



A taxonomic revision of *Germainia* (Andropogoneae: Poaceae) in Thailand

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Key words

Andropogoneae
Germainia
Poaceae
Thailand

Abstract A taxonomic revision of the genus *Germainia* (Andropogoneae, Poaceae) in Thailand is presented based on herbarium and field studies, including evidence from morphology, habitats and geographical distribution. Six of the nine recognized *Germainia* species are found in Thailand. We include a key to the taxa that are currently known from Thailand or may be expected, lists of species synonymies, species descriptions and lists of representative specimens.

Published on 17 January 2013

INTRODUCTION

Germainia Balansa & Poitr. is a small genus in the tribe Andropogoneae (Poaceae) comprising nine species and distributed in E India (Assam), S Myanmar (Tenasserim), Indo-China (Cambodia, Laos, Thailand, S Vietnam), S China (Guangdong (Canton), Yunnan), Indonesia (Aru Isl., Indonesian Papua), Papua New Guinea (Central, Sandaun (W Sepik), Western Prov.), and Australia (Northern Territory, N Queensland) (Chai-Anan 1972, Chen & Phillips 2006, Chen et al. 2007). *Germainia* was treated as a member of subtribe *Germainiinae* Clayton (represented by *Apocopsis* Nees, *Germainia* and *Trachypogon* Nees) by Clayton (1972) based on morphological and anatomical data and specifically on the shared reduction in the sessile spikelet. Recognition of this subtribe was supported by Teerawatananon et al. (2011) using molecular DNA sequence data. However, the relationships of species within *Germainia* are still very much unknown.

Currently *Germainia* includes three genera: *Germainia* s.str., *Chumsriella* Bor and *Sclerandrium* Stapf & C.E.Hubb., which were reduced to *Germainia* by Chai-Anan (1972). She proposed a new circumscription of the genus based on the presence of basal pairs of homogamous involucre spikelets surrounding the central fertile awned spikelets and the presence of a tough rachis. She enumerated five species for Thailand.

During the preparation of a revision of *Germainiinae* for the Flora of Thailand Project, a number of new results were acquired. In addition, it was necessary to consider the typification of some names that had not been previously typified in order to fix their applications. Six taxa of *Germainia* are here revised.

MATERIALS AND METHODS

There were two main sources of specimens used in this study: specimens collected from fieldwork in Thailand and herbarium specimens, also from other areas, obtained from the following herbaria: AAU, ABD, BK, BKF, BM, C, E, GH, K, KKU, L, NY, SING, TCD, US and the Herbarium of Natural History Museum, National Science Museum, Technopolis, Pathum Thani, Thailand. Four field trips, totalling a period of five months were made in Thailand during 2005 and 2006.

Several specimens per species were examined and measured if available. Spikelets from herbarium specimens were softened in water containing a small amount of detergent (c. 1 % of washing-up liquid), and measured using a stereomicroscope (Leica MZ-12) with a micrometer. Information on their distribution, ecology and habitat was taken from herbarium specimen data and field observations. Typification and synonymizations are based on literature (Chai-Anan 1972) and herbarium studies.

SYSTEMATIC TREATMENT

Germainia

Germainia Balansa & Poitr. (1873) 344, f. 1–9, non *Germanea* Lam. (1788). — *Anthistiria* L.f. sect. *Germainia* (Balansa & Poitr.) Benth. & Hook.f. (1883) 1136 ('*Germanea*'). — *Balansochloa* Kuntze (1903) 58, 247, 616, nom superfl. — *Themeda* Forssk. sect. *Germainia* (Balansa & Poitr.) Roberty (1960) 101. — Type: *Germainia capitata* Balansa & Poitr. *Sclerandrium* Stapf & C.E.Hubb. (1935) 33, t. 3262. — Type: *Sclerandrium truncatiglume* (F.Muell. ex Benth.) Stapf & C.E.Hubb. (≡ *Germainia truncatiglumis* (F.Muell. ex Benth.) Chai-Anan). *Chumsriella* Bor (1968) 467. — Type: *Chumsriella thailandica* Bor (≡ *Germainia thailandica* (Bor) Chai-Anan).

Etymology. The genus *Germainia* was named by Balansa & Poitrasson (1873) in honour of the collector, Rodolphe Germain.

