A New Variety of *Musa itinerans* (Musaceae) in Taiwan

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**Abstract.** *Musa itinerans* Cheeseman var. *formosana* (Warb.) Häkkinen & C. L. Yeh is one of the three wild bananas in Taiwan and represents the taxon previously recognized as *M. formosana* (Warb. ex Schum.) Hayata [= *M. basjoo* Siebold & Zucc. ex linum var. *formosana* (Warb. ex Schum.) S. S. Ying]. The gross morphology of *M. itinerans* var. *formosana* is stable. Some populations without variegation on the pericarps and the bracts of male buds were mainly found in a restricted area of northeast Taiwan. The morphological characteristics of the nonvariegated populations are otherwise similar to those of *M. itinerans* var. *formosana*. Their principal distinction is based on the absence of the purplish red streaking on both the pericarps and the male, fertile bracts. This character of nonvariegation is stable across the taxon's habitat and as cultivated through a 9-year period of observation. From molecular evidence, the DNA sequence for the ITS region of ribosomal DNA (rDNA) is highly similar in both populations. The nonvariegated population is herein segregated as the new variety, *M. itinerans* var. *kavalanensis* H. L. Chiu, C. T. Shih & T. Y. A. Yang. Photos for the three varietal taxa, *M. itinerans* var. *chinensis*, variety *formosana*, and variety *kavalanensis*, and a key to Taiwanese wild bananas are also provided.

Key words: IUCN Red List, Musa, Musaceae, native banana, Taiwan.

The Musaceae are distributed throughout tropical Asia, the Pacific Islands, Africa, and Australia. As currently circumscribed, the family includes three genera, *Musa* L., *Ensete* Horan., and *Mussella* (Franch.) C. Y. Wu (Cheeseman, 1947; Li, 1978). The largest and most economically important genus in this family is *Musa*, which contains roughly 60 to 70 species (Häkkinen & Väre, 2008), all native to Southeast Asia, ranging from India, Thailand, China, Taiwan, and south to New Guinea and Queensland in Australia. *Musa acuminata* Colla and its hybrids with *M. balbisiana* Colla account for edible bananas and plantains grown worldwide (Simmonds, 1962; Gawel et al., 1992).

Three native *Musa* species in Taiwan have been recognized in the literature, including *M. itinerans* Cheeseman var. *formosana* (Hayata) Häkkinen & C. L. Yeh (also known as *M. ×paradisiaca* var. *formosana* Warb. ex Schum.), *M. formosana* (Warb. ex Schum.), *M. insularimontana* Hayata, and *M. yamiensis* C. L. Yeh & J. H. Chen, respectively. The first taxon, *M. itinerans* var. *formosana*, has been studied by several taxonomists, e.g., Kao and Lai (1978), Ying (1985), Liaw (1992), Ying (2000), Chiu et al. (2004, 2007, 2010), Chiu (2005), Häkkinen and Väre (2008), and Häkkinen et al. (2010). This taxon was published in 1900 by Schuman, and in 1917 Hayata later transferred it from a variety to a distinct species, i.e., *M. formosana*; however, this rank was also accepted by Kao and Lai (1978), Wu and Kress (2000), Yang et al. (2001), Chiu et al. (2004, 2007, 2010), and Chiu (2005). Furthermore, Ying transferred this Taiwanese native species as a variety of a different species, i.e., *M. basjoo* var. *formosana* in 1985.

*Musa basjoo* has been commonly referred to as the Japanese fiber banana and is native to the Ryukyu Islands (Baker, 1891; Cheeseman, 1948; Wu & Kress, 2000; Turner et al., 2002). In fact, *M. basjoo* is also native to China and grows very commonly in the southern and southwestern parts of the country.
Based on the large, fleshy character of Musa plants and the ephemeral aspects of the flowers, their associated herbarium specimens represent poor material to examine (Argent, 2000). Fresh material as clones of the nonvariegated populations of *M. itinerans* were collected from northeastern Taiwan and conserved at TARI, Taichung, Taiwan. These characteristics were recorded according to the Revised List for Banana Descriptors (IBPGR, 1984; IPGRI-INIBAP/CIRAD, 1996). Our knowledge of the nonvariegated populations is based on the study of more than 50 living accessions in their native habitat and at the conserved repository at TARI.

