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# *Musa itinerans* (Musaceae) and Its Intraspecific Taxa in China

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**ABSTRACT.** *Musa itinerans* Cheesman (Musaceae) is dispersed across continental Southeast Asia from Northeast India to Vietnam and the adjacent islands, with only two previously described varieties. Its intraspecific taxa have not been comprehensively investigated. In this study, *M. itinerans* is morphologically circumscribed based on field studies in southern China. Four varieties are described as new: *M. itinerans* var. *chinensis* Häkkinen, *M. itinerans* var. *guangdongensis* Häkkinen, *M. itinerans* var. *lechangensis* Häkkinen, and *M. itinerans* var. *xishuangbannaensis* Häkkinen. We propose a new rank for *M. itinerans* subsp. *annamica* R. V. Valmayor, L. D. Danh & Häkkinen as *M. itinerans* var. *annamica* (R. V. Valmayor, L. D. Danh & Häkkinen) Häkkinen. A table for the distinguishing characteristics is provided for these varieties and for *M. itinerans* var. *itinerans* Cheesman. All of these studies are based on morphological characteristics observed in the field in China during 2005 and 2006, in various herbaria, and in the literature on Musaceae.

**Key words:** China, Guangdong, Guangxi, IUCN Red List, *Musa*, Musaceae, wild banana, Yunnan.

*Musa itinerans* Cheesman (Musaceae) is found commonly growing across continental Southeast Asia. This taxon has not had any commercial value, and for that reason it has not been dispersed by humans throughout Southeast Asia, as has been the case for its relatives *M. acuminata* Colla and *M. balbisiana* Colla (Colla, 1820). Several studies of the Musaceae in China and neighboring countries have been carried out (Fawcett, 1913; Simmonds, 1960; Li, 1978, 1981; Wu, 1979; Anderson, 1993; Li, 1996; Wu, 1997; Wu

& Kress, 2000; Liu & Li, 2001; Liu et al., 2002), but none distinguish the intraspecific variation of *M. itinerans* despite its wide variation in continental Asia. *Musa itinerans* was initially named and described by E. E. Cheesman (1949) based on plants grown in Trinidad from seeds from upper Myanmar (Burma). N. W. Simmonds further issued some critical notes on the species from India and Thailand, based on his banana collecting expedition to Southeast Asia in 1954–1955, but Simmonds never visited Myanmar and his observations were based on species from India and Thailand (Simmonds, 1956a, b). Valmayor et al. (2005) described *M. itinerans* subsp. *annamica* R. V. Valmayor, L. D. Danh & Häkkinen from North Vietnam, but it has later proved to be only a variety of *M. itinerans*, based on further studies in China. Another taxonomic misidentification involved *M. wilsonii* Tutcher (1902), which was later described as *Ensete wilsonii* (Tutcher) Cheesman (Roxburgh, 1814; Cheesman, 1947). Its taxonomic identification was correctly done by Liu and Li (2001), in which they recognized it to be *M. itinerans* Cheesman. In this study it is further distinguished as *M. itinerans* var. *xishuangbannaensis* Häkkinen. Several other *M. itinerans* varieties can be observed in Hainan, Taiwan, Vietnam, Thailand, Laos, Myanmar, and India, but these taxa are subjects for further study (Häkkinen, pers. obs.).

## HABITAT

Most of the wild banana regions in China are located in very mountainous areas or in nature reserves, which cannot be used for agriculture. In those areas the climate varies substantially. At lower

elevations the climate is tropical to subtropical, which allows wild bananas to flower in moist ravines throughout the year. At higher elevations (up to 1800 m), especially in the north, the climate restricts the flowering period to July to September. Frost damages the growth during the winter months of December and January. The fruits ripen within three months, allowing the plant just enough time to produce seeds before the next winter season (Häkkinen, pers. obs.).

#### MATERIAL AND METHODS

This paper is based on extensive field observations made by the authors during expeditions in 2005 and 2006 to Guangdong, Guangxi, and Yunnan provinces in China. Four new varieties are described from living plants in the field by completing the entire International Network for the Improvement of Banana and Plantain (INIBAP) *Musa* descriptor list (IPGRI-INIBAP/CIRAD, 1996). The descriptive terms here also follow traditional banana taxonomy as used by Simmonds (Simmonds, 1962, 1966). Relevant portions of the specimens were deposited as holotypes at the herbaria of the Xishuangbanna Tropical Botanical Garden (HTBC) and the South China Botanical Garden (IBSC), with isotypes at H, HITBC, IBSC, MO, PE, and QBG. The first author has studied Simmonds' expedition materials from northern Thailand and northeastern India, which are now at Kew. These materials consist of samples stored in spirit as well as numerous black-and-white photos, which support the identification of *Musa itinerans* var. *itinerans* (Simmonds, 1956a, b).

**1. *Musa itinerans*** Cheesman, Kew Bull. 4(1): 23. 1949. TYPE: Burma [Myanmar]. Myitkyina District: Tagwin Chaung, evergreen forests, 400 ft., 24 Nov. 1928, *C. E. Parkinson 1761* (lectotype, designated by Liu et al., 2002, K).

*Musa itinerans* was lectotypified by Liu et al. (2002) based on a sheet at K, *C. E. Parkinson 1761*. There is also a sheet at K (H. 1171/1949) taken from the type locality (Trinidad), but it is not known if it represents original material that Cheesman used.

