



Four new species of *Xyris* (Xyridaceae) from Thailand

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Abstract Four new species of *Xyris* (Xyridaceae), *X. bituberosa*, *X. buengkanensis*, *X. emarginata*, and *X. thailandica* from North-Eastern Thailand are described and illustrated. A provisional conservation assessment for each species is given.

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INTRODUCTION

Xyridaceae is a small tropical and subtropical family, comprising c. 385 species in five genera: *Abolboda* Humb. & Bonpl. (1813), *Achlyphila* Maguire & Wurdack (1960), *Aratitiopea* Steyerf. & P.E. Berry (1984), *Orectanthe* Maguire (1958), and *Xyris* L. (1753). *Xyris* is the largest genus of the family, with more than 250 species (Kral 2000), and is distributed mainly in tropical and subtropical North and South America, with about 50 species in Africa, and smaller numbers in Asia and Australia. The other four genera are restricted to South America (Dahlgren et al. 1985, Simpson 2006).

The family, as published in the Flora of Thailand (Hansen 1987), comprised 11 species. The family has also been dealt with for the Flora of China with six species, namely *X. bancana* Miq., *X. capensis* Thunb., *X. complanata* R.Br., *X. formosa* Hayata, *X. indica* L., and *X. pauciflora* Willd. (Wu & Kral 2000). During recent studies of Xyridaceae in Thailand and Southeast Asia, additional material was collected, and among these collections there are four hitherto undescribed species from North-Eastern Thailand.

The descriptions below were made from living full-grown plants in flower and/or in fruit and from the cited herbarium specimens. Leaf widths were measured in the middle of the blade. Sepal, petal, stamen and pistil morphology were measured in fully open flowers in the living state, as the flowers are so delicate that pressed material is of little use. Seed morphology was investigated by scanning electron microscopy (SEM) and light microscopy (LM). Conservation assessments follow the criteria set out by IUCN (2001). Regions follow floristic regions in the Flora of Thailand. The vernacular names were provided by the first author.

DESCRIPTION OF THE NEW TAXA

1. *Xyris bituberosa* Phonsena & Chantar., *sp. nov.* — Fig. 1; Plate 1a–c, 2a, b; Map 1

Xyridi tuberosae habitu caule subterranea cormiforme similissima, sed foliis linearibus vel subteretis, nec ensiformibus, caule subterranea bilobata dum in *X. tuberosa* plerumque elobato sed raro bilobata differt. — Typus: *Phonsena*

& Boonsuk 6418 (holo KKU; iso BK, BKF, C, L), Thailand, Bueng Kan, Phu Wua Wildlife Sanctuary, alt. 400 m, 25 Sept. 2009.

Etymology. The specific epithet refers to the 2-lobed corm.

Solitary perennial herb, 40–50(–75) cm tall with a 2-lobed corm. *Corm-lobes* yellowish brown, subglobose, (0.8–)1–1.5 by (1.2–)1.5–2.3 cm, containing starch grains. *Leaves* (2–)3–4 per plant, linear or subterete, (12–)25–37 cm by 2–2.3 mm, with a ligule; blade smooth, margin entire, apex bluntly oblique to acute. *Scape* terete, subterete below the spike, 1–1.5 mm diam. *Spike* obovoid to ellipsoid, (0.8–)1.2–1.8 by 0.5–0.9 cm. *Sterile bracts* 6–12, pale brown to reddish brown, ovate to obovate, 4–7 by 3–5 mm, margin entire, apex lacerate. *Fertile bracts* pale brown to reddish brown, ovate to obovate, 6–8 by 5–7 mm, margin entire, apex lacerate; stomate field triangular, 1.8–2.1 by 1.5–2.5 mm. *Lateral sepals* hyaline or pale brown, 5–6 by 1–1.5 mm, without or with a minute crest. *Petal limbs* yellow, obovate, 10–12 by 8–10 mm, margin distally lacerate. *Staminodia* bibrachiate, branches elongate-penicillate, c. 4 mm long. *Anthers* oblong, 2–3 mm long, shallowly bifid, deeply sagittate, filaments 1–1.5 mm long. *Style* terete, 5–6 mm long, distally 3-branched, branches c. 3 mm long. *Capsule* dark brown, obovoid, 3–3.4 by 2–2.2 mm. *Seeds* reddish brown, translucent, ellipsoid, c. 0.6 mm long, 0.2–0.3 mm diam, with 13–15 longitudinal ridges and 1–3 transverse ridges between the longitudinal ridges.

Distribution — Endemic to Thailand, known only from North-Eastern: Bueng Kan (Phu Wua Wildlife Sanctuary, Si Wilai).

Habitat & Ecology — On open, sandy soil, wet places in dry dipterocarp forest, at 180–450 m altitude.

Phenology — Flowering: September to November, between the late rainy season and the beginning of the dry season. The flowers open in the late morning at 11.30 a.m. and persist until 4.30 p.m.

Vernacular name — Kathin phu wua.

Specimens examined. Bueng Kan (Si Wilai, Na Sing, Ban Na Sai): *Phonsena* 6699 (BK, KEP, KKU, L), 180 m alt., 18°15'N, 103°46'E, 31 Dec. 2010; *Phonsena* & *Boonsuk* 6628 (BKF, C, L), 180 m alt., 28 Nov. 2010; *Phonsena* & *Sutthisaksopon* 6543 (KKU), 8 Aug. 2010; *Phonsena* & *Sutthisaksopon* 6568 (BM, C, K, KKU, QBG), 8 Oct. 2010. Bueng Kan (Bung Khla, Phu Wua Wildlife Sanctuary): *Phonsena* & *Boonsuk* 6418 (BK, BKF, C, K, KKU, L, QBG), 450 m alt., 18°14'N, 103°58'E, 29 Sept. 2009.

