

THE GENUS *BURRETIODENDRON*\* Rehder (Tiliaceae)

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## SUMMARY

1. Seven species of *Burretiodendron* are recognized, of which *B. siamensis* and *B. yunnanensis* are new to science.
2. The distributional area of the genus covers Siam (one species), Yunnan (two species), Kweichow (one species); Kwangsi (three species) and Tonkin (two species).
3. *B. tonkinensis* is reduced to the synonymy of *B. hsiennu*.
4. A key to the species is presented.

## ACKNOWLEDGEMENTS

I extend herewith my thanks to Dr. C. G. G. J. van Steenis, who went through the MSS critically, to Dr. R. C. Bakhuizen van den Brink, who corrected the Latin diagnoses and to Mr. Tem Smitinand, Bangkok, who put valuable material at my disposal.

*BURRETIODENDRON* Rehder

*Burretiodendron* Rehder in J. Arnold Arb. 17: 47. 1936; 18: 220. 1937; Chun & How in Acta phytotaxonomica Sinica 5: 4. 1956; Kostermans in Reinwardtia 5: 239. 1960.

Trees with spirally arranged, stellate-pubescent leaves, palmatinerved or triplinerved, entire or in their upper part lobed or crenulate, base symmetric or asymmetric; stipules early caducous; petiole usually long and slender, slightly swollen towards apex.

Flowers unisexual, dioecious, in small panicles or solitary, pedicel articulately attached to the branchlet; bracteoles 2—3 or none, often enveloping the flower buds, caducous; sepals 5, free, valvate, stellate pilose outside, inside glabrous with a glandular zone at base; petals as a rule 5, sometimes more, free, aestivation contort, more or less unguiculate; stamens numerous (15 - 60), almost free or over a short distance connate at base, the free part often in 5 fascicles; no staminodes; anthers linear-oblong, basifix, bilocular, longitudinally dehiscent; ovary in male flower

\* Named after C. E. M. Burret, formerly of the Botanical Museum, Berlin-Dahlem, well-known for his studies in Palmae and Tiliaceae.

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reduced; female flower unknown. Capsule lengthwise 5-winged, splitting septically into 5, one-seeded cocci, each coccus surrounded by a chartaceous wing. Ovules 2—6; seed smooth or partly rugose, hilus small, lateral.

TYPE SPECIES. — *B. esquirolii* (Lév.) Rehder

DISTRIBUTION. — S. E. Asiatic mainland, from Yunnan, Kweichow, Kwangsi to Siam and Tonkin.

Rehder segregated *Burretiodendron* for the following reasons. From *Luehea* it differs by its fruit, which dehisces into 5 one-seeded cocci and the unisexual flowers; the petals have no glandular spot.

According to Rehder a nectary at the base of the sepals is absent in all Tiliaceae, but this needs confirmation.

The fruit and general habit of the species of *Burretiodendron* resembles strongly the genus *Colona*, but the latter has bisexual flowers and the fruit does not dehisce in separate cocci.

*Eriolaena* has ligneous loculicidally dehiscent capsula with winged seeds.

*Pentace* has fruit similar to those of *Colona*, and the flowers have a row of staminodes and are bisexual.

The nearest genus is certainly *Colona*.

Although there was material only of three species available for examination, I venture to give a general revision of the genus, because of the discovery of two new species, the merging of *Parapentace* in the genus and the rarity of the Chinese publication of this group.

#### KEY TO THE SPECIES

1. a. Leaves with barbellate domatia on the lower surface in the axils of the main nerves . . . . . 2
- b. Leaves without domatia . . . . . 3
2. a. Leaves chartaceous, triplinerved; base acute. Capsules obconical 5. *B. obconicum*
- b. Leaves coriaceous, palmatinerved; base obtuse or subcordate. Capsules ellipsoid. . . . . 4. *B. hsienmu*
3. a. Capsule orbicular-ellipsoid (cf. also *B. brilletii*). . . . . 4
- b. Capsule elongate . . . . . 5
4. a. Leaves orbicular-ovate, hardly triplinerved, margin serrulate; nerves ending in a gland . . . . . 7. *B. combretoides*
- b. Leaves elliptical to oblong-elliptical, triplinerved; margin entire, no glands . . . . . 6. *B. yunnanensis*
5. a. Branchlets and inflorescence grey stellate-tomentose. Nerves not ending in a gland. Stamens 15—18, hardly connate. Flowers in an up to 4 cm long, slender panicle with caducous bracts . . . . . 3. *B. brilletii*



- b. Branchlets and inflorescence rusty, shortly stellate-pilose. Lateral nerves ending in a gland. Stamens ca 30. Flowers solitary or in up to 3 cm long congested bracteolate panicles . . . . . 6
6. a. Upper leaf surface glabrous; leaf base truncate to subcordate. Flowers solitary. Capsules 5 cm long . . . . . 2. *B. siamensis*
- b. Upper leaf surface pilose; leaf base cordate. Flowers in congested, bracteolate panicles. Capsule 3.5 cm long. . . . . 1. *B. esquirolii*

### 1. BURRETIODENDRON ESQUIROLII (Lév.) Rehder — Fig. 1

*Burretiodendron esquirolii* (Lév.) Rehder in J. Arnold Arb. 17: 48, t. 178. 1936; id. 18: 220. 1937; Chun & How in Acta phytotax. Sinica 5: 7, t. 1. 1956 — *Pentace esquirolii* Léveillé in Fedde, Rep. 10: 147. 1911; Fl. Kouy-Tchéou 419. 1915; Burret in Notizbl. bot. Gart. Berlin-Dahlem 9: 620. 1926; Chun & How, l.c. (sphalm.: *Pantace*). — *Cavalerie* 2848.