**1a. *Musa itinerans* var. *itinerans*** Cheesman. Figure 1A.

Variety *itinerans* is native to evergreen forest at Tagwin, Myitkyina District, in upper Myanmar and the bordering area to China in western Yunnan, where it commonly occurs. It was named from its habit of traveling from the spot where it is planted by means of its long rhizomes. In lower elevations, it flowers throughout the year in moist ravines. In higher

elevations to 1800 m, its flowering period is restricted from July to September due to the effect of freezing on growth during the winter. This variety differs from the other described new varieties, but variety *xishuangbannaensis* shares its creeping long rhizome, which in variety *itinerans* can extend up to 2 m from the mother plant (Häkkinen, pers. obs.). Its chromosome number of  $2n = 22$  was determined by N. W. Simmonds (1962). *Musa itinerans* varieties are easy to distinguish from the recently described *M. yunnanensis* Häkkinen & H. Wang and *M. acuminata* var. *chinensis* Häkkinen & H. Wang, as the latter have two rows of ovules per locule, whereas *M. itinerans* has four (Häkkinen & Wang, 2007).

*Additional specimens examined.* CHINA. Yunnan: Dehong Co., Yingjiang, Xima, on riverbank, Munai River, *Wang Hong 8384* (HTBC). THAILAND. *A. F. C. Kerr 3506* (K [4 sheets]).

**1b. *Musa itinerans* var. *annamica*** (R. V. Valmayor, L. D. Danh & Häkkinen) Häkkinen, stat. nov. *Musa itinerans* subsp. *annamica* R. V. Valmayor, L. D. Danh & Häkkinen, Philipp. Agric. Sci. 88: 241. 2005. TYPE: Vietnam. Yen Bai: Van Chan Distr., 30 Nov. 1994, *Le Dinh Danh 004* (holotype, Phu Ho Fruit Research Center Herbarium 005). Figure 1B.

*Musa itinerans* var. *annamica* was described earlier as a subspecies of *M. itinerans* from North Vietnam based on its unique method of bract opening—the bracts are revolute, but instead of rolling back, the bracts twist and curl sideways, thus exposing its whitish internal surface (Valmayor et al., 2005). However, further field studies in China support it as just a variety within the *M. itinerans* group. We propose a new varietal rank for the name. We could locate *M. itinerans* var. *annamica* only in Guangdong Province, Conghua, Daling Mountain, where we found some 10 individual plants (Häkkinen, pers. obs., 2006).

**1c. *Musa itinerans* var. *chinensis*** Häkkinen, var. nov. TYPE: China. Guangdong: Conghua, Daling Mtn., 500 m, 2 Apr. 2006, *M. Häkkinen 514* (holotype, IBSC; isotypes, H, HITBC, MO). Figure 2.

Planta usque 4 m alta, usque 12 surculos erectos prope stipitem viridem clarum, maculis latis rubro-brunneis praeditum efficiente; succo aquoso lacteo; habitu foliorum intermedio; floribus basalibus foemineis; gemmis masculinis ovatis, simul bracteas duas, revolutas, paulo cericeas, extus pallido-rubropurpureas marginibus flavis praeditas tollentibus; pericarpio maturo flavo.

Plant normal, suckering close to parent plant 10–30 cm, to 12 suckers, position vertical; mature

Table 1. Morphological comparison of *Musa itinerans* Cheesman and its six varieties.

	Var. <i>itinerans</i>	Var. <i>annamica</i>	Var. <i>chinensis</i>	Var. <i>guangdongensis</i>	Var. <i>lechangensis</i>	Var. <i>xishuangbannaensis</i>
Plant height	to 5 m	to 3 m	to 4 m	to 4.5 m	to 4 m	to 12 m
Rhizome length	2 m from parent plant	0.2–0.5 m from parent plant	0.1–0.3 m from parent plant	0.1–0.3 m from parent plant	0.1–0.3 m from parent plant	5 m from parent plant
No. of suckers	to 4 (rhizomatous)	to 7 (rhizomatous)	to 12 (clumping habit)	to 8 (clumping habit)	to 4 (clumping habit)	to 7 (rhizomatous)
Leaf habit	normal (intermediate)	normal (intermediate)	normal (intermediate)	normal (intermediate)	drooping	erect
Underlying color of the pseudostem	green	green	light green	green	light green	cream to yellow
Pigmentation of the underlying pseudostem	reddish brown	no pigmentation	large red-brown blotches	large black blotches	small purple blotches	large red-purple blotches
Sap color	watery milky	milky	watery milky	milky	watery milky	watery red
Petiole margins	erect margins	open with margins spreading	margins curved inward	erect margins	open with margins spreading	open with margins spreading
Leaf size	300 × 60 cm	170 × 70 cm	250 × 50 cm	290 × 55 cm	260 × 54 cm	500 × 105 cm
Color of leaf upper surface	dark green	green-yellow	green	medium green	dark green	dark green
Peduncle color	green to black	dark green	green to rusty brown	dark green	dark green	medium green
Peduncle hairiness	puberulent with short hairs	glabrous	puberulent with short hairs	very puberulent with short hairs	glabrous	very puberulent with long hairs
Female bud shape	ovate-lanceolate, 30 × 6 cm	lanceolate, 28 × 8 cm	lanceolate, 31 × 9 cm	lanceolate, 22 × 8 cm	obtuse, 26 × 10 cm	lanceolate, 80 × 20 cm
Female bract lifting	lifting several bracts at a time	lifting one at a time, twist and curl to side	lifting several bracts at a time	lifting several bracts at a time	lifting several bracts at a time	lifting one bract at a time
Color of the bract external face	dark purple with yellow margin	purple-red	red-purple with paler pinkish lines	red-purple with paler pinkish lines	red-purple	red-purple with paler pinkish lines
Basal flowers	female, 14 in 2 rows	female, 15 in 2 rows	female, 17 in 2 rows	female, 15 in 2 rows	female, 15 in 2 rows	hermaphrodite, 17 in 2 rows
Male bud shape	ovoid, 16 × 9 cm	lanceolate, 16 × 5 cm	ovoid, 15 × 9 cm	ovoid, 18 × 8 cm	rounded, 12 × 10 cm	intermediate, 20 × 12 cm
Color of the bract external face	dark purple with yellow margin	purple-red, no yellow margin	pale red-purple with a yellow margin	dark red-purple with a yellow margin	dark red-purple	red-purple
Male bract lifting	lifting 1 bract at a time, revolute	lifting 1 at a time, twist and curl to side	lifting 2 bracts at a time, revolute	lifting 1 bract at a time, revolute	lifting several bracts at a time, not revolute	lifting 1 bract at a time, revolute
Flowers per bract	12 in 2 rows	8 in 1 row	21 in 2 rows	15 in 2 rows	15 in 2 rows	10 in 1 row

Table 1. Continued.

