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Notes on *Smilax bockii* and *S. seisuiensis* (Smilacaceae), two newly recorded species from Laos and Thailand

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ABSTRACT

Smilax bockii is proposed as an accepted name, and *S. septemnervia* is treated as a new synonym of *S. seisuiensis*. *Smilax bockii* and *S. seisuiensis* are reported as new records from Laos and Thailand, respectively. The lectotypes of *S. bockii* and *S. stemonifolia* are designated. Detailed descriptions, taxonomic notes, photographs and a distribution map are provided.

KEYWORDS: accepted name, Southeast Asia, synonym, taxonomy.

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INTRODUCTION

Smilacaceae is a family of dioecious climbing plants mainly distributed in tropical and subtropical regions; it has approximately 262 accepted species. Ten genera have previously been enumerated for this family viz. *Aniketon* Raf. *Coprosmanthus* (Torr.) Kunth, *Dilax* Raf., *Heterosmilax* Kunth, *Nemexia* Raf., *Oligosmilax* Seem., *Parillax* Raf., *Pleiosmilax* Seem., *Pseudosmilax* Hayata and *Smilax* L. (Judd *et al.*, 2016; Christenhusz *et al.*, 2017; POWO, 2022). Most species are highly variable in leaf shape and size, and floral characters were mainly used for generic delimitation (Koyama, 1975). However, new molecular data and molecular phylogenies and re-consideration of the variation in floral structures (Cameron & Fu, 2006; Chen *et al.* 2006; Qi *et al.* 2013a) have led to all genera being synonymized under *Smilax*. At lower taxonomic ranks, there are additional difficulties in delimiting species which necessarily depends on a combination of small structures such as prophyll, perianth segment, staminal filament and anther. Moreover, due to the complex patterns of variation can be geographically correlated, and also through the misapplication of names. Consequently, there has been confusion over the identification and nomenclature of various complex species.

During preparation of the account of the Smilacaceae for the mainland Southeast Asia, we found that *Smilax bockii* Warb. was originally described from specimens that have a completely connate perianth, and that it was treated as a synonym of *Heterosmilax japonica* Kunth (Koyama, 1984; Noltie, 1994; Songyun & Koyama, 2000). However, *S. bockii* is the earliest legitimate name when this taxon is transferred to *Smilax*. *Smilax septemnervia* F.T.Wang & Tang supposedly differs from *S. seisuiensis* (Hayata) P.Li & C.X.Fu in its male perianth length (Koyama, 1984), but the study of Thai specimens illustrates that there is continuous variation in perianth length. Therefore, *S. septemnervia* is conspecific with *S. seisuiensis*. *Smilax bockii* and *S. seisuiensis* are new records from Laos and Thailand, respectively. The specimens examined including types, and the lectotypes of *S. bockii* and *S. stemonifolia* H.Lév. & Vaniot are proposed. Morphological descriptions and comparisons with allied species are provided, as well as photographs and a distribution map (Fig. 1).

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MATERIALS & METHODS

Herbarium specimens, including types, from BK, BKF, E, K, KKU, L, P and TI were examined. The type specimens from B, NYBG and O were observed by means of high-resolution images provided on the JSTOR and GBIF websites. Herbarium acronyms follow Thiers (2021, continuously updated). Comprehensive field observations in Thailand were also made. Taxonomic studies of the family Smilacaceae of various countries in Asia were consulted including, Bhutan (Rae, 1994), Cambodia, Laos and Vietnam (Koyama, 1983), China (Songyun & Koyama, 2000), Hong Kong (Koyama, 2000), India (Hooker, 1892), Laos (Newman *et al.* 2007 & 2017), Taiwan (Koyama, 1978) and Thailand (Koyama, 1975; Kladwong *et al.* 2018a, b; Kladwong & Chantaranothai, 2020). Morphological descriptions were prepared based on specimen observations. The distribution and habitat were recorded from the specimen labels and field observations.

TAXONOMIC TREATMENT

Smilax bockii Warb. in Diels, Bot. Jahrb. Syst. 29(2): 259. 1900. Type: China. Sichuan [Sze ch'uan], Nanchuan [Nan ch'uan], 1891, ♂, *Bock & von Rosthorn 2375* (lectotype **B** [B100366406!], designated here). Figs. 2, 3A & 4A.

— *Heterosmilax arisanensis* Hayata, Icon. Pl. Formosan. 5: 235. 1915. Type: Taiwan. Mt Alishan [Arisan], Taroyen, 1914, ♂, *Hayata & Ito s.n.* (holotype **TI**!).

