

# Taxonomic Notes on *Pavetta* L. (Rubiaceae) from Thailand and New Records for Cambodia, Laos and Myanmar

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Received: 16 September 2020; Accepted: 7 February 2021

**ABSTRACT.**— A taxonomic revision of genus *Pavetta* in Thailand is presented, 14 species (15 taxa) are listed, namely *P. aspera* Craib, *P. breviflora* Craib, *P. fruticosa* Craib, *P. graciliflora* Wall. ex Ridl., *P. humilis* Hook.f., *P. kedahica* Bremek., *P. napieri* (Ridl.) Bremek., *P. naucleiflora* R.Br. ex G. Don, *P. petiolaris* Craib, *P. salicina* (Ridl.) Bremek., *P. siamica* Bremek., *P. sylvatica* Blume, *P. tomentosa* Roxb. ex Sm., *P. tomentosa* var. *glabrescens* (Kurz) Craib and *P. wallichiana* Steud. ex Craib, one of which, *P. breviflora* is endemic to Thailand. Lectotypes for *Pavetta aspera*, *P. aspera* var. *breviflora* Craib, *P. graciliflora* var. *latifolia* Craib, *P. indica* L. var. *polyantha* Hook.f., *P. laoticensis* Bremek., *P. naucleiflora* R. Br. ex G. Don, *P. petiolaris* and *P. pierrei* Bremek. are designated. *Pavetta finlaysonianae* Wall. ex Bremek. and *P. laoticensis* Bremek., are reduced to synonymy under *P. aspera*. *Pavetta birmanica* Bremek., *P. birmanica* var. *glabrescens* Bremek., *P. birmanica* var. *tomentosa* Bremek. and *P. gamblei* Bremek., are reduced to *P. fruticosa* and *P. pusilliflora* Bremek. is reduced to *P. petiolaris*. *Pavetta formosa* Bremek. is also reduced to *P. wallichiana*. One species new to Thailand, *Pavetta napieri*; one new to Myanmar, *P. aspera*; one to Cambodia, *P. sylvatica* and two to Laos, *P. fruticosa* and *P. naucleiflora*. A key to the species of *Pavetta* in Thailand is provided with distribution, ecology and vernacular names. Specimens examined and photographs of some species are also given.

**KEY WORDS:** lectotype, Pavetteae, synonym, taxonomy

## INTRODUCTION

*Pavetta* L. (Rubiaceae-Pavetteae) is one of the large genera of the Rubiaceae, comprising ca 400 species with a pantropical distribution, which occur in Africa, through India, SE Asia and Australia. (Mabberley, 2008). The name *Pavetta* is derived from ‘pawatta’ a Sinhalese and Malayalee plant name (Wong, 1989). Most species are widespread along the margins of deciduous, mixed deciduous, dry evergreen and evergreen forests. The dark bacterial nodules on the leaves are the most distinguished characters of the genus. The plants in the Rubiaceae are familiar through cultivated ornamentals as *Gardenia* J. Ellis, *Ixora* L., *Mussaenda* Burm. ex L., *Pentas* Benth. and *Tarenna*

Gaertn. but not *Pavetta*. However, the beautiful and whitish flowers of most *Pavetta* species are worthy of horticultural attention. Exception the bacterial nodules on the leaves of the genus *Pavetta*, it resembles to *Ixora* and *Tarenna*. It differs from the former by having coherent stigmatic lobes for most of the length whereas the genus *Ixora* has one exerted style with 2-lobed and often recurved stigma. It differs from the latter by having 4-merous flower instead of 5-merous flower and often distinctly 4-angled on young stems and branches in *Tarenna*.

Craib (1932) described six new species of *Pavetta* which are based mainly on the Kerr’s collection. Later he published the first checklist of Thai *Pavetta* species, including new varieties and new combinations

in *Florae Siamensis Enumeratio* (1934) and recognised 11 species (14 taxa), one of which now is *Tarenna pilosa* (Craib) Bremek. According to the Species List of the Thai *Pavetta*, 16 species and one variety are distributed throughout the country (Govaert et al., 2019). Thangthong & Chantaranothai (2007) published another two new records, *P. kedahica* Bremek. and *P. salicina* (Ridl.) Bremek. for Thailand and 11 species (12 taxa) are in the list of the Thai Plant Names Tem Smitinand (The Forest Herbarium, Royal Forest Department, 2014). Many species have previously been and identified with *P. indica* L. (var. *indica*) which it is restricted to Sri Lanka and India (Bremekamp, 1934; Rout & Deb, 1999). Bremekamp (1934) accepted *P. indica* and *P. tomentosa* including var. *glabrescens* Kurz but Hook.f. (1880) and Rout & Deb (1999) accepted that *P. indica* has many varieties, including var. *indica*, var. *glabrescens* (Kurz) Deb & Rout and var. *tomentosa* (Roxb. ex Sm.) Hook.f. For Thailand, since the work of Craib (1934), *P. indica* has long been listed of the *Pavetta*. In addition, the situation of *P. indica* in Thailand is needed for clarification.

From literature, some problems of names and no key to species are available. Therefore, the aim of this paper is to provide a synopsis of the genus for Thailand which will serve as a basis of the Rubiaceae for the Flora of Thailand account. Full attention will be paid to synonymy which led to the reduction of some species to synonyms of others, thereby decreasing the number of recognized species. Fourteen species (15 taxa) of *Pavetta* in Thailand including a new record, is listed with their synonyms and preceded by a key to the species. During the revision of the

genus, it became evident that seven names are necessary to resolve several typification issues. Distribution, ecology, specimens examined are presented. Many species are newly recorded for Cambodia, Laos, Myanmar and Thailand.

## MATERIALS AND METHODS

This work is studied largely based on the available literature and more than 800 herbarium specimens kept at the following herbaria: AAU, BK, BKF, BM, CMU, K, KKU, KYO, PSU, QBG, SING, TCD and TI. Digital images of type at BR, L, LE and P were also cited. All herbarium acronyms follow Index Herbariorum (Thiers, 2019, continuously updated). All cited type specimens that have been seen by author are indicated by either an exclamation mark (!) or the phrase ‘digital image’, in case of online photograph examination. Field observations have also been made. Nearly all specimens cited here have been seen, those that have not been seen are indicated by *n.v.* Abbreviation of National Park and Wildlife Sanctuary are used as NP and WS, respectively. A key to species is made and distributions, ecology and vernacular names are provided.

## RESULTS

### Taxonomic treatment

#### *PAVETTA*

L., Sp. Pl. 1: 110. 1753.— *Crinita* Houtt. Handl. 7: 361, t. 40. 1777.— *Baconia* DC., Ann. Muz. Natl. Hist. Nat. 9: 219. 1807.— *Exechostylus* K. Schum. in Engler, Bot. Jahrb. Syst. 28(1): 67. 1899.— *Pavate* Adans, Fam. Pl. 2: 145. 1763.— *Verulamia* DC. ex Poir. in Lam. et al., Encycl. 8: 543. 1808.

Shrubs or treelets. *Leaves* opposite, petiolate, often with scattered dark bacterial nodules and with or without domatia in axils of lateral veins on the lower surface; stipules interpetiolar, ovate or triangular, apex acuminate, cuspidate or aristate, usually connate at base. *Inflorescences* terminal on main stems, terminal on secondary or reduced lateral branches and appearing axillary, or rarely axillary, cymose to corymbose, trichotomously branched, rarely

reduced to sub-capitulate, many-flowered, sessile or pedunculate; bracts leaf-like, lower ones connate at base, upper ones smaller, free at base. *Flowers* bisexual, 4-merous, fragrant, pedicellate or sessile. *Calyx* cup-shaped, with a short tube and 4 tiny lobes; lobes triangular or cusp-like, sometimes persistent on mature fruit. *Corolla* white or creamy, salver-shaped; tube long, slender with 4 spreading lobes, contorted, twisted in bud. *Stamens* 4;

### Key to the species

1. Corolla tube hairy outside.....2
1. Corolla tube glabrous outside.....3
2. Calyx tube densely erect-hairy. Corolla tube 9–16 mm long. Style 20–25 mm long.....**8. *P. naucleiflora***
2. Calyx tube sparsely or densely appressed hairy. Corolla tube 7–9 mm long. Style 14–15 mm long.....**7. *P. napieri***
3. Calyx tube glabrous.....4
3. Calyx tube hairy.....7
4. Lower surface of leaves with domatia and tufted hairs in axils of lateral veins.....5
4. Lower surface of leaves without domatia and tufted hairs in axils of lateral veins.....6
5. Stipules glabrous on both sides. Corolla throat glabrous or scantily hairy, margin of corolla lobe glabrous.....**12. *P. sylvatica***
5. Stipules glabrous outside, hairy inside. Corolla throat densely hairy, margin of corolla lobe hairy.....**6. *P. kedahica***
6. Leaves broadly elliptic to obovate, length at most 4 times the width, glabrous, sometimes with sparse hairs on veins on lower surface. Corolla lobe less than half of the corolla tube.....**4. *P. graciliflora***
6. Leaves narrowly elliptic, length at least 5 times the width, with scattered hairs on veins on lower surface. Corolla lobe more than half of the corolla tube.....**10. *P. salicina***
7. Calyx tube densely erect-hairy.....8
7. Calyx tube sparsely or densely appressed hairy.....9
8. Leaves with domatia and tufted hairs in axils of lateral veins. Stipules hairy on both sides. Petioles 1–1.5 cm long.....**14. *P. wallichiana***
8. Leaves without domatia and tufted hairs in axils of lateral veins. Stipules hairy outside, glabrous inside. Petioles 0.5–1 cm long.....**5. *P. humilis***
9. Stipules glabrous outside.....10
9. Stipules hairy outside.....11
10. Leaves with domatia and tufted hairs in axils of lateral veins. Calyx tube 0.6–0.8 mm long. Calyx lobes triangular.....**11. *P. siamica***
10. Leaves without domatia and tufted hairs in axils of lateral veins. Calyx tube 1–1.2 mm long. Calyx lobes cusp-like.....**9. *P. petiolaris***
11. Corolla tube glabrous inside.....**2. *P. breviflora***
11. Corolla tube hairy inside.....12
12. Stipules triangular. Corolla tube more than 2 cm long. Style more than 4 cm long.....**1. *P. aspera***
12. Stipules sheath-like. Corolla tube less than 2 cm long. Style than 4 cm long.....13
13. Leaves 8–18 x (3–) 4–9 cm, lower surface of leaves tomentose, sparsely puberulous or glabrescens. Inflorescence spreading.....**13. *P. tomentosa***
13. Leaves 4.5–8 (–12) x 2.5–5.5 cm, lower surface of leaves sparsely pilose. Inflorescence compact.....**3. *P. fruticosa***

filaments very short, inserted between corolla lobes at mouth of the corolla tube; anthers longitudinally spirally contorted at dehiscence, dorsifixed, linear, base sagittate, apex apiculate, exserted. *Ovary* 2 locular, with 1 (–2) ovules per locule on axile placentation; style filiform, slender, long exserted; stigma obscurely 2-lobed, erect. *Fruits* globose or ovoid, slightly 2-lobed drupe, usually shining black, glabrous or sparsely pubescent, with chartaceous pyrenes, 1–2-seeded. *Seeds* semi-globose with one face flattened.

About 400 species in sub-tropical and tropical Africa and Asia, 14 species and one variety in Thailand.

