

A SYSTEMATIC STUDY OF THE GENUS *ACER* (ACERACEAE) IN THAILAND

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ABSTRACT

Six species of the genus *Acer* (Aceraceae) are enumerated for the flora of Thailand. *Acer wilsonii* Rehd. is reported as a new record from Thailand. A new synonym, *A. sterculiaceum* Wall. subsp. *thomsonii* (Miq.) Murray, is included under *A. thomsonii* Miq. Apart from the diagnostic key to the *Acer* species in Thailand, ecological and geographical distributions of *Acer* in Thailand are also provided.

INTRODUCTION

Maple trees, genus *Acer* (Aceraceae) with 111 species distributed in north temperate and tropical mountains (MABBERLEY, 1997), have long been cultivated in temperate countries as shade trees and also for their ornamental foliage. The red, yellow, gold and bronze autumn colors create the spectacular landscapes of the deciduous forests of eastern North America and eastern Asia. Several species are a source of sugar that is found in the sap. Because maple leaves tend to be variable in size, shape, marginal toothing, degree of hairiness or glaucescence beneath, numerous names and synonyms have existed for species, varieties and cultivars.

During the course of revision on Aceraceae for the flora of Thailand, six indigenous maple species were enumerated. *Acer chiangdaoense* Santisuk, which thrives at the upper elevations of the limestone massif on Doi Chiangdao, Chiangmai, was described as new (SANTISUK, 1992). Surprisingly *A. wilsonii* Rehder, widely distributed in southwestern and southeastern China, is a new record for Thailand. This species is sporadically encountered on steep slopes in stream valleys (1,100–1,700 m above sea level) in the lower montane rain forest of Doi Phukha mountain range in Nan Province. All Thai maples are distributed in the mountainous areas at elevations of about 200 m a.s.l. in the peninsula (*A. laurinum* Hassk.) to above 2,000 m a.s.l. in Doi Inthanon and Doi Chang, Chiangmai (*A. laurinum* Hassk. & *A. calcaratum* Gagnep.).

CRAIB (1931), DELENDICK (1978), SANTISUK (1981, 1992) and MAXWELL (1991) can be consulted for previous studies on *Acer* from Thailand. Besides these, there exist several accounts on *Acer* from various floras of the South and Southeast Asian regions (BLOEMBERGEN, 1948; GAPNEPAIN, 1950; GRIERSON AND LONG, 1991; HARA, 1966; HIERN, 1875; KURZ, 1877; LECOMTE, 1912; STEENIS, 1954; XU TINGZHI, 1991).

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Based on the morphological characters of leaf, inflorescence, infructescence and fruiting samara, the diagnostic key to the maple species in Thailand is constructed:

KEY TO THE ACER SPECIES IN THAILAND

1. Leaves unlobed
 2. Inflorescences of lateral, leafless, glabrous, simple or compound racemes; samara-nutlets slightly laterally compressed, ovoid to ellipsoid; nutlet-locule glabrous inside **1. *A. laurinum***
 2. Inflorescences of pubescent to puberulous broad corymbs on terminal leafy shoots; samara-nutlets angular tetrahedral; nutlet-locule hairy or glabrous inside
 3. Leaves ± oblong-ovate-oblong, sparsely puberulous when young, then glabrescent, base obtuse, basally 3-nerved; infructescences usually glabrous; wings of samaras 2–4 cm long; nutlet-locule inside densely whitish villous **2. *A. oblongum***
 3. Leaves ± ovate-broadly ovate to triangular ovate, tomentose to pubescent when young, then puberulous to glabrescent, base rounded or subtruncate, basally 3–5-nerved; wings of samaras 1.4–1.8 cm long; nutlet-locule inside glabrous, smooth, glossy **3. *A. chiangdaoense***
1. Leaves normally palmately lobed
 4. Inflorescences of lateral racemes; fruit with 2 large samaras; wings 4.5–7.1 cm long, 1.3–2.2 cm broad, brownish red, ± parallel, overlapping to slightly diverging; samara-nutlets loosely and irregularly veined; leaves normally 3-lobed, basally 5–7-nerved; petioles 6–14 cm long **4. *A. thomsonii***
 4. Inflorescences of terminal corymbs or thyrses; fruit with 1 well-developed samara or 2 samaras; wings diverging almost horizontally; samara-nutlets smooth; leaves 3-lobed, basally 3–5-nerved; petioles 1.5–6.4 cm long
 5. Corymbs 2.4–5.6 cm long; infructescence ascending, with few fruits, usually with 1 well-developed samara; wing reddish; leaves all 3-lobed, with 2 lateral lobes below the middle, basally 3-nerved, fallen leaves reddish; petioles 1.5–4.6 cm long **5. *A. calcaratum***
 5. Thyrses 10–23 cm long; infructescence drooping with many fruits, all with 2 developed samaras; wings brownish-yellow; leaves normally 3-lobed above the middle (juvenile ones 3–5-lobed), basally 5-nerved, fallen leaves yellow to yellowish-brown; petioles 4.0–6.4 cm long **6. *A. wilsonii***

