A preliminary account of Burseraceae in Thailand

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ABSTRACT. A preliminary account of Thai Burseraceae is presented. Five genera and 20 species are found in the country. Some species which are commonly found near the Thai-Malaysian border, and which may occur in Thailand, are also included in the account. A description of the family is provided together with keys to genera and to species. Synopses of the species is given. Further study is required, especially the examination of more herbarium specimens and extra field work near theThai-Malaysian border.

INTRODUCTION

The Burseraceae is a family of trees and shrubs comprising 18 genera and 550 species occurring throughout the tropics, with a concentration of taxa in America and N.E. Africa (Mabberley, 1997). A preliminary account of Burseraceae in Thailand is presented here. A key to genera based on previous studies of S.E. Asian taxa (Leenhouts, 1952; Kalkman, 1953, 1954; Leenhout, 1959) is provided, and photographs show the basic characteristics of the family. Keys to species are mostly based on the Thai specimens that have been examined. A synopsis of each species is given. Full descriptions and illustrations will be provided in the forthcoming Flora of Thailand account (Pooma in prep.).

Specimens from Thai herbaria are very scarce, but material from the main European herbaria has been examined. Some species are still problematic due to the small number of specimens. Such material is often incomplete and lacks good field notes. There is a need for further field surveys, especially in the peninsular region. Specimens from neighbouring countries need to be consulted for a thorough revision of the group.

CLASSIFICATION

Burseraceae is related to the Simaroubaceae, Rutaceae, Anacardiaceae, and Meliaceae. The Burseraceae and Anacardiaceae used to be united under the Terebinthaceae (Baillon, Jadin as cited in Lam, 1932b; also in Blume, 1826) as they have nearly similar resiniferous ducts and wood anatomy, the main difference being the two epitropous ovules in each cell in Burseraceae and one apotropous ovule in Anarcardiaceae. Mabberley (1997), who included the Burseraceae in the Sapindales, referred to them as "close to Anacardiaceae though the seed shows affinites with Laurales, i.e. Magnoliales; chemistry similar to Rutaceae and Meliaceae but limonoides probably absent". Cronquist

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(1988), in his synoptic arrangement of the families of Sapindales, described the Burseraceae as having "resin not notably allergenic or poisonous, and Anacardiaceae with "resin often allergenic or poisonous to touch". Heywood (1993) distinguished the family from Rutaceae and Simaroubaceae by the presence of resin ducts in the bark, the distinct stamens, short single style, and the usual absence of transparent glandular dots on the leaves. He also included it in the Sapindales and Rosidae.

Fruits are essential for tribal and generic generic classification. Three tribes are generally recognised on the basis of fruit structure (after Leenhouts, 1959; Asiatic genera given in brackets):

Protieae: Pyrenes free and consisting only of the crustaceous endocarp; pericarp and mesocarp fleshy or dry (*Protium* and *Garuga*).

Bursereae: Pyrenes connate but usually detachable from each other; pericarp and mesocarp always dry (*Triomma*).

Canarieae: Pyrenes entirely connate, forming a single plurilocular stone made up of mesocarp and endocarp; pericarp fleshy. It can be divided into the following subtribes:

subtribe *Dacryodiinae* (*Dacryodes*, *Haplolobus*, *Rosselia* (Forman, 1994) *Santiria* and *Scutinanthe*): the receptacle takes no part in forming the fruit proper.

subtribe *Canariinae* (*Canarium*): an outgrowth of the receptacle forms the central part of the pyrenes, producing wings between the cells, thus dividing the mesocarp into 3 dehiscent lids.

Several genera of Burseraceae have been revised as part of monographic studies of S.E. Asian taxa. Such genera include *Protium* (Leenhouts 1952), *Garuga* (Kalkman, 1953), *Haplolobus* (Husson & Lam, 1953; Lam, 1955, 1958; Leenhouts, 1972a), *Dacryodes*, *Triomma* and *Santiria* (Kalkman, 1954) and *Canarium* and *Scutinanthe* (Leenhouts, 1959). The generic arrangement used here follows that developed in these previous studies.

BURSERACEAE

Kunth, Ann. Sci. (Paris) 2: 346. 1824, nom. cons.

Medium to large trees, up to 60 m in Malay Peninsula (*Canarium*). *Resin ducts* present the bark and pith, medullar vascular bundles present in twigs, petioles and petiolules (*Dacryodes*, *Santiria* and *Canarium*). *Bark* pale grey to brown, smooth or becoming scaly with age, sometimes with resin patches and lenticels; the inner bark iusually laminated (*Canarium*), resiniferous (resin white or clear, turning dark grey), light pink to brown; wood usually white. *Leaves* usually imparipinnate. spirally arranged; leaflets mostly opposite, entire or serrate, glabrous to pubescent with mostly simple hairs. *Stipules* sometimes present (*Canarium* and *Garuga*). *Inflorescences* usually paniculate and axillary, sometimes pseudoterminal to terminal. *Bracts* and *bracteoles* deltoid to subulate, ovate to orbicular, very early caducous. *Flowers* 3–5-merous, unisexual (bisexual in *Garuga*) usually dioecious, usually with vesitigial remains of the other sex; male flowers more numerous and slender than the female. *Receptacle* flat or

cupular. *Sepals* ± basally connate, regular, imbricate or valvate. *Petals* valvate or laterally imbricate, with usually with reflexed tips, white to greenish or creamy-yellow to pinkish. *Stamens* usually twice the number of petals (5 in *Triomma*), inserted in 1 whorl on the outer edge of the disc or on the top of it. *Filaments* usually free (connate in some *Canarium*); anthers basifixed or dorsifixed, introrse, dehiscing via longitudnal slits, slightly adnate in *Triomma*. *Disc* usually intrastaminal (except in *Triomma*), often brightly coloured (red, yellow or orange), nectar-producing, cup-shaped with free lobes, undulate or truncate and cushion-shaped, sometimes connate to a vestigial ovary in male flowers (*Canarium)*. *Style* absent or cylindrical with globular and slightly lobed stigmas. *Ovary* superior, containing 1–5 cells with 2 axile, epitropous, descending ovules in each cell. *Fruits* usually drupaceous with a fleshy pericarp and with woody or crustaceous to papyraceous endocarp (pyrenes) (winged and dehiscent in *Triomma*). *Stigma* persistent, usually apical, conspicuously excentric in *Santiria* and slightly excentric in *Dacryodes*, *Garuga* and *Protium* (meiomerous fruits). *Pyrenes* endocarpic in origin, lying free in the pericarp (*Garuga* and *Protium*), sometimes connate by axial intrusions, rarely developing into 3 wings (*Triomma*); intrusion connate to both the axis and mesocarp lid in *Canarium*; pyrenes connate without axial intrusion in *Dacryodes*, *Santiria* and *Scutinanthe*. *Seeds* 1 per cell, dispersed while still enclosed in (part of) the fruit wall (Vogel, 1980); embryo exalbuminous. *Cotyledons* fleshy, usually lobed, compound or entire, conduplicate or folded in seeds. x= 11, 13, 23.

Eighteen genera and 550 species; widespread in the tropics, with a concentration of species in Malesia, S. America and Africa. In Thailand the distribution range of many species is still incompletely known. For example until recently the only species known from northern Thailand were *Canarium subulatum*, *Garuga pinnata* and *Protium serratum*, but I recently collected two more species of *Canarium* (*C. strictum* and *C. euphyllum*) in the north both of which are rather common there. Moreover, J.F. Maxwell collected a species closely related to *C. parvum* in Chiang Mai province. This can be explained by the fact that being very large trees with inconspicuous flowers they are poorly collected. Many species of Burseraceae have been found in northern Malaysia close to the Thai border, but not in Thailand. Does this reflect the true situation or a lack of collecting on the Thai side? As yet this cannot be answered, but considering the ecological homogeneity across the Thai-Malaysian border within lowland forest and along the coastal hills, some species commonly found in northern Malaysia near the Thai border have been included in this treatment (see Table 1). This gives a total of five genera and 20 species already recorded in Thailand, rising to six or seven genera and ca. 25–30 species if the expected Malaysian taxa are included.

In the genus *Garuga,* the "stipules" are strictly pseudostipules or stipellae, originating from the lowest pair of leaflets, especially in young leaves. Weberling & Leenhouts (cited in Vogel 1980) used seedlings for clarification of morphological problems to explain the nature of the pseudostipules. They are stipule-like structures often regarded as representing a (rudimentary) pair of leaflets. The German terms are "Speicherkotyledon" (= storing cotyledons) for the food-storing cotyledon, and "Pseudokotyledon" for the first pair of opposite leaves. True stipules are present only in *Canarium* sect. *Canarium*.

KEY TO THE GENERA

1. Fruits 1–5, each a 1-celled pyrenes lying free in the pericarp; flowers 4–5-merous, bisexual or incomplete; stamens 10, free; drupes globose-oblique
   2. Leaves 3–4 jugate, without stipules and stipella; leaflets glabrous or pubescent, shallowly serrate to nearly entire; petiolulate, inflorescences axillary; flowers up to 3 mm long, incompletely bisexual; disc annular, adnate to the base of the flat receptacle **1. Protium** (*serratum*)
   2. Leaves 7–12 (15) jugate, with stipules and stipella; leaflets usually pubescent, strongly serrate, nearly sessile, inflorescences terminal; flowers more than 3 mm long, bisexual; disc an orbicular cup adnate to the cupular receptacle **2. Garuga**
1. Fruit 1, a 3-celled pyrene; flowers 3-merous, unisexual; stamens 3 or 6, free or connate; drupes oblong to ellipsoid or globose
   3. Pyrenes thin-walled, intrusion of carpel walls incomplete, 2 cells always reduced; stipules absent; leaflets always entire
      4. Drupes oblong to ellipsoid with persistent apical stigma; pericarp soft, coarsely wrinkled when dry; calyx caducous **3. Dacryodes**
      4. Drupes irregulary globose with distinctly excentric persistent stigma; pericarp not soft, smooth when dry; calyx usually persistent, not or slightly enlarged **4. Santiria**
   3. Pyrenes woody, thick-walled, intrusion of carpel walls complete, 1 or 2 cells often reduced; stipules present or absent; leaflets entire or not; drupes oblong to ellipsoid **5. Canarium**

Malaysian genera that could be expected in Thailand:

Triomma: Fruits winged, dry and dehiscent with 3-winged seeds. Flowers (4–)5-merous. Disc extrastaminal. No vascular bundles or resiniferous ducts in the medulla of petioles. Stamens 5. A monotypic genus, *Triomma malaccensis* has a distribution ranging from Malay Peninsula to Borneo and Sumatra.

Scutinanthe: Fruits globular with hard and bony pyrenes. Flowers 4–5-merous. Disc intrastaminal. Resiniferous vascular bundles or ducts conspicuous in the medulla of the petioles. Stamens 8–10. Two species, *S. brunnea* and *S. brevisepala* occurring in Malesia.

1. PROTIUM

Burm. f., Fl. Ind.: 88. 1768; Engl. in Monogr. Phan. 4: 60. 1883; Guill. in Gén. I.-C. 1: 721. 1911; H.J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 318. 1932; Leenh., Blumea 7: 154. 1952; in Fl. Mal. I. 5: 213. 1956; in Fl. Mal. I. 6: 820. 1976.— *Tingulonga* Rumph., Herb. Amb. 7: 54. 1755.—*Amyris* Willd., Sp. Pl. 2: 337. 1799.