Conservation status — *Xyris bituberosa* is endemic to Thailand, recorded from two localities, one within a wildlife sanctuary, and the other from disturbed dry dipterocarp forest near villages. The habitat outside the sanctuary has been disturbed

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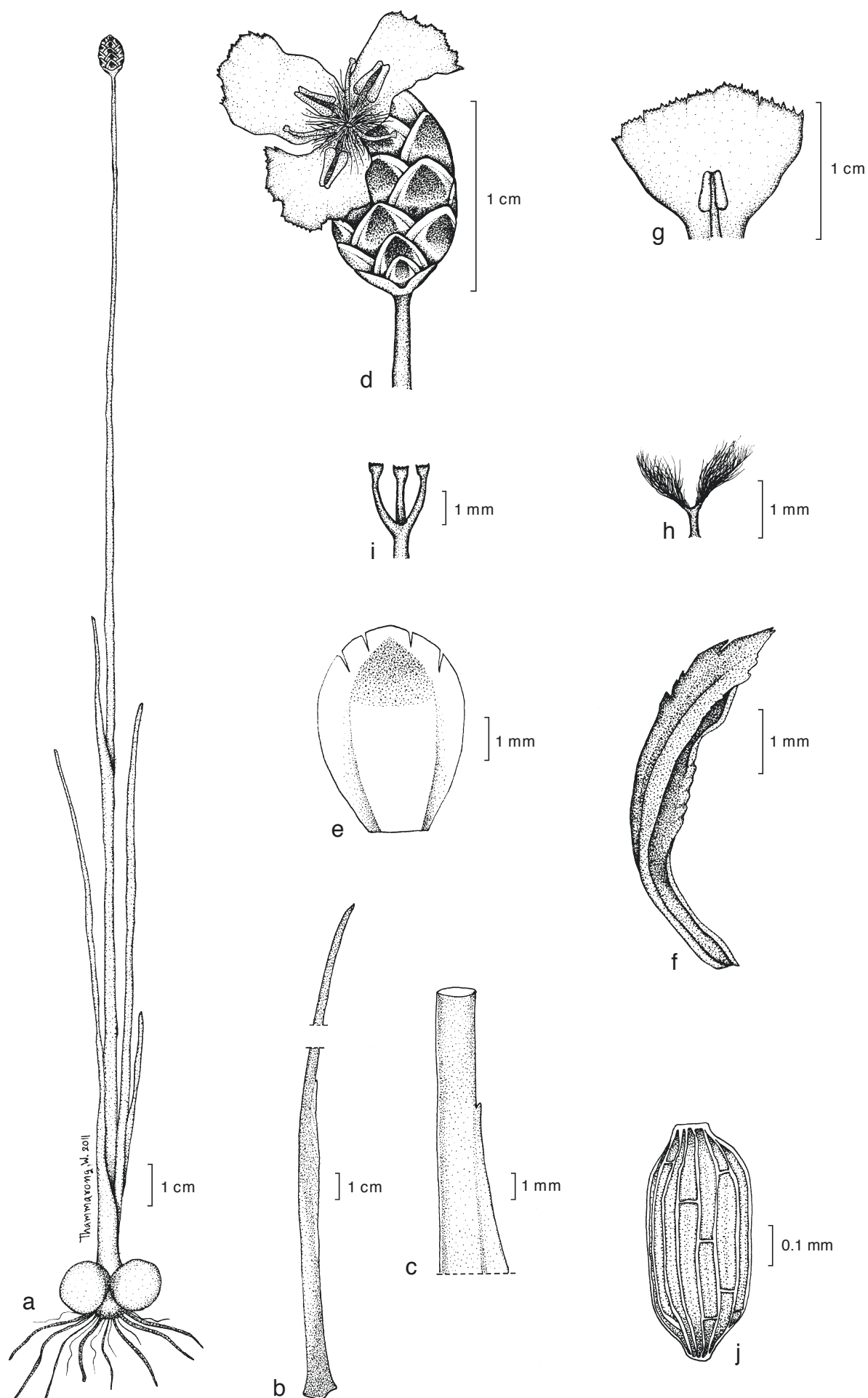


Fig. 1 *Xyris bituberosa* Phonsena & Chantar. a. Habit; b. leaf lamina and leaf apex; c. junction of leaf and sheathing base showing ligule; d. spike; e. fertile bract; f. lateral sepal; g. petal limb and stamen; h. staminode; i. style; j. seed (all: Phonsena & Boonsuk 6418, KKU). — Drawn by W. Thammarong.