**Taxonomic Treatment**


Figure 1.  A–B. *Musa itinerans* var. *chinensis* Hākkinen. —A. Male bud yellowish green with purple-red streaks and one fruit finger with pale-green pericarp and fertile male flowers. —B. Inflorescence with pale-green pericarps and yellowish green bracts with purple-red streaks. C–D. *M. itinerans* var. *formosana* Hākkinen & C. L. Yeh. —C. Inflorescence with yellowish green bracts variegated with purple-red streaks and pink-red pericarps if ovaries were fertilized or pale green pericarps if ovaries were not fertilized. —D. The basal nodes of the inflorescence, bearing female flowers with yellow-green bracts streaked with purple-red. E–H. *M. itinerans* var. *bavakanensis* H. L. Chiu, C. T. Shih & T. Y. A. Yang. —E. Plants in the field, from Niouxou, Yilan Co., the type locality. —F. Inflorescence in field. —G. Plants under cultivation at TARI. —H. Developing inflorescence at TARI. All photos were taken by H. L. Chiu.

Notes. *Musa itinerans* var. *formosana* is distributed across the entire island of Taiwan as well as its offshore islands in subtropical and tropical areas at altitudes from 200 to 1200 m, along roadsides, in river valleys and ravines, and on gentle or steep slopes. Large populations often occur in valleys or along rivers. It can withstand frost or snow when this occurs. Where frost kills the leaves, the pseudostem remains alive and new leaves emerge as temperatures rise. However, *M. itinerans* var. *chinensis* occurs only occasionally among the populations of variety
formosana, and its chromosome number of $2n = 22$ was determined by Chiu et al. (2010).

The pigmentation of *Musa itinerans* var. *formosana* on young leaves, pericarps, and bracts of male buds is developmentally uniform, but varies in the intensity and area of coverage in variegated streaking. The extent of streaking on the pericarps and bracts of the male buds can range from minimal to entirely covering the surface, and the pigmented intensity on the pericarps may be light initially and then darken with maturity. The principal difference between variety *formosana* and variety *chinensis* is the purplish red streaking on the pericarps only. In contrast, the pericarps of variety *chinensis* remain pale green even
at maturity. This variegation or its absence was a
stable character throughout the field investigations. 
Otherwise, it is hard to distinguish variety chinesis 
from variety formosana at vegetative stages.

1c. Musa itinerans var. kavalanensis H. L. Chiu, C. 
T. Shi & T. Y. A. Yang, var. nov. TYPE: 
Taiwan. Ilan [Yilan] Co., Tatung Township, 
Niou dou, 20 May 2008, H. L. Chiu 1 (holotype, 
TNM S133047, 1 of 5; isotypes, TNM S133047, 
2 to 5 of 5 [4]). Figures 1E–H, 2, 3.

Hae varietas a Musa itinerante Cheesman var. formosana (Warb. ex Schum.) Halkinen & C. L. Yeh pericarpio 
atque bracteis fertilibus omnibus non rubro-variegatis 
different.

Plants freely stoloniferous, developing long rhizo-
mizes 15 cm or more from the parent plant, position 
vertical, up to 5 suckers; mature pseudostems 2.5 m 
tall or more, to 4 m, 28–44 cm diam. at base, green 
with varying development of red-brown pigmentation 
according to age and exposure; the pseudostem 
covered with varying amounts of dead brown leaf 
sheaths, the underlying color light green with large 
red-brown blotches, shiny; sap watery. Leaf sheaths 
and petioles devoid of wax; leaf blades developing on 
the fourth, fully unfolded leaf basipetally from the 
plant apex, ca. 175–220 × 47–59 cm, bases obtusely 
rounded to oblique, entire, the apex obtuse, lateral 
venation prominent and parallel, midrib usually prom-
inent, blades often tearing between the lateral veins, 
yellowish green to green on both surfaces, glabrous; 
petioles 30–40 cm, usually green, canaliculate with the 
cauline wide, margins narrow, membranous and erect, 
not clasping the pseudostem. Inflorescence at first 
semi-erect to horizontal and then falling vertically 
downward; peduncle ca. 55–80 cm, robust, pale 
green to rusty brown, densely puberulent; sterile 
bracts 2, bracts deciduous at opening of the first 
flowers; basal flowers bisexual, the others male; 
spathe long-lingulate, 31.7 × 11.4 cm wide at center, 
apex convolute, bracts yellowish green, revolute and 
lifting one at a time after flowering, with the 
subsequent 1 to 2 bracts acropetally revolute, lifting 
before the older bract is deciduous; bract scars 
prominent. Flowers 11 to 13 per bract, biseriate, 
ovary inferior, pale green, glabrous, ca. 4.6 cm, 
markedly 5-angled, locules 3, ovules disposed in 4 
rows; compound tepals ca. 4.8 cm, with 2 prominent 
thickened keels, ribbed at the dorsal angles, with 5-
lobed, pale yellow apex, free tepals translucent white, 
ca. 3.2 cm, oblong-acuminate, smooth; stamens 5 
with sterile pollen, ca. 5.2 cm, filaments white, anther 
pale yellow; style straight, ca. 4.1 cm, creamy white, 

