (Malay, Yala). The Malay name literally means "Hog-fat resin", in Thai equivalent = Yang Man Moo. A preferred name is : YANG KLIANG, pertaining to the glabrous characters of the tree.

The species is a native of the hill tropical rain forest, and found from 100 – 900 m. altitude. It is rather rare and closely allied to *D. kerrii* King, and Perhaps a form of it.



D. t. commun intricatus Dyer

10. DIPTEROCARPUS INTRICATUS

D. intricatus Dyer in Journ. Bot. 12. 105. t. 145. fig. 21. 1874; Pierre Fl. For. Cochinch. t. 215. 1889; Brandis in Journ. Linn. Soc. 31. 39. 1896; Guerin in Lecomte, Fl. Gen. Indo-Chine, 1. 360. fig. 34, 1930; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine, 1. 340. 1943. excl. var. *glabra*.

Tree 20 – 25 m. tall, 150 cm. up in girth. Young twigs and stipules clothed with yellow stellate tomentose. Bark greyish brown, thick, ligneous, longitudinally furrowed.

Leaves ovate, entire, cordate, obtuse or rounded at the apex, 12–18 cm. long, 8.5 – 14 cm. wide, pubescent on both surfaces, stellate tomentose along the venation; petioles 2 – 3.5 cm. long, yellow stellate tomentose.

Flowers red, calyx with 5 undulate ridges, glabrous; fruits globose 2 cm. across with five transversely plicate accrescent ridges completely obscuring the tube. glabrous; wings oblong obtuse, chartaceous, glabrous 6 x 1.5 cm.

Flowering from November to December; fruiting from November to August.

North-Eastern: Udawn, **Kerr 8589!** (A, BKK, BM, E, K).

Loei, Wang Saphung, Sithan, **Din 120!**

Eastern: Buriram, Nang Rawng, **Kerr 8216!** (A, BKK, BM, E, K),

T. Klinsukhon 12!; Krabinburi, **R.F.D. Thailand 13618!**

Yan Ri, **R.F.D. Thailand 449!**

Nakhawn Rachasima, Huay Thlaeng, **Put 2235!** (A, BKK, BM, K), **2255!** (A, BKK, BM, K); Ban Chumsaeng, **Noe 258!**

(A, BKK, BM, E, K). **Witt s.n.!** (K); Non Sung, Chak Karat **R.F.D. Thailand 440!**

Srisaket, **Kerr s.n.!** (BKK, BM),

Surin, **Put 641!** (A, BKK, BM, K).

South-Eastern: Prachinburi, Phanom Sarakham, **R.F.D. Thailand s.n.!**

Aran Prathet, Nawng Waeng, **Put 52!**

Cholburi, Sriracha, **Kerr 4376!** (A, BM, K). **Collins 763!** (A, BM, K).

Rayawng, Ban Phae, **Put 2701!** (A, BM, E, K).

Chanburi, Makham, Ban Ang, **Put 208!, 402!**; **R.F.D.**

Thailand 12617!; Chit 361!

South-Western : Prachuap Khirikhan, Hua Hin, Pak Thawan, **Ladell 206!**
(A. BKK, K); Thung Luang, **Kerr 20634!** (BKK, BM).

