

Taxonomic notes on the Rutaceae of Thailand

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ABSTRACT

Nomenclatural problems with the name *Atalantia simplicifolia* are discussed, and it is shown that *A. roxburghiana*, often used for it, is illegitimate. Formerly part of *Murraya*, *Bergera* is recognized as separate genus for Thailand. *Murraya siamensis* is reduced to a synonym of *Bergera koenigii*.

KEYWORDS: *Atalantia*, Aurantioideae, *Bergera*, Flora of Thailand, *Murraya*.

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INTRODUCTION

Rutaceae are a nearly cosmopolitan family of herbs or (largely) woody plants with ca 155 genera and 1,600 species. They are distinguished from similar families by pellucid glands containing volatile oils, although recently some unusual genera that lack these glands have been added, among them *Harrisonia* R.Br. ex A.Juss. in Thailand (formerly Simaroubaceae).

In the course of studies for the preparation of an account for the Flora of Thailand, several taxonomic and nomenclatural problems were encountered. Two of these are discussed here, in *Atalantia* Corrêa and *Bergera* J.Koenig, two genera of subfamily Aurantioideae, which is characterized by fleshy, indehiscent fruits. Complete descriptions will be given in the forthcoming Flora of Thailand account.

TAXONOMY

ATALANTIA

Corrêa, Ann. Mus. Natl. Hist. Nat. 6: 383, 386. 1805, **nom. cons.**; DC., Prodr. 1: 535. 1824; Oliv., J. Proc. Linn. Soc., Bot. 5, Suppl. 2: 23. 1861; Hook.f. in Benth. & Hook.f., Gen. Pl. 1: 305. 1862, p.p. excl. *Merope*; Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 44: 136. 1876; Forest Fl. Burma 1: 194. 1877; Guillaumin in Lecomte, Fl. Indo-Chine 1: 668. 1911, p.p.; Ridl., Fl. Malay Penins. 1: 356. 1922; Swingle, Bot. *Citrus*: 322. 1943; K.Narayanan & Barrie,

Taxon 44: 429. 1995; D.X.Zhang & T.G.Hartley in D.X.Zhang *et al.*, Fl. China 11: 87. 2008; Kubitzki *et al.* in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 349. 2011. Type: *A. monophylla* (L.) DC.

— *Malnaregam* Adans., Fam. Pl. 2: 345. 1763, **nom. rej.** Type: *M. malabarica* Raf. [= *A. monophylla* (L.) DC.].

Atalantia is a genus of ca 17 species, distributed from India to SE Asia and China. In Thailand there are two widespread species.

Atalantia monophylla (L.) DC. is well characterized by usually spiny branches, leaves with a retuse (rarely mucronate) apex and flowers with a clavate calyx splitting into irregular lobes. It occurs throughout the country, from Chiang Mai to the Peninsula, in degraded, rocky places and coastal and littoral forests at low altitudes.

The second species is not spiny, the leaves have an acuminate apex and flowers have regular sepals. There has been a considerable confusion in past years over the name of this species, *A. simplicifolia* or *A. roxburghiana*, both in herbaria and publications. This was discussed by Burkill (1931), Swingle (1943) and recently by Gardner *et al.* (2018: 2262), but not finally resolved. *Atalantia simplicifolia* (Roxb.) Engl. was described (as *Amyris simplicifolia* Roxb.) from plants cultivated in Calcutta but being native to the Malay Peninsula. Although quite short, the protologue agrees well with the lectotype specimen

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in BM. The later confusion occurred because Hooker (1875) and Tanaka (1930) discussed plants from India as distinct from the Malaccan (Penang?) plants, but they used names nomenclaturally based on Roxburgh's type for the Indian plants. Hooker (1875) published the name *A. roxburghiana* for them, while Tanaka (1930) made the combination *Atalantia simplicifolia* (Roxb.) Tanaka, merely creating a superfluous combination (isonym). *Amyris simplicifolia* Roxb. was cited as synonym, which makes Hooker's name illegitimate. Tanaka (1930) clearly cited the Malaccan type, but wrote that Engler's name contradicted Roxburgh's description – which is hardly possible because Engler just made the combination *Atalantia simplicifolia* and did not discuss characters. Instead, Tanaka stated that the Malaccan and South-East Asian plants should be called *A. roxburghiana*, while the true *A. simplicifolia* only occurred in the Himalaya and Myanmar.