**1. *Pavetta aspera*** Craib, Bull. Misc. Inform. Kew 1932(9): 430. 1932. Type: Thailand, Trat (Krat), Ban Ta Kum, 13 May 1930, *Put* 2881 (lectotype **K** [K000763499! sheet 1], selected here, isolectotypes **BK** [BK257430!], **BM** [BM000945422!], **K** [K000763500! sheet 2]).— *P. aspera* Craib var. *breviflos* Craib, Fl. Siam. 2: 166. 1934. Type: Thailand, Prachuap Khiri Khan, Huai (Huay) Yang Waterfall, 5 July 1926, *Kerr* 10887 (lectotype **K** [K000763498!], selected here, isolectotypes **BK** [BK257431!], **BM** [BM000945423!]).— *P. nervosa* Craib, Bull. Misc. Inform. Kew 1932(9): 432. 1932. Type: Thailand, Surat Thani, Ko (Kaw) Pa-ngan, 6 June 1927, *Put* 807 (lectotype **K** [K000763493!], designated by Bremenkamp, 1934), isolectotypes **BK** [BK25743!], **BM** [BM000945425!]).— *P. finlaysoniana* Wall. ex Bremek., Repert. Spec. Nov. Regni Veg. 37: 116. 1934. Type: Thailand (Siam), *Wallich Numer. List* 6177 (*Finlayson* 435), (holotype **K-W** [K001123-238!]). **syn. nov.**— *P. laoticensis* Bremek., Repert. Spec. Nov. Regni Veg. 37: 101. 1934. Type: Laos, Vientiane (Vieng Chan), Muang Baw, 27 Apr. 1932, *Kerr* 21271 (lectotype **K**

[K000763501!], selected here, isolectotypes **BK** [BK222047!], **K** [K000-763503!]). **syn. nov.**

**Thailand.** — NORTHERN: Chiang Mai [Doi Suthep-Pui NP, E of Doi Suthep, Huai Kaw Mah Gatohment, 20 Apr. 1993, *Maxwell* 93-348 (**BKF, L**); Chai Prakan, Si Dong Yen subdistrict, Ban Wieng Pa Pattana, Lahu Village, 23 May 1991, *Maxwell* 91-449 (**AAU, E, L**); Doi Lhon, 5 Apr. 2004, *Maxwell* 04-186 (**BKF**)]; Nan [Doi Phu Kha NP, 6 Nov. 1998, *Srisanga* 338 (**BKF**)]; Tak [Ban Na, Bhumipol Dam, May 1959, *Ploenchit* 432 (**BK, K**); Doi Hua Mod, (wrongly cited as Pran Kratai, Kamphaeng Phet), 6 May 1976, *Sutheesorn* 3449 (**BK**)]; NORTH-EASTERN: Loei [Wang Saphung, 21 Oct. 1947, *Dee* 33 (**BKF**)]; Sakon Nakhon [Phu Phan NP, 12 Nov. 1984, *Murata et al.* T-51231 (**AAU, BKF**)]; EASTERN: Nakhon Ratchasima [Sakaerat, 23 Oct. 1971, *van Beusekom et al.* 3309 (**K**)]; SOUTH-WESTERN: Kanchanaburi [between Huai Ban Kao and Kritee, 5 July 1973, *Geesink & Phengklai* 6111 (**BKF, E, K**); Erawan NP, Lek Lai Cave, 31 Aug. 1995, *Parnell et al.* 95-590 (**K**)]; Prachuap Khiri Khan [Huai Yang, 5 July 1926, *Kerr* 10887 (**ABD, BM, K, TCD**); *ibid.*, 5 Oct. 1930, *Put* 3214 (**ABD, E, K**); Huai Yang Falls, 25 Apr. 1969, *Chermsirivathana & Kasem* 1505 (**BK**)]; CENTRAL: Saraburi [Mueang, Sam Lan, 3 Nov. 1973, *Maxwell* 73-586 (**BK**); *ibid.*, 19 May 1974, *Maxwell* 74-522 (**BK**); *ibid.*, 13 July 1974, *Maxwell* 74-704 (**AAU, BK**)]; SOUTH-EASTERN: Chon Buri [Ban Bueng, Ang Chang Nam, Khao Khieo Park, 27 June 1975, *Maxwell* 75-662 (**BK, L**); Ban Dan-Si Racha Forest, 23 Nov. 1927, *Collins* 1976 (**BK, BM, K**); Sattahip, Toong Brong, 10 June 1971, *Maxwell* 71-419 (**BK**)]; Chanthaburi [Pong Nam Ron, Pang Nawn R., S. Soi Dao Mountain, 13 May 1974, *Maxwell* 74-462 (**AAU, BK**); Khao Soi Dao WS, 10 June

1963, *Larsen 9968* (AAU, BKF); *ibid.*, around Headquarter, 20 May 2013, *Tagane et al. T1831* (BKF); Khao Srabap, *Chit 327* (BKF); Nong Bon, 25 km of Makham, 31 Aug. 1972, *Larsen et al. 32260* (AAU, K); Trat [Aw Ong Kang and Salak Koh, 8 May 1974, *Geesink et al. 6631* (AAU, BKF, K); Ta Kum, 13 May 1930, *Put 2881* (ABD, BM, K-2 sheets), TCD]; PENINSULAR: Surat Thani [Ban Tong Tao, 4 Aug. 1927, *Kerr 13389* (ABD, K); Ko Pha-ngan, 2 June 1927, *Put 753* (ABD, BK, BM, E, K, TCD); *ibid.*, 6 June 1927, *Put 807* (ABD, BK, BM, K, TCD); *ibid.*, 9 Nov. 1927, *Put 1237* (ABD, BK, BM, K); *ibid.*, 8 Sept. 1973, *Phromdej 34* (BKF-2 sheets); Na Mueang Waterfall, Ko Samui, 21 June 1966, *Sakol 1091* (BK)]; Phangnga [Khao Lak, S of Takua Pa, 5 May 1973, *Geesink & Santisuk 5186* (E); Song Phi Nong Waterfall, 14 Aug. 1977, *Santisuk 1165* (BKF (2-sheets))]; Nakhon Si Thammarat [20 July 1929, *Rabil 118* (ABD, BM, K); Khiri Wong, Khao Luang, 15 May 1968, *van Beusekom & Phengklay 736* (BKF, E, K); *ibid.*, 21 July 1999, *Wattana et al. 492* (E)]; Yala [Tho Moh, North side of Bang Lang Reservoir, 17 June 1992, *Larsen et al. 42953* (AAU, BKF); Than To, 10 Apr. 1993, *Winai & Parinya WP-195* (BK); Betong, Ban Chulabhorn Phattana 10, trail to giant *Tetrameles nudiflora* tree, 21 Apr. 2005, *Pooma et al. 5059* (BKF (2-sheets))]; Narathiwat [Sukhirin, Klong Prachin Checkdam, Ban Soy Prachin, 25 Aug. 2006, *Poopath et al. 157* (E); Waeng, 15 Apr. 1972, *Sangkhachand et al. 1032* (AAU, BKF, E)].

**Distribution.**— Laos.

**Ecology.**— Moist evergreen and dry evergreen forests, 350–800 m alt.

**Vernacular.**— Khem yai (เขมใหญ่), khao san noi (ข้าวสารน้อย), khao san lek (ข้าวสารเล็ก), khem khao (เขมขาว).

**Note.**— *Pavetta aspera* is distinguished by the sparsely or densely appressed hairy calyx tube, the triangular stipules which are hairy outside and the corolla tube is glabrous outside but hairy inside. Bremekamp (1934) made a monograph of the genus *Pavetta* and designated *Put 2881* at K is the lectotype of *P. aspera*, but Kew has 2 sheets. The sheet 1 (K000763499) is selected here as the second-step lectotype, the other is the isolectotype. I have examined the types of *P. finlaysonian* and *P. laoticensis* and found them conspecific with *P. aspera*. Maxwell (1975) placed all three of Craib's taxa, *P. aspera*, *P. aspera* var. *breviflora* and *P. nervosa* as synonyms of *P. indica* var. *hispida* Pierre ex Pit. (this taxon is a synonym of *P. pierrei* Bremek). I do not agree with Maxwell's view because they are different in hair type on the ovary. The specimen of *P. pierrei* at P, *Pierre 1241*, has erect hairs but all three of Craib's taxa have appressed hairs. *Pavetta pierrei* is an endemic species to Cambodia which it was described based on a collection of the type of *P. indica* L. var. *hispida* Pierre ex Pit. The collection has three sheets at P viz. P03967304!, P03967305! and P03967306! The second one is selected here as the lectotype because it has line drawing with details of flowers and the others are isolectotypes. *Pavetta pierrei* resembles *P. wallichiana* Steudl. by having erect hairs on calyx tube, comparison of some characters of them is needed to clarify the status of both species.

**2. *Pavetta breviflora*** Craib, Bull. Misc. Inform. Kew 1939(9): 431. 1932. Type: Thailand, Prachuap Khiri Khan, Ban Nong Klang (Nawang Kang), 8 July 1924, *Kerr 10908* (lectotype K [K000763504!], designated by Bremekamp (1934); isolecto-types BK [BK257432!], BM [BM0009454-21!]).

**Thailand.**— SOUTH-WESTERN: Prachuap Khiri Khan [Kui Buri NP, 20 Aug. 2002, *Middleton et al.* 1229 (**BKF, E**)]; CENTRAL: Phra Nakhon Si Ayutthaya [Ban Pachi, 25 May 1932, *Kerr* 21566 (**BK, BM, K**)].

**Distribution.**— Endemic.

**Ecology.**— Along stream in evergreen forest, ca 50 m alt.

**Vernacular.**— Khem kao dok lek (เข็มขาวดอกเล็ก).

**Note.** — *Pavetta brivituba* is characterized by having glabrous both inside and outside of the corolla tube, sparsely or densely appressed hairy calyx tube, and the hairy outside of the triangular stipules. The collector name of the type is Kerr not Lanz as indicated in the work of Bremekamp (1934).

**3. *Pavetta fruticosa*** Craib, Bull. Misc. Inform. Kew 1939(9): 431. 1932. Type: Thailand, Chaing Mai, Doi Suthep, 28 Apr. 1910, *Kerr* 1149 (lectotype **K** [K000763-494!], designated by Bremekamp (1934), **BM** [BM000945420!]).— *P. gamblei* Bremek., Repert. Spec. Nov. Regni Veg. 37: 114. 1934. Type: Myanmar (Burma), Irawaddi, Mejanoung, 4 Apr. 1872, *Gamble* 115 (holotype **K** [K000031502!], **CAL**, *n.v.*, **syn. nov.**— *P. birmahica* Bremek., Repert. Spec. Nov. Regni Veg. 37: 115. 1934. Type: Myanmar (Burma), Thayetungo district, Minhea, 17 Dec. 1904, *Lace* 2698 (holotype **K** [K000031503!], isotype **CAL** *n.v.*, **syn. nov.**— *P. birmahica* Bremek. var. *glabrescens* Bremek., Repert. Spec. Nov. Regni Veg. 37: 116. 1934. Type: same as *P. birmahica*, **syn. nov.**— *P. birmahica* Bremek. var. *tomentosa* Bremek., Repert. Spec. Nov. Regni Veg. 37: 116. 1934. Type: Myanmar (Burma), *Griffith* 3010 (holotype **K**!, without barcode), **syn. nov.** Fig. 1A.

**Thailand.**— NORTHERN: Mae Hong Son [20 June 1973, *Geesink et al.* 5976 (**AAU, BKF**)]; Chiang Mai [Bo Luang, 1 July 1968, *Larsen et al.* 1923 (**AAU, BKF, E**) &

1934 (**AAU, BKF, E**); *ibid.*, 7 June 1984, *Geesink et al.* 5782 (**AAU, BKF, E, K, KYO**); Doi Inthanon NP, Mae Klang Waterfall, 18 July 1988, *Fukuoka* T-62029 (**BKF, KYO**); *ibid.*, 3 Aug. 1988, *Tamura* T-60375 (**BKF**); *ibid.*, 18 July 1988, *Phengklai et al.* 6582 (**BKF** (2-sheets)); *ibid.*, 3 Aug. 1988, *Fukuoka* T-62485 & T-62486 (**BKF, KYO, L**); Mae Chaem, east side of Doi Chan Nah Dih, 25 May 1995, *Maxwell* 95-457 (**BKF, L**); *ibid.*, 7 Aug. 1996, *Maxwell* 96-1045 (**BKF, L**); Doi Suthep-Pui NP, 1 June 1993, *Phuakam* 23 (**BKF, L**); *ibid.*, 7 June 1960, *Smitinand & John* 6802 (**BKF**); *ibid.*, 2 May 1966, *Chermsirivathana* 610 (**BK**); *ibid.*, Pha Ngeub, 12 Oct. 1988, *Maxwell* 88-1193 (**BKF, L**); Om Koi, 14 May 1977, *Santisuk* 971 (**BKF** (2-sheets), **PSU**); Om Koi, 20 July 1987, *Phengklai et al.* 6257 (**BKF** (2-sheets)); Chiang Rai [Horticulture Research Center, 12 May 1993, *Parinya & Santi* 237 (**BK**)]; Lamphun [Mae Tha, 21 Apr. 1922, *Winit* 709 (**BK, BKF, K**); *ibid.*, Doi Khun Tan NP, 30 May 1994, *Maxwell* 94-652 (**BKF, L**); Lampang [Khun Tan, 13 Feb. 1933, *S.N.* 161 (**BKF-SN1378**)]; Wang Nuea, Chae Son NP, Mae Awe Station, 30 May 1996, *Maxwell* 96-762 (**BKF, L**); Tak [Umphang, Doi Hua Mot, 17 June 2011, *Chamchamroon et al.* 4919 (**BKF**-3 sheets); *ibid.*, 25 July 2012, *Suddee et al.* 4358 (**BKF**); Doi Hua Mot, 25 Apr. 2008, *Triboun s.n.* (**BK** (2-sheets) *ibid.*, second view point area, 24 Apr. 2004, *Pooma et al.* 4642A (**BKF**)]; NORTH-EASTERN: Phetchabun [Nam Nao NP, 20 May 1951, *Smitinand* 455 (**BKF**)]; Loei [Phu Luang WS, 17 June 1997, *Santisuk & Pooma* 1696 (**BKF, K**)]; SOUTH-EASTERN: Trat [Khlong Yai, 10 Aug. 1951, *Tempradit* 17 (**BKF**)].