stigma capitate, grayish black after pollination. Male 
buds lanceolate, 15.8 × 7.5 cm, pendulous, bracts 
yellowish green on both sides, convolute at the tip; 
bract lifting sequentially as 1 bract at a time, lifting 
and revolute, similar to those subtending the lower 
flowers; bract scars prominent. Male flowers 14 to 15 
per bract, in 2 rows, falling with the bract, compound 
tepals usually 5-lobed, ca. 4.5 cm, pale yellow, 
central lobes smaller than the outer lobes; free tepals 
translucent white, ca. 2.2 cm, oblong-acuminate, 
stemens 5, filaments white, ca. 4.3 cm; fertile 
gynoecium 1, style straight, stigma cream, ca. 4.3 

cm, ovary arched, pale green, glabrous, 1.1 cm. Fruits 
bunch nearly horizontally, compact, with 3 to 10 
hands per bunch. Individual fruit usually negatively 
geotropic, ca. 6.7–8.5 × 2.5–2.8 cm in diam., ca. 21– 
38 g in weight, straight, slightly ridged, obscurely 5-
angled at maturity, apically blunt with persistent 
floral remains; fruit pedicels 1.1–1.4 cm, pale green, 
minutely puberulent; immature pericarp whitish 
green, minutely puberulent, becoming pale green 
and splitting lengthwise occasionally at maturity, dull 
yellow at full ripeness, not strongly aromatic, sweet 
and sour taste; seeds small, dark brown, warty, ca. 
2.1 × 4.1–4.8 mm diam., irregularly angulate-
depressed, 100 seeds with a weight of 2.9 g.

Etymology. The epithet of the new variety honors 
the traditional name of the aboriginal people in Yilan 
County (the Kavalan).

Distribution and habitat. The known populations 
of Musa itinerans var. kavalanensis occur in mount-
ainous areas at elevations from 220 to 820 m, along 
the 202 logging track (Yingshih village) on gentle 
slopes and the roadside of Prov. 7 Highway (Niou dou 
village), Yilan County, which is located in northeastern 
Taiwan. No individual or population of variety 
kavalanensis has been found within the distributional 
areas of either M. itinerans var. formosana or variety 
chinesis.

IUCN Red List category. Musa itinerans var. 
kavalanensis was investigated by the authors in Taiwan 
from 1999 to 2010. For its conservation assessment, 
IUCN Red List categories were applied (IUCN, 2001). 
These native banana populations occur mainly in open 
places in mountainous areas at Niou dou and Yingshih 
villages, Yilan County, at altitudes from 220 to 820 m. 
Both observed and conserved materials of M. itinerans 
var. kavalanensis and variety formosana were occasion-
ally seen as growing sympatrically. However, no 
obvious hybrids were observed in those populations. 
This taxon is of minimal conservation concern and 
should be considered Least Concern (LC).
Table 1. Diagnostic morphological characters of the three varieties of *Musa itinerans* Choosman in Taiwan and Hainan. *Musa itinerans* var. *formosana* (Wach. ex Schum.) Hakkinen & C. L. Yeh and *M. itinerans* var. *karanalensis* H. L. Chiu, C. T. Shii & T. Y. A. Yang are found in Taiwan; *M. itinerans* var. *hainanensis* Hakkinen & X. J. Ge occurs in Hainan. The description of variety *formosana* is based on personal observations by the authors, and the description of variety *hainanensis* is taken from Hakkinen et al. (2010).