— *Heterosmilax indica* A.DC., Monogr. Phan. 1: 43. 1878. Type: India. Assam, ♂, *Hook.f. & Thomson 77* (lectotype **K** [K000820620!], designated by Koyama, 1984).

— *Heterosmilax raishaensis* Hayata, Icon. Pl. Formosan. 9: 138. 1920. Type: Taiwan. Raisha, ♂, *Matucla s.n.* (holotype **TI**!).

— *Heterosmilax tsaii* F.T.Wang & Tang, Bull. Fan Mem. Inst. Biol. Bot. 7: 87. 1936. Type: China. Yunnan, *Tsai 60416* (holotype **PE** fide Koyama, 1984).

— *Smilax japonica* (Kunth) P.Li & C.X.Fu, Phytotaxa 117(2): 58. 2013, non *S. japonica* (Kunth) A.Gray.— *S. goeringii* Kladwong, Chantar. & D.A.Simpson, Thai Forest Bull., Bot. 46(1): 51. 2018.— *Heterosmilax japonica* Kunth, Enum. Pl. 5: 270. 1850. Type: Japan. Nagasaki, ♀, *Goering s.n.* (holotype **L** fide Koyama, 1984).

— *Smilax planipeduncula* Hayata, J. Coll. Sci. Univ. Tokyo 36: 361. 1911. Type: Taiwan. Kurarusha, 1906, ♀, *Nakahara 877* (holotype **TI**! [without barcode]).

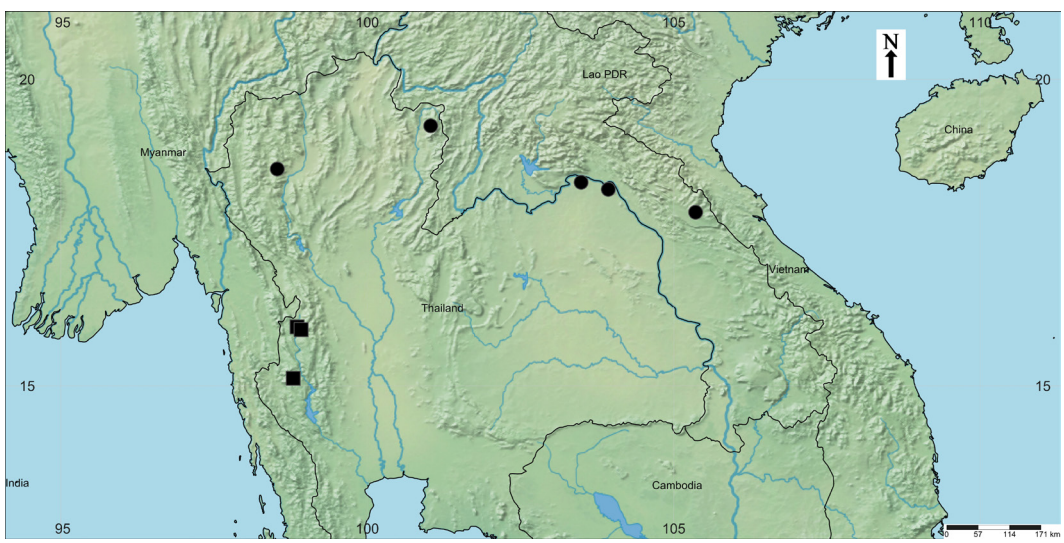

Figure 1. Distribution of *Smilax bockii* Warb. (●) and *S. seisuiensis* (Hayata) P.Li & C.X.Fu (■) in the Mainland Southeast Asia.

— *Smilax stemonifolia* H.Lév. & Vaniot in Léveillé, Liliac. & C. Chine: 28. 1905. Type: China. Hong Kong, 14 Aug. 1894, *Bodinier 804* (lectotype **E** [E00327122!], designated here; isolectotypes **E** [E00327123!], **P** [P00686873!]).