**Distribution.**— Myanmar (Chin).

**Ecology.**— Open area in dry dipterocarp and deciduous-oak forests, 900–2,000 m alt.

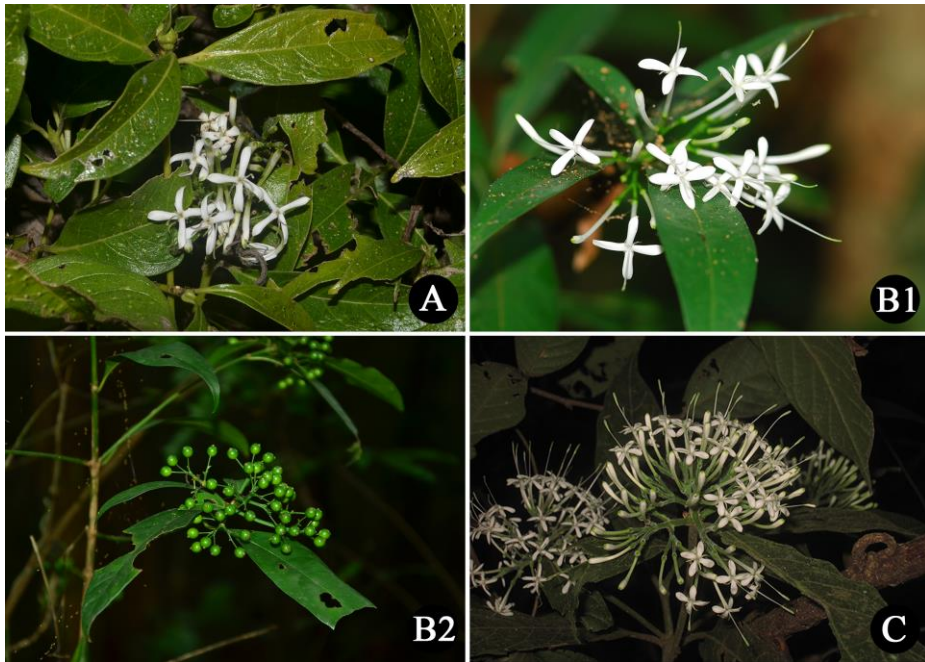


FIGURE 1. A. *Pavetta fruticosa*; B. *graciliflora*, B1. flowers, B2. fruits; C. *P. naucleiflora*

**Vernacular.**— Khem doi (เข็มดอย), yaa khao san (หญ้าข้าวสาร).

**Note.**— *Pavetta fruticosa* is distinctive in having sparsely pilose on the lower surface of leaves and compact inflorescence. It is found in high altitude. After examination the types of *Pavetta gamblei* and also three varieties under *P. birmahica* namely, var. *birmanica*, var. *glabrescens* and var. *tomentosa*, have been distinguished by Bremekamp (1934) showed that they are conspecific with *P. fruticosa*. *Pavetta fruticosa* is similar to a Vietnamese species, *P. chevalieri* Bremek. but the calyx tube of the latter has erect hairs. The specimen from Xam Nua district, Houa Phan province, Laos, *Leong-Skornickova et al. JLS 2314* at **E** (E00715078), is the first record of this species from Laos.

**4. *Pavetta graciliflora*** Wall. ex Ridl., J. Straits Branch Roy. Asiat. Soc. 86: 296. 1922. Type: Thailand, *Wallich Numer. List 6178* (*Finlayson s.n.*), (holotype **K-W** [K001123239!]).— *P.*

*graciliflora* var. *latifolia* Craib, Fl. Siam. 2: 168. 1934. Type: Thailand, Ranong, La-un, 3 Jan. 1929, *Kerr 16509* (lectotype **K** [K000763495!], selected here; isoelectotypes **BK** [BK222032!], **BM!** [BM000945426!]). Fig. 1B. **Thailand.**— NORTHERN: Chiang Mai [Doi Inthanon NP, the south side of main route, 25 July 1988, *Fukuoka T-62235* (**BKF**)]; Sukhothai [Khao Luang, 2 June 1922, *Kerr 5913* (**ABD, BK, BM, K**)]; Phitsanulok [Nakhon Thai, 12 Apr. 1921, *Kerr 5821* (**ABD, BK, BM, K**)]; Thung Salaeng Luang NP, 19 June 1967, *Phusomsaeng 242* (**BKF**); NORTH-EASTERN: Phetchabun [Nam Nao NP, 4 June 2005, *Sawai & Rob s.n.* (**BKF** (BKF200274))]; Loei [Na Haeo, Phu Suan Sai NP, 3 Nov. 2008, *Maknoi 2798* (**BKF**)]; Phu Kradueng], 20 Oct. 1967, *Prayad 1062* (**BK**); Phu Kradueng NP, 29 Aug. 1988, *Fukuoka T-63696* (**BKF**); *ibid.*, 8 Sept. 1988, *Takahashi & Tamura T-63434* (**BKF, KYO**); Wang Saphung, Phu Luang, 9 Aug. 1976, *Boonchu*

3143 (**BKF-2** sheets); *ibid.*, 7 Sept. 1966, *Phusomsaeng & Bunchuai* 32 (**BKF, K**); *ibid.*, Huai Baeng, 11 June 2004, *Wongprasert et al.* 046-26 (**BKF**); Phu Ruea, 8 May 2002, *Triboun* 3314 (**BK**); Udon Thani [HRH the Queen's 60th Birthday Anniversary Arboretum (Northeast), 17 July 2003, *Sidjium* 30 (**BKF**); Phu Hom, 8 Oct. 2004, *S.N.* (**BKF**); Nong Khai [Phon Phisai, Sam Huai, 6 June 1963, *Adisai* 476 (**BK**); Buengkan [Ban Phaeng, Nangua, Phu Langka NP, Tat Kham Waterfall, 21 May 2014, *Sirimongkol et al.* 608 (**BKF-2** sheets); Bung Khla, Phu Wua WS, 27 Aug. 2001, *Pooma et al.* 2785 (**ABD, BKF**); *ibid.*, 3 May 2002, *Pooma, et al.* 3424 (**BKF**); *ibid.*, 3 May 2002, *Pooma et al.* 3441 (**BKF**); *ibid.*, 21 May 2004, *Pooma et al.* 4161 (**BKF**); Sakon Nakhon [Phu Phan NP, without date, *Chantaranothai et al.* 1782 (**BKF**); *ibid.*, without date, *Chantaranothai et al.* 117 (**BKF**); Nakhon Phanom [Ban Phaeng, Phu Langka NP, Tad Kham Falls, 25 Aug. 2001, *Pooma et al.* 2640 (**BKF**); Maha Sarakham [Wapi Pathum, Thung Kula Ronghai, 11 Sept. 1972, *Sutheesorn* 2161 (**BK**); Khon Kaen [Phu Wiang, Ban Khok Sung, 18 May 1966, *S.N.* 382 (**BKF** (SN053787)]; EASTERN: Chaiyaphum [Ban Nam Phrom, 23 May 1974, *Geesink et al.* 6835 (**AAU, BKF, K**); Unknown locality, 15 Apr. 1971, *Hambhanon* 76 (**BKF**); Nakhon Ratchasima [Unknown locality, 14 Dec. 1962, *Phengklai* 515 (**BKF, K**); Khao Yai NP, Khao Khieo, 18 Oct. 1969, *van Beusekom & Charoenpol* 1695 (**BKF, E, K**); *ibid.*, Khao Rom, , 2 Dec. 1983, *Fukuoka & Ito T-345663* (**KYO**); *ibid.*, Wang Ta Kong, 21 Oct. 1969, *van Beusekom & Charoenpol* 1809 (**AAU, BKF, E**); *ibid.*, along route 2890 for Nakhon Nayok, 15 Oct. 1984, *Murata et al.* T-52567 (**BKF**); Pak Thong Chai, Kiew Stream, 19 May 2011, *Damrongsak* 575 (**BKF**); *ibid.*, Sakaerat Environmental Research Station, 28 Oct. 1969, *van Beusekom & Charoenpol* 1879 (**AAU, BKF, E, K**); *ibid.*, 4

Dec. 1984, *Fukuoka & Ito T-34679* (**KYO-2** sheets); *ibid.*, 5 Dec. 1984, *Fukuoka & Ito T-34735* (**BKF**); *ibid.*, 11 Aug. 1989, *Puff & Ueachirakan* 890811-1/3 (**BKF**); Sikhiu, Khao Phrik, 6 May 1976, *Maxwell* 76-308 (**BK**); Roi Et [Kaset Wisai, Ban Nam Om, 9 June 1982, *Paisooksantivatana & Sutheesorn Y1017-82* (**BK**); Pathum Rat, 14 Sept. 1983, *Paisooksantivatana & Sadakorn Y1290-83* (**BK**); SOUTH-WESTERN: Kanchanaburi [Thum Pha, 14 Dec. 1961, *Phengklai* 186 (**BKF**); Prachuap Khiri Khan [Hua Hin, Kaeng Krachan NP, Lao Noi Falls, 4 May 1998, *Wongprasert s.n.* (**BKF-122266**); Bang Saphan Yai, Suan Luang, 7 Nov. 1944, *Daeng* 76 (**BKF**); Thap Sakae, Huai Yang NP, Bun Sawan Waterfall, 26 Aug. 2002, *Middleton et al.* 1355 (**BKF, E**); CENTRAL: Saraburi [Mueang, 23 Aug. 1988, *Fukuoka T-63606* (**BKF**); Nakhon Nayok [Khao Yai NP, near the Orchid Waterfall, 8 Oct. 1979, *Shimizu et al. T-19629* (**KYO**); *ibid.*, Mo Singto, 13 Jan. 2004, *Maxwell & Boonkongohart* 04-29 (**BKF**); SOUTH-EASTERN: Sa Kaeo [Pangsida NP, 10 Aug. 1996, *Wongprasert s.n.* (**BKF-2** sheets); *ibid.*, Nam Tok Pangsrada, 5 July 2001, *Chamchumroon & Puff* 1181 (**BKF-2** sheets); *ibid.*, Huai Nam Yen (km 20), 6 July 2001, *Chamchumroon & Puff* 1192 (**BKF**); Chon Buri [Si Racha, Si Chang island, east side of Khao Kwang, 11 Sept. 1993, *Maxwell* 93-1049 (**BKF, L**); Chanthaburi [Khao Soi Dao WS, Khao Soi Dao North, 26 Nov. 1979, *Shimizu et al. T-23637* (**KYO**); *ibid.*, trail to Khao Soi Dao Waterfall, 29 June 2001, *Chamchumroon & Puff V. C.* 1116 (**BKF-2** sheets)]; PENINSULAR: Ranong [Kaper, Khao Pawta Luang Kaew, 10 Dec. 1979, *Shimizu et al. T-26798* (**KYO**) & T-26799 (**KYO**); Laem Son NP, Praphas Beach, 27 June 92, *Th. Wongprasert et al. BKF-96998* (**BKF**); La-un, 3 Jan. 1929, *Kerr* 16509 (**ABD, BK, BM, K, TCD, TI-photo**); Surat Thani [Ban Ta Khun, 28 Nov. 1986, *Niyomdham*



1277 (BKF-2 sheets, **K**); Khao ok NP, Phanom, 12 Dec. 1979, *Shimizu et al. T-27081* (**KYO**); Khirirat Nikhom, Tham Wang Badan, 8 Sept. 2008, *Middleton et al. 4371* (**BKF, E, K**); Khlong Phanom NP, Ban Nong Kum, Bang Nam Rat Road, 21 Feb. 2001, *Chayamarit et al. 2633* (**BKF-2 sheets**); Phangnga [Kuraburi, Si Phang-nga NP, 29 Jan. 2003, *Chamchumroon et al. V.C. 1888* (**BKF-2 sheets**); *ibid.*, Ton Daeng Waterfall, 21 July 2000, *Chamchumroon VC 899* (**BKF-2 sheets**); Ton Pariwat WS, 18 Nov. 2005, *Gargner & Khumchompoo ST1924* (**BKF**); Phuket [Talang, Phra Theaw Non-hunting Area, 5 Jan. 2000, *Wongprasert 001-14* (**BKF-2 sheets**); Krabi [Khao Phanom Bencha NP, 10 Jan. 2006, *Gardner & Sidisunthorn ST2206* (**BKF-2 sheets**); Nakhon Si Thammarat [Lan Saka, Ka Lom Waterfall, 5 Dec. 1972, *Santisuk & B.N. 299* (**BKF**); Lan Saka, Khao Luang NP, Gahrome Falls, 25 Nov. 1984, *Maxwell 84-499* (**BKF, PSU**); *ibid.*, 20 May 1985, *Ramsri 74* (**PSU**); Thapra Waterfall, Chang Talang, 11 July 2000, *Chamchumroon V.C. 838* (**BKF**); Trang [Khao Chong, 22 Jan. 1966, *Tagawa et al. T-6732* (**BKF**); *ibid.*, 26 Jan. 1966, *Tagawa et al. T-6747* (**BKF**); *ibid.*, 27 Jan. 1966, *Tagawa et al. T-6856* (**KYO**); *ibid.*, 10 Jan. 1968, *Sangkachand 1523* (**BKF, K**); *ibid.*, 13 June 1974, *Geesink et al. 7189* (**AAU, BKF, K**); Satun [Adang, 10 Jan. 1928, *Kerr 13980* (**ABD, BK, BM, K**); Khuan Kalong, 15 May 1967, *S.N. 340* (**BKF**); Thaleban, 29 Apr. 1990, *Pooma p27* (**BKF**)] Songkhla [Hat Yai, 16 Apr. 1963, *Prachit 243* (**BK**); *ibid.*, Ton Nga Chang WS, 22 Mar. 2004, *Gardner & Sidisunthorn ST0275* (**BKF, K**); *ibid.*, 3 Oct. 2004, *Gardner ST0934* (**BKF, K**); Rattaphum, 8 June 1984, *Maxwell 84-4* (**PSU**); *ibid.*, Boripat Falls Park, 16 Oct. 1984, *Maxwell 84-330* (**BKF, PSU**); Unknown location, Waterfall, Ko Take Far, 20 June 1974, *Geesink et al. 7357* (**AAU, BKF, K**).

