

STYRACACEAE (C. G. G. J. van Steenis, Buitenzorg)

Evergreen trees or shrubs. *Leaves* simple, spirally arranged, sometimes pseudo-alternate, margin entire or toothed, mostly with stellate or lepidote indumentum. Stipules 0. *Flowers* bisexual, actinomorphic, axillary or terminal. Calyx tubular more or less adnate to the ovary; lobes if present valvate. Corolla rarely of free petals, mostly united in a basal tube, 4–7, valvate or imbricate. Stamens equal and alternate, or double the number of the petals, mostly adnate to the tube. Disk absent; anthers 2-celled, introrse, splitting lengthwise. Ovary superior, rarely semi-inferior, 3–5-celled. Style 1; stigma punctiform to 3–5-lobed. Ovules 1–∞ in each cell, axile. *Fruit* capsular (rarely drupaceous) 1–∞-seeded, dehiscent or not, pericarp often thick and woody or corky, with a persistent calyx. Seeds with copious endosperm and straight or slightly curved embryo.

Distr. *Ca* 12 genera mostly in the N. hemisphere, absent in Australia and the Central Pacific, richly developed in E. Asia. No *Styracaceae* has yet been found in the Philippines proper, Central & East Java, and the Lesser Sunda Isl.. Sumatra is the richest centre in Malaysia.

Ecol. *Styrax* represents a northern type in the Malaysian flora but its representatives are found both in the lowland and the mountains up to *ca* 1600 m alt. Most peculiar galls are found in *Styrax*, caused by specially adapted Aphids, which surpass the European oak galls in variety (*cf.* DOCT. v. LEEUWEN, Bull. J.B.B. III, 4 (1922) 147; Zooec. D.E.I. (1926) 452; Tijd. Entom. 75 (1932) Suppl. 97; Ned. Kruidk. Archief 51 (1941) 217, and J. C. VAN DER MEER MOHR, Natur & Museum 63 (1933) 163, 6 fig.).

Uses. The wood is little used. Of some *Styrax spp.* the bark after having been softened by taps yields *benjoin* resin from incisions made in the bruised portion. This resin contains benzoic or cinnamic acid. Tapping benjoin is a common procedure in Sumatra, mainly Palembang and Tapanuli Res.. Benjoin is used as an antiseptic, in cigarettes and ceremonials, and is an important forest product of Sumatra.

Wood anat. See also generic descriptions. The ground tissue by MOLL & JANSSONIUS (2 (1920) 472) called fiber tracheids according to REINDERS's definitions (Handl. 3 (ed. 1941) 145) are libriform fibers; checked by C.A.R.-G.

Notes. The genus *Symplocos* was formerly often included in the *Styracaceae* or *Styracineae*, but is accepted to represent a separate family *Symplocaceae* in this Flora. *Styracaceae* possess stellate hairs, or scales, not fasciculate stamens, linear anthers, a half or wholly superior ovary, an imperfectly celled fruit, and differ, moreover, anatomically distinctly from the *Symplocaceae*.

KEY TO THE GENERA

1. Pedicels articulated. Flowers dull-creamy; lobes and stamens free. Ovary glabrous, imperfectly 5-celled. Seeds minute, numerous. Leaf margin serrulate 1. *Bruinsmia*
1. Pedicels not articulated. Flowers white; lobes and stamens connate in a basal tube. Ovary hairy, imperfectly 3–4-celled. Seed 1(–2), large. Leaf margin subentire 2. *Styrax*

1. BRUINSMIA

BOERL. & KOORD. Nat. Tijd. N.I. 53 (1893) 68; PERK. Pfl.R. 30 (1907) 14, 88; PERK. Gatt. Styr. (1928) 8, 13, 16, 24; STEEN. Bull. J.B.B. III, 12 (1932) 215.

Glabrate tree with flattened-angular branchlets through decurrent petioles. *Leaves* serrate, brownescent. *Flowers* in (mostly foliate) terminal thyrses. Pedicel with 1 bracteole, articulated at the apex. Buds solid. Calyx broad-campanulate with truncate margin, entire or sub-5-toothed. Corolla-lobes 5(–6), free, imbricate. Stamens 10(–12), 5 longer alternate, 5 shorter epipetalous, or 10 subequal, coherent mutually and with the base of the corolla-lobes. Ovary free for the greater part, imperfectly 5(–6)-locular. Style 5-angular, not grooved. Stigma capitate, sub-5–6-lobed. Ovules ∞. *Fruit* indehiscent, pear-shaped; style-base mostly persistent. Seeds small, prismatic-4-angular.

Distr. Monotypic, endemic in *Malaysia*.

1. *Bruinsmia styracoides* BOERL. & KOORD. &c. *ll.cc.*; STEEN. J. Arn. Arb. 28 (1947) 422.—*B. celebica* KOORD. Med.'s Lands Pl.T. 19 (1898) 525.—Fig. 1.

Evergreen tree 15–37 m, diam. 30–150 cm (mostly 25 m by 40 cm); clear bole 7–11 m, without buttresses, bark dirty orange in section. Adult leaves oval to oblong, base mostly rounded, apex acute to acuminate, sparsely hairy, 7½–19 by 3–10 cm; primary nerves 6–10 pairs; petiole sulcate 1–1½ cm long. Thyrses 10–25 cm. Pedicels 2 mm; bracteole narrow, 1–2½ mm long. Calyx 1½–2 mm high, 5–6½ mm diam. Corolla lobes pubescent on both sides, tip cap-shaped, ovate-oblong, acute, 9–10 by 4–4½ mm. Stamens 5–5½ and 6–6½ mm, sometimes subequal 3½–4 mm; filaments glabrous or short-hairy inside and marginal; cells 1½–3 mm long. Ovary 2–2½ mm high, 3–3½ mm diam. Style 3–5 mm long. Fruit 6 by 9 to 10 by 6 mm; style remnant ¾–6 mm long. Seeds 1½ mm long.