About 100 species, especially in tropical America. Four species in Asia, from India to New Guinea, namely *P. javanicum*, *P. macgregorii*, *P. connarifolium*, and *P. serratum*. One species in Thailand.

Protium serratum (Wall. ex Colebr.) Engl. in Monogr. Phan. 4: 88. 1883; Guill. in Fl. Gén. I.-C. 1: 722, f. 77: 7–12. 1911; Craib, Fl. Siam. En. 1: 247. 1926; H.J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 321. 1932; Leenh., Blumea 7: 155, f. 1. 1952.— *Bursera serrata* Wall. ex Colebr. Trans. Linn. Soc. 15: 361. 1827; Benn. in Fl. Br. Ind. 1: 530. 1875; Kurz, Fl. Burm. 1: 208. 1877; Kanjilal et al., Fl. Assam 1: 223. 1936; Brandis, Ind. Trees: 132, f. 62. reprint 1978; C.D. Dai in Ban, Fl. Tayg. En. 64. 1984; Grierson in

Fl. Bhutan 2(1): 27. 1991.— *Dracontomelon laoticum* Evrard & Tardieu, Adansonia n.s. 1: 198. 1961; in Fl. C.L.V. 2: 144, f. 10: 1–6. 1962.— *Santiria yunnanensis* Hu, Bull. Fan Mem. Inst., Bot. Ser. 10. 3: 129. 1940.— *Protium yunnanense* (Hu) Kalkman, Blumea 7: 546. 1954. Fig. 2 a, 3 a-b, 5 c, 6 g.

T h a i l a n d.— Throughout the country but not recorded further south than Chumphon.

D i s t r i b u t i o n.— India (type), Myanmar to Indo-China.

E c o l o g y.— Along streams in semi-evergreen to evergreen forest; also commonly found in pine-dipterocarp forest and dry dipterocarp to mixed deciduous forest, 100–1500 m. Leaves turn reddish before falling. Flowering January–April; fruiting April–September.

V e r n a c u l a r.— Ma faen (มะแฟน), ma fueang pa (มะเฟืองป่า), pi (ปี), fi (ฟี), phi-sae (พีแซ) (Karen-Chiang Mai) (Northern); faen som (แฟนส้ม), kho ling (ค้อลิง), som paen (ส้มแป้น) (North-eastern); sap-pha-tri (ซับผ้าตริ), ma-tri (มะตริ) (Khmer-Chanthaburi) (Eastern); ka tip (กะตีบ), ka pok ma (กะโปกหมา) (Prachuap Khiri Khan) (Peninsular).

U s e s.— The fruits are edible, tasting sweet and sour. Found in local markets.

N o t e.— *Bursera serrata* was described by Colebrooke in 1827 from living material; Wallich in 1829, described the same plant from dry specimens and named it *B. serrata* Wall. on *Icia indica* Wright & Arnott. (from attached letter, Kew). Lam (1932b) remarked that in male flowers the ovary is hardly reduced, often with cells and sometimes with (sterile) ovules. Most specimens examined do not have truly unisexual flowers.

2. GARUGA, nom. cons.

Roxb., Hort. Beng.: 33. 1814; Benn. in Fl. Br. Ind. 1: 528. 1875; Kurz, Fl. Burm. 1: 207. 1877; Engl. in Monogr. Phan. 4: 4. 1883; Guill. in Fl. Gén. I.-C. 1: 719. 1911; H.J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 325. 1932; Kalkman, Blumea 7: 459. 1953; in Fl. Mal. I. 5: 215. 1956.— *Katoukalesiana* Adans. Fa. Pl. 2: 510. 1763.

An old world genus found in continental S.E. Asia, Malesia, N. Australia and the western Pacific. Four species, of which one occurs in Thailand.

Garuga pinnata Roxb., Hort. Beng.: 33. 1814; Blume, Mus. Bot. 1: 227. 1850; Benn. in Fl. Br. Ind. 1: 528. 1875; Kurz, Fl. Burm. 1: 207. 1877; Engl. in Monogr. Phan. 4: 5. 1883; Guill. in Fl. Gén. I.-C. 1: 720. 1911; C.E. Parkinson in Forest. Fl. Andaman Isl.: 115. 1923; Craib, Fl. Siam. En. 1: 246. 1926; H.J. Lam, Ann. Jard. Bot. Btzg. 42: 201. 1932, Bull. Jard Bot. Buitenz. Sér. 3, 12: 330. 1932; Kanjilal et al., Fl. Assam. 1(2): 221. 1936; Kalkman, Blumea 7: 468. 1953; Brandis, Ind. Trees: 131. reprint 1978; Williams in En. Pl. Fl. Pl. Nep. 2: 84. 1979; Grierson in Fl. Bhutan 2(1): 27. 1991.— *G. pinnata* Roxb. var. *gennuina* (Roxb.) Cretzoin (sic), Acta Fauna et Fl. Univ., Ser. 2, 1: 9. 1933. Fig. 2 a, 3 c, 4 c-d, 5 e.

T h a i l a n d.— Throughout the country excluding the peninsula.

D i s t r i b u t i o n.— From India to Nepal, Bhutan, S. China, Myanmar and Indo-China.

E c o l o g y.— Common in mixed deciduous to dipterocarp forest. Often found on limestone. Flowering November–April; fruiting February–August.

V e r n a c u l a r.— Ta kham (ตะคร้ำ), wit (หวีด), ka tip (กะตีบ), khaek tao (แขกเต้า), kham (ค้ำ) (Northern); oi nam (อ้อยน้ำ), ma kok kan (มะกอกกาน) (Central); pi-cha-ong (ปีชะออง) (Karen-Kanchanaburi)

U s e s.— The fruits are edible.

N o t e.— None of the four *Garuga* species are easily distinguishable and identification depends mainly on flower and fruit size, receptacle shape and geographical distribution. Based on flower and fruit size, Thai material found to date should be assigned to *G. pinnata*. However there is some problematic material. A few specimens (*Thammachat* 4, *Vanpruk* 423, *Pooma* 1626) have leafy appendages at the base of the leaflets. This character is mostly associated with *G. floribunda*and is not normally found in *G. pinnata* (Lam, 1932b). *Likruae* s.n. BKF613 (BKF) was determined as *G. pierrei* by Kalkman due to its bulging receptacle, but in other characters is similar *G. pinnata*. *Smitinand, Sleumer et al.* 1363 (BKF) from Saraburi Province was identified by Kalkman as the first record for Thailand of *G. floribunda* var. *floribunda*. However, Malesian plants of this taxon have bluish fruits and small flowers, unlike Thai material which has larger flowers and greenish to yellowish fruits. For the time being it is best to recognise just the one species in Thailand, but further work is needed to resolve these problems.

Reddish-green to brown galls (*Phacopteron lentiginosum* Buckton) are often present on inflorescences and leaves (Mani, 1973).

3. DACRYODES

Vahl, Skrift. Dansk. Nat. Hist. Selsk. 4: 116. 1810; Engl. in Monogr. Phan. 4: 151. 1883; H.J. Lam., Bull. Jard. Bot. Buitenz. Sér. 3, 12: 334. 1932; Kalkman, Blumea 7: 500. 1954; Fl. Mal. I. 5: 219. 1956.— *Pachylobus* G.Don, Gen. Syst. 2: 89. 1832; Engl. in Monogr. Phan. 4: 101. 1883 (sub *Canarium*).— *Canarium* sect. *Tenuipyrene* Engl. in Monogr. Phan. 4: 104. 1883.— *Santiridium* Pierre, Bull. Soc. Linn. Paris 2: 1282. 1896.— *Curtisina* Ridl., J. Str. Br. Roy. Asiat. Soc. 82: 180. 1920.— *Hemisantiria* H.J. Lam. in Pl. Elm. Born.: 118. 1929.

Lam (1932b) and later Kalkman (1954) divided *Dacryodes* into three sections, *Dacryodes*, *Pachylobus* and *Tenuipyrena* (= section *Curtisina* in Lam, 1932b). The genus comprises about 29 species, with two species in tropical America, 10 species in tropical Africa (Leenhouts, 1972b), and 17 species in Indo-China and Malesia. Three species have been recorded in Thailand: *D. kingii*, *D. rostrata*, and *D. costata*.

KEY TO THE SPECIES

1. Petioles more than 15 cm long; leaves 6–8 jugate; inflorescences more than 20 cm long; flowers reddish; disc cupular, thick, 6-lobed; fruits distinctly oblique **2. D. kingii**
1. Petioles not more than 10 cm long; leaves 2–6 jugate; inflorescences up to 20 cm long; flowers white or yellowish; disc annular or cupular; fruits slightly oblique
2. Leaves usually 2–3-jugate; dry specimens brownish green; flowers nearly glabrous; disc annular; fruits 1.5 by 1 cm **1. D. costata**
2. Leaves 4–6-jugate; dry specimens brownish red; flowers densely pubescent; disc cupular, 6-lobed; fruits 1.75–3.5 by 0.75–1.75 cm **3. D. rostrata**

1. Dacryodes costata (Benn.) H.J. Lam, Ann. Jard. Bot. Buitenz. 42: 204. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 359. 1932; Kalkman, Blumea 7: 508. 1954; in Fl. Mal. I. 5: 222, f. 10. 1956.— *Santiria costata* Benn. in Fl. Br. Ind. 1: 537. 1875; Engl. in Monogr. Phan. 4: 157. 1883; King, J. As. Soc. Beng. 62: 260. 1893; Ridl., Fl. Mal. Pen. 1: 380. 1922.— *Canarium costatum* Ridl., Kew Bull. 1930: 82. 1930.

T h a i l a n d.— Nakhon Si Thammarat (Khao Luang).

D i s t r i b u t i o n.— Sumatra, Malay Peninsula (type), Borneo, Philippines.

E c o l o g y.— Scattered in evergreen forest, up to 300 m. Flowering April; fruiting August.

2. Dacryodes kingii (Engl.) Kalkman in Fl. Mal. I. 5: 224. 1956; Kochummen in Tree Fl. Mal. 1: 141. 1972.— *Santiria kingii* Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19a: 453. 1931.— *S. floribunda* King, J. As. Soc. Beng. 62: 254. 1893; Ridl., Fl. Mal. Pen. 1: 376. 1922.— *Dacryodes floribunda* (King) H.J. Lam, Ann. Jard. Bot. Buitenz. 42: 204. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 357, t. 5 f. 16. 1932; Kalkman, Blumea 7: 521. 1954. Fig. 4 e-f.

T h a i l a n d.— PENINSULAR: Narathiwat (Waeng).

D i s t r i b u t i o n.— Malay Peninsula (type).

E c o l o g y.— Scattered in evergreen forest, 100–300 m. In the Malay Peninsula commonly found up to 400 m and on limestone (Chung, 1973). Flowering April–May; fruiting June.

V e r n a c u l a r.— Kok daeng (กอกแดง) (Peninsular); kue-lo-sae (กือลอแซ) (Malay-Narathiwat).

U s e s.— In Malaysia, the leaves are used for making roofs.

