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Three new species, lectotypifications and synonymisations in *Millettia* (Fabaceae: Faboideae) for Thailand

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ABSTRACT

During preparation of the account of the genus *Millettia* (Fabaceae: Faboideae) for the Flora of Thailand, some new field collections and specimens from herbaria were found to represent three new species, and here they are described and illustrated with a distribution map. Lectotypes of *Millettia* names are designated for nine species, five new synonyms of *Millettia* are proposed and *Millettia tecta* is raised to species status.

KEYWORDS: Generic circumscription, Leguminosae, Millettieae, taxonomy.

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INTRODUCTION

The genus *Millettia* Wight & Arn. belongs to the tribe Millettieae *sensu* Geesink (1984), a tribe known to be not only particularly complicated taxonomically, but polyphyletic in the family Fabaceae (Doyle *et al.*, 1997, 2000; Hu, 2000; Hu *et al.*, 2000, 2002; Kajita *et al.*, 2001; Wojciechowski *et al.*, 2004). It was first described by Wight and Arnott (1834) based on two species, *M. rubiginosa* Wight & Arn. and *M. splendens* Wight & Arn. The genus comprises approximately 150 tropical species (Schrire, 2005). Recent molecular studies have shown that the circumscription of *Millettia* is confused, with other larger and smaller genera in the tribe Millettieae *sensu* Geesink (1984) nested within it (Käss & Wink, 1995, 1996; Doyle *et al.*, 1997, 2000; Hu 2000; Hu *et al.*, 2000, 2002; Kajita *et al.*, 2001; Wojciechowski *et al.*, 2004). These publications suggest the necessity for a re-consideration of the generic circumscriptions in this tribe, including *Millettia*. To date, phylogenetic relationships of *Millettia* and several other genera within the tribe Millettieae remain poorly understood and the genus *Millettia* itself shares several important characters with other closely related genera within the tribe (Hu *et al.*, 2000). Recently, Schrire (2005) has also suggested that the circumscription of a revised tribe is impossible unless the genera within the tribe are more comprehensively sampled in phylogenetic studies.

Working within the current generic framework (Dunn, 1912) for the Flora of Thailand, we describe three new species under the broad generic circumscription of the genus *Millettia* (*sensu* Geesink, 1984). Additionally, we present new synonymies, lectotypifications and a new status.

NEW SPECIES

1. Millettia phuwuaensis Mattapha & Suddee, **sp. nov.**

This species is similar to *Millettia penicillata* Gagnep. in having distinct red lines on the outer

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surface of the standard, but differs in its fewer leaflets (5–7 vs 9–17 in *M. penicillata*), shorter pseudoracemes or pseudopanicles (up to 10 cm long vs 8–28 cm in *M. penicillata*), monadelphous stamens (vs diadelphous stamens in *M. penicillata*) and a tubular disk (vs disk absent in *M. penicillata*). Type: Thailand, Bueng Kan Prov., Tham Phun waterfall, ca 300 m alt., deciduous and bamboo forests, 21 Oct. 2015, 141 m, 18°1559.2 N 103°54 13.3 E, *Mattapha, Suddee & BKF staff 1127* (holotype **BKF!**; isotypes **BK!**, **K!**, **KKU!**, **L!**, **P!**, **QBG!**). Fig. 1.

Climber, slender; young branches, inflorescences and fruits densely hairy with ferruginous hairs. *Leaves* imparipinnate, spiral; stipules ovate, 1–2 × ca 1 mm long, caducous, hairy; petioles 6–9 cm long, densely hairy; rachis 2–6 cm long, shallowly grooved above, hairy, ultrajugal part absent. *Leaflets* 5–7, opposite; stipels setaceous, 2–6 mm long, glabrous, persistent; petiolules 3–5 mm long; lamina elliptic, 8–22 × 3–7 cm, apex acute to caudate, base cuneate, margin entire, both surfaces sparsely hairy, moderately hairy along the midrib; lateral veins 10–18 pairs, raised below, terminal leaflet equal to lateral leaflets. *Pseudoracemes* up to 10 cm long or intermediate forms with pseudopanicles, axillary or inserted on old branches. *Brachyblasts* present, bearing 5–10 flowers; bracts of brachyblasts ovate, ca 1 × 0.5 mm, apex acute, margin hairy, outside glabrous, inside densely hairy with puberulent hairs, caducous; bracts of flowers similar to bracts of brachyblasts but smaller; bracteoles inserted at calyx base, similar to floral bracts but slightly smaller. *Pedicels* ca 4 mm long, puberulent. *Calyx* cup-shaped: tube ca 3 mm long, reddish to dark red; lobes triangular, minute, apex acute, margin entire, outside puberulent, inside glabrous. *Corolla* pinkish to pale purple; standard narrowly obovate, 14–15 × 12–13 mm, claw ca 2 mm long, apex retuse, base tapering to the claw, with basal callosities, margin entire, outside with scattered reddish lines, striate, puberulent in upper half, inside glabrous; wings more or less triangular, 9–10 × ca 4 mm, claw 3–4 mm long, base truncate, apex rounded, margin entire, both sides glabrous, sculptured outside and dilated near base; keel falcate, 8–9 × ca 4 mm, claw ca 5 mm long, apex rounded, margin entire, outside puberulent at apex, inside glabrous, dilated. *Stamens* monadelphous, with basal fenestrae, ca 2 mm long, glabrous; staminal tube 9–10 mm long; filaments 2–3 mm long; anthers oblong, ca 1 × 0.5 mm. *Disk* tubular, ca 1 mm long, not lobed. *Ovary* densely hairy, 7–8 mm long, 1- or 2-ovuled; style 3–4 mm long, hairy at base. *Fruits* elliptic to oblong, woody, dehiscent, 4–5 × 2–2.5 cm. *Seeds* 1 (or 2), orbicular, ca 2 × 2 cm.