*Eriolaena esquirolii* Léveillé, Fl. Kouy-Tcheou 405. 1916; Rehder, l.c.; Chun & How, l.c. — *Esquirol* 2717.

Tree up to 10 m high; branchlets densely minutely stellate-pilose; branches grey. Leaves asymmetric, chartaceous, ovate-rotundate to obovate-rotundate, 6—12 by 4—8 cm (sometimes up to 28 × 20 cm), upper part often grossly crenate; apex acute, base cordate, palmately 5—7-nerved both surfaces densely stellate-pilose; upper surface smooth, lower one reticulate, nerves 4—5 pairs, straight, rather erect, ending in a small protruding gland. Petiole 2.5—5 cm, slender, densely stellate-pilose.

Panicles of cymes short, dense, up to 3 cm long. Male flowers shortly pedicelled, at base with 2 or 3 broadly oval to elliptical, obtuse, concave, 7 mm long bracts, outside densely stellate-pilose, interspersed with glands, inside glabrous, before anthesis enveloping the flower buds. Sepals narrowly elliptical, acute, 10 mm long, 4 mm wide, outside densely stellate-pilose, inside glabrous with a basal, oblong, elevated, glandular part, about 3—4 mm long; petals glabrous, broadly obovate, almost truncate and ciliolate, 8—11 mm long, 7—8 mm wide, margin ciliolate; claw 3 mm long. Stamens ca 30, about 7 mm long; anthers 2 mm long; ovary rudiment circa 1 mm long, rostrate. Capsule oblong, stipitate, 1.3—3.5 cm long, circa 1.5 cm wide; wings papery, circa 6 mm wide; seeds 8 mm long, 3—4 mm wide; pedicel circa 1 cm long.

DISTRIBUTION. — Southeastern Yunnan and Kweichow.

I have not seen material of this species, which is near *B. siamensis* Kosterm.

CHINA. — Kweichow, fl., Y. Tsiang 7290 (NY); west of Lo-Fou (Kouai-Kou), *Cavalerie* 2648; *Esquirol* 817, and Yang-ly *Esquirol* 2717; Yunnan, Red River, Henry 9572 (NY), near Manhao, Henry 9573 (NY).



## 2. *Burretiodendron siamense* Kosterm., *spec. nov.* — Fig. 2.

*Burretiodendron esquirolii* (non Rehder) Smitinand in the Nat. Hist. Soc. Bull. of the Siam Society 19: 88. 1958. — Sinthiphongse 27 (BKF).

*Arbor mediocris; ramulis dense pilis brevissimis stellate-lepidotis vestitis, annotinis glabris lenticellatis; foliis chartaceis glabrescentibus late ovatis basi truncatis apice acutis, nervis basalibus 5 vel 7; nervis lateralibus suberectis strictis ad marginem in mucronum glandulosum exeuntibus, utrinque glabris costis pilis paucis exceptis; petiolis subglabris gracilibus; floribus in axillis foliorum plerumque singulis, ebracteatis, in alabastro solum visis, dense et minute stellato-pilosis; fructu immaturo ellipsoideo, alis glabris munito.*

Tree, 8—12 m tall, 11 cm diam.; bark greyish brown, rather smooth, shallowly streaked; branchlets densely, very shortly brown stellate-lepidote pilose; branches glabrous, grey, lenticellate, the older ones striate. Leaves chartaceous, glabrescent, broadly ovate, 8—15 × 5.5—10 cm, margin entire or 3-lobed at apex, base truncate or subcordate, apex acute, both sides minutely, densely areolate-reticulate, nerves slender, prominulous, basal nerves 5 or 7, straight, erect, ending in a small protruding gland, nerves 4—5 pairs, erect. Petiole glabrous (except apex), up to 5 cm long. Flowers solitary, axillary; pedicel 1—1.5 cm, densely pilose; buds conical, mucronulate, densely stellate-pilose. Capsule elliptical, glabrous, (young) 5 cm long, almost 2 cm wide; seed 10 mm long.

TYPUS. — *Sinthiphongse* 27 (BKF)

DISTRIBUTION. — Northern Peninsular Siam, Mergui region of Burma.

VERNAC. NAMES: Malai khao (Siam)

The species is related to *B. esquirolii*, differs by its almost glabrous leaves with a truncate base, the solitary flowers without bracts, the long pedicel, the shorter hairs of the flower buds and the much larger fruit.

Through the courtesy of Mr. Tem Smitinand (Royal Forest Department, Bangkok), I received a fragment of his number 1479 and the material, collected by Sinthiphong 27 (*Sinthiphongse* 27) both from the Northern part of Peninsular Siam.