3. Dacryodes rostrata (Blume) H.J. Lam, Ann. Jard. Bot. Buitenz. 42: 203, t. 11 f. 59, t. 13 f. 101, t. 14 f. 106d, 111b. 1932; Bull. Jard. Bot, Buitenz. Sér. 3, 12: 349, t. 4 f. 13. 1932; Guill., in Suppl. Fl. Gén. I.-C. 1: 675, f. 83: 1–2. 1946; Kalkman, Blumea 7: 519, f. 83. 1954; in Fl. Mal. I. 5: 225. 1956; Smith, Kew Bull. 26: 143. 1972; Kochummen in Tree Fl. Mal. 1: 140, f. 3. 1972; Keng, Conc. Fl. Singapore: 100. 1990.— *Santiria montana* Blume, Mus. Bot. 1: 212. 1850.— *S. rostrata* Blume, Mus. Bot. 1: 213. 1850.— *Dracontomelon? cuspidatum* Blume, Mus. Bot. 1: 232. 1850.— *Canarium rostriferum* Miq.,

Sum. 1: 526. 1861; Engl. in Monogr. Phan. 4: 137. 1883; Guill. in Fl. Gén. I.-C. 1: 711. 1911.— *C. kadondon* Benn. in Fl. Br. Ind. 1: 535. 1875; Engl. in Monogr. Phan. 4: 138. 1883; King, J. As. Soc. Beng. 62: 247. 1893; Ridl., Fl. Mal. Pen. 1: 373. 1922.— *C. reticulatum* Ridl., Kew Bull. 1930: 83. 1930.

T h a i l a n d.— PENINSULAR: Ranong (Lamlieng), Krabi (Ao Luk), Nakhon Si Thammarat (Khao Luang), Trang (Sikao, Khao Chong), Satun (Tung Wa).

D i s t r i b u t i o n.— Throughout Malesia (Borneo, type), Indo-China (Vietnam).

E c o l o g y.— Common in lowland evergreen forest near streams. Flowering January–April; in Malesia fruiting mainly March–September.

U s e s.— The resin is used for making torches. In Malaysia and Brunei the fruits are eaten and in Brunei it is cultivated (Leenhouts & Kalkman, 1972).

4. SANTIRIA

Blume, Mus. Bot. 1: 209. 1850; Benn. in Fl. Br. Ind. 1: 536. 1875; Engl. in Monogr. Phan. 4: 152. 1883; King, J. As. Soc. Beng. 62: 252. 1893; Ridl., Fl. Mal. Pen. 1: 376. 1922; H.J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 367. 1932; Kalkman, Blumea 7: 522. 1954, in Fl. Mal. I. 5: 229. 1956.— *Trigonochlamys* Hook.f., Trans. Linn. Soc. 23: 170. 1860; Benn. in Fl. Br. Ind. 1: 539. 1875; King, J. As. Soc. Beng. 62: 251. 1893; Ridl., Fl. Mal. Pen. 1: 380. 1922; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: 206. 1932.— *Icicaster* Ridl., J. Str. Br. Roy. Asiat. Soc. 75: 15. 1917; Fl. Mal. Pen. 1: 381. 1922.

Lam (1932b) divided the genus into three sections, *Santiriaopsis*, *Eusantiria* and *Trigonochlamys*. Kalkman (1954) recognised sections *Santiria* (=*Eusantiria*, 14 species, Malay Peninsula, Sumatra, Borneo and Philippines), *Iciocopsis* (=*Trigonochlamys*, three species, Malay Peninsula, Sumatra, Borneo, New Guinea) and *Santiriopsis* (six species, W. Africa). Three species occur in Thailand.

KEY TO THE SPECIES

1. Leaflets densely tomentose on lower surface; secondary veins not conspicuously arching to margin; flowers yellowish; stamens 6 **3. S. tomentosa**
1. Leaflets glabrous on both surface or pubescent along midrib on lower surface; secondary veins arching near margin; flowers white; stamens 3 or 6
   2. Leaves 3–6 jugate; glabrous but pubescent along midrib on lower surface and petioles; secondary veins inconspicuous, straight; sepals nearly free; stamens 3; fruits nearly globose, 0.7–1 by 0.7 cm **2. S. rubiginosa**
   2. Leaves 2–4 jugate, glabrous; secondary veins conspicuous, slightly curved; sepals rarely free; stamens 6; fruits obliquely globose to oblong, 1–1.5 by 0.8–1 cm **1. S. laevigata**

1. Santiria laevigata Blume, Mus. Bot. 1: 211, t. 40. 1850, incl. var. *applanata*; Benn. in Hook.f., Fl. Br. Ind. 1: 538. 1875; Engl. in Monogr. Phan. 4: 165. 1883; King, J. As. Soc. Beng. 62: 257. 1893; Ridl., Fl. Mal. Pen. 1: 378. 1922; H.J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 382, t. 6 f. 28. 1932; Kalkman, Blumea 7: 535. 1954; in Fl. Mal. I. 5: 232. 1956; Kochummen in Tree Fl. Mal. 1: 147, f. 5. 1972; Keng, Conc. Fl. Singapore:

100. 1990.— *S. rufescens* Blume, Mus. Bot. 1: 213. 1850.— *S. glabrifolia* Engl. in Monogr. Phan. 4: 164. 1883.— *S. violacea* H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 14 f. 107d. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 379, t. 6 f. 26. 1932; Kalkman, Blumea 7: 540. 1954.— *Dacryodes incurvata* Phengklai & Niyomdham, non (Engl.) H.J. Lam; Flora in peat swamp areas of Narathiwat: 28. 1991.

T h a i l a n d.— PENINSULAR: Narathiwat (Waeng, Su-ngai-padi, Kok Daeng).

D i s t r i b u t i o n.— Malay Peninsula, Sumatra (type), Borneo, Philippines.

E c o l o g y.— Common in lowland evergreen and peat swamp forests. Flowering mainly July–December in Malesia; fruiting February–March.

V e r n a c u l a r.— Kap oi (กาบอ้อย) (Peninsular), a-pa-tu-bu (อะปาตูบู) (Malay-Narathiwat).

2. Santiria rubiginosa Blume, Mus. Bot. 1: 213. 1850; Engl. in Monogr. Pha. 4: 158. 1883; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 14 f. 107b, 112a, t. 16 f. 126c. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 399, t. 7 f. 37. 1932; Kalkman Blumea 7: 542. 1954, Fl. Mal. I. 5: 237, f. 14–15. 1956; Anderson in Gard. Bull. Singapore 20: 164. 1963; Kochummen in Tree Fl. Mal. 1: 151, f. 6. 1972.— *S. planchonii* Benn. in Fl. Br. Ind. 1: 536. 1875; Engl. in Monogr. Phan. 4: 154, t. 3 f. 24–32. 1883.— *S. parviflora* Engl. in Monogr. Phan. 4: 155. 1883; Ridl., Kew Bull. 1930: 86. 1930.— *Canarium planchonii* King, J. As. Soc. Beng. 62: 240. 1894.— *Icicaster planchonii* Ridl. J. Str. Br. Roy. Asiat. Soc. 75: 15. 1917, Fl. Mal. Pen. 1: 381. 1922.— *Santiria havilandii* Ridl., Kew Bull. 1930: 85. 1930.— *S. nana* H.J. Lam, Ann. Jard. Bot. Buitenz. 42: 207. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 403, t. 7 f. 39. 1932; Kalkman, Blumea 7: 541, f. 11. 1954.

T h a i l a n d.— PENINSULAR: Nakhon Si Thammarat (Thung Song, Yong Fall), Krabi (Khao Pra Bang Kram).

D i s t r i b u t i o n.— Throughout Malesia to New Guinea.

E c o l o g y.— Scattered in evergreen forest, ca. 50 m. In Malaysia found frequently in swamp forest (Corner, 1978). Flowering mainly July–October in Malesia; fruiting April (October–June in Malesia).

3. Santiria tomentosa Blume, Mus. Bot. 1: 211. 1850; Engl. in Monogr. Phan. 4: 159. 1883; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: 206, t. 14 f. 107e. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 391, t. 7 f. 33. 1932; Kalkman, Blumea 7: 529. 1954, Fl. Mal. I. 5: 231. 1956; Anderson in Gard. Bull. Singapore. 20: 165. 1963; Kochumman, Tree Fl. Mal. 1: 151. 1972.— *S. multiflora* Benn. in Fl. Br. Ind. 1: 538. 1875; Engl. in Monogr. Phan. 4: 159. 1883; King, J. As. Soc. Beng. 62: 261. 1893; Ridl., Fl. Mal. Pen. 1: 380. 1922.— *Canarium. micrantherum* Stapf ex Ridl., Kew Bull. 1930: 82. 1930.—*Santiria mollissima* Ridl., Kew Bull. 1930: 85. 1930; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 11 f. 67. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 390, t. 7 f. 32. 1932; Kalkman, Blumea 7: 532. 1954.

T h a i l a n d.— PENINSULAR: Narathiwat (Waeng).

D i s t r i b u t i o n.— From Malay Peninsula, Sumatra (type) to Borneo and the Philippines.

E c o l o g y.— Scattered in lowland evergreen forest; frequently occurs in swamp forest in Malaysia (Corner, 1978). Flowering August; fruiting April.

V e r n a c u l a r.— Ngon kai (หงอนไก่) (Peninsular).

5. CANARIUM

L., Amoen. Acad. 4: 121. 1759; Engl., in Monogr. Phan. 4: 101. 1883; Ridl., Fl. Mal. Pen. 1: 369. 1922; H.J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 422. 1932; Leenh. in Fl. Mal. I. 5: 249. 1956; Blumea 9: 275. 1959; Backer & Bakh.f., Fl. Java 2: 114. 1965; C.D. Dai & Yakovlev in Bot. Zhurn. 70(6): 782. 1985.— *Pimela* Lour., Fl. Cochin.: 407. 1790.— *Canariopsis* Blume ex Miq., Fl. Ind. Bat. 1, 2: 651. 1859.— *Canariellum* Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 242. 1896.

This genus was revised by Leenhouts (1956) in a monograph which was the extension of Lam's work (1932a-b). The genus was divided into three sections (*Canarium*, *Pimela*, *Canariellum*) based on the presence or absence of stipules and degree of development of unisexual flowers, especially the reduction of the pistil in male flowers. Leenhouts (1972b) later amended his classification by raising these sections to the rank of subgenera, namely *Canarium* (formerly sections *Canarium* and *Pimela*) and *Canariellum* (formerly section *Canariellum*). He also established a third subgenus *Africanarium*. *Canarium* comprises ca. 75 species, mainly in Malesia, continental S. and S.E. Asia, Melanesia and western Polynesia, with two species in Africa, and three in Australia. Twelve species occur in Thailand.