Climber, stem and branches slender, terete, smooth. *Petiole* 1−4 cm long; sheath narrow, 4−7 × ca 1 mm. *Tendrils* up to 10 cm long, slender. *Leaf-blade* broadly ovate to ovate-lanceolate or lanceolate-oblong, (3−)6−15(−22) × 1.5−7 cm, base cordate or rounded to rounded-truncate or cuneate, apex narrowly acute to acuminate; main veins (3−)5−7, prominent beneath, separating at lamina base; lateral veinlets very slender, coriaceous or chartaceous to membranous. *Inflorescence* a single umbel, 5−30 (−40)-flowered; prophyll absent; peduncles of umbels slightly compressed or flattened, 2−8 cm long; receptacles globose or subglobose, 2−4 × 2−4.5 mm; bracteoles ovate, 1−1.5 × 0.6−0.8 mm; pedicels 1−4 cm long. *Tepals* connate into a bottle-shaped structure, 3-toothed at apex. *Male flower*: perianth obovoid or obovoid-ellipsoid shaped, 2−6.5 × 1.5−3.5 mm; apex open with 3 teeth, acute. *Stamens* 3−4; filaments 1.2−4 mm long, connate forming a column at base; anthers ovate or elliptic-oblong, 0.3−0.5 mm long, yellowish. *Female flower*: perianth globose or ovoid-globose shaped, 2−3.5 × 2−3 mm; apex open with 3 teeth, acute; ovary ovoid-globose; style short, ca 0.2 mm long; stigmas ca 1.8 mm long; staminodes 3, 1−2 mm long, needle-like. *Berry* globose or sub-globose, whitish green, 6−15 mm in diameter, with 1−6 seeds.

Thailand.— NORTHERN: Chiang Mai [Chom Thong, Ban Mae Klang Luang, 900 m alt., 30 May 1979, ♂, *Vidal et al. 1683* (**BKF**, **P**)]; Nan [Doi Phu Kha, Sapan Waterfall, 25 Oct. 2014, ♀, *Kladwong s.n.* (**KKU**)]; NORTH-EASTERN: Bueng Kan [Chanan Waterfall, 14 Sept. 2017, ♂, *Kladwong 406* (**KKU**); Ho Kham Community Forest, Pak Khat-Bueng Kan, 150 m alt., 4 May 2002, ♂, *Pooma et al. 3475* (**BKF**)].

Laos.— Khammouan [Vicinity of Ban Mak Pheuang, 13 Feb. 2005, *Newman et al. LAO 162* (**E**)].

Distribution.— India, Bhutan, China, Taiwan, Japan.

Note.— *Smilax bockii* is similar to *S. paniculata* (Gagnep.) P.Li & C.X.Fu and *S. pertenuis* T.Koyama in having three stamens, and the filaments connate at the base. However, it is distinguished based on an obovoid or obovoid-ellipsoid perianth vs ovoid-ellipsoid in *S. paniculata* and clavate in *S. pertenuis*. Furthermore, the filaments of *S. bockii* is 1.2−4 mm long vs 0.7−1 mm long in *S. paniculata* and 2−4.5 mm long in *S. pertenuis*. The anther of *S. bockii* is ovate or elliptic-oblong, 0.3−0.5 mm long vs ovate, 1.5 mm long in *S. paniculata* and ovate, ca 1 mm long in *S. pertenuis*.

Smilax bockii was validly published in Die Flora von Central-China by Warburg (1900). In the protologue, sepals and petals of this species are oblong, as well as having short filaments and oblong anthers. However, a careful investigation of the type specimens and additional specimens from Thailand and Laos indicated that this species has connate perianth and forming ellipsoid in shape. The stamens are 3 or 4. The filaments are connate at the base and the anthers are ovate or elliptic-oblong. These characters are conspecific with *Heterosmilax japonica*, which is consistent with the treatments of Noltie (1994) and Songyun & Koyama (2000).

According to the current generic concept, *Heterosmilax* is now united with *Smilax*. *Smilax japonica* (Kunth) P.Li & C.X.Fu was proposed as a new combination based on *H. japonica* (Qi *et al.*, 2013b), but the name is illegitimate because it is a later homonym of *S. japonica* (Kunth) A.Gray (Gray, 1856); therefore, *S. goeringii* Kladwong, Chantar. & D.A.Simpson was proposed as the replacement name of this taxon (Kladwong *et al.*, 2018b). Later, we found that *S. bockii* is the earliest legitimate name, and it has priority according to Art. 11.4 (Turland *et al.*, 2018).

The original protologue of *Smilax bockii* was based on two syntypes, *Bock & von Rosthorn 2375* at **B** [B100366406] and *2408* at **O** [V-2014850] (University of Oslo, 2022). These specimens have original annotations by Warburg as "*Smilax bockii* Warb." and fit the description in the protologue. However, *Bock & von Rosthorn 2375* deposited at **B** [B100366406] has more leaves and inflorescences. Therefore, we selected this specimen as the lectotype of this species.