**Distribution.**— Myanmar, Laos, Cambodia, Vietnam, Peninsular Malaysia.

**Ecology.**— In evergreen, dry evergreen and mixed deciduous forests, 0–750 m alt.

**Vernacular.**— Khem kliang (เข็มนกเลี้ยง) (Eastern), khem khao (เข็มนขาว), khem dong (เข็มนแดง), khem paa (เข็มนป่า), khem kliang bai kuang (เข็มนกเลี้ยงใบกว้าง).

**Note.**— *Pavetta graciliflora* is distinctive in having glabrous peduncle and all parts of flower except slightly hairy inside the corolla tube. The leaves of the type of *P. graciliflora* var. *latifolia*, *Kerr 16509* and *Niyomdham 1277* (**BKF-2 sheets, K**) are slightly larger than the others.

**5. *Pavetta humilis*** Hook.f., Fl. Brit. India 3(7): 151. 1880.— *Ixora humilis* (Hook.f.) Kuntz, Rev. Gen. Pl. 1: 287. 1891. Type: Peninsular Malaysia, Malacca, *Griffith 3007* (lectotype **K** [K001045930!], designated by Bremekamp, 1934).

**Thailand.**— SOUTH-WESTERN: Prachuap Khiri Khan [Thap Sakae, Namtok Huai Yang Waterfall NP, trail to summit of Khao Luang, 18 Feb. 2006, *Middleton et al. 3790* (**BKF, E**)]; PENINSULAR: Ranong [Kapur, Klong Naka WS, 7 Sept. 1984, *Fukuoka et al. T-35933* (**BKF**)]; Surat Thani [Bangbao, 7 Aug. 1955, *Ploenchit 85* (**BKF**); *ibid.*, 7 Aug. 1955, *Smitinand 2844* (**BKF**); Ban Na San, Kiansa, 10 Aug. 1955, *Sanan 344* (**BKF**)]; Nakhon Si Thammarat [Khao Luang NP, 9 Aug. 1927, *Kerr 13228* (**ABD, BK, BM, K**); Trang [Khao Chong, 30 May 1933, *S.N. 191* (**BKF-SN053800**); *ibid.*, 12 Aug. 1975, *Maxwell 75-786* (**AAU, BK, L**)].

**Distribution.**— India, Peninsular Malaysia.

**Ecology.**— Shaded evergreen forest, 200–400 m alt.

**Vernacular.**— Khem kao (เข็มนขาว), khem pa (เข็มนป่า).

**Note.**— *Pavetta humilis* is distinctive on account of its densely erect hairs on the

calyx tube, glabrous on the outside of corolla tube and the leaves without domatia.

**6. *Pavetta kedahica*** Bremek., Repert. Spec. Nov. Regni Veg. 37: 83. 1934. Type: Peninsular Malaysia, Kedah, Pulau Adang, Apr. 1894, *Ridley 15886* (lectotype **K** [K000763372!], designated by Bremekamp (1934), isolectotype **SING** [SING00686-96!]).

**Thailand.**— PENINSULAR: Phangnga [Takua Pa, Khao Lak-Lam Ru NP, 10 June 2004, *Gardner & Setsin ST0693* (**BKF, K**)].

**Distribution.**— Peninsular Malaysia, Sumatra.

**Ecology.**— Littoral vegetation, 0–2 m alt.

**Vernacular.**— Khem chai haad bai kwang (เข็มชายหาดใบกว้าง).

**Note.**— *Pavetta kedahica* is characterized by having domatia and tufted hairs in axils of lateral veins on the lower surface of leaves, dense hairs at the corolla throat and cilia at the margin of the corolla lobe. This species is found in littoral vegetation.

**7. *Pavetta napieri*** (Ridl.) Bremek., Repert. Spec. Nov. Regni Veg. 37: 96. 1934.— *Webera napieri* Ridl., J. Fed. Malay States Mus. 4: 34. 1909.— *Tarenna napieri* (Ridl.) Ridl., Fl. Malay Penins. 2: 102. 1923. Type: Peninsular Malaysia, Negri Sembilan, Bukit Tanga, near Seremban, *Napier s.n.* (holotype **SING** [SING0058435!]).— *P. naucleiflora* R.Br. ex G.Don var. *longifolia* Rild., Fl. Malay Penins. 2: 101. 1923. Type: Peninsular Malaysia, Kelantan, Chaning, *Ridley s.n.*, Feb. 1917 (holotype **K** [K001067638!]).

**Thailand.**— PENINSULAR: Phuket [Thalang, Khao Phra Thaew, Toen Ton Sai Falls, 1 Feb. 2003, *Chamchumroon et al. V.C.1895* (**BKF**)]; Songkhla [Ton Nga Chang, 18 Jan. 1992, *Niyomdham 2906* (**AAU, BKF-2** sheets)].

**Distribution.**— Peninsular Malaysia.

**Ecology.**— In evergreen forest, 100–150 m alt.

**Vernacular.**— Khem khon bai rieow (เข็มคนใบรีขาว).

**Note.**— The distinguishing features of *Pavetta napieri* are the sparsely or densely appressed hairs on the calyx tube and outside of corolla tube. In the original description of *P. naucleiflora* var. *longifolia*, Ridley (1923) indicated the locality, Chaning, Kelantan, without mention the collection. After careful examination, *Ridley s.n.* at **K** is matched with the protologue, therefore, the specimen here is the holotype. This species is the first recorded here for Thailand.

**8. *Pavetta naucleiflora*** [*naucleaeflora*] R.Br. ex G.Don, Gen. Syst. 3: 575. 1834. Type: Peninsular Malaysia, Penang, *Wallich, Numer. List 6171* (lectotype **K** [K000763507!], selected here; isolectotypes **BR** [BR0000005587728, digital image], **E** [E00327892! & E00327893!], **K-W** [K001123210!], **LE** [LE00017456, digital image]).— *Ixora naucleiflora* (R.Br. ex G.Don) Kurz, Forest Fl. Burma 2: 19. 1877 & J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 46(2): 147. 1877. Fig. 1C.

**Thailand.**— NORTH-EASTERN: Loei [Phu Kradueng, without date, *Bunpheng 331* (**BKF**)]; SOUTH-WESTERN: Kanchanaburi [Huai Bankau, 12 Nov. 1971, *van Beusekom et al 726* (**BKF**); *ibid.*, 12 Nov. 1971, *van Beusekom 3726* (**BKF, K**); between Kritee and Mueang Chah, 9 July 1973, *Geesink & Phengklai 6194* (**AAU, BKF, E**); Sangkhla Buri, Khao Yai, 2 Aug. 1968, *Prayad 1453* (**BK**); Si Sawat, 17 Jan. 1926, *Kerr 10242* (**ABD, BK, BM, E, K**); Thong Pha Phum, Sam Lang Village, 20 Feb. 1977, *Bunnak & Thanee 3190* (**BKF-2** sheets); *ibid.*, Thung Yai Naresuan WS, 26 Jan. 2003, *van de Bult 624* (**BKF**); Vicinity of Pilok, 9 Jan. 1985, *Koyama et al. T-48923* (**KYO**)]. PENINSULAR: Surat Thani [Ko Pha-ngan, 7 June 1927, *Put 812* (**ABD, BK, BM, E, K, TCD**); *ibid.*, 17 June 1927, *Put 885* (**ABD, BK, BM, K**); Ko Pha-ngan, 10 Nov. 1927, *Put 1249* (**BK, BM, K**); *ibid.*, 4 Dec 1974,

*Geesink et al. 7780 (BKF)*; Nakhon Si Thammarat [Khao Luang NP, Lan Saka, 15 Dec. 2009, *Chamcumroon et al. 3429 (BKF-2 sheets)*; *ibid.*, 18 Jan. 1966, *Tagawa et al. T-4637 (BKF)*; *ibid.*, Nopphitam, Krung Ching Waterfall, 12 Feb. 2005, *Williams et al. 1434 (BKF, E)*; Trang [Khao Chong, 12 Aug. 1964, *Suwannakoset 2154 (BKF)*]; Songkhla [Sadao, Khao Roon Chang, Padang Besar, 20 July 1986, *Maxwell 86-489 (AAU, BKF, L, PSU)*]; Pattani [Sai Khao Waterfall, 9 Oct. 1991, *Larsen et al. 42263 (AAU, BKF, PSU)*]; Yala [Mae Wat-Betong, Bang Lang NP, Ban Wang Sai, 18 July 2004, *Pooma et al. 4361 (BKF)*]; Unknown locality; Than Nam, 28 Jan. 1961, *Larsen 9334 (BKF)*.

**Distribution.**— India, Bhutan, Myanmar, Cambodia, Peninsular Malaysia.

**Ecology.**— Partly shaded area, limestones, mixed deciduous, dry evergreen and evergreen forests, 50–800 m alt.

**Vernacular.**— Khem khon (เข็มนาน) khem khon lek (เข็มนานเล็ก).

**Note.**— *Pavetta naucleiflora* superficially resembles *P. napieri* it is quite distinct in possessing densely erect-hairy on the calyx tube. *Pavetta naucleiflora* was described based on *Wallich Numer. List 6171* which has six sheets. The sheet K000763507 is selected as lectotype because it has more flowers and line drawings of dissected fruit. *Pavetta naucleiflora* is the first recorded from Ta Tay Leu, Thma Baing, Ko Kong, Cambodia which based on *Newman et al. 2103 (E00319009)*.

**9. *Pavetta petiolaris*** Craib, Bull. Misc. Inform. Kew 1939(9): 432. 1932. Type: Thailand, Chiang Mai, Doi Angka, Mae Ka Pak drainage, 21 Apr. 1928, *Garret 504* (lectotype **K** [K000763496! sheet 1], selected here; isolectotypes **E** [E008486-34!], **K** [K000763497! sheet 2], **L**

[L0001011, digital image], non Wall., 1831-1832.— *P. pusilliflora* Bremek., Repert. Spec. Nov. Regni Veg. 37: 117. 1934. Type: Thailand, Chiang Mai, Pang Tawn, 2 May 1931, *Put 3866* (holotype **K** [K0007634-92!], isotypes **BK** [BK222082!], **BM** [BM000945418!]). **syn. nov.**— *P. densiflora* Bremek., *nom. nud.*— *P. wallichiana* var. *glabrescens* Bremek., *nom. nud.* Fig. 2A.

