

## ***Shorea sumatrana* (Dipterocarpaceae), a remarkable new addition to the flora of Singapore**

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**ABSTRACT.** *Shorea sumatrana* (Slooten ex Thorenaar) Symington ex Desch is newly recorded for Singapore from remnant lowland dipterocarp forest in the Singapore Botanic Gardens' Rain Forest. The species is described and illustrated, the name is lectotypified and notes on distribution, ecology and conservation status are given. This species is assessed as Critically Endangered for Singapore.

**Keywords.** Conservation assessment, Peninsular Malaysia

### **Introduction**

*Shorea* Roxb. ex C.F. Gaertn. comprises about 196 species of trees that are distributed from South Asia through Myanmar, South China, continental Southeast Asia and Malesia. For Singapore, Newman et al. (1995) listed 12 species. Ganesan et al. (2018) recorded one more species thus bringing the total to 13. These are now extant in Singapore only in patches of remaining primary forests at Bukit Timah Nature Reserve, Central Catchment Nature Reserve and the Gardens' Rain Forest at Singapore Botanic Gardens. There are also relic primary forest trees in the Changi Tree Conservation Area (TCA) that include one species of *Shorea* (i.e. *Shorea gibbosa* Brandis). Here a new distributional record of *Shorea sumatrana* (Slooten ex Thorenaar) Symington ex Desch, for Singapore is presented.

This new distribution record is a result of new collections as part of research for the account of the family Dipterocarpaceae for the Flora of Singapore. The remarkable aspect of this find is that it is represented by a very large tree growing in the already well-studied 6 ha Gardens' Rain Forest, formerly known as the Gardens' Jungle, at the Singapore Botanic Gardens. This specimen has a diameter of 144 cm. The mean annual increment (MAI) of *Shorea sumatrana* is estimated at 0.86 cm/yr (Appanah & Weinland, 1993). Based on this, the age of this specimen is estimated at 167 years. This predates the establishment of the Singapore Botanic Gardens in 1859 and is evidence that this specimen is a component of the original native vegetation in the Gardens' Rain Forest. One of the reasons that this large tree may have been overlooked in the past is that it is hidden from view from the paths through the Gardens' Rain Forest. Other factors include the infrequent flowering and fruiting of this species which would have hampered identification. The first voucher record of fruits from this tree is April 2018 and this enabled identification of this tree as *Shorea sumatrana*.