The protologue of *Smilax stemonifolia* was based on *Bodinier 804* (Léveillé, 1905). On examination, we found that this collection has three duplicates, with one specimen in **P** [P00686873] and two specimens in **E** [E00327122 & E00327123]. All

Figure 2. Lectotype of *Smilax bockii* Warb. Image © Botanic Garden and Botanical Museum Berlin. [https://herbarium.bgbm.org/object/B100366406, image ID: 312143]

specimens have stems and leaves but lack reproductive structures. Not only there is no specimen designated as the holotype, but also no evidence to suggest that the material in **P** had not been seen by Léveillé and Vaniot. Therefore, we select sheet E00327122 at **E** as the lectotype for *S. stemonifolia* because Léveillé's main herbarium, which was acquired by George Forrest, is in **E** (Chaudhri *et al.*, 1972). Moreover, this specimen has the original label as "*Smilax stemonifolia sp. nov.*". The other specimens at **E** and **P** are isolectotypes.

Smilax bockii was formerly known in central China and is now known to occur in other areas where its synonyms are recorded such as India, Bhutan, Taiwan, Japan and Thailand. Moreover, this species is newly recorded from Laos where it grows near riverbanks and cultivated fields.

Smilax seisuiensis (Hayata) P.Li & C.X.Fu, Phytotaxa 117(2): 59. 2013.— *Heterosmilax seisuiensis* (Hayata) F.T.Wang & Tang, Sinensia 5: 427. 1934. — *Pseudosmilax seisuiensis* Hayata, Icon. Pl. Formosan. 9: 125. 1920. Type: Taiwan. Taitung, 1917, ♂, *Ito s.n.* (holotype **TI**! [without barcode]). Figs. 3B & 4B.

— *Smilax septemnervia* (F.T.Wang & Tang) P.Li & C.X.Fu, Phytotaxa 117(2): 59. 2013.— *Heterosmilax septemnervia* F.T.Wang & Tang, Sinensia 5: 428. 1934. Type: China. Guizhou, Kweiting, Yun-fo-shan, near Pinfa, 3 July 1930, ♂, *Tsiang 5570* (lectotype **PE** [PE00035741, image seen] designated by Koyama (1984); isolectotype **NYBG** [NY00319979, image seen]), **syn. nov.**

— *Heterosmilax hogoensis* (Hayata) T.Koyama, Quart. J. Taiwan Mus. 10: 219. 1957.— *Pseudosmilax hogoensis* Hayata, Icon. Pl. Formosan. 9: 125. 1920. Type: Taiwan. Hogo, 1916, ♂, *Hayata s.n.* (holotype **TI**! [without barcode]).

Climber, stem and branches slender, terete, glabrous. *Petioles* 1−3 cm long, subterete, ridged at abaxial surface; sheath narrow, 3−7 × ca 1 mm. *Tendrils* 1−12 cm long, slender. *Leaf-blade* broadly ovate or ovate to ovate-lanceolate, 5−15 × 2−6 cm, chartaceous to coriaceous, base rounded or truncate, apex acute or acuminate; main veins (3−)5−7, prominent on both surfaces, separating at lamina base; lateral veinlets very slender. *Inflorescences* of a single umbel, with 11−40 flowers; prophyll absent; peduncles of umbels terete or flattened, 0.3−7 cm long; receptacles globose, 2−4 mm in diameter; bracteoles ovate, 0.2−0.3 × 0.1−0.5 mm; pedicels 0.6−1.5 cm long. *Tepals* connate into a bottle-shaped structure, 3-toothed at apex. *Male flowers*: perianth broadly ellipsoid or narrowly ellipsoid, 2.5−8 × 2−3.5 mm; apex open with 3 teeth, acute. *Stamens* (7−)8−9(−10); filaments 2−4.5 mm long, connate forming a column variable in length from base to more than halfway up, upper part free; anthers elliptic to elliptic-lanceolate, 1.5−2 mm long, whitish. *Female flower*: perianth ovoid-globose shaped, 3−5 × 2.5−3.5 mm; apex open with 3 teeth, acute; ovary ovoid-globose; style short; staminodes 3−6, needle-like. *Berry* globose or subglobose, greenish, 7−13 mm in diameter, with 1−4 seeds.

Thailand.— NORTHERN: Tak [Doi Hua Mot, 850 m alt., 26 May 2008, ♂, *Pooma et al. 6944* (**BKF**, **E**, **L**); ibid, 19 Nov. 2015, ♀, *Kladwong 324* (**KKU**); 1 Dec. 2018, *Kladwong 443* (**KKU**); Thi Lo Su Waterfall, 20 Nov. 2015, ♀, *Kladwong 326* (**KKU**)]; SOUTH-WESTERN: Kanchanaburi [Ta Mong Lai, ♂, 9 Apr. 1965, *Chantanamuke 1012* (**BK**)].