**Thailand.**— NORTHERN: Mae Hong Son [Mae Sariang, 9 Apr. 2011, *Somprasong MH090411/6 (BK-2 sheets)*]; Chiang Mai [Unknown locality, 10 Feb. 1998, *Chayamarit 1187 (BKF)*]; Doi Chiang Dao, 16 Mar. 1956, *Ploenchit 1114 (BKF)*; *ibid.*, 3 June 1973, *Geesink et al. 5651 (BKF, E, K)*; *ibid.*, Pa Blaung Cave, 11 Mar. 1989, *Maxwell 89-327 (BKF)*; *ibid.*, 2 Apr. 1989, *Maxwell 89-417 (BKF)*; Doi Inthanon, 16 Apr. 1960, *Smitinand & Alsterlund 6706 (BKF, K)*; Mae Cham, Huai Hom, ban Chan, 11 Dec. 2007, *Tanaka HN8112 (KYO)*; Mae Rim, north part of Doi Sutep, 9 Jan. 1994, *Fukuoka & Koyama T-62056 (BKF)*; Chiang Rai [Khun Korn Fall, 22 June 2002, *Chamchumroon et al. 1604 (BKF-2 sheets)*]; Mae Sai, Ban Samphasak, 22 Mar. 2011, *Norsaengsri & Tathana 826 (BKF)*; Phu Chi Fa, 3 Apr. 2001, *Chueachom 512 (BKF-2 sheets)*; Nan [Pua, Doi Phu Kha NP, 8 Apr. 1999, *Srisanga & Watthana 660 (BKF)*; *ibid.*, 16 Nov. 2001, *Srisanga 2304 (BKF)*]; Phrae [Huai Ton Yang, 19 Mar. 1961, *Adisai 32 (BKF)*]; Mae Kawn, 25 Mar. 1926, *Winit 1672 (ABD, BK, BKF, K)*; Uttaradit [Phu Soi Dao NP, 20 Sept. 1996, *Pooma 1340 (BKF)*]; Tak [Phop Phra, Pa Charoen Waterfall, 20 June 2011, *Chamchumroon et al. 4958 (BKF)*]; Phitsanulok [Phu Hin Rong Kla, 3 May 2011, *Somprasong PS030511/3 (BK-3 sheets)*]; NORTH-EASTERN: Loei [Phu Luang WS, Pha Somdet, 13 Dec. 1997, *Wongprasert s.n. (BKF-SN111022)*; *ibid.*,

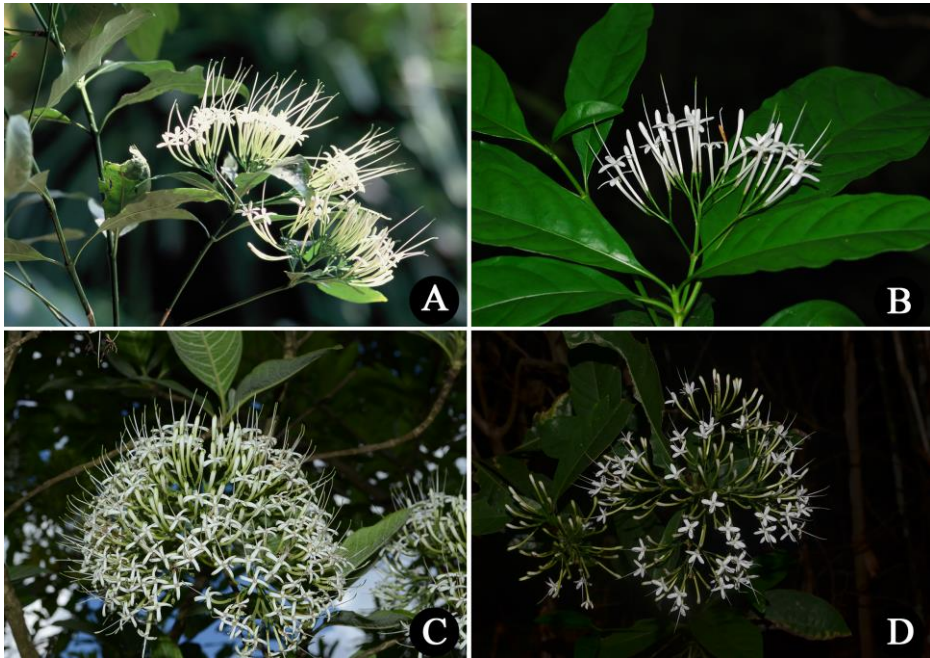


FIGURE 2. A. *Pavetta petiolaris*; B. *P. sylvatica*; C. *P. tomentosa*; D. *P. tomentosa* var. *glabrescens*

13 May 1998, *Wongprasert s.n.* (**BKF**-2 sheets-SN122419 & SN122420); *ibid.*, en route from Khok Nok Kraba to Lon Tae, 14 May 1998, *Wongprasert s.n.* (**BKF**-SN121009)]; EASTERN: Nakhon Ratchasima [Khao Yai NP, Khao Khiao, 25 Oct. 1988, *Santisuk 6851* (**BKF**)]; SOUTH-WESTERN: Kanchanaburi [Hin Dat, 1 July 1926, *Put 61* (**ABD, BK, BM**); Huai Kha Khaeng, Yang Dang substation, 5 May 1993, *Smitinand et al. 1601* (**BKF** (2 sheets)); Sangkhla Buri, 30 May 2006, *Triboun s.n.* (**BK**-265184); *ibid.*, Khao Ngi Yai, 4 Apr. 1968, *van Beusekom & Phengklai 337* (**AAU, BKF, E, K**); CENTRAL: Nakhon Nayok [Mueang, Khao Yai NP, 3 km south of Maw Sing To Reservoir, 28 June 2001, *Maxwell 01-345* (**BKF**)]; Bangkok [Unknown locality, 21 Apr. 1920, *Kerr 4215* (**BK, BM, K, TCD**)]; SOUTH-EASTERN: Prachin Buri [Khao Yai NP, 27 Mar. 1998, *Wongprasert s.n.* (**BKF**-2 sheets)]; Chanthaburi [Khitchakut

NP, Khao Pha Bat-Phaung, 28 June 2001, *Chamchumroon & Puff VC1078* (**BKF**-2 sheets); Khao Soi Dao WS, 15 May 2013, *Tagane et al. T1419* (**BKF**)]; PENINSULAR: Chumphon [Sawi, Tham Than Lod, Ban Khao Talu, 7 May 2002, *Pooma et al. 3526* (**BKF**-2 sheets)]; Phangnga [Takua Thung, 23 Mar. 2008, *Chamcumroon et al. VC2522* (**BKF**)]; Trang [Khao Chong, 21 Apr. 1943, *Boonyothon 2* (**BKF**); *ibid.*, 4 July 1969, *Sangkhachand 1957* (**BK**)].

**Distribution.**— India, Laos, Indonesia.

**Ecology.**— In moist evergreen, hill dipterocarp ad mossy montane forests, 350–1,700 m alt.

**Vernacular.**— Khem phae (เข็มพะยะ), ya khao san (หญ้าข้าวสาร)(Northern); bue-khli (บือคลี) (Karen-Mae Hong Son), ton khao sam (ต้นข้าวสาร).

**Note.**— *Pavetta petiolaris* is distinctive in having sparsely or densely appressed hairy calyx tube, glabrous on the outside of stipules and corolla tube, and the lower surface of the leaves without both domatia

and tufted hairs in axils of lateral veins. *Pavetta pusilliflora* has shorter corolla tube 7 mm long and inflorescences 4 cm long whereas corolla tube 10–12 mm long and inflorescence up to 11 cm long in *P. petiolaris* but in general they are conspecific. Bremekamp (1934) indicated *Garret 504* at **K** is the type, but the collection has 2 sheets, at **K** and one each at **E** and **L**. The K000763496 sheet 1, is selected as the second-step lectotype because it has more inflorescences. In addition, two collections of Kerr at Kew, *Kerr 21082* with 4 sheets from Laos (Chiang Kwang, Muang Cha) and *Kerr 1775* from Thailand (Doi Suthep) were named as *P. densiflora* and *P. wallichiana* var. *glabrescens* by Bremekamp, respectively, but these name have not been published and they are conspecific with *P. petiolaris* Craib.

**10. *Pavetta salicina* (Ridl.) Bremek.,** Repert. Spec. Nov. Regni Veg. 37: 103. 1934.— *Webera salicina* Ridl., J. Fed. Malay States Mus. 4: 34. 1909.— *Tarenna salicina* (Ridl.) Ridl., Fl. Malay Penins. 2: 104. 1923. Type: Peninsular Malaysia, Pahang, Telom Waterfall, 8 Nov. 1908, *Ridley 13610* (holotype **SING** [SING0058-845!], isotype **K** [K000763506!]).

**Thailand.**— PENINSULAR: Yala [Khao Han Kut, 27 Mar. 1998, *Niyomdham 5376* (**AAU, BKF**)].

**Distribution.**— Peninsular Malaysia.

**Ecology.**— Evergreen forest, sea level.

**Vernacular.**— Khem kao bai leiw (เขมขาวใบเหล็ก).

**Note.**— An elegant shrub remarkable for its narrow leaves (9–14 by 0.5–1.5 cm). Some leaves of the type specimen have larger leaves up to 21 by 4 cm.

**11. *Pavetta siamica* Bremek.,** Repert. Spec. Nov. Regni Veg. 37: 120. 1934. Type: Thailand, Bangkok, 21 Apr. 1920, *Kerr*

*4215* (holotype **K** [K000763491!]; isotypes **BM** [BM000945424!]).

**Thailand.**— NORTHERN: Chiang Mai [Doi Inthanon, 25 Dec. 1969, *Werawoat 68* (**BKF**); Mae Cham, Mae Sanga Watershed Management Unit, 6 May 2005, *Sookchaloem et al. 3347* (**BKF-2** sheets); Doi Suthep-Pui NP, trail near Youth Camping, 2 Dec. 2002, *Chamchumroon et al. VC1660* (**BKF-2** sheets)]; Chiang Rai [Mae Fa Luang, Wat Phatat Doi Tung, 17 Mar. 2005, *Pooma et al. 4862* (**BKF**)]; Nan [Doi Phu Kha NP, 8 Apr. 1991, *Pooma 436* (**BKF**); *ibid.*, 22 Aug. 2001, *Srisanga & Maknoi 2032* (**BKF**)]; Uttaradit [Phu Soi Dao NP, Lan Son, 19 Mar. 2002, *Chamchumroon & Puff VC1454* (**BKF**)]; NORTH-EASTERN: Loei [Na Haeo, Phu Suan Sao NP, 14 May 2008, *Maknoi & Srisanga 2181* (**BKF**); *ibid.*, 9 July 2008, *Maknoi 2501* (**BKF**); Wang Saphung, Pa Sithan, 20 Apr. 1948, *Din 269* (**BKF**)]; SOUTH-WESTERN: Phetchaburi [Kaeng Krachan NP, 8 May 2005, *Middleton et al. 3278* (**BKF, E**); *ibid.*, 25 Oct. 2013, *Tagane et al. T2117* (**BKF**)]; Prachuap Khiri Khan [Bang Saphan Noi, 12 June 2006, *Williams et al. 1643* (**BKF, E**)]; SOUTH-EASTERN: Chanthaburi [Khao Khitchakut NP, Khao Phra Bat, 30 Mar. 2008, *Phonsena 5907* (**BKF**)]; PENINSULAR: Chumphon [Langsuan, Pato, 27 Feb. 1927, *Kerr 12154* (**ABD, BK, BM, K**)]; Surat Thani [Ban Thamniap, Ratsatthatham, 6 Sept. 2008, *Middleton et al. 4298* (**E, K**)]; Phatthalung [Sala, 30 Apr. 1930, *Kerr 19242* (**ABD, BK, BM, K**)]; Trang [Khao Chong, 20 May 1960, *Chirayupin 35* (**BK**); *ibid.*, 21 Apr. 1969, *Phusomsaeng 222* (**BKF-2** sheets)]; Pattani [Ban Sai Khao, 4 Apr. 1928, *Kerr 15023* (**ABD, BK, BM, K**)]; Yala [Ban Rang, 24 Apr. 1974, *Geesink & Hattink 6383* (**BKF, K**)]; Unknown locality: [Bang Son, 10 Mar. 1928, *Put 1502* (**ABD, BK, BM**)].

**Distribution.**— Myanmar, Cambodia, Peninsular Malaysia.

**Ecology.**— In open montane scrub forest and evergreen forest, 10–1,240 m alt.

**Vernacular.**— Khem khao (เขมขาก), khem khao yai (เขมขากใหญ่), khem khom (เขมโขม).

**Note.**— *Pavetta siamica* is similar to *P. petiolaris* but differs by not having domatia and tufted hairs on the axils of lateral veins on lower leaf surface. The type collector number is *Kerr 4215*, not *4251* as indicated in the work of Bremekamp (1934).

**12. *Pavetta sylvatica*** Blume, Bijdr. Fl. Ned. Ind. 16: 953. 1826. Type: Indonesia, West Java, Gunung Suribu, *Blume 843* (holotype **L** [L0057798, digital image]).— *P. pauciflora* Ridl., J. Straits Branch Roy. Asiat. Soc. 86: 297. 1922. Type: Peninsular Malaysia, Selangor, Batu Caves, Dec. 1920, *Ridley s.n.* (holotype **SING** [SING0058846!]; isotype **K** [K001067636!]). Fig. 2B.