KEY TO THE SPECIES

1. Stipules present, sometimes in bud only
   2. Stipules flat or auricle-shaped
      3. Stipules fimbriate, persistent; leaflets glabrous, nearly entire; fruits 2–2.5 by 1–1.5 cm; pyrenes sligthly rounded **3. C. denticulatum**
      3. Stipules reniformis; very cauducous; leaflets glabrous or pubescent, entire or serrate; fruits 4–6 by 2–2.5 cm; pyrenes rounded or acute triangular
         4. Leaves 4–5 jugate; leaflets pubescent on lower surface, serrate; secondary veins conspicuos on lower surface; pyrenes acutely triangular **5. C. littorale**
         4. Leaves 2–3 jugate; leaflets glabrous on both surfaces, entire; secondary veins inconspicuous on lower surface; pyrenes rounded triangular **6. C. patentinervium**
   2. Stipules subulate
      5. Leaves (2) 3–5 jugate; pyrenes rounded or triangular, with or without angle-rips
         6. Leaflet entire; fruits white or black when ripe
            7. Leaflets nearly glabrous; stipules very caducous, pubescent, insert at the base of the petiole; fruits white when ripe; pyrenes rounded triangular **1. C. album**
            7. Leaflets more or less pilose; stipules persistent, pilose, insert on the petioles up to 2 cm from the base; fruits black when ripe; pyrenes triangular **8. C. pilosum**
         6. Leaflet serrulate or ciliolate; fruits green to yellow when ripe

8. Leaflets densely pubescent on lower surface, dark brown when dry; stipules very caducous, insert at the base of the petioles; pyrenes triangular with distinct angle ribs in cross section; male flowers stamens connate up to 3/4 from base **10. C. strictum**

8. Leaflets glabrous or pubescent on lower surface, light brownish green when dry; stipules rather persistent, insert at the base or on the petioles; pyrenes rouded in cross section, without angle-ribs; male flowers stamens connate at base **11. C. subulatum**

5. Leaves 6–10 jugate; pyrenes triangular, with angle-ribs **2. C. bengalense**

1. Stipules absent

9. Leaflets pubescent on lower surfaces, along midrib on upper surface, entire, nearly sessile; leaves 3–5 jugate; secondary veins conspicuous below, not distinctly arched to margin; fruits 6–8 by 4–5 cm; pyrenes triangular **9. C. pseudodecumanum**

9. Leaflets glabrous on both surface, entire or serrate; petiolulate; fruits 2–3.5 by 1–1.5 cm; pyrenes rounded or triangular

10. Leaves 7–10 jugate; entire; petioles 15–30 cm long; pyrenes rounded angular **12. C. sumatranum**

10. Leaves 4–5 jugate; shallowly serrate or entire; petioles less than 15 cm long

11. Leaflets (7)10–15 by 3.5–5.5 cm, shallowly serrate to nearly entire, coriaceous; petioles 3–4 mm in diam; secondary veins 12–22 pairs, apex short acuminate; pyrenes triangular with distinct angle-ribs **4. C. euphyllum**

11. Leaflets 7–10 by 2.5–3 cm, entire, chartaceous; petioles 2 mm in diam; secondary veins 10–14 pairs; apex long acuminate; pyrenes rounded triangular **7. C. parvum**

1. Canarium album (Lour.) Raeusch., Nom.Bot. ed. 3: 287. 1797; Engl. in Monogr. Phan. 4: 149. 1883; Guill. in Fl. Gén. I-C. 1: 714, f. 76, excl. fr.(= *C. subulatum* Guill.). 1911; Hayata, J. Coll. Sc. Imp. Univ. Tokio, 30: 52. 1911; Leenh., Blumea 9: 402, f. 24. 1959; in Fl. Mal. I. 6: 926. 1972; C.D. Dai & Yakovlev in Bot. Zhurn. 70(6): 785. 1985; Yongboonkerd in Thai Royal Institute, Pl. Tax.: 261, cum fig. 1995.— *Pimela alba* Lour., Fl. Cochin.: 408. 1790; Blume, Mus. Bot. 1: 220. 1850.— *Canarium tonkinense* Engl. in Engl. & Prantl, Nat. Pflanzenfam., 3(4): 240. 1896. Fig. 3 a.

T h a i l a n d.— Cultivated.

D i s t r i b u t i o n.— Vietnam (type), S. China.

E c o l o g y.— Cultivated areas, 400–1200 m. Flowering March–August; fruiting June–December.

V e r n a c u l a r.— Gana (กานา), nam liab (หนำเลี๊ยบ), samo chin (สมอจีน) (Central), Chinese white olive.

U s e s.— The fruits are either edible fresh or preserved and are used in cooking. They are greenish-white with a rather strong resinous flavour in the fresh state; preservation is carried out by first soaking in salt water followed by drying. In China, the trade name is *kan-lan.* In Malaysia, the fresh and preserved fruits are sold under the name buah cana (Keng, 1969). They are also used in human and veterinary medicine. These uses are similar to those of *Canarium pimela* Leenh. (Black Olive). The stone of *C. album* is pointed and rough, while that of *C. pimela* (bluish-purple ripe fruits) is blunt and smooth (Thrower, 1988).

2. Canarium bengalense Roxb., [Hort. Beng: 49. 1814, nom. nud.]; Fl. Ind. ed. 2. 3: 136. 1832; Fl. Ind. ed. Carey 4: 504. 1874; Benn. in Fl. Br. Ind. 1: 534. 1875; Kurz, Fl. Burm. 1: 209. 1877; Engl. in Monogr. Phan. 4: 118. 1883; King, J. As. Soc. Beng. 62:

185, t. 10. 1893; Kanjilal et al., Fl. Assam 1(2): 224. 1936; Leenh., Blumea 9: 412, f. 27. 1959; Brandis, Ind. Trees: 130. reprint 1978; C.D. Dai &Yakovlev in Bot. Zhurn. 70(6): 785. 1985.

T h a i l a n d.— EASTERN: Chanthaburi (Pong Namron).

D i s t r i b u t i o n.— India (type), Myanmar, Indo-China.

E c o l o g y.— Scattered in evergreen forest, 700 m. Flowering unknown in Thailand; fruiting January.

V e r n a c u l a r.— Ma kok fan (มะกอกฟาน) (Eastern).

U s e s.— The wood used for boxes and shingles; fruits used for food and drink and also as medince in India (Kew Economic Botany database).

3. Canarium denticulatum Blume, Bijdr. Fl. Ned. Ind. 17: 1162. 1826; Blume, Mus. Bot. 1: 217. 1850; Miq., Fl. Ind. Bat., 1(2): 644. 1859; Engl. in Monogr. Phan. 4: 136. 1883; Ridl., Fl. Mal. Pen. 1: 374. 1922; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 13 f. 104a, t. 15 f. 123a, c; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 521. 1932; Leenh. in Fl. Mal. I. 5: 272, f. 21j, 22k, 37. 1956; Blumea 9: 367. 1959; Backer & Bakh.f., Fl. Java 2: 115. 1965; Smith, Kew Bull. 26(1): 143. 1972; Kochummen in Tree Fl. Mal. 1: 129. 1972.— *C. sylvestre* auct. non Gaertn.: Blume, Mus. Bot. 1: 217. 1850; Engl. in Monogr. Phan. 4: 114. 1883.— *C. fissistipulum* Miq., Sum.: 525. 1861; Engl., in Monogr. Phan. 4: 115. 1883; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 11 f. 70, t. 15 f. 123b. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 524. 1932.— *C. spectabile* Miq. Ann. Mus. Bot. 4: 116. 1869; Engl. in Monogr. Phan. 4: 147. 1883.— *C. coccineo-bracteatum* Kurz, J. As. Soc. Beng. 41(2): 296. 1872; Fl. Burm. 1: 209. 1877.— *C. fuscum* Engl. in Monogr. Phan. 4: 116. 1883.— *C. manii* King, J. As. Soc. Beng. 62(2): 247. 1894.— *C. kunstleri* King, J. As. Soc. Beng. 62(2): 248. 1894. Fig. 1 a, 2 d, 3 b, 4 g.

T h a i l a n d.— PENINSULAR: Ranong (Pakchan, Ngao Fall), Patthalung (Khao Pu Khao Ya), Trang (Khao Chong), Narathiwat (Waeng).

D i s t r i b u t i o n.— Myanmar, Malesia (Java, type).

E c o l o g y.— Rather common in evergreen forest by streams, 100–200. In the Malay Peninsula found up to 700 m. Flowering January–April; fruiting May–November.

V e r n a c u l a r.— Lan ban (แลนบาน), han tao (หานเตา), samo (สมอ), khao ho mai po (ข้าวห่อไม่พอ) (Peninsular).

4. Canarium euphyllum Kurz, [Rep. Veg. Andaman Isl.: 33 & 36. 1870, nom. nud.]; J. As. Soc. Beng. 41(2): 295. 1872; Fl. Burm. 1: 208. 1877; Benn. in Fl. Br. Ind. 1: 535. 1875; Engl. in Monogr. Phan. 4: 123. 1883; King, J. As. Soc. Beng. 62: 241. 1894; C.E. Parkinson in Forest Fl. Andaman Isl.: 116. 1923; Brandis, Ind. Trees: 130. reprint 1978; Leenh., Blumea 9: 417, f. 28. 1959. Fig. 1 b, 2 f, 5 a, 6 b, 6 e.

T h a i l a n d.— NORTHERN: Chiang Mai, Nan (Doi Phukha); NORTH-EASTERN: Chaiyaphum (Phu Khiao).

D i s t r i b u t i o n.— Myanmar (type).

E c o l o g y.— Rather common in montane forest, 900–1500 m. It is also found commonly at low altitude in Myanmar. Flowering April–May; fruiting February–March.

V e r n a c u l a r.— Ma bai (มะไบ้), ma koem (มะเกิ้ม), mang (มาง) (Lawa) (Northern).

5. Canarium littorale Blume, Bijdr., Fl. Ned. Ind. 17: 1164. 1826; Blume, Mus. Bot. 1: 218. 1850; Engl. in Monogr. Phan. 4: 126. 1883; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 13 f. 104g, t. 15 f. 119b. 1932; Bull. Jard. Bot. Buitenz. Sér. 3,12: 498. 1932; Coner, Ways Trees: t. 39. 1940; Leenh. in Fl. Mal. I. 5: 256. 1956; Blumea 9: 337. 1959; Backer & Bakh.f., Fl. Java 2: 115. 1965; Kochummen in Tree Fl. Mal. 1: 130. 1972; C.D. Dai in Fl. Tayg. En.: 64. 1984, C.D. Dai & Yakovlev in Bot. Zhurn. 70(6): 783. 1985; Keng, Conc. Fl. Singapore: 99, f. 89.1. 1990; non Ridl., Fl. Mal. Pen. 1: 375. 1922 (= *C. patentinervium*).— *C. glaucum* Blume, Mus. Bot. 1: 219. 1850; Engl. in Monogr. Phan. 4: 140. 1883; King, J. As. Soc. Beng. 62(2): 249. 1894.— *C. tomentosum* Blume, Mus. Bot. 1: 219. 1850; Engl. in Monogr. Phan. 4: 120. 1830; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 12 f. 93, t. 15 f. 119d-e. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 496, t. 12 f. 81. 1932.— *C. purpurascens* Benn. in Fl. Br. Ind. 1: 532. 1875; Engl. in Monogr. Phan. 4: 115. 1883; King, J. As. Soc. Beng. 62(2): 245. 1883; Ridl., Fl. Mal. Pen. 1: 370. 1922.— *C. rufum* Benn. in Fl. Br. Ind. 1: 533. 1875; Engl. in Monogr. Phan. 4: 107. 1883; King, J. As. Soc. Beng. 62(2): 224. 1894; Ridl. Fl. Mal. Pen. 1: 372. 1922; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 11 f. 79, t. 13 f. 104l. 1932; Bull. Jard. Bot. Buitenz. Sér. 3,12: 494, t. 12 f. 80. 1932.— *C. secundum* Benn. in Fl. Br. Ind. 1: 532. 1875; Engl. in Monogr. Phan. 4: 116. 1883; King, J. As. Soc. Beng. 62(2): 250. 1894; Ridl., Fl. Mal. Pen. 1: 375. 1922.— *C. pruinosum* Engl. in Monogr. Phan. 4: 106. 1883; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 11 f. 69. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 492, t. 12 f. 79. 1932.— *C. flavum* Ridl., Kew Bull. 1930: 81. 1930. Fig. 3 e, 5 g.