1. *Acer laurinum* Hassk. in Tijdschr. Naturrl. Geschied. Physiol. 10:138. 1843; Steenis, Fl. Mal. I.4:592.1954; Santisuk in Acta Phytotax. Geobot. 32:40.1981; Nord. J. Bot. 12:697.1992. Figure 8

Synonyms. *A. niveum* Bl., Jaarb. Kon. Ned. Maatsch. Aanmoed. Tuinbouw 1844: 84.1845; Hiern in Fl. Br. Ind. 1:693.1875; Kurz, Fl. Burm. 1:289.1877; Bloembergen in Fl. Mal. I.4:3.f.1,2.1948.

A. philippinum Merr., Philip. Bur. Govt. Lab. Bull. 35:36.1906.

- A. curranii* Merr., Philip. J. Sci. Bot.4:285.1909.
A. garrettii Craib, Kew Bull. 1920:301.1920; Fl. Siam. En.1:337.1931; Gagnep. in Fl. Gén. I.-C. Suppl.:1012.1950; Maxwell, Nat. Hist. Bull. Siam Soc.39:72.1991.
A. pinnatinervium Merr., Brittonia 4:109.1941.
A. longicarpum Hu & Cheng, Bull. Fan. Mem. Inst. Publ.507:206.1948.

Ecology. In tropical evergreen rain forest by stream at elevations of about 200 m and in lower and upper montane rain forests up to ca. 2,400 m.

Distribution. Nepal, India (Assam), Burma, South China (Kwangtung, Hainan), Thailand, Vietnam, Cambodia, Malay Peninsula, Sumatra, Java-type, Borneo, the Philippines, Celebes to Timor.

Material studied. THAILAND, NORTHERN: Chiangmai, Doi Inthanon, **Sørensen et al. 3275** (AAU, BKF, C, E, K); same locality, **Ogawa & Yoda 110–86** (KYO, TI); same locality, ca. 2,300 m, **Phengklai & Smitinand 6073** (BKF); same locality, 1,700–2,000 m, **Phengklai et al. 6197** (BKF, K, KYO); same locality, 1,500–1,600 m, **Phengklai et al. 6233** (BKF, K, KYO); same locality, ca 1,600, **Phengklai et al. 7115** (BKF); same locality, ca 1,850, **Phengklai et al. 7312** (BKF); same locality, **Koyama et al. T. 39404 & T. 39482** (KYO); same locality, **Garrett 77** (K-type of *A. garrettii*); same locality, **Santisuk s.n.** (BKF); Doi Suthep, **Hosseus 222** (K); same locality, **Maxwell 91–229** (A, BKF, CMU, L); Doi Chiangdao, **Smitinand & Anderson 7252** (BKF); same locality, **Abbe & Smitinand 9312** (BKF); Maehongson, Doi Khun Huay Pong, **Hansen & Smitinand 12810** (BKF, C); Nan, Doi Phukha, **Suvarnasuddhi 173** (BKF). NORTHEASTERN: Loei, Phu Kradung, **Smitinand 2485** (BKF); same locality, **Smitinand 3280** (BKF, C, E, K); same locality, **Smitinand 4497** (BKF); same locality, **Abbe & Smitinand 9452** (BKF, E); same locality, **Sørensen et al. 3245** (C, E, K); same locality, **Sørensen et al. 7938** (C). SOUTHWESTERN: Kanchanaburi, Thakhanun, I-tong, **Chermisrivathana 682** (BK). PENINSULAR: Phangnga, Bangto, ca. 200 m., **Kerr 17158** (BKF, C, K).

NEPAL, CENTRAL: Pasupati, 4,200 ft. **Banerjee & Shrestha 3827** (KATH).

INDIA, Assam: 6,000–7,000 ft. 15/3/1935, **F. Kingdon-Ward 11115** (KATH).

CHINA, Hainan: **S.K. Lau 28202 & 28204** (KYO).

