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## *Mucuna guangxiensis*, a new species of *Mucuna* subg. *Macrocarpa* (Leguminosae-Papilionoideae) from China

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### Abstract

*Mucuna guangxiensis* sp. nov. (Fabaceae), a woody liana species bearing pods up to 70 cm long, which is only known from Guangxi Province in China, is described and illustrated here. The new species is similar to *Mucuna macrocarpa* but differs from it by totally yellowish or greenish white corolla and more densely sericeous hairs on the abaxial surface; and also to *Mucuna birdwoodiana* but differs from it by the thinly papyraceous leaves, the dense indumentum on the abaxial surface of leaflets, and the longer legumes without paired robust wings at both margin. This new species should be a new member of *Mucuna* subg. *Macrocarpa* according to its long ovary, numerous seeds per legume and linear and long legumes with woody epicarp, and a detailed key of the subgenus is provided in this article.

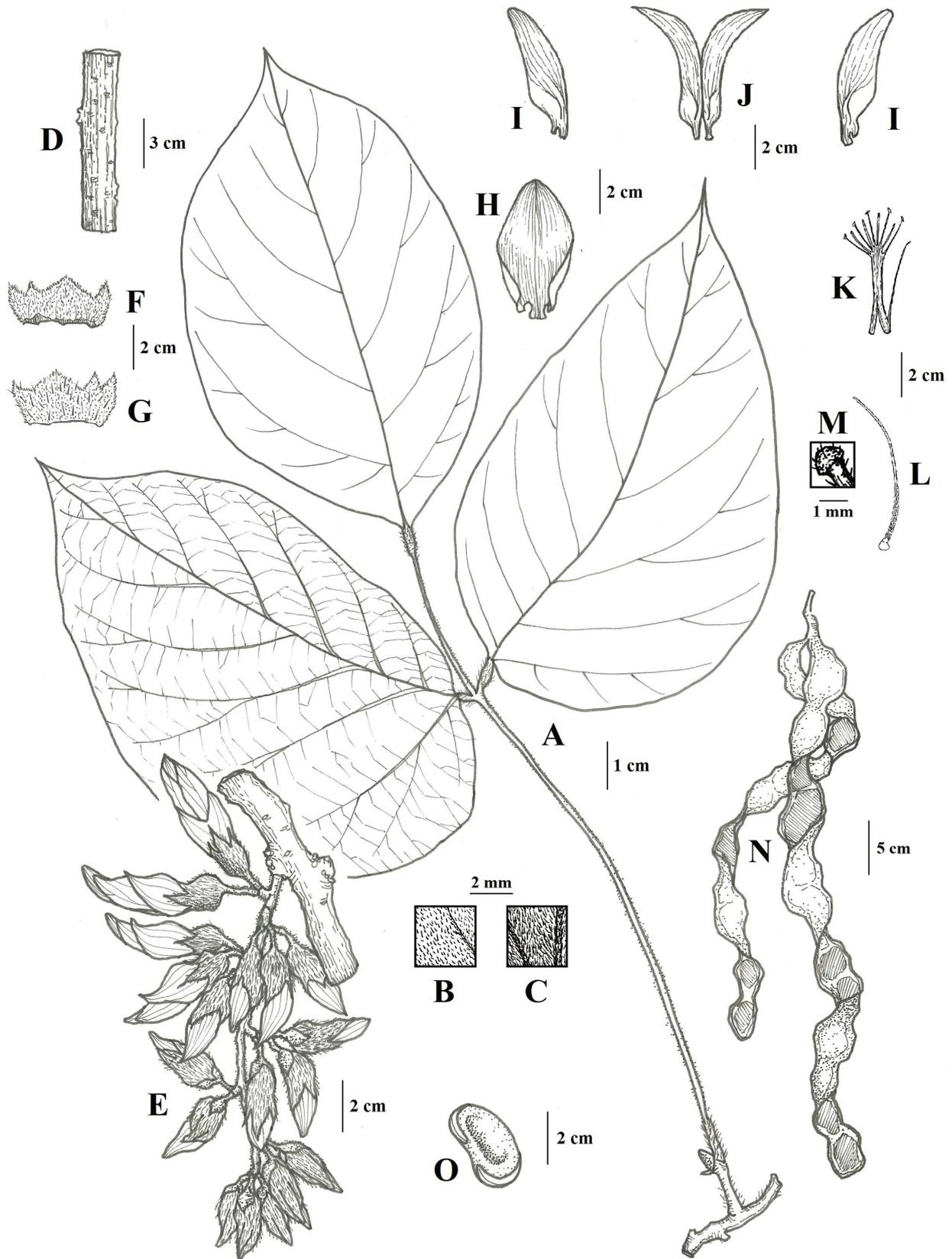
**Keywords:** Fabaceae, Guangxi Province, legume, taxonomy

