THAI FOREST BULL., BOT. 49(1): 49–56. 2021.
DOI https://doi.org/10.20531/tfb.2021.49.1.05

Thyrsostachys (Poaceae: Bambusoideae) in Thailand: taxonomy, lectotypification and natural distribution

SARAWOOD SUNGKAEW[1,2], SOMRAN SUDDEE[3], KHOON MENG WONG[4] & ATCHARA TEERAWATANANON[2,5,*]

ABSTRACT

A taxonomic account of the genus *Thyrsostachys* for Thailand, where its two recognized species, *T. oliveri* and *T. siamensis*, are among the most economically important and widely planted native bamboos, is provided. A second-step lectotypification of the name *Thyrsostachys oliveri* is proposed and information on the natural distribution of the genus is also included.

KEYWORDS: Bamboo, Gramineae, lectotype, nomenclature, typification.

Accepted for publication: 4 January 2021. Published online: 16 March 2021

INTRODUCTION

Approximately 500 species of Thai grasses were previously reported in several checklists for the country, but no data for bamboos (Bambusoideae) were included (Lazarides, 1980; Nanakorn & Norsangsri, 2001; Chayamarit *et al.*, 2014). Currently, an account of the family Poaceae for the Flora of Thailand is being undertaken with the collaboration of many grass taxonomists (David Simpson, pers. comm.) and it is our hope that the data for bamboos will be included. A study for the bamboos in Thailand was last undertaken more than 50 years ago (Lin, 1968). At that time, 42 species and 1 variety belonging to 10 genera were reported. However, despite the general classification of Bambusoideae and its generic delimitation having been much revised (e.g. Clayton & Renvoize, 1986; Ohrnberger, 1999; Sungkaew *et al.*, 2009; BPG, 2012; Kellogg, 2015; Wong *et al.*, 2016), comparatively little fieldwork has been carried out, so that the number of bamboo genera and species in Thailand remains unclear. Only piecemeal research has been published from time to time (e.g. Dransfield, 2000a, b; Sungkaew *et al.*, 2007; 2018; Rattamanee *et al.*, 2011). Perhaps because of the scarcity of flowering material, the taxonomy of bamboos will require continued study for many years to come (Clayton, 1990; Stapleton, 1993; Goh *et al.*, 2020). Gathering information in the field to accompany a good voucher specimen is usually time-consuming (Teerawatananon *et al.*, 2014; Sungkaew *et al.*, 2018; Goh *et al.*, 2020). In addition, one of the most important problems is that many collectors avoid collecting bamboos because of their size or the difficulties in trying to make good scientific specimens. However, useful information for making good bamboo collections is given in several works (e.g. McClure, 1966; Holttum, 1958; Soderstrom & Young, 1983; Wong, 1995; 2004) and we would like to encourage further collections.

Here, towards a revision of the Bambusoideae for the Flora of Thailand, we provide a taxonomic reassessment of the genus *Thyrsostachys* Gamble and provide information on its typification and geographical distribution.

[1] Department of Forest Biology, Faculty of Forestry, Kasetsart University, Bangkok 10900, Thailand.

[2] Center for Advanced Studies in Tropical Natural Resources; Center of Excellence for Bamboos, Kasetsart University, Bangkok 10900, Thailand.

[3] Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, 61 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand.

[4] Singapore Botanic Gardens, National Parks Board, 1 Cluny Road, 259569, Singapore.

[5] Natural History Museum, National Science Museum, Technopolis, Pathum Thani 12120, Thailand.

* Corresponding author: teerawaa@tcd.ie

The name *Thyrsostachys* was first mentioned (see Nomenclatural notes under *T. oliveri* below) by Gamble (1894: 1) based on the collection of *T. oliveri* Gamble by J.W. Oliver in Myanmar. Based on morphological data, *Thyrsostachys* is closely related to *Bambusa* Schreb. and *Dendrocalamus* Nees but differs by its thyrsoid paniculate, bracteate inflorescence and its paleas which are keeled and bifid in the lower florets and are not or hardly keeled in the upper ones (Gamble, 1894; 1896; Holttum, 1958; Bennet, 1988; Goh *et al.*, 2018). Its grouping within the subtribe Bambusinae of the Palaeotropical and Austral woody bamboo clade is supported by both morphological and molecular phylogenetic studies, but relationships within the subtribe are still largely unresolved (Holttum, 1946; 1958; Grosser & Liese, 1973; Clayton & Renvoize, 1986; Ohrnberger, 1999; Loh *et al.*, 2000; Sungkaew *et al.*, 2009; BPG, 2012; Zhou *et al.*, 2017; Goh *et al.*, 2018; Liu *et al.*, 2020).