The Indian-Himalayan plants which Hooker and Tanaka had in their hands were quite probably a distinct species that does not occur in Thailand, perhaps *Atalantia caudata* Hook.f. The Thai plants must be called *A. simplicifolia*. Gardner *et al.* (2018) treated the species as *A. roxburghiana* in the main part (2018: 1966), but in the second part including synonyms and additional discussions (2018: 2262) added the note that the correct name for *A. roxburghiana* might be *A. simplicifolia* but that this would not be clear.

Atalantia simplicifolia (Roxb.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 192. 1896; Burkill, Gard. Bull. Straits Settlements. 5: 216. 1931; Swingle, Bot. *Citrus*: 332. 1943; S.Gardner *et al.*, Forest Trees S. Thailand 3: 2262. 2018.— *Amyris simplicifolia* Roxb., [Hort. Bengal.: 88. 1814, **nom. nud.** ex] Fl. Ind., ed. 1832, 2: 244. 1832.— *Sclerostylis roxburghii* Wight, Icon. Pl. Ind. Orient. 1, 4: t. 72. 1838 ('*roxburghii*'), **nom. illeg. superfl.**— *Atalantia roxburghii* (Wight) Oliv., J. Linn. Soc. Bot. 5, Suppl. 2: 25. 1861, **nom. illeg. superfl.**— *Atalantia roxburghiana* Hook.f., Fl. Brit. India 1: 513. 1875, **nom. illeg. superfl.**; Ridl., Fl. Malay Penins. 1: 357. 1922; Swingle, Bot. *Citrus*: 333. 1943; S.Gardner *et al.*, Forest Trees S. Thailand 3: 1966, 2262. 2018.— *Atalantia simplicifolia* (Roxb.) Tanaka, J. Bot. (Morot) 68: 232. 1930, **isonym**. Type: Malaysia, Pulau Penang (cultivated in Calcutta), without date, *Roxburgh s.n.* (lectotype **BM** [BM000798422!],

designated by Tanaka, J. Bot. (Morot) 68: 232. 1930 (as 'type')).

Thailand.— NORTHERN: Chiang Mai [Doi Lahn, 9 Feb. 2005, *Maxwell 05-84* (**L**); 18 June 2005, *Maxwell 05-404* (**BKF, L**); 13 Apr. 2005, *Palee 798* (**BKF, L**); Lampang [Doi Luang, 26 Mar. 1997, *Maxwell 97-248* (**BKF, CMUB, L**); 13 July 1997, *Maxwell 97-747* (**BKF, CMUB, L**)]; SOUTH-WESTERN: Kanchanaburi [Tung Yai Naresuan Wildlife Sanctuary, 10 Apr. 1994, *Maxwell 94-465* (**CMUB, L**); 27 Feb. 2001, *van de Bult 385* (**CMUB, L**)]; PENINSULAR: Trang [Khao Chong, 8 Aug. 1975 *Sutheesorn 3412* (**BK**)]; Yala [Bang Lan National Park, 22 Apr. 2005, *Pooma et al. 5138* (**BKF, L, M**); Than To, 16 July 1970, *Smitinand 11000* (**BKF, E, K, L**)]; Narathiwat [Bacho, 11 June 1930, *SF (Hamid) 24212* (**BK, K, SING**); *SF (Kiah) 24311* (**K, SING**)].

Distribution.— Malay Peninsula (type from Pulau Penang), possibly also Lao PDR and Myanmar but not yet verified (morphologically similar collections sometimes confused with species of *Glycosmis* Corrêa).

Ecology.— In primary evergreen and deciduous seasonal hardwood forest with bamboo, evergreen gallery forest, on stream banks, rugged limestone terrain, over granite, shale or limestone bedrock; 100–1,100 m alt. Flowering February–June, fruiting April–August.