Perennial, tufted, rarely stoloniferous. Culms slender, erect; nodes glabrous to pubescent or pilose. Leaf-blades lanceolate to linear-lanceolate or linear, hairy to glabrous. Ligule an eciliate or ciliate membrane. Inflorescence of 1–2(–6) racemes, racemes capitate or elongate or subdigitate, closely appressed to divergent, rachis internodes tough, short or almost reduced, racemes with 2–14 sessile and pedicelled spikelets; peduncles usually exserted, rarely enclosed in uppermost sheath,

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Plate 1 a, b. *Germainia capitata* Balansa & Poitr. a. Habit; b. inflorescence. — c, d. *Germainia khasyana* Hack. c. Habit; d. inflorescence (a, b: Teerawatananon & Sungkaew 834; c, d: Teerawatananon & Sungkaew 906). — Photos: all A. Teerawatananon.



Plate 2 *Germainia lanipes* Hook.f. a. Habit; b. habit showing young shoot and old stems with dense hairs at base; c. habitats on limestone hill slopes in deciduous dipterocarp forest; d. inflorescence (all: Teerawatananon & Sungkaew 677). — Photos: a. S. Sungkaew; b–d. A. Teerawatananon.

espatheate, glabrous to hirsute. *Spikelets* in pairs, heteromorphous, sometimes basal pairs reduced to the sessile spikelets forming an involucre, dorsally compressed, 2 florets, without rachilla extension. *Sessile spikelets* male, persistent; lower glumes membranous or chartaceous (*G. pilosa*, *G. thailandica*) or coriaceous, glabrous to hairy, obliquely bifid, muticous, truncate or obtuse, 7–9(–11)-nerved, nerves sometimes anastomosing; upper glumes membranous, almost reaching or exceeding apex of lower glumes in spikelets, acute or obtuse or dentate or emarginate, 3–5-nerved; lower florets sometimes absent if present male or neuter; lower lemmas membranous, acute to obtuse, 1(–3)-nerved; lower paleas membranous, acute or obtuse or bifid or dentate, 2-nerved; upper florets male or neu-

ter; upper lemmas absent, if present linear or filiform, obtuse or acute to mucronate, 1-nerved; upper paleas as the lower one; lodicules absent; stamens 2. *Pedicelled spikelets* fertile, caducous; spikelet callus linear to obtuse, attached obliquely or transversely, hairy with yellowish to reddish brown hairs; glumes coriaceous, subequal, acute or obtuse or muticous, dentate or truncate, 3–7-nerved; lower florets usually suppressed, if present neuter, epaleate; upper florets female; upper lemmas reduced to the narrow stipitate base of awn base, awns geniculate with brown twisted columns, hirsutulous, caducous, 1-nerved; upper paleas membranous, almost glabrous; styles 2, stigmas plumose, exserted. *Caryopsis* with adherent pericarp, oblong, hilum punctiform.

Distribution — Nine species, distributed from India, Myanmar, China, Indo-China, Indonesia, Papua New Guinea to Australia.

Habitat & Ecology — Occurring in moist sandy soil, tropical grassland, tropical forest, and deciduous forest and also open and moist rocky plain areas. Found at elevations of 0–1300 m.

Note — Kuntze (1903) regarded the name as confusable with *Germanea* Lam. (1788, *Lamiaceae*), possibly named after J.J. de Saint Germain (c. 1784) (Backer 1936: 232). This has not been accepted and there are no combinations under the superfluous replacement name *Balansochloa* Kuntze.

KEY TO THAI GERMAINIA SPECIES

1. Basal sheaths densely covered with white to pale yellow lanate hairs 3. *G. lanipes*
1. Basal sheaths not covered with lanate hairs 2
2. Awn well-developed, at least 2 cm long 3
2. Awn reduced 3–4.7 mm long 7. *G. tenax*
3. Plant up to 15 cm tall. Lower glumes of sessile spikelets membranous to chartaceous 4
3. Plant more than 20 cm tall. Lower glumes of sessile spikelets coriaceous 5
4. Inflorescence well exserted; uppermost sheath with reduced blade; racemes capitate. Lower glumes of sessile spikelets apex muticous or truncate or slightly denticulate. Ligule an eciliate membrane 4. *G. pilosa*
4. Inflorescence enclosed in uppermost sheath with well-developed blade; racemes elongate. Lower glumes of sessile spikelets apex dentate. Ligule a ciliate membrane 5. *G. thailandica*
5. Leaf-blade linear-lanceolate, up to 5 cm long. Sessile spikelets 2–3 per raceme 6
5. Leaf-blade linear, more than 7 cm long. Sessile spikelets more than 4 per raceme 1. *G. capitata*
6. Three sessile and three pedicelled spikelets per raceme; lower glumes of sessile spikelets truncate to muticous without lateral teeth 2. *G. khasyana*
6. Two sessile and one pedicelled spikelet per raceme; lower glumes of sessile spikelets truncate with lateral caudate teeth 6. *G. thorelii*

1. *Germania capitata* Balansa & Poitr. — Plate 1

Germania capitata Balansa & Poitr. (1873) 344, f. 1–9. — *Themeda capitata* (Balansa & Poitr.) Roberty var. *capitata* Roberty (1960) 101, nom. inval. — Type: *Germain s.n.* in Herb. A. Poitrasson (holo L, barcode L 44451, photo in BRI; P), Vietnam, Ho Chi Minh ('Cochinchine, Saigon').