MATERIALS AND METHODS

Specimens from the following herbaria were examined using conventional herbarium techniques: BK, BKF, BM, K and THNHM. Digital images of type specimens from the K, L and P herbaria were also examined and, here appropriate, cited (https://plants.jstor.org/). Herbarium acronyms follow Index Herbariorum (Thiers, 2015, continuously updated) except for the herbarium of the Natural History Museum, National Science Museum, Technopolis, Pathum Thani, Thailand (THNHM); the latter abbreviation has been coined for use in this study. The following species descriptions are mainly based on herbarium specimens and are accompanied by observations made of living plants in the field. For dried material from herbarium specimens, spikelets were softened in water containing a small amount of detergent (ca 1% of dishwashing liquid), and measured using a stereomicroscope and graticule (Olympus SZ30).

Almost all type specimens of legitimate names and synonyms have been seen and are indicated by an exclamation mark (!) after the herbarium abbreviation. When there is no holotype or previous lectotypification for a name, a lectotype has been designated and the reasons for typification are given, following Article 9 of the International Code of Botanical Nomenclature (Shenzhen Code) (Turland *et al.*, 2018). Major floras and other publications in South-East Asia, surrounding areas and important monographs are cited where appropriate. Cited publication titles and author abbreviations follow IPNI (2020). Abbreviations of publications which are not included in the IPNI follow those commonly used in botanical literature or are given in full.

TAXONOMIC TREATMENT

THYRSOSTACHYS

Gamble, Indian Forester 20: 1, 1894; Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 58, 1896; Gamble in Hook.f., Fl. Brit. India 7: 397, 1897; Brandis, Indian Trees: 671, 1906; E.G.Camus, Les Bambusees: 137, 1913; Holttum, Gard. Bull. Singapore 16: 80, 1958; Ohrnb., Bamboos of the World: 315, 1999; D.Z.Li & Stapleton, Fl. China 22: 38, fig. 34(12–13), 2006; Sungkaew *et al.*, Bamboo of Thailand. [in Thai]: 237, 2011.— Type: *Thyrsostachys oliveri* Gamble.

Arborescent, unarmed bamboo. *Rhizomes* pachymorph with short necks, forming a clump usually with very dense culms. *Culms* erect, tips erect to slightly arched; internodes terete, lower ones usually solid or nearly so, otherwise hollow; lateral branch buds at each node solitary. *Branches* developing from the upper quarter of the culm upwards. *Mid-culm branch complement* several to many branches at each node, in a horizontal line, with 1 branch dominant, thinner than the mother culm. *Culm leaves* tardily deciduous to persistent; ligules short, membranous; auricles absent or inconspicuous, margins ciliate; blades usually erect, linear or triangular. *Foliage leaves* shortly pseudo-petiolate; ligules very short; auricles absent or inconspicuous, margins ciliate; blades lanceolate, cross-veins present. *Synflorescences* fully bracteate, paniculate, usually on leafless branches, inflorescence units iterauctant (indeterminate), composed of pseudospikelets. *Pseudospikelets* laterally compressed, 1.2–2.5 cm long; empty glumes 1–4, shorter than the spikelet; fertile florets 1–6(7), sometimes plus a barren rachilla extension, falling together, not disarticulating below each floret; rachilla internodes between the florets short. *Florets* with lemmas similar to glumes; paleas 2-keeled but the uppermost without keels; lodicules absent to 3; stamens 6, filaments free; ovary umbonate, short-stalked, hairy to glabrous, style 1, stigmas 1–3, feathery. *Caryopses* basic, terete, smooth, glabrous, with persistent style base.

The genus includes two species, *Thyrsostachys oliveri* and *T. siamensis* Gamble, with a natural distribution in Myanmar, Thailand and Indochina; both species were introduced to India and seeded there (Gamble, 1896; Bor, 1941). The natural habitat of *Thyrsostachys* is tropical mixed deciduous forest below 1,500 m elevation. Since then, *T. siamensis* has been planted in other tropical countries as ornamental plants and as wind-breaks (Bor, 1941; Bennet, 1988; Dransfield & Widjaja, 1995).

KEY TO THE SPECIES OF *THYRSOSTACHYS* IN THAILAND

1. Lodicules typically present. Foliage-leaf blades 10–22.5 × 0.7–1.8 cm **1. T. oliveri**
1. Lodicules (2)3, rarely absent. Foliage-leaf blades 5–15 × 0.3–0.7 cm **2. T. siamensis**

1. Thyrsostachys oliveri Gamble, Indian Forester 20: 1. 1894; Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 58, pl. 50. 1896; Gamble in Hook.f., Fl. Brit. India 7: 397. 1897; Bor, Indian Forest Rec., Bot. 2: 221. 1941; Brandis, Indian Trees: 671. 1906; E.G.Camus, Les Bambusees: 137. 1913; Rhind, Grasses of Burma: 16. 1945; W.C.Lin, Spec. Bull. Taiwan Forest Res. Inst. 6: 45. 1968; S.Dransf. & Widjaja, Pl. Resources S.-E. Asia 7: 154. 1995; Ohrnb., Bamboos of the World: 315. 1999; D.Z.Li & Stapleton, Fl. China 22: 38, fig. 34 (1–11). 2006; Sungkaew *et al.*, Bamboo of Thailand. [in Thai]: 238. 2011; Kumari, Plant. Sci. 1(6): 113. 2019.— Type: Myanmar, Katha District "Hills of Upper Burma in moist forests on ridges at 2,000 ft. elevation", *J.W. Oliver s.n.* (lectotype first step, designated by Kumari (2019: 113) and second step, designated here **K** [K000854869!]; isolectotypes **K** [K000854868!, K000854870!, K000854871!, K000854872!]). Fig. 1.