Distr. Sumatra, W. Java (W of Buitenzorg), Borneo, Celebes, and New Guinea, (400–)700–1600 m alt., expected to occur in the Philippines & Moluccas.

Ecol. In primary or partly devastated forests, rather rare; globose leaf-galls ½–1 cm diam. are found in Borneo and New Guinea.

Vern. Names local and not trustworthy.

Uses. Wood not durable and besides the tree is rare, though dimensions would be sufficient.

Wood anat. MOLL & JANSSONIUS, Mikr. Holzes 4 (1920) 498.

Notes. The Celebes and New Guinea specimens possess hairy anthers.



Fig. 1. *Bruinsmia styracoides* BOERL. & KOORD., × ¾.

2. STYRAX

LINNÉ, Sp.Pl. (1753) 444; PERK. Pl.R. 30 (1907) 14, 17; STEEN. Bull. J.B.B. III, 12 (1932) 220.—*Cyrta* LOUR. Fl. Coch. (1790) 278.—*Lithocarpus* BL. ex ROYLE, Ill. (1839), 261, in syn.

Shrubs or trees, at least the innovations stellate-hairy, tomentose or lepidote. Leaves mostly tomentose below; petiole sulcate. Calyx campanulate to cup-shaped, free, or the base connate with the ovary, truncate, rarely toothed. Flowers solitary, mostly in racemes or leafy panicles. Corolla lobes 5(–6–7), connate at the base with the annular staminal tube. Stamens (8–9–)10(–11–14), erect, connate at the base; anthers split lengthwise. Ovary imperfectly 3-locular, with few ovules per cell, or only 1. Style 3-angular; stigma punctiform or indistinctly 3-lobed. Fruit globular to oblong, dehiscent or not. Seeds 1(–2) attached at its base.

Distr. Ca 120 spp. in the tropics and subtropics of Europe, Asia, Malaysia, and America. In Malaysia the genus is richest in Sumatra, but the widest distributed species, *St. agreste*, is not found in that island.

Wood anat. *St. benzoin*: MOLL & JANSSONIUS, Mikr. Holzes 4 (1920) 503: *St. benzoin* & *St. paralleoneurum*: DEN BERGER, Med. Proefstat. Boschw. 13 (1926) 152 (hand lens).

Notes. In Java *St. tonkinensis* PIERRE furnishing Saigon benzoe is recently cultivated by the Forest Service. In the key below it is to be placed nearest to *St. ridleyanum* but differs distinctly by its narrow buds 7–10 by 2–3 mm.

KEY TO THE SPECIES

- 1. Undersurface of adult leaves with a closed tomentum, concealing the parenchyma.
- 2. Corolla imbricate in bud 8. *St. serrulatum* var. *mollissimum*
- 2. Corolla valvate in bud.
- 3. Indumentum glaucous without stellate brown hairs or scales in adult leaves 5. *St. oliganthes*
- 3. Brown stellate hairs or scales present in the indumentum on the undersurface of adult leaves.
- 4. Tomentum thin with appressed stellate scales. Fruit large, globose to ovoid-globose, 2½–3 by 2¾–3¼ cm. Seed shining brown, base broad, 1½ cm across, hilum 1 cm. 6. *St. paralleoneurum*
- 4. Tomentum with stellate hairs; scales absent.
- 5. Arms of brown stellate hairs ½ mm long. Leaves large 12½–18 by 6–12 (rarely 8 by 3) cm. Flowers shortly pedicelled, in linear many-flowered racemes. Fruit obovate, tip acute-acuminate, 1¾–2½ cm diam. 4. *St. crotonoides*

- 5. Stellate hairs minute, arms much smaller than 1/2 mm.
- 6. Inflor. much longer than the leaves. Youngest twigs dark-brown. Pedicels 4-9 mm. Buds 9-11 by 4 1/2-6 mm. Calyx 2 1/2-3 1/2 mm high, 4 1/2-5 1/2 mm diam. Petals not fleshy, sparsely pubescent inside. Connective shortly pubescent. Stigma large, 3-lobed, thrice as thick as the style 7. *St. ridleyanum*
- 6. Inflor. mostly shorter than the leaves. Youngest twigs greyish. Pedicels 1 1/2-4 mm. Mature buds 12 by 3 mm. Calyx 4-4 1/2 mm high, 3-3 1/2 mm diam. Petals fleshy, median part inside impressed and glabrous. Connective glabrous. Stigma punctiform as thick as the style 3. *St. benzoin*
- 1. Adult leaves not with a closed indumentum.
- 7. Corolla valvate. Racemes 2-17-flowered. Petals glabrous inside, 7-10 by 2-3 mm. Style 8 1/2-12 1/2 mm long. Fruit 8-18 by 3 1/2-7 1/2 mm, 1(-2)-seeded, not dehiscent, distinctly rostrate 1. *St. agreste*
- 7. Corolla imbricate.
- 8. Fruit apiculate. Calyx sparsely stellate-lepidote. Corolla lobes 16-17 by 7 1/2-8 1/2 mm, stellate-pubescent on both sides. Racemes 2-3-flowered. Style 15-20 mm. Fruit ca 12-13 by 8-10 mm, ± irregularly dehiscent at the base into 3 valves. Pedicels drooping, 1-2 cm . . . 2. *St. japonicum*
- 8. Fruit with rounded apex. Calyx tomentose. Flowers mostly in paniculate rich-flowered infl. Pedicels shorter, flowers not drooping . . . 8. *St. serrulatum*
- 9. Pericarp smooth. Leaves mostly subtomentose below. Panicles mostly many-flowered var. *mollissimum*
- 9. Pericarp rugose. Leaves subglabrous below. Depauperate racemes . . . var. *rugosum*