Germania schmidiana A.Camus (1957) 186. — Type: *Schmid 2349* (holo probably in Herb. M. Schmid, Paris, fide J.F. Veldkamp, pers. comm.), Vietnam, Khanh Hoa, Cam Lâm (Ba Ngoi).

Perennial, tufted. Culms 30–60(–90) cm tall, erect; nodes glabrous to pubescent. Leaf-sheaths 5–13 cm long, basal sheaths tomentose, densely covered with white to pale yellow hairs to glabrous, upper sheath shorter than internodes. Ligule a ciliate membrane, up to 1.5 mm long, with a dense row of hairs behind the ligule. Leaf-blades linear, 7–40 by 0.5–1 cm, tomentose to sparsely pubescent or glabrous on both surfaces, margins thick, tomentose to scabrous. Racemes 2, 2–4 cm long, capitate to elongate, usually with one main axis rarely with two, very closely appressed, composed of 4–14 sessile and pedicelled spikelets, basal homogamous 1–4 in number; peduncles 20–30 cm long, hirsute below the inflorescences. Sessile spikelets yellowish green to green, oblong, 15–23 by 2.5–4.5 mm; lower glumes coriaceous, oblong, 13–22 by 3–4.5 mm, pubescent to glabrous, obliquely bifid to muticous, upper margin

ciliate, 7–9-nerved, sometimes outer two nerves anastomosing; upper glumes linear-lanceolate, 16–23 by 3–4 mm, upper part pubescent, acute, upper margin ciliate, 3-nerved; lower lemmas linear-lanceolate, 15–20 mm long, acute and ciliate, 1(–3)-nerved; lower paleas ovate-lanceolate, 13–19 mm long, pubescent on nerves, bifid, upper margin ciliate; upper lemmas linear-lanceolate, 15–20 mm long, upper part pubescent, acute, upper margin ciliate; upper paleas lanceolate, 15–20 mm long, pubescent on nerves, acute, upper margin ciliate; stamens 2, anthers reddish purple, 9–12 mm long. Pedicelled spikelets lanceolate, 8–11 by 1.2–2.5 mm, caducous; pedicels 5–7 mm long, hirsute; spikelet callus linear, 3–3.5 mm long, attached obliquely, hairy, hairs 0.5–2 mm long; lower glumes lanceolate to ovate-lanceolate, 8–11 by 1.5–2.5 mm, pubescent, obtuse to muticous, upper margin ciliate, 3-nerved; upper glumes ovate-lanceolate, 7–9 by 1–1.8 mm, pubescent, obtuse to truncate, upper margin ciliate, 3(–5)-nerved; lower florets neuter or suppressed, lower lemmas linear, 6–7 mm long, truncate, upper margin ciliate, nerves obscure; lower paleas absent; upper lemmas linear, 3–4 mm long, awns 6–9(–11.5) cm long, columns 4–6 cm long; upper paleas oblong, 5–7 mm long, truncate and dentate, upper margin ciliate; styles 2, stigmas reddish purple, c. 1.5 mm long. Caryopsis oblong, 3–4 mm long.

Distribution — Thailand (NE: Loei; E: Chaiyaphum, Si Sa Ket; SE: Chanthaburi; PEN: Satun, Songkhla). This species also occurs in Vietnam to S China (Guangdong, Yunnan), Malesia: Aru Isl., New Guinea (Irian Jaya: Kebar, Baliem; Papua New Guinea: W Sepik, W Prov.), Australia (N Queensland).

Habitat & Ecology — Wet and open sandy and clayey soil areas in tropical grasslands, pine forests, 0–1300 m.

Vernacular name — Ya Kamong, from *Bunpheng 898* (BKF).