**Thailand.**— NORTHERN: Kamphaeng Phet [Unknown locality, 21 June 1930, *Kiah 24365* (**BK**, **K-2** sheets), **TI**-photo)]; EASTERN: Nakhon Ratchasima [Khao Yai NP, Khao Khiao, 15 Mar. 1968, *van Beusekom & Phengklai 69* (**E**, **K**)]; SOUTH-WESTERN: Phetchaburi [Kaeng Krachan NP, 26 May 2016, *Leeratiwong 16-456* (**PSU**); *ibid.*, 24 Oct. 2013, *Tagane et al. T2137* (**BKF**); *ibid.*, near Ban Krang Camp, 27 June 2000, *Newman et al. 1092* (**AAU**, **BKF**, **E**)]; CENTRAL: Nakhon Nayok [Khao Yai NP, near Pha Ta-Baeng Waterfall, 14 Oct. 1984, *Murata et al. T-52374* (**KYO**)]; PENINSULAR: Chumphon [Ban Racha Krude, 6 July 1992, *Larsen et al. 43157* (**AAU**, **BKF**); Mueang, Thungraya-Nasak WS, 29 Aug. 2002, *Middleton et al. 1450* (**BKF**); Phato, 2 May 1974, *Tippa 206* (**BK**); Sawi, Pak Tako, 6 June 1969, *Jaray 132* (**BK**, **K**); *ibid.*, 2 May 1974, *Larsen & Larsen 33571* (**AAU**, **K**); Ranong [Hadsin Dam, 24

June 1974, *Geesink et al. 7457* (**AAU**, **BKF**, **K**); Ngao Waterfall, 8 July 1992, *Larsen et al. 43234* (**AAU**, **PSU**); Surat Thani [Phanom, Khao Sok NP, 12 Dec. 1979, *Shimizu et al. T-27063* (**BKF**); *ibid.*, 25 Oct. 1990, *Larsen et al. 40890* (**AAU**, **K**)]; Phangnga [Moo Ko Surin NP, 15 Apr. 1994, *Niyomdham et al. 3623* (**BKF**); Ko Yao, Ban Nam Pao, Ko Yao Noi, 2 May 2007, *Suddee et al. 3181* (**BKF**); Takua Thung, Khao Phing Kan Island, 8 Sept. 1982, *Shimizu et al. T-29207* (**BKF**); *ibid.*, 8 Sept. 1982, *Shimizu et al. T-29212* (**BKF**, **KYO**)]; Krabi [Mueang, 4 Dec. 1990, *Tirvengadum 1995* (**AAU**); Ao Nang, 16 July 1992, *Larsen et al. 43467* (**AAU**, **BKF**); Khao Naung, 30 Oct. 2006, *Triboun 3700* (**BK**); Ko Phi Phi, 16 July 1992, *Larsen et al. 43477* (**BKF**, **PSU**); *ibid.*, Hat Noppharat Thara, 17 Sept. 1990, *Puff et al. 900917-2/3* (**BKF**); Than Bok Khorani NP, Ao Luk, 15 July 1992, *Larsen et al. 43435* (**BKF**); Nakhon Si Thammarat [Khao Luang, 18 Apr. 1972, *Ploenchit 327* (**BKF**); *ibid.*, 18 May 1928, *Kerr 15547* (**ABD**, **BK**, **BM**, **E**, **K**, **TCD**)]; Phatthalung [Tamote Falls NP, 9 Aug. 1986, *Maxwell 86-551* (**BKF**); Tha Mot [Tamot], 5 June 1992, *Larsen et al. 42676* (**AAU**); Tha Mot [Tamot], 24 Oct. 1993, *Larsen et al. 43956* (**AAU**)]; Trang [Khao Chong, 12 Aug. 1975, *Maxwell 75-783* (**BK**); Satun [Khuan Don, Thale Ban NP, 12 July 2000, *Middleton et al. 397* (**BKF**, **E**, **K**); Songkhla [Hat Yai, Ko Hong Hill, 6 Dec. 1985, *Maxwell 85-1080* (**BKF**); Khao Nam Khang NP, Na Thawee, 20 Oct. 1991, *Larsen et al. 42449* (**AAU**, **BKF**); *ibid.*, 28 Aug. 1995, *Larsen et al. 46085* (**AAU**); Rattaphum, Boripat Waterfall, 5 Aug. 1993, *Puff & Sridith 930805-1/4* (**AAU**, **PSU**); Pattani [Sai Khao NP, 16 July 1993, *Puff & Sridith 930716-1/2* (**AAU**, **PSU**); Narathiwat [Bacho Waterfall, 18 July 1993, *Puff & Sridith 930718-1/3* (**AAU**, **PSU**); Si Sakhont, Khao Paa Tuu Hub Paa, 26 Apr. 2001, *Puudjaa 893* (**BKF-2** sheets); Sukhirin, Hala-Bala WS, 2 May 2004,

*Poopath 18* (**BKF**-2 sheets); Waeng Hala-Bala, 28 Apr. 1999, *Puudjaa 554* (**BKF**); *ibid.*, 24 Aug. 2006, *Poopath et al. 101* (**BKF**-2 sheets); Mae Wat-Betong, Bang Lang NP, Ban Wang Sai, 18 July 2004, *Pooma et al. 4345* (**BKF**)

**Distribution.**— Myanmar, Cambodia, Sumatra, Peninsular Malaysia, Java, Borneo.

**Ecology.**— In evergreen, dry evergreen, hill evergreen and evergreen gallery forests, 5–1,300 m alt.

**Vernacular.**— Khem (เขម).

**Note.**— *Pavetta sylvatica* resembles to *P. kedahica* but differs in having glabrous or scantily hairy on the corolla throat and glabrous on the margin of the corolla lobe. The specimen *Khou 19*, from the Cardamon mountain range, Phnom Khmaoch, Veal Veng district, Pursat province, is the first recorded for Cambodia.

**13. *Pavetta tomentosa*** Roxb. ex Sm. in Rees, *Cyclop.*: 26, no. 2. 1814.— *Ixora tomentosa* Roxb., [*Hort. Beng.*: 11. 1814, *nom. nud.* ex] *Fl. Ind.* 1: 396. 1820.— *P. indica* L. var. *tomentosa* (Roxb. ex Sm.) Hook.f., *Fl. Brit. India* 3: 150. 1880. Type: Roxb. drawing in Wight, *Icon*, t. 186. 1840 as *Ixora tomentosa*.— *P. velutina* Wall., *Wallich Numer. List 6174*, **K-W** [K0011-23223!], *nom. nud.*— *P. mollis* R.Br. in *Wallich Numer. List 6179*, **K-W** [K0011-23240!], *nom. nud.*— *Ixora tomentosa* Roxb. var. *roxburghii* Kurz, *Forest Fl. Burma.* 2: 19. 1877.— *Pavetta tomentosa* Roxb. ex Sm. var. *roxburghii* (Kurz) Bremek., *Repert. Spec. Nov. Regni Veg.* 37: 114. 1934. Type: Myanmar (Burma), not cited in the protologue.— *P. indica* L. var. *canescens* Pit. in Lecomte, *Fl. Indo-Chine.* 3: 332. 1924.— *P. tomentosa* Roxb. ex Sm. var. *canescens* (Pit.) Craib, *Fl. Siam.* 2: 170. 1934. Type: Vietnam, Annam, Langbian Mts, *Chevalier 30658* (lectotype **P** [P03967302, digital image], designated by Bremekamp, 1934).— *P. pitardii* Bremek., *Repert. Spec. Nov. Regni Veg.* 37:

83. 1934. Type: based on type of *P. indica* var. *canescens*.— *P. indica* L. var. *mollis* Bremek., *Repert. Spec. Nov. Regni Veg.* 37: 119. 1934. Type: India, Andhra Pradesh, Cuddaph district, Guvalacharam ghat, July 1884, *Gamble 15021* (holotype **K n.v.**, isotypes **CAL n.v.**, **MH n.v.**— *P. praecox* Bremek., *Repert. Spec. Nov. Regni Veg.* 37: 114. 1934. Type: India, Madras, Karnataka, Belgaum, in Apr., *Ritchie 352* (holotype **K** [K000031489!], **CAL n.v.**).

**var. *tomentosa*** Fig. 2C.

**Thailand.**— NORTHERN: Chiang Mai [Bo Luang, 7 June 1974, *Geesink et al. 5779* (**AAU, BKF**); *ibid.*, 10 Nov. 1992, *Balick & Nanakorn 3439* (**AAU**); Doi Chiang Dao WS, 6 Dec. 2002, *Chamchumroon et al. V.C.1757* (**BKF**-2-sheets); *ibid.*, 2 June 1955, *Kanthachai 95* (**BKF, KYO**); *ibid.*, 19 Apr. 1956, *Ploenchit 1164* (**BKF**); *ibid.*, Pong Pho, 30 July 1968, *Larsen et al. 2838* (**AAU, BKF, E**); *ibid.*, Mae Taman Waterfall, Research Station, 22 May 2004, *Wongprasert et al. 045-74* (**BKF**-2 sheets); Chom Thong, Ban Ang Ka Noi, 1 June 1979, *Vidal et al. 6292* (**AAU, BKF**); Doi Inthanon NP, 5 Aug. 1988, *Fukuoka T-62511* (**BKF, KYO, L, TI**); *ibid.*, 30 Oct. 2000, *Chayamarit et al. 2212* (**BKF**); *ibid.*, 4 June 2000, *Chayamarit et al. 1957* (**BKF**); *ibid.*, 21 July 1988, *Fukuoka T-62129* (**BKF, KYO, TI**); *ibid.*, 22 July 1988, *Phengkklai et al. 6790* (**BKF**-2 sheets); *ibid.*, 30 May 1970, *Charl C 32* (**BKF**); *ibid.*, 30 May 1970, *Chaul 32* (**BKF**); *ibid.*, 22 July 1988, *Fukuoka T-62142* (**BKF, KYO**); *ibid.*, 7 June 2003, *Thangthong 368* (**KKU**); *ibid.*, Mae Klang river, 30 July 1988, *Fukuoka T-62383* (**BKF**); *ibid.*, 30 July 1988, *Fukuoka T-62363* (**BKF, KYO**); *ibid.*, 1 Aug. 1988, *Fukuoka T-62402* (**BKF, KYO**); *ibid.*, Mae Klang Waterfall, 18 July 1988, *Fukuoka T-62041* (**BKF, KYO, L, TI**); *ibid.*, 13 Nov. 1965, *Sangkachand 46*

**Key to the varieties**

- 1. Lower surface of leaves tomentose. Inflorescence tomentose.....**var. tomentosa**
- 1. Lower surface of leaves sparsely puberulous or glabrescens. Inflorescence sparsely puberulous  
.....**var. glabrescens**

(**BK**); *ibid.*, Mae Pan Waterfall, 13 Jan. 1994, *Fukuoka T-62139* (**BKF, L, TI**); *ibid.*, Mae Pan Waterfall, 29 July 1988, *Fukuoka T-62311* (**BKF, KYO, L**); Huai Nam Dang NP, 21 Jan. 2002, *Chayamarit et al. 3254* (**BKF**); Fang, Doi Ang Khang, 8 July 1975, *Sadakorn 565* (**BK**); *ibid.*, Ban Wieng Pa Pattana (Lahu Village), 10 July 1991, *Maxwell 91-642* (**AAU, E, L**); Khun Mae Ya Waterfall Management Unit, 7 May 2000, *Sookchaloem et al. 3408* (**BKF**); Kongloi, 29 June 1978, *Phengklai et al. 4196* (**BKF, K, KYO, L**); Mae Rim, Doi Mon Long, 11 June 1996, *Maxwell 96-813* (**BKF, L**); *ibid.*, San Pan See, QBG, 4 Aug. 1998, *Nanakorn et al. 11674* (**BKF**); Mae Tang, Mae Dtaman area, 27 May 1997, *Maxwell 97-538* (**BKF, L**); Me Ka Pak, Me Keng, 21 June 1928, *Garret 549* (**ABD, E, K-2** sheets); Doi Suthep-Pui NP, 20 July 1987, *Maxwell 87-681* (**BKF**); *ibid.*, 18 July 1909, *Kerr 725* (**BM, K**); *ibid.*, 21 July 1921, (*F.H.W.*) *Kerr 98* (**K**); *ibid.*, 16 Oct. 1921, *Hayata s.n.* (**TI**); *ibid.*, 9 Aug. 1948, *Soradet S24* (**BKF**); *ibid.*, 6 June 1949, *Soradet 471* (**BKF**); *ibid.*, 20 July 1958, *Sørensen et al. 4278* (**BKF, K**); Pae Ong Mong, 10 Sept. 1921, *Noi Mao s.n.* (**BK**); Samoeng, Ban Pa Kar, Samoengtai, 7 July 2008, *Jatupol 08-317* (**KYO**); Chiang Rai [Ban Tak, 15 Aug. 1967, *Prayad 985* (**BK**); Doi Luang NP, 10 Dec. 2002, *Chamchumroon et al. V.C. 1791* (**BKF-2** sheets); *ibid.*, 1 July 1998, *Maxwell 98-710* (**BKF**); Mae Suai, Ban San Sa At, 5 Aug. 1967, *Prayad 965* (**BK**); Phu Sang NP, 17 Sept. 1997, *S.N. SC50* (**BKF** (SN193567))); Nan [Unknown locality, Km 40-57 W of Nan along road to Phayao, 27 July 1992, *Larsen*