	<i>Var. itinerans</i>	<i>Var. annamica</i>	<i>Var. chinensis</i>	<i>Var. guangdongensis</i>	<i>Var. lechangensis</i>	<i>Var. xishuangbannaensis</i>
No. of fruits	4 hands, 13 fruits per hand on average	6 hands, 15 fruits per hand on average	7 hands, 17 fruits per hand in 2 rows	5 hands, 15 fruits per hand in 2 rows	3 hands, 15 fruits per hand in 2 rows	9 hands, 17 fruits per hand in 2 rows
Fruit shape	10 cm, slightly curved and pronounced ridged	10 cm, curved and slightly ridged	10 cm long, slightly curved and ridged	8 cm long, slightly curved and rounded	8 cm long, straight and pronounced ridged	13 cm long, slightly curved and ridged
Pedicel	3.5 cm, glabrous	3.5 cm, glabrous	2.5 cm, glabrous	4 cm, glabrous	2.5 cm, glabrous	4 cm, puberulent
Immature fruit peel color	pale green	silvery	pale green	green to purple	light green	light green
Fruit peel color at maturity	pale yellow	rusty brown	yellow	green to purple	pale yellow	rusty brown

pseudostem to 4 m high, to 15 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color light green with large red-brown blotches, shiny, sap watery milky. Petiole to 50 cm, petiole canal margins curved inward, petiole bases winged and clasping pseudostem without corrugated auricles, with sparse black-purple blotches; leaf habit intermediate, lamina to 250 × 50 cm, narrowly elliptic, truncate at apex, green abaxially and adaxially, appearance shiny, surface sparsely covered with wax coating, leaf bases asymmetric, both sides rounded and auriculate, midrib dorsally green and ventrally light green, with corrugated lamina. Inflorescence semi-pendulous and then falling vertically downward, peduncle to 30 cm, to 5 cm diam., puberulent with short hairs, green to rusty brown; sterile bracts 2, bracts persistent at the opening of first female flowers. Female bud lanceolate, to 31 × 9 cm, bracts red-purple with paler pinkish lines externally, bright yellow internally, without wax, not imbricate, lifting several bracts at a time, these revolute before falling; basal flowers female, ca. 11 cm, ovary light green, arrangement of ovules in 4 rows per locule, compound tepal ca. 4.8 cm, with 2 prominent thickened keels and hyaline margins, yellow to orange, free tepal ca. 3 cm, rounded, translucent white with thickened keel; stamens 5, without fertile pollen, ca. 4 cm, yellow; stigma ca. 0.8 cm diam., white. Male bud ovoid, ca. 15 × 9 cm, bracts pale red-purple externally with a yellow margin, bright yellow internally, with sparse wax outside, not imbricate, lifting 2 bracts at a time, these both revolute before falling; male flowers on average 21 per bract in 2 rows, falling with the bract, compound tepal ca. 4.8 cm, cream, with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 3 cm, translucent white, rounded, smooth, with thread-like orange apex; stamens 5, filaments white, anthers orange, anthers and style at the same level; stigma cream; ovary straight, pale green, without pigmentation. Fruit bunch lax, with 7 hands and 17 fruits per hand on average, in 2 rows, fingers curved toward the stalk, individual fruit ca. 10 cm, slightly curved and ridged, pedicel ca. 2.5 cm, glabrous, fruit apex blunt-tipped, with no floral relicts, immature fruit peel pale green, becoming yellow at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 5 mm diam., 250 to 270 seeds per fruit.

*Distribution and habitat.* Variety *chinensis* occurs all over southern China in subtropical regions at elevations from 300 to 1800 m, along roadsides, in river valleys and ravines, and on steep slopes. It can