### Introduction

The pantropical and subtropical genus *Mucuna* Adanson (1763: 579) is a member of the third-largest angiosperm family Leguminosae which contains ca. 105 species (LPWG 2017, Moura *et al.* 2018). Wilmot-Dear (1984) revised the genus in China and Japan, which recognized 15 species, three varieties, one subspecies and four incompletely known taxa (cited as *Mucuna* sp. “A”, “B”, “C” and “D” by Wilmot-Dear), distributed in China (including Taiwan). Sa & Wilmot-Dear (2010) revised the genus again in *Flora of China*, which recognized 18 species and one variety (*Mucuna* sp. “A” and “C” are treated as two new species, *Mucuna hirtipetala* and *Mucuna incurvata*, while the statuses of *Mucuna* sp. “B” and “D” are still uncertain).

Traditionally, the infrageneric classification recognized two subgenera, *i. e.* *Mucuna* subg. *Mucuna* and *Mucuna* subg. *Stizolobium* (P. Browne) Baker (1879: 186), Moura *et al.* (2016a) separated a new subgenus, *Mucuna* subg. *Macrocarpa* T. M. Moura, Wilmot-Dear, M. Vatanparast, A. M. G. Azevedo & G. P. Lewis from *Mucuna* subg. *Mucuna* based on the molecular evidence of Moura *et al.* (2016b), this subgenus is distinctive in its long woody pods with maximum number of seeds up to 18.

During our field work in 2018 and 2019, a *Mucuna* species with greenish white corolla was discovered in Guangxi Province in China. The species is similar to *Mucuna birdwoodiana* Tutcher (1905: 65–66) with the yellowish or greenish white color of corolla and to *Mucuna macrocarpa* Wallich (1830: 41) with the legumes have irregular longitudinal wrinkles on the surface. After examining the related literatures by the predecessors (Wilmot-Dear 1984, 1987, 1990, 1991, 1992, 2009, Wiriadianata & Ohashi 1990, Wiriadianata *et al.* 2016, Moura *et al.* 2016a, 2016b, Ingalhalikar *et al.* 2017), we confirmed it is a totally new member of *Mucuna* subg. *Macrocarpa* and has not been described before. Here we describe and illustrate it, and a distribution map of this new species is also provided in this paper.



**FIGURE 1.** *Mucuna guangxiensis* K.W. Jiang & Y.Feng Huang, *sp. nov.* (A) Leaf; (B) Indumentum on the adaxial surface of leaflets; (C) Indumentum on the abaxial surface of leaflets; (D) A segment of dry stem; (E) An inflorescence; (F) The inner surface of the calyx; (G) The outer surface of the calyx; (H) Standard; (I) Wings; (J) Keels; (K) Stamens; (L) Gynoecium; (M) Stigma; (N) Legume; (O) Seed. A–K from holotype, L–M from paratypes. L was drawn by Kai-Wen Jiang, the rest were drawn by Yi-Fan Li.



**FIGURE 2.** *Mucuna Guangxiensis* K.W. Jiang & Y.Feng Huang, *sp. nov.* (A) Vegetative branches; (B) Indumentum on the adaxial surface of leaflets; (C) Indumentum on the abaxial surface of leaflets; (D) The cross-section of an old stem, showed the red liquid; (E) A flower; (F) The calyx; (G) Standard; (H) Wings; (I) Keels; (J) An inflorescence; (K) Stamens; (L) Gynoecium; (M) Seeds; (N) Legumes; (O) Habit. B & C were photographed by Kai-Wen Jiang, M was photographed by Meng-Jiao Fu, the rest were photographed by Yun-Feng Huang.