Smitinand discovered another specimen, collected in Mergui, Birma (according to Smitinand: Muriels 836), mentioned by Prain in Journ. Linn. Soc. 37: 254. 1905 as Kalomet B under *Mansonia* (the true *Mansonia gagei* = Kalomet A). Brandis gave a short description (Indian Trees, Addenda p. 702. 1906), but no name.



The lower leaf surface shows scattered, scale-like, brown transparent exudation concretions. Dr. Howard (Arnold Arboretum) drew my attention to the fact, that they are not scales and are soluble in hot water.

Not all the lateral nerves end in glands, some are arcuately anastomosing at some distance from the margin.

BIRMA. — Mergui, *Muriels 836* (K, n.v.); SIAM. — Peninsular Siam, Prachuap Khirikan, Hua Hin, Khao Kailas, alt. 50 m, rocky slope in deciduous forest, not common, Dec., buds, *Smitinand 1479* (*For. Dept. Herb. 6821*) (BKF, BO); *ibid.*, Khao Chawng Kachok, common in deciduous forest, Dec., buds and young fr., *Thaew Sinthiphongse 27* (*For. Dept. Herb. 5549*) (BKF, L).

### 3. BURRETIODENDRON BRILLETII Kosterm. — Fig. 3.

*Burretiodendron brilletii* Kostermans in *Reinwardtia* 5: 240. 1960. — *Parapentace brilleftii* Gagnepain (*nom. inval.*) in *Bull. Soc. bot. France* 90: 71. 1943. — *Brillet 19* (P).

Tree, branchlets minutely, densely grey stellate-tomentose. Leaves chartaceous, broadly ovate to suborbicular, 7—11 × 4—10 cm, apex acuminate with blunt tip, base subcordate, both surface densely areolate-reticulate, above glossy, nerves very slender, glabrescent, lower surface paler with scattered stellate hairs on the nerves, 5 basal nerves, ca 5 pairs of erect, straight, slender, prominent nerves, arcuately running out near the entire margin; veins slender, parallel. Petiole slender, 1.5—4 cm long, densely, minutely stellate-pilose.

Inflorescences fascicled in the leaf-axils, laxly paniculate, up to 4 cm long, densely grey stellate-tomentose; main peduncle up to 3 cm long, slender; branches short, few. Pedicel 1—2 mm long; bracts caducous. Flower bud slender, ovoid-ellipsoid, acute, densely grey stellate-pilose, 5 mm long. Male flowers 7 mm long, about 10 mm in diam.; sepals lanceolate, acutish, concave, 6—10 mm long, outside pilose, inside glabrous with a small nectarial basal part; petals spatulate, slightly longer than the sepals, apex rounded or truncate, somewhat wavy, gradually narrowing towards the base. Stamens 15—18, hardly connate; filaments ca 5 mm long, anthers elliptical, 2 mm; pistillode ovoid, 1 mm, stellate-pilose, apex tricuspidate.

Female flower and fruit unknown.

DISTRIBUTION. — Tonkin.

Gagnepain mentioned in his discussion a third species of his genus *Parapentace*, based on a specimen, collected by Cavalérie near Lo-fou. This specimen, which is in fruit, represents *B. esquirolii* Rehd.

TONKIN. — Hoa Binh, fl., *Brillet 19* (BO, P), local name "Kieng Quang".



## 4. BURRETIODENDRON HSIENMU Chun &amp; How — Fig. 4.

*Burretiodendron hsienmu* Chun & How in Acta phytotaxon. Sinica 5: 9, t. 3. 1956. — C. F. Liang 31523 b.

*Pentace tonkinensis* A. Chevalier in Bull. écon. Indochina 20: 803. 1918 (*nomen semi-nudum*); Kostermans in Reinwardtia 5: 239. 1960. — *Parapentace tonkinensis* (Chev.) Gagnepain in Bull. Soc. bot. France 90: 70. 1943 (*nomen invalid.*); Kostermans, l.c. — *Burretiodendron tonkinensis* Kostermans in Reinwardtia 5: 239. 1960. — Brillet 8 (P).

Forb  et Trojani in Bull.  con. Indochine 33 (8 B): 51 (1928-29). 1930, *sub nom. vernac.* "Nghi n".

Tree up to 30 m high, up to 1 m in diam. with cylindrical bole and buttresses; bark grey, 1 cm thick, peeling off in large pieces; branchlets glabrous. Leaves coriaceous, glabrous, densely reticulate on both surfaces, ovate to broadly ovate, 8–10 × 9–18 cm, base rounded, apex long-acuminate with sharp tip; nerves slender, prominulous in a groove on the upper, prominent on the lower surface; basal nerves 3; nerves circa 5 pairs, rather erect, straight, arcuately running out near the margin, the axils bearing conspicuous tufts of hairs; lower axils foveolate; veins prominulous, numerous, parallel. Petiole slender, glabrous, slightly swollen at apex, up to 10 cm long.