Specimens examined. *Anonymous* 32, 57; *Brass* 5727, 6555, 8637, 11722; *Bunpheng* 898; *Buwalda* 5299; *BW* 12512 (*Versteegh*); *Clarkson* 7753; *Heyligers* 1615; *Kerr* 8831, 9583, 13687; *Kostermans & Soegeng* 814; *Lazarides* 7468; *Maxwell* 76-548, 85-215; *NGF* 9370 (*Womersley*), 10429 (*White & Gray*), 38777-2 (*Henty & Katik*), 49579 (*Henty*); *O'Connor & Niyomdham* 15679; *Pullen* 7210; *Raynal* 16983; *Sampson* 838a, 838b, 1162, 14302; *Sharpe & Dowling* 2264; *Sharpe & Elsol* 2660; *Smitinand* 367, 1794, 3598, 5856, 7154; *Sørensen et al.* 2369; *Teerawatananon & Sungkaew* 834, 888, 889, 898; *Tem & Ploenchit* 367; *Van Balgooy & Mamesah* 6267, 6381; *Van Beusekom et al.* 4265 (*NOT* 9265); *Van Leeuwen & Van der Ree* 16–23 May 1958.

Notes — Chai-Anan (1972) divided this species into two groups of high (1000–2000 m) and low (5–50 m) altitudes. Of the specimens examined in this study, only the specimens collected from the summit of Phu Kradueng (1000–1300 m) are assignable to the high altitude plants, while the specimens collected from the other places (0–800 m) are assignable to the low altitude plants. We agree with Chai-Anan that the distinction between the two forms is insufficient for any taxonomic recognition as some characters are inconsistent, e.g. the shape of the apex of the lower glume of sessile spikelet is variable and ranges from obliquely bifid to muticous which can be found in both groups of plants, although most specimens from low altitude tend to have obliquely bifid apices, while the specimens from high altitude tend to have muticous ones. More material for further study is needed to clarify this situation.

This scenario also happens with other grasses. For example, the disjunct distribution crossing the Equator and the Wallace which occurs in *Hemarthria*. *Hemarthria pratensis* (Balansa) Clayton (Van den Heuvel & Veldkamp 2000: 462) ranging from Thailand to Vietnam was described as *H. subulata* Reeder from the Western Province of Papua New Guinea. Other instances even more intriguing are the temperate species *Trisetum bifidum* (Thunb.) Ohwi var. *bifidum* from China, Korea, Japan and then above 2660 m in Papua New Guinea: the Star Mts and Mt Victoria. Approximately 39 subalpine species of *Poa* L. in

New Guinea belong to the Eurasian *Homalopoa* Dumort. and *Stenopoa* Dumort. (J.F. Veldkamp, pers. comm.).

2. *Germainia khasyana* Hack. — Plate 1

Germainia khasyana Hack. (1891) 50. — *Themeda capitata* (Balansa & Poitr.) Roberty var. *khasyana* (Hack.) Roberty (1960) 102, nom. inval. — Type: *Clarke 44830B* (lecto W, sheet *W-Hackel-1916-00027613*; iso W, sheet *W-Hackel-1916-00027614*), India or Khasya, Nartung, 1220 m.

Perennial. *Culms* slender, 25–40(–75) cm tall, erect, branched; nodes pilose. *Leaf-sheaths* 1.5–3 cm long, pilose with tubercle-based hairs, margins scarious. *Ligule* an eciliate membrane, 1–1.5 mm long. *Leaf-blades* lanceolate to linear-lanceolate, 2–4.5 by 0.3–0.4 cm, upper surface and margins pilose with tubercle-based hairs, margins thick. *Racemes* solitary, capitate, 1–1.7 cm long, composed of (2–)3(–4) sessile and pedicelled spikelets; peduncles slender, 6–14 cm long, waxy. *Sessile spikelets* yellowish green, oblong, 10–17 by 3–4 mm; lower glumes coriaceous, oblong, 6.5–12 by 3–4 mm, glabrous, truncate to muticous, upper margin ciliate, 7–9(–11)-nerved, nerves not anastomosing; upper glumes lanceolate to linear-lanceolate, 8–17 by 2–3 mm, pubescent on dorsal surface on the upper half, obtuse, upper margin ciliate, 3-nerved; lower lemmas linear-lanceolate, 6–14 mm long, obtuse, upper margin ciliate, 1-nerved; lower paleas linear-lanceolate, 6–14 mm long, obtuse, upper margin ciliate; upper lemmas absent; upper paleas similar to the lower ones; stamens 2, anthers purple, 4–7 mm long. *Pedicelled spikelets* lanceolate, 6–6.5 by 0.8–1(–2) mm, caducous; pedicels 2.5–4 mm long, sparsely hispid; spikelet callus linear, c. 1.5 mm long, attached obliquely, hairy, hairs 1–2 mm long; lower glumes lanceolate to ovate-lanceolate, 6–6.5 by 1–2 mm, pubescent, truncate or obtuse, upper margin ciliate, 5–7-nerved; upper glumes lanceolate to ovate-lanceolate, 5–5.5 by 1–1.8 mm, pubescent, truncate or obtuse, upper margin ciliate, 3-nerved; lower florets suppressed; upper lemmas linear, 2.5–4 mm long, awns 3.5–5.5 cm long, columns 2–4 cm long; upper paleas oblong, 2.5–3 mm long, truncate and dentate, upper margin ciliate; styles 2, stigmas white, 5–7 mm long. *Caryopsis* oblong, 3–3.2 mm long.