*et al. 43641* (**AAU**); Doi Kun Tang, 21 June 1948, *Smitinand 4687* (**BKF**); *ibid.*, 21 June 1991, *Smitinand 54* (**BKF**); Khun Mo Tom, 26 July 1992, *Larsen et al. 43609* (**AAU, BKF, PSU**); Lamphun [Mae Tha, Doi Khun Tan NP, 16 July 1993, *Maxwell 93-766* (**BKF, L**); *ibid.*, 26 Dec. 1984, *Koyama & Phengklai T-49502* (**BKF, KYO**); Lampang [Me Sung, 27 June 1926, *Winit 1735* (**BK, BKF, K, KYO**); Mueang Pan, Chae Son NP, 22 Sept. 1996, *Maxwell 96-1250* (**BKF**); Wang Nuea, Doi Luang NP, 3 June 1997, *Maxwell 97-575* (**BKF, L**); *ibid.*, 10 Dec. 2002, *Schanzer N02-116* (**BKF**); Phrae [Roadmark 56/57 km from Phrae, on route 11 to Lampang, 18 Aug. 1995, *Parnell et al. 95-221* (**K**); Tak [Lan Sang, 31 May 1973, *Geesink et al. 5594* (**AAU, BKF, E, K, KYO**); Umphang, Mae Ta-ngae-khi, Thung Yai Naresuan WS, 26 May 2008, *Pooma et al. 6976* (**BKF-2** sheets); Mae Sot, Thararak Waterfall, 30 May 1991, *Santisuk et al. 635* (**BKF-2** sheets)]; Sukhothai [Khiri Mat 23 Nov. 1977, *Phengklai et al. 3890* (**BKF-2** sheets); *ibid.*, Khao Luang, 22 June 1987, *Parikan & Prayad 73* (**BK**); Mueang Wat Sawang Arom Worawihan, 9 June 1972, *Maxwell 72-298* (**AAU, BK**); Phitsanulok [Namtok Chat Trakan NP], 19 Sept. 1996, *Pooma 1331* (**BKF**); Kaeng Sopha, 29 June 1967, *Phusomsaeng 268* (**BKF-2** sheets)]; Kamphaeng Phet [Khlung Lan, Mae Wong NP, 16 June 1997, *van de Bult 9* (**BKF-4** sheets); *ibid.*, Wong Phai, 2 Aug. 2000, *Chamchumroon V.C. 1008* (**BKF-2** sheets)]; Nakhon Sawan [Hua Wai, 28 Aug. 1931, *Put 4060* (**AAU, ABD, BK, BM, E, K**)]; NORTH-EASTERN: Phetchabun [Lom



- Kao, Phu Khoe, 8 May 1955, *Smitinand* 2678 (**BKF**); *ibid.*, Ban Low Ya, 15 Dec. 1966, *Prayad* 602 (**BK**); Nam Nao NP, 1 Dec. 2002, *Thangthong* 369 (**KKU**); *ibid.*, 29 Apr. 2003, *Chantaranothai et al. s.n.* (**KKU**); *ibid.*, 5 May 2004, *Thangthong* 370 (**KKU**); *ibid.*, 7 May 2004, *Chantaranothai et al. 179/2003* (**BKF**); *ibid.*, 7 May 2004, *Chantaranothai et al. 179-2003* (**KKU**); Loei [Na Haeo, Phu Suan Sai NP, 13 May 2008, *Maknoi & Srisanga* 2121 (**BKF**); *ibid.*, Hua Hom, 8 July 2008, *Maknoi* 2479 (**BKF**); Pa Sala, Chom View, 6 May 1966, *S.N. 324* (**BKF-SN053780**); Phu Kradueng NP, 28 Aug. 1988, *Fukuoka T-63675* (**BKF, KYO, L, TI**); *ibid.*, 12 Oct. 1967, *Prayad* 1021 (**BK**); Phu Rua NP, 4-5 May 1997, *Puff* 970505-1/1 (**BKF**); *ibid.*, 22 Jan. 2004, *Bunwong et al. 275* (**BKF**); *ibid.*, 10 May 2005, *Thangthong* 339 (**KKU**); Wang Saphung, 18 Apr. 1947, *Din* 184 (**BKF**); *ibid.*, 8 July 1948, *Dee* 75 (**BKF**); Nong Bua Lamphu [*Thangthong* 364 (**KKU**); Nong Khai [Dong Sichompoo, 27 June 1963, *Adisai* 573 (**BK**); Buengkan [Seka Ban Tong, Chet Si Waterfall, 20 May 2004, *Pooma et al. 4122* (**BKF**); Sakon Nakhon [Kusuman, 25 Aug. 2001, *Pooma et al. 2598* (**BKF-2** sheets); Phu Phan NP, 15 Nov. 1984, *Murata & Phengkhlai T-50350* (**BKF, KYO-2** sheets); *ibid.*, 8-10 May 1997, *Puff* 970508-1/2 (**BKF**); *ibid.*, 11 May 2002, *Mattapha Sawai* 11 (**KKU**); *ibid.*, without date, *Chantaranothai et al. 302* (**BKF, KKU**); Mukdahan [Don Tan, 10 May 1932, *Kerr* 21520 (**ABD, BK, BM, K**); Maha Sarakham [Borabue, 15 Apr. 2003, *Thangthong* 338 (**KKU**); Khon Kaen [Khon Kaen University, without date, *Wangwasit* 20 (**BKF, KKU**); EASTERN: Chaiyaphum [Huai Mak Daeng, 20 May 1971, *CH. 165* (**BKF**); Kaeng Khro, 25 Oct. 1965, *Sutheesorn* 661 (**BK**); *ibid.*, 24 Aug. 1988, *Takahashi T-63079* (**AAU, BKF**); Pa Ban Ru Phek, 10 Nov. 1966, *S.N. 258* (**BKF-SN053742**); Phu Khiao WS, 8 Nov. 1984, *Murata et al. T-41864* (**BKF, KYO-2** sheets); *ibid.*, 8 Nov. 1984, *Murata et al. T-50032* (**BKF, KYO-2** sheets); *ibid.*, Oct. 1999, *Phengkklai et al. 12328* (**BKF**); *ibid.*, 20 Sept. 1984, *Fukuoka T-36220* (**BKF, KYO, TI**); Thung Kamang, 30 May 1974, *Geesink et al. 7087* (**BKF, K**); 15 km north-east of Chaiyaphum, 14 Aug. 1972, *Larsen et al. 31848* (**AAU, BKF, E, K, KYO**); Nakhon Ratchasima [Ban Chum Seng, 17 Mar 1930, *Put* 2785 (**BK, BM, E, K**); Pak Thong Chai, Sakaerat Forest Reserve, 1 Nov. 1969, *van Beusekom & Charoenpol* 2009 (**AAU, BKF, K, KYO**); *ibid.*, 7 Dec. 1983, *Fukuoka & Ito T-34836* (**KYO**); *ibid.*, 1 June 1991, *Eiadthong W-228* (**BKF**); Ta Chang, May 1924, *Bourke s.n.* (**BK-SN222109**); Surin [Khao Sawai, 13 May 1965, *Sakol* 248 (**BK**); Ubon Ratchathani [Dong Fa Huan Botanical Garden, 21 Aug. 2001, *Pooma et al. 2163* (**BKF**); *ibid.*, 21 June 2004, *Puudjaa* 1327 (**BKF**); Khemarat, 18 Oct. 1998, *Chamchumroon s.n.* (**BKF-SN152360**); Phibun Mangsahan, 21 Aug. 2001, *Pooma et al. 2244* (**BKF**); Unknown locality, 8 June 1932, *Lakshaakara* 864 (**ABD, BK, BM, K, KYO-photo, TI**); SOUTH-WESTERN: Uthai Thani [Ban Rai, Khao Sanam, 15 July 1963, *Sangkhachand* 976 (**BKF, C, E, K**); *ibid.*, Huai Kha Khaeng WS, 23 Feb. 1970, *van Beusekom & Santisuk* 2920 (**AAU, BKF, E**); *ibid.*, 21 June 1991, *Santisuk et al. 127* (**BKF-3** sheets); *ibid.*, on the way to Khao nang Rum Research Station, 12 Nov. 1979, *Shimizu et al. T-22449* (**KYO**); Kanchanaburi [Bo Ploi, Khao Kam Paeng, Tham Than Lod NP, 8 Nov. 1979, *Shimizu et al. T-22150* (**KYO**) & *T-22690* (**KYO**); Erawan, 2 July 1974, *Larsen & Larsen* 34028 (**AAU, BKF, K**); Khao Salob, 18 Aug. 1968, *Nimanong & Phusomsaeng* 301 (**BKF, K**); Mueang, 19

Nov. 1969, *Bunnak 1584* (BKF); Si Sawat, 18 May 1962, *Karem 151* (BK); *ibid.*, 28 June 1974, *Larsen & Larsen 33913* (AAU, BKF, E, K); *ibid.*, 22 Aug. 1968, *Prayad 1532* (BK); Huai Ban Gow, 13 July 1973, *Sutheesorn 2604* (BK); *ibid.*, 9 Nov. 1971, *van Beusekom et al. 3578* (BKF, K, KYO); Thong Pha Phum, 15 Dec. 1993, *Winai & Parinya Wp 387* (BK); *ibid.*, Ban Linthin, 25 Aug. 1999, *Wongprasert 998-11* (BKF-2 sheets); *ibid.*, Thung Sau Ton, 30 Mar. 2003, *Thangthong 340* (KKU); Wang Khanai, 14 May 1927, *Kerr 12848* (AAU, ABD, BK, BM, E, K); Ratchaburi [Suan Phueng, Jone Waterfall, 6 Oct. 2002, *Niyomdham & Puujaa 7013* (BKF-2 sheets)]; Phetchaburi [Khao Son, Kaeng Krachan NP, 18 June 1987, *Santisuk s.n.* (BKF-SN096640)]; Prachuap Khiri Khan [Hua Hin, 3 Aug. 1920, *Marcan 371* (ABD, BM-2 sheets, K)]; Nawng Kae, 1 Oct. 1927, *Collins 1600* (BK, K); Unknown locality, 15 Sept. 1926, *Put 254* (AAU, ABD, BK, BM, K)]; CENTRAL: Suphan Buri [Dan Chang, Phu Toei NP, 29 June 2001, *Wongprasert 016-16* (BKF)]; *ibid.*, 9 June 2001, *Chayamarit et al. 2972* (BKF-4 sheets); Phu Toei NP, Dan Chang, 7 Sept. 2001, *Flora of Thailand; Western Forest Complex Project 131258* (BKF); *ibid.*, 7 Sept. 2001, *van de Bult 459* (BKF)]; Saraburi [Muenag Sam Lan, 2 June 1974, *Maxwell 74-577* (AAU, BK)]; SOUTH-EASTERN: Chon Buri [Si Racha, Khao Khieo, 10 Apr. 1975, *Maxwell 75-411* (AAU, BK)]; PENINSULAR: Ranong [Ko Chang, Ko Phayam, 24 Apr. 2006, *Wongprasert 064-26* (BKF-2 sheets)]; Surat Thani [Khiri Rat Nikhom, Khao Tam, 2 July 1966, *Sakol 1178* (BK)]; Songkhla [Chana, Khao Reng Hill, 19 Apr. 2009, *Inuthai 496* (PSU, BKF)]; *ibid.*, 20 June 2009, *Inuthai 514* (BKF, PSU-2 sheets); *ibid.*, 29 Aug. 2009, *Inuthai 546* (PSU)]; Hat Yai, Ton Nga Chang

WS, 14 Sept. 1990, *Puff et al. 900914-1/4* (BKF); *ibid.*, Ton Plio Waterfall, 2 June 2001, *Pooma et al. 1944* (BKF-2 sheets); *ibid.*, 21 Aug. 1992, *Niyomdham 3159* (BKF-2 sheets); Rattaphum, Ton Nga Chang WS, 2 Oct. 1984, *Maxwell 84-282* (BKF, PSU); *ibid.*, 14 May 2004, *Gardner & Sidisunthorn ST0519* (BKF, K)]; Unknown locality, without date, *Puff 000826-1/1* (BKF)].

**Distribution.**— India, Bhutan, Nepal, Myanmar, Laos, Cambodia, Vietnam, Peninsular Malaysia, Singapore.

**Ecology.**— In lowland evergreen, dry dipterocarp, mixed deciduous, hill evergreen, pine and dry evergreen forests, 10–1,400 m alt.