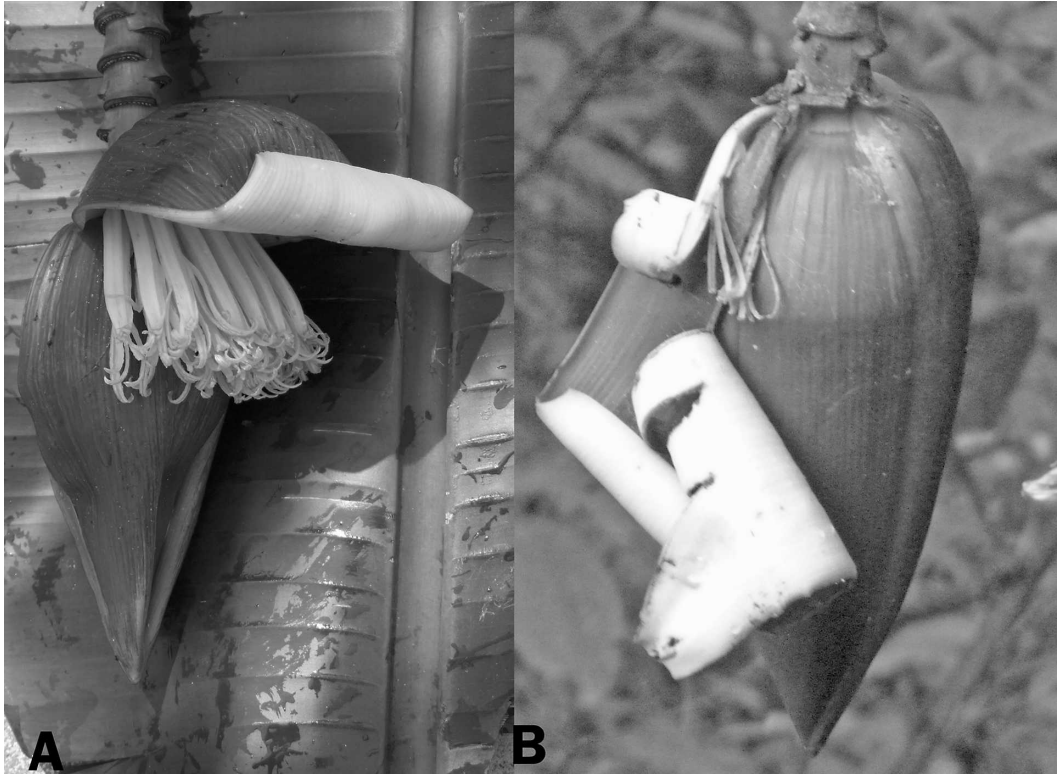


Figure 1. —A. *Musa itinerans* var. *itinerans* Cheesman, male bud. —B. *Musa itinerans* var. *annamica* (R. V. Valmayor, L. D. Danh & Häkkinen) Häkkinen, male bud. Photos by M. Häkkinen, taken in western Yunnan.

withstand seasonal frost and snow, which it faces each winter in the northern portions of its range. There frost kills the leaves, leaving the pseudostem alive from which new leaves rapidly emerge in spring, February to March. This delays any flowering to July to September in northern regions. We observed over 50 wild populations of variety *chinensis* during our field studies in Guangdong, Guangxi, and Yunnan provinces, with the individual populations varying from just a few plants up to 50. Variety *chinensis* is cultivated commonly at elevations up to 2200 m as fodder by farmers (Häkkinen, pers. obs.).

*Paratypes.* CHINA. Yunnan: Xishuangbanna, Jinghong Co., Nannuo Mtn., Gunian Zhai, *Wang Hong* 7993 (HITBC); Simao, Jiangcheng Co., Lixianjiang river, *Wang Hong* 8370, 8371, 8372 (HITBC); Xishuangbanna, behind Mangme hill, from Menglun to Jinghong, *Wang Hong* 8374, 8375, 8376 (HITBC); Jinghong Co., on hill behind Akelaozhai village, *Wang Hong* 8380 (HITBC).

**1d.** *Musa itinerans* var. **guangdongensis** Häkkinen, var. nov. TYPE: China. Guangdong: Conghua, Daling Mtn., 282 m, 2 Apr. 2006, *M. Häkkinen* 515 (holotype, IBSC; isotypes, H, HITBC, MO). Figure 3.

Planta usque 4.5 m alta, usque 8 surculos erectos prope stipitem viridem, latis nigris maculis praeditum efficiente; succo lacteo; habitu foliorum intermedio; floribus basalibus foemineis; gemmis masculinis ovatis simul bracteam unicum, revolutam, paulo cericeam, extus atro-rubropurpuream margine flavo praeditam tollentibus; pericarpio maturo ferrugineo-brunneo.

Plant normal, suckering close to parent plant 10–30 cm, to 8 suckers, position vertical; mature pseudostem to 4.5 m high, to 15 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color green with large black blotches, shiny, sap milky. Petiole to 50 cm, petiole canal wide with erect margins, petiole bases not winged and clasping the pseudostem with corrugated auricles and sparse black-purple blotches; leaf habit intermediate, lamina to 290 × 55 cm, narrowly elliptic, truncate at apex, medium green adaxially, light green abaxially, appearance shiny, surface sparsely covered with wax coating, leaf bases asymmetric, both sides rounded and auriculate, midrib dorsally and ventrally light green, with very corrugated lamina. Inflorescence semi-pendulous and then falling vertically downward, peduncle to 40 cm, to 5.5 cm diam., densely puberulent with short hairs,