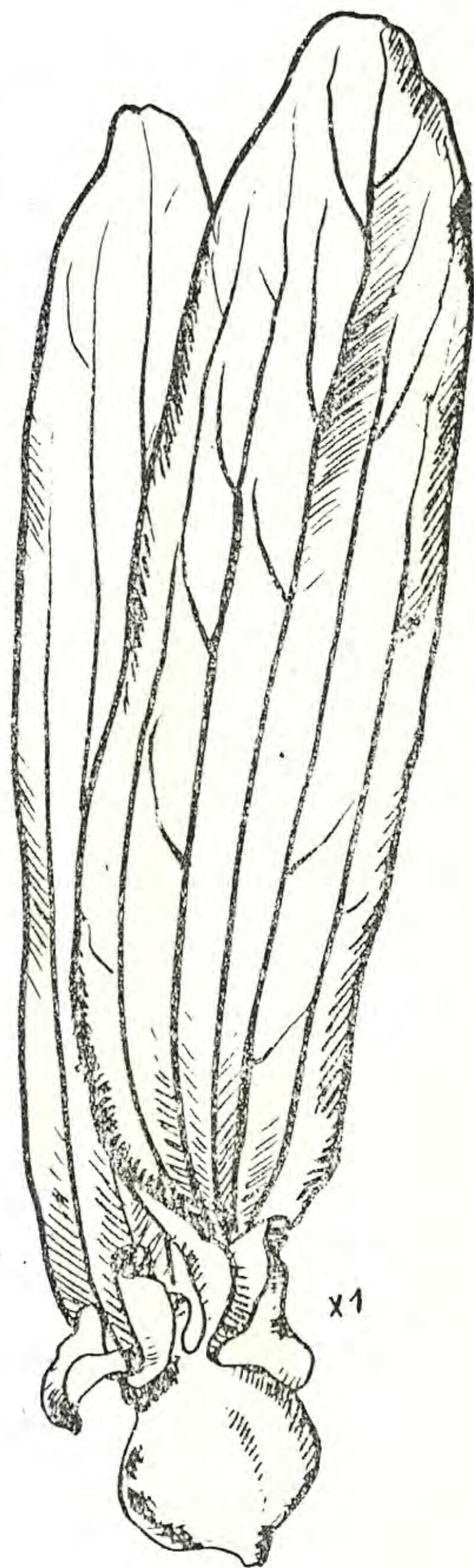
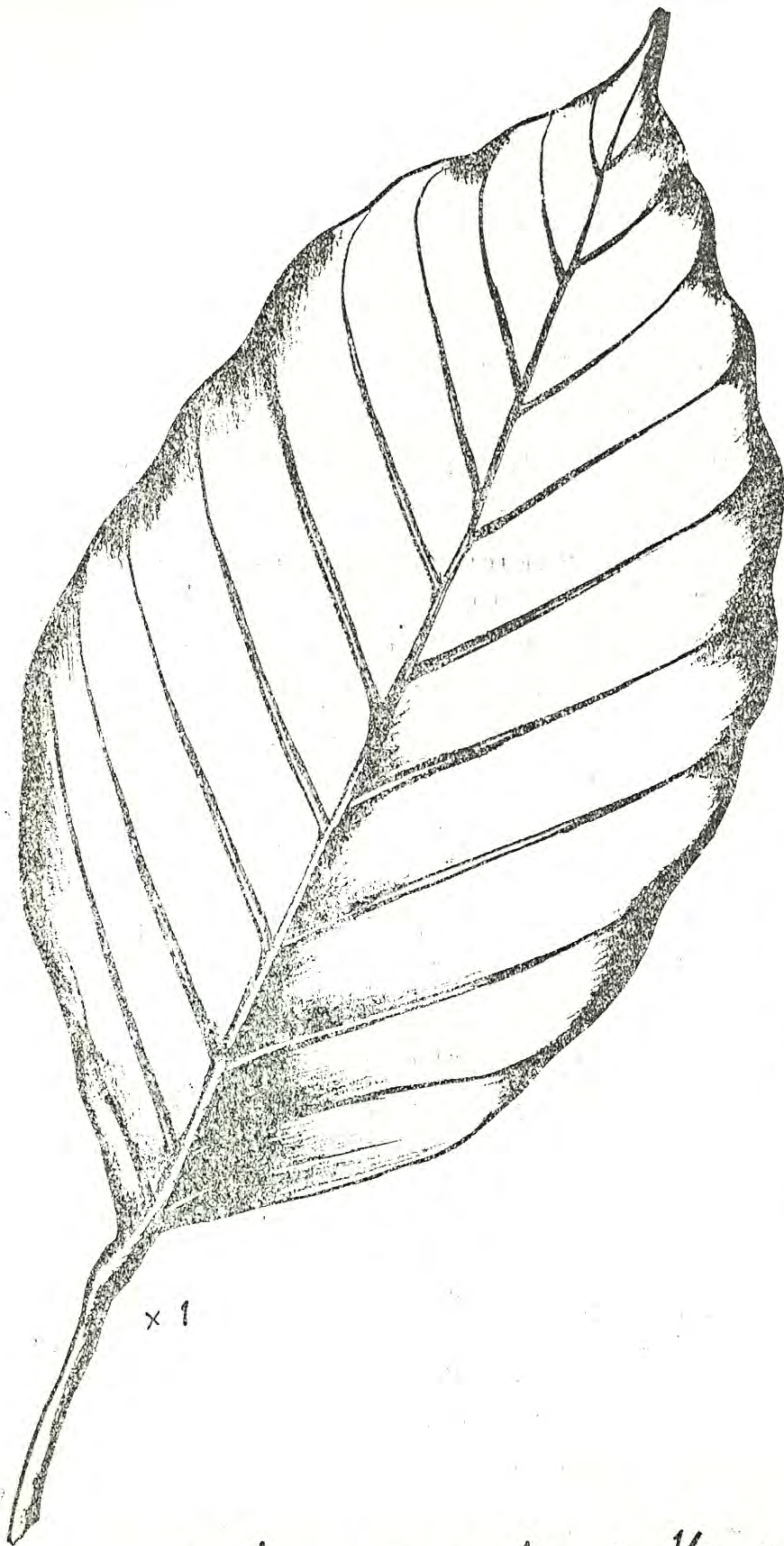
Distribution : Sabaeng (Udawn); Chabaeng, Yang hieng (Prachinburi);
Krat (Buriram, N. Rachasima); Tat (N. Rachasima);
Lang (Cholburi); Hueang (Rayawng); Hieng nam man
(Prachuap Khirikhan); Hieng (Buriram); **YANG KRAT**
(Preferred name).

This is a species belonging to open dry deciduous forests of the altitude from 10 — 200 m. It always associates with **D. obtusifolius Teijsm.**, which can be readily recognised by the dark foliage and stem, and the smooth fruits. The tree fruits freely and abundantly, the wings are bright red in colour; with greyish bark and bright red wings of its fruits, the tree looks remarkable indeed. 3-winged fruits are not uncommon in this species, the third wing is a little shorter than the other 2. The regeneration is rather fair. The soil is either salty or acid.

11. DIPTEROCARPUS KERRII

D. kerrii King in Journ. R. As. Beng. 62. part. 2. 93. 1893; Brandis in Journ. Linn. Soc. Bot. 31. 28. 1895; Ridley, Fl. Mal. Penins. 1. 215. 1922. in part; Craib, Fl. Siam. Enum. 1. 136. 1925. in part; van Slooten in Bull. Jard. Bot. Buitenz. Ser. 3. 8. 295, 1927; Parker, Ind. For. Rec. 16. 15. pl. x. 1931; Symington, Mal. For. Rec. 16. 181. 1943; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine 1. 336. 1943. in part.

Lofty tree about 35 m. tall, 200 cm. up girth. Young twigs and stipules drying blackish brown; stipules silky tomentose inside.



Dipterocarpus kerrii King

Leaves drying brown, elliptic, obviously and distantly crenate at least towards the upper part, short cuspidate, 8.5 – 15 cm. long, 5 – 7.5 cm. broad, both surfaces glabrous; secondary nerves 9 – 12 pairs; petioles drying blackish brown, 2.5 cm. long, glabrous.

Flowers pink, calyx smooth, glabrous, glaucescent. Fruits fusiform to globos smooth, glaucescent, oftenly lenticellate, 1.8 – 2 cm. across. Wings oblong, tip rounded coriaceous, glabrous, 12 x 2.5 cm.

Flowering from December to February; fruiting from April to July.

Peninsular : Ranawng, Lamlieng, **Kerr 16442!** (BKK, BM, K); Nam Chuet, **Kerr 11703!** (BKK, BM, K).

Surat, Bandawn, **R.F.D. Thailand 877!**; King Phanom, **Kerr 19347!** (BKK, K); Ban Na Seng 8!; **R.F.D. Thailand 13614!**; Huay Rakmai, **R.F.D. Thailand 443!**; Put s.n.!; Bangbao, **R.F.D. Thailand 14144!**

Smitinand 2831!; Khiensa, **Snan 339!**, Phang Nga, Rai Chawng, **Kerr 17544!** (BKK, BM, K); **S.F. 3879!** (**Hanif fet Nur**). Nakhawn Srithamarat, Ban Natawn, **Kerr 15640!** (BKK, BM, K); Sichon, **Kerr s.n.!** (BKK, BM). Rawn Phibul, Bang Yuan; **Snan 671!**

Phatalung, Nawong, **Kerr 15326!** (BKK, BM, K).