Inflorescences axillary below the new flush, consisting of a bare, slightly, minutely pilose (simple hairs) peduncle, up to 5 cm long and few branches (up to 2 cm long). Flowers white, articulately attached with a short pedicel (2 mm) to the pateriform upper part of the branchlets. Buds ellipsoid. Bracts small, caducous. Male flowers circa 2 cm diam.; sepals lanceolate, circa 1–1.5 cm long, densely stellate pilose, inside glabrous; basal glandular area small; petals usually 5, about as long as sepals, spatulate, top obtuse, obscurely crenulate, base merging into the claw. Stamens 25–60; the free, fascicled part of the filaments about 15 mm long, the tube about 5 mm long; anthers oblong, 2 mm, mucronulate; pistillode 0.5 mm, ovate. Capsule ellipsoid, up to 5.5 cm long, 3.5 cm wide, glabrous; wing about 2 cm wide; seed-part 1 cm long.

DISTRIBUTION. — Kwangsi, Tonkin (regions of Cai-kinh, Cao-bang; Thai-nguyen) and North, mountainous Annam.

Although no material of *B. hsienmu* was available for examination, the excellent description and plate of Chun and How leaves very little doubt, that *Parapentace tonkinensis* is conspecific with this species.

The specimen Thiriot (herb. Chevalier 37954) has mature fruit. Female flowers were not present in the material available to me.



Discrepancies between Gagnepain's and Chun and How's descriptions are attributable to the poor state of Gagnepain's material.

Why Gagnepain gives the petiole length as 3—5 cm is not clear, as the specimen: Gabillot, which he studied has petioles of 9 cm long!

The Annamite name is Nghiên; Thô: Kiêng, Giên.

The wood is very hard with a fine and dense grain, very durable, easy to saw in all directions; a slow-growing species.

TONKIN. — Thai-nguyên, mature fruit, *Thiriot = Herb. Chevalier 37954* (BO, P); May, fl., *Gabillot s.n.* (P); June, young buds, *Thiriot = Herb. Chevalier 38036* (K, P) et *38031* (P); Thai-nguyên, region of Xong-xa, Apr., sterile, *Thiriot = Herb. Chevalier 37950* et *37951* (P); Bac-Le, prov. of Bac-Giang, fr., *Service forestier s.n.* (BO, P); CHINA. — Kwangsi, Lung-An, Na-Chung Hsian, *Chung 9115, 9119 (n.v.)*; Lung-Tsin (Lungchow), Wu-Lien-Hsiang, March, *Liang 31523 a (n.v.)*; Apr., fl., *Liang 31523 b (n.v.)*; July., fr., *Liang 31536 (n.v.)*.

##### 5. BURRETIODENDRON OBCONICUM Chun & How — Fig. 5.

*Burretiodendron obconicum* Chun & How in *Acta phytotaxon. Sinica* 5: 11, t. 4. 1956. — *C. F. Liang 31537*.

Tree 20 m or higher, glabrous, branchlets greyish with small lenticels. Leaves chartaceous, triplinerved, elliptical to elongate-elliptical, 4.5—5.5 × 9—15 cm, apex gradually long-acuminate with sharp tip, base cuneate; upper surface smooth, nerves 4—5 pairs, rather erect, straight, towards margin running out arcuately, lowest pair ascendant, axils slightly bullate above, stellate-barbellate on lower surface; nerves prominulous on lower surface, veins obscure. Petiole glabrous, 4—8 cm long.

Infructescence racemose-cymose, axillary below the new flush, up to 5—7 cm long; peduncle 3—6 cm long or shorter, branches 1.5—3 cm long. Fruit pedicel slightly thickened, 4—5 mm long, articulate at base, elongate-obconical, 4.5—5 cm long, 2 cm in diam., glabrous; wings 5—8 mm wide, chartaceous; seeds obovoid-cuneate, circa 15 mm long, 4 mm diam., apex rounded, base acute, back convex, compressed laterally, pale brown, glossy with sculptured pattern.

DISTRIBUTION. — Kwangsi.

Only known from a single collection (non vidi) of the type locality.

CHINA. — Kwangsi, Lung-Tsin (Lungchow), Wu-Lien Hsiang, July, fr., *C. F. Liang 31537*.



6. *Burretiodendron yunnanensis* Kosterm., *spec. nov.* — Fig. 6.

*Arbor ramulis sulcatis crassis apicem versus laxe pilosis, foliis orbiculato-ovatis rigide chartaceis basi truncatis supra glabris subtus sparse et minute stellato-pilosis, infructescentiis paniculatis, dense pilosellis, fructibus albis orbiculatis papyraceis munitis.*

Tree 16 m tall; branchlets stout, superficially sulcate, towards apex laxly, minutely pilose; apical bud short, thick, covered by pilose scales (stellate hairs with a central, flat body). Leaves rigidly chartaceous, orbicular-ovate, 9—16 × 8—11 cm, base truncate (apex missing); upper surface glabrous with faint, vary lax reticulation; lower surface laxly stellate-pilose; midrib prominent, nerves 4—6 pairs, prominent, straight, erect-patent, the lowest pair starting from the petiole insertion; veins few, prominent. Petiole densely, light brown pilose, about 4 cm, slightly thickened at apex. Infructescence paniculate, axillary, few-branched, densely, minutely brown-pilose, main peduncle 5—6 cm long, branches spreading. Fruit pedicel 1—1.5 cm; seed-part of samara slender, 1.5 cm long, surrounded by the suborbicular, radiately veined papyraceous wing, which is about 3 cm long and 2—5 cm in diameter.