INDONESIA, Central Java: **S. Yoshida 1794** (KYO).

A. laurinum is usually found in the lower and upper montane rain forests above 1,000 m a.s.l. in northern and northeastern Thailand, but in the peninsula descending to about 200 m a.s.l. (**Kerr 17158**). In Borneo near Simpang, however, it has been recorded at only 27 m a.s.l. (Bloembergen, 1948). Superficially, *A. laurinum* bears resemblance to *A. oblongum* in its undivided, oblong, oblong-ovate to ovate-lanceolate leaves. However, *A. laurinum* can be readily distinguished from *A. oblongum* by the type and position of inflorescences aforementioned in the diagnostic key.

2. *Acer oblongum* Wall.ex DC., Prodr.1:593.1824; Hiern in Fl. Br. Ind. 1:693. 1875; Lec. in Fl. Gén. I.-C .1:10055. 1912 (incl. var. laosianum); Craib, Fl. Siam. En .1:337. 1931; Gagnep. in Fl. Gen. I.-C. Suppl.: 1007. 1950; Santisuk in Acta Phytotax. Geobot. 32:41. 1981.

Figure 9

Synonym. *A. lanceolatum* Molliard, Bull. Soc. Bot. Fr. 50: 134, t.5. 1903.

Ecology. In seasonal rain forest and lower montane rain forest on sandstone or limestone at the elevations between 500–1,500 m a.s.l.

Distribution. Himalayas, from India (Kashmir, Assam, Sikkim), Nepal-type to Bhutan, South China, Burma, Thailand, Laos and Vietnam (Annam).

Material studied. THAILAND, NORTHERN: Chiangmai, **Winit 1866** (BKF, K); same locality, **Kerr 5232** (BK, K); Kamphaengphet, Maewong National Park, 1,300 m, **Pooma 1139** (BKF). NORTHEASTERN: Phetchabun, Namnao, **Smitinand s.n. (BKF. no. 4107)** (BKF, K, L); Phu Hinrongkla National Park, 1,300 m, **Santisuk. s.n. (BKF)**; Chaiyaphum, Namphrom, **Beusekom et al. 4107** (BKF, K, L). EASTERN: Nakhon Ratchasima, Khao Laem, **Kerr 9961** (BK, K). CENTRAL: Uthai Thani, Huay Khakhaeng Wildlife Sanctuary, **Pooma et al. s.n. (BKF)**; same locality, **Edwards 521** (CMU). SOUTHEASTERN: Chanthaburi, Pong Namron, Klong Pratong, **Smitinand 3253** (BKF). SOUTHWESTERN: Kanchanaburi, **Winit 357** (K); Srisawat, Thamnam, **Larsen & Smitinand 9323 & 9345** (AAU, BKF); Srisawat, **Kerr 10232 & 10232A** (BK,K); Saiyok, **Sangkachand 801** (BKF); Huay Bankao, **Beusekom et al. 3769** (BKF, K, KYO, L).

NEPAL: Baitadi District, 1,350 m. **P.R. Sharya et al. 8343** (KATH); Gandari zone 1,940 m, **M. Suzuki et al. 94 800 90** (KATH); Bagmati zone, Pasupatinath forest, 1,300 m, **D.H. Nicolson 2957** (KATH); Kathmandu, between Pa supatinath & Ganeshwur, **H. Tabata et al. 12062** (KATH, KYO); Gabu to Rana, 10/6/1953, **S. Nakao s.n. (KYO)**; Near Talkot, **Tabata et al. 1413** (KYO); Hedangna to Gola, **Tabata et al. 11151** (KYO); Kathmandu, 27/12/1963, **Murata & Togashi s.n. (KYO)**.

BHUTAN: **Bartholomew & Boufford 3861** (TI); same locality, **Tabata et al. 11919** (TI); same locality, **Grierson & Long 4351** (E, TI).

CHINA: Szechuan, Mt. Omei, **W.P. Fang 19007** (KYO); Hupeh, **A. Henry 6392** (BM); Wuchan, **Y.Z. Long 273** (KYO).

A. oblongum occurs widely along the Himalayan track. The southeastern and southwestern areas in Thailand seem to mark the southern limit of this species.

Additional Record for *Acer chiangdaoense* Santisuk

3. *Acer chiangdaoense* Santisuk, Nord. J. Bot. 12:696. 1992.

Figure 7

Ecology. Scattered on the limestone outcrops in the lower montane rain forest at the elevations between 1,500–2,150 m a.s.l.

