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Stixis villiflora, a new species of Resedaceae from Yunnan, China

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ABSTRACT: *Stixis villiflora* (Resedaceae), a new species from Mengla, Yunnan, China, is described and illustrated. It is compared with four morphologically similar species *S. philippinensis*, *S. suaveolens*, *S. ovata* subsp. *fasciculata* and *S. scandens*. It differs from the preceding species by both leaf surfaces being pubescent and full of pustules, stamens 14–18, filaments lower half pubescent, upper half sparsely pubescent or glabrous, androgynophores ca. 1 mm long, lower half glabrous, upper half tomentose, gynophores and ovary with densely white hairs. A complete morphological description of *Stixis villiflora* is provided, together with photographs, a conservation assessment, and a diagnostic key to 10 species and 1 subspecies of *Stixis* from Asia.

KEY WORDS: China, new species, Resedaceae, *Stixis villiflora,* Xishuangbanna, Yunnan.

INTRODUCTION

The genus *Stixis* Lour. consists of 9 species and 1 subspecies of woody vines (or clambering shrubs) endemic to the Southeast Asia (Jacobs 1963; Sundara Raghavan 1986; Deb and Rout 1988). For a long time *Stixis* was placed in the tribe Stixeae of Capparaceae, with *Forchhammeria*, *Neothorelia*, and *Tirania*, and was considered close to *Forchhammeria* based on having flowers without petals (Pax and Hoffmann 1936). Doweld and Reveal (2008) proposed a familial rank for the tribe, Stixaceae. However, it was not be accepted or used by subsequent authors (APG III, 2009; Martín-Bravo *et al.* 2009, 2010; APG IV, 2016). In APG IV *Stixis* was placed in an expanded Resedaceae, in this study the delimitation of *Stixis* followed the treatments of APG IV (2016). The exact position of *Stixis* is still to be further studied (Su *et al.*, 2012).

Only one species of the genus *Stixis* was recorded in China before 2003, two new recorded species were discovered in Southeast Yunnan in 2003, to date China has recorded three species of the genus, and all these three species were reported in Yunnan province (Chen *et al.*, 2003; Zhang and Tucker 2008). During extensive botanical studies in Xishuangbanna Prefecture in Yunnan, the authors collected an unknown species in Mengla. This species is similar to *S. philippinensis* (Turcz.) Merr., *S. suaveolens* (Roxburgh) Pierre, *S. ovata* subsp. *fasciculata* (King) Jacobs and *S. scandens* Lour., and after literature review as well as morphological examination, the conclusion was made that this represents a new species. Given the rarity of *Stixis* throughout Southeast Asia, the discovery of new species in China is especially notable.

TAXONOMIC TREATMENT

Stixis villiflora J.Y. Shen, S. Landrein, W.G. Wang & X.D. Ma, ***sp. nov.*** **多毛斑果藤 Figs. 1& 2**

***Type*: CHINA,** Yunnan, Mengla, Guanlei, in dense forests, climbing on the tree, 21°45′ N, 101°12′ E, alt. 1284 m, 16 Mar. 2019, *J.Y. Shen, X.D. Ma & W.G. Wang 1413* (holotype: HITBC; isotype: HITBC, HIB, KUN)

Climbing shrubs, ca. 5–10 m in height, woody. Twigs tan-colored, stout, terete, fulvous hairs, densely lenticellate. **Petiole** 2.5–4.5 cm, terete, tan-colored, with fulvous hairs, apically with a slightly inflated pulvinus. **Leaf blades** oblong, or oblong-lanceolate, 8.5–21 × 3–7.5 cm, both surfaces pubescent and pustulate (each pustule is formed by a multicellular cushion from which one to several hairs can also be produced), acute or obtuse at base, apex acuminate and with a 10–20 mm tip, entire, broadest at middle, reticulate, herbaceous to subleathery, lateral nerves 7–10 on either side, arching obliquely towards the margin; midrib slightly sunken above with densely rust colored villous, prominent beneath, pubescent, each pustule is formed by a multicellular cushion from which one to several hairs can also be produced. **Inflorescences** axillary or terminal, racemes, 5–12 cm, erect, axes and bracts tomentose to downy-puberulous, bracts linear, ca. 3 × 0.5 mm, caducous, pubescent. **Pedicels** 2.5–3 mm, pubescent. **Floral Buds** cylindroid, ca. 2 mm diameter, 4–10 mm long. **Sepals** 6, in one whorl, reflexed at anthesis**,** yellow-green, lanceolate, 8–10 × 1 mm. both surfaces densely tomentose, apex acute to obtuse. **Androgynophore** ca. 1 mm, lower half glabrous, upper half tomentose. **Stamens** 14–18. **Filaments** 10–14 mm, white later turn to yellow, lower half pubescent, upper half glabrous or sparsely pubescent. **Anthers** ellipsoid, ca. 0.5 mm long, bright yellow. **Gynophore** 7–10 mm, elongating slightly during and after anthesis, up to 10 mm, densely green-yellow hair. **Ovary** ellipsoid, ca. 3 × 1.5 mm, densely white hair. **Style** ca. 1 mm, hirsute at the base, otherwise glabrous, stigma obscurely 3 (or 4)-lobed. Fruit not seen.