Culms 10–20(–25) m tall, 5–7.5 cm in diameter, covered with appressed white hairs when young, becoming glabrous when mature; internodes initially bright green, becoming dull green, 30–60 cm long; walls rather thick, particularly from lower internodes; nodes slightly prominent. *Culm leaves* relatively persistent, ca ¾ as long as the internodes, chartaceous; culm-leaf sheaths 20–35.5 × 10–25.5 cm, apex somewhat truncate or rounded to convex, 2–9 cm wide, back covered with appressed white to pale brown hairs; ligules 0.5–2.5 mm high, margin ciliolate; culm-leaf blades erect to slightly arched, deltoid to linear-lanceolate, 7.5–25 × 1.5–8 cm, base ca ½–⅔ width of the sheath apex, pubescent. *Foliage leaves* 5–7 per branchlet; pseudo-petioles 0.05–0.5 cm long; foliage-leaf sheaths 3–5.5 cm long, abaxially hairy to glabrous, margins ciliate; auricles absent, fimbriae and oral setae absent; ligules short, ca 0.5 mm high, margin ciliolate; foliage-leaf blades linear-lanceolate, (10–)12–22.5 × (0.7–)1–1.8 cm, adaxially scaberulous and hairy abaxially, to glabrous on both sides, base somewhat obliquely cuneate, apex acuminate. *Pseudospikelets* 1.5–2.5 cm long; bracts subtending prophyllate bud 2 or 3; empty glumes 1 or 2, rarely 3, 0.5–1.2 cm long, apex acute, margins entire or ciliolate towards the apex, chartaceous, 11–21-nerved, back pubescent to glabrous. *Fertile florets* 2–6(–7); rachilla internodes between fertile florets 1–3 mm long, scantly hairy to glabrous; lemmas similar to the glumes, 0.9–2.5 cm long, apex acute, margins ciliolate towards the apex, 9–29-nerved, abaxially slightly pubescent to glabrous; paleas membranous to thinly chartaceous, hairy abaxially, usually as long as or slightly shorter than the lemmas, apex obtuse to bifid for ¼–⅓ of its length, 2-keeled, keels ciliate, 5–7-nerved between keels and 2–4-nerved between each keel and the ciliate and involute margin; lodicules 2 or 3, conspicuous, membranaceous, ovate to lanceolate, 1–1.2 mm long, margin ciliate; anthers 5–6 mm long, apices acute to apiculate, glabrous; ovaries hairy to glabrous, style ca 1.5 cm long, stigmas 3. *Caryopses* ca 1 cm long, glabrous.

Thailand.— NORTHERN: Chiang Mai [Samoeng, The Royal Agriculture Station Pang Da, 28 Sept. 2003, *Teerawatananon & Sungkaew 2003-0204* (**THNHM**); Chom Thong "Jawm Tong", 17 Jan. 1993, *Maxwell 93-62* (**P** [P02581774]); Chiang Dao, 5 Feb. 2011, *Teerawatananon & Sungkaew 1384* (**BKF**, **THNHM**)]; Chiang Rai [Wiang Pa Pao, Hui Nam Rin, 25 Jan. 2004, *Sungkaew & Teerawatananon 2004-0019* (**THNHM**)].

Distribution.— Myanmar.

Ecology.— In mixed deciduous forest; elevation: 700–1,300 m.

Conservation status.— This species is assessed as Least Concern because it is widespread and does not face any major threats.