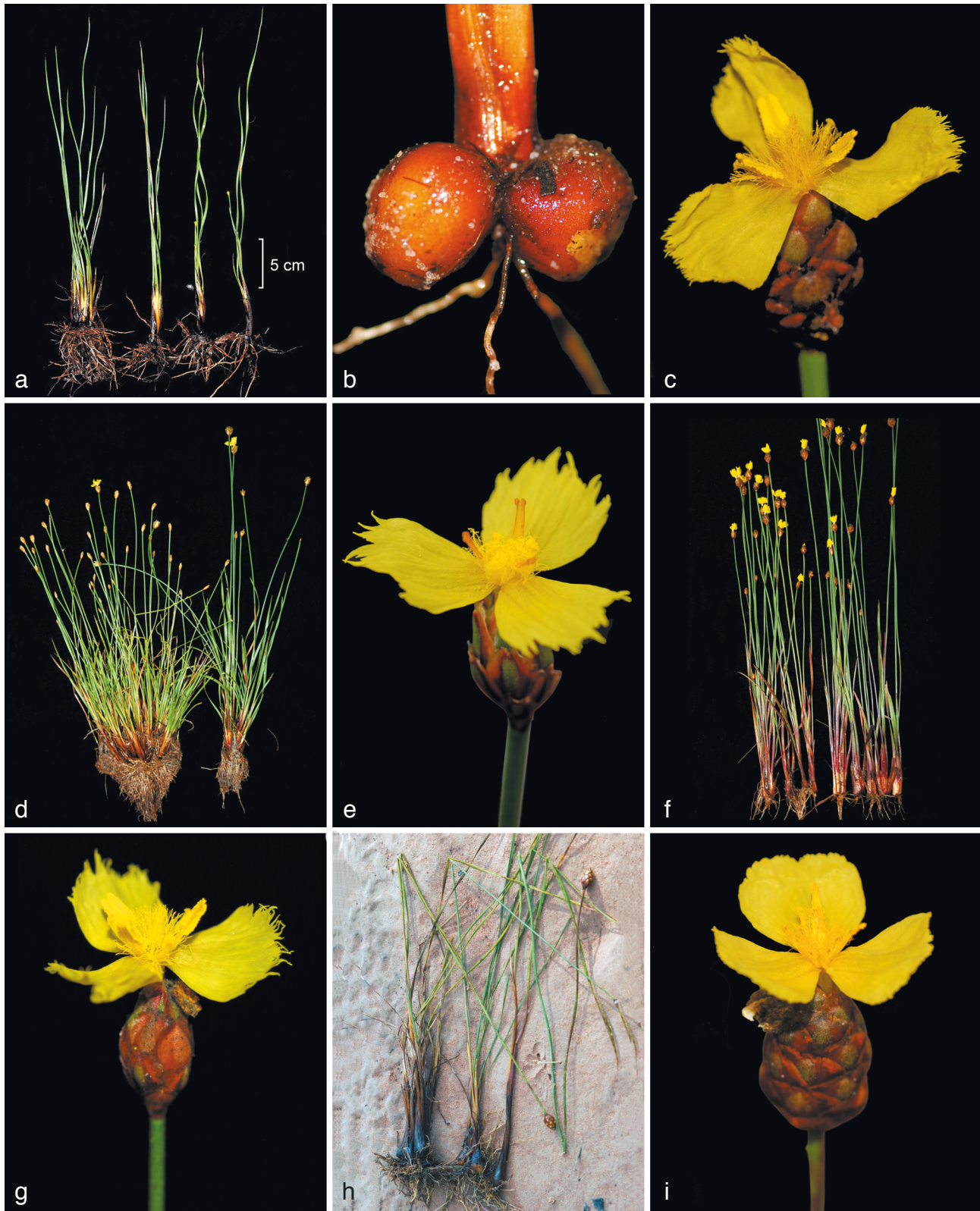


Plate 1 *Xyris bituberosa*. a. Habit; b. underground stem; c. inflorescence. — *X. buenganensis*. d. Habit; e. inflorescence. — *X. emarginata*. f. Habit; g. inflorescence. — *X. thailandica*. h. Habit; i. inflorescence (a: Phonsena & Sutthisaksopon 6543; b, c: Phonsena & Boonsuk 6418; d, e: Phonsena & Boonsuk 6542; f, g: Phonsena & Boonsuk 6585; h, i: Phonsena 6444; all KKU). — Photographed by a: P. Sutthisaksopon; b–i: P. Phonsena.

by farming activities which appear to be causing its rapid decline, but the population within the sanctuary is well protected. A rating of Endangered (EN, IUCN 2001) is merited.

Note — *Xyris bituberosa* resembles *X. tuberosa* Ridl., a species also with a tuber (underground corm-shaped stem), which is distributed in North-Eastern, Eastern and Peninsular Thailand. The latter species, however, differs in having simple (sometimes aggregated) and smaller tubers, and ensiform leaves.

2. *Xyris buenganensis* Phonsena & Chantar., *sp. nov.* — Fig. 2; Plate 1d, e, 2c, d; Map 1

A congeneribus asiaticis euronotis bracteis pentastichis non imbricatis differt. Bracteae fertiles *X. wallichii* similissimae in area stomatosa angusta infra-apicali, sed in posteriore angustiore (in priore 2–3-plo longa latiore, versus 3–10-plo in posteriore) et petali limbo fimbriato non integro. — **Typus:** Phonsena & Sutthisaksopon 6567 (holo KKU; iso BK, BKF, C, L, QBG), Thailand, Bueng Kan, Si Wilai, Na Sing, Ban Na Sai, alt. 180 m, 8 Oct. 2010.