T h a i l a n d.— PENINSULAR: Ranong, (La-un), Songkhla (Kalom fall), Narathiwat (Waeng, Ko Wotai, Sukhirin, Sirindhone fall).

D i s t r i b u t i o n.— Malesia (Java, type), Indo-China.

E c o l o g y.— Scattered in evergreen forest, 50–200 m. In Malay Peninsula found also in swamp forest and above 1000 m. Flowering November–April; fruiting May–September.

V e r n a c u l a r.— Ma kok khon (มะกอกขน), siet mot (เสียดมอด), kue-la-ma-ni (กือลามานี) (Malay-Narathiwat) (Peninsular).

U s e s.— The wood is rather soft; the resin is used as damar. In China it is used as a cure for itch.

N o t e.— This is the most common species of *Canarium* in Malaysia (Kochummen, 1972).

6. Canarium patentinervium Miq., Fl. Ind. Bat. Suppl.: 526. 1861; Kurz, J. As. Soc. Beng. 44(2): 142. 1875, sphalm. *patentissimum*; Engl. in Monogr. Phan. 4: 148. 1883; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 5 f. 11, t. 6 f. 29c. 1932; Bull. Jard. Bot. Buitenz.

Sér. 3, 12: 506. 1932; Leenh. in Fl. Mal. I. 5: 258. 1956; Blumea 9: 342, f. 15. 1959; Kochummen in Tree Fl. Mal. 1: 134. 1972; Keng, Conc. Fl. Singapore: 100. 1990.— *C. nitidum* Benn. in Fl. Br. Ind. 1: 533. 1875; Engl. in Monogr. Phan. 4: 108. 1883; King, J. As. Soc. Beng. 62(2): 251. 1894; Ridl., Fl. Mal. Pen. 1: 373. 1922.— *C. parvifloliumum* Benn. in Fl. Br. Ind. 1: 536. 1875; Engl. in Monogr. Phan. 4: 140. 1883; King, J. As. Soc. Beng. 62(2): 241. 1894.— *C.? littorale* auct. non Blume: Ridl., Fl. Mal. Pen. 1: 375. 1922.

T h a i l a n d.— PENINSULAR: Chumphon, Phangnga (Takua Pa), Songkhla (Ton Nga Chang).

D i s t r i b u t i o n.— Malay Peninsula, Sumatra (type), Borneo.

E c o l o g y.— Primary forest, up to 450 m. Also found scattered in swamp forest. Flowering November–May; fruiting September–April in the Malay Peninsula.

V e r n a c u l a r.— Phuam phrao (พวมพร้าว), samo pa (สมอป่า) (Peninsular).

N o t e.— *Geesink et al.* 7533 (BKF, C, K, L) from Ranong and *Beusekom & Phengklai* 725 (L) from Phangnga were identified by K.M. Kochummen as *Canarium reniforme* Kochummen & Whitmore. This species has large, persistent stipules but none of these specimens have stipules, although they may have fallen off. For the time being I prefer to place them in *C. patentinervium.*

7. Canarium parvum Leenh., Blumea 9: 408. 1959.— *C. tonkinense* auct. non Engl.: Guill. in Fl. Gén. I.-C. 1: 711, pro parte., f. 26. 1911; in Suppl. Fl. Gén. I.-C. 1: 680, t. 83 f. 3–8. 1946, pro maj. parte.

T h a i l a n d.— NORTHERN: Chiang Mai (San Kamphaeng).

D i s t r i b u t i o n.— Vietnam (type).

E c o l o g y.— Lower montane forest, 1100 m. Fruiting July.

N o t e.— Known in Thailand from only one collection (Maxwell 96-958).

8. Canarium pilosum Benn. in Fl. Br. Ind. 1: 533. 1875; Engl. in Monogr. Phan. 4: 121. 1883; King, J. As. Soc. Beng. 62: 234. 1894; Ridl., Fl. Mal. Pen. 1: 372, f. 39. incl. var. *hirtellum.* 1922; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 13 f. 104i. 1932, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 472, t. 11 f. 68. 1932; Leenh., Bull. Bish. Mus. 216: 24, f. 11. 1955; in Fl. Mal. I. 5: 281. 1956; Blumea 9: 398. 1959; Kochummen in Tree Fl. Mal. 1: 134. 1972; Chung, Limestone Fl. Mal.: 158. 1973; Keng, Conc. Fl. Singapore: 100. 1990.— *C. grandiflorum* Benn. in Fl. Br. Ind. 1: 533. 1875; Engl. in Monogr. Phan. 4: 122. 1883; King, J. As. Soc. Beng. 62(2): 242. 1894; Ridl., Fl. Mal. Pen. 1: 370. 1922.— *C. hirtellum* Benn. in Fl. Br. Ind. 1: 534. 1875; Engl. in Monogr. Phan. 4: 121. 1883; King, J. As. Soc. Beng. 62(2): 244. 1894.— *C. motleyanum* Engl. in Monogr. Phan. 4: 133. 1883. Fig. 3 g.

T h a i l a n d.— PENINSULAR: Songkhla (Ko Kho Hong, Khao Nam Khang).

D i s t r i b u t i o n.— Malay Peninsula (type), Sumatra, Borneo.

E c o l o g y.— Scattered in disturbed forest and evergreen forest, 150–200 m. In the Malay Peninsula, it is also found in swamp forest and was once recorded from limestone in an area with deep soil (Chung, 1973). Flowering September.

N o t e.— Leenhouts (1956) reduced *Dacryodes scandens* Husson to a synonym of *Canarium pilosum* although the type of *Dacryodes scandens* was mentioned by the collector as definitely scandent. He further reduced it as a synonym of *Canarium pilosum* subsp. *borneensis*.

9. Canarium pseudodecumanum Hochr., Pl. Bog. Exs: 61. 1904; H.J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 13 f. 104a. 1932, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 438, t. 9 f. 51. 1932; Leenh. in Fl. Mal. I. 5: 275. 1956, Blumea 9: 388. 1959; Kochummen in Tree Fl. Mal. 1: 135. 1972; Chung, Limestone Fl. Mal.: 158. 1973.— *Canariopsis decumana* auct. non Blume: Miq., Sum.: 206, 527. 1861.— *Canarium decumanum* autc. non Gaertn.: Engl. in Monogr. Phan. 4: 132. 1883. Fig. 2 b, 5 f, 6 a.

T h a i l a n d.— PENINSULAR: Songkhla (Ton Nga Chang).

D i s t r i b u t i o n.— Malay Peninsula, Sumatra (type), Borneo.

E c o l o g y.— Scattered by stream in lowland evergreen forest, 100–200 m. Once recorded from limestone in the Malay Peninsula (Chung, 1973). Fruiting August.

V e r n a c u l a r.— Han (หาน) (Peninsular).

U s e s.— In Malaysia, the resin is used for caulking canoes.

10. Canarium strictum Roxb., [Hort. Beng.: 49. 1814, nom. nud.]; Fl. Ind. 3: 138. 1832; Benn. in Fl. Br. Ind. 1: 534. 1875; Engl. in Monogr. Phan. 4: 118. 1883; King, J. As. Soc. Beng. 62: 186, t. 11. 1893; Leenh., Blumea 9(2): 414. 1959; Brandis, Ind. Trees: 130. reprint 1978; Grierson in Fl. Bhutan 2(1): 26. 1991.— *Pimela stricta* Blume, Mus. Bot. 1: 226. 1850.— *Canarium sikkimense* King, J. As. Soc. Beng. 62: 187, t. 12. 1893; Brandis, Ind. Trees: 130. reprint 1978.— *C. resiniferum* Brace ex King, J. As. Soc. Beng. 62: 188, t. 13. 1893; Brandis, Ind. Trees: 132. reprint 1978, sphalm. *C. resiniferus*. Fig. 1 c, 2 e, 3 f, 5 d, 6 c.

T h a i l a n d.— NORTHERN: Chiang Rai (Doi Tung), Nan (Doi Phukha).

D i s t r i b u t i o n.— India (type), and Upper Myanmar.

E c o l o g y.— Scattered in montane forest, occasionally on limestone (Doi Tung), 1100–1500 m. In India found from 0–1600 m. Flowering December–July; fruiting September–March.

V e r n a c u l a r.— Mong (โมง) (Lawa-Northern), Black dammar.

U s e s.— The resin, which is obtained through the destructive method of cutting gashes in the lower part of the stem and then setting it on fire, is an article of trade in Southern India. It is used in the manufacture of waxes and varnishes (King, 1893) and for medicinal purposes (Kew Economic Botany database, June 1998).

N o t e.— The young foliage has always a characteristic bright red colour.

11. Canarium subulatum Guill., Bull. Soc. Bot. Fr. 9: 613. 1908; in Fl. Gén. I.-C. 1: 715. 1911; in Suppl. Fl. Gén. I.-C. 1: 680, t. 84 f. 6–9. 1946; Leenh., Blumea 9: 410. 1959; C.D. Dai & Yakovlev in Bot. Zhurn. 70(6): 785. 1985.— *C. vittatistipulatum* Guill., Bull. Soc. Bot. Fr. 9: 612. 1908, in Fl. Gén. I.-C. 1: 713. 1911, in Humbert, Suppl. Fl. Gén. I.-C. 1: 680. 1946.— *C. rotundifolium* Guill., Bull. Soc. Bot. Fr. 9: 614. 1908. in Fl. Gén. I.-C. 1: 712. 1911, in Suppl. Fl. Gén. I.-C. 1: 680. 1946; Craib, Fl. Siam. En. 1: 248. 1926.— *C. thorelianum* Guill. in Fl. Gén. I.-C. 1: 712. 1911, in Humbert, Suppl. Fl. Gén. I.-C. 1: 680, t. 84 f. 1–9. 1946.— *C. kerrii* Craib, Kew Bull. 1911: 26. 1911; Guill. in Fl. Gén. I.-C. 1: 716. 1911; Craib, Fl. Siam. En. 1: 247. 1926.— *C. album* auct. non (Lour.) Raeusch.: Guill. in Fl. Gén. I.-C. 1: 714. 1911.— *C. cinereum* Guill. in Fl. Gén. I.-C. 1: 717. 1911.— *C. vernosum* Craib, Fl. Siam. En. 1: 248. 1926; non Guill. in Suppl. Fl. Gén. I.-C. 1: 678, t. 83 f. 9–10. 1946 (= *C. littoral* Blume). Fig. 1 d, 5 b, 6 d, 6 f.

T h a i l a n d.— Found throughout the country except in the peninsula.

D i s t r i b u t i o n.— Indo-China (type).

E c o l o g y.— Rather common in dry dipterocarp and mixed deciduous forests from 100–1200 m altitude. Flowering January–May; fruiting May–December.

V e r n a c u l a r.— Ma koem (มะเกิ้ม), koem (เกิ้ม), ma lueam (มะเลื่อม) (Northern); ma chim (มะฉิม), kok kan (กอกกาน) (North-eastern); ma kok phan (มะกอกพาน), kok lueam (กอกเลื่อม) (Prachinburi) (Eastern); ma kok kluean (มะกอกเกลื้อน), ma kok lueam (มะกอกเลื่อม) (Central); ma kok lueat (มะกอกเลือด) (Peninsular); sa-lak (ซาลัก) (Khmer); cay ca na (Vietnamese).

U s e s.— The fruits are edible raw or fermented in syrup as a snack (sold throughout the country). The medium quality timber is used for construction.