Distribution — Thailand (N: Phitsanulok). This species is also found in India (Meghalaya) and Myanmar (Kachin).

Habitat & Ecology — Open swampy areas, tropical grasslands, 150–1200 m altitude.

Typification notes — Hackel (1891) typified *G. khasyana* by citing the specimens of *Clarke 44830* and *Clarke 42558*. Roberty (1960: 102) selected the specimen of *Clarke 14568* as the type of *G. khasyana*. However that collection was not cited by Hackel (1891) and was not found in his herbarium (W) (J.F. Veldkamp, pers. comm.). Later, Chai-Anan (1972: 41) designated *Clarke 44830A* (BM, K) as holotype, but this lectotypification is incomplete as two sheets were mentioned. We have found that there are five sheets of *Clarke 44830*: *Clarke 44830A* (K), *Clarke 44830B* (W, 2 sheets), *Clarke 44830C* (K) and *Clarke 44830D* (BM) and three sheets of *Clarke 42558*: *Clarke 42558A* (K), *Clarke 42558D* (BM) and *Clarke 42558J* (RGB). Therefore, there are at least eight specimens of *Clarke* which could be selected as the holotype. We hereby designate *Clarke 44830B* as the lectotype. This lectotype is the one housed in his herbarium W (*W-Hackel-1916-00027613*) and that bears a label with Hackel's handwriting (J.F. Veldkamp, pers. comm.).

Specimens examined. *Clarke 6447*, *42558A*, *42558D*, *42558J*, *44830A*, *44830C*, *44830D*; *Hansen et al. 11231*; *Lace 6054*; *Teerawatananon & Sungkaew 906*, *907*.

3. *Germainia lanipes* Hook.f. — Plate 2

Germainia lanipes Hook.f. (1897) 163. — Type: *Helfer s.n.* (holo K), Myanmar, Tenasserim.

Perennial. *Culms* 20–45(–60) cm tall, erect, branched; nodes pubescent, sometimes pilose. *Leaf-sheaths* claspings, 4–10 cm long, basal sheaths densely covered with white to pale yellow lanate hairs, upper sheath shorter than internodes and sparsely pubescent at base and at throat, to glabrous. *Ligule* an eciliate membrane, 0.2–0.5 mm long, basal leaves with a dense row of hairs behind the ligule. *Leaf-blades* linear, 20–45 by 0.2–0.3 (–0.5) cm, lower surface covered with white wax, margins thick, pilose at base, margins spinulose-scarious. *Racemes* 1–2, 1.5–2(–3) cm long, elongate, closely appressed, composed of 4–11 sessile and pedicelled spikelets, basal homogamous 2(–3); peduncle 8–15(–20) cm long. *Sessile spikelets* green, oblong, 10–12(–15) by 3–4 mm; lower glumes coriaceous, oblong, 9–10(–12) by 1.8–3.5 mm, pubescent to hirsute at base, muticous, upper margin ciliate, 7–9-nerved, nerves not anastomosing; upper glumes linear-lanceolate, 10–15 by 1–1.5 mm, 3–4-dentate, 3-nerved, pubescent on nerves; lower florets male; lower lemmas linear-lanceolate, 9–12 mm long, acute, upper margin ciliate, 1-nerved; lower paleas linear-lanceolate, 8–10 mm long, pubescent on nerves, acute to 3-dentate; upper lemmas linear, 8–12 mm long, upper part pubescent, aristate; upper paleas similar to the lower one; stamens 2, anthers yellow to reddish purple, 6–7 mm long. *Pedicelled spikelets* lanceolate, 5–7 by 1–1.5 mm, caducous; pedicels 3–4 mm long, hispid; spikelet callus linear, 1–1.5 mm long, attached obliquely, hairy, hairs 0.5–1.5 mm long; lower glumes lanceolate to ovate-lanceolate, 6–7 by 1–1.5 mm, pubescent, obtuse to acute, 3-nerved; upper glumes ovate-lanceolate, 5–6 by 1–1.5 mm, pubescent, obtuse to acute, 3-nerved; lower florets suppressed; upper lemmas linear, 2–3 mm long, awns 3–5 cm long, columns 2–2.5 cm long; upper paleas oblong, 2.8–3.2 mm long, truncate and dentate; styles 2, stigmas white or rufous-red, 6–10 mm long. *Caryopsis* oblong, c. 3.5 mm long.