1. *Styrax agreste* (LOUR.) G. DON, Gen. Hist. 4 (1837) 5; PERK. Pfl. R. 30 (1907) 27; STEEN. Bull. J.B.B. III, 12 (1932) 224; J. Arn. Arb. 20 (1939) 220; *ibid.* 28 (1947) 423.—*Cyrta agrestis*

pairs; petiole 2 1/2-6 cm. Racemes 1 1/2-12 1/2 cm, lowest fls often axillary. Pedicels frequently united in twos, 4-6 mm, in fr. 9 mm. Calyx 3-5 mm across. Corolla tube 2-3 1/2 mm high, lobes oblong to lanceolate, acute, outside hairy. Stamens hairy below, upper part narrowed and glabrous, 7-10 mm; anthers linear, as long as the filaments, not glabrous. Ovary with a 2/3-1 1/4 mm long beak. Fruit 1-2-seeded, often oblique, rostrate by a 1-3 1/2 mm long beak. Seed acute at both ends, lengthwise grooved, lepidote, base contracted, 7-13 by 2 1/2-5 1/2 mm.

Distr. From Annam and Hainan through Malaysia to the Solomons & Micronesia, in Malaysia: Borneo, Celebes, Moluccas, New Guinea, and Bismarcks, 10-300, rarely to 1000 m alt. in the Solomons and NE. New Guinea.

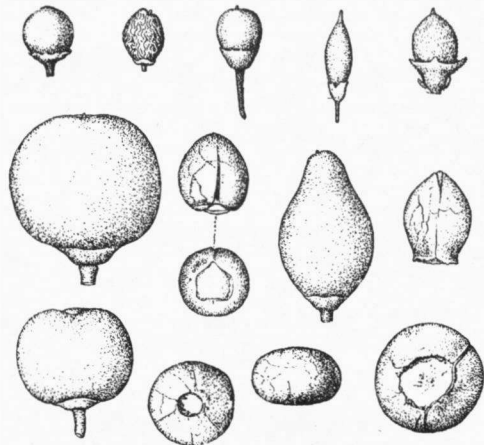


Fig. 2. Fruits and seeds of Malaysian *Styrax*. Upper row from left to right: *St. serrulatum* ROXB. var. *mollissimum* STEEN., *St. serrulatum* ROXB. var. *rugosum* STEEN., *St. oliganthus* STEEN., *St. agreste* (LOUR.) G. DON, *St. crotonoides* CLARKE. Second row: two forms of *St. paralleloneurum* PERK., with seed. Third row: *St. benzoin* DRYAND., right: a seed of *St. benzoin* DRYAND. var. *hiliiferum* STEEN., showing the large hilum, × 3/5.

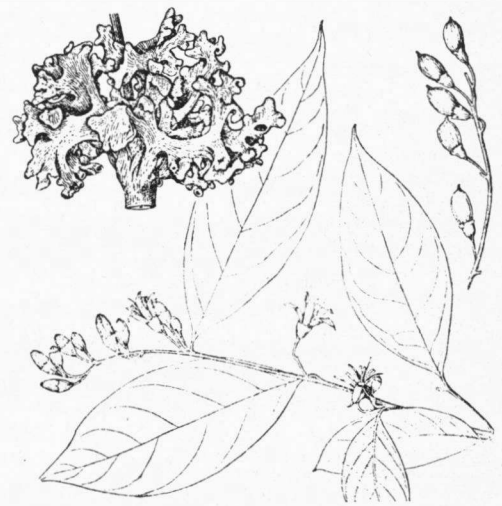


Fig. 3. *St. agreste* (LOUR.) G. DON, with fruits and a stem gall intermediate between the coralloid and the alcorniform types, × 1/2.

LOUR. Fl. Coch. (1790) 287.—*St. warburgii* PERK. Pfl. R. 30 (1907) 27.—*St. serrulatum* (non ROXB.) HUB. WINKL. Bot. Jahrb. 50 (1914) 195; HALL. f. B.B.C. 34, II (1916) 42.—*St. ledermannii* PERK. Notizbl. 10 (1928) 457.—*St. rostratum* HOSOKAWA, Trans. N. H. Soc. Form. 28 (1938) 65.—Fig. 2, 3. Shrub or small tree 3-12 m, up to 5 cm diam. Leaves thin, ovate-oblong to ovate-lanceolate, apex acute to acuminate, 3 1/2-13 by 2-6 cm; nerves 4-9

Ecol. Undergrowth of primary forests, in Borneo and New Guinea inundated in the wet season, *fl.* and *fr.* mostly simultaneous, March–Nov. From Borneo coralliform twig galls are described.

Vern. *Papunti* (SE. Born.), *kaju abu*, *berwewa* (Daj. Koetai), no fixed name.

Notes. A Hainan specimen was distributed as *St. subcrenata* H.M.

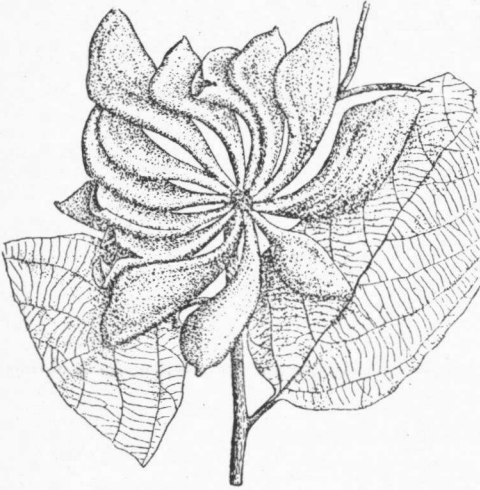


Fig. 4. Bark gall of *St. benzoin* DRYAND., $\times 7/8$.

2. *Styrax japonicum* SIEB. & ZUCC. Fl. Jap. 1 (1835) 53, t. 23; PERK. Pfl.R. 30 (1907) 73.—*St. kotoensis* HAYATA, Ic.Pl. Form. 5 (1915) 121.—*St. philippinensis* MERR. & QUIS. Philip. J.Sc. 56 (1935) 313, t. 1.