Thailand.— NORTH-EASTERN: Bueng Kan [Tham Phun waterfall, 21 Oct. 2015, *Mattapha et al. 1127* (**BK**, **BKF**, **K**, **KKU**, **L**, **P**, **QBG**)].

Distribution.— Only known from the type locality (Fig. 5, closed square).

Ecology.— Deciduous and bamboo forests, ca 300 m alt. Flowering October–November; fruiting December–January.

Vernacular.— Phan na rai phu wua (พรรณรายภูวัว).

Etymology.— The specific epithet refers to the type locality.

Conservation status.— Assessed using GeoCat (Bachman *et al.*, 2011), this taxon is Critically Endangered (CR), because its estimated Area of Occupancy (AOO) is <1 km^2 and its Extent of Occurrence (EOO) is 4 km^2. This is insufficient information to warrant formal designation, as only a single location is known so far. A further assessment, following the gathering of more distribution data, should be carried out.

Notes.— *Millettia phuwuaensis* has distinctive red lines and dense puberulent hairs on the outer surface of the standard. The reddish lines look superficially similar to those of *M. penicillata* but are thicker and more unevenly scattered (vs parallel in *M. penicillata*). Additionally, *Millettia phuwuaensis* is recognised by its narrowly obovate and larger standard petal (14–15 × 12–13 mm vs orbicular and 8–9 × 9–10 mm in *M. penicillata*).

2. Millettia pyrrhocarpa Mattapha, Forest & Hawkins, **sp. nov.**

This species is similar to *Millettia sericea* (Vent.) Wight & Arn. ex Hassk., in having ferruginous hairs on the exocarp surface of the fruits, but differs in its caudate leaflet apices (rather than the acute or retuse apices in *M. sericea*). The lower leaf surface is densely hairy along the midrib, but otherwise glabrous (vs densely sericeous throughtout in *M. sericea*), the standard petal has basal callosities tapering into the claw (vs basal callosities absent in