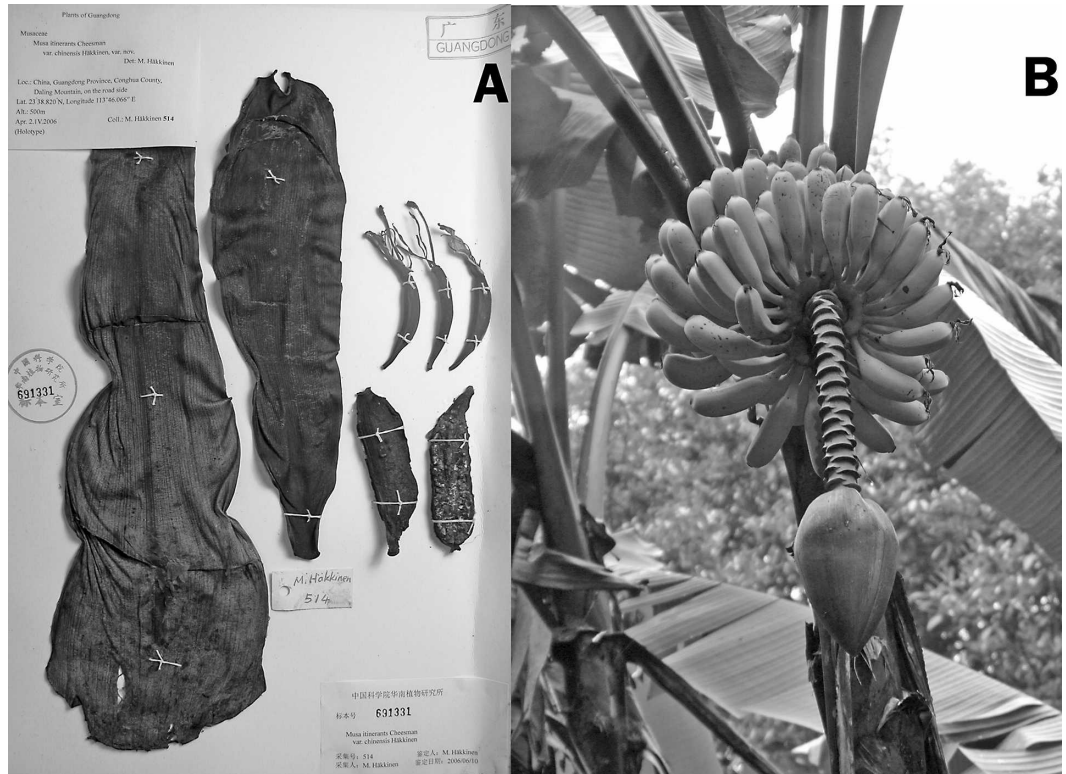


Figure 2. —A. *Musa itinerans* var. *chinensis* Häkkinen. Holotype *M. Häkkinen* 514, IBSC. —B. Inflorescence of variety *chinensis*. Photos by Xiangying Wen from IBSC (A), and M. Häkkinen from Guangdong (B).

dark green, sterile bracts 2, bracts deciduous at opening of first female flowers. Female bud lanceolate, to  $22 \times 8$  cm, bracts red-purple with paler pinkish lines externally, bright yellow internally, without wax, not imbricate, lifting several bracts at a time, these revolute before falling; basal flowers female, ca. 11 cm, ovary pale yellow, arrangement of ovules in 4 rows per locule, compound tepal ca. 4.8 cm, with 2 prominent thickened keels and hyaline margins, bright yellow, free tepal ca. 3 cm, rounded, translucent white with thickened keel; stamens 5, without fertile pollen, ca. 4 cm, yellow, stigma diam. ca. 0.8 cm, white. Male bud ovoid, ca.  $18 \times 8$  cm, bracts dark red-purple externally, bright yellow internally, with sparse wax outside, not imbricate, lifting one bract at a time, these revolute before falling, soon deciduous; male flowers on average 15 per bract in 2 rows, falling with the bract, compound tepal ca. 5.5 cm, yellow to orange with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 2 cm, translucent white, ovoid, smooth, with thread-like apex, stamens 5, filaments white, anthers yellow to orange, anthers and style exerted; stigma cream; ovary arched, light green. Fruit bunch

lax, with 5 hands and 15 fruits per hand on average, in 2 rows, fingers curved toward the stalk, individual fruit ca. 8 cm, slightly curved, rounded, pedicel ca. 4 cm, glabrous, fruit apex blunt-tipped, with no floral relicts, immature fruit peel green to purple, pedicel and apex medium green, remaining green to purple at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 5 mm diam., 200 to 220 seeds per fruit.

*Distribution and habitat.* Variety *guangdongensis* occurs in the northern part of Guangdong Province in temperate regions at elevations from 300 to 1600 m, along roadsides, ravines, and on steep slopes. It can withstand seasonal frost and snow, which it faces each winter from December to January in northern parts of its growing region. There frost kills the leaves, leaving the pseudostem alive from which new leaves rapidly emerge in the spring. This delays flowering to July to September. We observed some 40 wild populations of variety *guangdongensis* during our field studies in Guangdong Province, with the individual plants varying from just a few to up to 10. Variety *guangdongensis* is cultivated commonly as fodder by farmers (Häkkinen, pers. obs.).