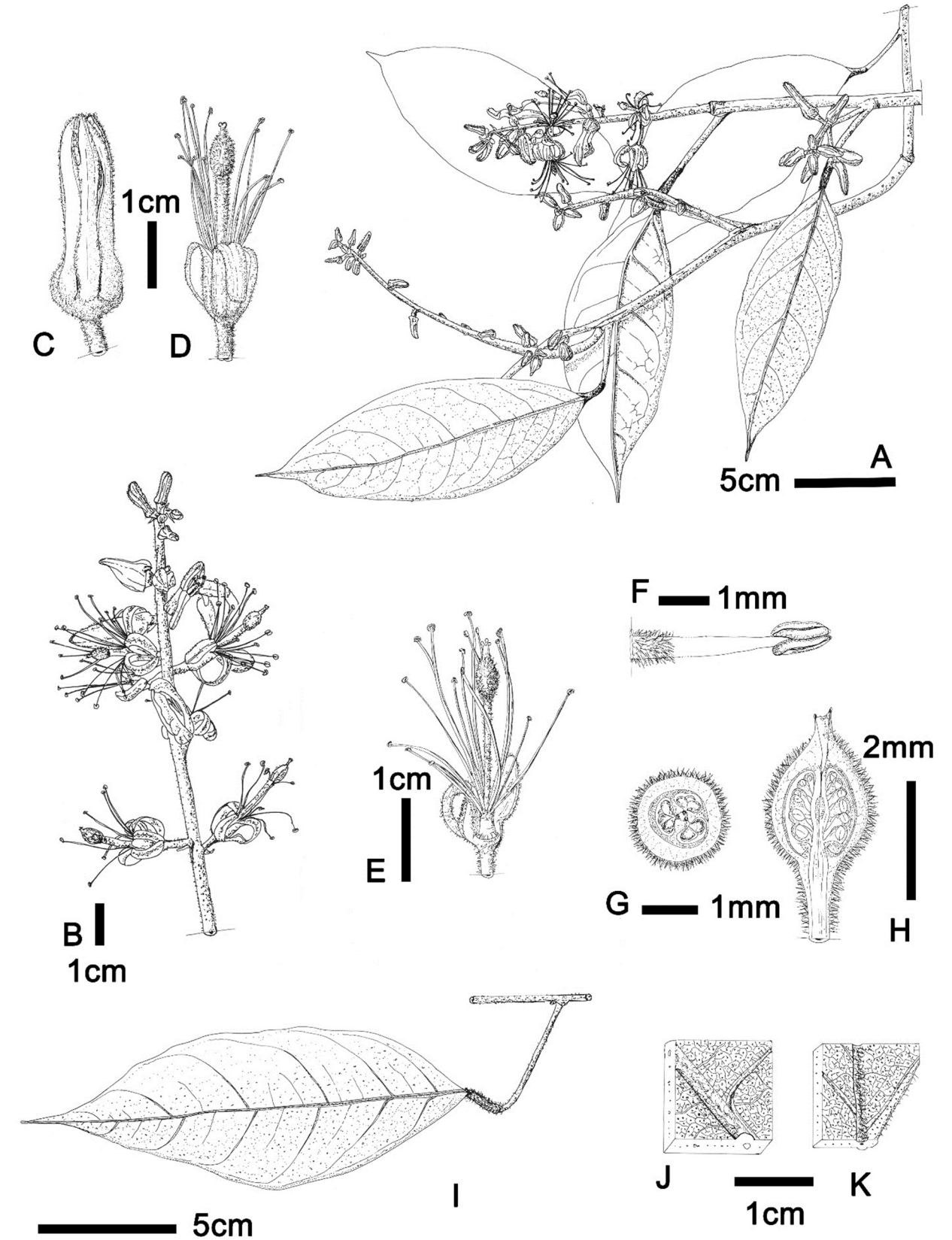

Fig. 1. *Stixis villiflora*. **A**. Flowering branch. **B**. Inflorescence. **C**. Flower bud. **D**. Flower open. **E**. Flower with corolla opened showing staminal column and nectary. **F**. Stamen. **G**. Cross section of the ovary. **H**. Longitudinal section of the ovary. **I**. Leaf. **J**. Abaxial leaf surface. **K**. Adaxial leaf surface. (Drawn by Sven Landrein)