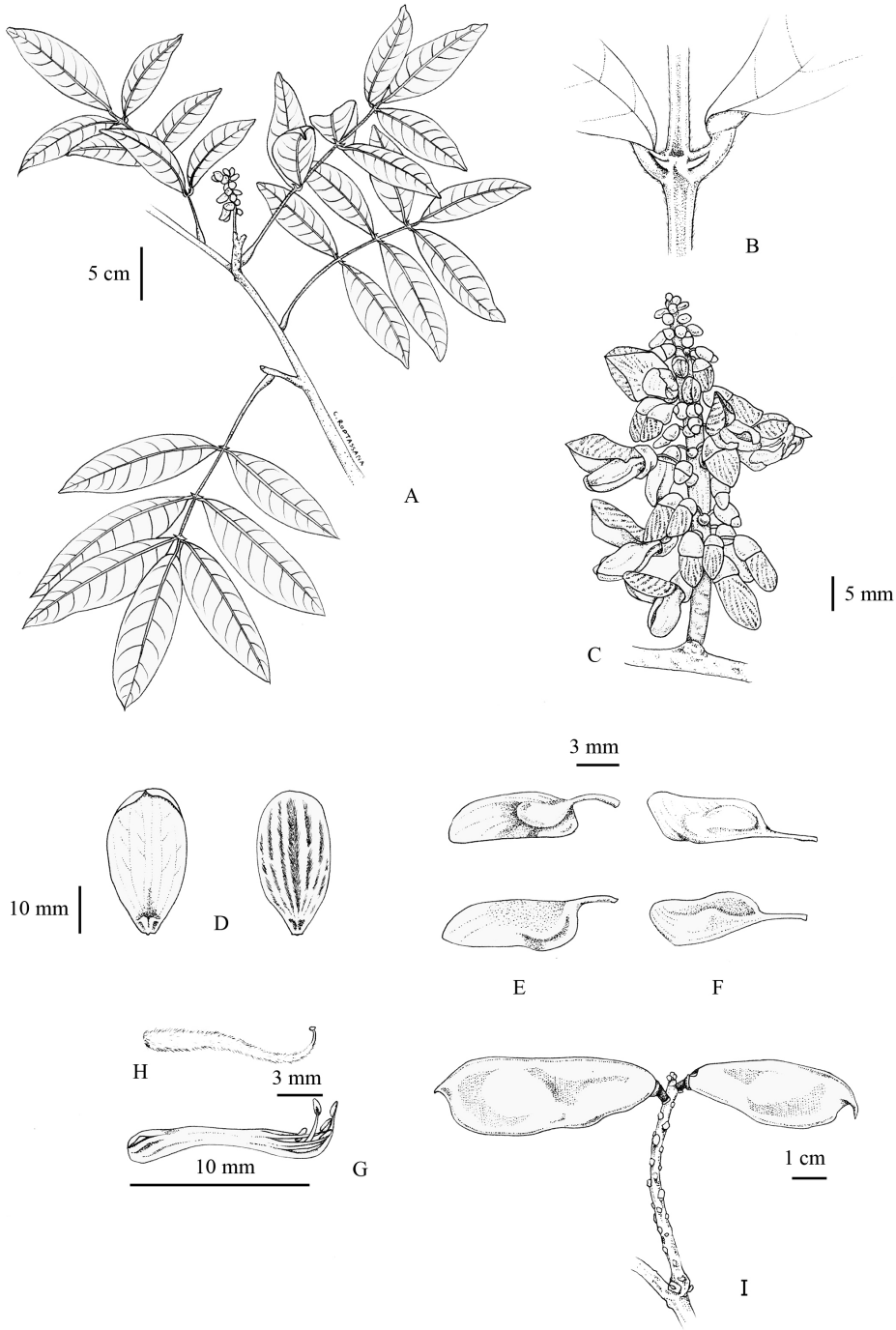

Figure 1. *Millettia phuwuaensis*: A. Leaves and inflorescence; B. Stipels; C. Inflorescence; D. Standard petals showing inside (left) and outside (right); E. Wing petals; F. Keel petals; G. Stamens; H. Ovary; I. Fruits (drawn from *Mattapha et al. 1127*). Illustrations by Chadtip Rodtassana.

M. sericea), and brachyblasts carry ca 3 flowers (vs 10 or more in *M. sericea*). Type: Thailand, Nakhon Nayok Prov., Mueang district, Hin Tang subdistrict, Khao Yai National Park, Nang Rong waterfall, 6 Apr. 2018, ca 100 m alt., 14°19'44.4"N 101°19'07.0"E, *Mattapha 1139B* (holotype **BKF!**; isotypes **BK!**, **K!**, **KKU!**, **L!**, **P!**, **QBG!**). Figs. 2 & 4 (A–B).

Woody climber; young twigs glabrous, lenticellate, indumentum of ferruginous hairs scattered throughout. *Leaves* imparipinnate, usually fasicled on terminal branches; petioles 5–7 cm long, glabrous; stipules triangular; rachis 8–10 cm long, shallowly grooved above, ultrajugal part 5–9 mm long. *Leaflets* ca 11, opposite; petiolules 4–5 mm long; lamina ovate, obovate or slightly oblong, terminal leaflet equal to lateral leaflets, 6–7 × 2–2.5 cm, paperaceous, apex caudate, base rounded to emarginate, margin entire, upper surface glabrous, sparsely hairy along midrib, lower surface glabrous, densely hairy along midrib; lateral veins 10–12 pairs, indistinct; stipels absent. *Inflorescences* pseudoracemes, axillary, up to 12 cm long, densely hairy with ferruginous hairs. *Brachyblasts* wart-like, 2–3 mm long, bearing ca 3 flowers; bracts of inflorescence axes similar to stipules; bracts of flowers broadly ovate, ca 1 × 1 mm, apex acute, margin hairy, outside densely hairy, inside glabrous; bracteoles similar to flower bracts, inserted at base of calyx tube. *Pedicels* 1.5–2 mm long, densely hairy. *Calyx* cup-shaped; tube 2–2.5 mm long, light red to pink; lobes minute, almost truncate, sometimes invisible, margin hairy, outside densely hairy, inside glabrous. *Corolla* pink; standard obovate with basal callosities tapering to the claw, 8–9 × 8–9 mm, claw ca 2 mm long, apex emarginate, base not auriculate, margin entire, both sides glabrous; wings slightly falcate, 6–7 × ca 2.5 mm, claw ca 2.5 mm long, base auriculate, ca 0.5 mm long, apex acute, base broader than apex, margin entire, outside sparsely hairy, inside glabrous; keel oblong to falcate, 5–6 × ca 2.5 mm, claw ca 3 mm long, apex rounded, base truncate, margin entire, outside hairy at apex, elsewhere glabrous, inside glabrous, lateral pocket ca 3 × 2 mm. *Stamens* diadelphous, glabrous; staminal tube 5–6 mm long; filaments 1–1.5 mm long; anthers ca 0.7 × 0.1 mm. *Disk* absent. *Ovary* densely hairy, ca 3.5 mm long, 2- or 3-ovuled; style 5–6 mm long, hairy at base, glabrous in upper part and stigma. *Fruits* strap-like, obovate, flattened, 6–8 × 2.5–3 cm, densely hairy with ferruginous hairs. *Seeds* 1–3, oblong, ca 1.4 × 1 cm.

Thailand.— CENTRAL: Nakhon Nayok [Mueang, Nang Rong waterfall, Khao Yai National Park, by the stream, 6 Apr. 2018, *Mattapha 1139B* (**AAU**, **BK**, **BKF**, **E**, **K**, **KKU**, **L**, **P**, **QBG**); ibid., 28 Oct. 2015, *Mattapha 1139A* (**BKF**, **KKU**); ibid, 4 Apr. 1972, *Maxwell 72-196* (**BK**, **BKF**, **L**); ibid., 13 May 1984, *Suvatabandhu s.n.* (**BK** SN210695)].

Distribution.— Only known from the type locality (Fig. 5, closed triangle).

Ecology.— Along waterfall, ca 100 alt. Flowering March–April; fruiting May–June.

Vernacular.— Nang rong (นางรอง).

Etymology.— The specific epithet refers to the densely ferruginous hairy fruits.

Conservation status.— Assessed using GeoCat (Bachman *et al.* 2011), its conservation status is Endangered (E), with an estimated EOO of ca 2,360 km^2 and an AOO of ca 20 km^2. We believe extant populations are abundant in the Khao Yai National Park. Further distribution information is needed for a formal designation.