Distribution. Endemic to northern Thailand. This species was hitherto known from the type locality in Doi Chiangdao, Chiangmai. Recent botanical excursions have also recorded its existence on the limestone ridged top of Doi Tung in Chiangrai.

Material studied. THAILAND, NORTHERN: Chiangmai, Doi Chiangdao, ca.1,800 m, **Santisuk 2694** (BKF-holotype); same locality, ca.1,900 m, **Smitinand 4729** (BKF); same locality, ca. 1,800 m, **Smitinand & Anderson 7252** (BKF); same locality, **Put 355** (BK, K); same locality, 1,800 m, **Sørensen et al. 4190** (C, K); same locality, 1,800–2,150 m, **Shimizu et al. T.21173** (KYO, SHIN); same locality, 1,525 m, **Maxwell 96–112** (A, BKF, CMU, L); same locality, 1,750 m, **Allen 46** (CMU, L); Chiangrai, Doi Tung, above Wat



Figure 1. *Acer calcaratum*; seedling leaves, Doi Phukha NP., Nan, ca 1,600 m, 19 Nov. 1992.



Figure 2. *Acer calcaratum*; mature leaves at shedding time, Phu Kradung NP., Loei, ca 1,300 m, 8 Dec. 1973.



Figure 3. *Acer calcaratum*; a fruiting branch, Phu Kradung NP., ca 1,300 m, 12 Mar. 1979.

Figure 4. *Acer wilsonii*; seedling leaves (green) and fallen leaves, Doi Phukha NP., ca 1,200 m, 16 May 1992.



Figure 5. Flowering branches of *Acer wilsonii* (right) at ca 1,200 m and of *A. calcaratum* at ca 1,600 m, Doi Phukha NP., 19 Nov. 1992.



Figure 6. *Acer wilsonii*; a fruiting branch, Doi Phukha NP., ca 1,100 m, 16 May, 1992.





Figure 7. *Acer chiangdaoense*; a fruiting branch, Doi Tung, Chiangrai, ca 1,300 m, 18 May 1992.



Figure 9. *Acer oblongum*; a fruiting branch, Huay Khakhaeng WS., Khao Khieo, Uthaitхани, ca 950 m, 18 Feb. 1991.

Figure 8. *Acer laurinum*; fruiting branches, Doi Inthanon NP., Chiangmai, ca 2,100 m, 30 Dec. 1996.



Figure 10. Typical fruiting material of *Acer thomsonii* (syn. *A. sterculiaceum* ssp. *thomsonii*) from India, Darjeeling (Togashi 782-KYO, TI).



Figure 11. *Acer thomsonii* specimen with a mature fruiting samara from Tak, northern Thailand (Hansen & Smitinand TDBS. 12892-BKF, C, K).



Figure 12. Typical fruiting material of *A. sterculiaceum* from E. Nepal (Shakya 7097-KATH).

Phrathat, in the remnant patch of lower montane rain forest with limestone outcrops, ca.1,350 m, Santisuk s.n. (BKF); same locality, **Pooma 751** (BKF, CMU); same locality, **Pooma 1170** (BKF).

New Synonym for *Acer thomsonii* Miq.

4. *Acer thomsonii* Miq., Arch. Neerl. 2:470. 1867; Brandis, Ind. Trees: 183. 1906; Hara in Fl. E. Himal.:193. 1966; Grierson & Long, Fl. Bhutan 2:66. 1991. Figures 10 & 11

Synonyms. *A. villosum* Wall. var. *thomsonii* (Miq.) Hiern in Fl. Br.Ind. 1: 695. 1875. *A. sterculiaceum* Wall. subsp. *thomsonii* (Miq.) Murray, Kalmia 1: 37. 1969 & Monog. Acerac. (Thesis. Penn.U.): 243. 1970; Santisuk in Acta Phytotax. Geobot. 32: 42. 1981. Type: Sikkim, 7,000–9,000 ft., **J.D. Hooker s.n.** (K) **syn.nov.**

Ecology. Uncommon on a stream slope in lower montane rain forest at ca.1,400 m.

Distribution. Eastern Himalayas, from E. Nepal, India (Assam, Sikkim, Manipur) to Bhutan, Burma (Bhamo & Myitkyina) and Thailand.

Material studied. THAILAND, NORTHERN: Tak, Doi Pae Poe, **Hansen & Smitinand TDBS.12892** (BKF, C, K).