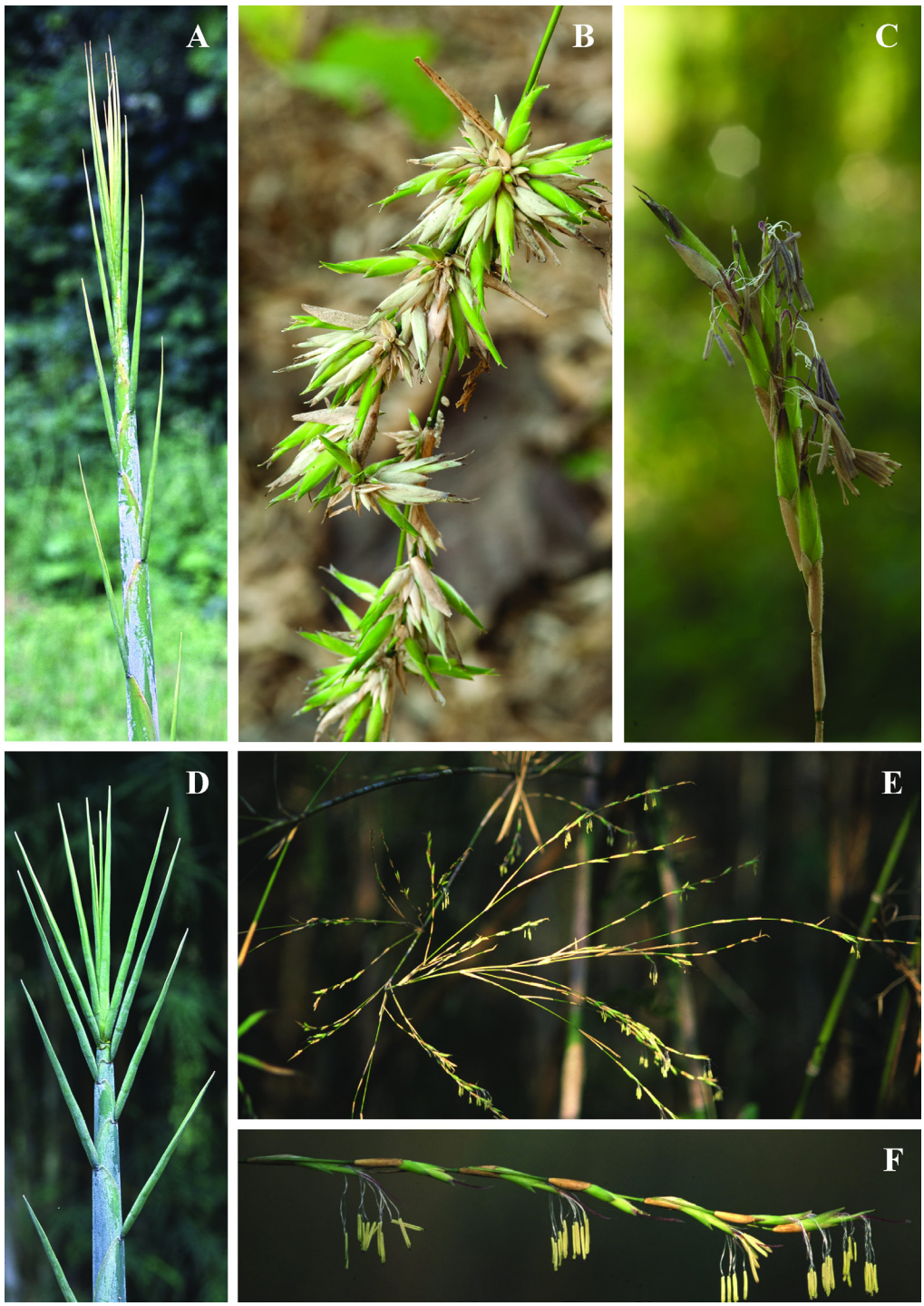

Figure 1. *Thyrsostachys oliveri* Gamble: A. Apex of a developing shoot, B. Flowering branch, C. Pseudospikelet clusters (A from *Teerawatananon & Sungkaew 2003-0204*, B & C from *Teerawatananon & Sungkaew 1384*); *Thyrsostachys siamensis* Gamble: D. Apex of a developing shoot, E. Flowering branch, F. Pseudospikelet clusters (D from Ratchaburi Province, E & F from *Teerawatananon & Sungkaew 2003-0031*). Photos by A. Teerawatananon.

Vernacular names.— Phai ruak dam (ไผ่รวกดำ), phai ruak yai (ไผ่รวกใหญ่), wa-bo-su (ว่าบอซู) (Karen: Mae Hong Son), sa-lon (สะหลอน) (Shan-Northern), pao (เปา) (Shan-Northern); Edible-seeded bamboo.

Uses.— Culms for construction, poles, pulp and paper, furniture, handicrafts, etc. Plants used in horticulture. Young shoots edible.

Nomenclatural notes.— The genus *Thyrsostachys* was first validly published in 1894 by Gamble (1894: 1), by provision of a single diagnosis (Turland *et al.*, 2018; Art. 38.5), with a single species *T. oliveri*: "The names of a genus and a species may be validly published simultaneously by provision of a single description (descriptio generico-specifica) or diagnosis, even though this may have been intended as only generic or specific... if...the genus is at that time monotypic". His documentation (Gamble 1894) of "...a new bamboo from Upper Burma, belonging to a new genus *Thyrsostachys*...characterized by its thyrsoid paniculate bracteate inflorescence and paleas keeled in the lower flowers and not or hardly keeled in the upper and having the lower ones deeply divided so as to present two long tails...discovered by Mr. J.W. Oliver, Conservator of Forests of the Eastern Circle of Upper Burma...only appropriate that its name should be *Thyrsostachys olivieri* [*sic*]" would satisfy these conditions and is effectively published (Turland *et al.*, 2018: Art. 29).