Notes.— *Millettia pyrrhocarpa* was collected in the same locality by different collectors, but has remained unrecognised as a new species. We found it amongst unidentified collections with other unnamed *Millettia* specimens, therefore, only when we had identified flowering and fruiting material could we confirm that it was a new species based on the standard having basal callosities tapering into the claw, presence of ca 3 flowers on the brachyblasts and the fruits covered with densely ferruginous hairs. Because of the ferruginous indumentum on the fruits, the species was compared with the most similar species, *M. sericea*. It differs from *M. sericea* in its smaller and thinner leaflets lacking sericeous hairs on the lower surface, and smaller standard petals (8–9 × 8–9 mm vs 10–13 × 10–12 mm in *M. sericea*), lacking sericeous hairs on their outer surface (vs densely sericeous in *M. sericea*).

3. Millettia suddeei Mattapha & Tetsana, **sp. nov.**

This species resembles *Millettia puerarioides* Prain, but differs in having stipels (stipels absent in *M. puerarioides*), sparsely pubescent hairs on the

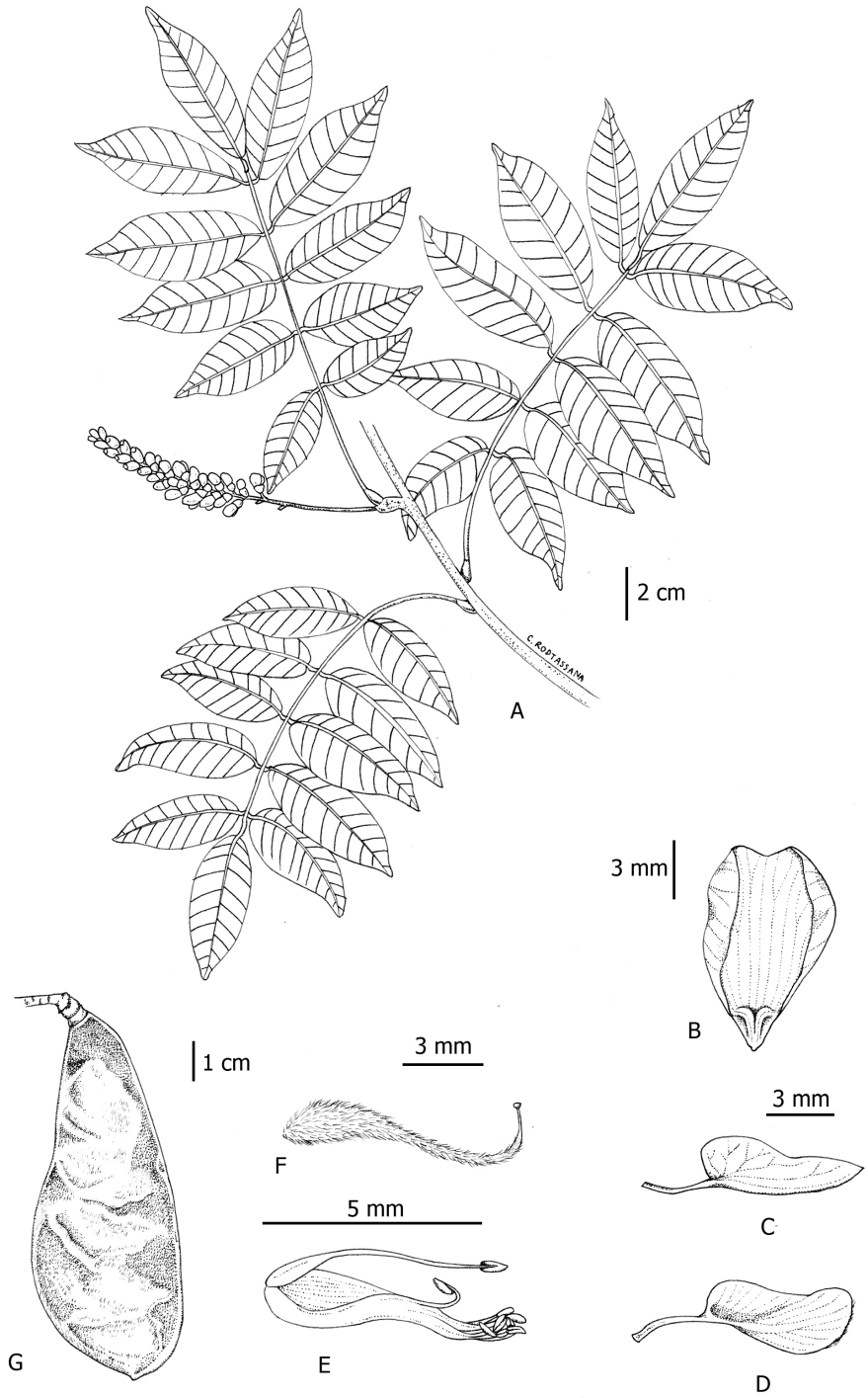

Figure 2. *Millettia pyrrhocarpa*: A. Leaves and inflorescence; B. Standard; C. Wing petal; D. Keel petal; E. Stamens; F. Ovary; G. Fruit (drawn from *Mattapha 1139B*). Illustrations by Chadtip Rodtassana.

lower surface of the leaflets (vs densely silky hairs in *M. puerarioides*), and diadelphous stamens (vs monadelphous in *M. puerarioides*). It is also characterized by having 7–9 leaflets (vs 5–7 in *M. puerarioides*), and a standard petal with pubescent hairs on the outer surface (vs densely silky hairs in *M. puerarioides*). Type: Thailand, Tak Prov., Umphang, Thung Yai Naresuan Wildlife Sanctuary East side, Ka Ngae Sot waterfall, dry evergreen forest along stream with limestone bedrock, 13 Apr. 2017, 760 m, 15°26′10″ N, 98°53′39″E, *Suddee, Tetsana & BKF staff 5206* (holotype **BKF!**; isotypes **BK!**, **BKF!**). Figs. 3–4 (C–E).