Shrub 2–3 m. *Leaves* on long-branches alternate, ovate to ovate-lanceolate, sparsely stellate-lepidote to subglabrous and often with domatia in the nerve-axils below, $4\frac{1}{2}$ – $9\frac{1}{2}$ by 2–6 cm; lateral nerves 4–5 pairs; petiole 4–7 mm. Pedicels 1– $1\frac{1}{4}$ cm, base densely lepidote, upwards sparsely so, thickened towards the calyx, drooping. *Calyx* campanulate, 4–5 mm high, stellate-lepidote. *Fruit* ellipsoid, apex truncate, mucronate, seed oblong, 3-sulcate, surface minutely pitted, 10–11 by 5–6 mm.

Distr. Japan, N. China, Riu Kiu and Formosa, in *Malaysia*: N. Philippines (Camiguin & Batan Isl., N. of Luzon), only twice found, apparently at low alt.

Ecol. *Fl.* in March, *fr.* in June.

Notes. A distinct northern type, here accepted as a slightly differentiated outlier of the *St. japonicum* population with somewhat larger flowers.

3. *Styrax benzoin* DRYAND. Phil. Trans. 77 (1787) II, 308; PERK. Pfl.R. 30 (1907) 59; STEEN. Bull. J. B.B. III, 12 (1932) 228; BURK. Dict. (1935) 2105.—*St. benzoë* BL. Cat. (1823) 6, *nomen*.—*St. benjoin* ROXB. Fl. Ind. (1832) 415.—*Lithocarpus benzoin* BL. ex ROYLE, III. (1839) 261, *in syn.*—*Plagiospermum benzoin* PIERRE, Fl. For. 4 (1889) 260.—*St. rauensis* BOERL. ms. ex GRESH. l.c. 118.—Fig. 2, 4, 5b.

Tree 8–34 m, trunk 10–100 cm diam., buttresses

small or absent; bark wine-red in section, 3–7 mm, wood white. *Leaves* ovate to oblong or lanceolate, base rounded, apex acuminate, 8–13 by $2\frac{1}{2}$ –5 cm; petiole sulcate 5–13 mm; nerves 7–13 pairs. *Flowers* fragrant, in 6–11 cm long panicles often forming a leafy panicle 13–20 cm long. Buds solid, blunt. Pedicels $1\frac{1}{2}$ –4 mm, top-shaped. Corolla lobes 9–12 by 2– $3\frac{1}{2}$ mm, tube 1–2 mm high. Staminal tube $2\frac{1}{2}$ –4 mm, anthers 5 and $5\frac{1}{4}$ mm long. Ovary 8– $12\frac{1}{2}$ mm high. *Fruit* depressed-globose 2 – $2\frac{1}{4}$ by $2\frac{1}{4}$ –3 cm, indehiscent; pericarp (3)–4–5 mm diam., subtended by a rarely appressed calyx 7–13 mm diam. Seed 1(–2), *ca* 15 by 19 mm, dull pale brown; hilum 3–6 mm diam., in *var. hiliferum* 10–12 mm diam.

Distr. *Malaysia*: Sumatra (only the main land), Malay Peninsula and West Java (rare, mostly W of Buitenzorg), 10–1500 (mostly 100–700) m, doubtful from Banka Isl. Erroneously recorded from the Philippines by F-VILL, Nov. App. (1880) 27.

Ecol. In mixed primary forests, often common, mostly on fertile soils; *fl.* & *fr.* not periodic, Jan.–Dec. Germination preferably in the shadow. Several gall forms are described, all of the saccate type. The fruit is eaten by swine and deer.

Uses. Cultivated in Sumatra (mostly Palembang and Tapanuli Res.), Java (also in monsoon climate) and W. Borneo, often in clearings; therefore, the tree occurs frequently gregarious in old secondary forests. Sumatrans often soak the fruit before planting, or peel them. Yields red benzoin, mostly consisting of benzoic acid. Resin can be drawn from 7 years old saplings. Wood worthless.

Vern. (*Ke*)menjan, hamindjan or kumajan, with various spelling and with various additional names.

Notes. No specimens are known with certainty from the Indochinese Peninsula; those recorded belong mostly to *St. benzoides* CRAIB which differs in the absence of brown-stellate hairs, smaller flowers (lobes 8 by $1\frac{1}{2}$ – $1\frac{3}{4}$ mm) and different fruit (1 cm high with $\frac{1}{2}$ mm thick 3-valved pericarp). This

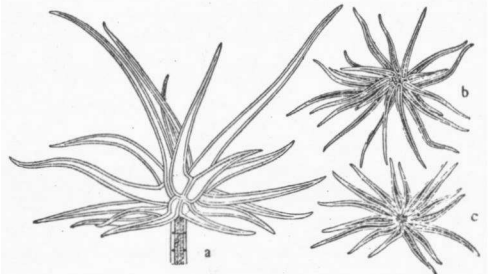


Fig. 5. Brown stellate hairs of a. *St. crotonoides* CLARKE, b. *St. benzoin* DRYAND., and c. scales of *St. paralleloneurum* PERK., $\times 160$.

continental species produces Siam benzoë (*cf.* HOOK. Ic. Pl. t. 2999).

var. hiliferum STEEN. l.c.—Seed subglobose 17–18 by 20–24 mm. Testa dark-brown. Hilum 10–12 mm diam.—Fig. 2.

Distr. *Malaysia*: Malay Peninsula (Pahang) and Sumatra (Tapanuli).

Vern. *Kemanjan bukit* (Mal. Pen.), *hamindjan minjak* (Batak, Sum.).