Krabi, Kaw Pu, **Kerr s.n.!** (BKK, BM).

Trang, Kaw Libong, **Kerr s.n.!** (BKK, BM); Chawng Put 258!; **R.F.D. Thailand 12726!**; Huay Yawt, Thale Sawnghawng, **R.F.D. Thailand 12726!**; Huay Yawt, Thale Sawnghawng, **R.F.D. Thailand 15734!**; Kantang, **R.F.D. Thailand 14436!**

Satul, Thung Wah, **Kerr 13915!** (BKK, BK, K).

Yala, Betong, **Kerr 7438!** (A, BKK, BM, K).

Distribution : Lower Burma and Malaysia.

Local names : Yang Sian (Ranawng, Surat N. Srithamarat); Yang (Phang Nag);

Yang Man Sai (Satul, Trang); Yang Wat (N. Srithamarat);
 YANG MAN MU (Krabi, Trang); Yang Man Khon (Trang).

This is a common species of the tropical rain forests in the lowland, sometimes found in bamboo and scrub forests near the sea level. The highest altitude so far recorded, is 400 m. It is tapped for oil.

The natural regeneration of this species is fairly good. The young trees have narrower leaves, the margin entire or wavy.

12. DIPTEROCARPUS OBLONGIFOLIUS

D. oblongifolius Bl., Mus. Bot. 2. 36. 1852; King in Journ. R. As. Beng. 62. 95. 1893; Ridley, Fl. Mal. Penins. 1. 216. 1922; Craib, Fl. Siam. Enum. 1. 136. 1925; van Slooten in Bull. Jard. Bot. Buitenz. Ser. 3. 8. 338. 1927; Foxworthy, Mal. For. Rec. 10. 86. 1932; Symington, Mal. For. Rec. 16. 184. 1943.

D. pulcherrima Ridl. in Trans. Linn. Soc. Ser. 2. 3. 1893.

Tree of poor shape, stem gnarled and twisted. Young twigs and stipules drying blackish brown, glabrous, lenticellate.

Leaves elliptic to elliptic-oblong, entire, base obtuse, caudate acuminate, 10–20 cm. long, 3–7.5 cm. broad; nerves 12–15 pairs, glabrous on both surfaces; petioles drying blackish, 1.5–2.5 cm. long, glabrous.

Flowers pinkish, calyx fusiform, densely fusco-tomentose, 5-ridged. Fruits elliptic oblong with 5 undulate ridges running down from top to base, 1–1.5 cm. across, yellow stellate pubescent, wings elliptic, obtuse, 9–11 cm. long, 1–1.5 cm. wide, pubescent.

Peninsular : Pattani, Saiburi, **Down** (ex Ridley et Craib).

Distribution : Malaya, Borneo.

Local name : There is no evidence of any local name for this species, therefore a preferred one is proposed: YANG KHLAWNG. Khlawng in the peninsular dialect means water way.

The species is a riparian, found along bank of rocky streams. It is not common, so far only once recorded from Thailand. Seedlings have very narrow leaves, adapted for the riparian habit.

13. DIPTEROCARPUS OBTUSIFOLIUS

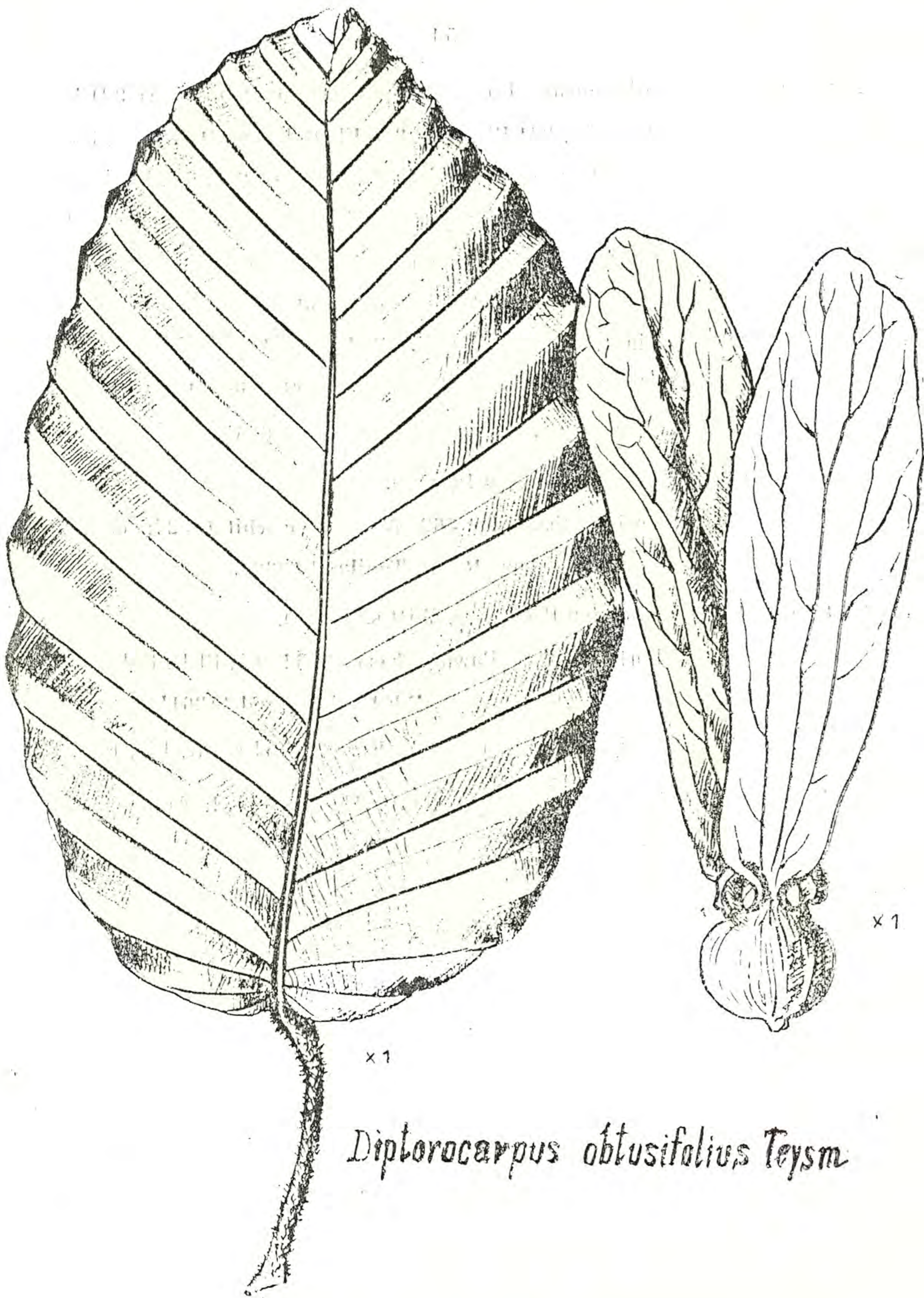
D. obtusifolius Teijsm. in Miquel, Ann. Bot. Lugd. Bat. 1. 214. 1863–64; Dyer in Hook. f., Fl. Brit. Ind. 1. 295. 1872; Kurz, For. Fl. Brit. Burm. 1. 115. 1877; Pierre Fl. For. Cochinch. tt. 222, 223. 1889; Brandis in Journ. Linn. Soc. Bot. 31. 27. 1895 et Ind. Trees, 65. 1910; Guerin in Lecomts, Fl. Gen. Indo-Chine, 1. 358. fig. 34. 1910; Ryan et Kerr in Journ. Siam Soc. 8. 3. 1911; Craib, Fl. Siam. Enum. 1. 136. 1925.