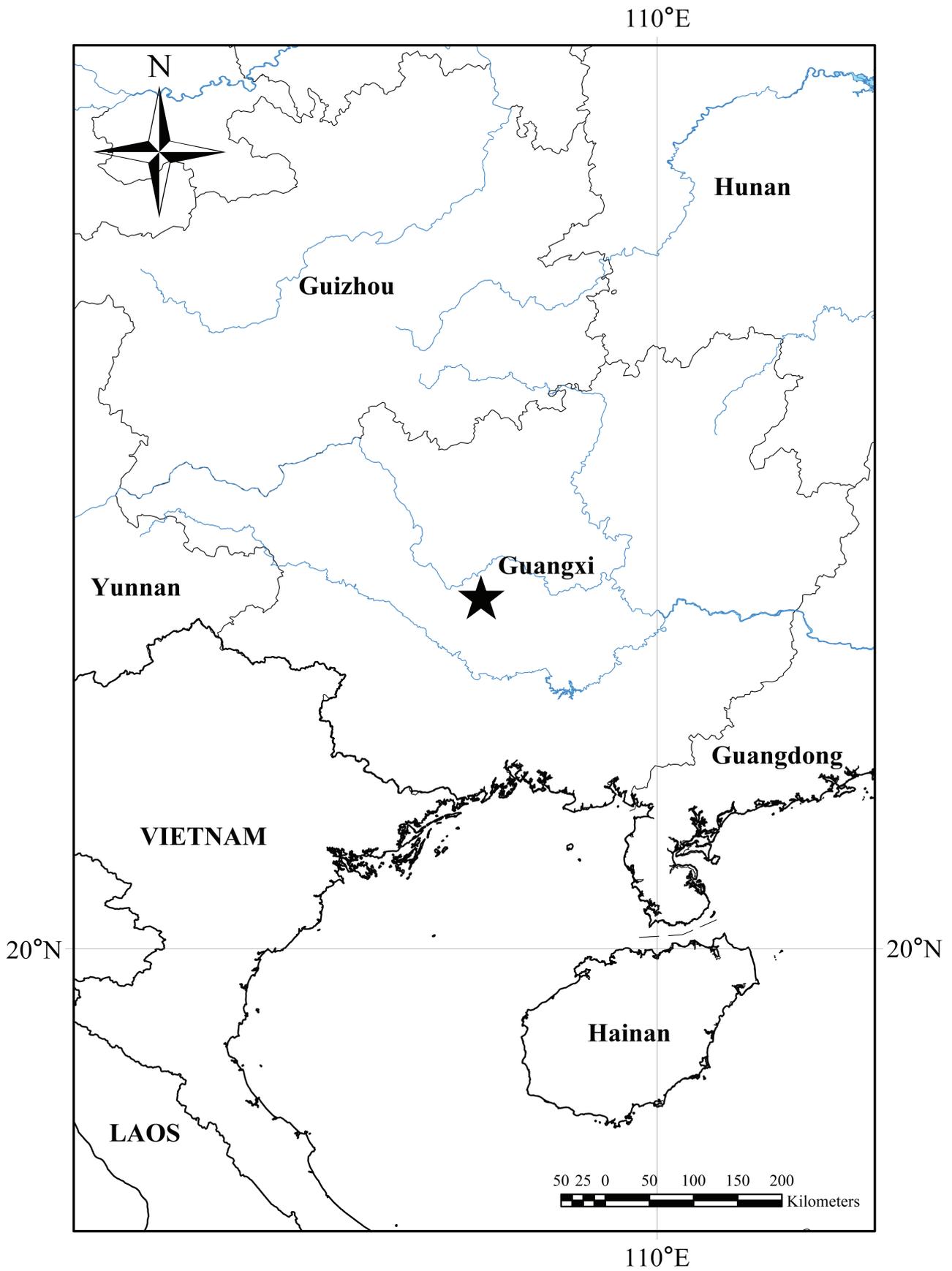


FIGURE 3. The distributional map of *Mucuna guangxiensis*. Prepared by Kai-Wen Jiang.

## Taxonomy

*Mucuna guangxiensis* K.W. Jiang & Y.Feng Huang, *sp. nov.* (广西油麻藤), Fig. 1 & 2

Type:—CHINA. Guangxi Zhuang Autonomous Region: Nanning Prefecture (南宁市), Mashan County (马山县), Baishan Town (白山镇), 13<sup>th</sup> April 2019 (fl.). *Huang Yun-Feng & Huang Yun-Dong 31405* (holotype CSH!, isotypes CSH!, GXMI!, SWFC!)