Distribution — Thailand (N: Tak; SW: Kanchanaburi, Ratchaburi) and Myanmar (Taninthayi = Tenasserim).

Habitat & Ecology — Open grassy *Shorea-Phoenix humilis* vegetation areas, dry hillsides in deciduous dipterocarp forests, open sandy soil areas on limestone hills, 150–900 m altitude. This species is confined to limestone or rocky areas.

Vernacular name — Ya Da Ru Nee from *Phengkklai et al. 12559* (BKF).

Specimens examined. *Helfer s.n.*; *Larsen 9134*; *Phengkklai 352*; *Phengkklai et al. 12559*; *Sirimongkol 148*; *Teerawatananon & Kritsanachandee 978*; *Teerawatananon & Sungkaew 677*.

4. *Germainia pilosa* Chai-Anan — Plate 3

Germainia pilosa Chai-Anan (1972) 39, f. 3. — Type: *Chantanamuck 224* (holo BKF; iso BK, K, L), Thailand, Sakon Nakhon.

Annual, tufted. *Culms* slender, up to 15 cm tall, erect, branched; nodes glabrous. *Leaf-sheaths* 0.5–1 cm long, pilose with tubercle-based hairs, margins scarious and glabrous. *Ligule* an eciliate membrane, 0.5–0.8 mm long. *Leaf-blades* lanceolate to linear-lanceolate, 1–2 by 0.2–0.25 cm, pilose with tubercle-based hairs on both surfaces, margins scarious. *Racemes* 1, 6–7 mm long, capitate, composed of 2–3(–4) pairs of spikelets; peduncles slender, 3–6 cm long, waxy. *Sessile spikelets* yellowish green to purplish, oblong, 4–4.5 by c. 2 mm; lower glumes chartaceous, oblong, 3.8–4 by 2–2.2 mm, glabrous, muticous or truncate or slightly denticulate, 7–9-nerved, nerves anastomosing below apex; upper glumes lanceolate, 4–4.5 by 0.8–1.5 mm, pubescent on the upper half, obtuse, 3-nerved;



Plate 3 *Germainia pilosa* Chai-Anan. a. Habit; b, d. habitats on moist sandy soil areas; c. inflorescence (b, c: Teerawatananon & Kritsanachandee 949; d: Teerawatananon & Sungkaew 886). — Photos: a–c. N. Kritsanachandee; d. A. Teerawatananon.

lower lemmas lanceolate, 3.5–3.8 mm long, pubescent on the upper half, obtuse, 1-nerved; lower paleas lanceolate, 3.5–3.8 mm long, pubescent on dorsal surface on the upper half, obtuse; upper lemmas absent; upper paleas similar to the lower palea; stamens 2, anthers yellow to purple, 2–3 mm long. *Pedicelled spikelets* lanceolate, 3.5–4 by 0.2–0.6 mm, caducous; pedicels 1–2 mm long, glabrous; spikelet callus linear, 0.5–1 mm long, attached obliquely, hairy, hairs 0.5–0.8 mm long; lower glumes chartaceous, lanceolate, 3.5–4 (–5.5) by 0.3–0.6 mm, pubescent, apex hispid, acute to obtuse, 3-nerved; upper glumes lanceolate, 3–4 (–5) by 0.2–0.5 mm, pubescent, acute to obtuse, 3-nerved; lower florets suppressed; upper lemmas linear, 2–2.5 mm long, awns 3–4.5 cm long, columns 1–2.5 cm long; upper paleas lanceolate, 2.8–3 mm long, dentate; styles 2, stigmas pale brown, 1.4–1.5 mm long. *Caryopsis* oblong, 1.3–1.5 mm long.

Distribution — Endemic to Thailand (NE: Sakon Nakhon, Mukdahan).

Habitat & Ecology — On moist sandy soil in open areas, along stream banks, deciduous dipterocarp and mixed deciduous forests, and also on open and moist rocky plain areas, 500–800 m altitude.

Specimens examined. *Chantanamuck* 224; *Esser* 98-207; *Murata et al.* 50818, 50864; *Norsangri* 568; *Sunarnakoses* 2016; *Teerawatananon & Kritsanachandee* 949; *Teerawatananon & Sungkaew* 886.