Woody climber; young twigs hairy. *Leaves* imparipinnate, spiral; petioles 7–10 cm long, red, hairy; stipules broadly ovate, ca 3 × 5 mm, outside hairy; rachis 7–15 cm long, shallowly grooved above, hairy, ultrajugal part up to 10–20 mm long. *Leaflets* 7–9, opposite; petiolules 5–7 mm long, hairy; lamina oblong to narrowly obovate, 6–15 × 3–6 cm, apex caudate, acumen 1–1.8 cm long, base rounded, margin entire, upper surface sparsely hairy along veins to glabrous, paperaceous; terminal leaflet equal to lateral ones or larger, obovate, lower surface sparsely pubescent; lateral veins 5–8 pairs; stipels setaceous, ca 2 mm long, hairy. *Inflorescences* pseudoracemose, axillary, 10–22 cm long, densely hairy. *Brachyblasts* wart-like, 0.5–1.5 mm diam, bearing 5–8 flowers; bracts ovate, ca 0.5 × 0.5 mm, apex acute, margin and outside densely hairy, inside glabrous; bracteoles similar to bracts, inserted at base of calyx tube. *Pedicels* 2–3 mm long, hairy. *Calyx* cup-shaped; tube ca 3 mm long, red; lobes minutely toothed, margin hairy, outside hairy, inside glabrous. *Corolla* purple with light purple lines; standard petal orbicular, 9–10 × 9–10 mm, claw ca 2 mm long, apex emarginate, base tapering into claw, without basal callosities, margin entire, outside hairy in upper part, glabrous in lower part, inside glabrous; wings triangular to oblong, 7–8 × ca 3 mm, claw ca 3 mm long, base truncate, apex acute, margin entire, both sides glabrous; keel almost falcate, 7–8 × ca 3 mm, claw ca 3.5 mm long, apex rounded, base rounded, margin entire, outside hairy, inside glabrous, lateral pocket (pouch) ca 3 × 2 mm. *Stamens* diadelphous, glabrous; staminal tube 7–8 mm long; filaments 2–2.5 mm long; anthers ca 0.8 × 0.3 mm. *Disk* absent. *Ovary* densely hairy, ca 7 mm long, 2- or 3-ovuled; style 3–3.5 mm long, hairy in lower half, glabrous in upper part. *Fruits* not seen.

Thailand.— NORTHERN: Tak Province [Umphang, Thung Yai Naresuan Wildlife Sanctuary East side, Ka Ngae Sot waterfall, dry evergreen forest along stream with limestone bedrock, 13 April 2017, *Suddee et al. 5206* (**BK**, **BKF**-2 sheets)].

Distribution.— Only known from the type locality (Fig. 5, closed circle).

Ecology.— Mixed deciduous forest, ca 760 m alt. Flowering March–April; possibly fruiting May–Jun.

Vernacular.— Phi lai somran (พิไลสมรัน).

Etymology.— The epithet refers to Dr. Somran Suddee, who first collected the species.

Conservation status.— Only known from the type locality. Re-asssesment of the species status is required when more distribution information is available.

Notes.— 1. We include this species in *Millettia*, despite the unavailability of fruits, because of the similarity of the available characters to a broad circumscription of this genus. The characters which indicate *Millettia* are: imparipinnate leaves, presence or absence of stipels, pseudoracemose inflorescences and flowers usually borne on brachyblasts or inflorescence nodes. The closely related genera, *Aganope* Miq., *Derris* Miq. *sensu stricto* and *Solori* Adans. (now *Brachypterum* (Wight & Arn.) Benth.) are morphologically distinct from *Millettia*, possessing a floral disk that is usually annular, finger-shaped or lobed tubular (Sirichamorn *et al.*, 2014). In constrast, floral disks found occasionally in *Millettia* species and, if present, tubular but not lobed. These characters are sufficient to incontrovertibly place this species in *Millettia sensu lato*, but pending a complete generic review, not *sensu stricto*. Characteristics of the fruit (presence or absence of a diagnostic wing) and molecular data may in future confirm or alter this classification.

2. *Millettia suddeei* has a caudate leaflet apex but not the very long caudate, sharp point found in *M. puerarioides*, the leaflet bases are rounded, compared to cuneate in *M. puerarioides*, and the shape of the leaflets is oblong to narrowly obovate but elliptic in *M. puerarioides*. *M. suddeei* has 2–3 ovules per ovary, compared to ± 5 in *M. puerarioides*. Other differences are described above.

Figure 3. *Millettia suddeei*: A. Leaves & Inflorescence; B. Component of the flowers, composed of standard (upper), wings (lateral) and keel petals (lower); C. Stamens (drawn from *Suddee et al. 5206*). Illustrations by Orathai Kerdkaew.