In 1896, he later provided full descriptions and detailed illustration for the genus and its type species *T. oliveri* (Gamble, 1896: pl. 50) using a collection of J.W. Oliver "J.W. Oliver's specimen of 1891". However, no specimens collected by Oliver in 1891 have been found in herbaria known to hold Gamble's types [**K**, **B**, **BM**, **CAL**, **DD**, **E**, **G**, **H**, **L**, **MH**, **OXF** and **US** (Dorr & Nicolson, 2009)]. Subsequently, Bor (1941) reviewed Gamble's descriptions (1896) and provided more type locality details (Katha District, Upper Burma). He also mentioned that this bamboo flowered in 1891 and was collected by J.W. Oliver who sent the specimens to Gamble. Only Oliver's specimens of 1892 from Katha were found at **K** [K000854868, K000854869, K000854870, K000854871 & K000854872], **L** [L1345390] and **US** [US00075053, US00075054 & US01049626].

The type specimen of *Thyrsostachys oliveri* was later proposed by Kumari (2019: 113), who indicated the specimen of *J.W. Oliver s.n.* at **K** as the type, but did not specify which of the five duplicates available in **K** should be the lectotype. This type citation has to be accepted as the first-step lectotypification, and a second-step lectotype has to be designated following Turland *et al.* (2018) (Art. 9.17 Ex. 14). Therefore, one of the *J.W.Oliver s.n.* specimens matching the information of Bor (1941: 225) at **K** [K000854869], has been designated here as the lectotype.

Taxonomy.— We note more variation than was given by Gamble, as we have identified more material as this species (as stated in the list of specimens given). Importantly, Gamble's material (coll. Oliver) consists only of inflorescences and leafy twigs, but comparison of floral detail of our collections *Teerawatananon & Sungkaew 1384* and *Sungkaew & Teerawatananon 2004-0019* with the type material satisfies us that the same species is considered.

2. Thyrsostachys siamensis Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 59, pl. 51. 1896, nom. cons.; Gamble in Hook.f., Fl. Brit. India 7: 397. 1897; E.G.Camus & A.Camus, Fl. Indo-Chine [P.H. Lecomte *et al.*] 7: 592, fig. 46 (1–6). 1922; Holttum, Gard. Bull. Singapore 16: 80. 1958; Brandis, Indian Trees: 672. 1906; E.G.Camus, Les Bambusees: 137. 1913; E.G.Camus Atlas, pl. 83 (C). 1913; Rhind, Grasses of Burma: 16. 1945; Bor, Dansk Bot. Ark. xxiii.: 168. 1965; W.C.Lin, Spec. Bull. Taiwan Forest Res. Inst. 6: 46, fig. 31. 1968; S.Dransf. & Widjaja, Pl. Resources S.-E. Asia 7: 145, fig. on page 146. 1995; Stapleton, Taxon 47(3): 739. 1998; Ohrnb., Bamboos of the World: 316. 1999; D.Z.Li & Stapleton, Fl. China 22: 38, fig. 34 (1–11). 2006; Sungkaew *et al.*, Bamboo of Thailand. [in Thai]: 241. 2011; Kumari, Plant. Sci. 1(6): 113. 2019.— *Bambusa regia* Thomson ex Munro, Trans. Linn. Soc. London 26(1): 146. 1868, *nom. rej*.— *Thyrsostachys regia* (Thomson ex Munro) Bennet, Indian Forester 114(10): 711. 1988, *nom. rej*.— *Thyrsostachys regia* (Thomson ex Munro) R.B.Majumdar, in S.Karthikeyan *et al.*, Fl. Ind. Enumerat. - Monocot.: 282. 1989, *nom. rej.* Type: Thailand, *Kurz s.n.* [lectotype **K** [K000290619!] designated by Stapleton (1998: 739)]. Fig. 1.

— *Bambusa siamensis* Kurz ex Munro, Trans. Linn. Soc. London 26(1): 116. 1868, *nom. nud*. as *syn*.