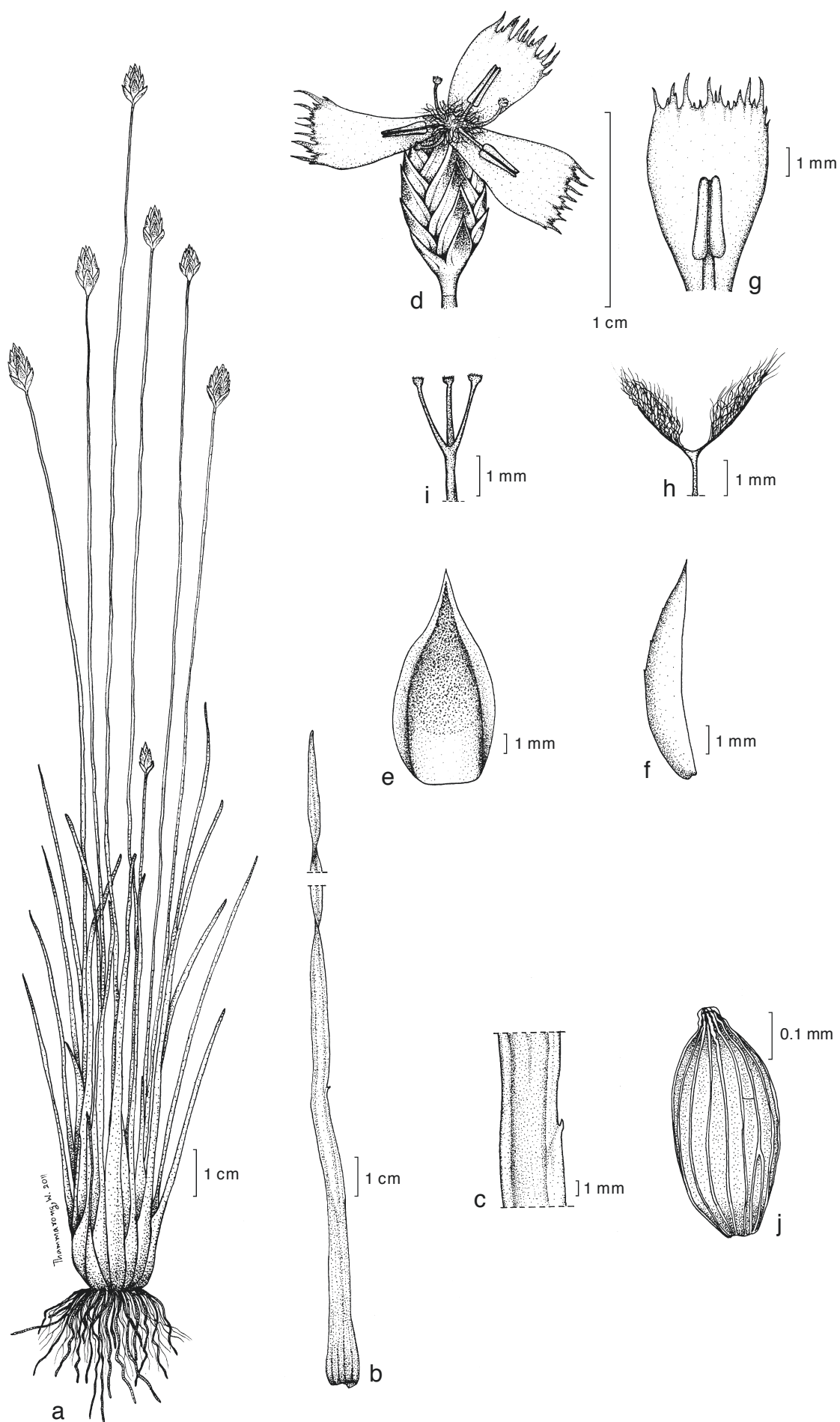


Fig. 2 *Xyris buengkanensis* Phonsena & Chantar. a. Habit; b. leaf lamina and leaf apex; c. junction of leaf and sheathing base showing ligule; d. spike; e. fertile bract; f. lateral sepal; g. petal limb and stamen; h. staminode; i. style; j. seed (a–i: Phonsena & Sutthisaksopon 6567; j: Phonsena & Sutthisaksopon 6542; all KKU). — Drawn by W. Thammamong.

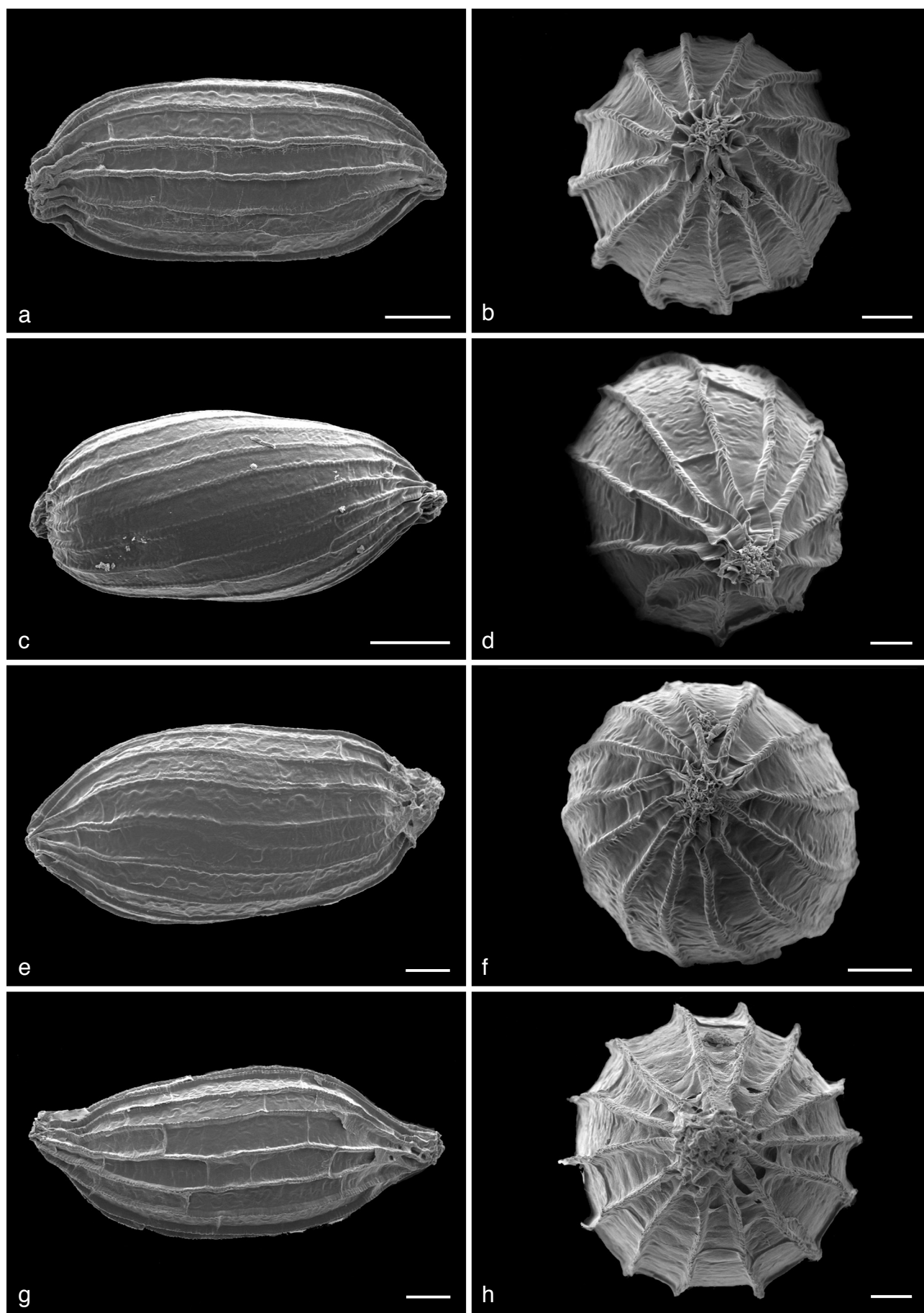
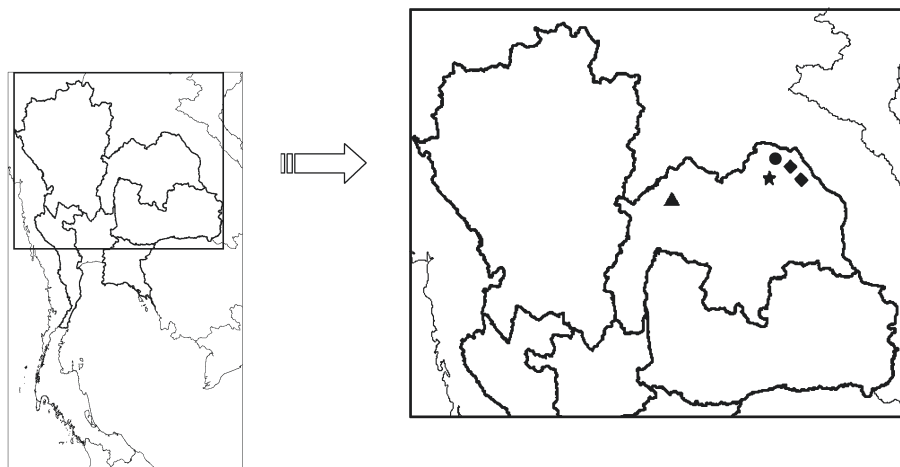