N o t e.— Two infraspecific groups could be distinguished, mainly based on leaf and fruit characters: group A comprises material previously recognised as *Canarium kerrii* and *C. subulatum* and group B material recognised as *C. vernosum*. However, in this study I prefer to follow Leenhouts (1959) and do not formally recognise these groups.

12. Canarium sumatranum Boerl. & Koord. in Koord.-Schum., Syst. Verz. 2: 25. 1910; H. J. Lam, Ann. Jard. Bot. Buitenz. 42: t. 5 f. 3, t. 11 f. 78, t. 16 f. 132. 1932; Bull. Jard. Bot. Buitenz. Sér. 3, 12: 474, t. 11 f. 69, excl. fr. 1932; Leenh. in Fl. Mal. I. 5: 286. 1956; Blumea 9: 432, f. 31. 1959; Kochummen in Tree Fl. Mal. 1: 136. 1972.

T h a i l a n d.— PENINSULAR: Trang (Khao Chong), Satun, Songkhla (Ton Nga Chang), Yala (Tan To).

D i s t r i b u t i o n.— Sumatra (type), Malay peninsula.

E c o l o g y.— Common in evergreen forest. Fruiting in August–November.

V e r n a c u l a r.— Bok yuak (โบกหยวก), long (ลอง) (Peninsular).

Doubtful species

1. Canarium pseudosumatranum Leenh., Blumea 8: 193, f. 4. 1955.— *C. sumatranum* auct. non Boerl. & Koord.: H. J. Lam, Bull. Jard. Bot. Buitenz. Sér. 3, 12: 474, t. 11 f. 69b. 1932, pro min. parte.; Leenh. in Fl. Mal. I. 5: 286. 1956; Blumea 9: 431. 1959; Kochummen in Tree Fl. Mal. 1: 135, f. 2. 1972.

Fruiting specimens have not yet been recorded. The fruits are said to be much larger than in *C. sumatranum*. The only Thai specimens identified as *C. pseudosumatranum* are *Kerr* 12234 (BM, L), 15839 (K) and 18791 (K, L), which were described as having a spiny trunk and 14-jugate leaves up to 1.3 m long. In the Malay Peninsula they are said to be much more common than *C. sumatranum*.

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Table 1: Burseraceae commonly found in Malaysia near Thai border. (bold character for species already recorded in Thailand)

species	habitats	areas
Canarium caudatum King	lowland forest	**Malay Peninsula**: widespread.
***Canarium denticulatum* Blume**	lowland and hill forest	**Malay Peninsula**: Kd, Pk, Sl. **Thailand**: Ranong, Trang, Pathalung, Narathiwat.
Canarium grandifolium (Ridl.) H.J. Lam	-	**Malay Peninsula**: Kd, Tg, Pk, Ph, NS, Jh, Sp.
***Canarium littorale* Blume**	lowland forest, occasionally in the highlands	**Malay Peninsula**: throughout. **Thailand**: Narathiwat, Songkhla.
***Canarium patentinervium* Miq.**	lowland and hill forest understorey	**Malay Peninsula**: Kd, Kl, Tg, Pk, Ph, Sl, NS, Ml, Jh, Sp. **Thailand**: Chumphon, Phangnga, Songkhla.
***Canarium pilosum* Benn.**	lowland and hill forest to 600 m	**Malay Peninsula**: widespread. **Thailand**: Songklha.
***Canarium pseudodecumanum* Hochr.**	damp or swampy lowland forest	Kd, Pk, Ph, NS **Thailand**: Songkhla.
Canarium pseudosumatranum Leenh.	lowland and hill forest	**Malay Peninsula**: Ps, Kd, Pk, Ph, Sl, Ns.
***Canarium sumatranum* Boerl. & Koord.**	lowland forest	**Malay Peninsula**: NS **Thailand**: Trang, Songkhla , Satun.
***Dacryodes costata* (Benn.) H.J. Lam**	lowland and hill forest	**Malay Peninsula**: Kd, Tg, Pn, Pk, Ph, Sl, NS, Jh, Sp. **Thailand**: Surat Thani, Nakhon Si Thammarat, Satun.
***Dacryodes kingii* (Engl.) Kalkman**	lowland forest to 400 m	**Malay Peninsula**: throughout **Thailand**: Narathiwat.
Dacryodes laxa (Benn.) H.J. Lam	lowland and hill forest	**Malay Peninsula**: widespread.
Dacryodes longifolia (King) H.J. Lam	hill forest, often coastal	**Malay Peninsula**: Kd, Kl, Tg, Pn, Pk, Ph, Sl, NS, Jh.
***Dacryodes rostrata* (Blume) H.J. lam**	hill forest, sometimes in swamps	**Malay Peninsula**: Ps, Kd, Tg, Pn, Pk, Ph, Sl, NS, Jh, Sp. **Thailand**: Ranong, Krabi, Satun.
Dacryodes rugosa (Blume) H.J. Lam	lowland forest	**Malay Peninsula**: Kd, Kl, Tg, Pk, Ph, Sl, NS, Mi, Jh.
***Garuga floribunda* Decne.**	forest on limestone	**Malay Peninsula**: Kl.
Santiria apiculata Benn.	lowland and hill forest to 1200 m	**Malay Peninsula**: Kd, Kl, Pk, Ph, Sl, NS, Ml, Jh.

Table 1: (continued)

species	habitats	areas
Santiria apiculata Benn. var. rubra (Ridl.) Kalkman	lowland and hill forest	**Malay Peninsula**: widespread.
***Santiria laevigata* Blume**	lowland to montane forest	**Malay Peninsula**: Kd, Kl, Tg, Pn, Pk, Ph, Sl, NS, Ml, Jh, Sp. **Thailand**: Narathiwat.
***Santiria rubiginosa* Blume**	lowlands to mountains	**Malay Peninsula**: Kd, Tg, Pk, Ph, Sl, NS, Jh, Sp. **Thailand**: Narathiwat.
***Santiria tomentosa* Blume**	swampy lowland forest	**Malay Peninsula**: Kd, Kl, Tg, Pn, Pk, Ph, Sl, NS, Ml, Jh, Sp. **Thailand**: Narathiwat.
Scutinanthe brunnea Thwaites	lowland and hill forest	**Malay Peninsula**: Kd, Pk, Ph, Sl, NS, Ml, Jh.
Triomma malaccensis Hook.f.	lowland forest	**Malay Peninsula**: scattered throughout.

Source: Turner (1995).

Note:

Jh = Johore

Kd = Kedah

Kl = Kelantan

Ml = Malacca

NS = Negeri Sembilan

Ph = Pahang

Pk = Perak

Pn = Penang

Ps = Perlis

Sl = Selangor

Sp = Singapore

Tg = Trengganu

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List of collectors' numbers

Akkanitat 17: 5.11 (BKF).

Ammnat 112: 5.11 (BKF).

Amnat 106: 1.1 (BKF).

Beusekom et al. 2502: 5.11 (C); 3579: 5.11 (BKF, C, K, L); 36780: 1.1 (K, L).

Beusekom & Phengklai 725: 5.6 (BKF, K, L).

Boworn s.n.: 5.11 (BKF).

Bunchai & Nimanong 1463: 5.11 (BKF, C, L).

Bunchuai 576: 5.11 (BKF, K, L); 1118: 1.1 (BKF); 1572: 2.1 (BKF).

Bunchui & Nimanong 1238: 4.3 (BKF, K);

Bunnab 48: 5.12 (BKF); 138: 5.3 (BKF); 323: 5.3 (BKF); 405: 5.3 (BKF).

Bunpheng 128: 1.1 (BKF); 151: 2.1 (BKF); 397: 2.1 (BKF); 1062: 1.1 (BKF); 1090: 1.1 (BKF).

Bunyarataphand 106: 1.1 (BKF, K).

Chantaranothai, Panell & Simpson 12: 5.11 (K).

Collin 402: 5.11 (BM); 403: 5.11 (BM, K); 1534: 5.11 (BK).

Collins 73: 2.1 (BM, K).

Dasadakorn 61: 5.3 (BK).

Din 46: 2.1 (BKF); 138: 5.11 (BKF); 324: 5.3 (BKF); 350: 5.12 (BKF).

Fukuoka T-62002: 5.11 (BKF); T-62372: 5.11 (BKF).

Geensink et al. 5590: 5.11 (C, K, L).

Geesink et al. 7533: 5.6 (BKF, C, K, L).

Kerr s.n.: 5.11 (BK, BM); 581: 1.1 (BM, K, L); 605: 5.11 (K); 605a: 5.11 (K); 933: 5.11 (BK); 1002: 2.1 (BM, L); 3192: 1.1 (BM, K); 3203: 5.11 (BM, K); 3576: 2.1 (BM); 3580: 2.1 (BM); 5081: 2.1 (BK, BM, K, L); 5224: 1.1 (BK, BM, K); 5397: 1.1 (BK, BM, K); 5405: 5.11 (BK, BM, K); 5406: 5.11 (BK, BM, K); 5406A: 5.11 (BK, BM, K); 5545: 5.11 (BK, BM, K); 5729: 5.11 (BK, BM, K); 5814: 5.11 (BK, K); 8753: 1.1 (BK, BM, K); 8914: 5.11 (BK, BM, K); 10466: 2.1 (BK); 10609: 5.11 (BK, BM, K, L); 11687: 5.3 (BK, BM, C, K, L); 12253: 5.3 (BK, BM, K, L); 12835: 5.11 (BK, BM); 12835: 5.11 (BK, BM, C, K, L); 13914: 3.3 (BK, BM, C, K, L); 14644: 5.12 (BM); 15839: 5.9 (BK, BM, K); 16396: 3.3 (BK, C, K, L); 16400: 4.1 (BM, K, L); 16506: 5.5 (BM); 18606: 3.3 (BK, BM, C, K, L); 19030: 3.3 (BK, BM, C, K, L); 20300: 1.1 (BK, K, L); 20336: 2.1 (BK, BM, K, L); 20662: 5.11 (BK, BM); 20911: 1.1 (BK).

Kopachon s131: 1.1 (CMU-Bio); s158 b1: 2.1 (CMU-Bio).

Kosterman 1340: 1.1 (L).

Kostermans 990: 2.1 (K, L).

Lakshnakara s.n.: 5.2 (BK, BM); 933: 5.11 (BM, K).

Larsen & Smitinand 9648: 1.1 (BKF, C).

Larsen 9663: 2.1 (BKF).

Larsen et al. 31088: 4.1 (K); 31394: 1.1 (K, L); 33958: 2.1 (BKF, K); 33970: 1.1 (L); 43606: 5.11 (BKF).

Marcan 1512: 2.1 (BM); 2169: 5.11 (BM, K); 2182: 5.11 (BM).