Tree about 20 m. tall, up to 150 cm. girth, erect, crown rounded with dark foliage. Young twigs and stipules clothed with long, shaggy, fulvous, stellate hairs. Bark greyish brown, ligneous, longitudinally and shallowly furrowed; cut yellowish brown, about 1 cm thick.

Leaves obovate to ovate-oblong, margin undulate, hairy, cordate or cuneate at the base, obtuse or rounded at the apex, 15–22 x 9–15 cm; lateral nerves 11 pair tomentose along the midrib on the upper surface, pilose tomentose underneath; petioles 3–4 cm. long, fulvous, shaggy tomentose.

Flowers pink, calyx fulvous, shaggy tomentose, to glabrous. Fruits globose 2–3 cm. across, glabrous to glabrescent; wings oblong-spathulate, coriaceous, 12 x 2.5 cm.; puberulous with stellate hairs to glabrous.

Flowering from November to January; fruiting from February to June.



Diptorocarpus obtusifolius Teysm

- Northern :** Chiengmai, Doi suthep, **Thawngba s.n.!** **Kerr 931!**
 (BM, K), **931 B!** (BM), **931 F!** (BM, K) **931 G!** (BM, K)
931 H! (BM, K). **s.n.!** (BM); **Hosseus 298!** (A, BM, K);
 Mae Taeng, **Kerr s.n.!** (BKK); Chiengdao, **Smitinand**
2734!; 2719!; Mae Rim, **R.F.D. Thailand 15807!**
 Chiengrai, Chiengkham, **Smitinand 1624!**
 Phrae, Huay Muang, **S. Pholchand 19!**
 Phetchabun, Lomsak, Huay Wah, **Smitinand 2715!;** Na
 Phawsawng, **Smitinand 2644!;** **Dee 625!**
- North-Eastern :** Udawn, **Kerr s.n.!** (BKK).
 Loei, Sithan, **Dee 562-A!;** **Phloenchit 1362!;** on trail
 Loei-Petchabun, **R.F.D. Thailand 12329!**
- Eastern :** Nakhawn Rachasima, **Witt s.n.!** (K).
 Buriram, Nang Rawng, **Kerr 8213!** (A, BKK, BM, E, K).
 Srisaket, Kanthrarom, **R.F.D. Thailand 11261!**
 Chaiphum, Khawn San, **Kerr 29175!** (BKK, BM, K)
- South-Eastern :** Prachinburi, Krabin, **R.F.D. Thailand 447!;** Aran Prathet,
Put 8!
- South-Western :** Phetburi, Bang Rong, **Kerr 20617!** (BKK, BM); Noen
 Nawng Kop, **Vanpruk 2**
- No exact locality :** Mea laen, **Kerr s.n.!** (BM); **Haase s.n.!** (BM); **R.F.D.**
Thailand 469!, 445!, 451!
- Distribution :** India, Burma and Indo-China.
- Local names :** Krat (Phrae, Aran Prathet), Sat (Phetchabun, Prachinburi),
 Ta, baeng (N. Rachasima); Tat (Chaiphum), **Hieng**
 (Chiengmai, Phetcuri), Phluang (Srisaket). **YANG HIENG**
 (Preferred name).

This is a xerophytic species but sometimes found in localities subjected to periodical inundation, in evergreen forests (**Smitinand 2644**) and in pine forests. It can be detected from other xerophytic species by its rounded, dense, dark foliage crown. The natural regeneration is fairly good, and usually forms a purestand. The tree coppices well, and occurs from 200 – 600 m. altitude.

VAR. VESTITUS

D. obtusifolius Teijsm., var. *vestitus* (Vesque) Smitinand in Thai For. Bull. (Bot.) 1.5 1954.

D. vestitus Vesque, Wall. Cat. No. 954, nomen; Dyer in Hook. f., Fl. Brit. Ind. 1. 295. 1875.

D. obtusifolius Teijsm., var. *glabricalyx* Smitinand in Thai Forest Bulletin (Bot.) 1. 1954.

Characters of the type species differ only the canescent stipules grey tomentose young twigs and petioles, and calyx tube glabrous to glabrescent.

Northern : Phrae, Mae Haet. **Vibulwanakit 17!, 101!**

North-Eastern : Loei, Sithan, **Smitinand 1219!, s.n.!, Dee 462!**

(Type of **var. glabricalyx** Smitinand).