**Diagnosis:**—*Mucuna guangxiensis* is similar to *Mucuna birdwoodiana* with yellowish or greenish white color of petals, but it can be distinguished from the latter one in leaflets with dense sericeous hairs on the abaxial surface (vs. glabrous or with sparse hairs on the abaxial surface) and the longer fruits (up to 70 cm) with short yellow erect hairs but without caducous bristles and paired wings along the both margins (vs. fruits up to 45 cm, with dense, spreading, dark brown or red-brown pubescence and caducous bristles; both margin with a pair of wings). It is also similar to *Mucuna macrocarpa* with the woody legumes with irregular longitudinal wrinkles when dry, but the petals are totally yellowish or greenish white in *M. guangxiensis* (vs. the standard is white while the wings and keels are purple).

**Description:**—Large woody twinning liana up to 15 m long. Old stems canaliculate when dry; bark grayish brown, lenticellate; cross-section with red liquid. **Branches** slender, sparsely with adpressed or  $\pm$  spreading pubescent hairs, canaliculate. **Leaves** 27–38 cm long; petiole 11–21 cm long, with a pulvinus ca. 1 cm long at base, sparsely covered with adpressed or  $\pm$  spreading, pale or somewhat yellowish-brown pubescent hairs similar to which on the branches, with more dense hairs at base; stipules and stipels absent; petiolules 6–7 mm, densely with adpressed yellowish sericeous hairs; rachis 3.5–5.5 cm, with indumentum similar to petiole; leaflets thinly papyraceous or papyraceous, with abundant of adpressed pale pubescence on the adaxial surface, more dense on veins, abaxial surface with denser and longer grayish white sericeous hairs,  $\pm$  spreading; lateral veins usually 6–7 pairs, somewhat curved at apex; terminal leaflet broadly rhombic ovate to broadly ovate, 7.0–9.3  $\times$  11.3–17 cm, base broadly cuneate or somewhat truncate, apex usually acuminate with an acumen ca. 4 mm long, rarely obtuse or emarginate; lateral leaflets rather asymmetrical, with the ratio of abaxial to adaxial halves 1.66–2.20, 8.3–15.1  $\times$  6.5–10.3 cm, base truncate or somewhat broadly cuneate, apex similar to which of terminal leaflet. **Inflorescence** a pseudoracemose, usually arising from old stems, the axis 1–10 cm long, canaliculate, densely with adpressed or spread minute brown hairs, with 2–3 flowers per node, the nodes spiral, the internodes 7–15 mm long; bracts and bracteoles caducous, not seen on the specimens; pedicel ca. 1.2 cm, with dense pale pubescent hairs and sparse yellow bristles (ca. 1 mm long). Flowers 6.5–8.0 cm long. **Calyx** with dense minute spreading hairs and sparse yellow caducous bristles on the outer surface, with dense adpressed hairs on the inner surface; tube ca. 17  $\times$  8–9 mm; the adaxial lobe formed by two entirely connate sepals, ca. 20  $\times$  5 mm, lateral lobes ca. 5  $\times$  5 mm, the lowest ca. 5  $\times$  8 mm, all lobes with an acute apex. **Corolla** yellowish or greenish white, nigrescent when dry, each petals with a somewhat ciliate apex, standard 2.7–3.4  $\times$  3.0–3.3 cm, glabrous, rounded at apex, with claw and auricles at base, claw 6–7 mm, auricle ca. 0.3 mm; wings ca. 6  $\times$  1.3 cm, obtuse at apex, with claw and auricle at base, adaxial surfaces densely with spread minute hairs around the base, claw 0.9–1.0 cm, auricle ca. 5 mm; keels 6.0–7.0  $\times$  0.8–1.1 cm, glabrous, apex at ca.  $\frac{1}{3}$  of the length curved, with an apex horny ca. 1 cm, base with a claw, 0.6–1.0 cm, auricle absent. **Stamens** 10, diadelphous, 9+1, with 1 free and the other 9 fused at 80% of the of filaments length to form a staminal tube, dimorphic with 5 larger, sub-basifixed anthers and 5 smaller, dorsifixed anthers (including the anther on the free stamen). **Gynoeceium** somewhat longer than stamens, ca. 9 cm, with only one carpel; ovary linear, sessile, ca. 2.5 cm long, with conspicuous groove when dry, densely with pale hairs; style ca. 5.5 cm, linear, rather sparsely covered with  $\pm$  spread hairs; stigma terminal. **Fruit** a large woody legume, linear, 22–70  $\times$  4.5–5.5 cm, not or  $\pm$  constrict between seeds, the outer surface of valve densely with yellowish brown pubescence, somewhat caducous when old, bristles not seen, with longitudinal wrinkles near the margins, sometimes with a stipe at base, beaked at apex, dehiscent along one or both sutures, if dehiscent along both sutures, valves sometimes coiling after opening. **Seeds** 6–15 per pod, dark brown to black, compressed, surrounded by a sponge seed stalk when in legume, ca. 3.0  $\times$  2.5  $\times$  0.8 cm, hilum black, length ca.  $\frac{1}{4}$  of the seed circumference.