TYPUS. — *Henry 11442 (A)*

The specimen is in a poor condition; the fruit are detached and resemble those of *B. combretoides*. As I had no opportunity to study material of the latter, the segregation of *B. yunnanensis*, from *B. combretoides* is not very clear.

CHINA. — *Y u n n a n*, Mengtse, S.W. Mts., 5000 ft., fr., *Henry 11442 (A)*.

7. *BURRETIODENRON COMBRETOIDES* Chun & How — Fig. 7

*Burretiodendron combretoides* Chun & How in *Acta phytotaxon. Sinica* 5: 8, t. 2. 1956. — *S.P. Ko 55838*.

Tree, 6—8 m tall, branchlets minutely purplish-black pilose. Leaves subtriplinerved, chartaceous, elliptical or oblong-elliptical, 8—12 × 4.5—6.5 cm, obtusely acute, base rounded or truncate, rarely subcordate, margin serrulate, at the end of the nerves mucronulate (glands), above glabrous, beneath obscurely, minutely pilose, hairs stellate, on the nerves simple, axils densely stellate-pilose; basal nerves short; lateral ones 6—7 pairs, slender, ascendant-arcuate, at margin anastomosing. Petiole 1.3—3 cm, minutely pilose. Infructescence in the axils of the apical leaves, few-branched, stellate-haired. Capsule broadly elliptical or suborbicular, 3—3.2

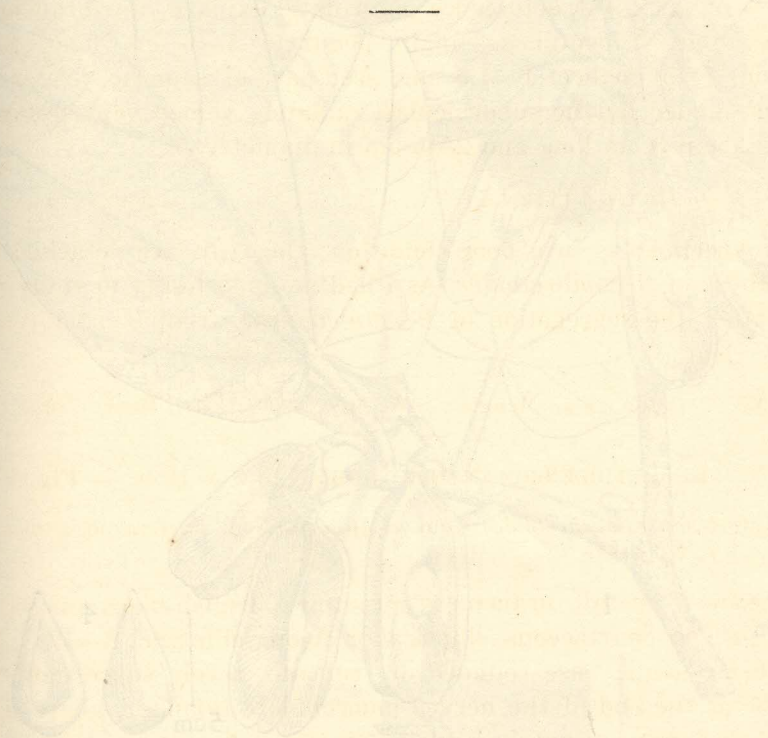


cm high, 2.5—3 cm wide, papery, slightly stellate-puberulous, red-brown; wing 1—1.5 cm wide, rounded both ends or base somewhat cordate, transversely reticulate; pedicel circa 1 cm long, articulately attached to branch; ovules 6, biseriate; seed 1 cm long, about 4 mm wide, apex curved-acuminate.

DISTRIBUTION. — Kwangsi.

Only known from one collection from the type locality (non vidi). In fruit shape it conforms with *B. yunnanensis* Kosterm.

CHINA. — Kwangsi, between Tsin-Si and Muk-Pien, Sept., fr., *S. P. Ko 55838*.