Central : Saraburi, Dan Kaunthot, **Anuwatwanarak 71! (BKK).**

South-Eastern : Chanburi, Makham, **Kerr 9578! (A, BM, K), Lakshnakara 467! (BKK, BM, K).**

Peninsular : Satul, Tola, **Kerr 13863! (BKK, BM, K).**

Distribution : Burma and Indo-China.

Local names : Hieng (Chanburi, Loei, Satul).

VAR. SUBNUDUS

D. obtusifolius Teijsm., var. *subnudus* Ryan et Kerr in Journ. Siam Soc. 8. 3. 1911; Craib, Fl. Siam. Enum. 1. 137. 1925; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine, 1. 338. 1943; Symington, Mal. For. Rec. 16. 184. 1943.

D. punctulatus Pierre; Fl. For. Cochinch. 1889.

Characters of the typical species differ only in the glabrous and lenticellate young twigs, glabrous stipules and partly tomentose or glabrous petioles.

- Northern :** Chiengmai, Doi Suteh, **Kerr 931 A!** (BM, K), **931 C!** (BM, K), **931 D!** (BM, K), **931 K!** (BM, K), **931 Y!** (BM).
Phrae, **Vanpruk 126!** (A, K); Huay Khamin, **Suvarnathat 46!**, **Thatthiemrom 18!**, **Unhanand 2!**
Lampang, Ngao, Mae Huat, **Smitinand 1573!**
Nakhawn Sawan, Tham Phadaeng, **Hosseus 147!** (A, BM, C. K).
- South-Eastern :** Trat, Khao Kuap, **Kerr 17717!** (BKK).
- South-Western :** Kanburi, Wang Khanai, **Marcen 2184!** (A).
Prachuap Khirikhan, Khan Kradao, **Put 2300!** (BKK, BM, K).
- Peninsular :** Satul, **Kerr 14260!** (BKK, BM, K).
- Without exact locality :** R.F.D. Thailand **444!**, **445!**
- Distribution :** Burma, Indo-China and Malaya.
- Local Names :** Hieng (Phrae).

14. DIPTEROCARPUS RETUSUS

D. retusus Blume, Cat.'s, Lands Plantentuin, 77. 1823; Heyne, Nutt. Pl. Ned. Ind. ed. 2. 1097. 1926; van Slooten in Bull. Jard. Bot. Buitenz. Ser. 3. 8. 286 1927; Foxworthy, Mal. For. Rec. 10. 60. 1932; Symington, Mal. For. Rec. 16. 186. 1943.

Lofty tree about 30 m. tall. Young twigs glabrous, lenticellate; stipules brown villous.

Leaves broad elliptic, margin undulate, base rounded, apex cuspidate, 19 – 24 cm. long, 11 – 14 cm. wide, glabrous on both surfaces; lateral nerves. 20 pairs; petioles 6 cm. long, sparsely pilose.

Fruits ovate-oblong to globose 2.5 cm. across, smooth, glabrescent; wings spathulate-oblong, apex truncate or retuse, 17 x 3.5 cm., coriaceous, puberulous with stellate hairs.

Peninsular : Krabi, Phanom Benja, **Kerr 18753!** (BKK, BM, K).

Distribution : Malaya and Indonesia.

Local name : A preferred name is coined: YANG KHUAN, pertaining to its habitat, KHUAN=mountain in the peninsular dialect.

This is a species of the hill tropical rain forests. It seems to be a rare species, as is only once recorded from Thailand. The closely allied species is **D. baudii Korth.**, which the main difference is the stellate hairy of the leaves.

15. DIPTEROCARPUS TUBERCULATUS

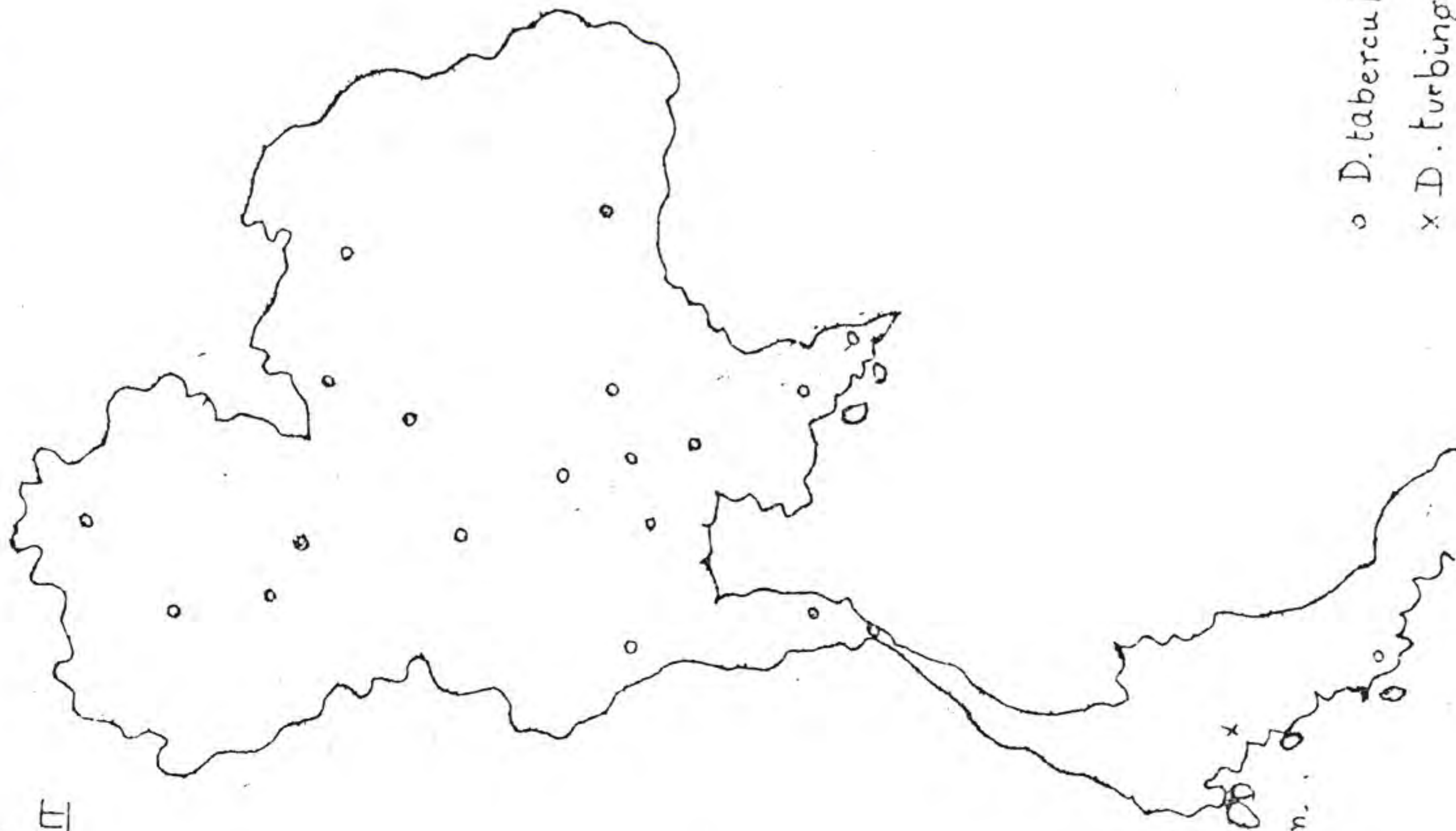
D. tuberculatus Roxburgh, Hort. Beng. 93. 1814. nomen et Flora Indica 2. 614. 1832; Hook. f., Fl. Brit. Ind. 1. 614. 1875; Kurz, For. Fl. Fl. Brit. Burm. 1. 113. 1877; Guerin in Lecomte, Fl. Gen. Indo-Chine, 1. 361. 1910. Brandis, Ind. Trees. 66. 1921; Craib, Fl. Siam. Enum. 1. 138. 1925; Parkinson, Burm. For. Bull. 27. 27. 1932; Tardieu-Blot in Humbert, Suppl. Fl. Gen. Indo-Chine, 1. 340. 1943. in clavis.