Culms 5–15 m long, 1.5–6 cm in diameter, covered with appressed white hairs when young, becoming glabrous when mature; internodes initially green, becoming gray-green, 15–30 cm long; walls very thick to solid or nearly so, particularly from lower internodes; nodes slightly prominent, with a white waxy ring below. *Culm leaves* very persistent; 3/4–1 as long as internodes, chartaceous; culm-leaf sheaths 10–20 × 5–15 cm, apex somewhat truncate or rounded to convex, 2–3 cm wide, abaxially covered with appressed white to pale brown hairs; ligules 0.5–2.5 mm high, margin ciliolate; culm-leaf blades erect to slightly arched, deltoid to linear-lanceolate, 3.5–15 × 1–2 cm, base ca ½–⅔ width of the sheath apex, pubescent. *Foliage leaves* (3–)5–7 per branchlet; pseudo-petioles 0.05–0.15 cm long; foliage-leaf sheaths 2.5–3.5 cm long, abaxially hairy, margins ciliate; auricles absent, fimbriae and oral setae absent; ligules short, ca 0.5 mm high, margin ciliolate; foliage-leaf blades narrowly linear, 5–15 × 0.3–0.7 cm, adaxially scaberulous only on lateral veins near the margin and near the midrib or glabrous, abaxially hairy, base somewhat truncate to cuneate or acute, apex acuminate. *Pseudospikelets* 1.2–1.4 cm long; bracts subtending prophyllate bud 2 or 3; empty glumes (1–)2 or 3, 0.75–1.2 cm long, apex acute, margins entire or ciliolate towards the apex, chartaceous, 8–15-nerved, back hairy, especially near the base, or glabrous. *Fertile florets* 1–3; rachilla internodes between fertile florets 1–2 mm long, scantly hairy to glabrous; lemmas similar to the glumes, 1–1.4 cm long, apex acute, margins ciliolate towards the apex, 14–29-nerved, abaxially slightly pubescent only near the base and the tip, otherwise glabrous; paleas membranous to thinly chartaceous, hairy to glabrous abaxially, usually as long as or slightly shorter than the lemmas, apex usually bifid for 1/10–½ of its length, 2-keeled, keels ciliate, 2 or 3-nerved between keels and 0 or 1-nerved between each keel and the ciliate and involute margin; lodicules (2–)3, rarely absent; anthers ca 3.5 mm long, apices acute to mucronate, glabrous; ovaries usually glabrous, style ca 1 cm long, stigmas 1–3. *Caryopses* 0.5–0.8 cm long, glabrous.

Thailand.— NORTHERN: Lampang [Mae Tha, 14 Jan. 2012, *Maxwell 12-18* (**P** [P00949410]); Tak [Bhumibol Dam, May 1959, *Boonnak 645* (**BKF**)]; Nakhon Sawan [Takli, 25 Nov. 1928, *Put 2104* (**BK**)]; SOUTH-WESTERN: Kanchanaburi [Muang, 3 Mar. 2009, *Maxwell 09-41* (**P** [P00949411]); Sai Yok, 26 Jan. 1962, *Larsen 9292* (**BKF**); Si Sawat, 19 Oct. 2019, *Sungkaew & Teerawatananon 1592-1–3* (**THNHM**); Southwestern of Kanchanaburi, 15 July 1963, *Ploenchit 2104* (**BKF**); Nong Daeng, 20 Dec. 1961, *Phengkhlai 254* (**BKF**)]; Ratchaburi [Suan Phung, Kao Chuan Waterfall, 15 Feb. 2003, *Teerawatananon & Sungkaew 2003-0031* (**THNHM**); ibid, 21 Feb. 2003, *Teerawatananon & Sungkaew 2003-0032* (**THNHM**); ibid., 2 July 2004, *Sungkaew & Teerawatananon 020704-3* (**THNHM**)]; Phetchaburi [Cha-am, 14 Mar. 2002, *Puudjaa 1065* (**BKF**)]; Prachuap Khiri Khan [Sam Roi Yot, 19 Nov. 1964, *B.S. 1093* (**BKF**)]; CENTRAL: Lop Buri [Khok Samrong, 12 Aug. 2008, *Rattamanee M087* (**BK**)]; Saraburi [Khao Khaow, 5 Mar. 1965, *Smitinand & Phengkhlai 8663* (**BKF**); Muang, Sam Lan, 30 June 1974, *Maxwell 74-647* (**BKF**)]. No Locality: *Kurz s.n.*(**K**).

Distribution.— Myanmar & Laos (Chaiyalad *et al.*, 2013).

Ecology.— Commonly found in mixed deciduous forest, occasionally in deciduous dipterocarp forest; elevation: 70–1,000 m.

Conservation status.— This species is assessed as Least Concern because it is widespread and does not face any major threats.

Vernacular names.— Phai ruak (ไผ่รวก), mai ruak (ไม้รวก), ti yo (ตีโย) (Central), phai huak (ไผ่ฮวก) (Northern), wa-bo-bo (ว่าบอบอ) (Karen-Mae Hong Son), wae-bang (แวบ้าง) (Karen-Mae Hong Son), wae-pang (แวปั่ง) (Karen-Mae Hong Son), sa-lom (สะลอม) (Shan-Mae Hong Son); Monastery bamboo, Siamese bamboo, Thai bamboo, Umbrella bamboo, Thai umbrella bamboo.

