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A taxonomic revision of *Musa aurantiaca* (Musaceae) in Southeast Asia

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Abstract Since the initial description, the name *Musa aurantiaca* Baker (1893) has been unclear to most botanists. The aim of this study is to settle its true identity and to update the description. The plant is distributed in the regions of Upper Assam and Arunachal Pradesh, India, Northern Myanmar and Tibet, China where it occurs commonly but it is not mentioned in Chinese literature at all. In this paper, the authors also review the description and the literature history of *M. aurantiaca* from 1893 to the present. *Musa aurantiaca* Baker is typified here.

Key words *Musa*, *Musa aurantiaca*, Musaceae, Southeast Asia, wild banana.

Musa aurantiaca was described by John Gilbert Baker based on a specimen collected by a German botanist Gustav Mann in 1889 at Assam (Baker, 1893). The description was based on a Wendland's herbarium (Herrenhausen Botanic Garden, Hanover, Germany) sample, today at Kew, which is typified here as a lectotype. Although Baker gives Mann as the author, the description was done by Baker alone. He placed the new species in the section *Rhodochlamys*.

Musa aurantiaca Baker in Ann. Bot. 7: 222. 1893. Type: India. Assam: Mahuni Forest; Lakhinpur, IX. 1890, *Gustav Mann* (lectotype designated here, K 000308203!) (Fig. 1).

The diagnosis was: "*M. aurantiaca,* Mann, Herb. Habit of *M. sanguinea*, but forming larger clumps of rather shorter stems. Panicle moderately dense, finally 8–9 in. (20–23 cm) long; rachis glabrous; bracts bright orange-yellow, glabrous; lowest sterile, lanceolate, a foot long; upper oblong-lanceolate, persistent, 3–4 in. (7.5–10 cm) long; female flowers in 5 clusters of 4–5 each. Calyx yellow, above an inch long, 5-toothed at the tip; petal linear, obtuse, as long as the calyx. Fruit green, glabrous. Forests of Upper Assam, Mann! Differs mainly from *M. sanguinea* by its orange-coloured bracts".

A living *M. aurantiaca* was introduced during the following year to Kew Garden London, United Kingdom through Herrenhausen, by German botanist Hermann Wendland who had been trained earlier at Kew. The species was introduced to Herrenhausen Botanic Garden Hanover, Germany from Assam, India by Gustav Mann (Baker, 1894). He was also trained at Kew and later worked at the Indian Forest Service, India. He collected several *Musa* L. specimens and sent them to Herrenhausen and Kew. *Musa aurantiaca* was also introduced to horticulture in the United Kingdom in 1894 but it fell into oblivion at the beginning of the 20th century.

The first diagnosis was somewhat imperfect according to Baker (1894) himself, and he supplemented it based on the living specimen at Kew from Herrenhausen as: "*MUSA AURANTIACA*, G. Mann; Baker, in *Ann. Bot.* vii, 222.* This fine new *Musa* was described somewhat imperfectly from the dried specimens and notes furnished by its discoverer, Mr. Gustav Mann, in my monograph of the Museae published last year in the *Annals of Botany.* Now I have been furnished by Herr Wendland with a complete living plant that has been flowered in the garden under his charge at Herrenhausen, in Hanover. It will be a valuable acquisition, to horticulture, not for the sake of its fruit, but on account of its brilliant orange bracts and flowers. It belongs to the third section of the genus, *Rhodochlamys*, which is distinguished by having few flowers in a cluster, non-edible fruits, and bright-coloured bracts. It is closely allied to *M. coccinea* and *M. sanguinea*, but the bracts and flowers are bright yellow instead of red. It is a native of the forests of Upper Assam. Caudex elongated, cylindrical, above one inch in diameter. Leaves oblong, bright green, thin and easily splitting and curling up, 2.5 to 3 feet (80–96 cm) long , under 1 foot broad, broadly rounded at the base; petiole above 1 foot long, deeply channelled. Peduncle short, stout, glabrous. Spike dense, under 1 foot long in the flowering stage; flowers usually three in a cluster, sessile; clusters of fruits three to four; bracts bright orange, the lowest lanceolate, 1 foot long, the uppermost ovate, 2 to 3 inches (5–7.5 cm) long; several

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of the upper not expanding. Calyx 1.25 to 1.5 inches (3–3.8 cm) long, bright yellow, spathaceous, 5-toothed at the tip. Petals lingulate, obtuse, as long as the calyx. Stamens rather longer than the calyx. Immature fruits oblong-trigonous, green, glabrous. J. G. Baker".