Tree 15 – 20 m. high, 150 cm. up in girth; young twigs glabrous lenticellate to fulvous pubescent; stipules canescent to fulvous shaggy tomentose; deeply longitudinally furrowed, ligneous.

Leaves ovate, cordate, slightly crenate, 14 – 36 cm. long, 12 – 30 cm. broad, lateral nerves 15 pairs, lower pairs obviously forked, glabrous to tomentose, petioles 4 – 9 cm. long, glabrous to tomentose.

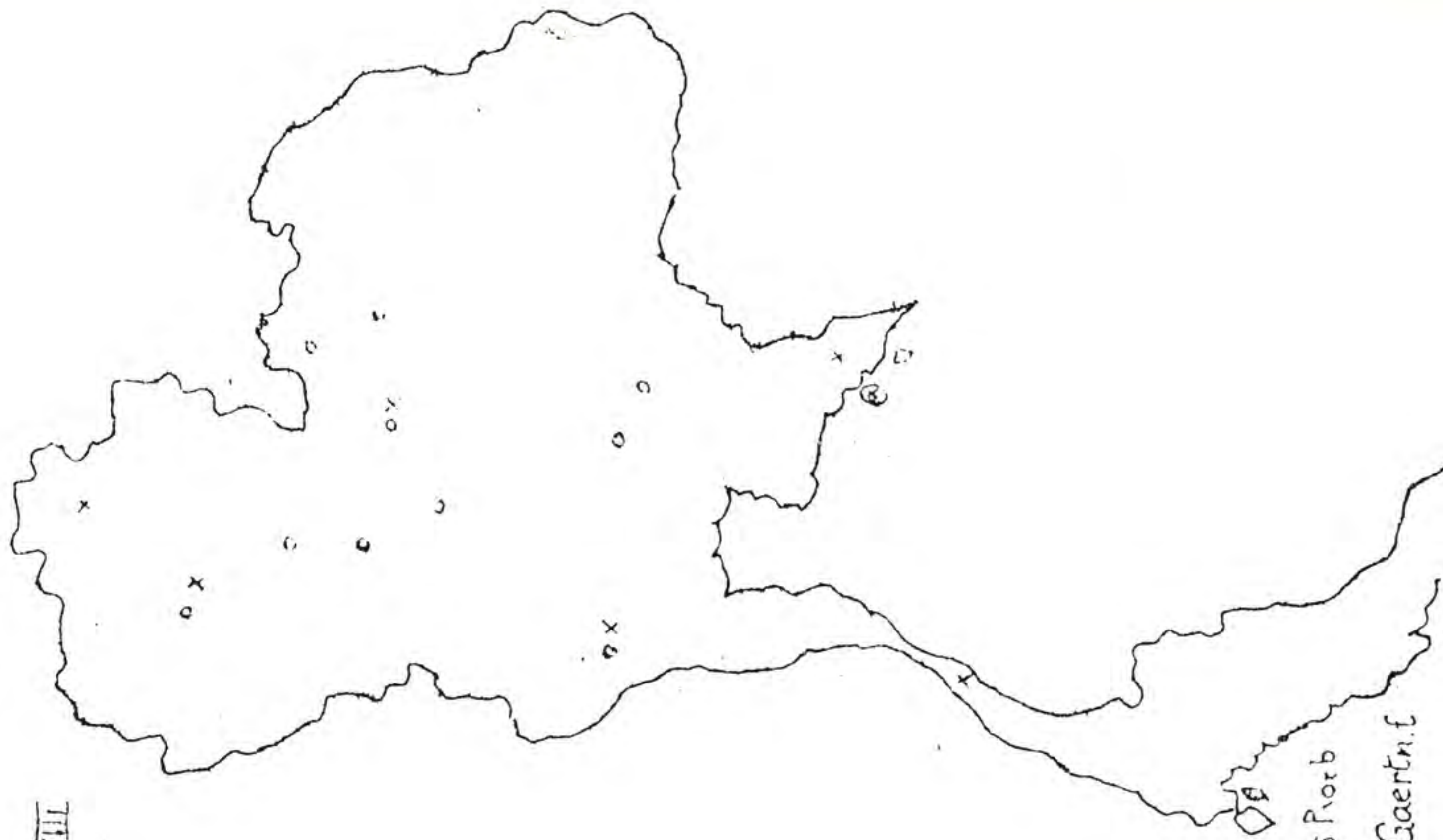
DISTRIBUTION MAPS

VII



o *D. obtusifolius* Telism.
x *D. reflexus* Bl.