Uses.— Leaves are used for respiratory problems (Gardner *et al.*, 2018).

BERGERA

J.Koenig in L., Mant. Pl. 2: 555, 563. 1771 (**nom. rej.** vs *Murraya* J.Koenig); DC., Prodr. 1: 537. 1824; F.J.Mou & D.X.Zhang, Nordic J. Bot. 27: 298. 2009; Kubitzki *et al.* in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 10: 344. 2011; Mabb., Fl. Australia 26: 501. 2013.— *Chalcas* sect. *Berbera* (J.Koenig) Tanaka, J. Soc. Trop. Agric. 1: 41. 1929.— *Murraya* sect. *Berbera* (J.Koenig) But & Y.C.Kong, Acta Phytotax. Sin. 24: 189. 1986. Type: *B. koenigii* L.

— *Chalcas* auct. non L.: Tanaka, J. Soc. Trop. Agric. 1: 23. 1929, p.p.

— *Murraya* auct. non J.Koenig: Kurz, Forest Fl. Burma 1: 190. 1877, p.p.; Guillaumin in Lecomte, Fl. Indo-Chine 1: 657. 1911, p.p.; Swingle, Bot. *Citrus*: 192, 200. 1943, p.p.; D.X.Zhang &

T.G.Hartley in D.X.Zhang *et al.*, Fl. China 11: 86. 2008, p.p.

Berbera had been considered as separate genus for several decades after its first description, but was later united with the similar *Murraya* J.Koenig, e.g., by Hooker (1862). This view was upheld until quite recently, accepting a single genus *Murraya* divided into two distinct species groups (e.g., Zhang & Hartley in Zhang *et al.*, 2008), sometimes separated as sections.

Recent studies showed that there are notable differences between *Berbera* and *Murraya*, in

Morphological differences are:

1. Stem and roots brown, petals small (not more than 0.8 cm long), stamens dilated, fruits globose, ripening purplish black, seeds glabrous **Berbera**
1. Stem and roots yellowish, petals large (1–2.5 cm long), stamens not dilated, fruits ellipsoid, ripening red, seeds villous **Murraya**

Berbera is a name rejected against *Murraya*, but if the genus is accepted as distinct, the name is available for use. *Berbera* includes ten or more species from India through SE Asia to Malesia, Taiwan and New Caledonia, with several species restricted to China. There is only one species in Thailand, which is also the most widespread one of the genus.

Berbera koenigii L., Mant. Pl. 2: 563. 1771; DC., Prodr. 1: 537. 1824.— *Murraya koenigii* (L.) Spreng., Syst. Veg. ed. 16, 2: 315. 1825; Hook.f., Fl. Brit. India 1: 503. 1875; Kurz, Forest Fl. Burma 1: 190. 1877; Guillaumin, Notul. Syst. 1: 217. 1910; Craib, Fl. Siam. 1: 230. 1926; Swingle, Bot. *Citrus*: 200. 1943; S.Gardner *et al.*, Field Guide Forest Trees N. Thailand: 101. 2000; D.X.Zhang & T.G. Hartley in D.X.Zhang *et al.*, Fl. China 11: 87. 2008; S.Gardner *et al.*, Forest Trees S. Thailand 3: 1980, 2270, fig. 2563. 2018.— *Chalcas koenigii* (L.) Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 44: 132. 187. 1876; Tanaka, Bull. Soc. Bot. France 75: 710. 1928; J. Soc. Trop. Agric. 1: 29. 1929; Bull. Mus. Natl. Hist Nat., sér. 2, 2: 159. Mar. 1930; J. Bot. (Morot) 68: 229. Aug. 1930; Meded. Rijksherb. Leiden 69: 7. 1931. Type: India, without further locality, without date, *König s.n.*, *Herb. Linn. No. 548.1* (lectotype **LINN** image seen, designated by Tanaka, Meded. Rijksherb. Leiden 69: 7. 1931; second step lectotype designated by Coode in Bosser