<table>
<thead>
<tr>
<th>Character</th>
<th>var. <em>formosana</em></th>
<th>var. <em>hainanensis</em></th>
<th>var. <em>karanalensis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height</td>
<td>to 3 m</td>
<td>to 4 m</td>
<td>to 4 m</td>
</tr>
<tr>
<td>Rhizome length</td>
<td>0.3–1 m from parent plant</td>
<td>0.5–2 m from parent plant</td>
<td>0.5–1 m from parent plant</td>
</tr>
<tr>
<td>Number of suckers</td>
<td>to 5 (rhizomatous)</td>
<td>to 5 (rhizomatous)</td>
<td>to 5 (rhizomatous)</td>
</tr>
<tr>
<td>Leaf habit</td>
<td>normal (intermediate)</td>
<td>normal (erect)</td>
<td>normal (intermediate)</td>
</tr>
<tr>
<td>Underlying color of the pseudostem</td>
<td>light-green</td>
<td>light-green</td>
<td>light-green</td>
</tr>
<tr>
<td>Pigmentation of the pseudostem</td>
<td>red-brown to black blotches</td>
<td>large black blotches</td>
<td>red-brown blotches</td>
</tr>
<tr>
<td>Sap consistency</td>
<td>watery</td>
<td>milky</td>
<td>watery</td>
</tr>
<tr>
<td>Petiole margins</td>
<td>erect</td>
<td>spreading</td>
<td>erect</td>
</tr>
<tr>
<td>Leaf size</td>
<td>180 × 52 cm</td>
<td>250 × 50 cm</td>
<td>175–220 × 47–59 cm</td>
</tr>
<tr>
<td>Color of adaxial surface of leaf</td>
<td>green</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>Peduncle color</td>
<td>pale green to rusty brown</td>
<td>green to rusty brown</td>
<td>pale green to rusty brown</td>
</tr>
<tr>
<td>Basal flowers</td>
<td>8 to 12 in two rows on average, bisexual</td>
<td>15 in two rows on average, bisexual with aril composed of colore</td>
<td>11 to 13 in two rows on average, bisexual</td>
</tr>
<tr>
<td>Male bud shape and size</td>
<td>ovate-lanceolate, 13 × 7 cm</td>
<td>pale yellow, tinted with green</td>
<td>lancelolate, 15.8 × 7.5 cm yellowish green</td>
</tr>
<tr>
<td>Color of the external face of the bract</td>
<td>yellowish green with purple-red streaking apically</td>
<td>pale yellow, tinted with green</td>
<td>yellowish green</td>
</tr>
<tr>
<td>Male bract lifting and dehiscence pattern</td>
<td>lifting one bract at a time, revolute</td>
<td>lifting two bracts at a time, revolute</td>
<td>lifting one bract at a time, revolute</td>
</tr>
<tr>
<td>Male flowers per bract</td>
<td>12 to 17 in two rows</td>
<td>17 in two rows on average</td>
<td>11 to 13 in two rows</td>
</tr>
<tr>
<td>Number of fruits</td>
<td>3 to 11 hands, 8 to 12 fruits per hand on average</td>
<td>9 hands, 15 fruits per hand in two rows on average</td>
<td>8 to 10 hands, 11 to 13 fruits per hand on average</td>
</tr>
<tr>
<td>Fruit length and shape</td>
<td>7 cm, straight and ridged</td>
<td>6.5 cm, rounded</td>
<td>6.7–8.5 cm, straight and slightly ridged</td>
</tr>
<tr>
<td>Fruit pedicel</td>
<td>3 cm, pubescent</td>
<td>4.5 cm, pubescent</td>
<td>1.1–1.4 cm, minutely pubescent whitish green</td>
</tr>
<tr>
<td>Immature pericarp color</td>
<td>pale green tinted with purple-red spots</td>
<td>pale green</td>
<td>pale green</td>
</tr>
<tr>
<td>Mature pericarp color</td>
<td>pale green tinted with variable purple-red streaks</td>
<td>dull black</td>
<td>dull black</td>
</tr>
<tr>
<td>Fruit at maturity</td>
<td>splitting lengthwise occasionally</td>
<td>splitting lengthwise occasionally</td>
<td>splitting lengthwise occasionally</td>
</tr>
</tbody>
</table>

**Note.** A new variety of *Musa itinerans* was described recently as variety *hainanensis* Hakkinen & X. J. Ge by Hakkinen et al. (2010), with pale green pericarps equipped with yellowish green bracts of male buds. The distinguishing characteristics of *M. itinerans* var. *karanalensis*, variety *hainanensis*, and variety *formosana* are provided in Table 1.


**Key to the Species of Musa and Variations of M. itinerans in Taiwan**

1a. Plants rhizomatous.

2a. Fertile bracts yellowish green; pericarps pale green, both lacking redish variegation................. *Musa itinerans* var. *karanalensis*

2b. Fertile bracts yellowish green, variegated with purplish red streaks toward apex.

3a. Pericarps pale green............... *Musa itinerans* var. *chinensis*

3b. Pericarps pale green, variegated with purplish red streaks............... *Musa itinerans* var. *formosana*
1b. Plants not rhizomatous.

4a. Bracts dark purplish red abaxially........

.......... Musa insularimontana Hayata

4b. Bracts yellowish green abaxially........

.......... Musa yamienensis C. L. Yeh & J. H. Chen

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Literature Cited


International Plant Genetic Resources Institute—International Network for the Improvement of Banana and Plantain/Centre de Coopération internationale en recherche agronomique pour le développement [IPGRI-INIBAP/ CIRAD]. 1996. Description for Banana (Musa spp.). Int. Network for the Improvement of Banana and Plantain, Montpellier, France/Centre de coopération int. en recherche agronomique pour le développement, Montpellier, France; International Plant Genetic Resources Institute Press, Rome.


Liao, M. J. 1992. Investigation on Electrophoretic Patterns of SkDH and PGD Isozymes of Musa Germlumps and Native Species in Taiwan. Master’s Thesis, Graduate Institute of Horticulture, Taiwan University, Taipei.


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