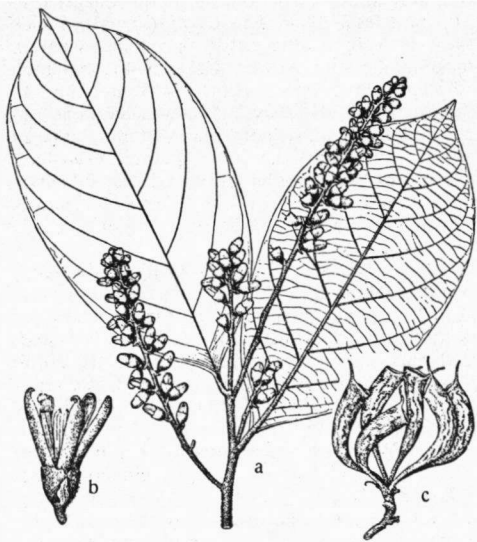


Fig. 6. *Styrox crotonoides* CLARKE, $\times 1/3$, flower, nat. size, bunch of sack-galls, $\times 1/3$.

4. *Styrox crotonoides* CLARKE, in HOOK. f. *Fl. Br. Ind.* 3 (1882) 589; STEEN. *Bull. J.B.B. III*, 12 (1923) 239; BURK. *Dict.* (1935) 2107.—Fig. 2, 5a, 6.

Tree 13–27 m by 25–50 cm. *Leaves* oblong to broad-elliptic, rarely subovate, base rounded, margin entire, apex acute-acuminate; nerves (7–)9–11 pairs, connected by transverse veins. *Infl.* mostly

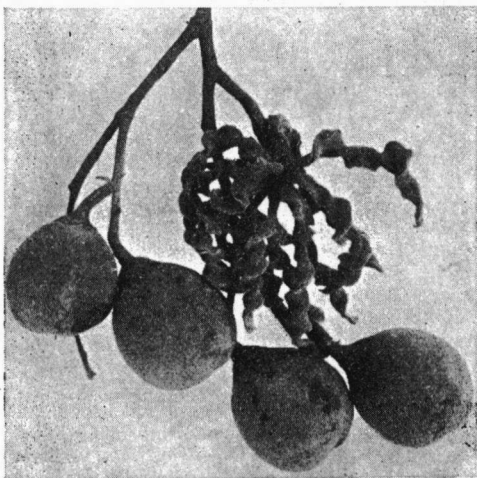


Fig. 7. Spiral galls of *St. paralleloneurum* PERK., on a fruiting twig, $\times 2/3$.

unbranched spike-shaped, rachis stout, straight, bearing fls from the base; fls solitary or in pairs. Pedicels $1/2$ – $3 1/2$ mm, rusty tomentose. *Calyx* 4–5 mm across. *Corolla* lobes 10 by $2 1/2$ mm, tube 1–2 mm high. *Staminal tube* 2 mm; filaments 1 mm; connective lepidote; anthers 5–6 mm. *Style* 6–7 mm. *Mature fruit* rusty tomentose.

Distr. *Malaysia*: Malay Peninsula, 50–300 m alt.

Ecol. Mixed primary forests on low hills. Umbellate rusty coloured sack-galls are described. As far as is known it yields no benzoin.

5. *Styrox oliganthus* STEEN. *Bull. J.B.B. III*, 12 (1932) 241.—Fig. 2.

Tree up to 33 m, trunk 50–60 cm diam. *Leaves* ovate-oblong, rarely lanceolate, often oblique, base cuneate or rounded, apex blunt-acuminate, margin recurved *s.s.*, 7– $9 1/2$ by 3–4 cm; primary nerves 7–8

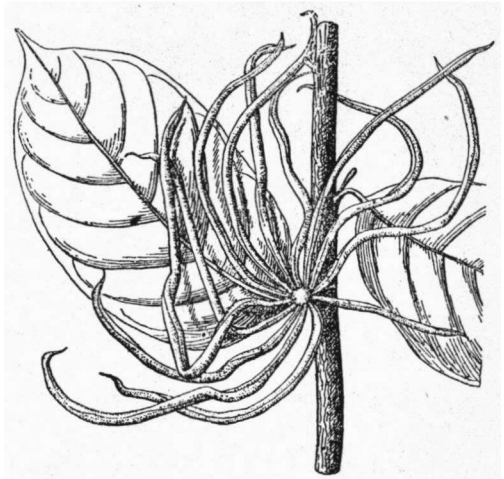


Fig. 8. Bark gall of *St. paralleloneurum* PERK., $\times 4/5$.

pairs; petiole $3 1/2$ –8 mm. *Flowers unknown*. *Calyx* in fruit $3 1/2$ –4 by $6 1/2$ – $7 1/2$ mm. *Fruit* obovate not dehiscent, apex broadly rounded, short-mucronate, 10–13 by $8 1/2$ – $9 1/2$ mm. *Seed* ovate, dull dark-brown, without papillae, $9 1/2$ by 6 mm; hilum 4 by 3 mm.

Distr. *Malaysia*: Sumatra (Eastcoast Res.), ca 500 m alt. Only once collected.

Ecol. Primary mixed forest, fr. Febr.

Notes. By its height, non-dehiscent fruit, pauciflorous infl. and not papillose seeds different from *St. tonkinensis* CRAIB. and *St. benzoides* CRAIB from continental Asia; the flowers may yield additional characters.

6. *Styrox paralleloneurum* PERK. *Bot. Jahrb.* 31 (1902) 484; *Pfl.R.* 30 (1907) 37; STEEN. *Bull. J.B. B. III*, 12 (1932) 243.—*St. sumatranus* J.J.S. *Tect.* 10 (1917) 204.—Fig. 2, 5c, 6–8.