Plate 2 Seeds: *X. bituberosa*. a. Side view; b. top view. – *X. buengkanensis*. c. Side view; d. top view. – *X. emarginata*. e. Side view; f. top view. – *X. thailandica*. g. Side view; h. top view (a, b: Phonsena & Boonsuk 6418; c, d: Phonsena & Boonsuk 6542; e, f: Phonsena & Boonsuk 6585; g, h: Phonsena 6444; all KKU). — Scale bars: a, c, e, g = 0.1 mm; b, d, f, h = 0.05 mm.



Map 1 Distribution in Thailand of *X. bituberosa* (◆), *X. buengkanensis* (★), *X. emarginata* (●), and *X. thailandica* (▲).

Etymology. The specific epithet refers to Bueng Kan, the newest province of Thailand, where the type specimens were collected.

Caespitose perennial herb, 20–50 cm tall. *Leaves* 5–35 per plant, ensiform, (8–)15–22 cm by 2–5 mm, ligulate; blade smooth, margin entire, apex bluntly oblique to acute. *Scape* terete, 1–1.3 mm thick. *Spike* ellipsoid, 0.9–1.3 by 0.3–0.7 cm. *Sterile bracts* 6–11, in 5 rows, pale brown with hyaline margin, ovate, 4–7 by 2–3 mm, margin entire. *Fertile bracts* in 5 rows, pale brown with hyaline margin, narrowly elliptic to elliptic, 7–12 by 3–5 mm, margin entire; stomate field triangular, 5–8 by 2–3 mm. *Lateral sepals* hyaline, 7–9 by 1.3–2 mm with narrow, distantly shortly serrate or entire crest. *Petal limbs* yellow, obovate to elliptic, 11–14 by 8–10 mm, margin fimbriate. *Staminodia* bibrachiate, branches elongate-penicillate, 3–4 mm long. *Anthers* oblong, 2–3 mm long, shallowly bifid, deeply sagittate; filaments c. 1 mm long. *Style* terete, 7–8.5 mm long, distally 3-branched, branches 3–3.5 mm long. *Capsules* dark brown, obovoid, 7–8 by 2–3 mm. *Seeds* brown, translucent, ellipsoid, slightly twisted at apex, 0.4–0.6 mm long, 0.2–0.3 mm diam, with 11–14(–15) longitudinal ridges and with 0–2 transverse ridges between the longitudinal ridges.

Distribution — Endemic to Thailand, North-Eastern: Bueng Kan (Si Wilai), only known from the type locality. It should be looked for in nearby areas within the Mekong basin of Laos and Thailand.

Habitat & Ecology — On open, sandy soil, wet places in dry dipterocarp forest, at 180 m altitude.

Phenology — Flowering: September to November, between the late rainy season and the beginning of the dry season. The flowers open at about 10.30 a.m. and persist until 4.30 p.m.

Vernacular name — Kathin bueng kan.

Specimens examined. Bueng Kan (Si Wilai, Na Sing, Ban Na Sai, 180 m alt., 18°15'N, 103°46'E): *Phonsena* 6700 (BKF, KEP, KKU, L), 31 Dec. 2010; *Phonsena* & *Boonsuk* 6423 (BK, BKF, C, KKU, L), 25 Sept. 2009; *Phonsena* & *Boonsuk* 6627 (BKF, KKU, QBG), 28 Nov. 2010; *Phonsena* & *Sutthisaksopon* 6542 (BKF, KKU), 8 Aug. 2010; *Phonsena* & *Sutthisaksopon* 6567 (BK, BKF, C, K, KKU, L, QBG), 8 Oct. 2010.