Maxwell 72-117: 2.1 (BK); 74-145: 2.1 (BK); 74-248: 2.1 (BK); 74-290: 5.11 (BK); 74-640: 5.11 (BK); 75-97: 1.1 (BK, L); 75-202: 1.1 (BK, L); 75-203: 5.11 (BK, L); 75-371: 1.1 (BK, L); 75-516: 5.11 (BK, L); 75-610: 1.1 (BK, L); 76-105: 1.1 (BK, L); 76-396: 1.1 (BK, L); 84-262: 5.8 (BKF, PSU); 86-90: 1.1 (BKF); 86-139: 3.1 (L); 86-139: 3.3 (PSU); 87-91: 5.3 (CMU-Ph., PSU); 87-307: 5.3 (BKF, PSU); 87-608: 5.11 (BKF, CMU-Ph., L); 87-979: 1.1 (BKF, CMU-Pha, L); 88-178: 1.1 (BKF, L); 88-203: 2.1 (L); 88-205: 2.1 (BKF); 88-331: 1.1 (BKF, CMU-Pha, L); 88-

472: 5.11 (BKF, CMU-Ph., L); 88-587: 2.1 (BKF, CMU-Pha); 88-735: 5.11 (BKF, CMU-Ph., L); 88-795: 1.1 (BKF, L); 88-811: 1.1 (BKF, CMU-Pha, L); 89-354: 1.1 (BKF, CMU-Pha, L); 89-494: 5.11 (BKF, CMU-Ph., L); 89-515: 2.1 (BKF, L); 89-587: 2.1 (BKF, L); 89-602: 2.1 (L); 89-943: 1.1 (L); 89-964: 1.1 (L); 89-975: 5.11 (L, CMU-Pha); 89-1010: 2.1 (L); 90-323: 5.11 (CMU-Ph., L); 90-324: 2.1 (L); 90-329: 2.1 (L); 90-347: 1.1 (L); 90-519: 5.11 (L, CMU-Pha.); 90-650: 2.1 (L); 92-83: 2.1 (CMU-Bio); 92-308: 1.1 (CMU-Bio); 92-307: 2.1 (CMU-Bio); 92-314: 1.1 (CMU-Bio); 92-315: 2.1 (CMU-Bio); 92-529: 5.11 (BKF, CMU-Ph., L); 93-250: 2.1 (CMU-Bio); 93-329: 1.1 (CMU-Bio); 93-567: 5.11 (BKF, CMU-Ph., L); 93-586: 2.1 (CMU-Bio); 93-730: 1.1 (BKF, CMU-Bio); 93-736: 1.1 (CMU-Bio); 94-269: 2.1 (CMU-Bio); 94-298: 2.1 (CMU-Bio); 94-397: 1.1 (CMU-Bio); 94-550: 1.1 (CMU-Bio); 95-292: 1.1 (BKF, CMU-Bio); 95-517: 1.1 (BKF, CMU-Bio); 96-445: 2.1 (CMU-Bio); 96-585: 5.11 (BKF, CMU-Ph., L); 96-766: 5.11 (BKF, CMU-Ph., L); 96-962: 1.1 (CMU-Bio); 96-958: 5.7 (BKF, CMU-Bio); 96-1168: 1.1 (BKF, CMU-Bio); 96-1286 (BKF, CMU-Bio); 97-303: 2.1 (CMU-Bio); 97-368 1.1 (CMU-Bio); 97-674: 2.1 (CMU-Bio); 97-843: 1.1 (CMU-Bio).

Merrill 5475: 2.1 (L), 5478: 2.1 (K, L).

Merrill et al. s.n.: 1.1 (L); 50587: 2.1 (BKF); T-50613: 5.11 (BKF).

Murata, Fukuoka & Phengklai T-16346: 1.1 (L).

Nai Noe 218: 2.1 (BK, BM).

Nai Noi 191: 5.11 (BK, BM, K).

Nakkan 46: 2.1 (BKF); 138: 5.11 (BKF); 156: 5.11 (BKF).

Nimanong 106: 1.1 (BKF, C, K, L); 706: 1.1 (L);

Nimanong & Phusomsaeng 1715: 1.1 (BKF, L); 1778: 1.1 (BKF, PSU).

Niyomdham 50A: 1.1 (BKF, C, L); 722: 5.5 (BKF, C); 784: 4.1 (BKF, K, L); 895: 1.1 (BKF); 1670: 4.1 (BKF, K, L); 5158: 5.5 (BKF).

Niyomdham & Phudjaa 3169: 5.12 (BKF).

Niyomdham et al. 2050: 4.2 (BKF).

Panauchon 11: 1.1 (BKF, L).

Peerapat s.n.: 5.6 (BK).

Phengaren 436: 1.1 (BKF, L).

Phengklai & Smitinand 1216: 5.3 (BKF).

Phengklai 82: 2.1 (BKF); 86: 2.1 (BKF); 113: 5.11 (BKF, C, L); 688: 2.1 (BKF).

Phengklai et al. 6555: 5.11 (C, K).

Phengklai, B. Sangkhachand & Nimanong 2974: 2.1 (K, L).

Phusomsaeng 146: 5.3 (BKF (L).

Phusomsaeng et al. 13: 5.3 (BKF, K).

Pooma 133: 1.1 (BKF, CMU-Bio); 490: 1.1 (BKF, CMU-Bio); 517: 5.11 (BKF); 630: 1.1 (BKF); 668-1: 5.1 (BKF); 668: 5.11 (BKF); 726: 5.11 (BKF); 737: 5.11 (BKF); 774: 5.11 (BKF); 782: 5.11 (BKF); 811: 2.1 (BKF, CMU-Bio); 814: 1.1 (BKF, CMU-Bio); 823: 1.1 (BKF); 827: 5.11 (BKF); 829: 5.11 (BKF); 848: 5.11 (BKF); 849: 5.11 (BKF); 850: 5.11 (BKF); 851: 5.11 (BKF); 1110: 5.10 (BKF); 1111: 5.10 (BKF); 1118: 1.1 (BKF, CMU-Bio); 1218: 5.10 (BKF); 1304: 5.10 (BKF); 1305: 5.4 (BKF, CMU-Bio); 1306: 5.4 (BKF, CMU-Bio); 1319: 5.11 (BKF, CMU-Ph); 1322: 5.5 (BKF); 1332: 5.11 (BKF, CMU-Ph.); 1348: 5.11 (BKF); 1380: 5.4 (BKF); 1383: 5.10 (BKF); 1389: 1.1 (BKF); 1406: 5.10 (BKF); 1416: 5.10 (BKF); 1424: 5.4 (BKF, CMU-Bio); 1467: 5.10 (BKF); 1474: 5.4 (BKF, CMU-Bio); 1483: 1.1 (BKF, CMU-Bio); 1506: 5.4 (BKF, CMU-Bio); 1511: 5.4 (BKF, CMU-Bio); 1521: 1.1 (BKF, CMU-Bio); 1522: 2.1 (BKF, CMU-Bio); 1534: 5.10 (BKF, CMU-Bio); 1538: 2.1 (BKF, CMU-Bio); 1552: 5.11 (BKF); 1553: 5.11 (BKF); 1626: 2.1 (BKF, CMU-Bio); 1734: 5.3 (BKF); 1744: 3.3 (BKF); 1745: 5.8 (BKF); 1746: 5.5 (BKF); 1755: 5.9 (BKF); 1761: 3.2 (BKF).

Pracha 6: 5.11 (BKF).

Praphat 17: 1.1 (BKF).

Put 2795: 1.1 (C); 15: 2.1 (BKF); 2795: 2.1 (BK, C, K).

Puudja 59: 5.6 (BKF); 184: 5.11 (BKF); 497: 5.5 (BKF).

S.N. 296: 5.11 (BKF).

Sakarin 192: 2.1 (BKF).

Samruay, Sakrin & Adithep 192: 2.1 (BKF).

Sangkhachand 1536: 5.3 (BKF, C, K, L).

Sangkhachand B. 611: 2.1 (BKF); 660: 2.1 (BKF); 754: 2.1 (BKF); 765: 1.1 (BK, BKF, K); 881: 4.1 (K); 1415: 1.1 (C); 1486: 1.1 (BKF, C, K, L).

Sangkhachand B. et al. 3131: 1.1 (PSU).

Sangkhachand B., Phusomsaeng & Nimanong 1089: 4.3 (BKF, K, L).

Sangkhachand P. 152: 3.3 (BKF); 225: 5.11 (BK); 828: 1.1 (BK); 944: 5.11 (BK); 1415: 1.1 (BK); 1877: 3.3 (BK, L).

Sanoh 48: 2.1 (BKF).

Santisuk 1124: 5.11 (BKF).

Santisuk et al s.n.: 1.1 (BKF).

Setbubpa 057: 1.1 (BKF).

Sidisunthorn & Gardner 2512.0: 2.1 (CMU-Bio); 2543.0: 2.1 (CMU-Bio).

Singhasatit 428: 1.1 (BKF).

Smitinand 90-63: 1.1 (BKF); 90-172: 5.11 (BKF); 1708: 5.11 (BKF); 2708: 5.11 (BKF); 2926: 3.1 (BKF); 3309: 1.1 (BKF); 3526: 5.2 (BKF); 10526: 5.12 (BKF); 10920: 5.5 (BKF, C, K); 10958: 3.2 (BKF, K, L); 11741: 4.2 (BKF); 11975: 3.1 (BKF); 11978: 3.3 (BKF).

Smitinand & Santisuk et al 344: 2.1 (BKF).

Snan 1039: 3.1 (BK, BKF, K).

Soejarto, Taylor & Nantasan 5835: 2.1 (BKF, L).

Somphob 1: 5.11 (BKF).

Somsak 11: 5.11 (BKF).

Soradet 428: 1.1 (L).

Sorensen, Larsen & Hansen 3193: 5.11 (K).

Srisanit s.n.: 2.1 -BKF no 614: 2.1 (BKF).

Steenis 19645: 2.1 (L); 19646: 5.11 (BKF, L), 19646a: 5.11 (L).

Suriya s158b1 H1-H3: 2.1 (CMU-Bio);

Sutheesorn 2882: 1.1 (BK); 2948: 2.1 (BK); 323: 5.11 (BK); 2401: 5.11 (BK); 3505: 5.11 (BK).

Suvarnasuddhi 358: 5.11 (BKF).

Tanthana & Sawangchote 628: 5.9 (PSU).

TDBS 2559: 5.11 (BKF, C); 3193: 5.11 (BKF, C), 5346: 5.11 (C); 5628: 5.11 (C).

Teysmann s.n.: 2.1 (L).

Thamachat 4: 2.1 (BKF).

Vanpruk 171: 2.1 (K); 402: 1.1 (BKF, K); 423: 2.1 (BKF).

Winit 77: 1.1 (BM, K); 126: 5.11 (BM, K); 127: 1.1 (BM, K).

Wongprasert 49: 1.1 (K).

Worawoat 41: 5.11 (BKF).

No collector name (BKF no 611): 5.11 (BKF); (BKF no. 079230): 5.3 (BKF).