Figure 4. A–B: *Millettia pyrrhocarpa*: A. Inflorescence; B. Fruit. C–E: *M. suddeei*: C. Leaves and inflorescence; D. Part of the inflorescence; E. Papilionaceous flower (Right) and stamens (Left). Photos by Sawai Mattapha (A–B) & Naiyana Tetsana (C–E).

Figure 5. Distributions of *Millettia phuwuaensis* (closed square), *M. pyrrhocarpa* (closed triangle) and *M. suddeei* (closed circle). The map was created using QGIS version 2.14.1-Essen (QGIS Development Team, 2016).

LECTOTYPIFICATIONS

1. Millettia brandisiana Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 69. 1873. Type: Myanmar, Pegu, Yomah, 28 March 1871, *Kurz 2538* (lectotype **CAL** [CAL0000008168!], designated here; isolectotypes **K** [K000848699!], **K** [K000848700!], **CAL** [CAL0000008167!]).

— *Millettia laotica* Gagnep., Notul. Syst. (Paris) 2: 358. 1913. Type: Laos, Vientiane, *Thorel s.n.* (1866-68) (lectotype [first-step] designated by Lôc & Vidal (2001) **P** [P02141784!]; lectotype [second-step] **P** [P02141784!], designated here; isolectotypes **K** [K000848787!], **P** [P02141785!, P02141786!]).

— *Millettia venusta* Craib, Bull. Misc. Inform. Kew 1927(2): 59. 1927; **syn. nov.** Type: Thailand, Loei, ca 200 m alt. *Kerr 8787* (lectotype **K** [K000848782!], designated here; isolectotypes **BK!**, **BM** [000997278!], **K** [K000848783!], **NY** [NY00026407!], **P** [P02141874!], **TCD** [TCD0015726!]).

Notes.— 1. Craib (1927) distinguished *Millettia venusta* from *M. brandisiana* on its broad-based leaflets and ovary with sparsely pubescent hairs. After *M. venusta* was carefully examined, we found it appeared to be morphologically identical to *M. brandisiana* and the two are, therefore, considered conspecific.

2. For lectotypification of *M. brandisiana*, two sheets, **CAL** [CAL0000008167, CAL0000008168], are available. The latter sheet is more appropriate because it has leaflets and numerous flowers, whilst the first bears fewer leaflets and has fruits but no flowers.

3. Lôc & Vidal (2001) indicated that the holotype of *Millettia laotica* is deposited at **P**, but did not annonate "designated here" or use an equivalent phrase to identify the type. However, the sheet **P** [P02141784] has "holotype" written on the label, and **P** [P02141785, P02141786] are annotated as isotypes. Following Turland *et al.* (2018), Art. 9.17 [second-step], they are designated here as lectotypes.

4. We select sheet **K** [K000848782] as the lectotype for *M. venusta*, because it is the most complete specimen, with flowers and fruits.

5. The species is widely grown as an ornamental for providing shade in public parks, gardens and roadsides, etc. It is distinguished by having many (15–21), oblong to lanceolate leaflets and the presence of brachyblasts bearing 2–5 flowers.

2. Millettia extensa (Benth.) Baker in Hook.f., Fl. Brit. India 2(4): 109. 1876; Kurz, Forest Fl. Burma 1. 352. 1877; Dunn, J. Linn. Soc., Bot. 41: 182. 1912.— *Otosema extensa* Benth., Pl. Jungh. 2: 249. 1852.— *Pongamia extensa* Grah. in Wall., Cat. No. 5900 (K-W), **nom. nud.** Type: Burma [Myanmar], Moulmein [Mawlamyine], 1827, *Wallich s.n.* [Wall. Cat. No. 5900], lectotype **K** [K000848731!], designated by Dunn (1912); isolectotype **K-W** [K001122527!].

— *Millettia auriculata* Baker ex Brandis, For. Fl. Ind.: 138. 1874.

—*Millettia auriculata* Baker ex Brandis var. *extensa* (Benth.) Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 66(2): 363. 1897; Craib, Contrib. Fl. Siam, Dicot. 1: 55. 1912

— *Millettia auriculata* Baker ex Brandis f. *extensa* (Benth.) Dunn., J. Linn. Soc., Bot. 41: 183. 1912. Type: India, *Wallich s.n.* [Wall. Cat. No. 5892A],

lectotype **K-W** [first-step], designated by Dunn (1912); lectotype [second-step] **K-W** [K001122516!], designated here; isolectotypes **E** [E00301105!, E00301106!].

Notes.— 1. Dunn (1912) included *Millettia extensa* under *M. auriculata* and annotated the sheet [K000848731] at **K** as the type, in his revision which was made before 1st January 2001. This is regarded as Dunn's (1912) choice and is accepted as effective lectotypification.

2. In Dunn's (1912) revision, *Millettia auriculata* was accepted with two syntypes cited, Wall. Cat. No. 5892 and 5892A. Dunn (1912) indicated the latter as the type in the publication, but attached the type label onto the first sheet. The type designation by Dunn (1912) could be accepted as the first-step lectotype, so that Wall. Cat. No. 5892A would be the type, however, there are three sheets labelled Wall. Cat. No. 5892A, K001122516, E00301105 and E00301106, and none of them was annonated by him. Following, therefore, Turland *et al.* (2018), Art. 9.17, a second-step lectotype must be made and the first sheet, **K** [K001122516], is appropriate as the lectotype, because it has numerous leaflets and many flowers, while in comparison the other sheets have few leaflets and flowers.