**Vernacular.**— Khao san pa (ข้าวสารป่า), khem phae (เข็มพะยะ)(Chiang Mai), khem paa (เข็มป่า) phee suea luang (ตีนเหี่ยวหลวง).

**Note.**— *Pavetta tomentosa* var. *tomentosa* is easily to recognize. The lower surface of leaves and inflorescence are whitish tomentose.

**var. *glabrescens*** (Kurz) Craib, Fl. Siam. 2: 171, Feb. 1934.— *Ixora tomentosa* Roxb. var. *glabrescens* Kurz, Forest Fl. Burma 2: 19. 1877.— *P. tomentosa* Roxb. ex Sm. var. *glabrescens* (Kurz) Bremek., Repert, Spec. Nov. Regni Veg. 37: 114, Nov. 1934.— *P. indica* L. var. *glabrescens* (Kurz) Rout & Deb, J. Bomb. Nat. Hist. Soc. 89(3): 351. 1992. Type: Myanmar (Burma), Pegu, 23 Jan. 1871, *Kurz 3057* (lectotype CAL, right hand specimen, selected by Rout & Deb (1999), *n.v.*— *P. polyantha* R.Br. in *Wallich Numer. List 6176, nom. nud.*— *P. indica* L. var. *polyantha* Hook.f., Fl. Brit. India 3: 150. 1880.— *P. polyantha* (Hook.f.) Bremek., Repert, Spec. Nov. Regni Veg. 37: 103. 1934. Type: India, Meghalaya, Silhet Mt. (Jowai), *De Silva & Gomez s.n.* in *Wallich Numer. List 6176* (lectotype K-W [K001123237!], selected here, isolectotype (K [K000031477!]).— *P. neglecta* Bremek., Repert, Spec. Nov. Regni Veg. 37: 92.

1934; Fischer, Rec. Bot. Surv. Ind. 12(2): 102. 1938. Type: India, Assam, Mizoram, S. Lushai hill, Thady Forest, Aug. 1928, *Wenger 214* (holotype **K** [K000031465!], **CAL** *n.v.*).— *P. bengalensis* Bremek., Repert, Spec. Nov. Regni Veg. 37: 99. 1934. Type: India, Bengal, *Hooker & Thomson s.n.*, Nov. 1850 (holotype **K-W** [K000031472!], **CAL** *n.v.*).— *P. griffithii* Bremek., Repert, Spec. Nov. Regni Veg. 37: 99. 1934. Type: Bhutan, *Griffith 2114* (holotype **K-W** [K000031481!], **CAL** *n.v.*).— *P. amabilis* Bremek., Repert, Spec. Nov. Regni Veg. 37: 100. 1934. Type: Myanmar (Burma), Upper Burma, *Toppin 3032* (holotype **E** [E00327895!], isotype **CAL** *n.v.*).— *P. assamica* Bremek., Repert, Spec. Nov. Regni Veg. 37: 119. 1934. Type: India, Assam, Gauhattty, *Simons 16* (holotype **K** [K000031491!], **CAL** *n.v.*).

— *P. polyneura* Bremek., Repert, Spec. Nov. Regni Veg. 37: 119. 1934. Type: Myanmar (Burma), South Tenasserim, Kyein Chaung, 12 June 1926, *Muang Law Tek 1379* (holotype **K** [K000031504!], **CAL** *n.v.*). Fig. 2D.

**Thailand.**— NORTHERN: Chiang Mai [Chiang Dao, 13 May 2007, *Pooma et al. 6730* (**BKF**); Mae Chaem, Huai Yah Disi (Karen) Village, 9 June 1998, *Maxwell 98-630* (**BKF**); Samoeng, Ban Watchan, 18 Jan. 1988, *Pooma & Werner 29* (**BKF**); Phayao [Chiang Kham, 25 June 1954, *Smitinand 1642* (**BKF**); Phayao University, 13 May 2009, *Nangngam 1801* (**BKF**); Nan [Ban Luang, 22 Nov. 1993, *Larsen et al. 44748* (**AAU**); Lampang [Ngao, 4 May 1948, *Amnat 4* (**BKF**); Phrae [10 June 1914, *Vanpruek 185* (**BKF, K**); Tak [Mae-Moei NP, 15 July 1999, *Chayamarit et al. 1624* (**BKF-2** sheets); Mae Ramat, Sam Lan, Khun Phra Wo NP, 20 June 2011, *Chamchumroon & Wongngoen 4964* (**BKF**); *ibid.*, 29 June 2011, *Chamchumroon et al. 4964* (**BKF-2** sheets); Tha Song Yang,

15 Sept. 2005, *Pooma 5695* (**BKF**); Phitasanulok [Thung Salaeng NP, 23 Oct. 1984, *Murata et al. T-38745* (**KYO**)]; EASTERN: Chaiyaphum [Ban Lui Lai, 25 May 1974, *Geesink et al. 6929* (**AAU, BKF, K**)]; SOUTH-WESTERN: Kanchanaburi [Nong Daeng, 20 Dec. 1961, *Phengklai 249* (**BKF**); Thong Pha Phum, Ku Yae, 2 May 1949, *Charoenwayu 488* (**BKF**); Tinuay Forest Protection Unit, 1 May 1992, *Th. S. et al. SN109464* (**BKF-2** sheets); *ibid.*, 6 May 1992, *Th. S. et al. SN109434* (**BKF-2** sheets)]; Phetchaburi [Kaeng Krachan NP, 29 Oct. 2013, *Tagane et al. T2449* (**BKF**)]; Prachuap Khiri Khan [Hua Hin, 26 Apr. 1926, *Lakshanakara 70* (**ABD, BK-2** sheets), **K**]; *ibid.*, 26 Apr. 1926, *Lakshanakara 74* (**K**); *ibid.*, 16 Aug. 2002, *Middleton et al. 1126* (**BKF, E, K**)]; CENTRAL: Saraburi [Khao Yai NP, Khao Yai, Haew Suwat, 7 June 1979, *Vidal et al. 6354* (**AAU, BKF**)]; SOUTH-EASTERN: Sa Kao [Nam Wan, Centennial RFD (Roi Pee) Botanic Garden, 28 Oct. 1998, *Greijmans 146-98* (**BKF**)]; Chanthaburi [Khao Soi Dao WS, 30 June 2001, *Chamchumroon & Puff V.C. 1118* (**BKF** (2-sheets))]; Trat [Ko Kut, Klong Chao-Aow Prow, 6 Apr. 2002, *Phengklai et al. 13499* (**BKF**)]; PENINSULAR: Ranong [Mueang, Ko Chang, Ko Phayam, 24 Apr. 2006, *Wongprasert 064-14* (**BKF**)].

**Distribution.**— India, Myanmar, Cambodia.

**Ecology.**— In open grassy pine forest, along the stream in dry secondary forest, hill dipterocarp and evergreen forests, 50-250 m alt.

**Vernacular.**— Khem (เข็มน), khem pa (เข็มนป่า).

**Note.**— *Pavetta tomentosa* var. *canescens* differs from the typical variety by having pubescent on the lower surface of leaves or on the veins and sparsely pubescent inflorescence. The type of *P. indica* var. *polyantha* based on *De Silva et al.* in *Wallich Numer. List 6176* but it has two

sheets, K000031477 and K001123237. The latter is selected as the lectotype because it has more flowers on the sheet.

**14. *Pavetta wallichiana*** Steud. ex Craib, Fl. Siam. 2(2): 171. 1934. Type: Singapore, *Wallich Numer. List 6181*, **K-W** [K0011-23242!].

— *P. canescens* R. Br. in *Wallich Numer. List 6181*, *nom. nud.*, non DC. (1830).

— *P. indica* L. var. *canescens* (R. Br.) Ridl., Fl. Mal. Pen. 2: 100. 1921. Type: Singapore, *Wallich Numer. List 6181*, **K-W** [K001123242!]

— *P. petiolaris* Wall., *Wallich Numer. List 6180*, **K-W** [K001123241!], *nom. nud.*, non Craib (1932).

— *P. peninsularis* Bremek., Repert. Spec. Nov. Regni Veg. 37: 84. 1934. Type: Peninsular Malaysia, Penang, *Wallich, Numer. List 6180*, **K-W** [K001123241!].

— *P. formosa* Bremek., Repert. Spec. Nov. Regni Veg. 37: 85. 1934. Type: Peninsular Malaysia, Malacca, *Lobb 105* (**K!** without barcode), not *Lobb 105* (**K** [K000769902!]), for *Rhododendron moulmainense*, Ericaceae), **syn. nov.**

**Thailand.**— NORTHERN: Chiang Mai [Fang Hot Spring NP, 17 Sept. 2000, *Wongprasert 009-19* (**BKF-2** sheets)]; Nan [Pua, Doi Phu Kha NP, 5 Nov. 1998, *Srisanga 306* (**BKF**)]; SOUTH-WESTERN: Phetchaburi [Kaeng Krachan NP, 25 Jan. 2005, *Williams et al. 1076* (**BKF, E**)]; PENINSULAR: Chumphon [Lang Suan, Khao Nom Sao, 2 Feb. 1927, *Kerr 12071* (**ABD, BK, BM, K, TCD**)]; Ranong [Khong Nakha WS, 7 Sept. 1984, *W.N. 653* (**BKF**)]; Kra Buri, 29 Feb. 1968, *Vacharapong 180* (**BK**); Phangnga [Kapong, 23 Feb. 2001, *Chayamarit et al. 2662* (**BKF-2** sheets); Khura Buri, Khlong Saeng WS, 7 Sept. 1990, *Fukuoka & Na Nakhon T-36075* (**BKF**)]; Takua Thung, Khao Bo Ngu Luam, 25 Aug. 1967, *Shimizu*

*et al. T-8071* (**BKF**); Krabi [Ban Kram Forest Reserve, Jan. 2000, *Larsen et al. 43383* (**AAU**)]; Nakhon Si Thammarat [Khao Luang NP, 14 July 2000, *Chamchumroon vc848* (**BKF**); *ibid.*, Phrom Lok Falls, 12-13 July 1993, *Puff & Sridith 930712-1/7* (**AAU, PSU**)]; Trang [Khao Chong, 14 Oct. 1965, *Boonnab 68* (**BKF**); *ibid.*, 20 Nov. 1965, *Boonnab 240* (**BKF**); *ibid.*, 17 Dec. 1979, *Shimizu et al. T-27507* (**BKF**); *ibid.*, 30 Sept. 1949, *Mangarn 331* (**BKF**); *ibid.*, 10 Sept. 1990, *Puff et al. 900910-1/11* (**BKF**) Yan Ta Khao, Khao Banthad WS, 7 Apr. 2003, *Middleton et al. 1980* (**BKF**); *ibid.*, 15 Mar. 2006, *Gardner & Chamchumroon ST2479* (**K**); *ibid.*, Sai Rung Waterfall, 29 July 1993, *Puff & Sridith 930729-1/1* (**AAU, PSU**)]; Yala [Betong, Piyamit 2, 21 May 2000, *Niyomdham 6159* (**AAU, BKF-2** sheets)]; Narathiwat [Sukhirin, Toh Moh, 15 Apr. 1996, *Niyomdham 4671* (**BKF**)]; Unknown locality: [between Takuapah and Surat Thani, 16 July 1972, *Larsen et al. 31038* (**K**)]. **Distribution.**— Myanmar, Peninsular Malaysia, Singapore.

**Ecology.**— In submontane and evergreen forests and tropical rainforest, by stream or limestone area, 50–750 m alt.

**Vernacular.**— Vernacular.— Khem pa (เขมปา), khem kao cho hoi (เขมขาวช่อห้อย).

**Note.**— *Pavetta wallichiana* is similar to *P. humilis* but differs by having domatia on the axils of the lower surface of the leaves and sheath-like stipules. Examination of type material of *P. wallichiana* and a new species, *P. formosa* of Bremekamp (1934) showed that the difference of hair type on the leaves and inflorescence position between them are so small and unreliable that is the best united under *P. wallichiana*. *Kerr 1775* (**K**) was in the specimen examined list under *P. peninsularis* but it

was labelled by Bremekamp as *P. wallichiana* var. *glabrescens* Bremek. This variety has not been published and it belongs to *P. petiolaris* Craib which has glabrous on the outside of the stipules instead of pubescent on the outside of stipules in *P. wallichiana*.

### ACKNOWLEDGEMENTS

I express my gratitude to the Faculty of Science, Khon Kaen University for financial assistance and the directors, curators and staff of the herbaria AAU, BK, BKF, BM, CMU, E, K, KKU, KYO, PSU, QBG, SING, TCD and TI which I visited. I also thank Soulivanh Lanorsavanh, Charan Leeratiwong, Pongsak Phonsena and Teerawat Srisuk for the photographs, Pornchai Kladwong and Pongsakorn Kunasit for field trips and helping in various ways in Thailand and abroad.

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