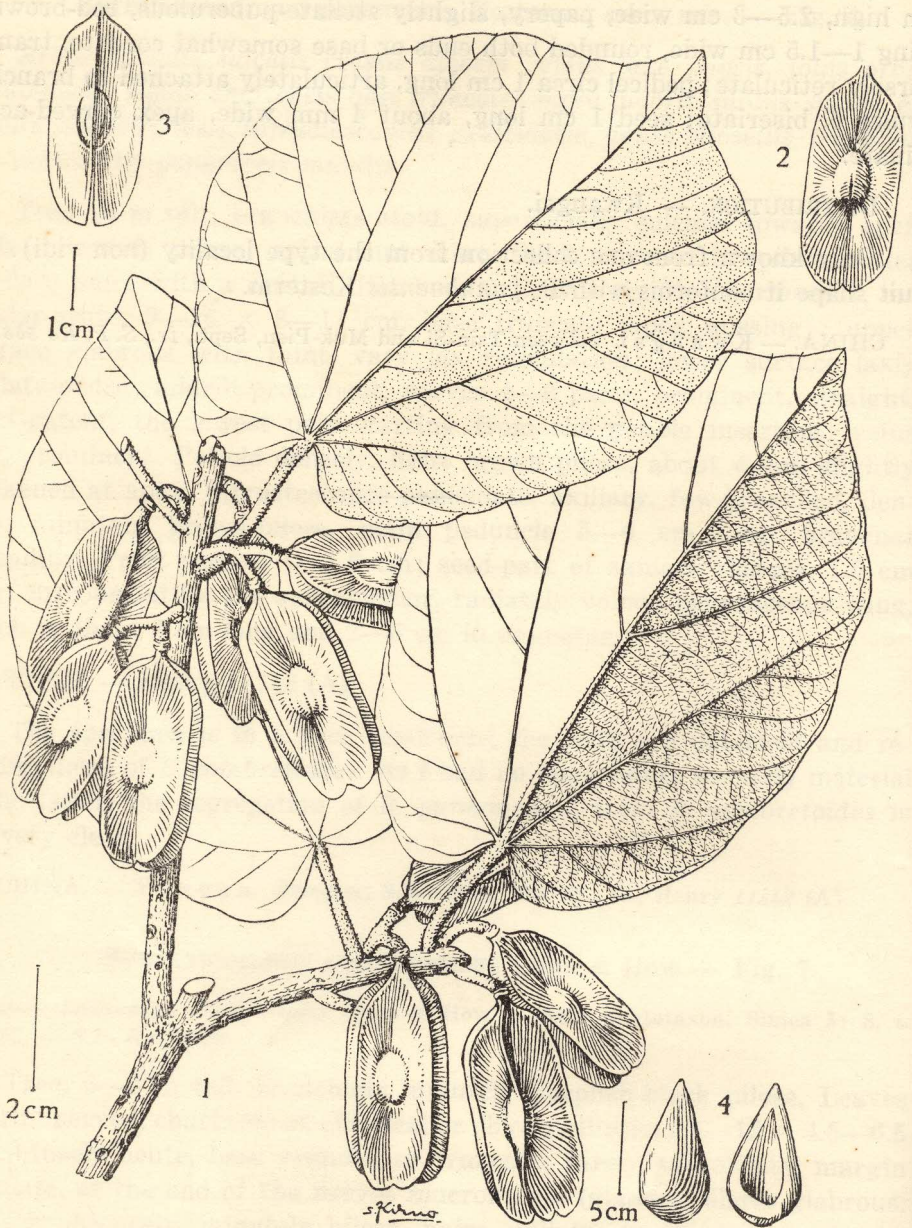


FIG. 1. — *Burretiodendron esquirolii* (Lév.) Rehd. — After Chun & How, l.c.