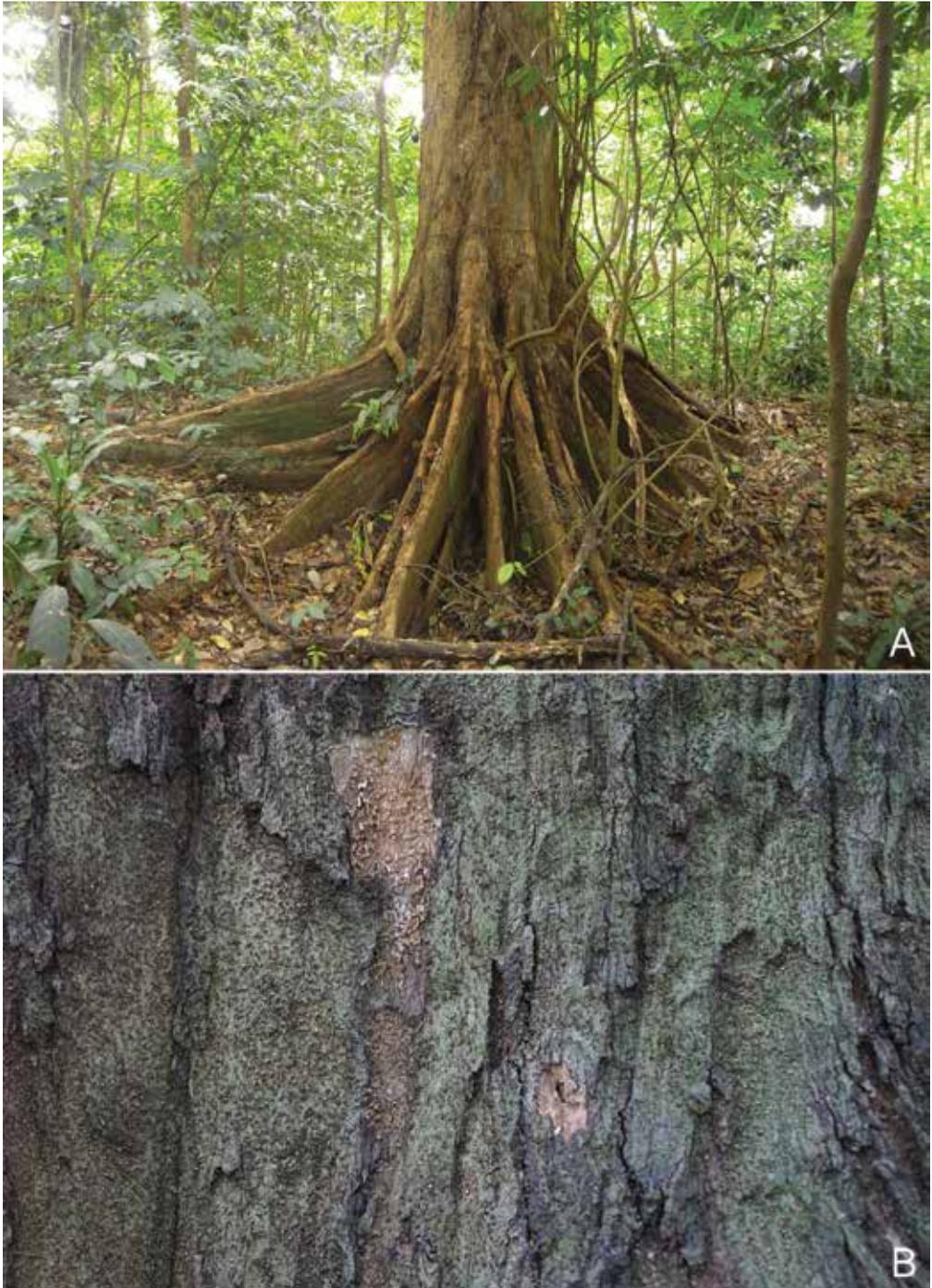
The key character enabling the identification of the Singaporean material as *Shorea sumatrana* is that the fruiting calyces are rotate with orbicular lobes. *Shorea sumatrana* is the only species of *Shorea* in the Malay Peninsula that has these characters. *Shorea seminis* (de Vriese) Slooten from Borneo and the Philippines also shares these characters but has never been recorded for the Malay Peninsula. *Shorea sumatrana* has been recorded in the Malay Peninsula as far south as southern Johor and it is known that the flora of Singapore has very close affinities with that of southern Johor (Kiew & Turner, 2003). Based on the morphological characters and the floristic affinities of Singapore and southern Johor, the Singaporean material is most likely to be *Shorea sumatrana* and very unlikely to be *Shorea seminis*. Both *Shorea sumatrana* and *Shorea seminis* belong to *Shorea* sect. *Shorea* subsect. *Shorea* which corresponds to the informal Balau (called Selangan Batu in Borneo) group that was recognised by Symington et al. (2004). The only reliable way to distinguish these two species is in the number of stamens (Ashton, 1982). However, according to Ashton (1982), these two species could be conspecific, in which case *Shorea seminis* would have priority.

### New species record in Singapore

***Shorea sumatrana*** (Slooten ex Thorenaar) Symington ex Desch, Malayan Forest Rec. 3: 195 (1934); Ashton, Fl. Males., Ser. 1, Spermat. 9(2): 453 (1982); Newman et al., Man. Dipt. Forest.: Sumatra Medium & Heavy Hardwoods 134 (1998); Symington et al., Malayan Forest Rec. 16: 116 (2004); Pooma et al., Fl. Thailand 13(4): 663 (2017). – *Isoptera sumatrana* Slooten ex Thorenaar, Meded. Proefstat. Bosch. 16: 115 (1926); Foxworthy, Malayan Forest Rec. 10: 238 (1932). – TYPE: Indonesia, Palembang, August 1919, *F.H. Endert* 555 (lectotype L [L0382635], designated here). (Fig. 1,2)

*Isoptera borneensis* auct. non Scheff. ex Burck: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65(2): 129 (1893); Ridley, Fl. Malay Penins. 1: 245 (1922).