morphology (Kubitzki *et al.*, 2011; Mabberley, 2013), palynology (Mou & Zhang, 2009) and chemotaxonomy (But *et al.*, 1986, 1988; Kong *et al.*, 1986). Molecular phylogenies (e.g., Samuel *et al.*, 2008; Bayer *et al.*, 2009; Morton, 2009) showed that the two genera are not sister groups. Kubitzki *et al.* (2011) placed *Berbera* in tribe Clauseneae ('*Berbera* Alliance', together with *Clausena* Burm.f., *Micromelum* Blume and *Glycosmis* Corrêa); according to Samuel *et al.* (2008), *Berbera* is sister to *Clausena*. *Murraya*, on the other hand, is part of tribe Aurantieae ('*Citrus* Alliance', with *Merrillia* Swingle, *Triphasia* Lour. and other genera).

et al. (eds), Fl. Mascareignes 65: 25. 1979; possible isolectotype **C** image seen; see also Mabberley, 2016).

— *Murraya siamensis* Craib, Bull. Misc. Inform. 1926: 340. 1926, **syn. nov.**; Fl. Siam. 1: 230. 1926; Swingle, Bot. *Citrus*: 202. 1943.— *Chalcas siamensis* (Craib) Tanaka, Bull. Soc. Bot. France 75: 710. 1928; J. Soc. Trop. Agric. 1: 34. 1929; Bull. Mus. Natl. Hist Nat., sér. 2, 2: 160. 1930. Type: Thailand, Lampang, Mè Kat, 24 Apr. 1923, *Winit 849* (lectotype **K!**, designated by Tanaka, Bull. Soc. Bot. France 75: 711. 1928; isolectotype **BKF!**).

Thailand.— NORTHERN: Chiang Mai [Meh Ping, 20 Oct. 1911, *Kerr 2188* (**K**, syntype of *M. siamensis*)]; Nan [Tham Sakoen National Park, 13 May 2011, *La-ongsri et al. 1717* (**KYO**)]; Lampang [Pang Pue, 28 Mar. 1914, *Kerr 3176* (**K**); 23 May 1915, *Kerr 3176A* (**K**); Mae Ta district, Doi Pahk Dtoot, 13 Jan. 2012, *Maxwell 12-8* (**L, M**); Me Kat, 24 Apr. 1923, *Winit 849* (**BKF, K**, lectotypes of *M. siamensis*)]; Tak [Ban Na, 23 Feb. 1960, *Kasem 825* (**BCU, BK**); 18 Mar. 1913, *Kerr 2961* (**K**)]; Nakhon Sawan [Takli, 26 Nov. 1928, *Put 2123* (**BK, K, L, TCD**)]; NORTH-EASTERN: Phetchabun [Bo Tai, 20 Jan. 1969, *Vacharapong 360* (**BK**)]; Loei [Wang Saphung, 16 Apr. 1941, *Adisouprasert 91* (**BKF**)]; EASTERN: Nakhon Ratchasima [Pak Chong, 4 Sep. 1958, *Smitinand 4854* (**BKF, C**)]; SOUTH-WESTERN: Kanchanaburi [Salak Pra Wildlife Sanctuary, 26

Aug. 2010, *Maxwell 10-16* (L, M); Tah Ma Nau village, Mahng Dong subdistrict, 4 Mar. 2009, *Thampatak 4* (M); Bo Phoi, 15 Apr. 2000, *Wongprasert s.n.* (BKF); Phetchaburi [Cha-am, 08 Jan. 2002, *Chayamarit et al. 3018* (BKF)]; Prachuap Khiri Khan [Hadd Wanakorn Forestry Training Camp, 5 Sep. 2018, *Esser et al. 18-01* (BKF, M); Pran Buri, s.dat., *Ladell 215* (BK, K); Sam Roi Yot National Park, 23 Feb. 2000, *Chayamarit et al. 1847* (BKF); 5 Apr. 1974, *Larsen & Larsen 33650* (BKF, KYO, L); 17 Aug. 2002, *Middleton et al. 1139* (BKF, L, M); 29 June 2000, *Newman et al. 1133* (BKF, L, PSU); 6 Feb. 2005, *Williams et al. 1245* (BKF, L, M)]; CENTRAL: Lop Buri [19 Nov. 1984, *Murata et al. T-51037* (BKF, KYO); 22 May 1941, *Premrasmi s.n.* (BKF)]; Saraburi [Phu Khae Botanical Garden, 3 Sep. 1967, *Hardial 610* (SING); 15 Jan. 1984, *Soejarto & Chotkrang 5719* (K); 30 Mar. 1987, *Soejarto et al. 5834* (A, L)]; Krung Thep Maha Nakhon [Wat Bovorn (Bowon) Nivet Viharn, 1 Sep. 1971, *Suvatabundhee s.n.* (BK)]; SOUTH-EASTERN: Sa Kaeo [Krabin, 22 Dec. 1924, *Kerr 9740* (BK, K, SING)]; Chon Buri [Nong Kae, 30 Sep. 1927, *Collins 1597* (BK, K)].