Conservation status — *Xyris buengkanensis* is endemic to Thailand, and is so far known from only one locality. Its extent of occurrence is estimated as to be less than 100 km². Its habitat has been disturbed by farming activities and its occurrence is declining. A rating of Critically Endangered (CR, IUCN 2001) is merited.

Note — The bracts of this species are arranged in five rows but in other SE Asian *Xyris* they are imbricately arranged. The margin of the bract is hyaline, thin, entire in living plants but mostly fimbriate when dry. The fertile bracts of this species are similar to *X. wallichii* but the stomate field of the fertile bract in

this species is 2–3 times longer than wide, whereas 3–10 times longer than wide in *X. wallichii*. *Xyris buengkanensis* differs also in its fimbriate margin of the petals (entire in *X. wallichii*).

3. *Xyris emarginata* Phonsena & Chantar., *sp. nov.* — Fig. 3, Plate 1f, g, 2e, f; Map 1

Xyridi lobbii similissima bracteis fertilibus apice emarginato, sed margine lacerato non integro differt. *Xyridi complanatae* quoque similissima bracteeae fertilis margine, sed ab ea folii aciebus et scapo laevi non tuberculoso differt. — Typus: *Phonsena* & *Boonsuk* 6585 (holo KKU; iso BK, BKF, C, K, L, QBG), Thailand, Bueng Kan, Bueng Khong Long, Pho Mak Khaeng, Ban Dong Chomphu, alt. 180 m, 25 Oct. 2010.

Etymology. The specific epithet refers to the emarginate apex of the fertile bracts.

Caespitose perennial herb, 30–40(–45) cm tall, base dilated, bulbous. *Bulb* ovoid, 0.6–1 by 0.4–0.6 cm. *Leaves* 2–4 per plant, linear, twisted, 10–20 cm by 1.5–2.2 mm, with a ligule; blade smooth, margin entire, apex bluntly oblique to acute. *Scape* terete, 1–1.5 mm thick, smooth. *Spike* ellipsoid, 0.8–1.5 by 0.5–1 cm. *Sterile bracts* 8–12, reddish brown to brown, obovate, 3–6 by 2–4 mm, margin entire. *Fertile bracts* reddish brown to brown, ovate, 7–8 by 4–5.5 mm, margin entire, apex emarginate; stomate field ovate, 2.5–3 by 1.2–2 mm. *Lateral sepals* pale brown, 7–8 by 1.5–2 mm, crest coarsely and distantly serrate. *Petal limbs* bright yellow, obovate, 8–10 by 7–8 mm, margin fimbriate. *Staminodia* bibrachiate, branches elongate-penicillate, 3–3.5 mm long. *Anthers* oblong, c. 3 mm long, shallowly bifid, deeply sagittate; filaments 1–1.5 mm long. *Style* terete, 7–8.5 mm long, distally 3-branched, branches 3–3.5 mm long. *Capsules* dark brown, obovoid, 3–5 by 2–3 mm. *Seeds* brown to dark brown, translucent, narrowly ellipsoid to oblong, 0.5–0.8 mm long, 0.2–0.3 mm diam, with 13–15 longitudinal ridges and with 0–4 transverse ridges between the longitudinal ridges.

Distribution — Endemic to Thailand, North-Eastern: Bueng Khong Long, only known from the type locality. It may be assumed that it has a wider distribution in nearby areas along the Mekong basin of Laos and Thailand.

Habitat & Ecology — On open, sandy soil, in wet places in dry dipterocarp forest, at 180 m altitude.

Phenology — Flowering and fruiting: October to December, between the late rainy season and the beginning of the dry season. The flowers open in the morning at 08.30 a.m. and persist until 12.30 p.m.

Vernacular name — Kathin khok.

Specimens examined. Bueng Kan (Bueng Khong Long, Pho Mak Khaeng, Ban Dong Chomphu, 180 m alt., 17°58'N, 104°05'E): *Phonsena* 6704 (KKU),