**Tree** up to 30 m tall, diameter at breast height up to 144 cm. **Buttresses** present. **Bark** irregularly cracked, brown with lighter patches [or scaly according to Symington et al. (2004)], inner bark brown. **Twig** terete, grey-buff pubescent. **Stipules** early caducous, lanceolate, up to 7 mm long. **Leaves** alternate; petiole slender, 1.1–1.7 cm long, grey-buff pubescent; blade simple, chartaceous or subcoriaceous, symmetric or slightly asymmetric, ovate, lanceolate or elliptic, 7–14 × 4–7 cm, base obtuse or cuneate, apex acuminate, acumen 0.6–1.2 cm long, upper surface glabrous, lower surface yellow lepidote or glabrous, midrib visible and sunken above, prominent below, secondary veins 9–12 pairs, faintly visible and sunken above, visible and prominent below. **Inflorescences** terminal or axillary, paniculate, to 10 cm long, single-branched, secund, each branch with up to 6 flowers. **Flower bud** lanceolate, up to 9 × 2 mm. **Sepals** ovate, 1.5–2.0 × 1.0–1.5 mm, apex obtuse, outer surface shortly pubescent, inner surface glabrous. **Petals** hardly contorted, linear-lanceolate, c. 10 × 2 mm, apex acute, pink



**Fig. 1.** *Shorea sumatrana* (Slooten ex Thorenaar) Symington ex Desch. **A.** Buttress. **B.** Close up of bark. All from *Ganesan & Ali SKG 450*. (Photos: A, Ali Ibrahim; B, S.K. Ganesan)

proximally, yellow or cream distally, outer surface tomentose, inner surface glabrous. **Stamens** 22–27; filaments flat, broad proximally, tapering to narrow distally, sparsely hairy, c. 5 mm long; anthers 4-celled, oblong, c. 2 mm long; connective-appendages c. 2 mm long, bristles few. **Ovary and stylopodium** conical, tomentose, c.  $1.5 \times 1$  mm; style glabrous, c. 2 mm long; stigma obscurely 3-lobed. **Fruit** stalk sessile; fruiting calyx lobes subequal, rotate, orbicular,  $0.8\text{--}1.1 \times 0.9\text{--}1.2$  cm, inner surface and outer surface sparsely buff pubescent, ripening woody; nut globose or ovoid,  $1.1\text{--}1.4 \times 1.0\text{--}1.5$  cm, buff tomentose, with short stout stylar remnant.

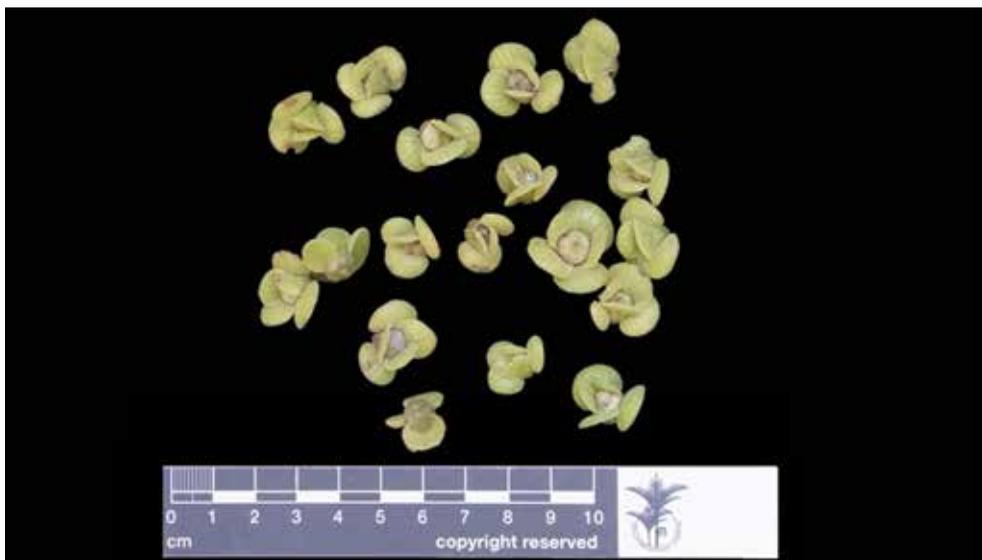
*Distribution.* Peninsular Thailand, Peninsular Malaysia, Sumatra (Ashton, 1982). In Peninsular Malaysia this species has been recorded from southern Johor which is adjacent to Singapore. In Singapore it is known from one mature individual and 91 saplings all in a very small area in the Gardens' Rain Forest. The new distribution record for Singapore is congruent with the overall global distribution for this species.