Uses.— Culms used for construction, poles, pulp and paper, furniture, handicrafts, umbrella and broom handles. Young shoots are edible and very popular. Cultivated widely as an ornamental and used as a wind-break.

ACKNOWLEDGEMENTS

The authors are grateful to the curators and staff of the herbaria cited. We would like to thank Prof. Dr Henrik Balslev, Dr Kongkanda Chayamarit, Dr Timothy M.A. Utteridge, Dr Anna Trias Blasi and Dr Panida Kachina for their valuable help. This research was financially supported by the Carlsberg Foundation 2019.

REFERENCES

Bennet, S.S.R. (1988). Notes on an exotic bamboo-*Thyrsostachys siamensis* Gamble. The Indian Forester 114: 711–713.

Bamboo Phylogeny Group (BPG). (2012). An Updated Tribal and Subtribal Classification of the Bamboos (Poaceae: Bambusoideae). Bamboo Science and Culture: The Journal of the American Bamboo Society 24(1): 1–10.

Bor, N.L. (1941). *Thyrsostachys oliveri* Gamble. The Indian Forest Records. 2(2): 221–225, pl. 65–66.

Chaiyalad, S., Siripatanadilok, S. & Sungkaew, S. (2013). Morphology of Some Bamboos Commonly Used in Lao PDR. Thai Journal of Forestry 32(1): 1–8.

Chayamarit, K., Pooma, R. & Pattharahirantricin, N. (2014). A Checklist of Plants in Thailand Vol. 1. Office of Natural Resources and Environmental Policy and Planning, Bangkok, Thailand, 238 pp.

Clayton, W.D. (1990). The spikelet. In: G.P. Chapman (ed.), Reproductive versatility in the grasses, pp. 32–51. Cambridge University Press, New York.

Clayton, W.D. & Renvoize, S.A. (1986). Genera Graminum: grasses of the world. Kew Bulletin Additional Series 13. Her Majesty's Stationery Office, London, England, 389 pp.

Dransfield, S. (2000a). Notes on 'Pek' and 'Chote', members of the genus *Vietnamosasa* (Poaceae-Bambusoideae) in Thailand. Thai Forest Bulletin (Botany) 28: 163–176.

_____. (2000b). *Temochloa*, a new bamboo genus (Poaceae-Bambusoideae) from Thailand. Thai Forest Bulletin (Botany) 28: 179–182.

Dransfield, S. & Widjaja, E.A. (1995). Plant resources of South-East Asia No. 7: Bamboos. Leiden: Backhuys Publishers, Leiden, The Netherlands, 189 pp.

Dorr, L.J. & Nicolson, D.H.A. (2009). Taxonomic Literature. A selective guide to botanical publications and collections, with dates, commentaries and types. Vegetabile 150. Suppl. 8 (Fres-G). Koeltz Scientific Books, Germany, 550 pp.

Gamble, J.S. (1894). A handsome new Burmese Bamboo. Indian Forester 20(1): 1.

_____. (1896). The Bambuseae of British India. Annals of the Royal Botanic Garden, Calcutta 7: 1–133, plates 131–119.

Goh, W.L., Sungkaew, S., Teerawatananon, A., Ohrnberger, D., Widjaja, E.A., Sabu, K.K., Gopakumar, B., Koshy, K.C., Xia, N.H. & Wong, K.M. (2020). The phylogenetic position and taxonomic status of the Southeast and South Asian bamboo genera *Neohouzeaua* and *Ochlandra* (Poaceae: Bambusoideae). Phytotaxa 472 (2): 107–122.

Goh, W.L., Sungkaew, S., Teerawatananon, A., Ohrnberger, D., Xia, N.H., Chan, K.S., How, Y.X. & Wong, K.M. (2018). The hybrid origin of Phai Liang, a bamboo of recent introduction into horticulture in Southeast Asia, and a new nothogenus, ×*Thyrsocalamus* (Bambuseae: Bambusinae). Phytotaxa 362 (3): 271–281.

Grosser, D. & Liese, W. (1973). Present status and problems of bamboo classification. Journal of the Arnold Arboretum 54: 293–308.

Holttum, R.E. (1946). The classification of Malayan bamboos. Journal of the Arnold Arboretum 27: 340–346.

_____. (1958). The bamboos of the Malay Peninsula. Gardens' Bulletin Singapore 16: 1–135.

IPNI. (2020). International Plant Names Index. The Royal Botanic Gardens, Kew, Harvard University Herbaria & Libraries and Australian National Botanic Gardens.

Kellogg, E.A. (2015). Flowering plants, monocots, Poaceae. In: K. Kubitzki (ed.) The Families and Genera of Vascular Plants, Vol. 13. Springer, Heidelberg, pp. 1–416.

Kumari, P. (2019). The Bambusoideae in India: An Updated Enumeration. Plantae Scientia, 1(6): 99–117.