Tree, 5–35 m by 23–60 cm; clear bole 6–25 m. *Leaves* ovate to lanceolate, mostly ovate-oblong,

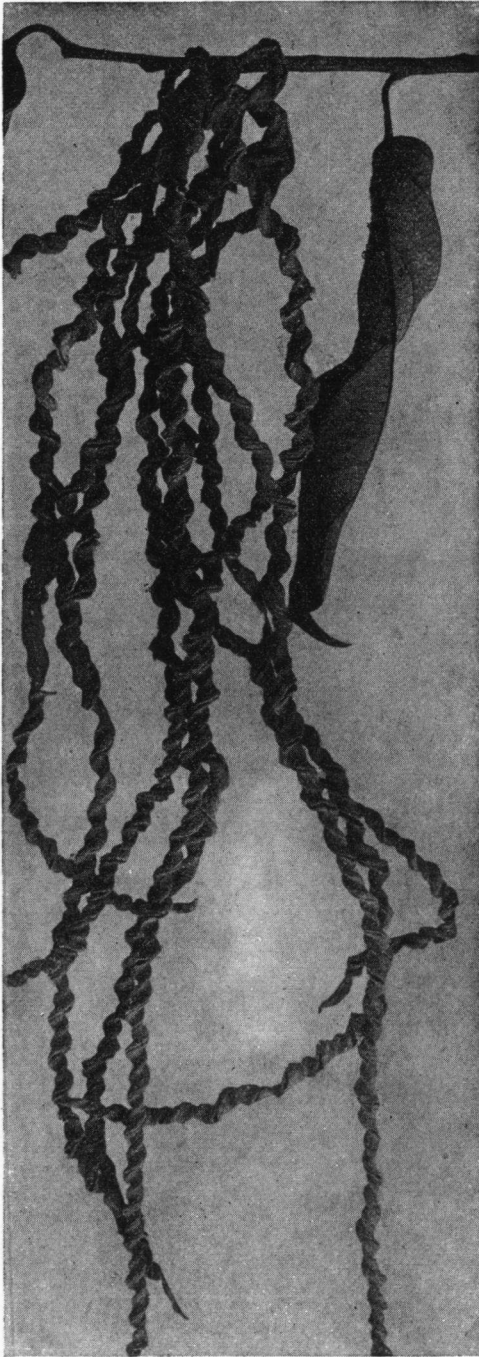


Fig. 9. Spiral galls of *St. paralleloneurum* PERK., $\times \frac{3}{5}$. These twisted galls have essentially the same structure as sack-galls, and contain a cavity.

distinctly acuminate, 6–16 by $2\frac{1}{2}$ – $6\frac{1}{2}$ cm; tomentum of undersurface thinner than in *St. benzoin* and not woolly, golden-brown lepidote; nerves 6–8 pairs glabrate, with distinct transverse veins, mostly cinnamon-coloured, petiole 7–15 mm. Larger infl. leafy, panicles 2–11 cm long. *Corolla* in mature buds $2-4 \times$ as long as the calyx. Fls violet-scented, drooping, 4–6 mm stalked. Calyx 3– $4\frac{1}{2}$ mm high and slightly broader. Corolla 13–15 mm, tube 4– $4\frac{1}{2}$ mm; lobes 11–13 by 3– $3\frac{1}{2}$ mm. Stamens 12– $12\frac{1}{2}$ and 13–14 mm; filaments 9–10 mm; anthers 4–5 mm, margin of the cells lepidote. *Fruit*-base included by the cupular, fleshy, thickened calyx, shell 5–9 mm diam. hard-fleshy. Seeds 1(–2) ovate-globose, with broad base; testa shining, bony, dark-brown.

Distr. *Malaysia*: Sumatra (only main land) & Malay Peninsula, 575–1700 m.

Ecol. Primary mixed forests, rarely in secondary forest (old clearings), often common but scattered, mostly on slopes, sometimes on ridges. Habit as in *St. benzoin*, resembling nutmeg trees. Galls unique, spirally twisted sack-galls. *Fl.* mostly March–July, *fr.* July–Nov.

Uses. Wood of inferior quality. Tapping yields white benzoin chiefly consisting of cinnamic acid, in Sumatra (Tapanuli Res.) planted in clearings and secondary forests, in Java by the For. Serv.

Vern. (*Ke*)*menjan*, in different spellings and additional epithets, as in *St. benzoin*.

Notes. Very distinct from *St. benzoin*, and easily recognizable in the sterile state by the transverse veins and appressed scales on the underside of the leaves.

f. inutilis STEEN. *l.c.*—Tomentum of leaf undersurface tinged light brown, scales few; upper surface light brown to brown *s.s.*; benzoin said to be worthless.

Distr. Once found in Tapanuli, said to be removed from plantations.

Vern. *Kemenjan bulu* (also used for *St. benzoin*).

7. *Styrax ridleyanum* PERK. *Pfl.R.* 30 (1907) 61; STEEN. *Bull. J.B.B.* III, 12 (1932) 247; FISCHER, *Kew Bull.* (1937) 438.—*St. subpaniculatus* (non JUNGH. & DE VR.) BACKER *ex* HEYNE, *Nutt. Pl.* (1927) 1260, *in nota*; BURK. *Dict.* (1935) 2107.

Tree up to 30 m by 30 cm, buttresses up to 80 cm, clear bole 15 m. *Leaves* generally alternate, ovate to oblong-ovate, distinctly often abruptly acuminate, 7–17 by $3\frac{1}{2}$ –8 cm; nerves 7–9 pairs; petiole $\frac{1}{2}$ –1 cm long; axillary buds 3–5 mm long, brown-tomentose. Panicle leafy at the base, $7\frac{1}{2}$ –20 cm long. *Flowers* fragrant. *Corolla* tube 2 mm high; lobes valvate or slightly induplicate-valvate, margin thickened, 9–10 by 3 mm. Stamens subequal, tube $\frac{2}{3}$ –1 mm high; filaments $1\frac{1}{3}$ –2 mm long; anthers 6– $6\frac{1}{2}$ mm, connective prominent and broadened above the cells. Style 8 mm. Stigma lobed to truncate or hammer-shaped. *Fr.* unknown.

Distr. Burma and *Malaysia*: Sumatra & Malay Peninsula, low alt.