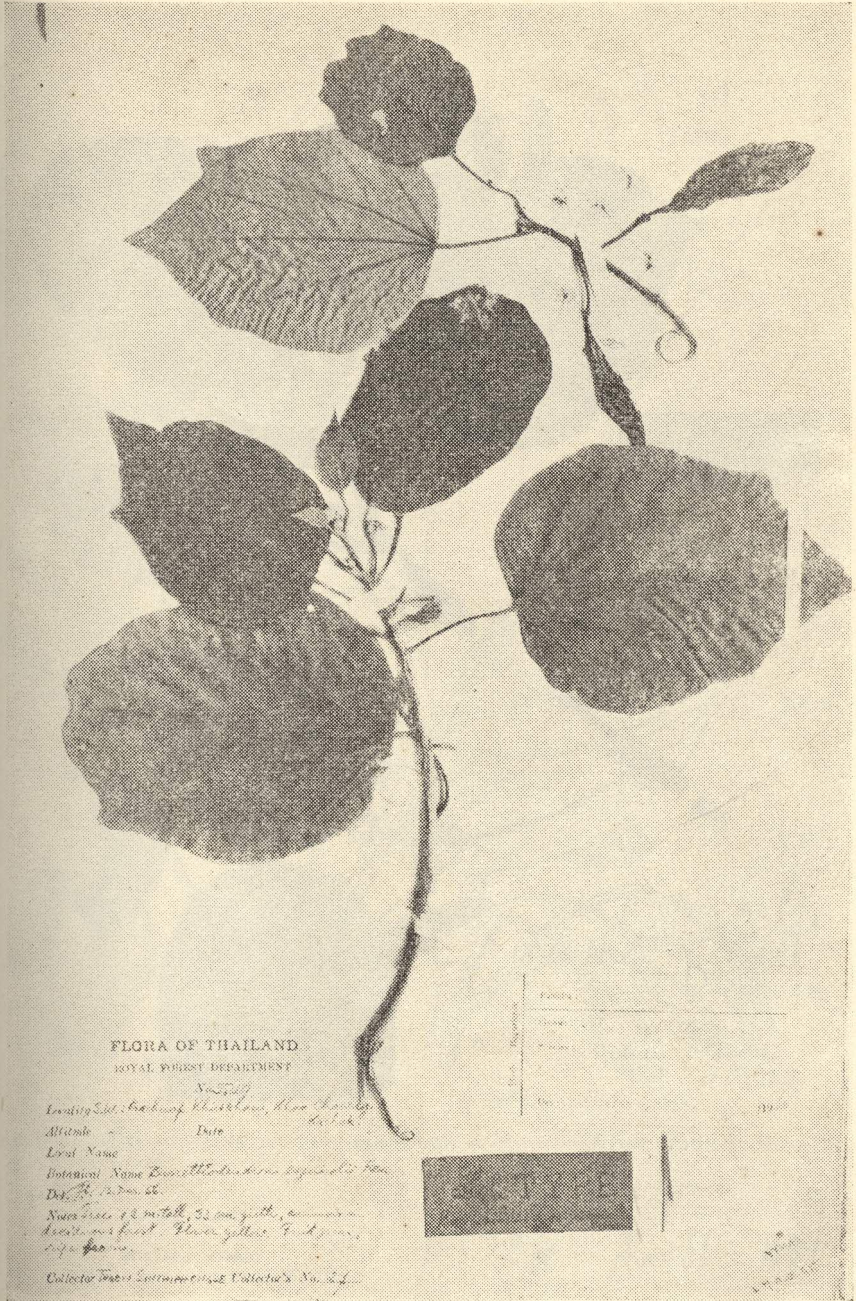


FIG. 2. — *Burretiodendron siamense* Kosterm.





FIG. 3. — *Burretiodendron brilletii* Kosterm.



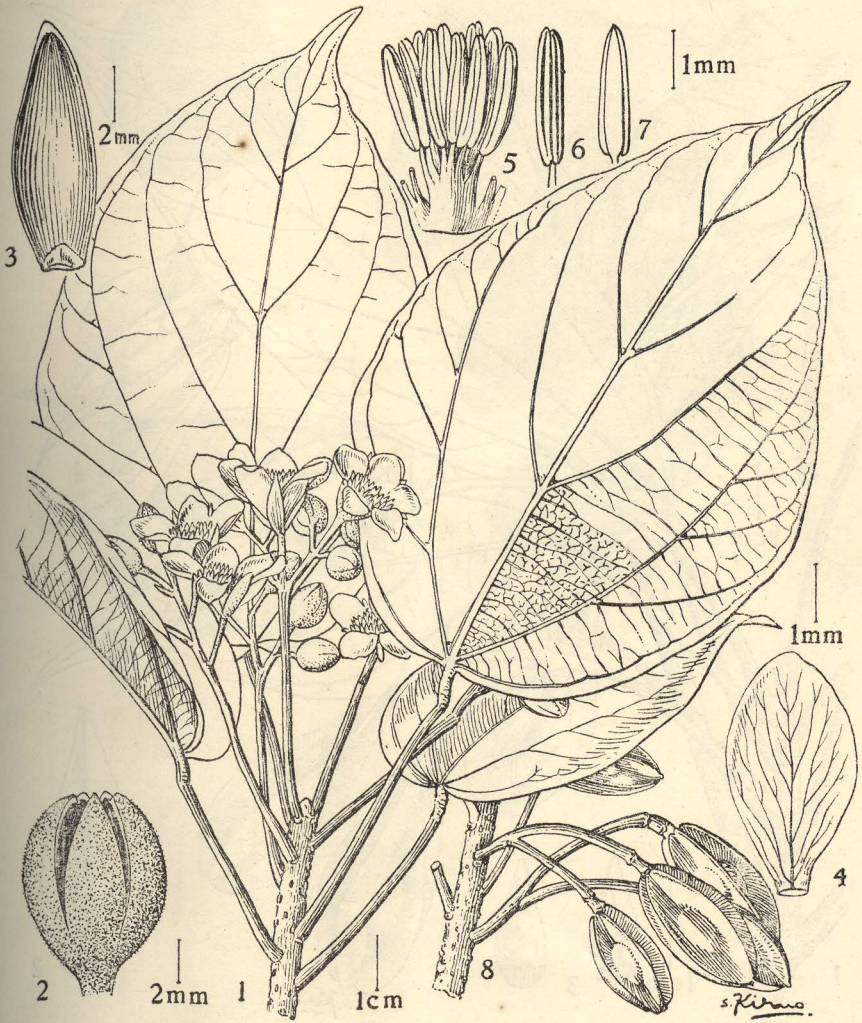


FIG. 4. — *Burretiodendron hsienmu* Chun & How — After Chun & How, l.c.