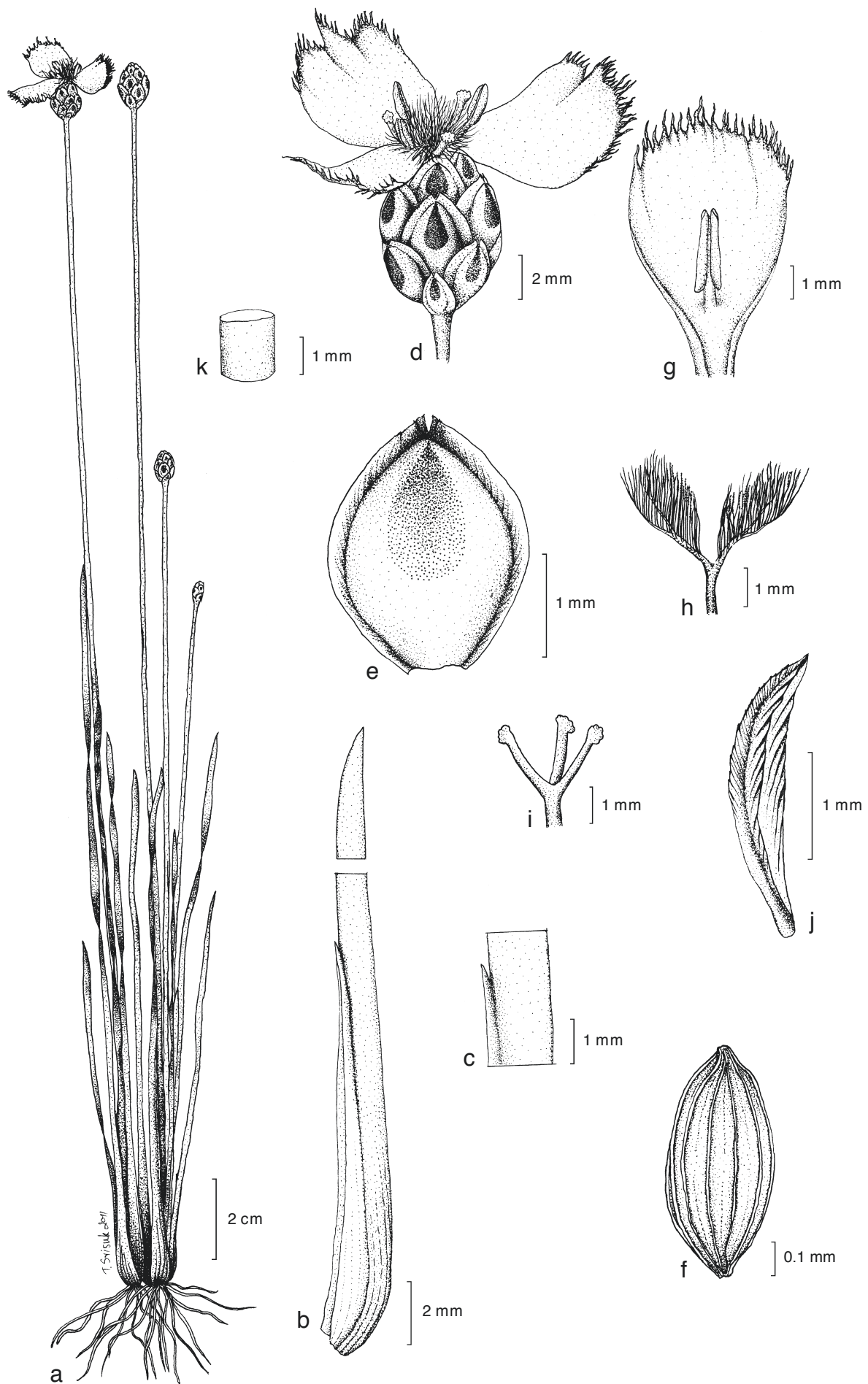


Fig. 3 *Xyris emarginata* Phonsena & Chantar. a. Habit; b. leaf lamina and leaf apex; c. junction of leaf and sheathing base showing ligule; d. spike; e. fertile bract; f. seed; g. petal limb and stamen; h. staminode; i. style; j. lateral sepal; k. section of scape (a–e, g–k: Phonsena & Boonsuk 6585; f: Phonsena & Boonsuk 6622; all KKU). — Drawn by T. Srisuk.