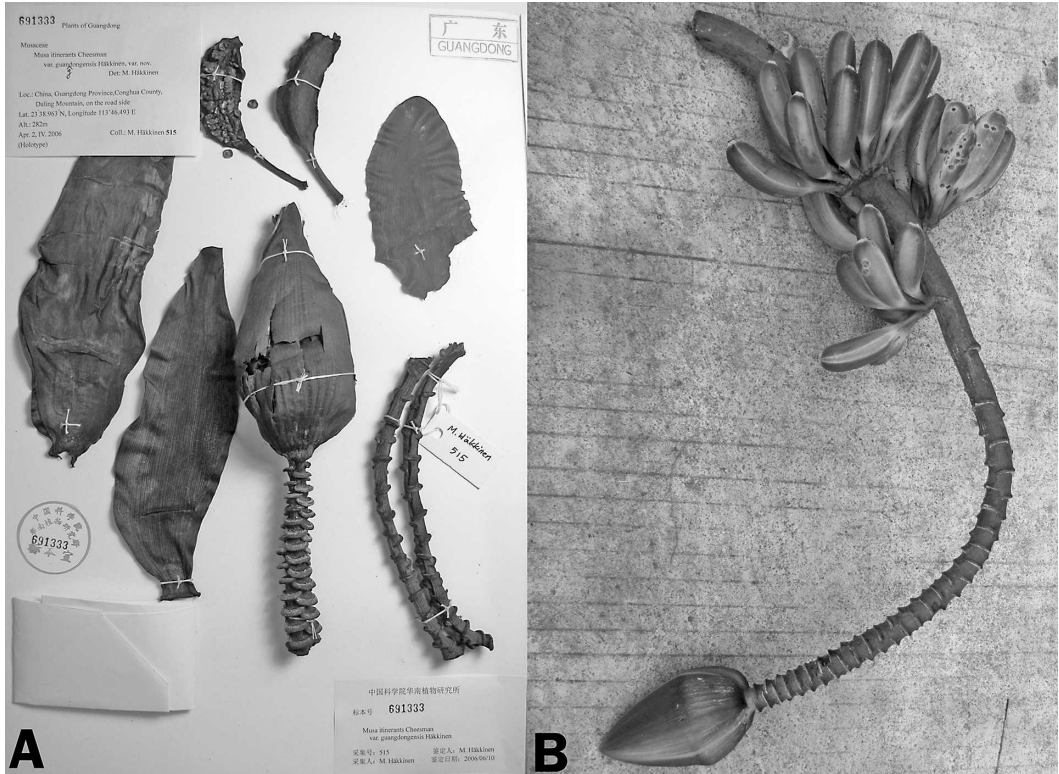


Figure 3. —A. *Musa itinerans* var. *guangdongensis* Häkkinen. Holotype *M. Häkkinen* 515, IBSC. —B. Inflorescence of variety *guangdongensis*. Photos by Xiangying Wen from IBSC (A), and M. Häkkinen from Guangdong (B).

*Paratypes*. CHINA. **Guangdong**: Lechang Co., Beixiang, *M. Häkkinen* 517, 518 (IBSC).

**1e. *Musa itinerans* var. *lechangensis* Häkkinen, var. nov.** TYPE: China. Guangdong: Lechang Co., Beixiang, 343 m, 1 May 2006, *M. Häkkinen* 516 (holotype, IBSC; isotypes, H, HITBC, MO). Figure 4.

Planta usque 4 m alta, usque 4 surculos erectos, proxime ad stipitem viridem clarum, parvis purpureis maculis praeditum efficiente; succo aquoso lacteo; habitu foliorum demisso; floribus basalibus foemineis; gemmis masculinis rotundatis simul bracteis plures, non revolutas, extus atropurpureas tollentibus; pericarpio maturo pallide flavo.

Plant normal, suckering close to parent plant 10–30 cm, to 4 suckers, position vertical; mature pseudostem to 4 m high, to 15 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color light green with purple blotches, shiny, sap watery milky. Petiole to 45 cm, petiole canal open with margins spreading, petiole bases not winged and not clasping the pseudostem with corrugated auricles and small black-purple blotches; leaf habit drooping, lamina to 260 × 54 cm, narrowly elliptic, truncate at apex, dark green adaxially, light green abaxially, appearance shiny,

surface sparsely covered with wax coating, leaf bases symmetric, both sides rounded and auriculate, midrib dorsally light green and ventrally yellow, with very corrugated lamina. Inflorescence semi-pendulous and then falling vertically downward, peduncle to 30 cm, to 4 cm diam., glabrous, dark green, sterile bracts 2, bracts deciduous at opening of first female flowers. Female bud obtuse, to 26 × 10 cm, bracts dark red-purple externally, bright yellow internally, with sparse wax outside, not imbricate, lifting several bracts at a time, these not revolute before falling; basal flowers female, ca. 12 cm, ovary pale green, arrangement of ovules in 4 rows per locule, compound tepal ca. 5.8 cm, with 2 prominent thickened keels and hyaline margins, cream, free tepal ca. 3.1 cm, ovoid, translucent white with thickened keel; stamens 6, without fertile pollen, ca. 2 cm, brown, stigma ca. 0.8 cm diam., cream. Male bud rounded, ca. 12 × 10 cm, bracts dark red-purple; male flowers on average 15 per bract in 2 rows, falling with the bract, compound tepal ca. 5.5 cm, cream with 2 thickened orange apex, central lobes smaller than outer lobes, free tepal ca. 2 cm, translucent white, ovoid, smooth, with thread-like apex; stamens 5, filaments white,