*Ecology.* This species has been recorded in low-lying and frequently swampy habitats in Peninsular Malaysia (Symington, 2004). The specimens from Singapore were collected from remnant lowland dipterocarp forest on the slope of a depression that could have been a former stream. Saplings were observed only in the immediate vicinity of the mature tree. No regeneration was observed elsewhere.

*Vernacular name.* Sengkawang (Malay).

*Provisional IUCN conservation assessment.* *Shorea sumatrana* has been assessed globally as Endangered EN A2cd (Pooma & Newman, 2017). Only one mature individual and 91 saplings near the base of the mature individual have been found in Singapore thus far. *Shorea sumatrana* produces Balau timber which is prized regionally for external construction work. Previous exploitation, in addition to loss of habitat, may therefore have resulted in the reduction of population to the sole mature individual in Singapore. Based on the IUCN ver. 3.1 (IUCN, 2012) criteria as interpreted in Davison (2008), as there are fewer than 50 mature individuals, the national conservation status of *Shorea sumatrana* in Singapore is assessed here as Critically Endangered CR/D. Die-back has been observed in the larger saplings and no pole-sized regeneration has been observed. The tree is able to produce fruit, the fruit is able to germinate, but the seedlings are not surviving and growing to a larger size. It is possible that as the seedlings become older, they require more light which is not available at the base of the mother tree. It is therefore recommended that saplings at the base of the mature tree be collected and relocated. These efforts can form part of a species recovery programme.

*Specimens examined.* SINGAPORE: **Singapore Botanic Gardens:** Gardens' Rain Forest, 12 Apr 2002 (ster), Mohd. Noor et al. NR 60 (SING [SING0040432]); ibid., 15 Apr 2002 (ster), Mohd. Noor et al. NR 108 (SING [SING0036905]); ibid., 31 Jan 2018 (ster), Ganesan & Ali SKG 449 (SING [SING0248461]); ibid., 30 Apr 2018 (fr), Ganesan & Ali SKG 450 (SING [SING0248462]).



**Fig. 2.** Fruits of *Shorea sumatrana* (Slooten ex Thorenaar) Symington ex Desch., with calyces that are rotate with orbicular lobes.(Photo: S.K. Ganesan)

PENINSULAR MALAYSIA: **Johor:** Kota Tinggi, Sungai Sedili, 16 Jul 1940 (fr), *Corner 37049* (SING[SING0122822]). **Pahang:** Rompin, 16 Oct 1919 (fl), *Lambak 2731* (SING[SING0216305]). **Selangor:** Kepong, 20 Mar 1957 (fl), *Sow 83496* (SING[SING0126283]); *ibid.*, 1 Jan 1972 (fl), *Ng FRI 6268* (SING [SING0126315]).

*Notes.* As flowers were not available from Singaporean material, Peninsular Malaysian material was used in the above description of the flowers. A key to the *Shorea* species in Singapore will be provided in the forthcoming Flora of Singapore account.

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