Lazarides, M. (1980). Phanerogamarum monographiae XII: the tropical grasses of Southeast Asia. J. Cramer, Vaduz, Liechtenstein, 225 pp. Strauss & Cramer GmbH, Hirschberg, Germany, 225 pp.

Lin, W.C. (1968). The bamboos of Thailand (Siam). Special bulletin of Taiwan Forestry Research Institute No. 6. Taiwan Forestry Research Institute, Taipei, Taiwan, 52 pp., 35 figs.

Liu, J.-X., Zhou, M.-Y., Yang, G.-Q., Zhang, Y.-X., Ma, P.-F., Guo, C., Vorontsova, M.S. & Li, D.-Z. (2020). ddRAD analyses reveal a credible phylogenetic relationship of the four main genera of *Bambusa-Dendrocalamus-Gigantochloa* complex (Poaceae: Bambusoideae). Molecular Phylogenetics and Evolution 146: 106758.

Loh, J.P., Kiew, R., Set, O., Gan, L.H. & Gan, Y.Y. (2000). A study of genetic variation and relationships within the bamboo subtribe Bambusinae using amplified fragment length polymorphism. Annals of Botany 85(5): 607–612.

McClure, F.A. (1966). The bamboos; a fresh perspective. Harvard University Press, Cambridge, Massachusetts, United States, 347 pp.

Nanakorn, W. & Norsangsri, N. (2001). Species enumeration of Thai Gramineae. Herbarium Queen Sirikit Botanic Garden, Thailand, 92 pp.

Ohrnberger, D. (1999). The bamboos of the world: annotated nomenclature and literature of the species and the higher and lower taxa. Elsevier Science, Amsterdam, 585 pp.

Rattamanee, C., Sungkaew, S. & Paisooksantivatana, Y. (2011). Additional notes on *Maclurochloa montana* (Poaceae: Bambusoideae) in Thailand. The Gardens' Bulletin Singapore 62(4): 297–300.

Soderstrom, T.R. & Young, S.M. (1983). A guide to collecting bamboos. Annals of the Missouri Botanical Garden 70: 128–136.

Stapleton, C.M.A. (1993). Bambuseae. In: M.E. Barkworth, K.M. Capels & S. Long (eds), Flora of North America North of Mexico Vol. 24, pp. 15–17. Oxford University Press, New York & Oxford.

_____. (1998). Proposal to conserve the name *Thyrsostachys siamensis* against *T. regia* (Poaceae, Bambusoideae). Taxon 47(3): 739–740.

Sungkaew, S., Teerawatananon, A., Parnell, J.A.N., Dransfield, S., Stapleton, C.M.A. & Hodkinson, T.R. (2007). *Dendrocalamus khoonmengii*, a new bamboo species (Poaceae: Bambusoideae) from peninsular Thailand. Thai Forest Bulletin (Botany) 35: 98–102.

Sungkaew, S., Stapleton, C.M.A., Salamin, N. & Hodkinson, T.R. (2009). Non-monophyly of the woody bamboos (Bambuseae; Poaceae): a multi-gene region phylogenetic analysis of Bambusoideae *s.s.* Journal of Plant Research 122: 95–108.

Sungkaew, S., Hodkinson, T.R., Xia, N.H. & Teerawatananon, A. (2018). *Chimonocalamus auriculatus*, one more new temperate woody bamboo species of the genus (Poaceae: Bambusoideae: Arundinarieae) described from Thailand. Phytotaxa 357: 66–70.

Teerawatananon, A., Sungkaew, S., Marod, D. & Hodkinson, T.R. (2014). Studies in the recent new genus record *Pseudostachyum* (Poaceae: Bambusoideae) from Thailand: notes on its taxonomy, distribution and habitat. Nordic Journal of Botany 32: 51–54.

Thiers, B. (2015, continuously updated). Index Herbariorum: a global directory of public herbaria and associated staff. The New York Botanical Garden, New York.

Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F. (2018). International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. [Regnum Vegetabile 159] Glashütten: Koeltz Botanical Books, 254 pp.

Wong, K.M. (2004). Bamboo, The Amazing Grass. International Plant Genetic Resources Institute (IPGRI), Selangor Darul Ehsan, Malaysia and University of Malaya, Kuala Lumpur, Malaysia, 80 pp.

Wong, K.M., Goh, W.L., Chokthaweepanich, H., Clark, L.G., Sungkaew, S., Widjaja, E.A. & Xia, N.H. (2016). A subtribal classification of Malesian and Southwest Pacific woody bamboos (Poaceae: Bambusoideae: Bambuseae) informed by morphological and molecular studies. Sandakania 22: 1–36.

Zhou, M.-Y., Zhang, Y.-X., Haevermans, T. & Li, D.-Z. (2017). Towards a complete generic-level plastid phylogeny of the paleotropical woody bamboos (Poaceae: Bambusoideae). Taxon 66: 539–553.