Ecol. Apparently rare in lowland primary mixed forests.

Vern. *Kemenjan burong* (also for *St. benzoin*), *k. landak* (Mal. Pen.).

Notes. The nearest ally of *St. benzoin*, and only differing in the flowers, though the fruit will probably show additional characters when known. Not known to yield resin.

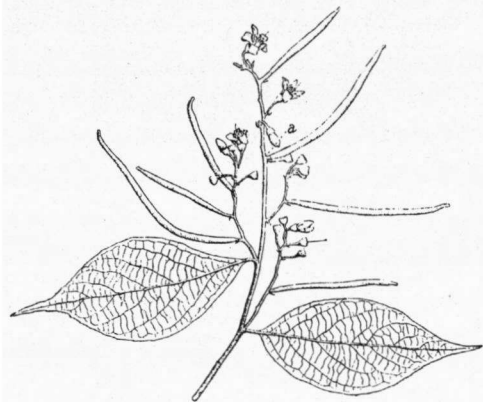


Fig. 10. Flower galls of *St. serrulatum* ROXB. var. *mollissimum* STEEN., $\times 1/2$.

8. *Styrax serrulatum* ROXB. Fl. Ind. ed. CAREY 2 (1832) 415; CLARKE in HOOK. f. Fl. Br. Ind. 3 (1882) 588, p.p.; STEEN. Bull. J.B.B. III, 12 (1932) 248.

No Malaysian specimen agrees entirely with the Indian ones, and I assume that the Malaysian specimens represent distinct varieties. It is a rather variable species and it is closely related to a group of allied species in SE. Asia: *St. grandiflorum* GRIFF., *St. caudatum* WALL., *St. hookeri* CLARKE, *St. virgatum* KURZ, all of them possessing a larger corolla; *St. japonicum* is distinct by drooping, long, glabrous pedicels and a glabrous calyx. The aestivation is variable, being subvalvate or imbricate in bud, even in one flower.

var. *rugosum* STEEN. l.c.—*St. serrulatum* auct. p.p.; GRESHOFF, Schetsen (1896) 118; GAMBLE, Mat. Fl. Mal. Pen. (1905) 251, excl. fr.; RIDL. Fl. Mal. Pen. 2 (1923) 296; BURK. Dict. (1935) 2107, p.p.—*St. porterianum* WALL. Cat. (1828) no 4401, nomen; G. DON, Gen. Hist. 4 (1837) 5; DC. Prod. 8 (1844) 267; MIQ. Fl. Ind. Bat. 1, 2 (1859) 463; PERK. Pfl. R. 30 (1907) 77.—*St. floribundum* GRIFF. Not. Pl. As. 4 (1854) 287.—Fig. 2.

Small to medium tree up to 20 m. Leaves on both surfaces with scattered small stellate hairs, 5–11 by 3–5 cm; nerves 5–6 pairs. Racemes short, terminal on the shoots, or axillary in depauperate racemes or even solitary. Corolla lobes 10–11 by 4 mm. Filaments 5 mm, glabrous towards the apex; anthers 3½–5 mm. Style 11–14 mm. Fruit ovate to obovate-globose, pericarp rugose 2 mm diam. Seed 6–8 mm across; hilum 5 mm long.

Distr. ? India, Andamans, Mergui, Tenasserim and Malaysia: Penang Isl. and Malay Peninsula (Malacca, once).

Ecol. Mixed primary forests, up to 200 m. Fl. fr. March-May.

var. *mollissimum* STEEN. Bull. J.B.B. l.c.—*St. subpaniculatum* JUNGH. & DE VR. Pl. Nov. Ind. Bat. 1 (1845) 9; MIQ. Fl. Ind. Bat. 1, 2 (1859) 464, Suppl. (1860) 187; GRESH. Schets. (1896) 118; PERK. Bot. Jahrb. 31 (1902) 483; Pfl. R. 30 (1907) 72; BURK. Dict. (1935) 2107.—*Indet.* MIQ. Linnaea 26 (1853) 285.—*Hopea* sp. MIQ. l.c. Suppl. (1860) 492, in adnot.—*St. subdenticulatum* MIQ. l.c. 187, 474; GRESH. Schets. (1896) 118; PERK. l.c.; S. MOORE, J. Bot. (1925) Suppl. 65; v. D. MEER MOHR, Trop. Nat. 20 (1931) 158.—*Styrax* sp. DOCT. v. L. Bull. J.B.B. III, 4 (1922) 158; Zoocec. (1926) 457.—Fig. 2, 10–12.

Tree 10–30 m by 8–45 cm. Leaves stellate-pubescent to subtomentose on the lower surface, the parenchyma remaining visible, 7–14 by 3½–7½ cm; nerves 6–8 pairs. Flowers in pyramidal brown-yellow tomentose panicles 5–17 cm long; lobes 7–8½ by 2½–3½ mm, pubescent all over, distinctly imbricate. Anthers 2¾ and 3–3¼ mm. Style 8–10 mm. Fruit obovate, not dehiscent; pericarp smooth ¾ mm diam. Seed 9½ by 6 mm; hilum 3 mm long.

Distr. Malaysia: Sumatra, 350–1500 m alt.

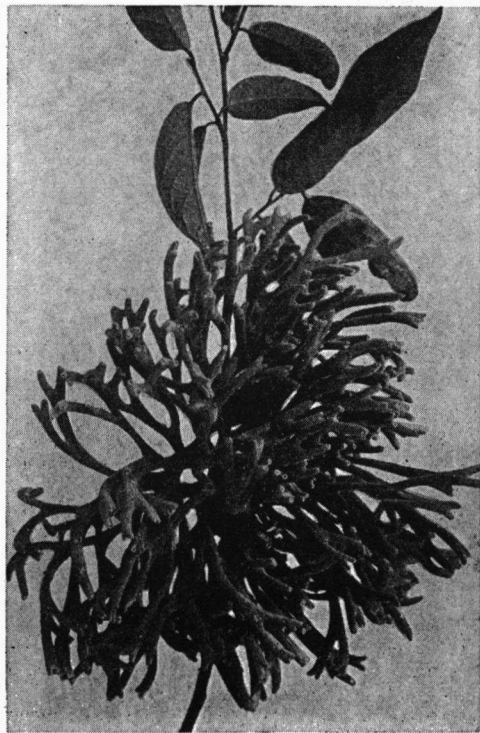


Fig. 11. Alcornorniform galls of *St. serrulatum* var. *mollissimum* STEEN., $\times 1/3$.