Note — Chai-Anan (1972) mentioned that the width of the lower glume of the pedicelled spikelet was 1–1.4 mm. However, we examined the holotype and isotype from BKF, L, as well as fresh specimens in the field and found that their lower glumes are not wider than 0.6 mm.

5. *Germainia thailandica* (Bor) Chai-Anan

Germainia thailandica (Bor) Chai-Anan (1972) 37, f. 2. — *Chumsriella thailandica* Bor (1968) 467, f. on p. 468. — Type: *Boonchuay* 1436 (holo K, barcode K 290143; iso AAU, BKF, BM, L, sheet 084742, barcode L 44454), Thailand, Chiang Mai, Doi Inthanon.

Annual, tufted. *Culms* slender, up to 10 cm tall, erect, branched; nodes glabrous. *Leaf-sheaths* 0.8–1.5 cm long, upper part pilose with tubercle-based hairs, margins scarious and glabrous. *Ligule* a ciliate membrane, 0.8–1 mm long. *Leaf-blades* lanceolate to linear-lanceolate, 1–2.5 by 0.2–0.3 cm, densely patently pilose with tubercle-based hairs on both surfaces, margins scabrous. *Racemes* 2, 0.8–1.5 cm long, elongate, more or less divergent, composed of 3–4 pairs of spikelets on each, basal homogamous solitary or absent; peduncle slender, 1–2 cm long, enclosed in the uppermost sheath with well-developed blade. *Sessile spikelets* oblong, 4–5 by 1–2 mm; lower glumes membranous to chartaceous, oblong, 3.5–4.5 by 1–2 mm, glabrous, apex 3–4-dentate, the mid-lobe shorter than the laterals, upper margin ciliate, 7–9-nerved, nerves anastomosing below apex; upper glumes lanceolate, 4–5 by 1–1.2 mm, glabrous, truncate to emarginate, upper margin ciliate, 1-nerved; lower florets absent, if present neuter; lower lemmas lanceolate, 2.7–3.7 mm long, obtuse, upper margin ciliate, nerves obscure; lower paleas absent; upper lemmas filiform, 4–4.5 mm long; upper paleas lanceolate, 4–4.2 mm long, glabrous, obtuse, upper margin ciliate; stamens not seen. *Pedicelled spikelets* lanceolate, 3.5–4 by 0.5–1.2 mm, caducous; pedicels 1–1.5 mm long, sparsely pubescent; spikelet callus obtuse, attached transversely, hairy, hairs 0.3–0.5 mm long; lower glumes lanceolate, 3.5–4.3 by 0.8–1.2 mm, densely hirsute, 2–3-dentate, upper margin ciliate, 3-nerved, anastomosing; upper glumes lanceolate, 2.8–3.2 by 0.8–1 mm, densely hirsute, obtuse with 2–3-dentate, 3-nerved; lower florets suppressed; upper lemmas linear, 1.5–2 mm long, awns 2.5–4.5 cm long, columns

1–1.2 cm long; upper paleas oblong, 1–1.7 mm long, acute, glabrous. *Caryopsis* oblong, 1.3–1.5 mm long.

Distribution — Endemic to Thailand, only known from Doi Inthanon (N: Chiang Mai).

Habitat & Ecology — Evergreen forests.

Typification notes — Bor (1968) stated that the specimen of *K. Boongoheng* 1436 housed in K was the holotype of *Chumsriella thailandica* Bor and regarded the duplicates in BKF, BM and AAU as isotypes. However, the label on the holotype sheet indicated that '*Booncheuy* 1436' was the collector. The isotype in BM was labelled as '*Boocheng* 1436', while the isotype in BKF was labelled using the signature of a collector 1436 written in Thai but can be spelled either '*Booncheuy*' or '*Boonchuay*'. As this species was transferred to *Germainia* by Chai-Anan (1972), a Thai grass-taxonomist, she stated the collector name of the holotype was '*Boonchuay*'. The collector's name can be spelled in English in different ways. Thus, the correct name should be '*Boonchuay*' as Chai-Anan (1972) indicated.

Vernacular name — Ya Hang Ma, from *Boonchuay* 1436 (BKF).

Specimen examined. *Boonchuay* 1436.

6. *Germainia thorelii* A.Camus

Germainia thorelii A.Camus (1919) 287. — *Themeda capitata* (Balansa & Poitr.) Roberty var. *thorelii* (A.Camus) Roberty (1960) 102, nom. inval. — Type: *Thorel s.n.* (holo P; iso L, barcode L 44455), Laos, Rivi re d'Ubon.