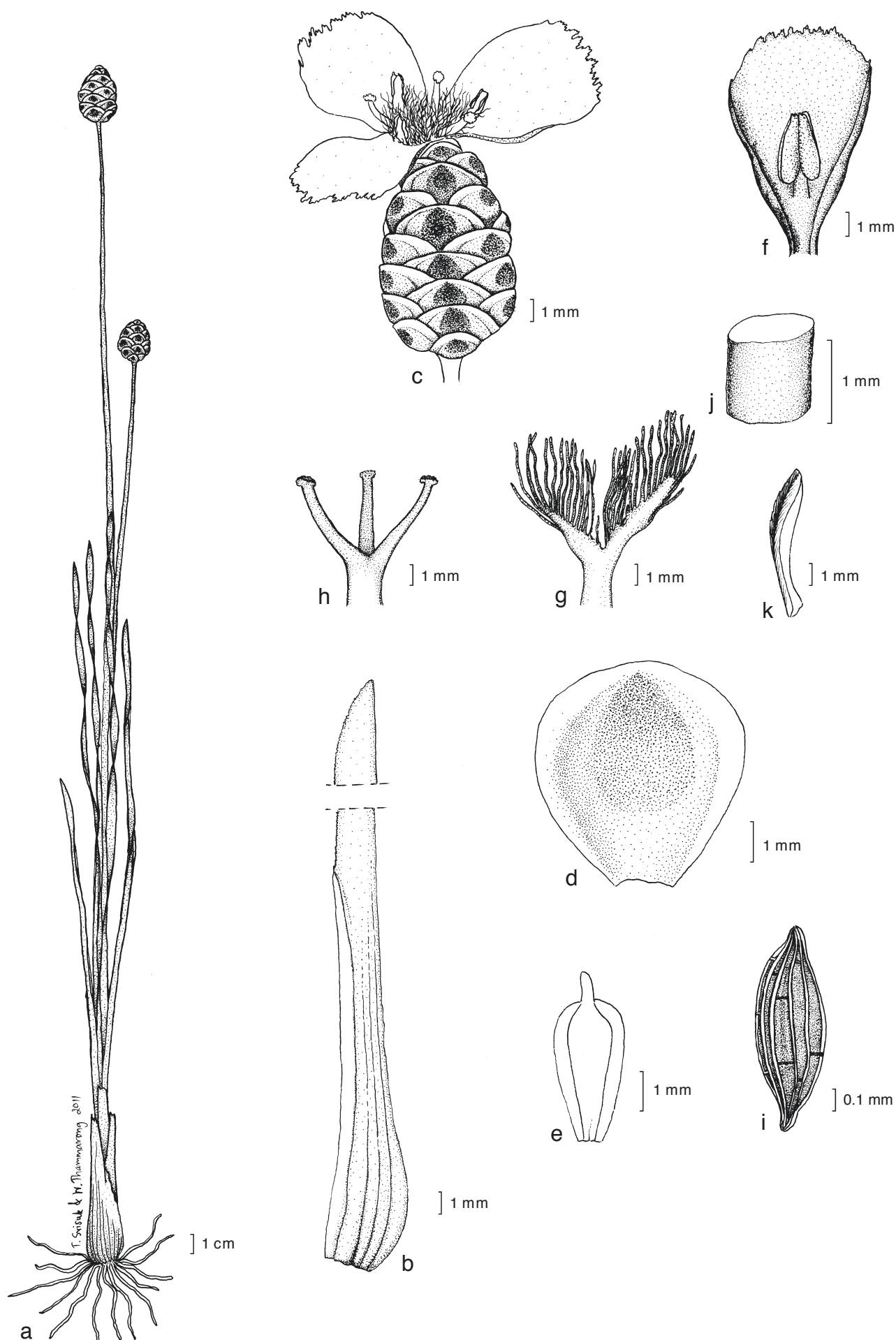


Fig. 4 *Xyris thailandica* Phonsena & Chantar. a. Habit; b. leaf lamina and leaf apex; c. spike; d. fertile bract; e. fruit; f. petal limb and stamen; g. staminode; h. style; i. seed; j. section of scape; k. lateral sepal (all: Phonsena 6444, KKU). — Drawn by T. Srisuk and W. Thammarong.

31 Dec. 2010; *Phonsena & Boonsuk* 6585 (BK, BKF, C, K, KKU, L, QBG), 25 Oct. 2010; *Phonsena & Boonsuk* 6622 (BKF, KEP, L), 28 Nov. 2010.

Conservation status — *Xyris emarginata* is known from a restricted area which is under pressure from agricultural and urban development. The extent of occurrence is estimated as to be less than 100 km². A rating of Critically Endangered (CR, IUCN 2001) is merited.

Note — The fertile bracts of *X. emarginata* resemble those of *X. lobbii* Rendle in its emarginate apex, but differ in its lacerate margin (entire in *X. lobbii*). The margin of the fertile bracts also resemble those found in *X. complanata*, but the new species differs from the latter in the leaf margin and the scape being smooth, not rough with tubercles.

4. *Xyris thailandica* Phonsena & Chantar., *sp. nov.* — Fig. 4; Plate 1h, i, 2g, h; Map 1

Xyridi linifoliae similis habitu cormo subterraneo, sed foliis linearibus (versus teretibus), folii marginibus papillois (versus laevibus) differt. — Typus: *Phonsena* 6444 (holo KKU; iso BK, BKF, L), Thailand, Loei, Phu Kradueng National Park, trail from Lang Pae to Pha Mak Duk, 1280 m, 28 Oct. 2009.

Solitary perennial herb, 25–50(–70) cm tall, base abruptly dilated and bulbous. *Bulb* ovoid, 1.6–2.5 by 0.9–1.8 cm. *Leaves* (2–)3 per plant, linear, flattened, twisted, 20–50 cm by 1.5–2.2 mm, without a ligule; blade smooth, margin papillose or finely serrate, apex bluntly oblique to acute. *Scape* terete, 1.6–2 mm thick. *Spike* ovoid to ellipsoid, 1.1–1.6 by 0.7–1 cm. *Sterile bracts* 4–7, reddish- to blackish brown, obovate to circular, 4–6 by 3–6 mm, margin entire, apex lacerate or entire. *Fertile bracts* reddish- to blackish brown, ovate, 5–6 by 4–5 mm, margin entire, apex lacerate or entire; stomate field triangular, 1.4–1.6 by 0.9–1.2 mm. *Lateral sepals* hyaline or brown, 5–7 by c. 1 mm, crest entire. *Petal limbs* yellow, obovate, 10–13 by 8–9 mm, margin distally lacerate. *Staminodia* bibrachiate, branches elongate-penicillate, 3.5–4 mm long. *Anthems* oblong, c. 2.5 mm long, shallowly bifid, deeply sagittate, filaments 1.5–2 mm long. *Style* terete, 6.5–7 mm long, distally 3-branched, branches c. 3 mm long. *Capsules* brown, obovoid, 4–5 by 2–3 mm. *Seeds* reddish brown, translucent, narrowly ellipsoid, 0.9–1.1 mm long, 0.3–0.4 mm diam, with 14–15 longitudinal ridges and with 1–4 transverse ridges between the longitudinal ridges.

Distribution — Endemic to North-Eastern Thailand, known only from a restricted area in Phu Kradueng National Park and Phu Ruea National Park.

Habitat & Ecology — On open places, among grasses in lower montane pine-oak forest at 1187–1280 m altitude.

Phenology — Flowering: September to November, between the late rainy season and the beginning of the dry season. The flowers open in the afternoon at 2.00 p.m. and persist until 5.00 p.m.

Vernacular name — Kathin phu.

Specimens examined. Loei (Phu Kradueng National Park, trail from Lang Pae to Pha Mak Duk, 1280 m alt., 16°53'N, 101°49'E): *Phonsena* 6444 (BK, BKF, KKU, L), 28 Oct. 2009; *Phonsena* 6588 (BK, BKF, K, QBG), 13 Nov. 2010. Loei (Phu Ruea National Park, Phu Son Camping Ground, 1187 m alt., 17°30'N, 101°20'E): *Phonsena & Sutthisaksopon* 6759 (BKF, KKU), 1 Oct. 2011.

Conservation status — *Xyris thailandica* is endemic to Thailand, recorded only from Phu Kradueng National Park and Phu Ruea National Park. Its extent of occurrence is estimated to be less than 50 km², but the population in these national parks are well protected. A rating of Endangered (EN, IUCN 2001) is merited.

Note — *Xyris thailandica* is similar to *X. linifolia* by having a bulbous underground stem, but differs in its flat, linear leaves (terete in *X. linifolia*) and in its papillose margin of the leaves (entire in *X. linifolia*). *Xyris thailandica* is a montane species, occurring above 1 000 m altitude whereas *X. linifolia* occurs in the lowland, between 180–200 m altitude.

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