**Distribution and ecology:**—*Mucuna guangxiensis* is only known from the type locality, Mashan Town in Nanning, Guangxi (Fig. 3). It occurs at the elevations of ca. 250 m, in the sparse forest from the foot to the mountainside of stone mountains.

**Phenology:**—Flowering March to April, fruiting September to October.

**Etymology:**—The Latin epithet is given here as *guangxiensis*, which refers to the type locality of this species, Guangxi Province. The Chinese name “广西油麻藤” is also derived from the Latin name, “广西” is the Chinese character writing of Guangxi, while “油麻藤” is the Chinese common name for the genus *Mucuna*.

**Vernacular name:**—In the local Vahcuengh of the type locality, the new species is called as “gaeu-nuem”(坵喃), which means “python vine” in English.

**Conservation status:**—We do not have adequate information to make the conservation assessment of *Mucuna guangxiensis*, therefore, we consider this species as Data Deficient (DD) for a while according to the IUCN criteria (IUCN 2014).

**Taxonomic notes:**—Moura *et al.* (2016a) provided four main diagnostic characteristics for *Mucuna* subg. *Macrocarpa*: (1) ovary (1–)2–3 cm long (vs. 0.5–1.4 cm long for the other two subgenera); (2) ovules (4–)9–18 per ovary (vs. 1–5(–10) for the other two subgenera); (3) fruit linear, length at least 6 times width, epicarp woody, usually somewhat wrinkled but otherwise lacking any ornamentation (vs. relatively broader, epicarp leathery, usually ornamented by lamellae, ribs or rarely  $\pm$  wrinkled or lacking ornamentation in *M.* subg. *Mucuna* and epicarp fleshy in *M.* subg. *Stizolobium*); (4) fruits are usually 30–60 cm long and up to 18-seeded. The characteristics of *Mucuna guangxiensis* is in line with the diagnose: ovary ca. 2 cm long; ovules 6–15 per ovary (we did not observe the actual amount of ovules in ovary, the amount here is reference the amount of seeds in legume); fruit linear, length usually more than 6 times width (some short fruits do not meet this standard), epicarp woody, wrinkled; fruits 22–70 cm long, up to 15-seeded.

The differences between *M. guangxiensis*, *M. birdwoodiana* and *M. macrocarpa* are summarized in Table 1.

**TABLE 1.** Morphological differences between *Mucuna guangxiensis*, *M. birdwoodiana*, and *M. macrocarpa*.

| Character   | <i>M. guangxiensis</i>  | <i>M. birdwoodiana</i>  | <i>M. macrocarpa</i>  |
|---|---|---|---|
| Texture of leaflets                                       | thinly papyraceous or papyraceous   | sub-coriaceous  | papyraceous or coriaceous   |
| Indumentum on the adaxial surface                         | with abundant of adpressed pale pubescence                                      | glabrous or sparsely with short hairs   | glabrous or with grayish white or reddish adpressed pubescence  |
| Indumentum on the abaxial surface                         | densely with grayish white sericeous hairs                                      | glabrous or sparsely with short hairs   | with ferruginous, spreading, often dense hairs  |
| Color of the corolla                                      | greenish or yellowish white   | greenish or yellowish white   | bi-colored, with standard greenish or pinkish white, wings dark purple, keel lighter mauve or yellowish green |
| Length of flowers   | 6.5–8.0 cm  | 7–8.5 cm  | 5.5–6(–7) cm  |
| Legume shape  | not or $\pm$ constrict between seeds  | torulose  | markedly constrict between seeds  |
| Indumentum on the outer surface of the legume             | densely with yellowish brown pubescence, somewhat caducous with age             | with a dense, spreading, dark brown or red-brown pubescence and caducous bristles | densely pubescence, rarely glabrous with age  |
| Legume margin   | without wings or any distinct thickened rim or central groove along the sutures | with a pair of wings along both sutures   | without wings or any distinct thickened rim or central groove along the sutures                               |
| Ornamentation on the outer surface of the legume when dry | with longitudinal wrinkles near the margins                                     | smooth  | with irregular longitudinal wrinkles  |