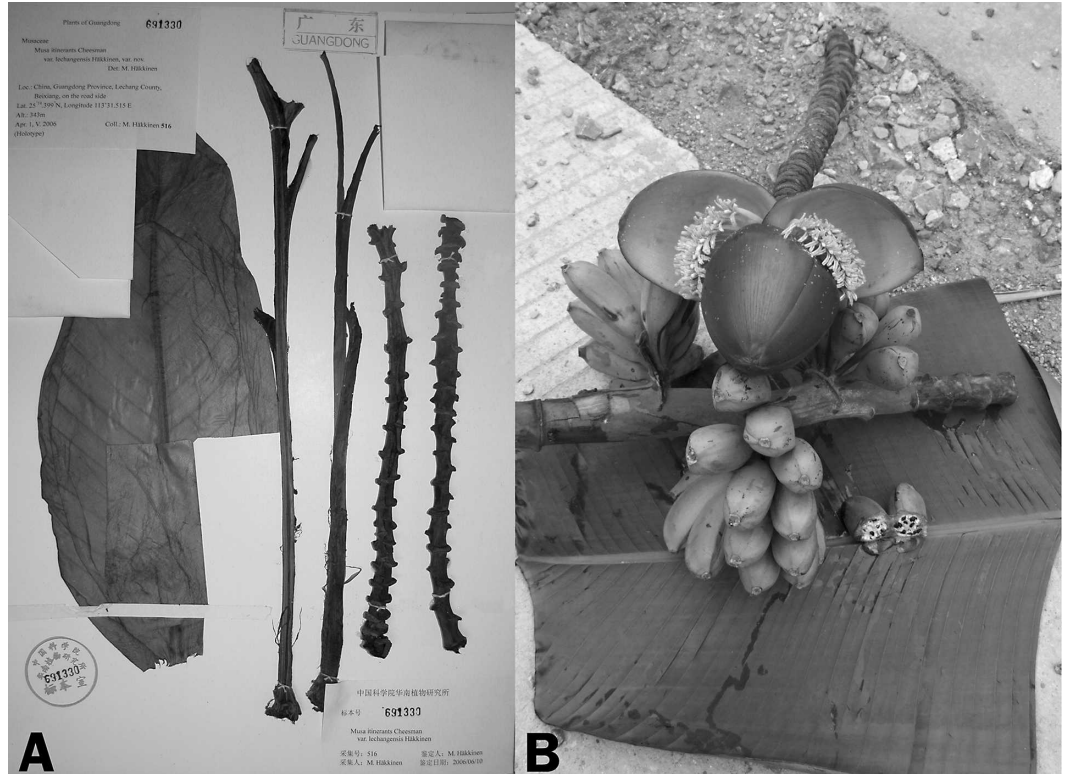


Figure 4. —A. *Musa itinerans* var. *lechangensis* Häkkinen. Holotype *M. Häkkinen* 516, IBSC. —B. Inflorescence and leaf part of variety *lechangensis*. Photos by Xiangying Wen from IBSC (A), and M. Häkkinen from Guangdong (B).

anthers brown, anthers exerted, style inserted; stigma cream; ovary arched, cream. Fruit bunch lax, with 3 hands and 15 fruits per hand on average, in 2 rows, fingers pointed outward from the stalk, individual fruit ca. 8 cm, straight, pronounced ridges, pedicel ca. 2.5 cm, glabrous, fruit apex almost rounded, with no floral relicts, immature fruit peel pale green, becoming pale yellow at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 5 mm diam., 200 to 220 seeds per fruit.

*Distribution and habitat.* We found variety *lechangensis* only in one ravine, in Beixiang in north Guangdong, with only a few individual plants without any frost damage in April. It is notable that all of the wild and cultivated plants of variety *guangdongensis* in adjacent areas had severe frost damage during the previous winter (2005–2006), despite being located in a subtropical region at a rather low elevation (300 to 500 m) (Häkkinen, pers. obs.).

**If. *Musa itinerans* var. *xishuangbannaensis* Häkkinen, var. nov.** TYPE: China. Yunnan: Xishuangbanna, Jinhong Co., 1154 m, 20 July 2005, *M. Häkkinen* 510 (holotype, HITBC [12 sheets]; isotypes, H, IBSC, MO, QBG). Figure 5.

Planta gigantea, usque 12 m alta, usque 7 surculos erectos, semotos e stipite cremeo vel flavo, latis rubropurpureis maculis praedito efficiente; succo aquoso rubro; habitu foliorum intermedio flabelliformi; floribus basalibus hermaphroditis; gemmis masculinis ovato-rotundatis, simul bracteam unicam, revolutam, paulo cericeam, extus rubropurpuream, intus flavam claram tollentibus; pericarpio maturo ferrugineo-brunneo.

Plant huge, robust, sparsely suckering in many instances, to 5 m from parent plant, to 7 suckers, position vertical; mature pseudostem to 12 m high, to 50 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color cream to yellow with large red-purple blotches, shiny, sap watery red. Petiole to 100 cm, petiole canal open with margins spreading, petiole bases not winged and clasping the pseudostem with corrugated auricles and sparse red-purple blotches; leaf habit erect, top-like, lamina to 500 × 105 cm, narrowly elliptic, truncate at apex, dark green adaxially, light green abaxially, appearance dull, surface sparsely covered with wax coating, leaf bases asymmetric, both sides rounded and auriculate, midrib dorsally medium green, ventrally orange to red-purple, with very corrugated lamina. Inflorescence first horizontal then pendulous, peduncle to 45 cm, to 7 cm diam., densely puberulent



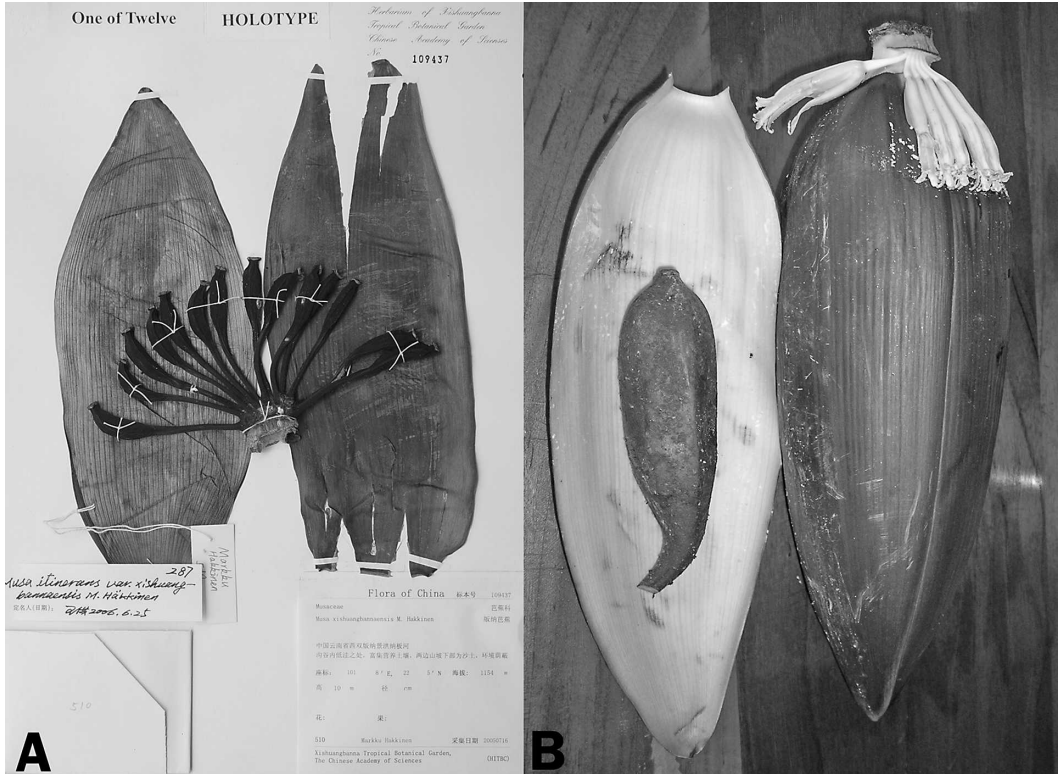


Figure 5. —A. *Musa itinerans* var. *xishuangbannaensis* Häkkinen. Holotype M. Häkkinen 510, HITBC. —B. Male bud and bract and ripe fruit of variety *xishuangbannaensis*. Photos by Wang Hong from HITBC (A), and M. Häkkinen from southern Yunnan. (B).