NEPAL, Eastern Nepal, **Stainton 6439** (TI)

INDIA, Assam, **N.L. Bor 4490** (K); Sikkim, 7,000–9,000 ft., **J.D. Hooker s.n.** (K-type); same locality, **Stainton 5314** (TI); Darjeeling, Kurseong, **M. Togashi 782** (KYO, TI); Manipur, **Watt 5875** (K).

BURMA, Bhamo, **Uaung Kya 5339** (K); Myitkyina, Fengshumiling Pass, **Kermode 17215** (K).

A. thomsonii from Thailand is only represented by the collection of **Hansen & Smitinand 12892** which marks its southernmost distribution. This material well matches the type specimen at K (**J.D. Hooker s.n.**). I recognize *A. thomsonii* as a distinct species separable from *A. sterculiaceum* Wall. (syn. = *A. villosum* Wall. non J. & K. Presl, 1822) by the following characters:

Characters	<i>A. sterculiaceum</i>	<i>A. thomsonii</i>
Leaf division	Normally 5-lobed, never unlobed (if 3-lobed, then often with 2 additional, small irregular lobes near the base).	Normally 3-lobed (rarely almost unlobed).
Leaf margin	Distinctly serrate or serrulate, rarely obscurely serrate.	Entire or obscurely serrate.
Leaf indumentum	Softly pubescent beneath when young, then pubescent at least along the veins and in the vein-axils beneath.	Glabrous when mature.
Samara-wing	Brownish-yellow, less narrowed at the base, ± covering the apical part of nutlet.	Reddish, narrowed at the base and decurrent on the nutlet.
Samara-nutlet indumentum	± Pilose	Finely pubescent to glabrescent.

A. sterculiaceum (Figure 12) is widely distributed from the western Himalayas (Kashmir) to Nepal, India (Sikkim, Manipur), Bhutan and SW. China (Yunnan). There is no record of this species from Thailand.

Material studied. (*A. sterculiaceum*): NEPAL, Wallich 1224 (BM, K-type); Masu Pass to Dillikot, Kalikot, 2,600 m, Rajbhandari & Roy 2974 (KATH); Budkhori, 8,300 ft., T.B. Shrestha 4084 (KATH); Bajhang, Naya odar-Topu, 2,480 m, Sharya *et al.* 8288 (KATH); Near Bajhang, Tabata *et al.* 1707 (KYO); Dhawalagiri zone, Mustang, 2,440 m, M. Mikage; Langtang, 3,200 m, N.P. Manandhar *et al.* 487 (KATH); Bagmati zone, Rasuwa, 1,820 m, Suzuki & Noshiro 540024 (KATH, TI); Solukhumbu, Tabata *et al.* 10401 (KYO, TI) & 10515 (KYO); Thangjet-Kilojet, Kanai & Shakya 672103 (KYO); Marshandi River, S. Nakao s.n. (KYO); Dhumpa, S. Nakao s.n. (KYO); Timang, S. Nakao s.n. (KYO); Bhuspate Danra, Hara *et al.* 6303089 (KYO, TI); Minchin Dhap-Mul Pokhari, near Taplejung, Hara *et al.* 6303083 (KYO, TI); Tashigaon-Bhainsinharka, 2,410 m, M.N. Subedi 449 (KATH); Khiraunle-Thare, 8,700 ft., P.Q. Shakya 7097 (KATH). BHUTAN, Ritang-Pelela-Rukubi, Kanai *et al.* 2531 (KYO).

5. *Acer calcaratum* Gagnep., in Not. Syst. Paris 13:192. 1948; in Fl. Gén. I.-C. Suppl. 1011, f. 131 (3-4). 1950. Figures 1, 2, 3 & 5

Synonym. *A. craibianum* T. Delendick in Brittonia 30: 474, f.1. 1978.

Ecology. Scattered by stream in the lower & upper montane rain forest at the elevations between 1,300-2,400 m.

Distribution. Burma, Vietnam (Annam-type) and Thailand.

Material studied. THAILAND, NORTHERN: Chiangmai, Doi Inthanon, Santisuk s.n. (BKF); Mae Taeng, Doi Chang, Shimizu *et al.* T. 20480 (KYO); Doi Khun Huay Pong, Hansen & Smitinand TDBS.12818 (BKF, C), TDBS. 12861 (AAU, BKF, C, E, L, P) &

TDBS. 12896 (BKF, E, K, L, P); Nan, Doi Phukha National Park, 19/4/92, **Santisuk s.n.** (BKF). NORTHEASTERN: Loei, Phu Mieng, **Hansen et al. TDBS. 11171** (BKF, C); Phu Kradung, **Smitinand 2486** (BKF); same locality, **L.B. Abbe et al. 9453** (BKF); same locality, **Beusekom & Phengkhai 3145** (K, KYO); same locality, **Murata et al. T. 42497, T. 42665, T. 42847 & T. 42600** (KYO); same locality, **Koyama et al. T. 31252** (KYO); same locality, **Takahashi & Tamura T. 63357 & T. 63454** (KYO); same locality, **Pooma 376** (BKF, CMU).