3. *Millettia extensa* is easily recognized by its leaflets that vary considerably in size, (5–)15–22 × (2.5–)5–15 cm. Inflorescences are either pseudoracemose or pseudopaniculate and are present on terminal and old branches with the flowers arranged in fascicles. This species can be a woody climber or a small tree with straggling branches, and the leaves often fall before flowering. Scale-like bracts are persistent on the peduncles of old, corky branches.

3. Millettia glaucescens Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 67. 1873. Syntypes: Myanmar, Pegu, Martaban, *Kurz 1777*; *Kurz 2613* (**CAL** [CAL0000012565], **K** [K000848740!, K000627944!, K000627945!, K000627946!, K000848739!, K000627943!, K000627941!]).

— *Millettia glaucescens* var. *siamensis* Craib, Fl. Siam. 1(3): 389. 1928; **syn. nov.** Type: Thailand, Ranong, Kao Talu, ca 50 m alt., *Kerr 11817* (lectotype **K** [K000627954!], designated here; isolectotypes **BK** [SN258011!], **BM**, **E**, **TCD** [0015784! (**BM**, **E**)]).

Notes.— 1. *Millettia glaucescens* was described by Kurz (1873), but a type was not designated. Dunn (1912) chose *Kurz 1777* as the type, but did not select any particular sheet to be the lectotype, therefore, following Turland *et al.* (2018), Art. 9.17 [second-step], as above, a lectotype must be designated. However, the lectotypification will be carried out in the further study because we have not seen the type, *Kurz 1777*.

2. Craib (1928) described var. *siamensis* based on collections that differ from the typical taxon by their acute leaflets (vs obtuse, abruptly acuminate or apiculate in the typical taxon) and winged fruits with 5 seeds (vs 1–3 seeds in the typical taxon). His collections did not include flowers and he noted that more collections were necessary to confirm the varietal status.

3. Collections, *Gardner et al. ST1575* (**BKF**); *Niyomdham & Puudjaa 6449* (**BKF**), which included flowers, showed the characters of var. *siamensis*, but are not significantly different from the typical variety, therefore, var. *siamensis* is synonymized.

4. Millettia leucantha Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 68. 1873. Type: Myanmar, Prom, Pegu, Yomah, *Kurz 2600* (lectotype **K** [K000845723!], designated here; isolectotypes **K** [K000845722!, K000845724!]).

— *Millettia latifolia* Dunn, J. Linn. Soc., Bot. 41: 187. 1912; Craib, Contrib. Fl. Siam, Dicot. 1: 55. 1912; **syn. nov.** Type: Thailand, Chiang Mai, Doi Suthep, 30 Mar. 1911, *Kerr 1733* (lectotype **K** [K000848788!], designated here; isolectotypes **CAL** [CAL0000008099!, CAL0000008100!], **E** [E00275440!, E00275441!], **K** [K000848789!, K000848790!], **P** [P02141824!]).

— *Millettia leucantha* Kurz var. *latifolia* (Dunn) P.K.Lôc in Morat, Fl. Cambodge, Laos & Vietnam 30: 113. 2001; **syn. nov.**

— *Millettia utilis* Dunn, Bull. Misc. Inform. Kew 1914(6): 207. 1914; **syn. nov.** Type: Myanmar, Pegu, Wunpeiu Reserve, 150 m alt., *Lace 6101* (lectotype **K** [K000848721!], designated here; isolectotypes **CAL** [CAL0000008091!], **E** [E00301099!, E00301100!, E00301101!], **K** [K000848719!, K000848720!]).

KEY TO THE VARIETIES

1. Lower leaflet surface moderately hairy along veins. Fruits hairy to glabrescent with white hairs — **a.** var. **leucantha**
1. Lower leaflet surface densely tomentose. Fruits densely tomentose with brown hairs — **b.** var. **buteoides**

a. var. **leucantha**

Notes.— 1. We select a sheet, K000845723 at **K**, for designation here as the lectotype, although further sheets are deposited at **CAL**, they were not seen in the course of this study. K000845723 is the most complete specimen seen, it bears inflorescences with numerous flowers and a fruit, the others at **K** bear only infructescences.

2. Lôc & Vidal (2001) considered *M. latifolia* to be a variety of *M. leucantha*, distinguished by its ovate to obovate leaflets (vs ovate-lanceolate in *M. leucantha*), with acuminate to obtuse apex (vs acuminate to acute in *M. leucantha*) and 7–9 pairs of lateral veins (vs 10–12 in *M. leucantha*). We examined both herbarium specimens and plants in the field and found that leaflets of var. *latifolia* varied considerably in size and shape, depending on the habitat. Therefore, var. *latifolia* is reduced here to a synonym of var. *leucantha*. We found seven sheets of *Kerr 1733*, three deposited at **K** [K000848788, K000848789, K000848790], two at **CAL** [CAL0000008099, CAL0000008100], two at **E** [E00275440, E00275441], and one at **P** [P02141824]. As there is more than one sheet, following Turland *et al.* (2018), Art. 9.17 [second-step], the sheet K000848788 is designated here as lectotype, it has leaflets, more flowers than the other specimens seen and illustrations of the flowers.