Distribution.— Pakistan, Sri Lanka, India (type), Bhutan, Nepal, China (Yunnan, Hainan), Laos, Vietnam, Malay Peninsula (Langkawi), Indonesia (Java, Sumatra). It is widely cultivated and naturalized as the indispensable ‘curry leaf’, so its natural distribution is somewhat uncertain.

Ecology.— In semi-deciduous littoral forest, dry deciduous scrub forest, deciduous secondary growth thicket in agricultural area, degraded deciduous seasonal hardwood and bamboo forest, in sand, over shale or limestone bedrock; sea level to 500 m alt. Flowering February–May, fruiting the whole year through.

Vernacular.— Hom khaek (หอมแขก)(Bangkok); mo noi (หมอน้อย)(Kanchanaburi); prong fa (ไปรงฟ้า)(Sa Kaeo); samat yai (สามัคใจใหญ่)(Nakhon Ratchasima); curry leaf tree (English).

Uses.— The fresh leaves are used in many dishes in the Indian subcontinent as ingredient of curries (‘curry leaf’). The fruits are edible but of no culinary use. Gardner *et al.* (2018: 2270) list numerous additional uses, many of them from India.

Notes.— *Bergera koenigii* is remarkably variable in fruit size. In the Flora of China (Zhang

& Hartley in Zhang *et al.*, 2008: 87, under *Murraya*), the fruit size is given as ‘1–1.5 cm’. For Thailand, Craib (1926a, 1926b) described the similar *Murraya siamensis*. He distinguished it from *M. koenigii* only by its ‘more or less rounded, larger (up to 15 mm diameter) fruits’, but he compared it only with *Kerr 3176*, a collection of *M. koenigii* with immature fruits that are smaller and oblongoid just because they are immature. The situation was complicated by Tanaka (1929), who accepted both species and tried to find additional distinguishing characters (under *Chalcas*). In the key to species, Tanaka (1929: 40) separated *M. siamensis* with ‘berry somewhat 4-grooved, apex depressed, about 1 cm in diameter’ from *M. koenigii* with ‘berry globose, somewhat apiculate, not more than 7 mm in diameter’. In the detailed description, Tanaka (1929: 34–35) noted some minor differences in the shape of floral organs, and also a more pronounced pubescence of the whole plant of *M. siamensis*. The latter character was probably based on *Kerr 2961*, a specimen with immature and densely pubescent leaves, whereas all collections studied here have an identical indumentum on the mature leaves, with pubescent petiole and midveins, but are subglabrous otherwise, i.e., they are glabrescent. Swingle (1943) re-studied the same specimens Tanaka had seen, but could not verify Tanaka’s findings and found the fruits of *M. siamensis* 15–17 mm in diameter and slightly depressed but not grooved. He then listed *M. siamensis* as a separate but doubtful species. In the present study the observed variation of fruit sizes was 8–15 by 9–15(–20) mm in Thai plants, but without any clear discontinuity. Therefore *M. siamensis* is now considered as a synonym of *M. koenigii*. This synonymy had been suspected previously by B. Hansen (in sched. 1967), but apparently remained unpublished.

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