"**Musa aurantiaca*, G. Mann.—Caudice elongate cylindrico; foliis longe petiolatis oblongis viridibus basi rotundatis; pedunculo brevi crasso glabro; floribus sessilibus saepissime 3-nis. in spicam densam aggregatis; bracteis splendide aurantiacis infimis lanceolatis, superioribus brevibus ovatis; calyce aurantiaco apice 5-dentato; petala lingulata calyce aequilonga, fructu angulato glabro".

After Baker's descriptions, *M. aurantiaca* was mentioned in the literature mainly by quoting parts of Baker's first description in 1893 or by name only (Anonymous, 1894; Schumann, 1900; de Wildeman, 1912; Fawcett, 1913; Cheesman, 1947; Simmonds, 1960, 1962; Champion, 1967).

The Kew Curator William Watson (1894) wrote in Garden and Forest, New York: "*MUSA AURANTIACA*—This is a handsome-flowered dwarf *Musa*, which was discovered in Assam by Mr. Gustav Mann, who sent it to Mr. Wendland, of the Herrenhausen Botanic Garden, some years ago, where it flowered lately, and the inflorescence has been forwarded to Kew. It is like the old *M. coccinea* in habit and stature, the stems being only two or three feet long, the leaves three feet long, and the terminal, erect, stout scape nearly a foot long. The charm of the plant is in the rich orange color of the large bracts which clothe the upper part of the scape and partly enclose the yellow flowers, which occur usually in threes. There are examples of this species in the Palm-house at Kew, where it forms crowded clusters of stems in pots about fifteen inches (38 cm) in diameter. It is a worthy companion to *M. coccinea* and *M. mannii*, and these three Musas deserve to be in every good collection of stove-plants".

Some descriptions of *M. aurantiaca* and the *Musa* section *Rhodochlamys* have been given based on literature, herbaria samples and field studies from Upper Assam, India, the state bordering Tibet, China (Sagot, 1887; Baker, 1893; Cheesman, 1947; Häkkinen & Sharrock, 2002; Häkkinen, 2005; Uma et al, 2006; Häkkinen, 2007). However, several studies of Musaceae in China have been carried out but none mentions *M. aurantiaca* even though it is rather common in southern Tibet bordering India where it is native to (e.g. Li, 1981; Wu & Kress, 2000; Liu et al., 2002).

Here is an updated description of *M. aurantiaca*, including observations of cultivated living plants in the Xishuangbanna Tropical Botanical Garden, introduced from Mêdog County, Xizang (Tibet), China, by completing the entire INIBAP *Musa* Descriptor List (IPGRI-INIBAP/CIRAD, 1996). The descriptive terms here also follow the tradition of banana taxonomy as used by Simmonds (1962, 1966). Relevant parts of the specimen were deposited at the Xishuangbanna Tropical Botanical Garden herbarium (HITBC) with running herbarium numbers: *111530* (Fig. 2), *111629*, *111630* and *111631*.

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The re-description is based on XTBG's living specimen 00, 2003, 1766 introduced from Mêdog County, Xizang (Tibet), China. (Figs. 3, 4) Plant slender, suckering freely, close to parent plant, up to 12 suckers (in natural habitat 25–30 suckers), position vertical. Mature pseudostem up to 1.1 m high and 5 cm in diameter at base, in appearance varying with amounts of dead brown sheaths, underlying colour light green with large brown blotches, shiny, sap watery. Petiole up to 25 cm long, petiole canal margins straight with erect margins, petiole bases winged and not clasping the pseudostem with sparse brown blotches. Leaf habit intermediate, lamina up to 80 cm long and 27 cm wide, narrowly elliptic, truncate at the apex, colour of upper surface green and lower surface medium green, appearance dull, little wax on surface, leaf bases asymmetric, both sides rounded, midrib dorsally medium green and ventrally light green, with corrugated lamina. Inflorescence erect, peduncle up to 15 cm long and 2.5 cm in diameter, hairless and light green to red in colour, sterile bract one, bracts persistent at the opening of the first female flowers. Basal flowers female in 5 clusters of 4–5 each, ovary light green, arrangements of ovules in two rows per loculus. Male bud, ovate, 11 cm long and 4 cm wide, bracts orange red in external side, orange yellow internal side, with few waxes outside, no imbrications, lifting 1–2 bracts at a time, revolute before falling. Male flowers on average 5 per bract in 1 row, falling with the bract, compound tepal 4 cm long, orange in colour with two thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, the central lobes smaller than the outer lobes, free tepal 4.3 cm long, orange tinted with yellow, rectangular, simple folding under apex, with accordion like obtuse apex, stamens 5, filaments rusty brown, anthers cream, anthers and style at the same level, stigma orange, ovary straight, orange, without pigmentation. Fruit bunch lax, with 5 hands and 4–5