with long hairs, medium green, sterile bracts 2, bracts deciduous at opening of first female flowers. Female bud lanceolate, to  $80 \times 20$  cm, bracts red-purple with paler pinkish lines externally, bright yellow internally, without wax, not imbricate, lifting one bract at a time, these not revolute before falling; basal flowers hermaphrodite, ca. 12 cm, ovary light green, arrangement of ovules in 4 rows per locule, compound tepal ca. 6 cm, with 2 prominent thickened keels and hyaline margins, cream to yellow, free tepal ca. 2.3 cm, oval, translucent white with thickened keel and orange lobe; stamens 5, with fertile pollen, style ca. 4.6 cm, cream to light green, stigma ca. 1 cm diam., white. Male bud lanceolate, ca.  $20 \times 12$  cm, bracts red-purple externally, bright yellow internally, with sparse wax outside, not imbricate, lifting one bract at a time, these revolute before falling; male flowers on average 10 per bract in 1 row, falling with the bract, compound tepal ca. 5 cm, cream with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 2.6 cm, translucent white, rounded, smooth, with thread-like orange apex, stamens 5, filaments cream, anthers

yellow, anthers and style exerted; stigma orange; ovary arched, cream. Fruit bunch compact, with 9 hands and 17 fruits per hand on average, in 2 rows, fingers curved toward stalk, individual fruit ca. 13 cm, slightly curved, slightly ridged, pedicel ca. 40 mm, puberulous, fruit apex pointed, with no floral relicts, immature peel light green, becoming rusty brown at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 6 mm diam., 150 to 180 seeds per fruit.

*Distribution and habitat.* At 12 m, variety *xishuangbannaensis* is the second largest known wild banana in the world after *Musa ingens* Simmonds (1960) from Papua New Guinea, which reaches 15 m in height. In the southern regions of Yunnan, this plant is a common pioneer species in the succession process, after tropical rainforests have been destroyed. It also grows in isolated canopy gaps in upper mountainous valleys and slopes with moist fertile soils, to 1600 m in elevation. These plants grow vigorously and often develop in monomorphic communities. It has a huge corm, up to 1 m high and 0.5 m in diameter, that can store a significant amount of nutrition and water for the dry season. It can

tolerate the seasonal frost without damage, which occurs from December to January at higher elevations in Xishuangbanna. The flower buds are commonly sold in markets for human consumption, and the inner part of the pseudostem is used for refreshment. We observed some 10 populations, each consisting of 10 to 20 individuals.

*Paratypes.* CHINA. **Yunnan:** Xishuangbanna, Jinghong Co., *M. Häkkinen 511, 512, 513* (HITBC); Longpa village, *Wang Hong 8301* (HITBC); Mengla Co., E Xiaola hwy., 10 km from Mengyuan village, *Wang Hong 8337* (HITBC); Guangnali village, *Wang Hong 8365, 8366, 8367, 8368* (HITBC); Mengla Co., Menglun village, *He Li-qing 30, 32, 35, 37* (HITBC).

*IUCN Red List categories.* Six distinct varieties of *Musa itinerans* have been studied by the authors in China in 2005 and 2006. For their conservation assessment, IUCN Red List categories were applied (IUCN, 2001). Variety *itinerans* has 20 known wild populations in the border area west of Yunnan and continuing toward Myanmar (Häkkinen, pers. comm.) and can probably be considered Least Concern (LC). In contrast, only a few plants of variety *annamica* were seen in one ravine near Conghua, Guangdong, and another population of a few plants in Yen Bai, Vietnam. This taxon is of conservation concern and should be considered Vulnerable (VU), but further study is needed. Variety *chinensis* had 50 known wild populations spread over three provinces, and its status can be assessed as LC. Variety *guangdongensis* has 40 known wild populations across Guangdong and can be assessed as LC. Only a few plants of variety *lechangensis* were seen in one ravine in Beijiang, Guangdong. This variety must be considered of conservation concern, at a minimum assessment of VU. Finally, the striking variety *xishuangbannaensis* had 10 known wild populations across Xishuangbanna and can be assessed as LC.

*Conclusion.* Six distinct varieties of *Musa itinerans* have been studied by the authors. Four are described herein as new varieties, and one variety is established by a rank change from subspecies. It became quite evident during this study that *M. itinerans* is native to southern China, occurs across China's wild banana region, and has evolved into several different forms. However, varieties in countries neighboring China still remain poorly understood and should be subject to further study. Newly described varieties of *M. itinerans* may have breeding value in that these plants are cold tolerant and can stand temperatures several degrees below freezing. Severe freezing and snow cause the leaves to die off, but new leaves rapidly reappear when warmer weather arrives in February. The plants can still flower in early

autumn (July to September) and produce mature fruits before the next freeze comes in December. These varieties have also evolved drought tolerance, withstanding seasonal droughts between October and May due to the monsoonal climate in the Guangdong and Yunnan provinces. They appear disease resistant, as no common banana diseases have been observed in any of the wild populations. They are commonly cultivated throughout rural areas, principally as fodder at 2200 m elevation (Häkkinen, pers. obs.).

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