**Additional specimens examined (paratypes):**—CHINA. Guangxi Province: Nanning Prefecture, Mashan County, Baishan Town, 20<sup>th</sup> April 2018 (fr.). *Huang Yun-Dong 01* (CSH!); Nanning Prefecture, Mashan County, Baishan Town, 27<sup>th</sup> September 2018 (fr.). *Huang Yun-Dong 01* (CSH!, GXMI!).

## Key to the species of *Mucuna* subg. *Macrocarpa*:

1. Indumentum on the abaxial surface of the leaflets sericeous and usually dense but never red-brown .....2
- Indumentum on the abaxial surface of the leaflets absent or sparse or if dense then spreading and often red-brown .....3
2. Flowers 6.5–8.0 cm long; corolla greenish or yellowish white; legumes 22–70 cm long, with 6–15 seeds per pod *M. guangxiensis*
- Flowers 3.5–4.5 cm long; corolla purple; legumes 13–15 cm long, with up to 7 seed ..... *M. calophylla*
3. Legumes with a pair of wings along both sutures ..... *M. birdwoodiana*
- Legumes without wings along either suture .....4
4. Plant with latex; legumes with two sides parallel to each other, with an obtuse apex ..... *M. laticifera*
- Plant without latex; legumes ± constricted between seeds, apex beaked .....5
5. Leaflets with a dense, soft, pale, spreading but never ferruginous indumentum ..... *M. bodinieri*
- Leaflets glabrous or sparsely hairy or with a ferruginous indumentum .....6
6. Legumes with a thin epicarp, at least with irritant bristles on the outer surface, without irregular wrinkles .....7
- Legumes with a thick epicarp, without irritant bristles but densely with pubescent hairy (or turn glabrous with age) and irregular wrinkles on the outer surface .....8
7. Leaves with a petiole 7–16.5 cm long; leaflets glabrous or rarely with a sparse indumentum of stiff, pale hairs; legumes with both dense, short, fine red-brown hairs and sparse, caducous reddish brown bristles on the outer surface ..... *M. sempervirens*
- Leaves with a petiole 4–6.5 cm long; leaflets glabrous; legumes with only a few irritant bristles ..... *M. kawakabuti*
8. Corolla bi-colored, with standard greenish or pinkish white, wings dark purple, keel lighter mauve or yellowish green; legumes with margins often markedly constricted between seeds ..... *M. macrocarpa*
- Corolla greenish white; legumes with margins not or slightly constricted between seeds ..... *M. thailandica*

**Notes:**—Moura *et al.* (2016a) recognized six species of *Mucuna* subg. *Macrocarpa*. Ingalhalikar *et al.* (2017) described a new species of *Mucuna* endemic to India, *i. e.* *Mucuna laticifera* Ingalhalikar, N.V. Page & S.S. Gaikwad (2017: 118), and it should also be a member of *Mucuna* subg. *Macrocarpa* based on its description (ovary 2.5–3.0 cm long; legumes linear, 25–40 cm long, with a woody epicarp, with seeds 8–15 per pod), thus here we recognize it. *Mucuna kawakabuti* Wiriadinata (1990: 97), which was only known from its type locality, Sumba Island in Indonesia, was described as a new species by Wiriadinata & Ohashi (1990), and should also be a member of *Mucuna* subg. *Macrocarpa* due to its similar appearance to *Mucuna macrocarpa* (Wiriadinata & Ohashi 1990, Wiriadinata *et al.* 2016). However, this species was described based on a specimen without inflorescence and flowers, though we include this species in our key, the taxonomic status of this species is still suspected, which need further research.

Moura *et al.* (2016a) also provided the total distribution of *Mucuna* subg. *Macrocarpa*: from the eastern Himalayas through southern China to northern Thailand and Indochina. Exceptionally, the newly recognized species in this paper, *Mucuna kawakabuti* was distributed in Sumba Island, which is rather far from the distribution center of the subgenus.

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