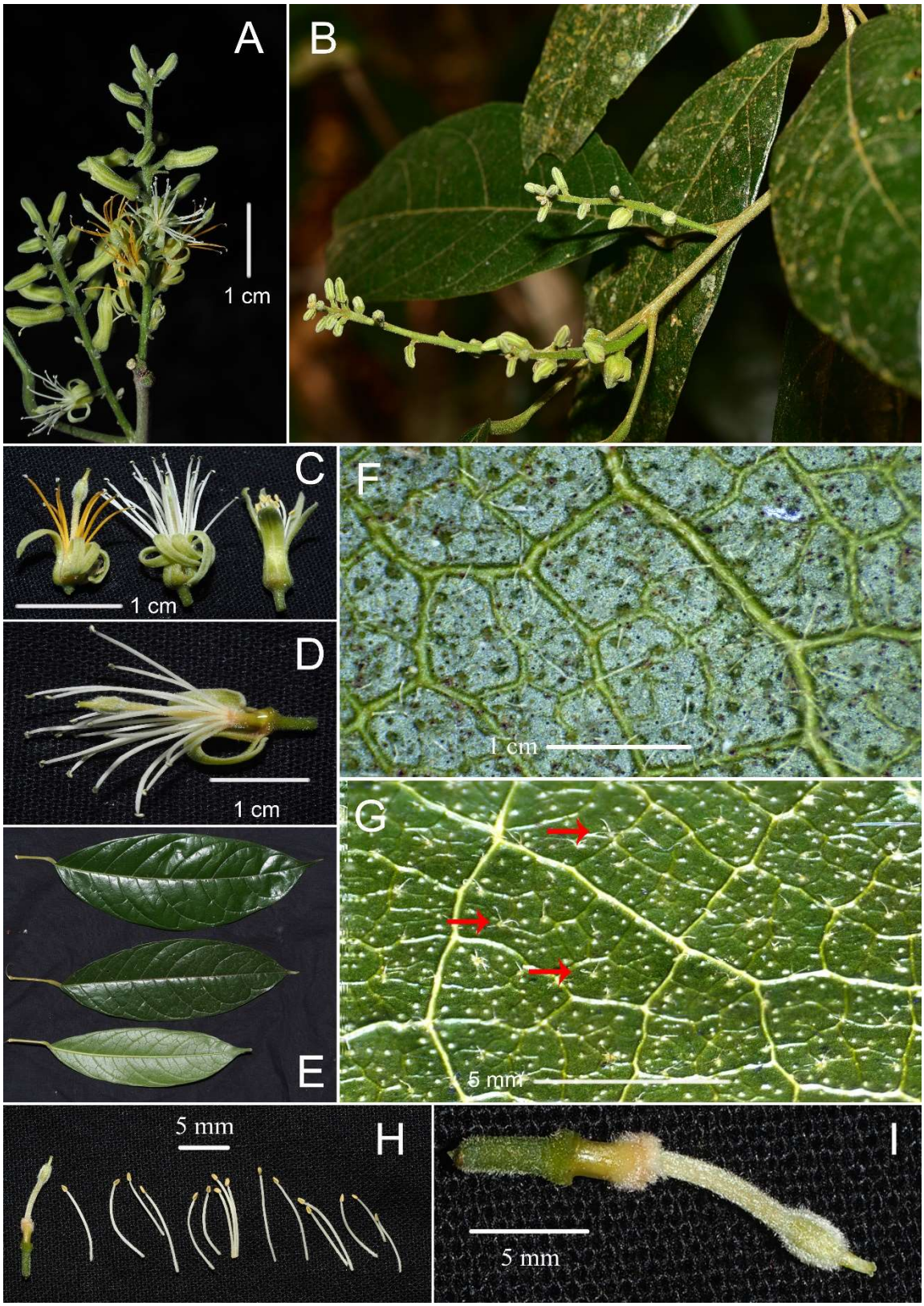

Fig. 2. *Stixis villiflora*. **A**. Inflorescence. **B**. Habit. **C**. Flowers from different periods to show the sepals, filaments, gynophore and pistil. **D**. Flower after remove 3 sepals. **E**. Leaf, adaxial and abaxial surface. **F**. Abaxial leaf surface to show the pustules and hairs. **G**. Adaxial leaf surface to show the pustules and hairs (red arrows). **H**. Flower dissection (remove sepals). **I**. Flower dissection (remove sepals and filaments) to show androgynophore, gynophore, pistil.