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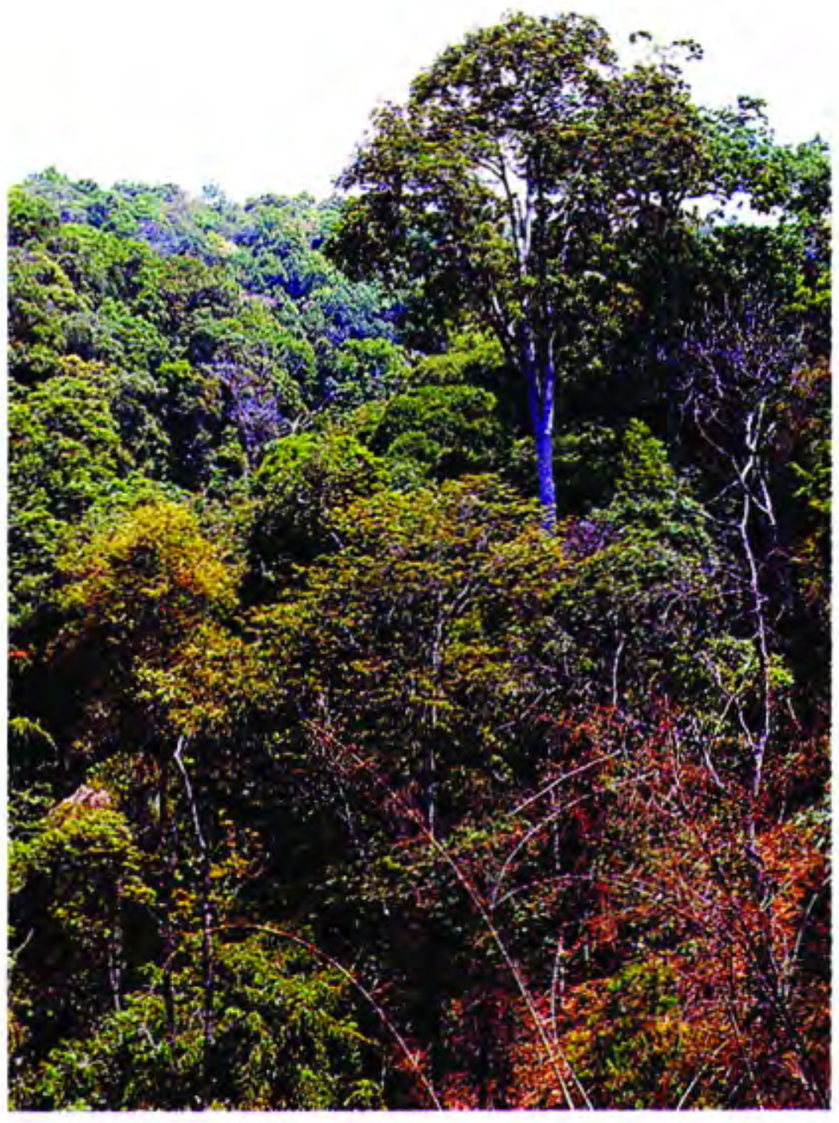

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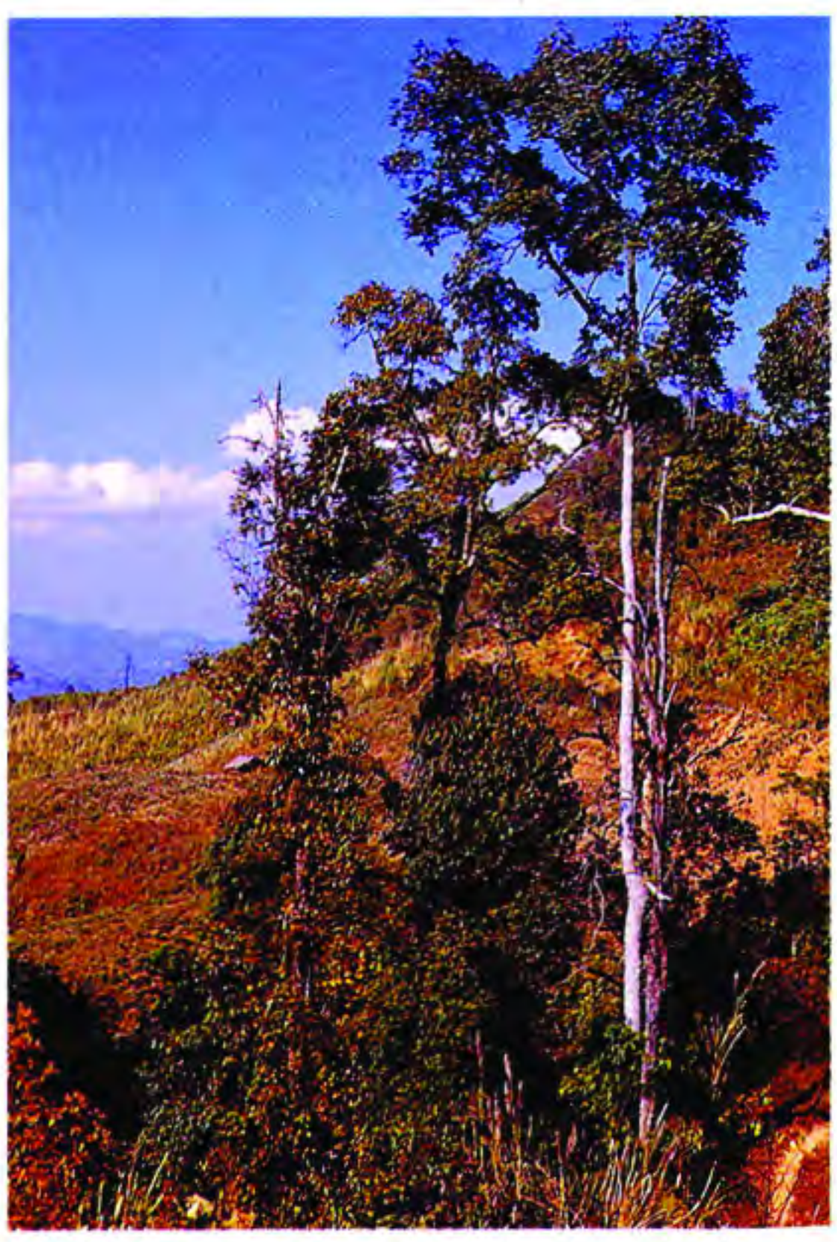

c

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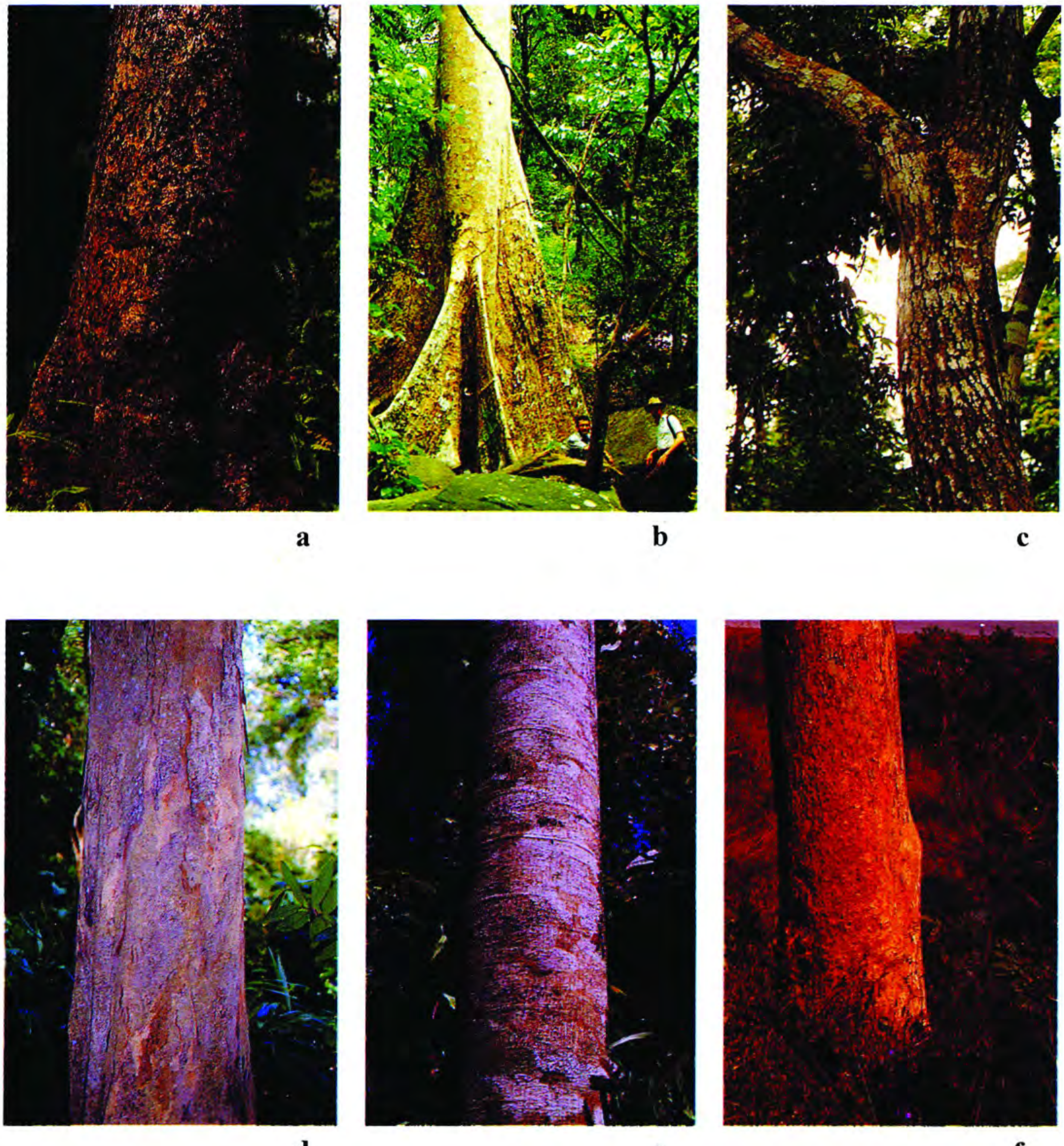

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a

b

c

d

e

f

g

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a

b

c

d

e

f

g

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a

b

c

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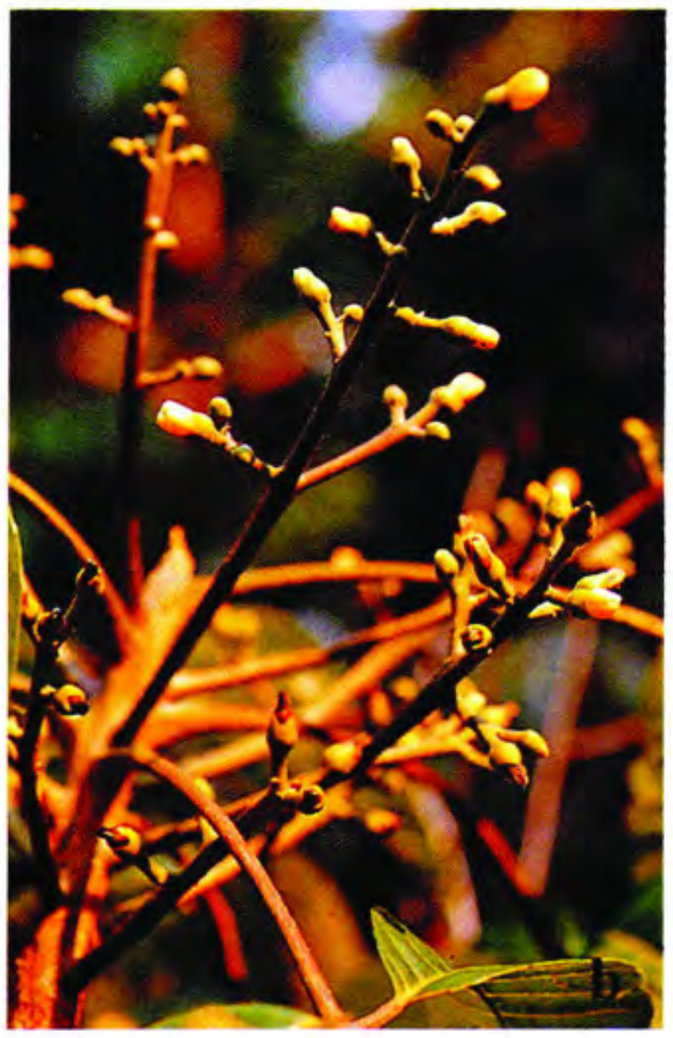

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