Distribution.— China, Taiwan, Vietnam.

Note.— *Smilax seisuiensis* superficially resembles *S. binchuanensis* P.Li & C.X.Fu in having an ovate or broadly ovate lamina and ellipsoid perianth, but the filaments of *S. seisuiensis* are fused from the base to halfway or more than halfway of its length, leaving the upper part free vs entirely fused and forming a column in *S. binchuanensis*.

In the protologue, *Smilax septemnervia* (previously *Heterosmilax septemnervia*) as reflected in the specific epithet, differs from *S. seisuiensis* (previously *H. seisuiensis*) based on it having seven main veins in the leaf. In addition, this species is also distinguished from *S. seisuiensis* in having shorter peduncle, less than 5 cm long as well as the filaments are connate more than halfway up from the base (Wang & Tang, 1934). However, Koyama (1984, still placing the species within *Heterosmilax*) proposed that the difference between them is only the length of staminate perianth which is 5.7−7.2 mm long in *H. septemnervia* vs 2.5−3 mm long in *H. seisuiensis*. In the Flora of China, Songyun & Koyama (2000) indicated that the staminate perianth of *H. septemnervia* is 4–8 mm long. Moreover, Hsu *et al.* (2011) reported that the length of the perianth of *H. septemnervia* is ca 9.4 mm long.

Figure 3. Photograph of dried specimens: A. *Smilax bockii* Warb. from **BKF**; B. *S. seisuiensis* (Hayata) P.Li & C.X.Fu. from **BK**.

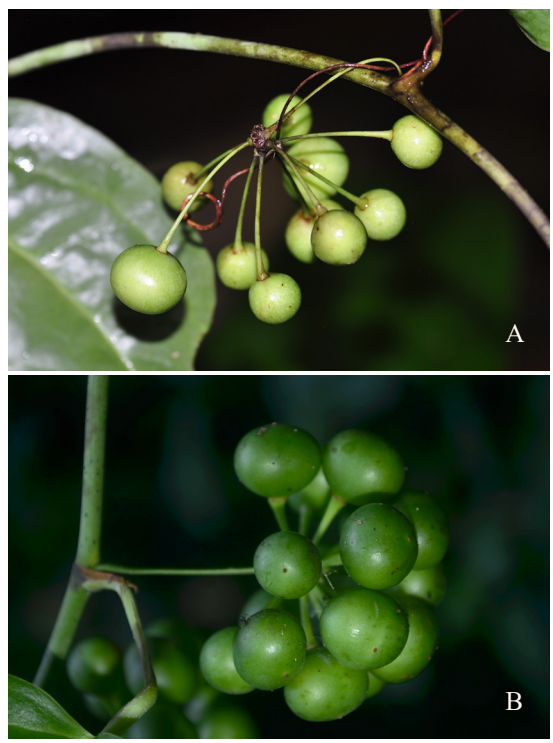

Figure 4. Photographs of infructescences: A. *Smilax bockii* Warb.; B. *S. seisuiensis* (Hayata) P.Li & C.X.Fu. Photographs: A. by P. Sutthisaksopon; B. by S. Mattapha.

Examination of the specimens from Thailand, showed that the specimens have broadly ovate or ovate to ovate-lanceolate laminas with 5−7 main veins. Moreover, the staminate perianth is 2.5−5.5 mm long, and the number of stamens is 8−9 or rarely 7 or 10 according to Songyun & Koyama (2000). Indeed, the filaments are 2−2.5 mm long, connate from base to more than halfway up its length. After comparing the type specimens and the previous descriptions of *Smilax septemnervia* and *S. seisuiensis*, we found that the length of the staminate perianth of specimens from Thailand indicates continuous variation of this character with intermediates found between *S. septemnervia* and *S. seisuiensis*. Therefore, we conclude that *S. septemnervia* and *S. seisuiensis* should be reduced to a single taxon. *Smilax seisuiensis* has priority because it is the earliest legitimate name according to Art. 11.4 (Turland *et al.*, 2018), and *S. septemnervia* is now united with *S. seisuiensis*.

Smilax seisuiensis was formerly considered endemic to Taiwan but is now known to occur in China. Moreover, it is a new record from the Northern and South-Western floristic regions of Thailand where it grows in mixed deciduous and open scrub forests on limestone mountains.

Ta Mong Lai, a locality in Kanchanaburi [Kanburi] province recorded in *Chantanamuke 1012*, is an old name for the area of Tham Sua near Thi Kong Ranger Station in Thung Yai Naresuan Wildlife Sanctuary.

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