Table 1. Morphological comparison of *Stixis villiflora*, *S. philippinensis*, *S. suaveolens*, *S. ovata* subsp. *fasciculata* and *S. scandens*.

Characters	*S. villiflora*	*S. philippinensis*	*S. suaveolens*	*S. ovata* ssp. *fasciculata*	*S. scandens*
Leaf surface	both surfaces pubescent and full of pustules on both sides	glabrous but full of pustules on both sides	both surfaces glabrous	both surfaces sparsely pubescent with stellate hairs, eventually glabrous except along veins	both surfaces glabrous or abaxially sometimes with a few hairs near veins,
Leaf apex	acuminate and with a 10–20 mm tip	distinctly acuminate	nearly rounded to ± acuminate and with a 5–12 mm tip	nearly rounded to acuminate and with a 5–12 mm tip	nearly rounded to ± acuminate and with a 5–12 mm tip.
Sepal	reflexed, 8–10 × 1 mm.	reflexed, 9-10 × 1.5-2 mm	erect or spreading, never reflexed, (4–) 5–6 (–9) × 2–3 mm	reflexed, 4–6 × 1.5–2.5 mm	reflexed, 5–6 × 1–1.2 mm
Stamen	14–18, filaments 10–14 mm, lower half pubescent, upper half sparsely pubescent or glabrous	20, filaments ca. 10 mm	(27–) 40 to ca. 80, filaments 4–6 (–11) mm, pubescent	(20–) 26–30 (–40), filaments 3–5 mm, glabrous	16–24, filaments 2.5–5 mm, pubescent
Androgynophore	ca. 1 mm, lower half glabrous, upper half tomentose	3.5 mm, glabrous	ca. 2 mm, glabrous	ca. 1.5 mm long, glabrous	0.2–0.5 mm, glabrous
Gynophore	7–10 mm long, densely white hair	9.5–10.5 mm long, with dense tan pubescence	7–10 mm long, with dense tan pubescence	2–2.5 mm long, with dense tan pubescence	0.7–1.5 mm, with dense brownish pubescence
Ovary	densely white hairs	glabrous	glabrous or basally sometimes with hairs	glabrous or basally sometimes with hairs	pubescent
style	one, ca. 1 mm, sparsely hirsute at the base, otherwise glabrous	one, 1.5 mm, glabrous	three (or four), 0.75–1 mm, glabrous	one, 1–1.5 mm, hirsute at the base, otherwise glabrous	one, ca. 0.5 mm, glabrous
stigma	3 (or 4)	3	absent	3	absent

***Distribution & habitat*:** Currently known only from the type locality and found growing in dense forests at ca. 1300 m high elevation.

Phenology: Flowers were observed from mid-March to late March.

***Etymology*:** Because the flower, pedicels, sepals, stamens, upper half of androgynophore, gynophore and ovary are hairy, we give the specific epithet "villiflora". Chinese name is "多毛斑果藤" (duō máo bān guǒ téng), which means the flower is hairy.

***Conservation assessment*:** There is only one known population of *Stixis villiflora* in Mengla (Xishuangbanna, Yunnan Province, China). All the surrounding forests were surveyed carefully, but no additional populations were identified. Within the single population in Mengla, only 15 individual plants were observed. Based on the limited population size and restricted distribution of *Stixis villiflora,* this new species should be assessed as Critically Endangered (CR; criteria B1ab (i, v) + 2ab (i, v), D).

***Features and affinities*:** Morphological similarities shared among *Stixis villiflora*, *S. philippinensis*, *S. suaveolens*, *S. ovata* subsp. *fasciculata* and *S. scandens* could suggest a relationship among these species (See Table 1). *Stixis villiflora* can be distinguished from its morphologically closest relatives *S. philippinensis*, *S. suaveolens*, *S. ovata* subsp. *fasciculata* and *S. scandens* by both surfaces pubescent and full of pustules on both sides, stamens 14–18, filaments lower half sparsely pubescent, upper half glabrous, androgynophores ca. 1 mm, lower half glabrous, upper half tomentose, gynophores and ovary with densely green-yellow hairs.