fruits per hand on average, in 1 row, fingers curved towards to the stalk, individual fruit 4.5 cm long, straight, angular, pedicel 6 mm long and hairless, fruit apex rounded and with floral relicts, immature fruit peel colour light green, becoming yellow at maturity, immature fruit pulp white, becoming cream and soft at maturity. Seeds rounded, about 2 mm in diameter, 50–55 seeds per fruit. Chromosome numbers are $2n$=22 (Cheesman, 1947).

Figs. 1–4. 1. Lectotype specimen of *Musa aurantiaca* (K000308203). Courtesy of Martin Xanthos, Kew. **2.** Specimen of *Musa aurantiaca* (HITBC 111530). Courtesy of XTBG. **3.** Living specimen of *Musa aurantiaca* at XTBG. Photo: M. Häkkinen. **4.** Living specimen of *Musa aurantiaca* at XTBG. Courtesy of XTBG.

Key to some closely related species of *Musa* sect. *Rhodochlamys*

1a. Basal flowers female, 4–5 per bract, peduncle light green to red, male bracts orange in external side, orange yellow internal, fruits 4.5 cm long, straight, angular, becoming yellow at maturity…..…….……..……..……..…… **Musa aurantiaca**

1b. Basal flowers hermaphrodite, 3 per bract, peduncle bright red, male bracts blood-red in external and internal side, fruits 4.5 cm long, straight, angular, becoming pale yellow-green and variegated with red at maturity…..……..……..……..…… 2

2a. Up to 12 pseudostems in the same plant, inflorescence erect, free tepal as long as compound tepal…..……**M. sanguinea**

2b. Up to 3 pseudostems in the same plant, inflorescence first erect then horizontal, free tepal 3/4 long as compound tepal…….…... 3

3a. Plant small, slender, 70 cm high, with 2–3 suckers, leaves 60 cm long and 15 cm wide, dark green, underneath midrib red, bracts rose……..... **M. mannii**

3b. Plant 180 cm high, with up to 12 clumping suckers, leaves 200 cm long and 35 cm wide, inflorescence erect, bracts pink…… ……..…..…..…**M. ornata**

Additional specimens examined:

India. Assam: 13. I. 1894. From H. Wendland, Assam 23.VIII. 1909. I. H. Burkill 32654. Ex HERB. R.E.P. (CAL); District of Lakhinpur by the Sidi stream, alt. 1600 ft. 1. II. 1912. I. H. Burkill 365-82. ex HERB. R. E. P. (K); District of Changlang: between Deban (27° 29′ N, 96° 23′ E) and Haldi Barie (27° 31′ N, 96° 24′ E), 16. I. 1994. NRFP 27 (E).

Distribution and habitat *Musa aurantiaca* has a wide distribution in an area bounded in the Northwest by Tibet's southern slope of the Himalayas, by Northern Arunachal Pradesh in the Northeast, extending as far South as Northern Assam, and East to Putao in Northern Myanmar, where it was reported recently in 2006. It grows mostly in higher altitudes at elevations between 300 and 1200 m in moist ravines of evergreen forests and along riversides.

This highly ornamental, forgotten *Musa* species is totally unknown in Western horticulture markets and it should be re-introduced there, especially since its low cold sensitivity makes it suitable for horticulture as an ornamental plant in temperate regions.

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