A. calcaratum proliferates by stream in the lower montane rain forest on the flat-topped sandstone mountains of Phu Kradung, Phu Mieng and Phu Luang in the northeast. Whilst it is rather sporadic in the lower and upper montane rain forests in the north.

New Record of *Acer wilsonii* Rehder from Thailand

6. *Acer wilsonii* Rehder, in *Trees and Shrubs* 1: 157, f. 74 (1–4).1905; Murray, Monog. Acerac.: 256. 1970; Xu Tingzhi, in *Fl. Yunnan*. 5: 222, f.78 (1). 1991. Figures 4, 5 & 6 **Synonym.** *A. angustilobum* H.H. Hu, *J. Arn. Arb.* 12:154. 1931 (non Heer, 1859).

Ecology. The trees are sporadic on steep slopes in shady stream valleys in the lower montane rain forest between 1,100–1,700 m.a.s.l. of Doi Phukha National Park, uncommonly found along with *A. calcaratum*.

Distribution. China [Hupeh, **Wilson 303**-type (A, K, W), Fujian, Gansu, Guangdong, Guizhou, Hubei, Hunan, Kwangsi, Shanxi, Sichuan, Yunnan, Zhejiang] and Thailand.

Material studied. THAILAND: Nan, Pua District, Doi Phukha National Park, ca.1,100 m, samaras greenish-yellow, 16 May 1992, **Santisuk et al. s.n.** (BKF); same locality ca.1,100–1,400 m, 19 Nov. 1992, **Santisuk 8592** (BKF); same locality, **Pooma et al. 1447** (BKF, CMU).

CHINA: Guangdong, **S.P. Ko 54033 & 54560** (KUN); Guangxi, **S.H. Chun 13095 & 13288** (KUN); Guizhou, Yinjiang Xian, Huguoshi, in the valley above Zhangjiaba on the wet side of the Fanjing Shan ca. 850–1,300 m, **B. Bartholomew et al. 1592** (A, KYO); Kwangsi, Yao Shan, **C. Wang 39265** (A, SYS); Yunnan, **K.M. Feng 11514 & 11910** (KUN); **Wang 82882** (KUN); **Wang & Liu 84488** (KUN).

A. wilsonii is widely distributed in southwestern and southeastern China. The upper elevations of Doi Phukha along the Luang Prabang mountain range in Nan Province of Thailand seem to mark the southern limit of this species. In sterile stage the tree superficially resembles *A. calcaratum* in its 3-lobed leaves. However, *A. wilsonii* is distinguishable readily from *A. calcaratum* by a terminal, drooping thyse, the 2 well developed samaras on each fruiting stalk and the yellowish fallen leaves.

Herbarium Abbreviations:

A	Arnold Arboretum, Massachusetts, U.S.A.
AAU	Institute of Biological Sciences, U. of Aarhus, Denmark.
BK	The Bangkok Herbarium, Dept. of Agricultural Technology, Bangkok, Thailand.
BKF	The Forest Herbarium, Royal Forest Dept., Bangkok, Thailand.
BM	British Museum of Natural History, London, U.K.

- C Botanical Museum, U. of Copenhagen, Denmark.
 CMU Dept. of Biology, Faculty of Science, Chiangmai U., Thailand.
 E Royal Botanic Garden, Edinburgh, U.K.
 K Royal Botanic Gardens, Kew, U.K.
 KATH His Majesty's Govt. of Nepal, Dept. of Plant Resources, Kathmandu.
 KUN Kunming Institute of Botany, Academia Sinica, Yunnan, China.
 KYO Dept. of Botany, Kyoto U., Japan.
 L Rijksherbarium, Leiden, The Netherlands.
 P Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris, France.
 SHIN Dept. of Biology, Shinshu U., Matsumoto, Japan.
 SYS Botanical Institute of Sun-Yat-Sen-U., Kwangtung, China.
 TI Dept. of Botany, Tokyo U., Japan.
 W Naturhistorisches Museum, Wien, Austria.

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