Annual. *Culms* slender, 25–50 cm tall, erect, branched; nodes glabrous. *Leaf-sheaths* 1–2.5 cm long, glabrous to appressed pubescent, margins scarious. *Ligule* an eciliate membrane, 0.4–1.2 mm long. *Leaf-blades* lanceolate to linear-lanceolate, 1–2.5 by 0.2–0.3 cm, strigose and pilose with tubercle-based hairs especially on the upper surface, margins thick. *Racemes* 1, 1–1.4 cm long, capitate, composed of 2 sessile and 1 pedicelled spikelets; peduncles slender, 9–14 cm long, glabrous. *Sessile spikelets* oblong, 10–14 by 2–3 mm; lower glumes coriaceous, oblong, 9–12 by 2–3 mm, glabrous, truncate with 2 lateral caudate 1–3.5 mm long, upper margin ciliate, 7–9-nerved, nerves not anastomosing; upper glumes lanceolate to linear-lanceolate, 10–14 by 1.8–2 mm, pubescent on dorsal surface on the upper half, obtuse, upper margin ciliate, 3-nerved; lower lemmas linear-lanceolate, 8–12 mm long, obtuse, upper margin ciliate, 1-nerved; lower paleas linear-lanceolate, 8–9 mm long, obtuse, upper margin ciliate, nerves obscure; upper lemmas absent; upper paleas as the lower one; stamens 2, anthers, 3.5–6.5 mm long. *Pedicelled spikelets* lanceolate, 6–7 by 0.6–2 mm, caducous; pedicels 2–3.2 mm long, sparsely pubescent; spikelet callus linear, 2–2.5 mm long, attached obliquely, hairy, hairs 1–1.5 mm long; lower glumes lanceolate to ovate-lanceolate, 6–7 by 1–2 mm, hirsute on dorsal surface on the upper half, truncate or obtuse, upper margin ciliate, 3-nerved; upper glumes lanceolate to ovate-lanceolate, 5–6.5 by 1–1.8 mm, hirsute on dorsal surface on the upper half, truncate or obtuse, upper margin ciliate, 3-nerved; lower florets suppressed; upper lemmas linear, 3–4 mm long, awns 6.5–10.5 cm long, columns 3–4 cm long; upper paleas oblong, 3–3.5 mm long, glabrous, 3–4-dentate, upper margin ciliate; styles 2, stigmas 4–5 mm long. *Caryopsis* oblong, 3–3.5 mm long.

Distribution — Thailand (E: Ubon Ratchathani) and Laos (between Louangphrabang and Viangchan = Vientiane).

Habitat & Ecology — On sloping sandstone with seeping water areas and grasslands on limestone areas, 150–900 m altitude.

Specimens examined. *Joseph* Apr1913 in *Herb. d'Alleizette* 8022; *Lae-gaard et al.* 21834.

CONCLUSION

Almost all members of this genus prefer moist and open sandy soil especially sandstone areas with seeping water. Only *G. lanipes* is restricted to limestone hills and can be found in the western part of Thailand.

There are six species of *Germainia*, viz. *G. capitata*, *G. khasyana*, *G. lanipes*, *G. pilosa*, *G. thailandica* and *G. thorelii*, known from Thailand, of which two are endemic (*G. pilosa*, *G. thailandica*). Previously, *G. tenax* (Balansa) Chai-Anan was reported as probably occurring in Thailand (Chai-Ann 1972, Lazarides 1980, Nanakorn & Norsangsri 2001). However, we have examined the type specimen of *G. tenax* (Laos, *Harmand s.n.* (L)) and found that none of the specimens collected from Thailand corresponded to authentic *G. tenax*.

Acknowledgements The authors are grateful to the curators and the staff of the following herbaria: AAU, ABD, BK, BKF, BM, C, E, GH, K, KKKU, L, NY, SING, TCD, US and the Herbarium of Natural History Museum, National Science Museum, Technopolis, Pathum Thani, Thailand, for the use or loan of specimens. Thanks to Prof. John A.N. Parnell for his kind comments and useful suggestions. Dr. J.F. Veldkamp (L) critically read the manuscript and provided a number of additional data. A special thanks to Bhanumas Chantarasuwan and Dr. Anna Trias Blasi for their help with sourcing references and material. This paper was supported by the TRF/BIOTEC Special Programme for Biodiversity Research and Training Grant BRT_148026, the Trinity College Dublin Postgraduate Travel Reimbursement Fund, Natural History Museum, National Science Museum, Technopolis, Pathum Thani, Thailand. This work is dedicated to the memory of Mrs. Chumsri (Hambananda) Chai-Anan (1930–2009). As an excellent teacher she introduced us to the world of Thai grasses.

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