Ecol. Scattered in primary mixed forests, *fl.* mostly Jan.–Febr., *fr.* mostly May–June. Three kinds of galls are known, viz coralliform, alci-corniform and siliqua-shaped ones (*cf.* v. D. MEER MOHR and DOCR. v. L.).

Uses. Once reported to yield benzoin used as incense.

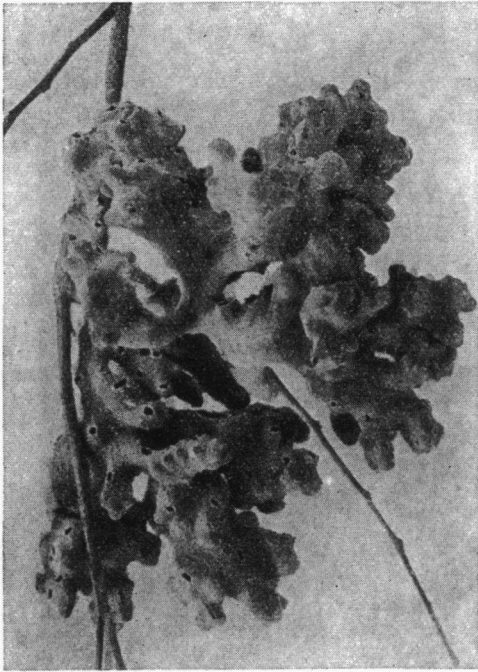


Fig. 12. Coralloid galls of *St. serrulatum* var. *mollissimum* STEEN., $\times 2/5$.

Excluded

Styrax ceramense WARB. Bot. Jahrb. 13 (1891) 302 = *Diospyros*.

Styrax ellipticum JUNGH. & DE VR. Pl. Nov. Ind. Bat. (1845) 10; MIQ. Fl. Ind. Bat. 1, 2 (1859) 464, Suppl. (1860) 187; GRESH. Schets. (1896) 118; PERK. Bot. Jahrb. 31 (1902) 484; Pfl.R. 30 (1907) 86; STEEN. Bull. J.B.B. III, 12 (1932) 253.—I have not succeeded in locating the type specimen. It is certainly not *Styracaceae* and possibly belongs to *Xanthophyllum* or *Vatica*.

Styrax glabratum (non SCHOTT) WARB. *l.c.* = *Diospyros*.

Styrax javanicum BL. Bijdr. 13 (1825) 671 = *Alangium*.

Styrax obovatum RIDL. J. As. Soc. Str. Br. 61 (1912) 28 = *Symplocos*.

Styrax rassamala REINW. *ex* STEUD. Nomencl. ed. 2 (1841) 651 = *Alangium*.

Styrax villosum Bl. Bijdr. *l.c.* = *Alangium*.

Styracin. gen. nov.? ZOLL. Syst. Verz. 2 (1854) 136 = *Vatica*.

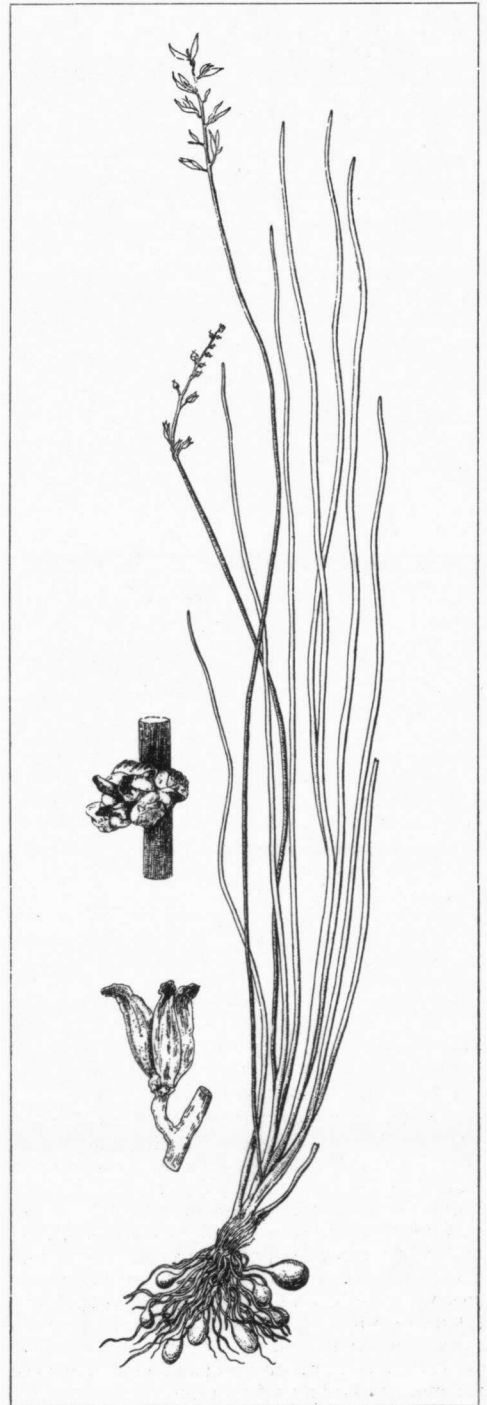


Fig. 1. *Triglochin procera* R.BR. var. *dubia* BTH. Habit, $\times 2/5$, flower and juvenile fr. enlarged.