VIII



o *D. taberculatus* Porb
x *D. turbingtus* Gaertn.f

Flowers pink, calyx tube with 5 tuberculate at the top and slightly ridged towards the middle, glabrous. Fruits obconic to globose with 5 tuberculates on the upper portion, 2 - 2.5 cm. across, glabrous; wings spatulate-oblong, horny, minutely tuberculated, 10 - 14 cm. long, 2 - 2.8 cm. wide, glabrous.

Flowering from March to May; fruiting from March to July.

Northern : Chiengmai, Doi Suthep, **Hosseus 448!** (BM, K); **Kerr 1066!** (BKK, BM, K); **Smitinand 103!**

Sukhothai, Thani, **S. Denduang 3!**, sans loc. **Thook 6!**
Petchabun, Lomsak, Huay Wah, **Smitinand 2714!**

Distribution : India, Burma and Indo-China.

Local names : Kung (Chiengmai, Phetchabun), Tueng (Chiengmai), Kuang, Phluang (Sukhothai) **YANG PLUANG** (Preferred name).

This is a typical species of the dry deciduous forest, ranging from 100 - 500 m. altitude. It is a variable species, of which 2 varieties are being recognised:—

VAR. GRANDIFOLIUS

D. tuberculatus Roxb., var *grandifolius* (Teijsm.) Craib, Fl. Siam. Enum. 1. 138. 1925.

D. grandifolius Teijsm. ex Miq., Ann. Mus. Bot. Lugd. Bat. I. 214. 1863 - 64.

Characters of the typical species differ only the canescent stipules, and larger leaves.

Northern : Chiengmai, Mae Taeng, **Kerr s.n.!** (BKK, BM, K); Mae Rim, **R.F.D. Thailand 15810!**; San Mahaphol **Huay Rai, Phananchorn 12!**

Lampang, Ngao, Mae Huat, **Smitinand 1601!**

Phichit, **A. Kaewkangwan 2!**



Dipterocarpus tuberculatus Roxb.

- North—Eastern :** Loei, Wang Saphung, Sithan, **Smitinand 2456!**, **1217!**
Phloenchit 1417!
- Eastern :** Nakhawn Rachasima, **Witt s.n.!** (K)
 Buriram, **R.F.D. Thailand 456!**
- South—Western :** Kanburi, **Teijsm. s.n.!** (Type of *D. grandifolius* Teijsm. ex Miq., K).
- Distribution :** Burma to Indo—China
- Local names :** Tueng Khao, Tueng (Chiengmai), Kruang, Kuang, Tueng (N. Rachasima), Phluang (Kanburi, Phichit), Kung (Loei), Tueng (Lampang).

VAR. TOMENTOSUS

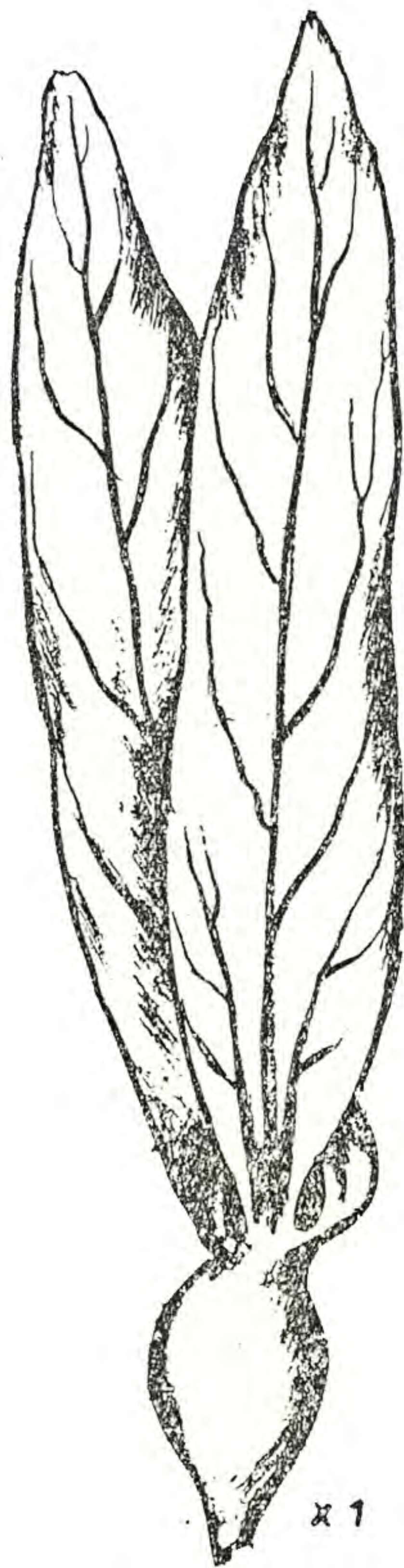
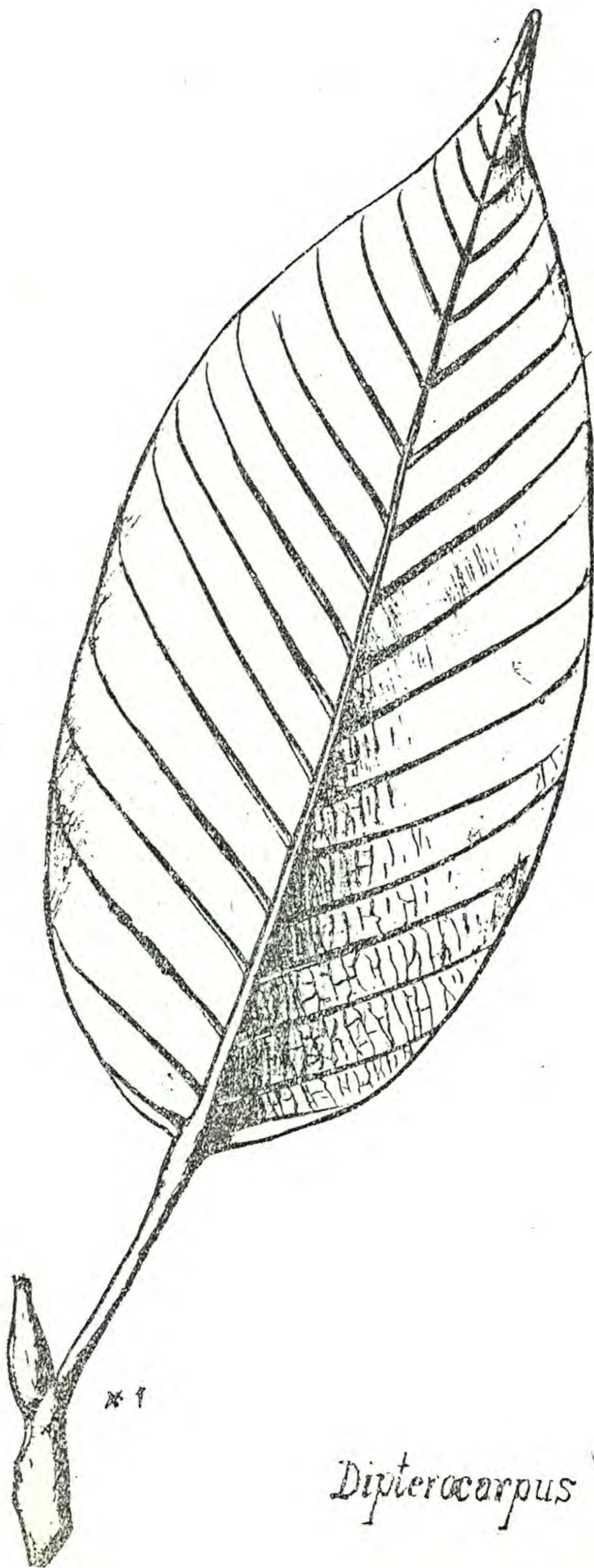
D. tuberculatus Roxb., var. *tomentosus* Craib, Fl. Siam. Enum. 1 (1925) 138.