3. Dunn (1914) named *Millettia utilis* based on Lace's collecton (*Lace 6101*). We examined leaves and flowers of this species and found the characters to be identical to those of *M. leucantha*, therefore we synomise it here under *M. leucantha*. The sheet K000848721 at **K** is appropriate as a lectotype and is designated here, because it bears many flowers, some dissected, and, although it lacks fruits, a collection at **CAL** is in relatively poorer condition.

b. var. **buteoides** (Gagnep.) P.K.Lôc in Morat, Fl. Cambodge, Laos & Vietnam 30: 114. 2001.— *M. buteoides* Gagnep., Notul. Syst. (Paris) 3: 198. 1916. Type: Thailand, Nakhon Phanom, *Thorel 3228* (expedition 1866–1868) (lectotype **P** [P02141825!], designated by Lôc & Vidal (2001); isolectotypes **K** [K000848746!], **P** [P02141826!, P02141827!]).

— *Millettia buteoides* Gagnep. var. *siamensis* Craib, Fl. Siam. 1(3): 388. 1928; **syn. nov.** Type: Thailand, Saraburi, Muak Lek, *Israngkura* (*Nai Noe*) *124* (holotype **K** [K000848749!]; isotypes **BK** [SN258014!], **BM** [BM000997283!], **E!**, **TCD** [TCD0015721]).

— *Millettia bassacensis* Gagnep., Notul. Syst. (Paris) 2: 351. 1913. Type: Cambodia, Peunongs, *Thorel 2419* (holotype **P** [P02141828!]; isotype **K** [K000848747!]).

Notes.— 1. Var. *buteoides* is similar to the typical variety in its flowers and the shape of the pod, but differs in having densely tomentose hairs on the lower surface of the leaflets, and fruits with densely tomentose, brown hairs. The inflorescences are also usually shorter and thicker, with the flowers more dense, than the typical variety.

2. We combine var. *siamensis* under var. *buteoides*, since it is identical to var. *buteoides*.

5. Millettia ovalifolia Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 68. 1873 & Forest Fl. Burma 1: 356. 1877; Baker in Hook.f., Fl. Brit. India 2: 107. 1876; Dunn, J. Linn. Soc., Bot. 41: 173. 1912; Craib, Contrib. Fl. Siam, Dicot. 1: 55. 1912 & Fl. Siam. 1: 392. 1928.

— *Millettia peguensis* Ali, Kew Bull. 21(3): 489. 1968; **nom. superfl.** Type: Myanmar, Pegu, *Kurz 2605* (lectotype **K** [K000623182!], designated here; isolectotypes **CAL** [CAL0000012551!, CAL0000012552!], **K** [K000623181!]).

Notes.— 1. *Millettia ovalifolia* is recognized by its distinctly reticulate veins on the lower surface of the leaflets and subtruncate or minutely toothed calyx lobes. It is easily confused with *Millettia xylocarpa* Miq., because its leaflet shape is elliptic, ovate or obovate, and it has 5–11 pairs of leaflets.

2. The sheet K000623182 at K is appropriate as the lectotype and is chosen here, because it has many flowers, fruits with seeds and illustrations of the flowers.

6. Millettia tecta (Craib) Mattapha & Chantar., **stat. nov.**— *M. macrostachya* Collett & Hemsl.

var. *tecta* Craib, Fl. Siam. 1(3): 392. 1928, *pro parte*. Type: Thailand, Chiang Mai, *Kerr 2902* (lectotype **K** [K000848755!], designated here; isolectotypes **BM** [BM000997289!], **TCD** [TCD0015718!]).

Notes.— 1. *Millettia macrostachya* var. *tecta* was originally described by Craib (1928) who referred to three collections: *Kerr 2210* (**K** [K000848755], **BM** [BM000997289] & **TCD** [TCD0015718]), *Kerr 2902* (**K** [K00084875] & **BM** [BM000997290]) and *Winit 1570* (**BK** [SN210726]). These collections have mixed specimens of two different taxa: *Millettia macrostachya* var. *macrostachya* and *M. macrostachya* var. *tecta* Craib. The leaflet characteristics of *Kerr 2210* and *Winit 1570*, which belong to var. *tecta*, look almost identical to *Kerr 2902*, which, however, belongs to var. *macrostachya*. *Kerr 2902* is sterile so that flower and fruit comparisons cannot be made. When we visited all the localities which Craib (1928) mentioned in his protologue, to collect flowers and fruits of both taxa, we concluded, after close examination, that they are completely different in several important morphological characters. Following Turland *et al.* (2018), Art. 9.17, which refers to a type which is later found to contain multiple specimens, a sheet of *Kerr 2210* at **K** [K000848755] with leaflets and fruits is selected here as the lectotype and a new status, *Millettia tecta*, is proposed, to replace *M. macrostachya* var. *tecta*.

2. *Millettia tecta* differs morphologically from *M. macrostachya* in having 10–14-paired secondary veins (vs 8–10 in *M. macrostachya*); stipels absent (vs present in *M. macrostachya*); spreading inflorescences up to 25 cm long (vs 20–45 cm in *M. macrostachya*); distinct callosities on the inner surface of the standard petal (absent in *M. macrostachya*); large flowers, 20–30 × 20–30 mm (vs 18–19 × 15–16 mm in *M. macrostachya*); pedicels 10–12 mm (vs 14–15 mm in *M. macrostachya*); diadelphous stamens (vs monadelphous in *M. macrostachya*); and long and thick fruits, 20–35 × 3–5 cm (vs 14–15 × 1.5–2 cm in *M. macrostachya*).

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