In order to facilitate identification, we here provide a diagnostic key to the 10 species and 1 subspecies of *Stixis* known from Asia.

Diagnostic key to species of *Stixis*.

1a. Leaves 3-foliolate ……...…… 1. ***S. nayarii***
1b. Leaves simple ……... 2
2a. Ovary stellate hairy ……..…….. 2. ***S. manipurensis***
2b. Ovary glabrous or hairy, never with stellate hair ……..…… 3
3a. Gynophore longer than 6 mm ……..…… 4
3b. Gynophore shorter than 5 mm ……..……..…….. 6
4a. Sepals more or less spreading during anthesis, not reflexed.. …… …… 3. ***S. suaveolens***
4b. Sepals reflexed in anthesis ……..……..…..…… 5
5a. Ovary hairy. Leaves surfaces pubescent …….. 4. ***S. villiflora***
5b. Ovary glabrous. Leaves surfaces glabrous …. 5. ***S. philippinensis***
6a. Adult leaves hairy underneath ……..…… 7
6b. Adult leaves glabrous, occasionally with a few hairs on the nerves …….. 8
7a. Gynophore glabrous all over. Flowers in axillary racemes, rarely in a terminal panicle, the inflorescence mostly shorter than 12 cm ……. ……..…..…… 6. ***S. ovata*** subsp. ***ovata***
7b. Gynophore glabrous only at the base, otherwise hirsute. Flowers in terminal panicles about 12-35 cm long, or in axillary racemes longer than 12 cm ……..…..... 7. ***S. ovata*** subsp. ***fasciculata***
8a. Gynophore glabrous ……..…..…..…….. 9
8b. Gynophore hairy ……..……..……..... 10
9a. Inflorescences terminal. ……..…… 8. ***S. scortechinii***
9b. Inflorescences axillary. ……..…… 9. ***S. hookeri***
10a. Ovary glabrous ……...……..…..…… 10. ***S. obtusifolia***
10b.Ovary hairy …… 11. ***S. scandens***

***Specimens of S. philippinensis examined*: Phillippines.** Luzon, Laguna, 1841, *H. Cuming 541* (BM, G, K, L).

***Specimens of S. suaveolens examined*: China.** Yunnan: Xishuangbanna, 2 June 1980, *K. S. Chow et al. 80132* (PE), Jinghong City, 29 July 1977, *Tao G. D. 16457* (HITBC), Luchun County, 22 June 1974, *Luchun Exped. 1104* (HITBC), Mengla County, 21 April 1960, *Li Y.H. 1831* (HITBC), Mengla County, 10 May 1960, *Li Y. H. 1980* (HITBC), Hekou County, 22 April 1940, *Zhang H. D. 1103* (IBSC). **Hainan:** Baoting County, 26 May 1935, *Hou K. Z. 72594* (IBSC), Changjiang County, 24 April 1989, *Li Z.X. et al. 6088* (IBSC). **Guangxi:** Napo County, 15 April 1998, *Qing H. N. et al. 763* (PE), Napo County, 24 June 2010, *Huang Y. F. et al. 446* (GXMG). **Vietnam:** Saigon, July 1872, *Pierre 4021*(K). **Bangladesh:** Sillet, *Wallich, N. 4200a* (M). **India:** Calcutta, *Wallich, N. 4200b* (M).

***Specimens of S. ovata subsp. fasciculata examined*: China.** Yunnan: Hekou, 5, Arpil, 1997, *Yang Z.G. 008* (KUN), Jinping, 1999, *Huai H. Y. T 05* (KUN). **Laos.** *Callatly 499*(CAL, DD). **Vietnam.** Hanoï, 1, January, 1891, *Balansa, B. 4711* (P). Cochinchina, 24, March, 1877, *Pierre, L. 4023* (G, K, L, P). Tonkin, 15, June, 1886, *Balansa, B. 4073*(K, L, G).

***Specimens of S. scandens examined*: China.** Yunnan: Hekou, 5, April, 2000, *Shui Y.M. et al. 12443* (KUN). **Vietnam.** Cochinchina, without collection date, *Harmand 4021* (K, P). **Myanmar.** Without detailed location, without collection date, *Griffith 175* (L, K, P). Sagaing, 25, October, 2014, *Yin H. S. B. et al. 007* (NY).

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