Characters of the typical species differs in the tomentose twigs and petioles, leaves tomentose on both surfaces.

- Northern :** Chiengmai, Mae Tuen, **Kerr s.n.!** (BM, K); Doi Suthep, **Kerr 1066 A!** (BM, K). **1765!** (BM, K).
- North—Eastern :** Khawn Kaen, Phu Wieng, **Kerr 20008!** (BKK, K).
- Distribution :** Burma.
- Local names :** Kung (Khawn Kaen).

16 DIPTEROCARPUS TURBINATUS

D. turbinatus Gaertn. f., Fruct. 3. 51. t. 188. 1805; Engl. & Prantl, Nat. Pflanzenfam. 3. 256. 1895; Dyer in Hook. f., Fl. Brit. Ind. 1. 295. 1873. in part; Brandis, Ind. Trees, 65. 1921. in part; Ryan & Kerr in Journ. Siam Soc. 8. 3. 1911; Craib, Fl. Siam Enum. 1. 139. 1925; Parkinson, Burm. For. Bull. 27. 29. pl. 16. 1932.



Dipterocarpus turbinatus Gaertn. f.

D. laevis Ham. in Mem. Linn. Soc. 299. 1832; Kurz, For. Fl. Brit. Burm. 1. 114. 1877.

D. jourdainii Pierre, Fl. For. Cochinch. Pl. 220, 1890; Guerin in Lecomte, Fl. Gen. Indo-Chine, 1. 356. 1910.

Lofty tree 25 m. tall, 20 m. up to the first branch, girth 200 cm. up. Young twigs canescent, stipules pink canescent. Bark greyish brown, rather smooth, distantly cracked longitudinally, cut light brown, slightly granulous, 1.5 cm. thick.

Leaves ovate-oblong, slightly crenate, base rounded, apex obtuse to short cuspidate, 17–24 cm. long, 9–12 cm. wide; nerves 16–19 pairs, glabrous on both surfaces, upper surface glossy, drying slaty brown; petioles 3–3.5 cm. long, canescent or glabrous.

Flowers pinkish, calyx smooth, glaucescent. Fruits fusiform, 2.4 cm. across, smooth, glaucescent; wings elliptic-spathulate, 12–14 cm. long, 2.5–2.8 cm. wide, coriaceous, glaucescent.

Flowering from November to March; fruiting in April.

Northern : Chiengmai, Chawmthawng, **Suvarnasuddhi 443!**, Mae Klang, **Kerr s.n.!** (BKK); Sop Aep, **Khachoet 16!**, **Chayanond 10** **Kanphrom 10!**; Doi Suthep, **Kerr 1152!**, (A, BM, K), **R.F.D. Thailand s.n.!** (A); Mae Rim, **R.F.D. Thailand 15809 !**; **Vanpruk 982! , 983!**
Chiengrai, Chiengkham, Ban Tham, **Smitinand 1623!**;
on the trail to Pong, **R.F.D. Thailand 10852!**
Phetchabun, Tha Duang, **Kerr 20358!** (BKK, BM, K);
Lomkao, Huay Hok, **Smitinand 2696!**, Sambawn, **Smitinand 2624**, Trail between Huay Rahong and Ban Wangtat, **Smitinand 2692** Nam Duk, **Smitinand 2713!**

South-Eastern : Trat, Baw Rai, **Kerr 9470!** (BKK, BM, K); Kaw Chang, Khao Laem Takien, **Bunnak 350!**

- South.-Western :** Kanburi, Kaw Noi, **Kerr s.n.!** (BM); Doi Duan, **Kerr s.n.!** (BM).
 Chumphawn, Tha San, **Kless & Robinson 6858** (K), **6925** (K).
- Distribution :** Burma and Indo-China.
- Local names :** YANG DAENG (Phetchabun). Yang khao, Yang Pai, Yang nu (Chiengrai), Yang khaeng (Phetchabun), Yang phluang, (Chiengrai), Yang na (Trat).

This species occurs both in dry upper mixed deciduous and ever-green forests, though itself is a deciduous one, from the altitude of 100 to 800 m. It often associates with **D. costatus Gaertn. f.**, from which can be distinguished by the glossy, slate brown, glabrous and larger leaves. It is frequently tapped for oil.

The natural regeneration of this species is rather poor.