FIG. 5. — *Bursera abrotanifera* Chun & How — After Chun & How, *loc. cit.*



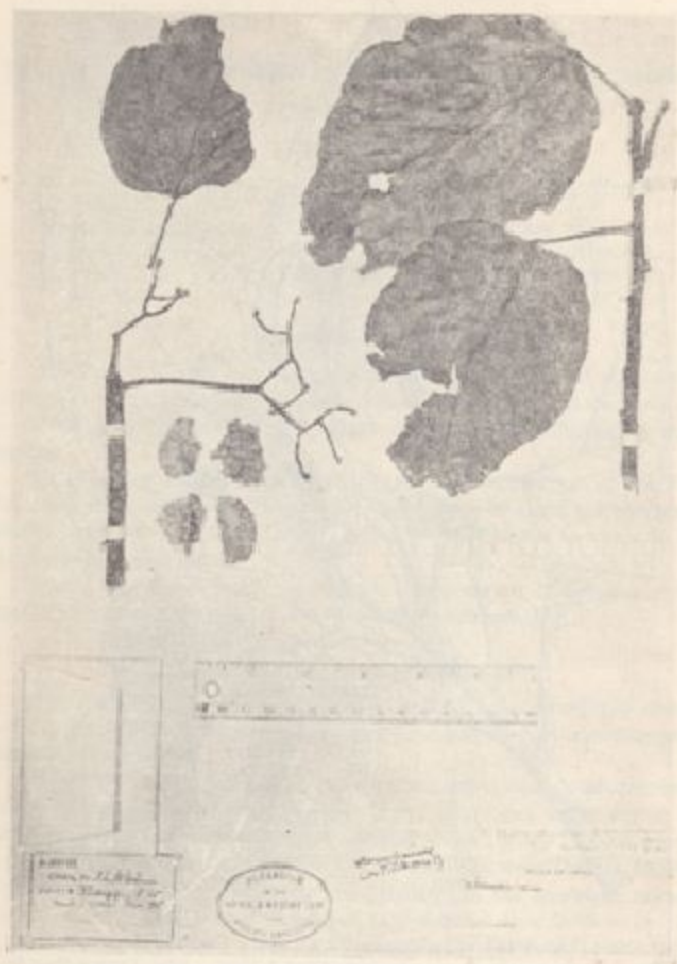


FIG. 6. — *Burretiodendron yunnanensis* Kosterm.



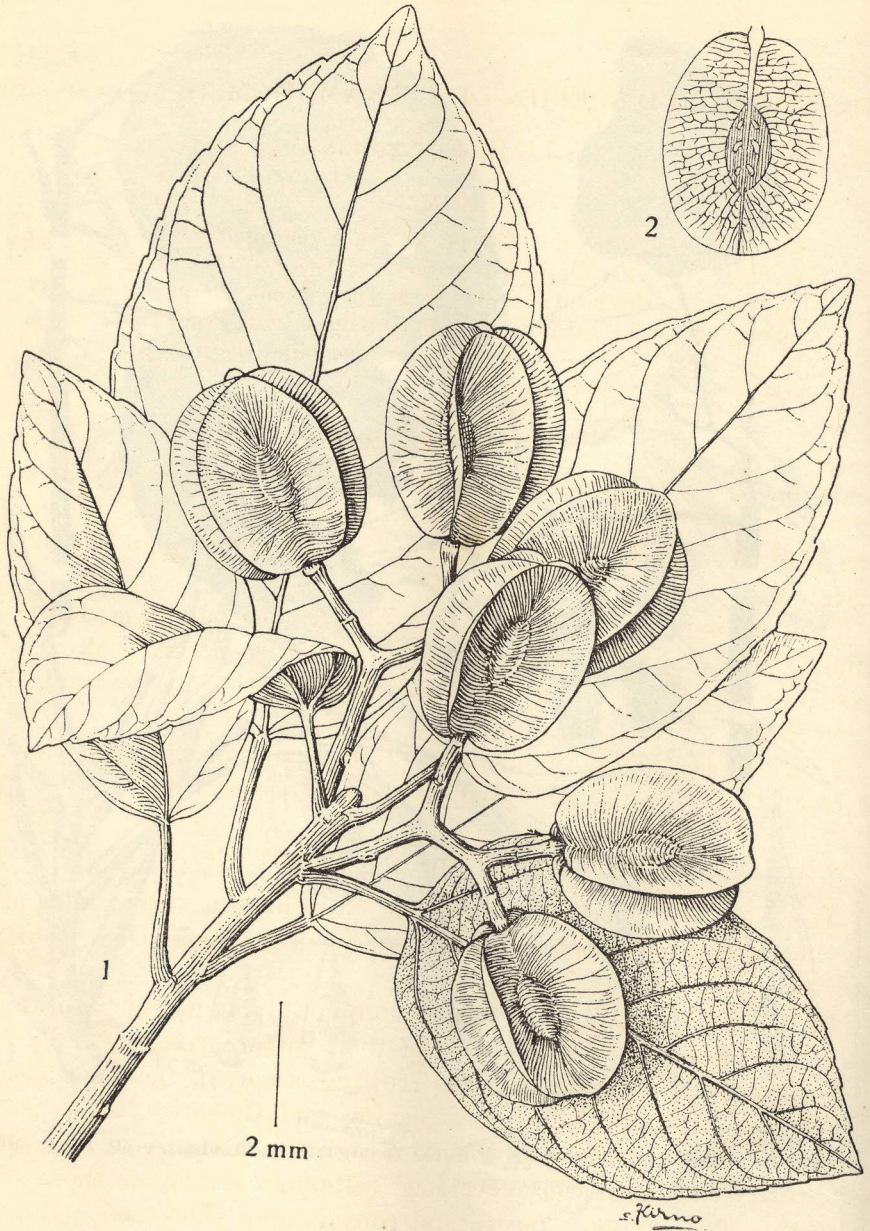


FIG. 7. — *Burretiodendron combretoides* Chun & How — After Chun & How, l.c.